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East Fork Poplar Creek — Sewer Line Beltway Remedial Investigation Report

Appendixes A - L

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AN INVENTORY OF WETLANDS IN THE EAST FORK POPLAR CREEK FLOODPLAIN ANDERSON AND ROANE COUNTIES, TENNESSEE

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ABSTRACT

An inventory of wetlands within the floodplain of East Fork Poplar Creek (EFPC) in Anderson and Roane Counties, Tennessee was conducted during October, 1991 through May, 1992 for the U. S. Department of Energy (DOE) by the U. S. Army Corps of Engineers, Nashville District. About 15 miles of EFPC channel and 500 acres of its floodplain are contaminated with mercury and other contaminants released from the Y-12 Plant on the DOE Oak Ridge Reservation. The wetland inventory will serve as baseline information for DOE's remedial action planning and National Environmental Policy Act compliance efforts related to the contamination. In order to provide broad wetland determinations beyond which future wetland definitions are unlikely to expand, the 1989 *Federal Manual for Identifying And Delineating Jurisdictional Wetlands* was utilized. Using the manual's methodology in a contaminated system under the approved health and safety plan presented some unique problems, resulting in intrusive sampling for field indicators of hydric soils being accomplished separately from observation of other criteria. Beginning with wetland areas identified on National Wetland Inventory Maps, the entire floodplain was examined for presence of wetland criteria, and 17 wetlands were identified ranging from 0.08 to 2.81 acres in size. The majority of wetlands identified were sized under 1 acre. Some of the wetlands identified were not delineated on the National Wetland Inventory Maps, and much of the wetland area delineated on the maps did not meet the criteria under the 1989 manual.

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AN INVENTORY OF WETLANDS IN THE EAST FORK POPLAR CREEK FLOODPLAIN ANDERSON AND ROANE COUNTIES, TENNESSEE

INTRODUCTION.

East Fork Poplar Creek (EFPC) is located in Anderson and Roane counties of eastern Tennessee approximately 20 miles northwest of Knoxville. EFPC originates from the east end of the Y-12 Plant on the Oak Ridge DOE (Department of Energy) Reservation, passes through the city of Oak Ridge and rural Roane County, re-enters the Oak Ridge Reservation, and empties into Poplar Creek, which in turn flows into the Clinch River. The total length of EFPC is about 15 miles. The creek and approximately 500 acres of its floodplain have been contaminated as a result of process operational upsets and accidental releases at the Y-12 Plant. Mercury was used at Y-12 to separate different isotopes of lithium. Prior to 1982, an estimated 239,000 lbs. of mercury were released from the Y-12 Plant to EFPC, and mercury is the major contaminant found in EFPC and its floodplain. To a lesser extent other heavy metals, radionuclides, and some organic compounds have also been found in EFPC and its floodplain soils. DOE is studying appropriate remediation to deal with the contaminated areas.

Remediation measures considered by DOE can potentially impact various environmental resources, including wetlands, in the EFPC floodplain. Wetlands are sensitive environmental resources that have been extensively impacted Nation-wide over the years to the point that they now receive special consideration in project planning and in regulatory reviews. President Bush announced a goal of "no net loss" of the Nations remaining wetlands, and Executive Order 11990 (Protection of Wetlands) from the Carter administration remains in effect. DOE regulations regarding wetlands are under 10 CFR 1022, which implements the above Executive Order and Executive Order 11988 (Floodplain Management). In order to develop baseline information for use in remediation planning and the National Environmental Policy Act (NEPA) process, DOE requested the Nashville District Corps of Engineers to inventory wetlands within the EFPC floodplain.

OBJECTIVES.

Generally stated, the objective of this investigation is to identify and characterize the wetlands within the EFPC floodplain so that the effects on wetlands of remedial action plans for the contamination may be assessed. The information developed will be used for planning purposes, including preparation of a feasibility study and an Environmental Impact Statement, and to facilitate compliance with

10 CFR 1022, the DOE regulation that implements Executive Order 11990 (Protection of Wetlands). Specific objectives are to identify the wetlands within the EFPC floodplain, to designate the wetlands on maps using CADD (Computer Aided Drafting and Design) system software, and to provide a written description of the technical identification criteria present and the logic supporting identification of each wetland.

METHODS AND PROCEDURES.

The Interagency Agreement initiating the inventory was executed while controversy concerning the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* continued to build, and amid speculation and rumors about the proposed provisions of a revised manual. Further, before field work could be commenced, Congress prohibited use of the 1989 manual to delineate wetlands for jurisdictional purposes using money appropriated through the 1992 Energy and Water Development Appropriation Act. The option of using the 1989 manual for the inventory remained open, however, since this delineation of wetlands would be for planning and impact assessment purposes only, and since no funds appropriated by the Act would be used. Following discussions between the Corps and DOE, it was jointly determined that the 1989 manual was most appropriate to address the objectives of the investigation. Therefore, the 1989 manual was used because it has been tested and contains replicative methodology, delineating wetland bounds which would likely include all wetlands defined under any foreseeable future manual.

The 1989 manual is based on the premise that wetlands possess three essential characteristics: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. These characteristics each have technical criteria for identification as described in the manual. The technical criteria must all be met for an area to be defined as a wetland, although under some conditions field indicators for a criteria may not be detected (problem or disturbed area wetlands).

The 1989 manual presents four approaches or methods for identifying and delineating wetlands. The four methods cover situations ranging from office determinations to highly complex field determinations for regulatory calls anticipated to be challenged through litigation. The Routine Onsite Method was selected for use in conducting the inventory because: (a) an onsite procedures must be used to insure identification of all wetlands present in the EFPC floodplain, (b) project planning and impact assessment do not require wetland boundaries to be set with a high degree of precision or marked on the ground, (c) different criteria for defining and delineating jurisdictional wetlands (thus different boundaries) will probably be applicable by such time as planning progresses to the point where impact areas are known, and (d) it is the least labor

intensive and least costly of the onsite methods.

All onsite investigations were accomplished in accordance with the health and safety plan procedures developed by Radian/Lee Wan Associates. Prior to entering the site, all personnel performing onsite investigations were required to successfully complete appropriate training under OSHA 29 CFR 1910.120, and additional site-specific training. The above personnel were also placed under medical surveillance to document any occupational exposure to contaminants. Strict adherence to the buddy system was required during all onsite activities, and an escort furnished by Science Applications International Corporation (SAIC) accompanied the Corps investigators in the field at all times. Level D clothing including coveralls, rubber boots, and safety glasses was sufficient for routine onsite observations and thermoluminescent dosimeters were worn as the primary means of determining exposure to ionizing radiation. However, during intrusive sampling to identify hydric soils, additional personal protective equipment including Tyvek coveralls and latex gloves were required. The probe holes and soil samples were monitored with a Jerome mercury vapor sniffer and a Geiger counter. Should an unacceptable level of mercury vapor have been detected, all personnel would have left the sample site immediately, returning to complete the observation after donning a full-face or half-face respirator complete with a cartridge affording protection from mercury vapor. Decontamination procedures were followed as required. Personal protective equipment and monitoring personnel, when required, were provided by Radian/Lee Wan Associates.

To initiate the inventory, National Wetlands Inventory maps, soil surveys, and any other available, pertinent information was studied for a preliminary indication of the likely location of wetlands in the EFPC floodplain. Based on suspected location of the wetlands, field work and access were planned. A field crew, guided by the SAIC escort, began visiting each potential wetland site in October, 1991 to identify those with field indicators of the three technical criteria for classification as wetlands (wetland hydrology, hydric soils, and hydrophytic vegetation). Also, the entire floodplain was reconnoitered for potential wetland sites not apparent through offsite investigations. Because of the impending leaf fall and the more stringent health and safety procedures required for intrusive sampling, only vegetation and hydrology indicators were observed on the first site visit. Sites which apparently met the vegetation and hydrologic criteria were subsequently observed over the winter and spring to examine the soils and observe any additional hydrologic indicators. Soil samples were taken with a "backsaver" probe to a depth of 18 inches where possible. The only area where this multiple visit approach for potential wetlands sites was not used was the Oak Ridge Sportsmen's Association (ORSA) property. Limited

periods of access to the ORSA property (partial and complete range closures) during November and December were negotiated, and special security and safety procedures were implemented for the protection of sampling personnel. Thus, field indicators for all three parameters were observed at ORSA sites during the limited onsite time available, despite the difficulty of characterizing the dominant vegetation during winter.

One-foot contour base maps for use in the inventory were transferred to the Corps Computer Aided Drafting Design (CADD) system from SAIC. Wetlands within the EFPC floodplain were designated on copies of the base maps in the field as accurately as possible without formal land surveying techniques. The wetlands were then entered on the base maps in the Corps CADD system and the mapping was transferred back to the SAIC system. Hard copies of maps depicting the wetlands delineated in this study are presented as Exhibit 1. Field notes were recorded on the standard data form for the Routine Onsite Determination Method, and were used to prepare the written characterization of each wetland as presented in this report.

A few problems were encountered during performance of the study, but all were overcome. One problem was the unfavorable timing of vegetation observation efforts (advanced fall through early spring) necessitated by the project schedule. As previously mentioned, the initial field work for the study was rushed to complete as much observation of the vegetation criterion as possible before leaf fall made that task even more difficult. A few plants were encountered in such a deteriorated state as to make identification virtually impossible, and two or three grasses were beyond the identification capabilities of the investigators. However, in all such cases enough dominant species were identifiable at the site to confidently determine whether the vegetation criterion was met. In limited cases where a plant could not be identified beyond the genus level, the indicator status for the most upland species reasonably expected to occur in the study area was used (incidentally never drier than Facultative). On the ORSA property where access was limited to winter and late fall, vegetation which could be identified and considered in determining whether the vegetation criterion was met consisted entirely of woody and persistent herbaceous species. This, also, was not a serious problem largely because of the SAIC escort's expertise in dendrology.

In the Roane County portion of the study area, the lack of a recent soil survey (most recent survey published in 1942) was a handicap for determining whether the hydric soil criterion was met. Many of the wetlands in that portion of the study area are developing wetlands lacking strong hydric soil indicators, and best judgement with consideration to the strength of the other wetland criteria was utilized in determining whether the soil criterion is met. Thus,

some soils determinations in that area are somewhat subject to disagreement.

Finally, the most serious problem encountered was conversion of data from the SAIC CADD system to the Corps CADD system and the resultant delay in acquiring good maps for use in the field. The conversion problem was eventually rectified to the point that the mapping could be used for the inventory, but anomalies still exist on the mapping in the Corps CADD system. Further, details of the contours in the mapping seem, often, to disagree with the topography observed in the field. For this reason, several of the wetlands delineated on the base maps include illogical contours.

RESULTS

General. A total of 17 wetlands were identified as meeting all three criteria of the 1989 *Federal Manual for Identifying_and Delineating Jurisdictional Wetlands*. The wetlands ranged in size from 0.08 acre to 2.81 acres, with the overwhelming majority under 1 acre. The number and acreage of wetlands meeting the criteria of the 1989 manual is substantially less than those identified on the National Wetlands Inventory maps of the area. This reduction was contrary to the expectations of the investigators, but is understandable upon considering that the National Wetland Inventory maps are based on remote sensing and are vegetation driven with little or no means of considering hydrology and soil parameters. The National Wetland Inventory maps identified almost all of the EFPC floodplain forest as wetland, but only the sites identified below meet the criteria for wetland hydrology and hydric soils. Attainment of the hydric soil criteria was generally the hardest determination to make, since field indicators were often quite subtle and, the only reliable county soil survey indicated only marginal hydric soils (hydric, if ponded) for the area it covered (Anderson County only). The lack of conspicuous field indicators for hydric soil at sites strongly meeting the other two parameters may be due to human alteration of the hydrology and sedimentation causing sites to change to or from wetland. It is also possible that the soil discoloration at some of the areas with higher contamination levels may have masked the soil colors normally indicative of hydric soils. Particularly where soils were concerned, a liberal approach was used in determining the attainment of criteria, to assure that the inventory is all inclusive. Thus for some areas listed in this inventory, a criterion may be rather marginally attained, and other investigators may reasonably disagree that all three wetland criteria are met. In such cases the logic behind the call is noted so that refinements may be made if desired. It is hoped that the observations noted for this inventory will be usable to aid any furure determinations under the revised manual.

Detailed Descriptions. The following are descriptions of each wetland site and the field indicators supporting attainment of technical criteria for the three wetland parameters at the site. The wetland sites are identified by the nearest surveyed transect number or EFPC Mile number where no transect is reasonably close. The Transects are those established in the field for the other DOE contract studies of EFPC, and are based on state plane coordinates. Right and Left Bank notations are from a downstream-facing orientation. Locations relative to test wells or cultural features such as businesses or schools are also given when deemed helpful.

Mile 14.1, Right Bank. The most upstream wetland site is situated on the right (descending) bank of EFPC immediately downstream of the Y-12 dike/culvert and adjacent to a commercial car wash. The site is 0.39 acre in size. Ground elevation varies within the site, with small mounded areas separating depressions which hold water up to about 6 inches deep. An aquic moisture regime is apparent, and free-standing water immediately fills probe holes to within 3 inches of the surface at the highest elevations. The dominant vegetation is distributed with 3 species in each of the shrub and herbaceous strata, and 2 species in each of the sapling and tree strata. The woody species are relatively young, indicating a possible disturbance 25 or more years ago. Dominant plant species at the site are green ash (*Fraxinus pennsylvanica*) (tree and shrub strata), alder (*Alnus spp.*), sycamore (*Platanus occidentalis*) (tree and sapling strata), black willow (*Salix nigra*) (sapling and shrub strata), white heath aster (*Aster pilosus*), whitegrass (*Leersia Virginica*), and an unidentified grass. Of the dominant plant species, 75% to 86% have an indicator status of Facultative Wetland (FACW-) or wetter. The Anderson County Soil Survey indicates that the soil is Newark, which is listed as a hydric soil when ponded. Also, the aquic moisture regime is usually an indicator of a hydric soil. The soil exhibits some mottling and Munsell Soil Color Chart chromas of 2 below the top 2 layers. Munsell soil colors observed are as follows.

Sample 1		Sample 2*		Sample 3	
0"-3"	10YR 4/3	10.5"	2.5YR 3/2	0"-4"	10YR 3/3
3"-5"	10YR 3/4			4"-8"	5YR 4/6
>5"	5YR 3/2			mottles	2.5YR 5/2
				>8"	5YR 4/2

*Sample 2 was taken from the same area as Sample 1, as soils were too wet for extraction of a full probe.

Mile 14, Left Bank. This tiny (0.01 acre) man made wetland is

located on the left (descending) bank across EFPC from Lane Chrysler/Plymouth and southwest of Wells AN E2 and AN E1. The basic conditions for development of the wetland were created by a drastic alteration of topography resulting from removal of fill material. A constant sheet flow of spring water provides the wetland hydrology, and the ground surface is inundated to a depth of about 3" in places. The thin soil layer of 2"-3" above parent material is probably the result of sediment deposit. The soil matrix color is 10R 4/2 on the Munsell Chart, and there is a strong sulphur smell when the soil is disturbed. Both indicate reducing conditions and are reasonable indicators that the hydric soil criterion is met in a newly created wetland. Dominant plant species on the site are soft rush (*Juncus effusus*) and common cattail (*Typha latifolia*) with indicator statuses of Facultative Wet+ (FACW+) and Obligate (OBL) respectively.

Transect N-33468, Left Bank. Forested wetland extends from the base of the steep slope defining the western boundary of the EFPC floodplain along a small water course which empties into EFPC. It appears that fill material pushed over the slope has possibly encroached on the area somewhat. The wetland area is 0.57 acre in size. The hydrology of the area is derived from groundwater seepage as well as runoff from the uplands. The area is inundated only following flood events but normally has an aquic moisture regime or saturated soils. Free water immediately filled probe holes to within 5 inches of the surface in February and to within 2 inches of the surface in April and May. The dominant vegetation on the site is rather evenly distributed with 2 species in each of the tree, sapling, and shrub strata, and 1 species in the herbaceous stratum. Dominant plant species are swamp chestnut oak (*Quercus michauxii*), sweetgum (*Liquidambar styraciflua*) (tree and sapling strata), American hornbeam (*Carpinus caroliniana*), spicebush (*Lindera benzoin*), green ash (*Fraxinus pennsylvanica*), and an unidentified grass. Even assuming the indicator status of the unidentified grass as upland, 86% of the dominant plant species have indicator statuses of Facultative (FAC) or wetter. As in most of the upper EFPC floodplain, the Anderson County Soil Survey indicates that the soil is Newark, a hydric soil when ponded. Also, the aquic moisture regime is usually an indicator of a hydric soil. Direct soil observations revealed a highly mottled layer at 9.5" through 13.5" depth, bright streaks along root channels, and a matrix chroma of 2 on the Munsell Chart at 13.5" through 18" depth. All these are hydric soil indicators. As a side note, the dark black layer associated with the mercury contamination was encountered at this site. Observed Munsell Soil Color Chart colorations are as follows.

0"-4.5"	10YR 3/3
4.5"-9.5"	Contaminated black layer.
9.5"-13.5"	Highly Mottled:

	10YR 5/6 matrix.
	10YR 4/2 mottles
	5YR 5/8 streaks along root channels
13.5"-18"	10YR 4/2

Transect N33806: W-12, Left Bank. This 0.56 acre forested wetland is situated in the vicinity of Well AN D4. As with the previous wetland, it extends from the base of the steep slope defining the western boundary of the EFPC floodplain along another small water course which empties into EFPC. The hydrology of the area is derived from a combination of groundwater seepage and runoff from the uplands. There are slight, irregular variations in elevation throughout the area. Puddles up to 2 inches deep are present for long periods of time through the spring and early summer, and there is otherwise an aquic moisture regime. Free water immediately filled probe holes to within less than 1 inch of the surface in April and May. Movements of sampling personnel in the vicinity caused the water standing in the probe holes to pulsate. The dominant vegetation on the site is evenly distributed among the tree, sapling, and shrub strata, and no species were apparent in the herbaceous stratum. Dominant plant species are sycamore, sweetgum, box elder (*Acer negundo*), red maple (*Acer rubrum*), spicebush, and green ash. All of these dominant plant species have an indicator status of FAC or wetter. Once more, the Anderson County Soil Survey indicates that the soil is Newark, a hydric soil when ponded. Additionally, an aquic moisture regime is usually an indicator of a hydric soil. Direct soil observations revealed mottling, bright streaks along root channels, and a matrix chroma of 2 on the Munsell Chart within various layers. All these are hydric soil indicators. Munsell Soil Color Chart colorations observed at the site are as follows.

0"-3.5"	10YR 3/4
3.5"-5'	10YR 3/2 matrix
	5YR 5/8 mottles
	(mercury contamination indicated by detector)
5"- 8"	10YR 4/2 matrix
	5YR 5/8 mottles
8"-11.5"	10YR 4/3 matrix
	5YR 5/8 streaks
11.5"-13"	10YR 4/2 matrix
	10YR 5/8 streaks

Transect N34452: E-06, Right Bank. A 0.85 acre area of forested wetland is situated in the floodplain forest on the right bank near the Holiday Inn and the New K-Mart store. It appears that the wetland area may have been larger before encroachment by fill for commercial development. The area is adjacent to a small water course which empties into EFPC from the east. The hydrology of the

area is derived from surface runoff. There are slight variations in elevation throughout the area, and much of the area is inundated to depths of 2-3 inches through a normal spring. On portions that are not inundated, there is an aquic moisture regime, and free water immediately filled probe holes to within less than 2 inches of the surface throughout April and into early May. The dominant vegetation on the site is distributed among the strata, with most species occurring in the shrub and sapling strata. Dominant plant species are green ash (tree and sapling strata), sweetgum (tree and sapling strata) , box elder, privet (*Ligustrum spp.*), honeysuckle (*Lonicera japonica*), white heath aster, and an unidentified grass. Even without considering the unidentified grass a hydric species, 55% of the dominant plant species have an indicator status of FAC or wetter. According to the Anderson County Soil Survey, Newark, a hydric soil when ponded, continues through this area. The aquic moisture regime which is usually an indicator of hydric soil, is the only other evidence in support of hydric soil at the site. Soil probe samples revealed no low chromas or other hydric soil indicators. However, this investigator believes that the ponding and aquic moisture regime on Newark soil are sufficient indicators that the hydric soil criterion is met.

Transect E58069: N-16, Right Bank. A 0.09 acre wetland is developing in and about a poorly drained pocket across the street from Robertsville Baptist Church and adjacent to Robertsville Jr. High School. Inundation and saturation in this area appear to occur throughout most of the year, and probably results from construction of the adjacent roadways. The inundated portion of the site has a water depth of up to 8 inches, and free water immediately filled probe holes to within 1 inch of the surface during March and May sampling visits. The dominant vegetation on the site is in the shrub and herbaceous strata. Dominant plant species are black willow, button bush (*Cephalanthus occidentalis*), sedge (*Cyperus spp.*), cattail, soft rush, creeping Jenny (*Lysimachia nummularia*), and jewel weed (*Impatiens capensis*). All of the dominant plant species have an indicator status of FACW or OBL. According to the Anderson County Soil Survey, the soil at the site is Hamblen. However, construction activities have probably resulted in the native soil being replaced. Examination of soil samples at the site revealed a layer with matrix chroma of 1 and oxidized root channels. These strong internal indicators in conjunction with the presence of hydrophytic vegetation and wetland hydrology in a developing wetland support a determination that the hydric soil criterion is also met. Munsell Soil Color Chart colorations observed at the site are as follows.

0"-6"	10YR 3/3
6"-12"	10YR 4/1
	5YR 4/6 root channels

Transect E54788: N-08, Right Bank. This young forested wetland is situated between the sewer line and the Oak Ridge Turnpike adjacent to approximate Miles 11.05 - 11.15 of EFPC (also known as Bruner's), and covers approximately 2.12 acres. There are two zones apparent within the wetland based on elevations, which in turn results in differences in hydrology and plant communities. The lower elevations which are subject to periodic, almost seasonal, inundation from late winter through late spring or early summer cover the major portion of the site . The inundation zone extends from the turnpike fill to roughly 30 - 40 feet from the edge of the wooded area and the water can reach maximum depths of 6 - 8 inches. The saturation zone extends from the inundation zone almost to the edge of the wooded area. The hydrology is derived from retained flood waters and surface runoff. Outside the inundated zone, there is an aquic moisture regime, and free water immediately filled probe holes to within 1 inch of the surface from February through early May. The vegetation in the inundation zone occupies the tree, sapling, shrub and herbaceous strata, while the vegetation in saturation zone lacks a shrub stratum. The dominant plant species in the inundation zone are green ash, box elder (tree and sapling strata), black willow, silky dogwood (*Cornus amomum*), and false nettle (*Boehmeria cylindrica*). All have indicator statuses of FACW or wetter. The dominant plant species in the saturation zone are green ash (tree and sapling layer), box elder (tree and sapling strata), ground ivy (*Glechoma hederacea*), white heath aster, and lowland white aster (*Aster simplex*). Of the species in the saturation zone, 85.7% have indicator statuses of FAC or wetter. According to the Anderson County Soil Survey, Newark, a hydric soil when ponded, continues through this area. The aquic moisture regime, which is usually an indicator of hydric soil, and the periodic inundation are sufficient evidence to support satisfaction of the hydric soil criterion, despite the weakness of indicators in actual soil samples. Munsell chroma of 2 was noted in portions of the soil sample, and full notation of Munsell Soil Color Chart colorations observed near the edge of the saturation zone are as follows.

0"-4" 10YR 3/3
4"-9" 10YR 4/3
9"-18" 10YR 4/2

Efforts to sample soils further out into the saturation zone were unsuccessful because the soils were too wet for extraction in the probe. Investigators were able to note, however, a Munsell coloration of 10YR 3/2 at 0"-3" depths.

Transects E53804 and E53476, Left Bank. A narrow linear wetland of about 0.91 acre parallels the base of the valley slope in the left bank floodplain opposite approximate EFPC Miles 10.9 - 11.0.

The source of hydrology for the area was unclear to the investigators, but groundwater is probably involved along with surface runoff and retained floodwaters. SAIC personnel reported that the area remains saturated from late winter through, at least, early summer. The aquic moisture regime was apparent during late February, and free water immediately filled probe holes to within 2 inches of the surface. The area is a young forest with vegetation occupying the tree, shrub, sapling, and herbaceous strata. The dominant plant species are green ash (tree and sapling strata), box elder, silky dogwood, ground ivy, and creeping Jenny. Indicator statuses of the dominant vegetation are 83% FACW and FACW+. According to the Anderson County Soil Survey, Newark, a hydric soil when ponded, continues through this area. The aquic moisture regime, which is usually an indicator of hydric soil, and the presence of mottles in the 11"-18" layer are sufficient evidence to support meeting the hydric soil criterion. The black layer associated with the mercury contamination was encountered, and the high levels of mercury may have influenced the Munsell Soil Chart color readings. The Munsell colors are as follows.

0"-7"	10YR 3/3
7"-11"	Black contaminated layer
11"-18"	10YR 4/4 matrix
	10YR 4/2 mottles

The soil and hydrology criteria may be considered rather marginally attained, and other investigators may reasonably disagree that all three wetland criteria are met at this area.

Transect E43306, Right Bank. A 2.81 acre young forested wetland occupies a basin formed around an unnamed forked tributary entering EFPC at approximate Mile 8.2, right bank in a corner of the Oak Ridge Sportsmen's Association (ORSA) property. The hydrology of the area is derived from a continuous spring flow and by surface runoff. The basin floor has an intricate topography, with lower areas normally inundated to 1 - 5 inch depths. Areas of the floor not inundated are normally saturated, and free water immediately filled probe holes to the ground surface level. Because access to the site was limited to December, a vigorous herbaceous layer which appeared to include several hydrophytic species could not be adequately assessed. The woody vegetation on the site consisted largely of shrubs with a few saplings and immature trees. Dominant woody species noted are green ash (tree, sapling, and shrub strata), button bush, and silky dogwood. Indicator statuses of all these species are FACW or OBL. The soil survey for Roane county is so outdated (1942) as to be useless for hydric soil determinations. However, hydric soil for this area might be assumed, based on the strong aquic moisture regime and the FACW and OBL indicator status of the dominant woody vegetation. Some Munsell Soil Color Chart

observations at the site are as follows and support attainment of the hydric soil criterion.

Surface layer apparently silty clay loam 10YR 3/3 with mottling.
At 5" 10YR 4/3 matrix
10YR 5/2 streaks
7.5YR 4/4 streaks
From another sample:
At 8" 7.5YR 4/2 matrix
10YR 5/2 streaks.

Transect E42324, Left Bank. This 0.12 acre forested wetland cuts across the inside of a slight bend in EFPC on the ORSA property, and may be a scar from an old channel change. The site exhibited inundation of 3 - 4 inches and soil saturation for a number of days after a relatively low frequency flood event when examined in December. It seems reasonable to assume that when such an event occurs during the growing season, similar hydrology is present for sufficient duration to meet the hydrology criterion. The only dominant species persisting were green ash and box elder (sapling and shrub strata) both with the indicator status of FACW. The soil was too wet for an accurate reading on the Munsell Charts, but was assumed hydric based on the saturation and the indicator status of FACW for all dominant plant species. The soil and hydrology criteria might be considered rather marginally attained, and other investigators may reasonably disagree that all three wetland criteria are met at this area.

Transect E40024, Right Bank. This 0.21 acre forested wetland occupies part of the floor of a small cove on the ORSA property just upstream of the Gum Hollow Road bridge. On the ground, the cove floor seems to slope slightly down from the streambank which causes it to retain floodwater and surface runoff from the adjacent slopes. As with the previous site, inundation of 3 - 4 inches and soil saturation were exhibited for a number of days following a relatively low frequency flood event when examined in December. It seems reasonable to assume that when such an event occurs during the growing season, similar hydrology is present for sufficient duration to meet the hydrology criterion. Dominant vegetation occupies the tree, sapling, and herbaceous strata, and 66% or more is FAC or wetter. Dominant plant species are sycamore, green ash, elm (*Ulmus spp.*), honeysuckle, white heath aster, and an unidentified grass. As previously mentioned, the soil survey for Roane county is so outdated (1942) as to be useless for hydric soil determinations. However, the following Munsell Chart colorations and hydric soil indicators support a conclusion that the hydric soil criterion is met.

Sample 1. Sample 2.

13"-14"	10YR 4/3 matrix oxidized root channels mottling iron or manganese nodules.	1"-2" 16"-18"	10YR 4/2 matrix 10YR 4/2 matrix 5YR 2/1 nodules

Due to limited accessibility, evidence supporting the soil and hydrology criteria might be considered rather marginal, and other investigators may reasonably disagree that all three wetland criteria are met at this area.

Transect 30674, Left Bank. An old channel bendway, possibly cut off when the turnpike was constructed lies south of the turnpike and just east of Transect 30674. The size of this permanently flooded area is 0.45 acre. The dominant plant species is duckweed (*Lemna spp*), which has an indicator status of OBL. It was not necessary to characterize the soils since the area is permanently inundated, and hydric soils may be assumed.

Transect E20339, Right Bank. This wetland area has formed around a backwater intrusion at approximate EFPC Mile 0.6. The entire site including standing water/mud flat is approximately 0.61 acre in size. Backwater from Watts Bar Reservoir and spring water flow are the primary sources of the site's hydrology, and zones of shallow inundation and soil saturation both occur under normal conditions. Free water immediately filled probe holes to within less than 2 inches of the surface. Immediately adjacent to the fluctuation zone is a band approximately 5 feet wide and consisting almost entirely of creeping Jenny and smartweed (*Polygonum spp.*). Above this band is a thick community of dominant plant species consisting of black willow, silky dogwood, and honeysuckle. All of the dominants in both communities have indicator statuses of FAC or wetter. While soil survey information is not available, there are sufficient field indicators that the hydric soil criterion is met. There is an aquic moisture regime present and organic material is abundant in the soil down to about 6.5 inches. There are mottles in the upper soil layer, and the Munsell chroma is 2 below 3.5 inches. Typical Munsell Soil Color Chart observations at the site are as follows.

0"-3.5"	10YR 3/3 matrix 10YR 5/8 mottles
3.5"-6.5"	10YR 3/2
6.5"-15"	10YR 4/2

Transect E20011, Left Bank. This tiny 0.08 acre wetland is situated in a low area on the inside of a bend of EFPC just upstream of the cited transect and adjacent to Mile 0.5. The area is frequently saturated by backwater fluctuations from Watts Bar Reservoir, and

exhibited saturated soils even during the relatively dry October, 1991 period. Vegetation at the site is well distributed among the tree, sapling, shrub, and herbaceous strata and 89% of the dominant species have indicator statuses of FAC or wetter. Dominant plant species at the site are sycamore (tree and sapling strata), green ash, box elder (tree, sapling and shrub strata), silky dogwood, smartweed, and white heath aster. As mentioned previously, the soil survey for Roane county is so outdated as to be useless for hydric soil determinations. However, the hydric soil criterion for this area might be assumed, based on the aquic moisture regime, the high organic material content of the soil, and the changing character of the site. The site is subject to high sediment deposition which may have obscured any hydric soil indicators, and may eventually cause the wetland characteristics of the site to be lost. Typical Munsell Soil Color Chart observations at the site are as follows.

0"-4"	10YR 4/3	
4"-13"	10YR 4/3	matrix
	7YR 4/4	mottles
10"-16"	10YR 5/3	

Transect E20339: N-14, Right Bank. Located almost directly across EFPC from the previous site, this 0.86 acre wetland has hydrology derived chiefly from spring flow and Watts Bar Reservoir fluctuations. During the April 23 site visit (the driest observation at this site), free water filled probe holes to within 4 inches of the surface in about 3 minutes. Above the unvegetated inundation zone, two communities of vegetation can be visually distinguished, based more on relative abundance and density than a great difference in species composition. Dominant species of the interior community are 66% or greater FACW and OBL, while those of the exterior community are 63% or greater FACW and OBL. Dominant plant species of the interior community are green ash, sycamore, button bush, creeping Jenny and two unidentified grasses. Dominant species of the exterior community are green ash, box elder, button bush, dogwood, privit, creeping Jenny, and two unidentified grasses. Soil sampling at the site did not reveal hydric soil indicators other than an aquic moisture regime and much black organic material in the soil. Munsell soil colorations noted at the site are as follows.

0"-3.5"	10YR 4/3	
3.5"-11"	10YR 4/3	matrix
	7.5YR 4/4	mottles

Soils were too wet to extract a full probe tube. Based on the aquic moisture regime, organic material in the soil, and hydrophytic vegetation present, and changes due to tailwater influence at the site it was concluded that the hydric soil criterion is met at the site.

Transect E19682, Left Bank. A wetland area has formed around a backwater intrusion just downstream of Mile 0.3. The entire site including standing water/mud flat is approximately 0.39 acre in size. Backwater from Watts Bar Reservoir is the primary source of the site's hydrology, and inundation of a few inches or saturation within less than 2 inches to 4 inches of the surface occurs as the normal condition. Above the unvegetated backwater fluctuation zone, are four plant communities. Taken in order of decreasing site wetness, indicator statuses of dominant plant species are 100% OBL, 60% FAC or wetter, 83% FACW or wetter, and 75% FAC or wetter. The community in the edge of the inundation zone is 100% button bush. The community adjacent to the inundation zone is all herbaceous and the dominant species are smartweed, creeping Jenny, bedstraw (*Galium spp.*), jewel weed, and an unknown grass. The third community has shrub and herbaceous strata and its dominant species are box elder, dogwood, button, bush, creeping Jenny, jewel weed and an unidentified grass. The outermost community added a tree stratum and dominant species are green ash, sycamore, box elder, dogwood, creeping Jenny, smartweed, and two unidentified grasses. At the outermost zone, soils were quite moist, but no free water was readily apparent in probe holes and the hydrology criterion is probably not met. Soils supporting the other communities did not have classic Munsell hydric colorations, but included mottled layers and iron/manganese concretions. Because those soils are typically saturated, support hydric vegetation, and are part of a system developing due to influence of the tailwaters, the hydric soil criterion was considered met, nevertheless. Munsell colorations observed at the site are as follows.

Button bush community:

0"-4"	10YR 3/3
4"-10"	10YR 4/3 matrix
	7.5YR 4/4 mottles
	iron/manganese concretions noted.
10"-16"	2.5YR 5/4

Herbaceous and shrub/herbaceous communities:
(free water at <2" and 3"-4" respectively)

0"-4"	10YR 3/3
4"-7"	10YR 4/3 matrix
	5YR 4/8 mottles
7"-10.5"	10YR 4/3 matrix
	5YR 5/8 mottles
10.5"-15.5"	10YR 10YR 4/4

Transect E19355, Right Bank. The furthest downstream wetland area is formed around a backwater intrusion adjacent to EFPC Mile 0.2. The entire site including standing water/mud flat is approximately

0.8 acre in size. Backwater from Watts Bar Reservoir is the primary source of the site's hydrology, and soil saturation occurs as the normal condition. Above the unvegetated backwater fluctua- tion zone, are two plant communities, both with all dominant plant species FACW or OBL. Dominant plants in around the margin of the mud flat are button bush, flatsedge (*Cyperus cuspidatus*), and soft rush. Immediately up gradient from the previous community is a dense growth of dogwood (no herbaceous stratum). Although the Munsell soil colors do not indicate a hydric soil, several hydric soil indicators are present including a sulphur odor in disturbed soils, iron/manganese concretions, oxidized root channels, and organic detritus in the uppermost 1 or 2 layers. In addition to these field indicators, soil may be assumed hydric when the dominant plant species are all FACW and OBL and the wetland boundary is abrupt as in this case. Munsell colorations are as follows.

Margin of mud flat:

0"-4"	10YR 3/3	(with organic detritus)
4"-7.5"	10YR 4/3	matrix (with organic detritus)
	5YR 5/8	mottles
7.5"-10.5"	10YR 4/3	matrix
	7.5YR 4/4	mottles
10.5"-16"	10YR 6/1	(with iron/manganese concretions, oxidized root channels)

Dogwood community:

0"-8"	10YR 3/3	matrix (with organic detritus)
	7.5YR 5/8	oxidized root channels
8"-12"	10YR 4/3	matrix
	5YR 3/4	mottles (less than previous area)
12"-16.5"	10YR 4/3	matrix

DISCUSSION AND CONCLUSIONS

As previously stated, this wetland inventory is not for jurisdictional purposes, but rather for planning and impact assessment purposes, only. At such time as site specific proposals for remedial action plans are finalized, detailed wetland delineations may be completed under the appropriate contemporary methodology for jurisdictional delineation. Nevertheless, it is timely to present some general considerations concerning regulatory jurisdiction for the EFPC wetlands. The legal opinion currently held by the Corps of Engineers and the Environmental Protection Agency is that Congress did not intend for Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) response actions to be subject to Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. Thus, the Corps does not conduct permit reviews for actual CERCLA clean-up actions. However, support activities for CERCLA responses (access roads, staging areas, etc.)

are subject to normal permit requirements. Since policies and legal opinions are subject to change, it is recommended that DOE coordinate any remedial action plans with the Nashville District Corps of Engineers, Regulatory Branch (615/736-5181). Other activities involving deposition of dredged or fill material into any of the EFPC wetlands that are determined to be jurisdictional will require a full permit review.

As mentioned, the National Wetland Inventory maps identified almost all of the EFPC floodplain forest as wetland, but only the sites identified in this inventory meet all the wetland criteria. However, many areas from the National Wetland Inventory not meeting all the wetland criteria are environmentally valuable areas, if contamination levels are ignored. Such areas are moist floodplain forests and are highly productive for wildlife purposes, although the desirability of providing wildlife habitat in significantly contaminated areas is debatable. These floodplain forests perform other functions of wetlands such as floodwater attenuation and sediment retention. Particularly notable in this regard are the wide forested floodplain off South Illinois Avenue (EFPC Miles 13.3 - 13.95), the forested area adjacent to the Robertsville Jr High School athletic field, and wide forested floodplain areas on either side of EFPC between its mouth and the confluence of Bear Creek (EFPC Miles 0 - 1.5). A variety of wildlife including deer (*Odocoileus virginianus*), wild turkeys (*Meleagris gallopavo*), great blue herons (*Ardea herodias*) and wood ducks (*Aix sponsa*) were sighted in some of these areas during sampling activities.

Relatively flat floodplain forest areas may hold some opportunity for wetland development or mitigation efforts, since the hydrophytic vegetation criterion is already met at these sites, and the floodplain often slopes slightly away from the streambank. All that is needed to develop or expand wetlands at some of these sites is the addition of sufficient hydrology. For example, weirs might be utilized to expand the backwater intrusion wetlands on lower EFPC. Also the wooded area adjacent to Robertsville Jr. High School would develop into a forested wetland if the drainage were blocked to make the area wetter, and is ideally located for an environmental demonstration/education area. Finally, the wetlands in the floodplain off South Illinois Avenue and the floodplain across from Bruner's could be expanded to occupy the full floodplain through use of a weir or drainage restriction. However, it might not be desirable to develop wetlands in these areas due to contamination levels, and there are a myriad of other considerations in any wetland development project.

ACKNOWLEDGMENTS

The Corps of Engineers, Nashville District gratefully acknowledges

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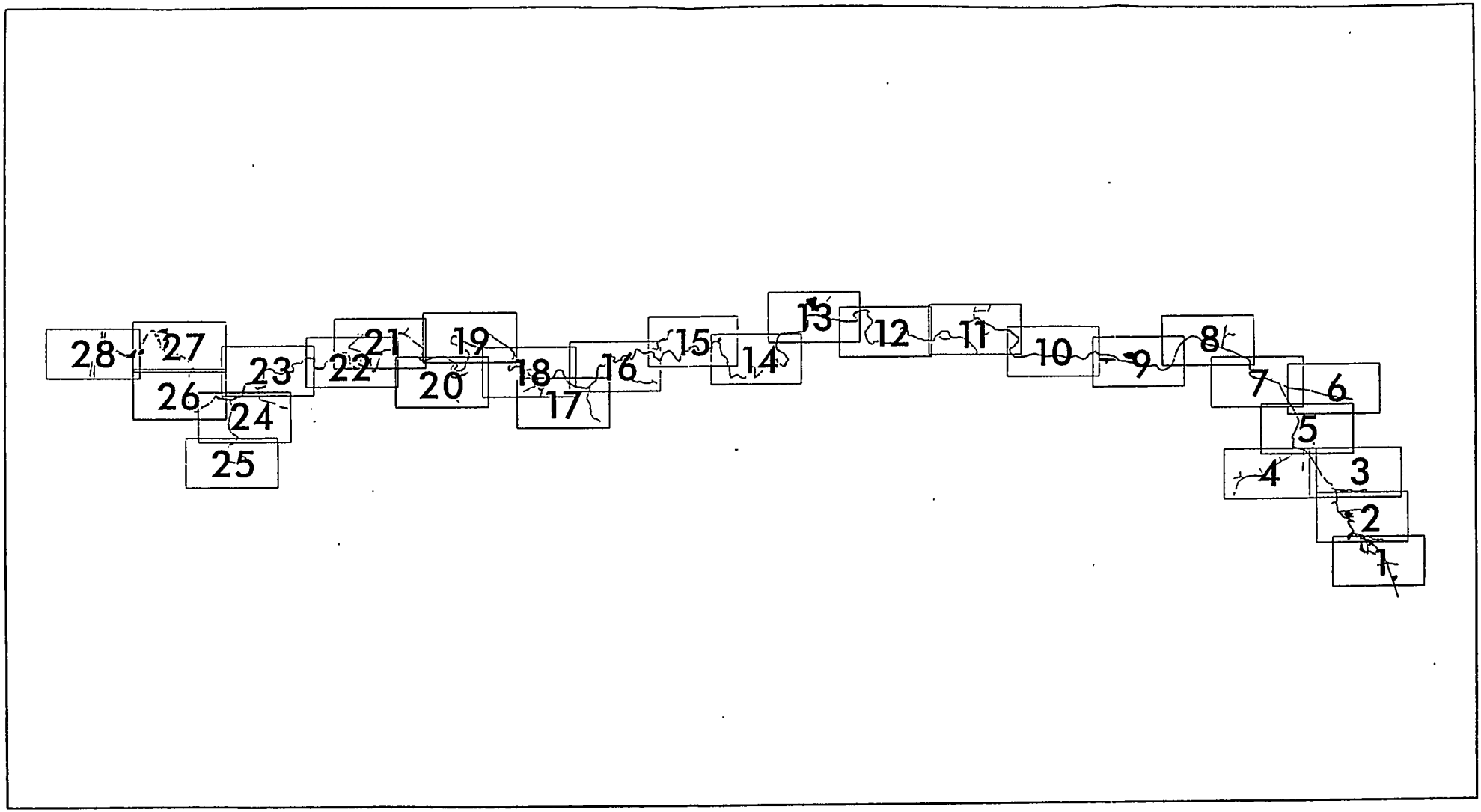
APPENDIX 1

WETLAND MAPS



EAST FORK POPLAR CREEK

LEGEND

Wetland Area

100' 0 100'

TITLE

East Fork Poplar Creek
Wetland Areas
Index

US Army Corps
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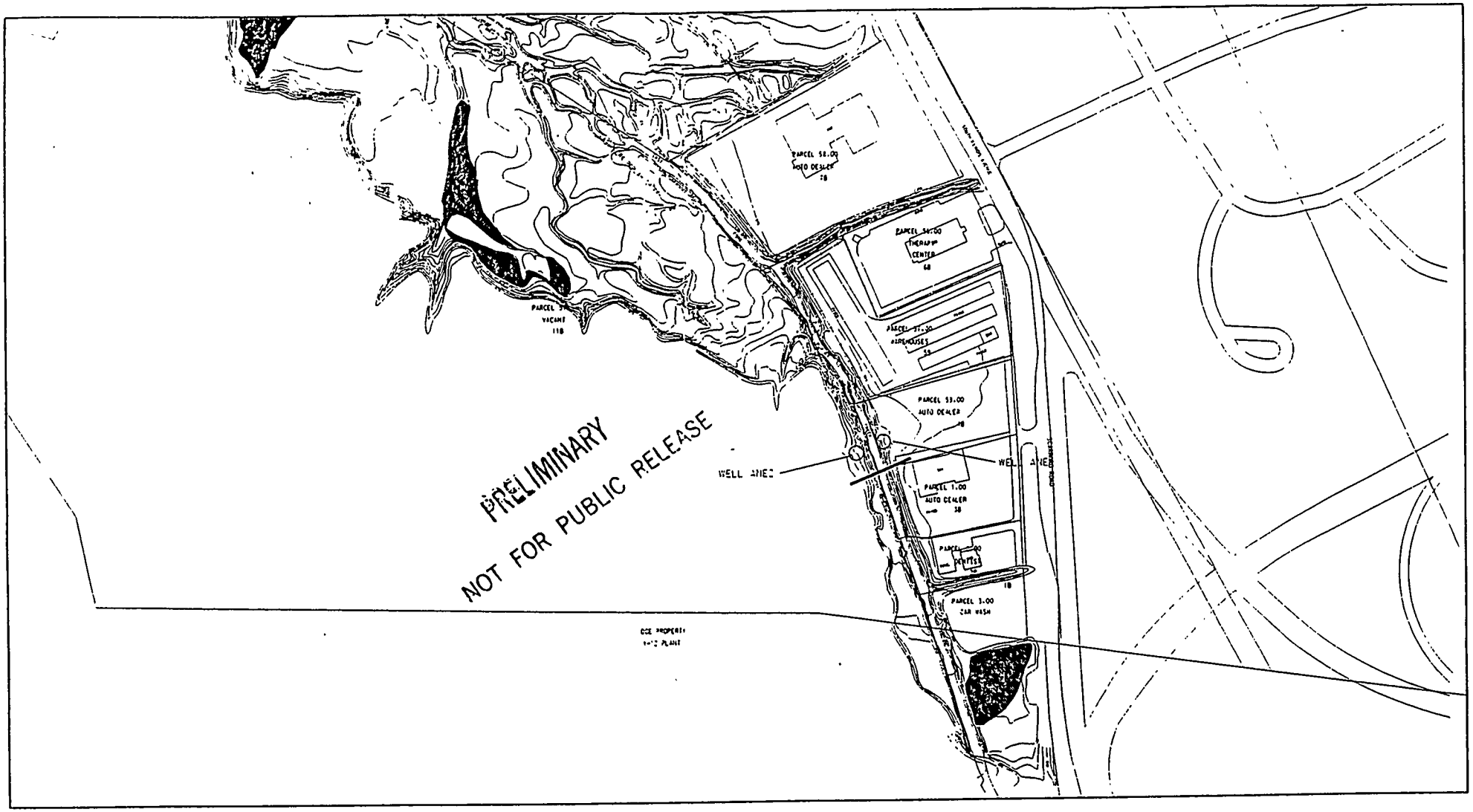
Nashville District



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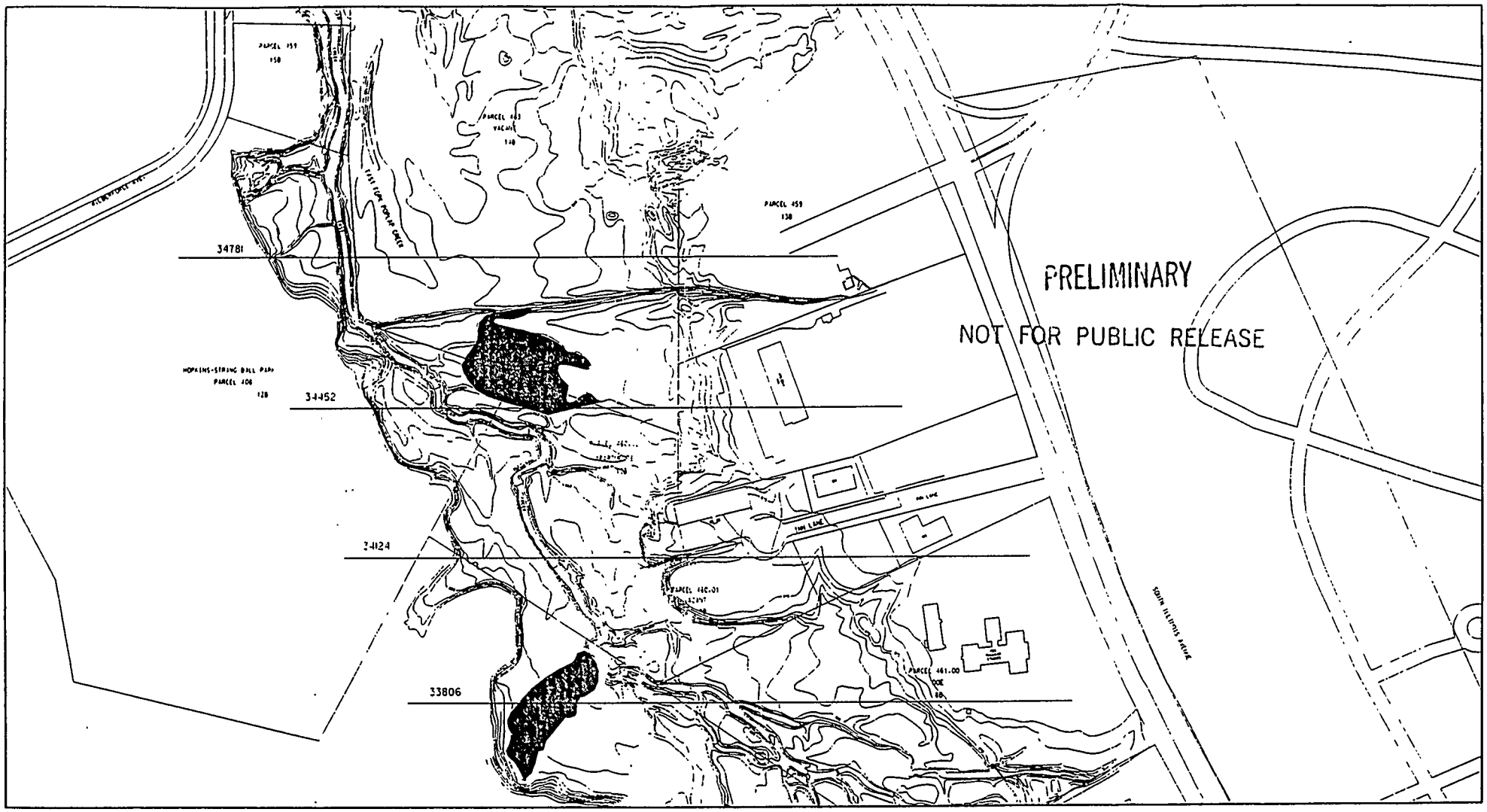

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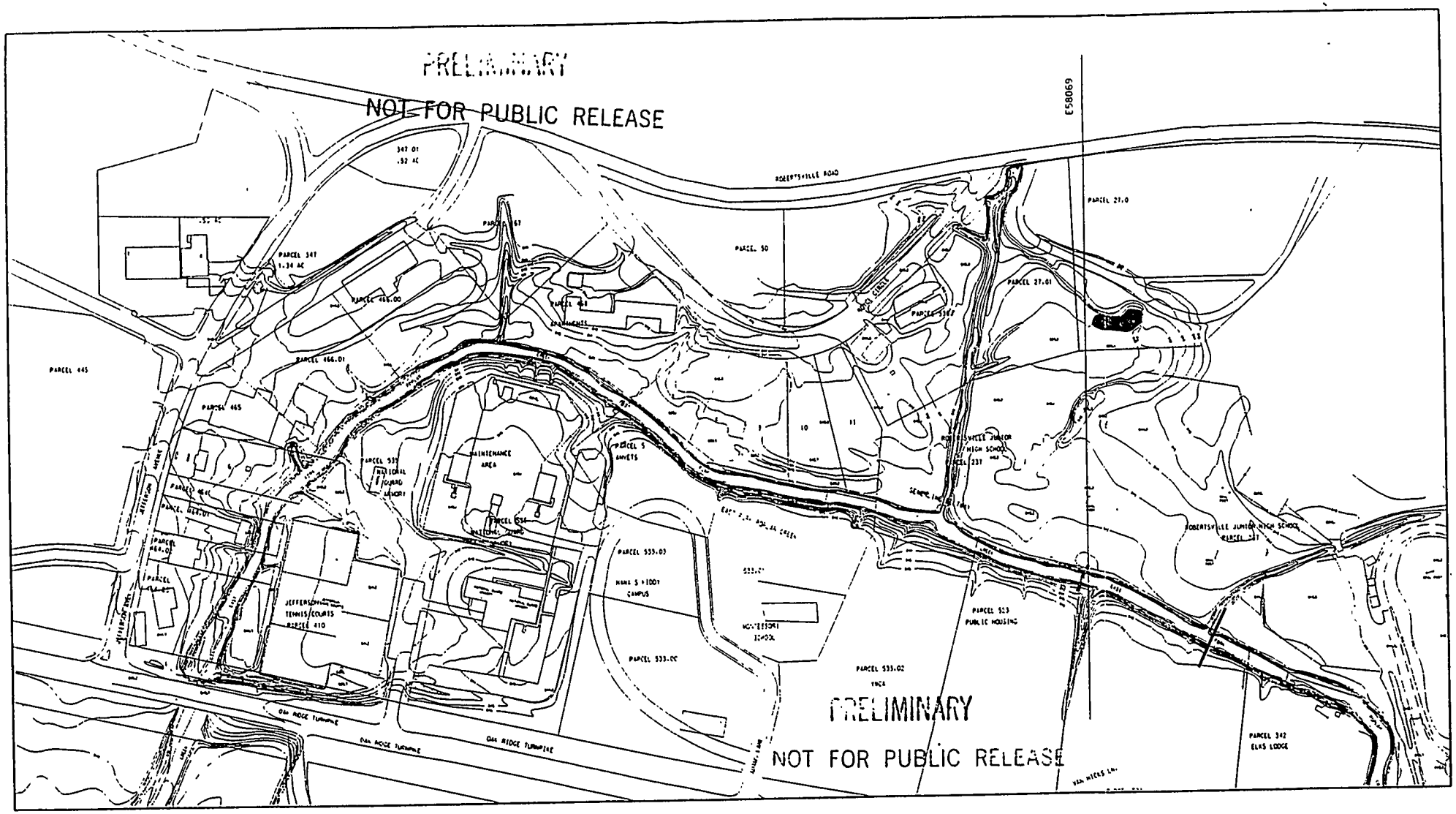

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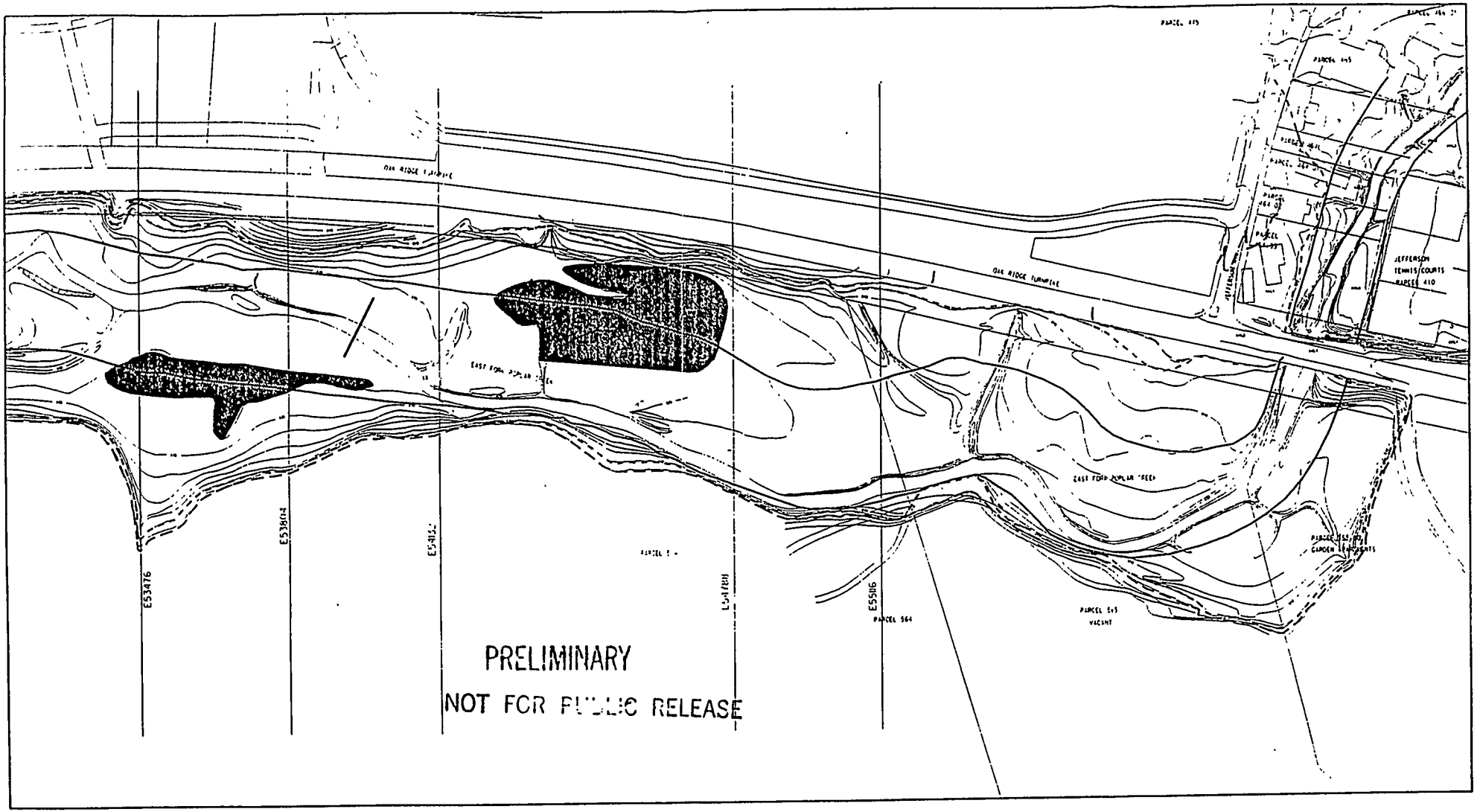

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EAST FORK POPLAR CREEK

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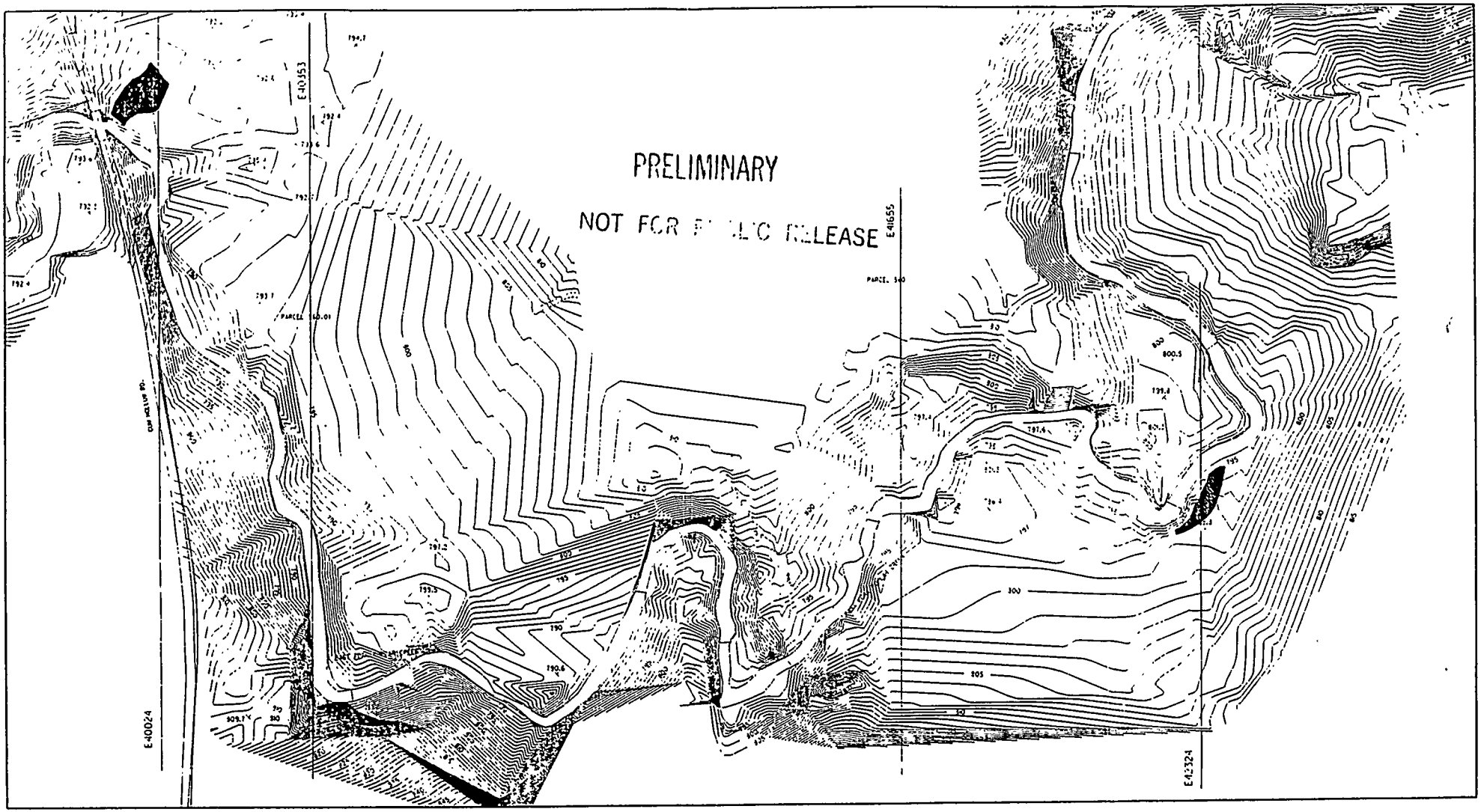

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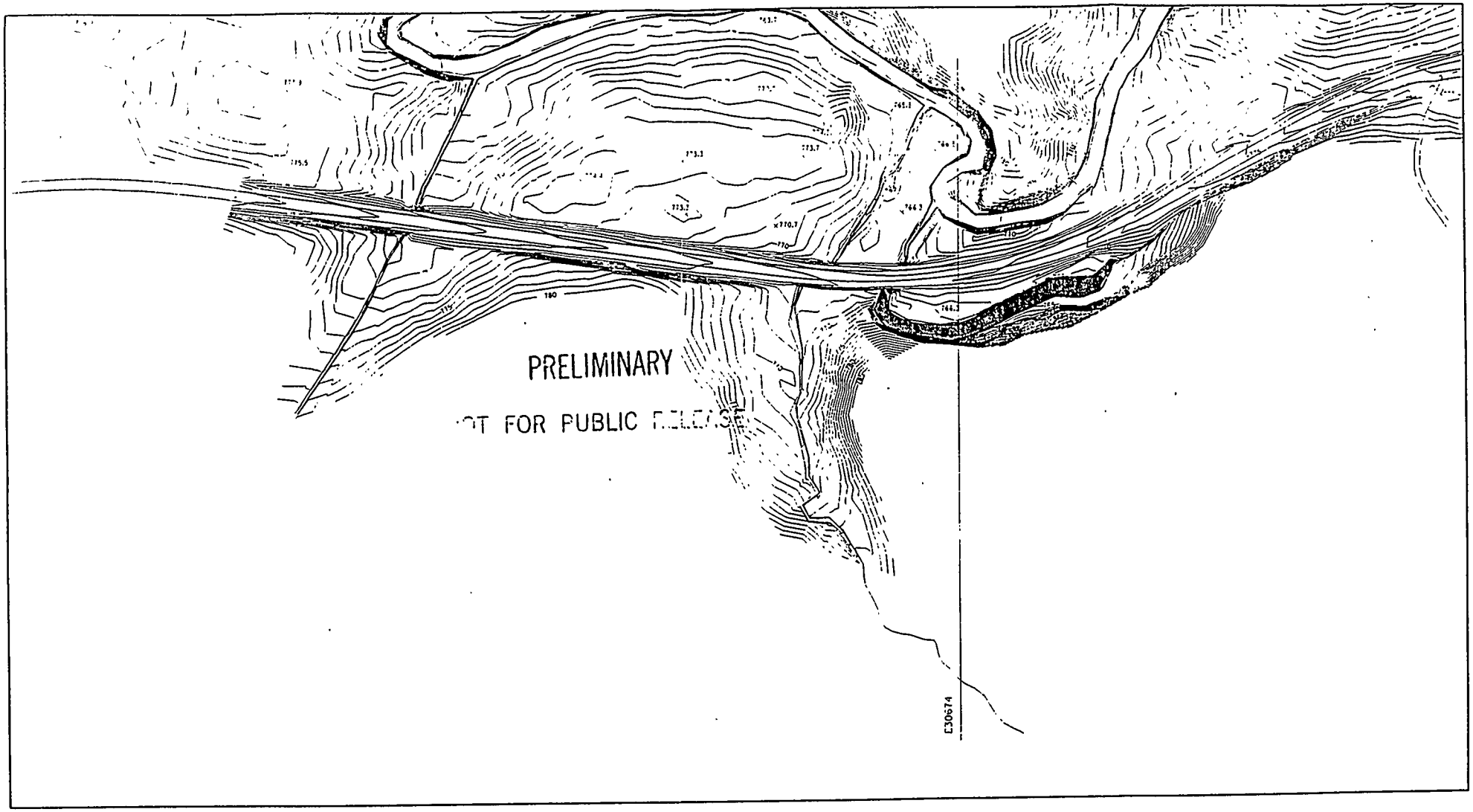

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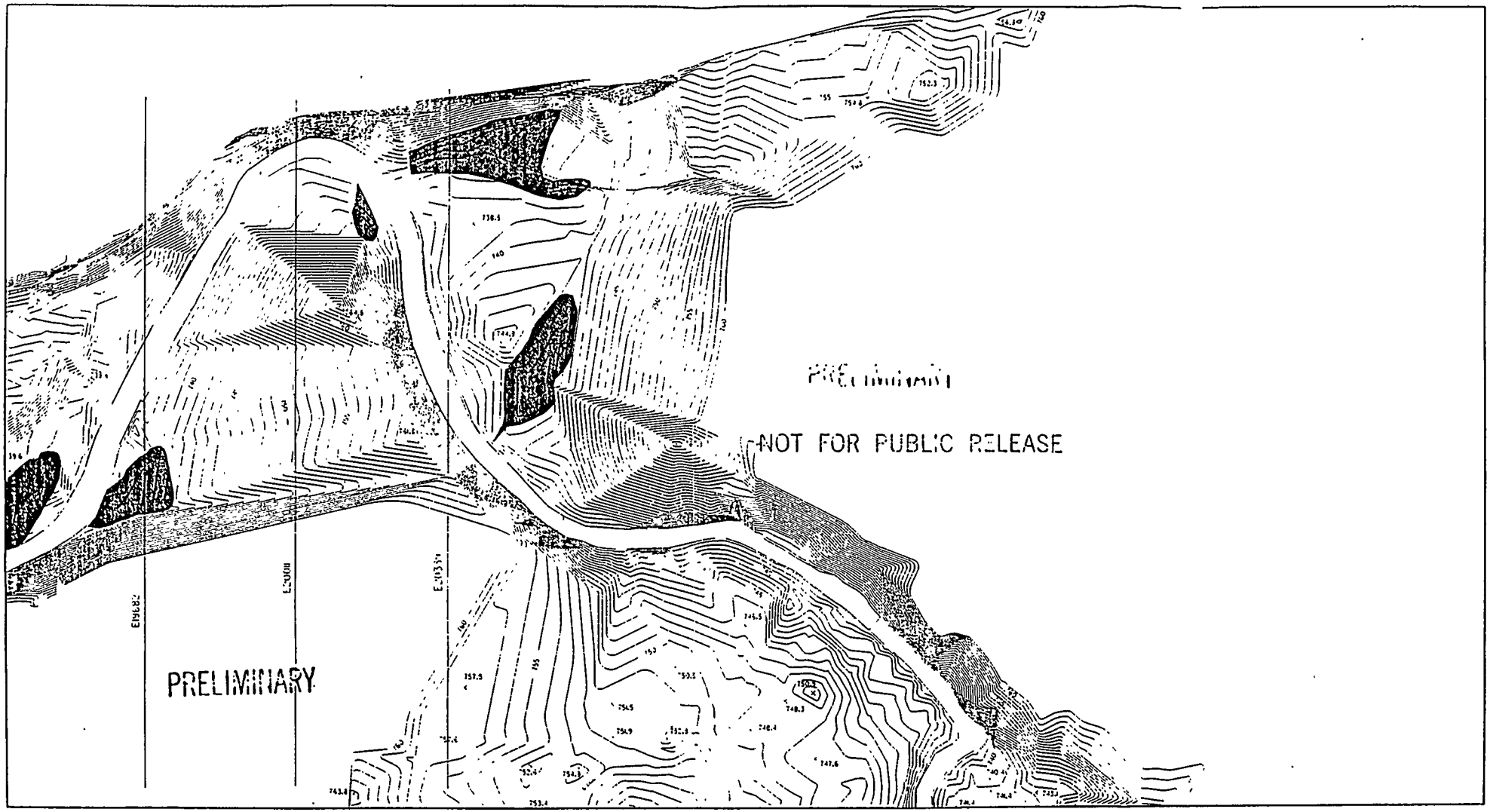

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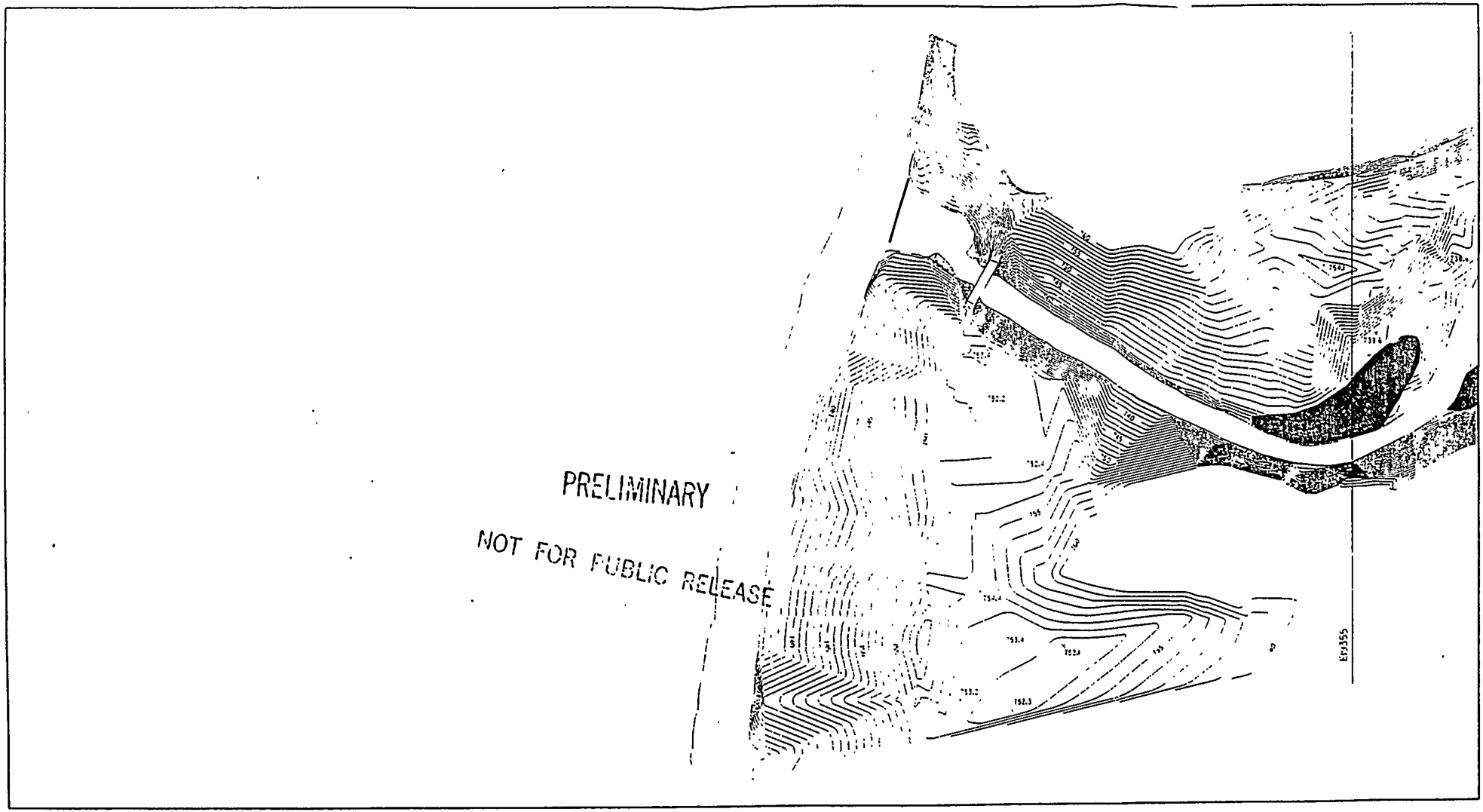

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APPENDIX 2

GLOSSARY OF WETLAND TERMS

Source: Federal Interagency Committee For Wetland Delineation. 1989. Federal manual for identifying and delineating jurisdictional wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington, D.C. Cooperative technical publication. 76 pp. plus appendices.

Glossary

Adaptation - The condition of showing fitness for a particular environment, as applied to characteristics of a structure, function, or entire organism; a modification of a species that makes it more fit for reproduction and/or existence under the conditions of its environment.

Adventitious roots - Roots found on plant stems in positions where roots normally do not occur.

Aerenchymous tissue (Aerenchyma) - A type of plant tissue in which cells are unusually large, resulting in large air spaces in the plant organ; such tissues are often referred to as spongy and usually provide increased buoyancy.

Aerobic - A condition in which molecular oxygen is a part of the environment.

Alfisols - Soils having significantly more clay in the B-horizon than in the A-horizon and high base status.

Anaerobic - A condition in which molecular oxygen is absent (or effectively so) from the environment.

Annual - Occurring yearly or, as in annual plants, living for only one year.

Aqualfs - Soils with an aquic or peraquic moisture regime and having clay accumulating in the B-horizon; wet Alfisols.

Aquents - Soils with an aquic or peraquic moisture regime and lacking distinct soil horizons in the subsoil; wet Entisols.

Aquepts - Soils with an aquic moisture regime and showing some soil development in the B-horizon; wet Inceptisols.

Aquic moisture regime - A moisture condition associated with a seasonal reducing environment that is virtually free of dissolved oxygen because the soil is saturated by ground water or by water of the capillary fringe, as in soils in Aquic suborders and Aquic subgroups.

Aquods - Soils having an accumulation of iron, aluminum, and organic matter in the B-horizon in addition to having an aquic moisture regime; wet Spodosols.

Areal cover - A measure of dominance that defines the degree to which above ground portions of plants cover the ground surface; it is possible for the total areal cover for all strata combined in a community or for single stratum to exceed 100 percent because: 1) most plant communities consist of two or more vegetative strata; 2) areal cover is estimated by vegetative layer; and 3) foliage within a single layer may overlap.

Disturbed condition - As used herein, this term refers to areas in which indicators of one or more characteristics (vegetation, soil, and/or hydrology) have been sufficiently altered by man's activities or natural events so as to make it more difficult to recognize whether or not the wetland identification criteria are met.
Artificial wetlands - Wetlands created by the activities of man, either purposefully or accidentally.

Basal area - The cross-sectional area of a tree trunk measured in square inches, square centimeters, etc.; basal area is normally measured at 4.5 feet above ground level and is used as a measure of dominance; the most commonly used tool for measuring basal area is a diameter tape or a D-tape (then convert to basal area).

Criteria - Technical requirements upon which a judgment or decision may be based.

Deepwater habitat - Any open water area in which the mean water depth exceeds 6.6 feet at mean low water in nontidal and freshwater tidal areas, or is below extreme low water at spring tides in salt and brackish tidal areas, or the maximum depth of emerging vegetation, whichever is greater.

Density - The number of individuals per unit area.

Detritus - Fragments of plant parts found on the soil surface or in water; when fused together by algae or soil particles, this detritus is an indicator that the soil surface was recently inundated.

Diameter at breast height (dbh) - The width of a plant stem (e.g., tree trunk) as measured at 4.5 feet above the ground surface.

Dike - An embankment (usually of earth) constructed to keep water in or out of a given area.

Disturbed area - An area where vegetation, soil, and/or hydrology have been significantly altered, thereby making a wetland determination difficult.

Dominance - As used herein, refers to the spatial extent of a species; commonly the most abundant species in each vegetation stratum that, when ranked in descending order of abundance and cumulatively totaled, immediately exceeds 50 percent of the total dominance measure (e.g., areal cover or basal area) for the stratum, plus any additional species comprising 20 percent or more of the total dominance measure for the stratum.

Dominance measure - The means or method by which dominance is established, including areal coverage and basal area; the total dominance measure is the sum total of the dominance measure values for all species comprising a given stratum.

Dominance threshold number - The number at which 50 percent of the total dominance measure for a given stratum is represented by one or more plant species when ranked in descending order of abundance (i.e., from most to least abundant); when this number is immediately exceeded, the dominant species for the stratum are realized.

Dominant species - For each stratum, dominant species are those that, when ranked in descending rank order and cumulatively totaled, immediately exceed 50 percent of the total dominance measure (i.e., the dominance threshold number), plus any additional species comprising 20 percent or more of the total dominance measure for the stratum.

Drained, effectively - A condition where ground or surface water has been removed by artificial means to the point that an area no longer meets the wetland hydrology criterion.

Drift line - An accumulation of water-carried debris along a contour or at the base of vegetation that provides direct evidence of prior inundation and often indicates the directional flow of flood waters.

Duff - The matted, partly decomposed, organic surface layer of forested soils.

Duration (of inundation or soil saturation) - The length of time that water stands above the soil surface (inundation), or that water fills most soil pores near the soil surface; as used herein, "duration" refers to a period during the growing season.

Entisols - Soils of slight or recent development; common along rivers and floodplains.

Growing season - The portion of the year when soil temperatures are above biologic zero (41° F) as defined by "Soil Taxonomy;" the following growing season months are assumed for each of the soil temperature regimes: (1) thermic (February-October); (2) mesic (March-October); (3) frigid (May-September); (4) cryic (June-August); (5) pergelic (July-August); (6) isohyperthermic (January-December); (7) hyperthermic (February-December), (8) isothermic (January-December) and (9) isomesic (January-December).

Hardpan - A very dense soil layer caused by compaction or cementation of soil particles by organic matter, silica, sesquioxides, or calcium carbonate, for example.

Hemists - Organic soils (mucky peats and peaty mucks) in which plant remains show a fair amount of decomposition; between one-third and two-thirds of the fibers are still visible upon rubbing the material between the fingers.

Herb - Nonwoody (herbaceous) plants including graminoids (grass and grasslike plants), forbs, ferns, fern allies, and nonwoody vines; for the purposes of this manual, seedlings of woody plants that are less than three feet in height are also considered herbs.

Herb stratum - Any vegetative layer of a plant community that is composed predominantly of herbs.

Histic epipedon - A 8- to 16-inch soil layer at or near the surface that is saturated for 30 consecutive days or more during the growing season in most years and contains a minimum of 20 percent organic matter when no clay is present or a minimum of 30 percent of organic matter when 60 percent or more clay is present; generally a thin horizon of peat or muck if the soil has not been plowed.

Histosols - An order in "Soil Taxonomy" (Soil Survey Staff 1975) composed of organic soils (mucks and peats) that have organic soil materials in more than half of the upper 32 inches or that are of any thickness if overlying rock.

Horizon - A distinct layer of soil, more or less parallel with the soil surface, having similar properties such as color, texture, and permeability; the soil profile is subdivided into the following major horizons: A-horizon, characterized by an accumulation of organic material; B-horizon, characterized by relative accumulation of clay, iron, organic matter, or aluminum; and the C-horizon, the undisturbed and unaltered parent material. (*Note*: Some soils have an E-horizon, characterized by leaching of organic and other material.)

Hue - A characteristic of color related to one of the main spectral colors (red, yellow, green, blue, or purple), or various combinations of these principle colors; one of the three variables of color; each color chart in the Munsell Soil Color Charts (Kollmorgen Corporation 1975) represents a specific hue.

Hydric soil - A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrology - The science dealing with the properties, distribution, and circulation of water.

Hydrophyte - Any macrophyte that grows in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; plants typically found in wetlands and other aquatic habitats.

Hydrophytic vegetation - Plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Hypertrophied lenticels - An exaggerated (oversized) pore on the stem of woody plants through which gases are exchanged between the plant and the atmosphere; serving to increase oxygen to plant roots during periods of inundation or soil saturation.

Nonwetland - Any area that has sufficiently dry conditions that hydrophytic vegetation, hydric soils, and/ or wetland hydrology are lacking; it includes upland as well as former wetlands that are effectively drained.

Normal circumstances - Refers to the soil and hydrology conditions that are normally present, without regard to whether the vegetation has been removed.

Obligate wetland species - A plant species that is nearly always found in wetlands; its frequency of occurrence in wetlands is 99% or more.

Offsite determination method - A technique for making a wetland determination in the office.

Onsite determination method - A technique for making a wetland determination in the field.

Organic soil - See Histosols.

Overbank flooding - Any situation in which inundation occurs as a result of the water level of a river or stream rising above bank level.

Oxidation-reduction process - A complex of biochemical reactions in soil that influences the valence state of elements and their ions found in the soil; long periods of soil saturation during the growing season tend to elicit anaerobic conditions that shift the overall process to a reducing condition.

Oxidized rhizospheres - Oxidized channels and soil surrounding living roots and rhizomes of hydrophytic plants.

Parent material - The unconsolidated and more or less weathered mineral or organic matter from which the soil profile is developed.

Pedogenic - Related to soil-building processes occurring within the soil.

Peraquic moisture regime - A soil condition in which reducing conditions always occur due to the presence of ground water at or near the soil surface.

Perennial (plant) - Living for many years.

Periodically - Used herein, to define detectable regular or irregular saturated soil conditions or inundation, resulting from ponding of ground water, precipitation, overland flow, stream flooding, or tidal influences that occur(s) with hours, days, weeks, months, or even years between events.

Permanently flooded - A water regime condition where standing water covers the land surface throughout the year (but may be absent during extreme droughts).

Permeability - The quality of the soil that enables water to move downward through the profile, measured as the number of inches per hour that water moves downward through the saturated soil.

Phase, soil - A subdivision of a series based on features such as slope, surface texture, stoniness, and thickness.

Physiological adaptation - A peculiarity of the basic physical and chemical activities that occur in cells and tissues of a species, which results in it being better fitted to its environment (e.g., ability to absorb nutrients under low oxygen tensions).

Plant community - The plant populations existing in a shared habitat or environment.

Sample plot - As used herein, an observation point at which a wetland determination is made.

Sapling - Woody vegetation between 0.4 and 5.0 inches in diameter at breast height and greater than or equal to 20 feet in height, exclusive of woody vines.

Saprists - Organic soils (mucks) in which most of the plant material is decomposed and the original constituents cannot be recognized; less than one-third of the fibers remain visible upon rubbing the material between the fingers.

Saturated - A condition in which all easily drained voids (pores) between soil particles are temporarily or permanently filled with water; significant saturation during the growing season is considered to be usually one week or more.

Seedling - A young tree that is generally less than 3 feet high.

Shrub - Woody vegetation usually greater than 3 feet but less than 20 feet tall, including multi-stemmed, bushy shrubs and small trees and saplings. (*Note*: Woody seedlings less than 3 feet tall are considered part of the herbaceous layer.)

Soil - Unconsolidated material on the earth's surface that supports or is capable of supporting plants out-of-doors.

Soil horizon - A layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical, and biological properties or characteristics (e.g., color, structure, and texture).

Soil matrix - The portion of a given soil having the dominant color; in most cases, the matrix will be the portion of the soil having more than 50 percent of the same color.

Soil permeability - The ease with which gases, liquids, or plant roots penetrate or pass through a layer of soil.

Soil phase - A subdivision of a soil series having features (e.g., slope, surface texture, and stoniness) that affect the use and management of the soil, but which do not vary sufficiently to differentiate it as a separate series.

Soil pore - An area within soil occupied by either air or water, resulting from the arrangement of individual soil particles or peds.

Soil profile - A vertical section of the soil through all its horizons and extending into the parent material.

Soil series - A group of soils having horizons similar in differentiating characteristics and arrangements in the soil profile, except for texture of the surface layer.

Soil structure - The combination or arrangement of primary soil particles into secondary particles, units, or peds.

Soil surface - The upper limits of the soil profile; for mineral soils, the upper limits of the highest mineral horizon (A-horizon); for organic soils, the upper limit of undecomposed organic matter.

Soil texture - The relative proportions of the various sizes of particles (silt, sand and clay) in a soil.

Somewhat poorly drained - A condition in which water is removed slowly enough that the soil is wet for significant periods during the growing season.

Vegetation unit - A patch, grouping, or zone of plants evident in overall plant cover, which appears distinct from other such units because of the vegetation's structure and floristic composition; a given unit is typically topographically distinct and typically has a rather uniform soil, except possibly for relatively dry microsites (e.g., tree bases, old tree stumps, mosquito ditch spoil piles, and small earth hummocks) in an otherwise wet area or relatively wet microsites (e.g., small depressions) in an otherwise dry area.

Very long duration (flooding) - A duration class in which inundation for a single event is greater than 1 month.

Vertisols - Shrinking and swelling dark clay soils; most common in Texas.

Very poorly drained - A condition in which water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season.

Water mark - A line on vegetation or other upright structures that represents the maximum height reached in an inundation event.

Water table - The zone of saturation at the highest average depth during the wettest season; it is at least six inches thick and persists in the soil for more than a few weeks.

Wetlands - As used herein, areas that under normal circumstances have hydrophytic vegetation, hydric soils, and wetland hydrology.

Wetland boundary - The point on the ground at which a shift from wetlands to nonwetlands occurs.

Wetland determination - The process by which an area is identified as a wetland or nonwetland.

Wetland hydrology - In general terms, permanent or periodic inundation or prolonged soil saturation sufficient to create anaerobic conditions in the soil.

Wetland indicator status - The exclusiveness with which a plant species occurs in wetlands; the different indicator categories (i.e., facultative species, and obligate wetland species) are defined elsewhere in this glossary.

Wooded swamp - A wetland dominated by trees; a forested wetland.

Zone of influence - The area contiguous to a ditch, channel, or other drainage structure that is directly affected by it.

APPENDIX 3

FIELD DATA FORMS

1

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton et. al. Date: 10/22/91, 2/20/92
Project/Site: EFPC below Y-12 State: IN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: See back
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back) but Cutover > 25 years ago
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back) hydrology affected by road, levee.

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Green Ash	FACW	T	11.		
2. 25% Sycamore	FACW-	T	12.		
3. 80 Alder	FACW	Sh	13.		
4. 85 Purple Grass?	?	h	14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC ≥ 75%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: At least 75% of dominant species are FACW- or wetter

SOILS

Series/phase: Newark Subgroup:[2] Fine-silty, mixed, mesic Aeric Fluvaquents (Ponded)
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: See Back. Mottle Colors: ____
Other hydric soil indicators: aquic Moisture regime.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Matrix Color indicator and aquic moisture regime are present.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: < 2" 20 Feb. 92
List other field evidence of surface inundation or soil saturation.
Subtle water stains, soil saturation both visits
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Saturation observed even during dry portion of the year

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

(2)

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton Date: 10/22/92, 2/20/92
Project/Site: EFDC below Y-12 State: In County: Anderson
Applicant: DOE Plant Community #/Name: Scrub shrub. See back
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ____ No ✓ (If no, explain on back) Previously cleared.
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back) old fills have affected hydrology.

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Black Willow	OBL	Sap	11.		
2. 20 Sycamore	FACW-	Sap	12.		
3. 40 Alder (Alnus)	FACW	Sh	13.		
4. 30 Green Ash	FACW	Sh	14.		
5. 20 Black Willow	OBL	Sh	15.		
6. 50 Aster P.	FAC-	h	16.		
7. 30 Leersia V.	FACW	h	17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 86%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of dominants are FACW or wetter.

SOILS

Series/phase: Newark Subgroup:[2] See sheet 1
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ (ponded)
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ____
Matrix Color: See back Mottle Colors: See back
Other hydric soil indicators: aquic moisture regime, oxidized root channels.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Newark is hydric when aquic moisture regime present: coloration and oxidized root channels support hydric determination

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: up to 6"
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: < 3" at highest elevations (2/20/92)
List other field evidence of surface inundation or soil saturation.
Direct observation wet/inundated through April and in October.
Is the wetland hydrology criterion met? Yes ✓ No ____ Sulphur smell.
Rationale: Observed long term saturation/inundation. Sulphur smell in turned soil.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All 3 criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

(3)

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton et. al. Date: 10/22/91 2/20/92
Project/Site: EFPC see back State: IN County: Anderson
Applicant/[redacted]: DOE Plant Community #/Name: Perched Emergent Wetland.
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Fill has been removed - topog drastically modified.
Yes ____ No ✓ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Juncus effusus	FACW+	h	11.		
2. 20 Typha latifolia	OBL	h	12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 100% of dominant species are FACW+ or OBL.

SOILS Thin soil layer. 2"-3" to parent material.

Series/phase: N/A - Developing Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ✓ Undetermined ____
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ____
Matrix Color: 10R 4/2 Mottle Colors:
Other hydric soil indicators: Sulphur smell.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Limited soil at site displays reducing characteristics. Indicators seem reasonable for newly created wetland.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: to 3"
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: N/A
List other field evidence of surface inundation or soil saturation.
Constant flow of groundwater across area.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Constant flow across area observed over long term.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: Newly created wetland. Strong indicators for hydrology and vegetation. Indicators for soil seem reasonable.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

B-2 * Small artificial perched wetland. May not be in Flood plain.

(4)

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, Cross, et al Date: 10/22/91, 2/20/92
Project/Site: EFPC below Y-12 - see back State: IN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back) but oil sheen on creek water.
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back) but cutover in past.

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 30% Boxelder	FACW	I	11.		
2. 30% Sycamore	FACW-	I	12.		
3. 30 Green Ash	FACW	I	13.		
4. 90 Purple Grass	?	h	14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 75%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of dominant species are FAC or wetter

SOILS

Series/phase: Newark Subgroup:[2] See sheet 1.
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ (ponded)
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: NONE
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: NO hydric soil indicators observed 2/20/92

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.
Crayfish mounds near channel.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: No inundation, saturation for any length of time even during wet period.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton, et. al. Date: 10/22/91, 3/20/92
Project/Site: EFPC. Transect N-33468 State: Tn County: Anderson
Applicant/~~Owner~~: DOE Plant Community #/Name: NWI Mapped PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 20 Sycamore	FACW-	T	11.		
2. 40 Boxelder	FACW	Sap	12.		
3. 40 Ironwood	FAC	Sap	13.		
4. 60 Boxelder	FACW	Shrub	14.		
5. 20 White Grass?	?	H	15.		
6. 20 Dioscorea	NL	H	16.		
7. batatus			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC ≥ 66%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of dominant species FAC or better.

SOILS

Series/phase: Newark Subgroup:[2] See sheet 1
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ (ponded)
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No hydric soil indicators observed

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: None apparent.
List other field evidence of surface inundation or soil saturation. Crayfish mounds, braided channels shallow roots.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Despite low-lying appearance, area is well drained.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick Cross, Grotal et al. Date: 10/22/91, 2/20/92
Project/Site: EFPC-N-3346B - See back State: TN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: NWI - PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Swamp Chestnut Oak	FACW-	T	11.		
2. 35 Sweetgum	FAC+	T	12.		
3. 40 Carpinus	FAC	Sap	13.		
4. 35 Sweetgum	FAC+	Sap	14.		
5. 30 Spicebush	FACW	Sh	15.		
6. 10 Green Ash	FACW	Sh	16.		
7. 70 White Grass	?	h	17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC ≥ 86%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: Greater than 50% of dominants FAC or better.

SOILS

Series/phase: Newark Subgroup:[2] See sheet 1
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ (ponded)
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ____
Matrix Color: See back Mottle Colors: See back.
Other hydric soil indicators: Aquic moisture regime
Is the hydric soil criterion met? Yes ✓ No ____
Rationale:

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth:
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: 5" in Feb., < 2" in late April
List other field evidence of surface inundation or soil saturation.
Grayish mounds, braided drainage. Soil saturation observed.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Soil saturation was observed for sufficient duration during the growing season.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton et.al. Date: 10/22/91, 3/20/92
Project/Site: EFPC - N 33606 ; W-02 State: TN County: Anderson
Applicant/[redacted]: DOE Plant Community #/Name: AWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Sycamore	FACW-	T	11. 40 Dioscorea batatus	NL	h
2. 30 Swamp Chest. Oak	FACW-	T	12. 20 White Grass	?	h
3. 15 Buckeye	FAC	SAP	13.		
4. 15 Swamp Chest Oak	FACW-	SAP	14.		
5. 15 Sweetgum	FAC+	SAP	15.		
6. 10 Y. Poplar	FAC	SAP	16.		
7. 15 Spice Bush	FACW	sh	17.		
8. 15 Pawpaw	FAC	sh	18.		
9. 10 Giant Cane	FACW	sh	19.		
10. 5 Euonymus	FAC-	sh	20.		

Percent of dominant species that are OBL, FACW, and/or FAC ≥ 75%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of dominant species FAC or wetter

SOILS

Series/phase: Newark Subgroup:[2]
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ (ponded)
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No hydric indicators.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.
Crayfish mounds, braided drainage
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Subsequent observations during wet period (3/20, 4/22) revealed that hydrology probably not present.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, Cross, et al. Date: 2/20/92
Project/Site: N33806:W-12, near well AN-D4 State: TN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: NWI PFO'G
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 45% Sycamore	FACW-	T	11.		
2. 40 Sweetgum	FAC+	T	12.		
3. 60 Box Elder	FACW	S	13.		
4. 20 red maple	FAC	S	14.		
5. 50 Spice bush	FACW	Sh	15.		
6. 20% Green Ash	FACW	Sh	16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: All the dominants are FAC or wetter.

SOILS

Series/phase: Newark Subgroup:[2] ____
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ if ponded.
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ____
Matrix Color: See back Mottle Colors: ____
Other hydric soil indicators: Aquic moisture regime.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Chroma of 2 with mottles. Aquic moisture regime in Newark soil.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: to 2" deep
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: <1"
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Aquic moisture regime and inundation observed over long term

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross Grotod et al Date: 10/22/91, 2/20/92
Project/Site: FFPU N 34 1/2:4 : E-00 State: IN County: Anderson
Applicant/[redacted]: DOE Plant Community #/Name: NWF PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 60% Green Ash	FACW	T	11.		
2. 20 Sugar Maple	FACU	T	12.		
3. 20 Sycamore	FACW-	T	13.		
4. 80 Sugar Maple	FACU-	Sap	14.		
5. 60 Sugar Maple	FACU-	Sh	15.		
6. 20 Paw Paw	FAC	Sh	16.		
7. 90 Dioscorea b.	NL	H	17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 50% w/o herb layer
Is the hydrophytic vegetation criterion met? Yes ____ No ✓
Rationale: No indicator available for dominant species in herb layer. Only 50% FAC or wetter in remaining layer.

SOILS

Series/phase: Newark Subgroup:[2]
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: No indicators observed.
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No hydric soil indicators were observed.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.
Crayfish Mounds, shallow roots. Braided drainage.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: No inundation or saturation during wet spring period.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met. Vegetation is at best borderline.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

4/24/92

Field Investigator(s): Hedrick, Groton, Cross et al Date: 10/29/91, 2/20/92
Project/Site: EFPC N34452 : E06 State: TN County: Anderson
Applicant/Owner: [redacted] Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 70% Green Ash	FACW	T	11.		
2. 20 Sweetgum	FAC+	T	12.		
3. 50 G. Ash	FACW	SAP	13.		
4. 20 Boxelder	FACW	SAP	14.		
5. 20 Sweetgum	FAC+	SAP	15.		
6. 30 Ligustrum	NI	Sh	16.		
7. 30 Lonicera jap	FAC-	Sh	17.		
8. 60 White Gr. (Panicum)	?	H	18.		
9. 20 Aster pilosis	FAC-	H	19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 55
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: >50% of dominant species are FAC or wetter.

SOILS

Series/phase: Newark Subgroup:[2] See page 1.
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ (ponded)
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: Aquic moisture regime.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Aquic Moisture regime (Fluvaquent) present 2/20 – 4/24. Fluvaquents are hydric when aquic Moisture regime present.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: 2/20, 4/24.
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: < 2" 2/20 & 4/24
List other field evidence of surface inundation or soil saturation.
Crayfish mounds, braided channels, shallow roots.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Directly observed during normal spring.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria present.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton et al Date: 10/22/91, 2/20/92, 3/20/92
Project/Site: EFPL N 34781 E-00 State: IN County: Anderson
Applicant/Owner: DOE Plant Community s/Name: NWIE PEOIA
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Green Ash	FACW	T	11.		
2. 30 Sycamore	FACW-	T	12.		
3. 30 Box elder	FACW	Sap	13.		
4. 30 G. Ash	FACW	Sap	14.		
5. 20 Buckeye		Sap	15.		
6. 20 Spice Bush	FACW	Sh	16.		
7. 10 Privet	NI	Sh	17.		
8. 60 Purple Grass	?	H	18.		
9. 30 Dioscorea bat	AL	H	19.		
10. 50 Horse tail	FAC	H	20.		

Percent of dominant species that are OBL, FACW, and/or FAC ≥ 75
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 75% or more of dominant species are FAC or wetter.

SOILS

Series/phase: Newark Subgroup:[2]
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ ponded
Is the soil a Histosol? Yes ____ No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: Mottle Colors:
Other hydric soil indicators:
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No hydric indicators or aquic moisture regime observed.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth:
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole:
List other field evidence of surface inundation or soil saturation. Crayfish mounds. Reports of flooding during growing season
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Obviously floods, but duration too short to meet hydrology criterion.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton et. al Date: 10/22/91, 2/20/92, 3/20/92
Project/Site: EFPC - See Back State: IN County: Anderson
Applicant/Owner: DOE Plant Community s/Name: AWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 50% Green Ash	FACW	T	11.		
2. 20 Boxelder	FACW	T	12.		
3. 20 Hackberry	FACW	T	13.		
4. 20 Boxelder	FACW	SAP	14.		
5. 20 Hackberry	FACW	SAP	15.		
6. 10 Privet	NI	SH	16.		
7. 60 Glechoma h.	FACU	H	17.		
8. 50 Lysimachia num.	FACW+	H	18.		
9. 20 Aster pilosus	FAC-	H	19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 87.5 (75% FACW)
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of dominants are FAC or wetter.

SOILS

Series/phase: Hamblen Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ✓ Undetermined ____
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: None
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: could see no hydric soil indicators.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: Only during February visit
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation. Water marks, Crayfish mounds.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Soil is moist but not inundated or saturated for sufficient duration during the growing season.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Hydrology and soil criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1] 5/20/92

Field Investigator(s): Hedrick, Cross, Groton et al Date: 2/20/92, 3/20/92
Project/Site: DOE E 58069 : N-16 State: TN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: Small emergent wetland
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? By Robertsville Baptist Church
Yes ____ No ✓ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 20% Willow	OBL	Sh	11.		
2. 10 Button Bush	OBL	Sh	12.		
3. 50 Cyperus sp	OBL	H	13.		
4. 10 Cattail	OBL	H	14.		
5. 10 soft rush	FACW+	H	15.		
6. 20 creeping Jenny	FACW+	H	16.		
7. 20 Jewelweed	FACW	H	17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: All of the dominant species are FACW or OBL.

SOILS

Series/phase: Hamblen Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ✓ Undetermined ____
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: See Data Mottle Colors:
Other hydric soil indicators: oxidized root channels
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: This is a newly created wetland. Based on soil chroma of 1, oxidized root channels and strong indicators for vegetation and hydrology criteria, soil is considered hydric.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: to 8"
Is the soil saturated? Yes ✓ No ____ on margins.
Depth to free-standing water in pit/soil probe hole: 1" on margins
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Surface inundation, saturation appears to be present throughout most of year.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton Date: 10/23/91, 2/20/91
Project/Site: EFPC upstream of Essilix-02 State: TN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ____ No ✓ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 100% Boxelder	FACW	Sap	11.		
2. 70 Gleditsia h.	FACU	h	12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 50
Is the hydrophytic vegetation criterion met? Yes ____ No ✓
Rationale: Percentage of dominants that are FAC or wetter do not exceed 50%.

SOILS

Series/phase: Newark Subgroup:[2]
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ if ponded.
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: Not recorded Mottle Colors:
Other hydric soil indicators: None
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No hydric indicators or moisture regime present.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth:
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole:
List other field evidence of surface inundation or soil saturation. Spiny projections on base of boxelders. Elevations appear favorable for flooding
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Area floods but duration is too short to meet criterion.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Hydric soils and hydrology criteria are not met. Although borderline, vegetation criterion is not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1] 3/20/92, 4/23/92

Field Investigator(s): Hedrick, Cross, Groton et al Date: 10/23/91, 2/20/92
Project/Site: EFPC E5478R: N-08 downstream State: IN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: Mapped PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back) Old road fill and sewer line

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 70% Green Ash	FACW	T	11.		
2. 20 Boxelder	FACW	T	12.		
3. 60 Green Ash	FACW	Sap	13.		
4. 30 Boxelder	FACW	Sap	14.		
5. 60 Glechoma h	FACU	H	15.		
6. 20 Aster pilosus	FAC-	H	16.		
7. 20 Aster ES1	FACW	H	17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 85.7
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of dominant species are FAC or wetter (71% FACW)

SOILS

Series/phase: Nowack Subgroup:[2]
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Colors: ____
Other hydric soil indicators: Much organic matter mixed throughout.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Aquic moisture regime present even though colors are marginal.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ✓ No ____ Feb. thru April.
Depth to free-standing water in pit/soil probe hole: <1"
List other field evidence of surface inundation or soil saturation.
crayfish mounds.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Aquic moisture regime observed 2/20 through 4/23.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are present.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

3/20/92, 4/23/92

Field Investigator(s): Hedrick, Cross, Groton et al Date: 10/23/91, 2/20/91
Project/Site: EFPC E54788: N (downstream) State: IN County: Anderson
Applicant/~~Owner~~: DOE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back) Grazing, sewerline, and road fill for Turnpike

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 45% Green Ash	FACW	T	11.		
2. 25 Box elder	FACW	T	12.		
3. 25 Willow	OBL	T	13.		
4. 25 Box elder	FACW	SAP	14.		
5. 20 S. Dogwood	FACW+	Sh	15.		
6. 10 Boehmeria	FACW+	H	16.		
7. Cylindrica			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 100% of dominant species are FACW or wetter

SOILS

Series/phase: Newark Subgroup:[2] ____
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____ (Too wet for sample to stick in probe.
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators:[1] aquic moisture regime
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Newark is hydric when ponded.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: 2/20 - 4/24
Is the soil saturated? Yes ____ No ____
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.
Adventicious roots. Water marks. Moss around tree trunks.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Observed to be inundated for more than the prescribed duration during the growing season.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ____
Rationale for jurisdictional decision: ____

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

B-2 * This area is apparently lower and meanders within area described on sheet 13.

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton et.al. Date: 10/23/91, 2/21/92
Project/Site: EFPL, E53B04 & E53476 State: IN County: Anderson
Applicant/Owner: DOE Plant Community s/Name: PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 80% Green Ash	FACW	T	11.		
2. 40 Boxelder	FACW	Sap	12.		
3. 20 Green Ash	FACW	Sap	13.		
4. 20 Silky Dogwood	FACW+	Sh	14.		
5. 70 Grotto Ivy	FACU	H	15.		
6. 30 Creeping Jenny	FACW+	H	16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 83%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 83% of the dominant vegetation is FACW.

SOILS

Series/phase: Newark Subgroup:[2]
Is the soil on the hydric soils list? Yes ✓ No ____ Undetermined ____ (Ponded)
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ____
Matrix Color: See Back Mottle Colors: ____
Other hydric soil indicators: Aquic moisture regime.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Newark is hydric when aquic moisture regime is present. Contamination may have masked soil colors

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: 2" during Feb. sampling.
List other field evidence of surface inundation or soil saturation.
Area appears to be saturated most of year. Possible seep.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Area has aquic moisture regime much of year

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria present.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Grafton, et al Date: 10/23/91, 3/20/92
Project/Site: Behind fire hall State: TN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ____ No ✓ (If no, explain on back) Grazed
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 60% Green Ash	FACW	T	11.		
2. 20 Box elder	FACW	T	12.		
3. 30 Green Ash	FACW	SAP	13.		
4. 25 Box elder	FACW	SAP	14.		
5. 45 Aster sp.	FACW	H	15.		
6. 35 Aster p	FAC-	H	16.		
7. 20 Unk grass	?	H	17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 66%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of the dominants are FACW.

SOILS

Series/phase: Hamblen Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ✓ Undetermined ____
Is the soil a Histosol? Yes ____ No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: Hamblen is not normally a hydric soil and there are no over-riding circumstances

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: After observation, don't believe area is wet for sufficient duration.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton et al Date: 10/24/91, 2/21/92
Project/Site: E 39692; N-04 R.B. State: TN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 50% Sycamore	FACW	T	11.		
2. 20 Box Elder	FACW	T	12.		
3. 20 Box Elder	FACW	S	13.		
4. 20 Hackberry	FACW	Sh	14.		
5. 90 Unk grass	?	H	15.		
6. 20 Common Violet	FAC	H	16.		
7. 20 Aster p	FAC-	H	17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 71%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of the dominants are FAC or wetter.

SOILS

Series/phase: Hamblen Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ✓ Undetermined ____
Is the soil a Histosol? Yes ____ No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: Soil is not on hydric soil list and displays no hydric indicators.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation. Drift lines.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Hydrology not met for sufficient duration.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton Cross et. al. Date: 10/24/91, 2/21/92
Project/Site: ±50 yds downstream E 39/04h:5-06 State: TN County: Anderson
Applicant/~~Owner~~: DOE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 50% Boxelder	FACW	T	11.		
2. 25 Sycamore	FACW	T	12.		
3. 25 Green Ash	FACW	T	13.		
4. 50 Cane	FACW	Sh	14.		
5. 45 Privet	NI	Sh	15.		
6. 60 Aster P.	FAC-	H	16.		
7. 30 Rudbeckia Lac.	FACW	H	17.		
8. 20 Common Smartweed	FACW	H	18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 75%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 75% of the dominants are FACW.

SOILS

Series/phase: Hamblen Subgroup:[2] ____
Is the soil on the hydric soils list? Yes ____ No ✓ Undetermined ____
Is the soil a Histosol? Yes ____ No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: Soil is not on hydric list and no hydric indicators were found

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.
crayfish mounds, drift lines.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Too well drained.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Cross, Groton, et al Date: 10/24/91, 2/21/92
Project/Site: E 37400: S-05 State: IN County: Anderson
Applicant/Owner: DOE Plant Community #/Name: NWIE PEO14
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 70% Sycamore	FACW	T	11.		
2. 20 Box elder	FACW	T	12.		
3. 20 Privet	NI	Sh	13.		
4. 20 Aster p.	FAC-	H	14.		
5. 20 Smartweed	FACW	H	15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 60%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 60% of the dominant species are FACW.

SOILS

Series/phase: Hamblen Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ✓ Undetermined ____
Is the soil a Histosol? Yes ____ No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: Soil is not on hydric list and no hydric indicators were found.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation. Drift line-

Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Area floods but duration is not sufficient.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, Cross Date: 10/25/91
Project/Site: BFPC Sea Dock State: TN County: Roane
~~Applicant~~/Owner: DOE Plant Community #/Name: Bend Cutoff
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 70% Duckweed	OBL	H	11.		
2.			12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: The dominant species is OBL.

SOILS

Series/phase: NA Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ____
Is the soil a Histosol? Yes ____ No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Hydric soil criterion can be assumed to be met if both vegetation and hydrology criteria are met.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: up to 8"
Is the soil saturated? Yes ____ No ____
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Area is permanently ponded.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: Vegetation and hydrology criteria are met. Soil criterion is assumed. Vegetation all obligate.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick Groton et. al. Date: 10/28/91, 5/20/92
Project/Site: Upstream of E23929 LB State: TN County: Roane
Applicant/Owner: DOE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 50% Box elder	FACW	T	11.		
2. 30 Sycamore	FACW	T	12.		
3. 20 Walnut	FACU	T	13.		
4. 20 S. Dogwood	FACW	Sh	14.		
5. 25 Aster p	FAC-	H	15.		
6. 25 Solidago	FAC	H	16.		
7. 20 Smartweed	FAC-/-	H	17.		
8. 20 Cirsium Jenny	FACU	H	18.		
9. 20 Unk. Grass		H	19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 66%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 66% of the dominants are FAC or wetter.

SOILS

Series/phase: UNKnown Subgroup:[2] ✓
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No hydric indicators could be found in soil samples.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation. Big drift line. Remains moist.

Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Area floods but does not have sufficient hydrology for wetland.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, et al Date: 10/28/91, 4/23/92
Project/Site: E 21a52 see back. State: IN County: Roane
Applicant/Owner: DOE Plant Community #/Name: NWE PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back) Back water influence from Melton Hill

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 50% Green Ash	FACW	T	11.		
2. 30 Boxelder	FACW	T	12.		
3. (1 big Willow)	OBL	T	13.		
4. 50 Og. Ash	FACW	SAP	14.		
5. 30 Boxelder	FACW	SAP	15.		
6. 40 Dogwood	FACW	SAP	16.		
7. 20 Boxelder	FACW	Sh	17.		
8. 40 Smartweed	FAC-OBL	H	18.		
9. 30 Aster	FAC-	H	19.		
10. 20 Creeping Jenny	FACW+	H	20.		

Percent of dominant species that are OBL, FACW, and/or FAC 90%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 90% of the dominant vegetation is FAC or wetter.

SOILS

Series/phase: Unknown Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Color: See back
Other hydric soil indicators: Stained root channels
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: Indicators not strong enough to support hydric criterion without soil survey information or stronger hydrology.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: N/A
List other field evidence of surface inundation or soil saturation. Drift line. Topography. Soil observed to stay moist.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Duration of soil saturation is too brief.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Hydrology criterion is not met and soils are doubtful.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

B-2 * An area of really nice environmental quality.

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, etal Date: 10/29/91, 4/23/92
Project/Site: EFDC E21333 LB State: TN County: Roane
~~Applicant~~/Owner: DOE Plant Community s/Name: NWE PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 80% Sycamore	FACW	T	11.		
2. 20 Green Ash	FACW	T	12.		
3. 80 Boxelder	FACW	Sap	13.		
4. 20 Sycamore	FACW	Sap	14.		
5. 80 S. Dogwood	FACW	Sh	15.		
6. 20 Alder	FACW	Sh	16.		
7. 20 Privet	NI	Sh	17.		
8. 45 Aster	FAC-	h	18.		
9. 35 Smartweed sp	FAC-OBL	h	19.		
10. 20 unk grass	?	h	20.		

Percent of dominant species that are OBL, FACW, and/or FAC ≥ 70%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: At least 70% of the dominant species are FAC or wetter.

SOILS

Series/phase: unknown Subgroup:[2] ____
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See Back Mottle Colors: See back
Other hydric soil indicators: Iron stains
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Colors and mottles are there although not strong. Soil is subject to argument.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓ moist
Depth to free-standing water in pit/soil probe hole: N/A
List other field evidence of surface inundation or soil saturation. Drift line, Topography, Crayfish,
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: While area stays moist, saturation could not be observed at sufficient duration.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Hydrology criterion is not met and soil criterion is subject to argument.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

B-2 * Another high quality environment / floodplain forest.

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, et al Date: 10/29/91, 4/23/92
Project/Site: EFPC upstream of E20011 LP State: Id County: Bonne
Applicant/Owner: DOE Plant Community s/Name: NWF PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Yes ✓ No ____ (If no, explain on back) Hydrology influenced by Melton Hill Backwater.
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Sycamore	FACW-	T	11.		
2. 30 G. Ash	FACW	T	12.		
3. 20 Boxelder	FACW	T	13.		
4. 40 Sycamore	FACW-	Sap	14.		
5. 20 Boxelder	FACW	Sap	15.		
6. 40 S. dogwood	FACW	Sh	16.		
7. 20 Boxelder	FACW	Sh	17.		
8. 45 Smartweed	FACW	H	18.		
9. 40 Aster	FAC-	H	19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 89%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 89% of the dominant vegetation is FAC or wetter

SOILS

Series/phase: UNKNOWN Subgroup:[2] ____
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Colors: See back
Other hydric soil indicators: aquic moisture regime
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Area of high deposition during floods, and a developing wetland. Thus, believe criterion is met though colors are not strong.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.
Influenced by fluctuations from reservoir tailwaters.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Melton Hill tailwater keeps the area saturated during the growing season.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All 3 criteria are met although soil indic are not strong because of high deposition/development.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

(25 a)*

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, et al. Date: 10/29/91, 4/23/92
Project/Site: EFPC at E196.62 LB State: TN County: Roane
Applicant/Owner: DOE Plant Community #/Name: Backwater intrusion zone.
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Yes ✓ No ____ (If no, explain on back) Hydrology is influenced by
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ✓ No ____ (If yes, explain on back) backwater from reservoir.

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 20% Button Bush	OBL	Sh	11.		
2.			12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: The dominant vegetation is OBL.

SOILS

Series/phase: Unknown Subgroup:[2] ✓
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Colors: See back.
Other hydric soil indicators: Iron and Manganese Concretions at 4"-10".
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Sufficient indicators are present despite coloration. Where vegetation is all obligate, hydric soils are assumed.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: few inches
Is the soil saturated? Yes ✓ No ____ Daily fluctuation from Melton Hill backwater
Depth to free-standing water in pit/soil probe hole: N/A
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: The area is inundated/saturated by backwater fluctuations from Melton Hill Reservoir.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

 * 25 a-d represent 4 zones of a wet area.

(25 b)

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, et al. Date: 10/29/91, 4/23/92
Project/Site: EFPC E 19682 L B State: IN County: Roane
~~Applicant~~/Owner: DOE Plant Community #/Name: Herbaceous Layer
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ✓ No ____ (If yes, explain on back)

Backwater fluctuations from Melton Hill Reservoir.

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Smartweed	FAC-OBL	H	11.		
2. 40 Unknown Grass	?	H	12.		
3. 20 Creeping Jenny	FACW+	H	13.		
4. 20 Golden rod	FACU	H	14.		
5. 20 Impatiens capensis	FACW	H	15.		
6. (Jewelweed)			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 60 %
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: 60% or more of the dominant vegetation is FAC or wetter.

SOILS

Series/phase: Unknown Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Colors: See back
Other hydric soil indicators:
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Soil is artificially drained and supports hydric vegetation. Developing nature of wetland over rules lack of other indicators.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth:
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: < 2"
List other field evidence of surface inundation or soil saturation.
Direct observation of Melton Hill Backwater.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Direct observation of saturation due to backwater fluctuations.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All hydric criteria are met, although soil criterion is subject to requirement.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

(25 c)

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, et al. Date: 10/29/91, 4/23/92
Project/Site: EEPC E19682 LB State: IN County: Roane
Applicant/Owner: DOE Plant Community #/Name: Shrub Border
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Backwater influence from
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed? Melton Hill Reservoir.
Yes ✓ No ____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Bakelder	FACW	Sh	11.		
2. 40 Dogwood	FACW	Sh	12.		
3. 20 Buttonbush	OBL	Sh	13.		
4. 95 Creeping Lamp	FACW+	H	14.		
5. 20 Jewelweed	FACW	H	15.		
6. 20 Tall Grass	?	H	16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 83%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: At least 83% of the dominant species are FACW or wetter.

SOILS

Series/phase: unknown Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: Same as 25b Mottle Colors: Same as 25b
Other hydric soil indicators:
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Same as 25b

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth:
Is the soil saturated? Yes ✓ No ____ quite wet, though not to surface.
Depth to free-standing water in pit/soil probe hole: 3"-4"
List other field evidence of surface inundation or soil saturation.
Drift line. Topography.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Soil is wet [illegible] aquic moisture regime.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All [illegible] criteria are met, although soils and hydrology are subject to argument.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

(25 d)

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Grotowl, et al. Date: 10/29/91, 4/23/92
Project/Site: EFPC E 196.R2 LB State: TN County: Roane
Applicant/Owner: DOE Plant Community #/Name: Forested Border
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Backwater from Melton Hill influences soil moisture.
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ✓ No ____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Green Ash	FACW		11.		
2. 30 Sycamore	FACW		12.		
3. 20 Boxelder	FACW		13.		
4. 65 Dogwood	FACW		14.		
5. 40 Creeping Jenny	FACWT		15.		
6. 30 Smartweed	FAC-OBL		16.		
7. 30 Tall Grass	?		17.		
8. 20 Unknown Grass	?		18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 75%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: At least 75% of the dominant vegetation is FAC or wetter.

SOILS

Series/phase: UNKNOWN Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: Same as 25b Mottle Colors: Same as 25b.
Other hydric soil indicators: Iron and manganese concretions.
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: Hydric soil indicators are weak and there is no overriding hydrology to indicate a developing wetland.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth:
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: none apparent.
List other field evidence of surface inundation or soil saturation.
Crayfish mounds. Drift lines, minor butressing on trees.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Soil is quite moist, but don't believe the hydrology is there for sufficient duration

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and vegetation criteria not quite met. This probably represents the upland boundary of the area 25 a-d.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, et al Date: 10/29/91, 4/23/92
Project/Site: E 20339 : N-14 RB State: IN County: Boone
Applicant/Owner: Plant Community #/Name: Backwater Extension
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Backwater fluctuation from Yes ✓ No ____ (If no, explain on back) Melton Hill Reservoir.
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Species	Indicator Status	Stratum
Lower Zone	1. 30% Green Ash	FACW	T		11. 80 Privet (one size)	NI	Sh
	2. 20 Sycamore	FACW	T		12. 40 Creeping Jenny	FACW+	H
	3. 35 Button Bush	OBL	Sh		13. 25 Tall Grass	?	H
	4. 40 Creeping Jenny	FACW+	H		14. 20 Short grass	?	H
	5. 30 Tall Grass	?	H		15.		
	6. 20 Unknown Grass	?	H		16.		
Upper Zone	7. 40 Green Ash	FACW	T		17.		
	8. 10 Boxelder	FACW	T		18.		
	9. 80 Button Bush	OBL	Sh		19.		
	10. 40 Dogwood	FACW	Sh		20.		

Percent of dominant species that are OBL, FACW, and/or FAC 66% / 63%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: More than 50% of the dominants are FACW or wetter.

SOILS

Series/phase: unknown Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Colors: See back
Other hydric soil indicators: Aquic moisture regime: Black organic material present.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Although coloration doesn't indicate hydric soil, aquic moisture regime and hydric vegetation are present. Believe this is a developing wetland.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ✓ No ____ This is border of mud flat.
Depth to free-standing water in pit/soil probe hole: about 4"
List other field evidence of surface inundation or soil saturation. Observed influence by backwater from reservoir. Spring discharges into upper end.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Backwater from reservoir and discharge from spring keeps the area wet.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groted, et al. Date: 10/29/91, 4/23/92
Project/Site: Upstream of E 20339 State: IN County: Rowe
Applicant/Owner: DOE Plant Community #/Name: Scrub shrub intrusion
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back) Backwater intrusion from
Has the vegetation, soils, and/or hydrology been significantly disturbed? Melton Hill Reservoir.
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Band surrounding mud flat.
upper zone

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 90% Creeping Jenny	FACW+	H	11.		
2. 40 Smartweed	FAC-OBL	H	12.		
3. 10 Willow	OBL	T	13.		
4. 80 Dogwood	FACW	Sh	14.		
5. 60 Honeysuckle	FAC	Sh	15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100 % / 100 %
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: All of the dominant vegetation is FAC or wetter.

SOILS

Series/phase: UNKNOWN Subgroup:[2] ____
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Colors: See back.
Other hydric soil indicators: Lots of organic matter in top 2 layers
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Chroma of 2 below 3.5". Presence of mottles. Lots of organic material.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: about 2"
List other field evidence of surface inundation or soil saturation.
Silt on leaves. Adjacent to fluctuation zone. Spring fed.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Area observed to remain wet.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton Date: 10/29/91, 4/24/92
Project/Site: Well downstream of E 21323 RB State: TN County: Roane
Applicant/Owner: DOE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back) Backwater from reservoir.

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Green Ash	FACW	T	11.		
2. 30 Sycamore	FACW-	T	12.		
3. 20 Box elder	FACW	Sap	13.		
4. 2% Privet	NI	Sh	14.		
5. 2% Dogwood	FACW	Sh	15.		
6. 4% Unknown Grass	?	H	16.		
7. 40 Aster p	FAC-	H	17.		
8. 20 Smartweed	FACW	H	18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC ≥ 62%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: At least 62% of the dominant vegetation is FAC or wetter.

SOILS

Series/phase: Unknown Subgroup:[2] ✓
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No strong indicators.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓ but moist.
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.
Drift lines - crawfish mounds.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Too well drained. Floods, but does not hold water sufficient duration.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton Date: 10/29/91, 4/24/92
Project/Site: ≈ 300 yds downstream E21652 RB State: TN County: Roane
Applicant/Owner: DOE Plant Community s/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40% Sycamore	FACW-	T	11.		
2. 40 Box elder	FACW	T	12.		
3. 20 Green Ash	FACW	T	13.		
4. 10 Privet	NI	Sh	14.		
5. 90 Ground Ivy	FACU	H	15.		
6. 30 Aster	FAC-	H	16.		
7. 20 UNK. Grass	?	H	17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 50%
Is the hydrophytic vegetation criterion met? Yes ____ No ✓
Rationale: Only 50% of the dominants can be documented as FAC or Wetter.

SOILS

Series/phase: UNKnown Subgroup:[2] ✓
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: NO INDICATORS.
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No hydric indicators apparent.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓ quite moist.
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation.
Drift lines. Topographic.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Area remains moist but is too well drained to meet hydrology criterion.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met. Vegetation is doubtful.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton et al Date: 10/29/91, 4/23/92
Project/Site: Just upstream - E 19355 State: IN County: Boone
Applicant/Owner: DOE Plant Community #/Name: Mud Flat / herb / shrub
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back) backwater influence.

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 50% Buttonbush	OBL	Sh	11.		
2. 40% Juncus cuspidatus	FACW	H	12.		
3. 10 Soft rush	FACW+	H	13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: All dominants are FACW or OBL.

SOILS

Series/phase: Unknown Subgroup:[2] ✓
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ____
Matrix Color: See back Mottle Colors:
Other hydric soil indicators: Sulphur odor, concretions. Leaves down to 7.5"
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Colors, concretions, organic material. Soil is assumed hydric when all vegetation FACW+ OBL and the boundary is abrupt.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth:
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: Very wet in top 10".
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Fluctuation of reservoir keeps area saturated throughout growing season.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, et al Date: 10/29/91, 4/23/92
Project/Site: just upstream - E 19355 State: TN County: Roane
Applicant/Owner: DOE Plant Community s/Name: shrub fringe
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back) backwater influence.

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 85% Dogwood	FACW	Sh	11.		
2.			12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: Dominants are all FACW.

SOILS

Series/phase: UNKNOWN Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: see back Mottle Colors:
Other hydric soil indicators: Muck organic matter. Oxydized area.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Based on indicators. Also soil can be assumed hydric when all vegetation is FACW and/or OBL and the boundary is abrupt.

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth:
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: very wet in top 10"
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Hydrology observed. Reservoir fluctuation keeps area wet throughout growing season.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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CRSA

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, Cross Date: 11/21/91
Project/Site: E 40353 : 4x157 State: IN County: Rodne
Applicant/Owner: DNE Plant Community #/Name: NWI PFO1A
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 80 Box elder	FAC	T	11.		
2. 10 Privet	NI	Sh	12.		
3. 20 Unk. Grass	?	H	13.		
4. 15 Creeping Jenny	FACW	H	14.		
5. 15 Aster pi	FAC-	H	15.		
6. 15 Duchesnia Ind.	FACU	H	16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 60
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: over 50% are FAC or wetter.

SOILS

Series/phase: Unknown Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ____ Gleyed? Yes ____ No ____
Matrix Color: ____ Mottle Colors: ____
Other hydric soil indicators: ____
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No hydric field indicators could be found

HYDROLOGY

Is the ground surface inundated? Yes ____ No ✓ Surface water depth: ____
Is the soil saturated? Yes ____ No ✓
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation: Spongy soil, Drift lines. Depressions that look like could retain water.
Is the wetland hydrology criterion met? Yes ____ No ✓
Rationale: Observed after flood event. Does not have sufficient duration of saturation to meet criterion.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and hydrology criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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ORSA

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton, Cross Date: 11/21/91
Project/Site: K.B. bet. E 40024 & Gum Hollow Rd State: TN County: Roane
Applicant/Owner: DOE Plant Community #/Name: FOREST
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 50% Sycamore	FACW	T	11.		
2. 20 Green Ash	FACW	T	12.		
3. 15 ELM	FAC	S	13.		
4. 25 Honeysuckle	FAC	Sh	14.		
5. 5 Unk. Grass	?	H	15.		
6. 5 Aster P.	FAC-	H	16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 66 %
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: At least 66 % of the dominant vegetation is FAC or better.

SOILS

Series/phase: Unknown Subgroup:[2] ____
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See Pink Mottle Colors: ____
Other hydric soil indicators: oxidized root channels, iron or manganese nodules
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Field indicators were noted including mottles, low chroma matrix, oxidized root channels and iron or manganese nodules.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: ____
Is the soil saturated? Yes ✓ No ____ for week or more following big rain event.
Depth to free-standing water in pit/soil probe hole: ____
List other field evidence of surface inundation or soil saturation. Drift line - No herbaceous layer in lower elevations, slopes away from EFPC.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Direct observation of hydrology after flood event.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are present, although soils may be subject to argument.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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ORSA

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton Date: 12/5/91
Project/Site: E 4/6 65: N-04 (Transect No 1) State: TN County: Roane
Applicant/Owner: DOE Plant Community #/Name: Forest / Shrub
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Swale bending away from EFPC.
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 60% Box elder	FACW	T	11.		
2. 80% Privet	NI	Sh	12.		
3. 40 Creeping Jenny	FACW	H	13.		
4. 20 Ground Ivy	FACU	H	14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 50 %
Is the hydrophytic vegetation criterion met? Yes ____ No ✓
Rationale: More than 50 % of the dominant vegetation is not FAC or wetter.

SOILS

Series/phase: Unknown Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: Mottle Colors:
Other hydric soil indicators: NONE observed
Is the hydric soil criterion met? Yes ____ No ✓
Rationale: No field indicators were found.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth:
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: 1"-2"
List other field evidence of surface inundation or soil saturation. Drift lines, water stains
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Direct observation of hydrology for sufficient duration following flood event

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ✓
Rationale for jurisdictional decision: Soil and vegetation criteria are not met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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ORSA

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton Date: 12-5-91
Project/Site: E 4 :3-02 L.B. State: TN County: Roane
Applicant/~~Owner~~: DOE Plant Community #/Name: Green Ash/Boxelder
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 80% Green Ash	FACW	T	11.		
2. 40 Box Elder	FACW	S	12.		
3. 20 Box Elder	FACW	Sh	13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: All dominants are FACW.

SOILS

Series/phase: Unknown Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ____ No ✓ Gleyed? Yes ____ No ✓
Matrix Color: See back Mottle Colors:
Other hydric soil indicators: Aquic moisture regime
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Too wet for Munsell reading. Assumed hydric because the vegetation all FACW and edge of community is well defined.

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: 1" - 8"
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: 1"
List other field evidence of surface inundation or soil saturation. Holds water several days behind levee. Topograph holds water when creek comes out of bank.
Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Inundation/saturation will occur after any minor flood event during growing season. Will pond water for sufficient duration.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

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ORSA

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Hedrick, Groton Date: 12-6-91
Project/Site: NE corner of ORSA Property State: IN County: Kosciusko
Applicant/~~Owner~~: DOE Plant Community #/Name: Scrub Shrub
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Some influence from turnp
Yes ✓ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed? but system still intact.
Yes ____ No ✓ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. 40 Green Ash	FACW	T	11.		
2. 15 Green Ash	FACW	S	12.		
3. 35 Button Bush	OBL	Sh	13.		
4. 30 Dogwood	FACW	Sh	14.		
5. 25 Green Ash	FACW	Sh	15.		
6.			16.		
7. Vigorous herb layer, but all			17.		
8. dominants not easy to identify			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes ✓ No ____
Rationale: All dominants are FACW or OBL.

SOILS

Series/phase: UNKNOWN Subgroup:[2]
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ✓
Is the soil a Histosol? Yes ____ No ✓ Histic epipedon present? Yes ____ No ✓
Is the soil: Mottled? Yes ✓ No ____ Gleyed? Yes ____ No ✓
Matrix Color: See back. Mottle Colors:
Other hydric soil indicators: Aquic moisture regime.
Is the hydric soil criterion met? Yes ✓ No ____
Rationale: Displays mottling, chroma of 2, and aquic moisture regime. Assumed hydric when all dominants FACW & OBL and boundary is abrupt

HYDROLOGY

Is the ground surface inundated? Yes ✓ No ____ Surface water depth: 1"–5" variable
Is the soil saturated? Yes ✓ No ____
Depth to free-standing water in pit/soil probe hole: to surface
List other field evidence of surface inundation or soil saturation. Fed by multiple springs.

Is the wetland hydrology criterion met? Yes ✓ No ____
Rationale: Spring runoff -en. Long term inundation/saturation obvious.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ✓ No ____
Rationale for jurisdictional decision: All three criteria are met.

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

STF1A TABLE P12 FOR Tract 201
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	16	17
1 AND 2 YEAR	36	39
3 AND 4 YEARS	45	35
5 YEARS	14	18
6 YEARS	25	14
7 TO 9 YEARS	55	55
10 AND 11 YEARS	30	39
12 AND 13 YEARS	26	30
14 YEARS	14	17
15 YEARS	11	21
16 YEARS	18	16
17 YEARS	16	15
18 YEARS	17	20
19 YEARS	11	15
20 YEARS	14	20
21 YEARS	16	24
22 TO 24 YEARS	56	64
25 TO 29 YEARS	103	103
30 TO 34 YEARS	118	113
35 TO 39 YEARS	111	120
40 TO 44 YEARS	71	90
45 TO 49 YEARS	63	84
50 TO 54 YEARS	59	66
55 TO 59 YEARS	69	74
60 AND 61 YEARS	22	35
62 TO 64 YEARS	53	63
65 TO 69 YEARS	70	105
70 TO 74 YEARS	31	80
75 TO 79 YEARS	43	64
80 TO 84 YEARS	14	37
85 YEARS AND OVER	2	25

STF1A TABLE P12 FOR Tract 202
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	25	21
1 AND 2 YEAR	71	55
3 AND 4 YEARS	79	55
5 YEARS	50	48
6 YEARS	38	33
7 TO 9 YEARS	146	132
10 AND 11 YEARS	109	85
12 AND 13 YEARS	96	81
14 YEARS	36	42
15 YEARS	55	44
16 YEARS	49	26
17 YEARS	39	50
18 YEARS	31	35
19 YEARS	28	30
20 YEARS	28	22
21 YEARS	22	22
22 TO 24 YEARS	88	78
25 TO 29 YEARS	114	150
30 TO 34 YEARS	186	198
35 TO 39 YEARS	229	281
40 TO 44 YEARS	266	307
45 TO 49 YEARS	211	204
50 TO 54 YEARS	183	180
55 TO 59 YEARS	158	188
60 AND 61 YEARS	76	72
62 TO 64 YEARS	92	136
65 TO 69 YEARS	185	225
70 TO 74 YEARS	108	169
75 TO 79 YEARS	75	158
80 TO 84 YEARS	30	102
85 YEARS AND OVER	30	98

STF1A TABLE P12 FOR Tract 203
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	18	29
1 AND 2 YEAR	59	62
3 AND 4 YEARS	54	49
5 YEARS	24	42
6 YEARS	29	25
7 TO 9 YEARS	89	91
10 AND 11 YEARS	64	49
12 AND 13 YEARS	64	49
14 YEARS	21	28
15 YEARS	24	22
16 YEARS	26	12
17 YEARS	27	25
18 YEARS	19	16
19 YEARS	27	23
20 YEARS	22	22
21 YEARS	17	21
22 TO 24 YEARS	65	69
25 TO 29 YEARS	168	172
30 TO 34 YEARS	176	209
35 TO 39 YEARS	180	190
40 TO 44 YEARS	147	163
45 TO 49 YEARS	117	136
50 TO 54 YEARS	85	87
55 TO 59 YEARS	71	77
60 AND 61 YEARS	39	63
62 TO 64 YEARS	59	93
65 TO 69 YEARS	154	196
70 TO 74 YEARS	100	128
75 TO 79 YEARS	65	101
80 TO 84 YEARS	37	58
85 YEARS AND OVER	12	29

STF1A TABLE P12 FOR Tract 204
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	22	22
1 AND 2 YEAR	49	44
3 AND 4 YEARS	48	45
5 YEARS	30	20
6 YEARS	21	17
7 TO 9 YEARS	58	86
10 AND 11 YEARS	45	51
12 AND 13 YEARS	61	40
14 YEARS	19	24
15 YEARS	24	24
16 YEARS	30	22
17 YEARS	26	21
18 YEARS	23	23
19 YEARS	34	18
20 YEARS	29	23
21 YEARS	31	31
22 TO 24 YEARS	82	71
25 TO 29 YEARS	160	190
30 TO 34 YEARS	177	183
35 TO 39 YEARS	172	160
40 TO 44 YEARS	140	137
45 TO 49 YEARS	106	126
50 TO 54 YEARS	83	82
55 TO 59 YEARS	92	124
60 AND 61 YEARS	36	46
62 TO 64 YEARS	67	95
65 TO 69 YEARS	164	244
70 TO 74 YEARS	158	188
75 TO 79 YEARS	103	132
80 TO 84 YEARS	44	82
85 YEARS AND OVER	10	29

STF1A TABLE P12 FOR Tract 205
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	20	22
1 AND 2 YEAR	58	62
3 AND 4 YEARS	55	49
5 YEARS	36	31
6 YEARS	26	20
7 TO 9 YEARS	87	88
10 AND 11 YEARS	56	55
12 AND 13 YEARS	65	52
14 YEARS	27	23
15 YEARS	21	26
16 YEARS	21	29
17 YEARS	28	23
18 YEARS	29	25
19 YEARS	35	34
20 YEARS	28	17
21 YEARS	22	26
22 TO 24 YEARS	65	72
25 TO 29 YEARS	124	164
30 TO 34 YEARS	153	168
35 TO 39 YEARS	140	170
40 TO 44 YEARS	113	136
45 TO 49 YEARS	85	107
50 TO 54 YEARS	76	86
55 TO 59 YEARS	61	122
60 AND 61 YEARS	43	44
62 TO 64 YEARS	60	85
65 TO 69 YEARS	104	144
70 TO 74 YEARS	85	124
75 TO 79 YEARS	54	66
80 TO 84 YEARS	19	41
85 YEARS AND OVER	4	21

STF1A TABLE P12 FOR Tract 206
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	8	10
1 AND 2 YEAR	20	25
3 AND 4 YEARS	26	25
5 YEARS	13	21
6 YEARS	19	12
7 TO 9 YEARS	56	43
10 AND 11 YEARS	40	34
12 AND 13 YEARS	45	39
14 YEARS	14	16
15 YEARS	26	11
16 YEARS	35	24
17 YEARS	25	16
18 YEARS	16	17
19 YEARS	19	10
20 YEARS	15	8
21 YEARS	8	10
22 TO 24 YEARS	30	24
25 TO 29 YEARS	40	50
30 TO 34 YEARS	71	79
35 TO 39 YEARS	91	107
40 TO 44 YEARS	112	123
45 TO 49 YEARS	125	126
50 TO 54 YEARS	101	94
55 TO 59 YEARS	72	111
60 AND 61 YEARS	46	50
62 TO 64 YEARS	81	76
65 TO 69 YEARS	106	98
70 TO 74 YEARS	48	47
75 TO 79 YEARS	29	30
80 TO 84 YEARS	7	15
85 YEARS AND OVER	2	10

STF1A TABLE P12 FOR Tract 207
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	13	16
1 AND 2 YEAR	26	27
3 AND 4 YEARS	25	27
5 YEARS	16	15
6 YEARS	21	12
7 TO 9 YEARS	38	45
10 AND 11 YEARS	33	33
12 AND 13 YEARS	41	55
14 YEARS	19	16
15 YEARS	11	15
16 YEARS	21	14
17 YEARS	21	21
18 YEARS	22	15
19 YEARS	19	19
20 YEARS	16	17
21 YEARS	26	18
22 TO 24 YEARS	63	42
25 TO 29 YEARS	91	73
30 TO 34 YEARS	72	79
35 TO 39 YEARS	78	77
40 TO 44 YEARS	84	84
45 TO 49 YEARS	65	69
50 TO 54 YEARS	68	60
55 TO 59 YEARS	50	58
60 AND 61 YEARS	18	19
62 TO 64 YEARS	35	23
65 TO 69 YEARS	41	42
70 TO 74 YEARS	26	53
75 TO 79 YEARS	15	47
80 TO 84 YEARS	17	25
85 YEARS AND OVER	4	14

STF1A TABLE P12 FOR Tract 208
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	35	23
1 AND 2 YEAR	72	62
3 AND 4 YEARS	73	60
5 YEARS	24	28
6 YEARS	36	35
7 TO 9 YEARS	87	90
10 AND 11 YEARS	66	64
12 AND 13 YEARS	83	69
14 YEARS	37	31
15 YEARS	28	32
16 YEARS	36	27
17 YEARS	36	37
18 YEARS	41	42
19 YEARS	40	30
20 YEARS	33	32
21 YEARS	43	36
22 TO 24 YEARS	89	110
25 TO 29 YEARS	173	182
30 TO 34 YEARS	191	170
35 TO 39 YEARS	156	157
40 TO 44 YEARS	159	182
45 TO 49 YEARS	154	158
50 TO 54 YEARS	135	134
55 TO 59 YEARS	109	128
60 AND 61 YEARS	40	50
62 TO 64 YEARS	78	80
65 TO 69 YEARS	94	131
70 TO 74 YEARS	82	114
75 TO 79 YEARS	53	108
80 TO 84 YEARS	27	78
85 YEARS AND OVER	21	64

STF1A TABLE P12 FOR Tract 209.01
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	18	31
1 AND 2 YEAR	40	53
3 AND 4 YEARS	63	48
5 YEARS	25	31
6 YEARS	30	33
7 TO 9 YEARS	79	81
10 AND 11 YEARS	64	58
12 AND 13 YEARS	60	68
14 YEARS	24	22
15 YEARS	29	25
16 YEARS	38	33
17 YEARS	27	38
18 YEARS	30	38
19 YEARS	29	12
20 YEARS	23	19
21 YEARS	22	15
22 TO 24 YEARS	71	69
25 TO 29 YEARS	129	143
30 TO 34 YEARS	161	177
35 TO 39 YEARS	166	179
40 TO 44 YEARS	159	176
45 TO 49 YEARS	139	152
50 TO 54 YEARS	137	97
55 TO 59 YEARS	93	124
60 AND 61 YEARS	40	39
62 TO 64 YEARS	63	74
65 TO 69 YEARS	91	123
70 TO 74 YEARS	65	111
75 TO 79 YEARS	61	76
80 TO 84 YEARS	39	90
85 YEARS AND OVER	25	73

STF1A TABLE P12 FOR Tract 209.02
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	33	30
1 AND 2 YEAR	52	51
3 AND 4 YEARS	53	51
5 YEARS	23	21
6 YEARS	39	32
7 TO 9 YEARS	92	89
10 AND 11 YEARS	60	54
12 AND 13 YEARS	48	69
14 YEARS	30	28
15 YEARS	35	25
16 YEARS	27	32
17 YEARS	35	30
18 YEARS	39	27
19 YEARS	43	34
20 YEARS	21	30
21 YEARS	23	26
22 TO 24 YEARS	78	86
25 TO 29 YEARS	164	170
30 TO 34 YEARS	166	173
35 TO 39 YEARS	179	182
40 TO 44 YEARS	176	174
45 TO 49 YEARS	162	132
50 TO 54 YEARS	93	109
55 TO 59 YEARS	117	103
60 AND 61 YEARS	33	41
62 TO 64 YEARS	62	63
65 TO 69 YEARS	75	87
70 TO 74 YEARS	41	47
75 TO 79 YEARS	40	52
80 TO 84 YEARS	14	34
85 YEARS AND OVER	15	27

STF1A TABLE P12 FOR Tract 210
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	37	34
1 AND 2 YEAR	77	66
3 AND 4 YEARS	74	72
5 YEARS	39	35
6 YEARS	43	53
7 TO 9 YEARS	150	111
10 AND 11 YEARS	76	74
12 AND 13 YEARS	97	103
14 YEARS	43	48
15 YEARS	43	49
16 YEARS	53	51
17 YEARS	57	52
18 YEARS	45	43
19 YEARS	41	49
20 YEARS	64	30
21 YEARS	40	41
22 TO 24 YEARS	103	123
25 TO 29 YEARS	225	211
30 TO 34 YEARS	246	262
35 TO 39 YEARS	247	239
40 TO 44 YEARS	213	244
45 TO 49 YEARS	196	172
50 TO 54 YEARS	162	182
55 TO 59 YEARS	139	171
60 AND 61 YEARS	55	57
62 TO 64 YEARS	72	112
65 TO 69 YEARS	111	131
70 TO 74 YEARS	85	106
75 TO 79 YEARS	54	68
80 TO 84 YEARS	18	55
85 YEARS AND OVER	10	33

STF1A TABLE P12 FOR Tract 211
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	13	12
1 AND 2 YEAR	55	31
3 AND 4 YEARS	36	31
5 YEARS	23	23
6 YEARS	18	18
7 TO 9 YEARS	56	53
10 AND 11 YEARS	32	43
12 AND 13 YEARS	39	49
14 YEARS	17	18
15 YEARS	13	26
16 YEARS	18	14
17 YEARS	21	28
18 YEARS	25	16
19 YEARS	12	18
20 YEARS	22	11
21 YEARS	7	14
22 TO 24 YEARS	40	53
25 TO 29 YEARS	89	91
30 TO 34 YEARS	117	127
35 TO 39 YEARS	125	123
40 TO 44 YEARS	127	131
45 TO 49 YEARS	120	110
50 TO 54 YEARS	95	92
55 TO 59 YEARS	69	70
60 AND 61 YEARS	30	32
62 TO 64 YEARS	48	42
65 TO 69 YEARS	63	72
70 TO 74 YEARS	38	40
75 TO 79 YEARS	32	36
80 TO 84 YEARS	7	20
85 YEARS AND OVER	2	17

STF1A TABLE P12 FOR Tract 212.01
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	27	17
1 AND 2 YEAR	54	64
3 AND 4 YEARS	66	73
5 YEARS	21	35
6 YEARS	25	44
7 TO 9 YEARS	89	101
10 AND 11 YEARS	72	73
12 AND 13 YEARS	61	61
14 YEARS	37	28
15 YEARS	30	46
16 YEARS	36	27
17 YEARS	32	33
18 YEARS	31	28
19 YEARS	22	21
20 YEARS	29	28
21 YEARS	29	25
22 TO 24 YEARS	73	92
25 TO 29 YEARS	147	180
30 TO 34 YEARS	178	176
35 TO 39 YEARS	173	191
40 TO 44 YEARS	172	142
45 TO 49 YEARS	114	136
50 TO 54 YEARS	107	114
55 TO 59 YEARS	101	117
60 AND 61 YEARS	33	42
62 TO 64 YEARS	59	59
65 TO 69 YEARS	81	92
70 TO 74 YEARS	61	76
75 TO 79 YEARS	30	41
80 TO 84 YEARS	25	47
85 YEARS AND OVER	5	23

STF1A TABLE P12 FOR Tract 212.02
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	36	45
1 AND 2 YEAR	91	63
3 AND 4 YEARS	63	73
5 YEARS	45	32
6 YEARS	32	51
7 TO 9 YEARS	98	113
10 AND 11 YEARS	77	69
12 AND 13 YEARS	55	59
14 YEARS	44	35
15 YEARS	33	31
16 YEARS	30	26
17 YEARS	35	43
18 YEARS	36	34
19 YEARS	40	39
20 YEARS	46	49
21 YEARS	37	50
22 TO 24 YEARS	147	146
25 TO 29 YEARS	274	289
30 TO 34 YEARS	218	243
35 TO 39 YEARS	172	188
40 TO 44 YEARS	146	171
45 TO 49 YEARS	112	138
50 TO 54 YEARS	114	139
55 TO 59 YEARS	105	153
60 AND 61 YEARS	42	61
62 TO 64 YEARS	74	104
65 TO 69 YEARS	114	165
70 TO 74 YEARS	90	174
75 TO 79 YEARS	67	135
80 TO 84 YEARS	55	121
85 YEARS AND OVER	27	77

STF1A TABLE P12 FOR Tract 213.01
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	21	18
1 AND 2 YEAR	47	47
3 AND 4 YEARS	27	36
5 YEARS	12	25
6 YEARS	19	14
7 TO 9 YEARS	68	62
10 AND 11 YEARS	50	29
12 AND 13 YEARS	39	25
14 YEARS	16	10
15 YEARS	16	20
16 YEARS	24	21
17 YEARS	26	20
18 YEARS	9	14
19 YEARS	20	16
20 YEARS	15	12
21 YEARS	10	15
22 TO 24 YEARS	36	44
25 TO 29 YEARS	96	114
30 TO 34 YEARS	125	130
35 TO 39 YEARS	108	115
40 TO 44 YEARS	108	106
45 TO 49 YEARS	106	93
50 TO 54 YEARS	77	87
55 TO 59 YEARS	72	73
60 AND 61 YEARS	27	25
62 TO 64 YEARS	33	46
65 TO 69 YEARS	57	82
70 TO 74 YEARS	51	58
75 TO 79 YEARS	44	54
80 TO 84 YEARS	16	30
85 YEARS AND OVER	14	21

STF1A TABLE P12 FOR Tract 213.02
ANDERSON COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	31	37
1 AND 2 YEAR	104	95
3 AND 4 YEARS	90	86
5 YEARS	49	44
6 YEARS	55	51
7 TO 9 YEARS	148	124
10 AND 11 YEARS	115	96
12 AND 13 YEARS	97	91
14 YEARS	46	42
15 YEARS	40	41
16 YEARS	39	47
17 YEARS	51	58
18 YEARS	51	52
19 YEARS	64	43
20 YEARS	45	45
21 YEARS	23	53
22 TO 24 YEARS	125	113
25 TO 29 YEARS	234	244
30 TO 34 YEARS	283	266
35 TO 39 YEARS	253	292
40 TO 44 YEARS	262	288
45 TO 49 YEARS	244	202
50 TO 54 YEARS	169	193
55 TO 59 YEARS	164	153
60 AND 61 YEARS	56	57
62 TO 64 YEARS	75	85
65 TO 69 YEARS	126	120
70 TO 74 YEARS	76	78
75 TO 79 YEARS	32	54
80 TO 84 YEARS	19	37
85 YEARS AND OVER	15	16

STF1A TABLE P12 FOR Tract 301
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	5	8
1 AND 2 YEAR	23	18
3 AND 4 YEARS	25	28
5 YEARS	9	18
6 YEARS	11	17
7 TO 9 YEARS	49	44
10 AND 11 YEARS	36	22
12 AND 13 YEARS	42	49
14 YEARS	17	26
15 YEARS	23	31
16 YEARS	26	28
17 YEARS	19	16
18 YEARS	17	16
19 YEARS	13	9
20 YEARS	7	11
21 YEARS	9	3
22 TO 24 YEARS	21	25
25 TO 29 YEARS	36	30
30 TO 34 YEARS	56	71
35 TO 39 YEARS	85	88
40 TO 44 YEARS	105	125
45 TO 49 YEARS	138	159
50 TO 54 YEARS	140	128
55 TO 59 YEARS	123	106
60 AND 61 YEARS	39	35
62 TO 64 YEARS	40	43
65 TO 69 YEARS	75	74
70 TO 74 YEARS	28	23
75 TO 79 YEARS	24	25
80 TO 84 YEARS	7	14
85 YEARS AND OVER	4	5

STF1A TABLE P12 FOR Tract 302.01
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	22	24
1 AND 2 YEAR	44	44
3 AND 4 YEARS	58	59
5 YEARS	41	26
6 YEARS	27	19
7 TO 9 YEARS	90	84
10 AND 11 YEARS	57	63
12 AND 13 YEARS	77	63
14 YEARS	40	33
15 YEARS	41	30
16 YEARS	37	26
17 YEARS	51	36
18 YEARS	27	30
19 YEARS	29	36
20 YEARS	33	22
21 YEARS	24	15
22 TO 24 YEARS	64	68
25 TO 29 YEARS	139	169
30 TO 34 YEARS	158	169
35 TO 39 YEARS	200	225
40 TO 44 YEARS	191	185
45 TO 49 YEARS	170	143
50 TO 54 YEARS	108	111
55 TO 59 YEARS	126	134
60 AND 61 YEARS	46	31
62 TO 64 YEARS	68	78
65 TO 69 YEARS	99	105
70 TO 74 YEARS	65	76
75 TO 79 YEARS	40	45
80 TO 84 YEARS	23	34
85 YEARS AND OVER	14	25

STF1A TABLE P12 FOR Tract 302.02
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	27	18
1 AND 2 YEAR	68	52
3 AND 4 YEARS	50	50
5 YEARS	37	33
6 YEARS	27	29
7 TO 9 YEARS	119	95
10 AND 11 YEARS	75	70
12 AND 13 YEARS	81	68
14 YEARS	32	46
15 YEARS	38	37
16 YEARS	48	31
17 YEARS	34	39
18 YEARS	51	47
19 YEARS	43	25
20 YEARS	34	32
21 YEARS	41	26
22 TO 24 YEARS	113	80
25 TO 29 YEARS	183	184
30 TO 34 YEARS	200	224
35 TO 39 YEARS	236	247
40 TO 44 YEARS	226	211
45 TO 49 YEARS	178	189
50 TO 54 YEARS	183	156
55 TO 59 YEARS	140	174
60 AND 61 YEARS	71	94
62 TO 64 YEARS	109	155
65 TO 69 YEARS	208	236
70 TO 74 YEARS	135	168
75 TO 79 YEARS	66	102
80 TO 84 YEARS	42	79
85 YEARS AND OVER	13	44

STF1A TABLE P12 FOR Tract 303
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	24	19
1 AND 2 YEAR	43	58
3 AND 4 YEARS	52	46
5 YEARS	28	26
6 YEARS	29	44
7 TO 9 YEARS	82	82
10 AND 11 YEARS	81	60
12 AND 13 YEARS	79	66
14 YEARS	32	41
15 YEARS	28	42
16 YEARS	36	37
17 YEARS	38	30
18 YEARS	34	40
19 YEARS	33	27
20 YEARS	30	22
21 YEARS	28	20
22 TO 24 YEARS	75	62
25 TO 29 YEARS	143	145
30 TO 34 YEARS	154	183
35 TO 39 YEARS	192	176
40 TO 44 YEARS	173	157
45 TO 49 YEARS	152	146
50 TO 54 YEARS	146	162
55 TO 59 YEARS	138	134
60 AND 61 YEARS	44	54
62 TO 64 YEARS	75	81
65 TO 69 YEARS	124	125
70 TO 74 YEARS	85	81
75 TO 79 YEARS	52	57
80 TO 84 YEARS	25	39
85 YEARS AND OVER	9	19

STF1A TABLE P12 FOR Tract 304
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	37	33
1 AND 2 YEAR	60	74
3 AND 4 YEARS	70	64
5 YEARS	40	38
6 YEARS	26	44
7 TO 9 YEARS	114	107
10 AND 11 YEARS	72	83
12 AND 13 YEARS	93	85
14 YEARS	40	30
15 YEARS	43	39
16 YEARS	43	34
17 YEARS	45	36
18 YEARS	45	37
19 YEARS	36	36
20 YEARS	35	42
21 YEARS	28	35
22 TO 24 YEARS	94	110
25 TO 29 YEARS	177	184
30 TO 34 YEARS	199	243
35 TO 39 YEARS	196	221
40 TO 44 YEARS	229	237
45 TO 49 YEARS	168	196
50 TO 54 YEARS	182	188
55 TO 59 YEARS	151	164
60 AND 61 YEARS	73	65
62 TO 64 YEARS	88	112
65 TO 69 YEARS	184	186
70 TO 74 YEARS	100	131
75 TO 79 YEARS	53	73
80 TO 84 YEARS	38	75
85 YEARS AND OVER	23	51

STF1A TABLE P12 FOR Tract 305
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	24	21
1 AND 2 YEAR	61	55
3 AND 4 YEARS	49	32
5 YEARS	15	25
6 YEARS	21	17
7 TO 9 YEARS	67	61
10 AND 11 YEARS	47	55
12 AND 13 YEARS	52	43
14 YEARS	26	23
15 YEARS	18	21
16 YEARS	43	25
17 YEARS	24	17
18 YEARS	21	33
19 YEARS	41	43
20 YEARS	27	28
21 YEARS	27	33
22 TO 24 YEARS	76	88
25 TO 29 YEARS	122	151
30 TO 34 YEARS	133	121
35 TO 39 YEARS	99	140
40 TO 44 YEARS	105	116
45 TO 49 YEARS	97	112
50 TO 54 YEARS	89	114
55 TO 59 YEARS	92	121
60 AND 61 YEARS	27	56
62 TO 64 YEARS	71	74
65 TO 69 YEARS	83	158
70 TO 74 YEARS	72	118
75 TO 79 YEARS	54	108
80 TO 84 YEARS	38	99
85 YEARS AND OVER	21	88

STF1A TABLE P12 FOR Tract 306
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	14	11
1 AND 2 YEAR	35	43
3 AND 4 YEARS	45	40
5 YEARS	26	19
6 YEARS	29	19
7 TO 9 YEARS	76	71
10 AND 11 YEARS	47	52
12 AND 13 YEARS	54	42
14 YEARS	23	17
15 YEARS	26	24
16 YEARS	35	17
17 YEARS	25	28
18 YEARS	30	32
19 YEARS	22	32
20 YEARS	32	25
21 YEARS	17	22
22 TO 24 YEARS	47	74
25 TO 29 YEARS	122	108
30 TO 34 YEARS	140	146
35 TO 39 YEARS	134	151
40 TO 44 YEARS	123	141
45 TO 49 YEARS	128	102
50 TO 54 YEARS	89	107
55 TO 59 YEARS	86	70
60 AND 61 YEARS	29	38
62 TO 64 YEARS	42	60
65 TO 69 YEARS	61	74
70 TO 74 YEARS	35	52
75 TO 79 YEARS	29	30
80 TO 84 YEARS	13	17
85 YEARS AND OVER	8	14

STF1A TABLE P12 FOR Tract 307
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	24	21
1 AND 2 YEAR	63	59
3 AND 4 YEARS	53	42
5 YEARS	30	26
6 YEARS	23	19
7 TO 9 YEARS	77	82
10 AND 11 YEARS	50	64
12 AND 13 YEARS	65	69
14 YEARS	38	31
15 YEARS	32	27
16 YEARS	39	35
17 YEARS	44	37
18 YEARS	40	46
19 YEARS	53	32
20 YEARS	35	39
21 YEARS	31	26
22 TO 24 YEARS	93	108
25 TO 29 YEARS	149	152
30 TO 34 YEARS	143	152
35 TO 39 YEARS	184	164
40 TO 44 YEARS	167	185
45 TO 49 YEARS	148	153
50 TO 54 YEARS	125	133
55 TO 59 YEARS	123	159
60 AND 61 YEARS	49	57
62 TO 64 YEARS	82	104
65 TO 69 YEARS	113	148
70 TO 74 YEARS	71	107
75 TO 79 YEARS	56	85
80 TO 84 YEARS	22	42
85 YEARS AND OVER	15	39

STF1A TABLE P12 FOR Tract 308
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	19	37
1 AND 2 YEAR	81	83
3 AND 4 YEARS	87	75
5 YEARS	44	46
6 YEARS	46	44
7 TO 9 YEARS	128	139
10 AND 11 YEARS	94	85
12 AND 13 YEARS	94	100
14 YEARS	48	43
15 YEARS	47	45
16 YEARS	40	35
17 YEARS	57	41
18 YEARS	58	42
19 YEARS	50	43
20 YEARS	41	54
21 YEARS	45	40
22 TO 24 YEARS	101	123
25 TO 29 YEARS	207	263
30 TO 34 YEARS	244	249
35 TO 39 YEARS	242	231
40 TO 44 YEARS	176	206
45 TO 49 YEARS	165	185
50 TO 54 YEARS	143	167
55 TO 59 YEARS	149	170
60 AND 61 YEARS	39	70
62 TO 64 YEARS	81	126
65 TO 69 YEARS	142	185
70 TO 74 YEARS	109	158
75 TO 79 YEARS	76	155
80 TO 84 YEARS	48	108
85 YEARS AND OVER	31	112

STF1A TABLE P12 FOR Tract 309
ROANE COUNTY
RACE BY SEX BY AGE
UNIVERSE: PERSONS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

	TOTAL	
	MALE	FEMALE
UNDER 1 YEAR	33	32
1 AND 2 YEAR	83	72
3 AND 4 YEARS	89	80
5 YEARS	36	42
6 YEARS	55	38
7 TO 9 YEARS	137	110
10 AND 11 YEARS	83	71
12 AND 13 YEARS	92	91
14 YEARS	47	42
15 YEARS	39	38
16 YEARS	45	51
17 YEARS	49	45
18 YEARS	56	40
19 YEARS	40	41
20 YEARS	33	27
21 YEARS	38	36
22 TO 24 YEARS	108	94
25 TO 29 YEARS	208	224
30 TO 34 YEARS	221	217
35 TO 39 YEARS	235	265
40 TO 44 YEARS	211	232
45 TO 49 YEARS	210	173
50 TO 54 YEARS	144	133
55 TO 59 YEARS	122	126
60 AND 61 YEARS	46	65
62 TO 64 YEARS	78	68
65 TO 69 YEARS	103	128
70 TO 74 YEARS	68	93
75 TO 79 YEARS	43	78
80 TO 84 YEARS	32	44
85 YEARS AND OVER	12	32

ROANE COUNTY
OCCUPANCY STATUS
UNIVERSE: HOUSING UNITS
PREPARED BY THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

TRACT	OCCUPIED	VACANT
0301	943	80
030201	1,668	197
030202	2,495	172
0303	1,740	360
0304	2,309	261
0305	1,607	116
0306	1,259	91
0307	1,849	122
0308	2,523	274
0309	2,060	208

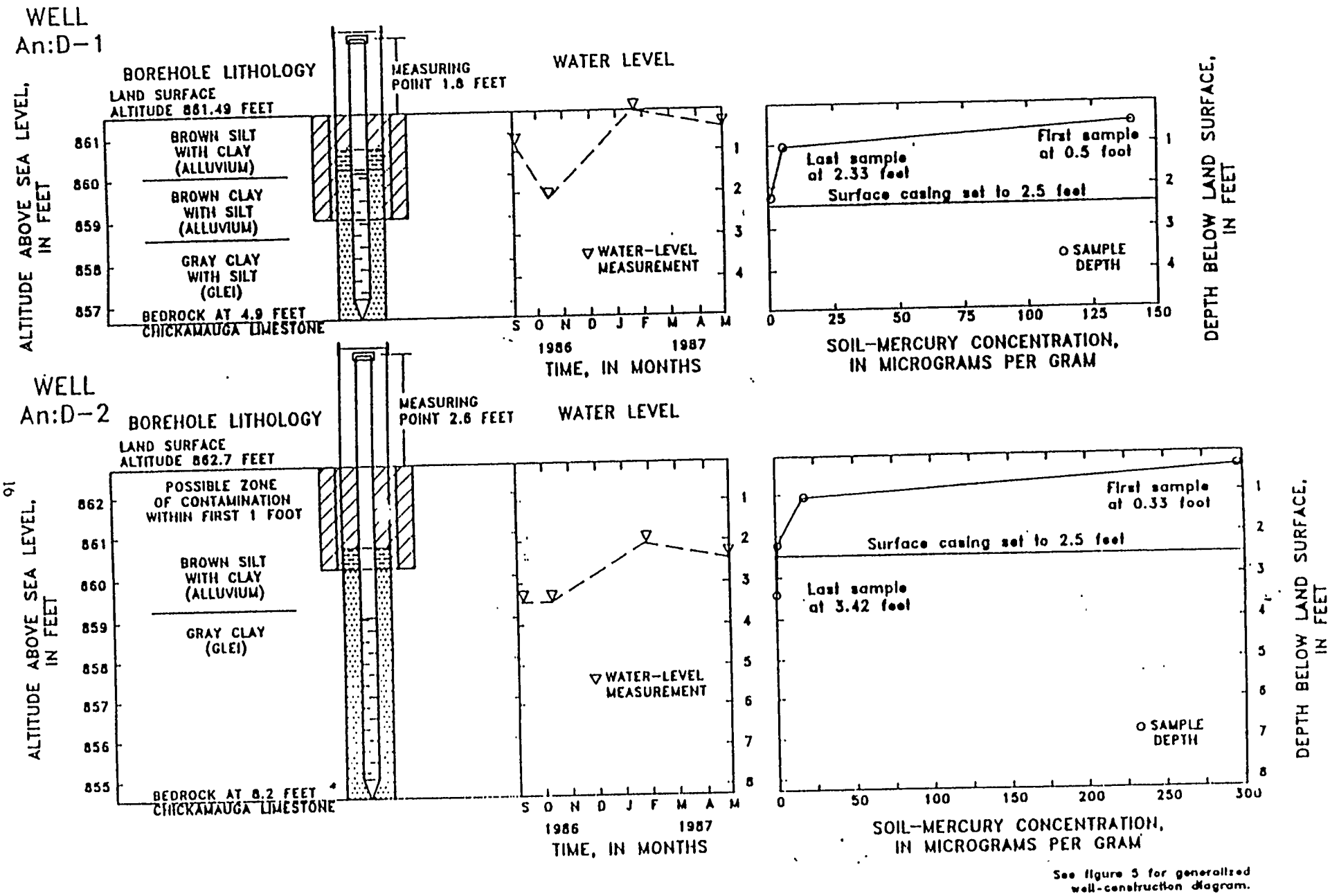


Figure 6.--Construction, lithology, soil-mercury concentrations, and water levels at site 1 wells An:D-1 and An:D-2.

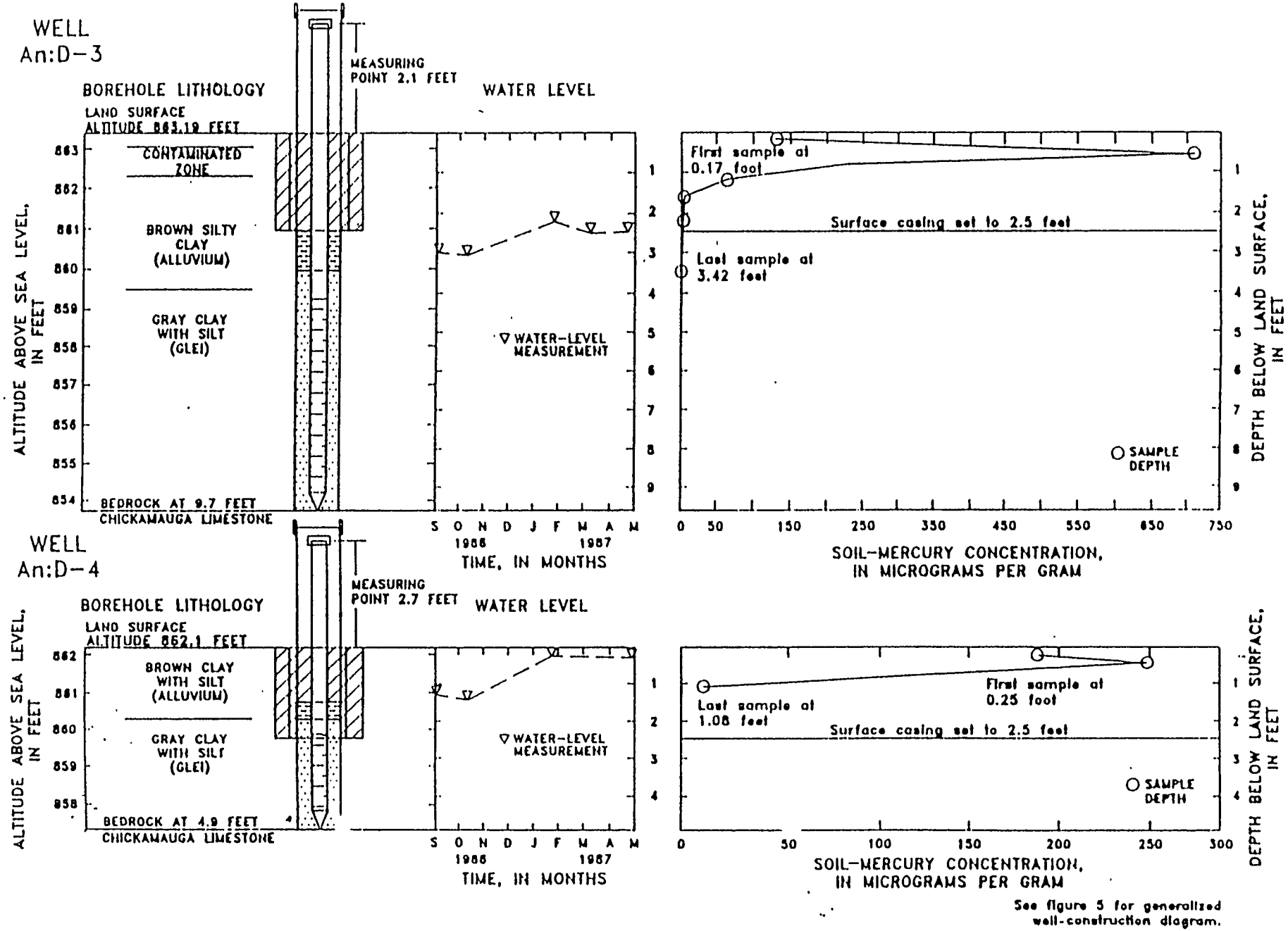


Figure 7.--Construction, lithology, soil-mercury concentrations, and water levels at site 1 wells An:D-3 and An:D-4.

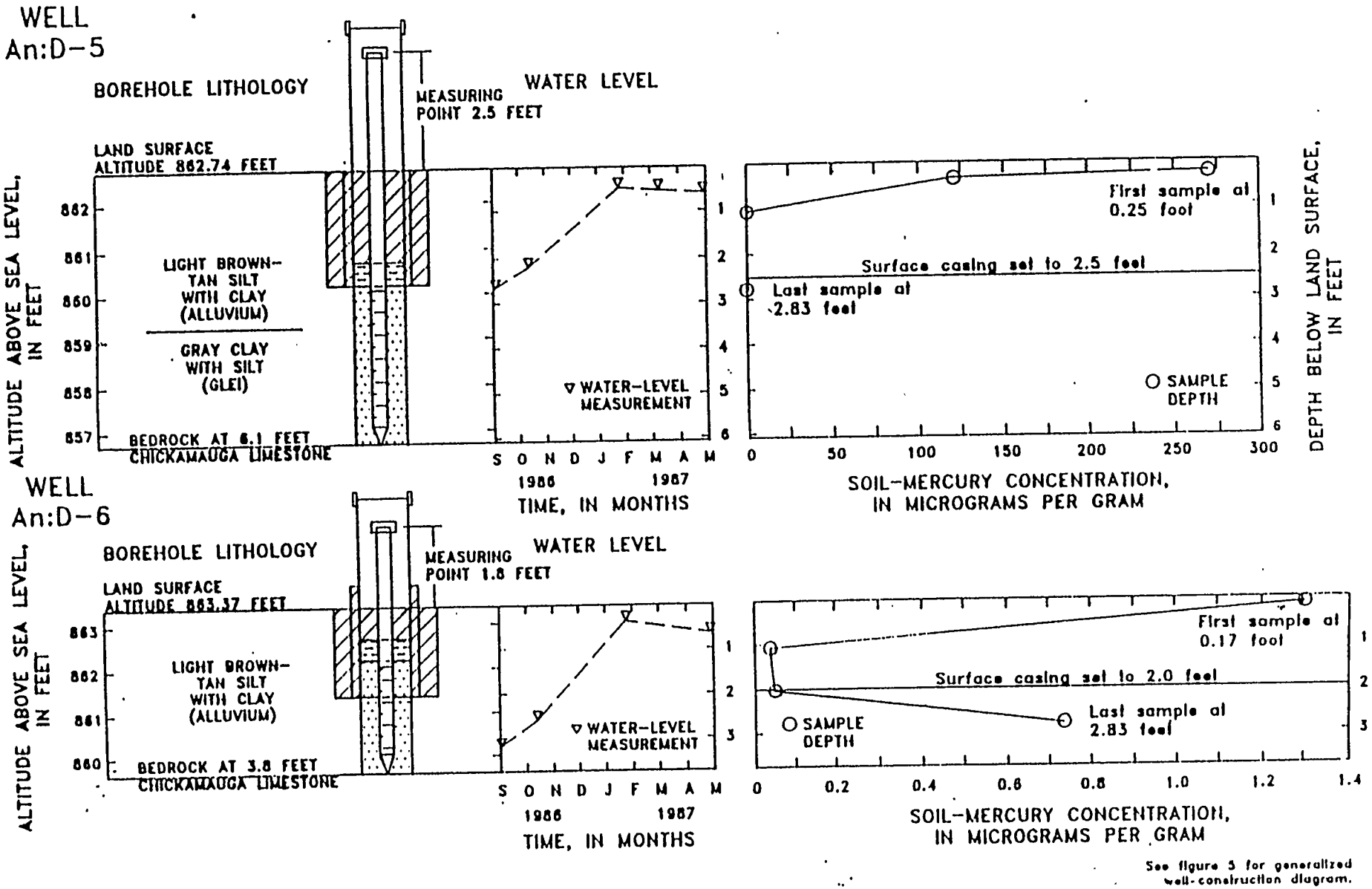


Figure 8.--Construction, lithology, soil-mercury concentrations, and water levels at site 1 wells An:D-5 and An:D-6.

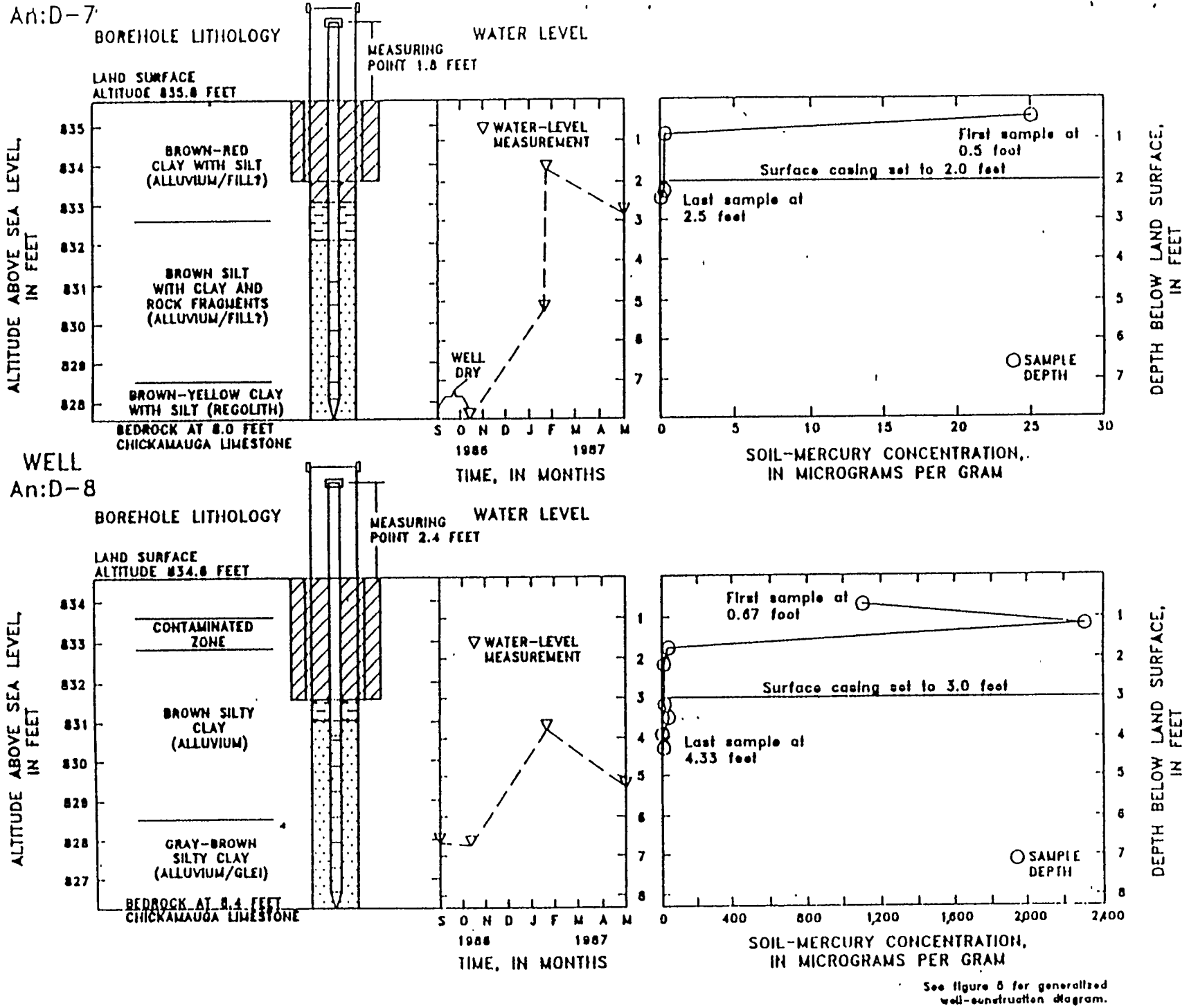


Figure 9.--Construction, lithology, soil-mercury concentrations, and water levels at site 2 wells An:D-7 and An:D-8.

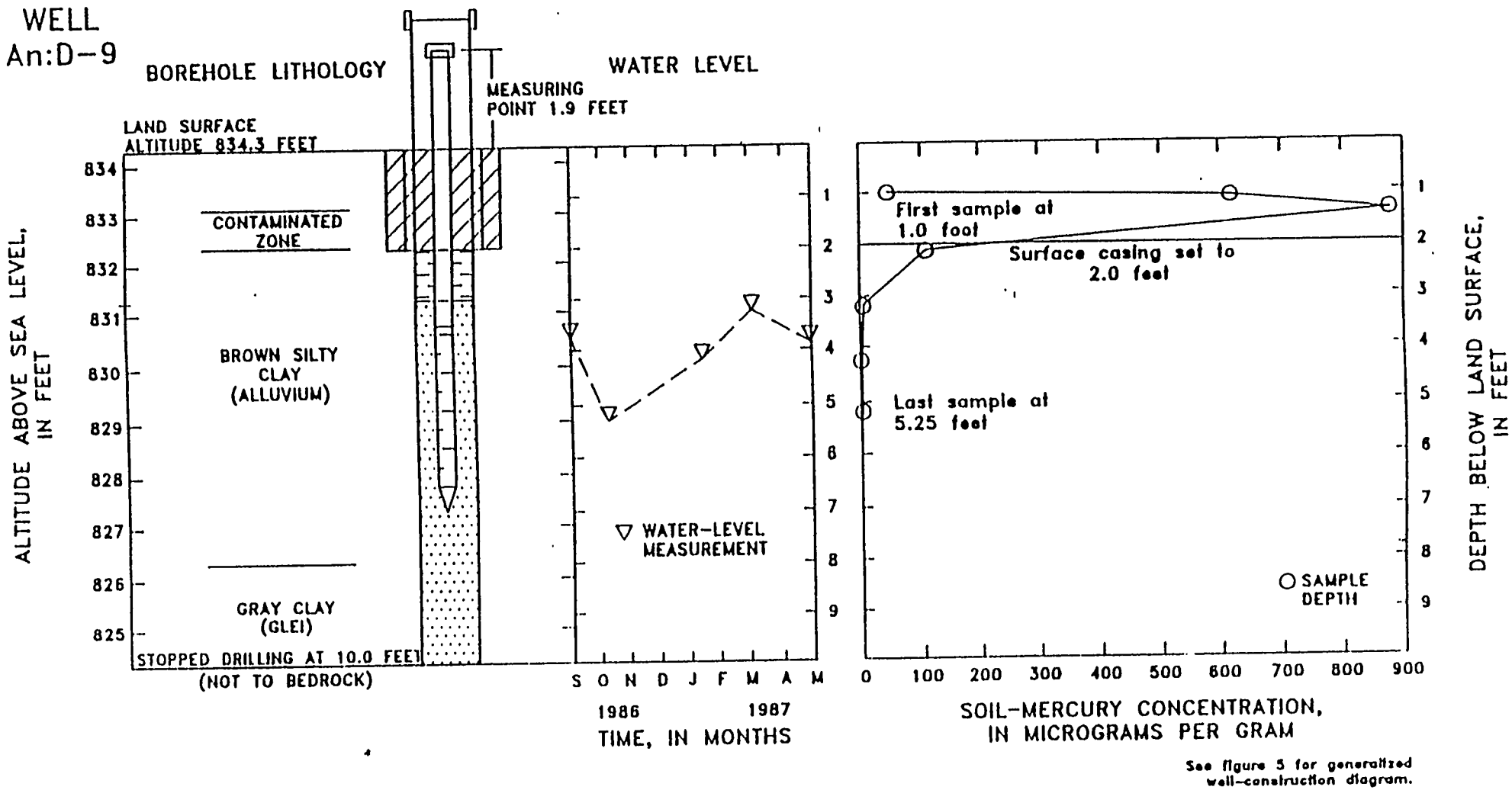


Figure 10.--Construction, lithology, soil-mercury concentrations, and water levels at site 2 well An:D-9.

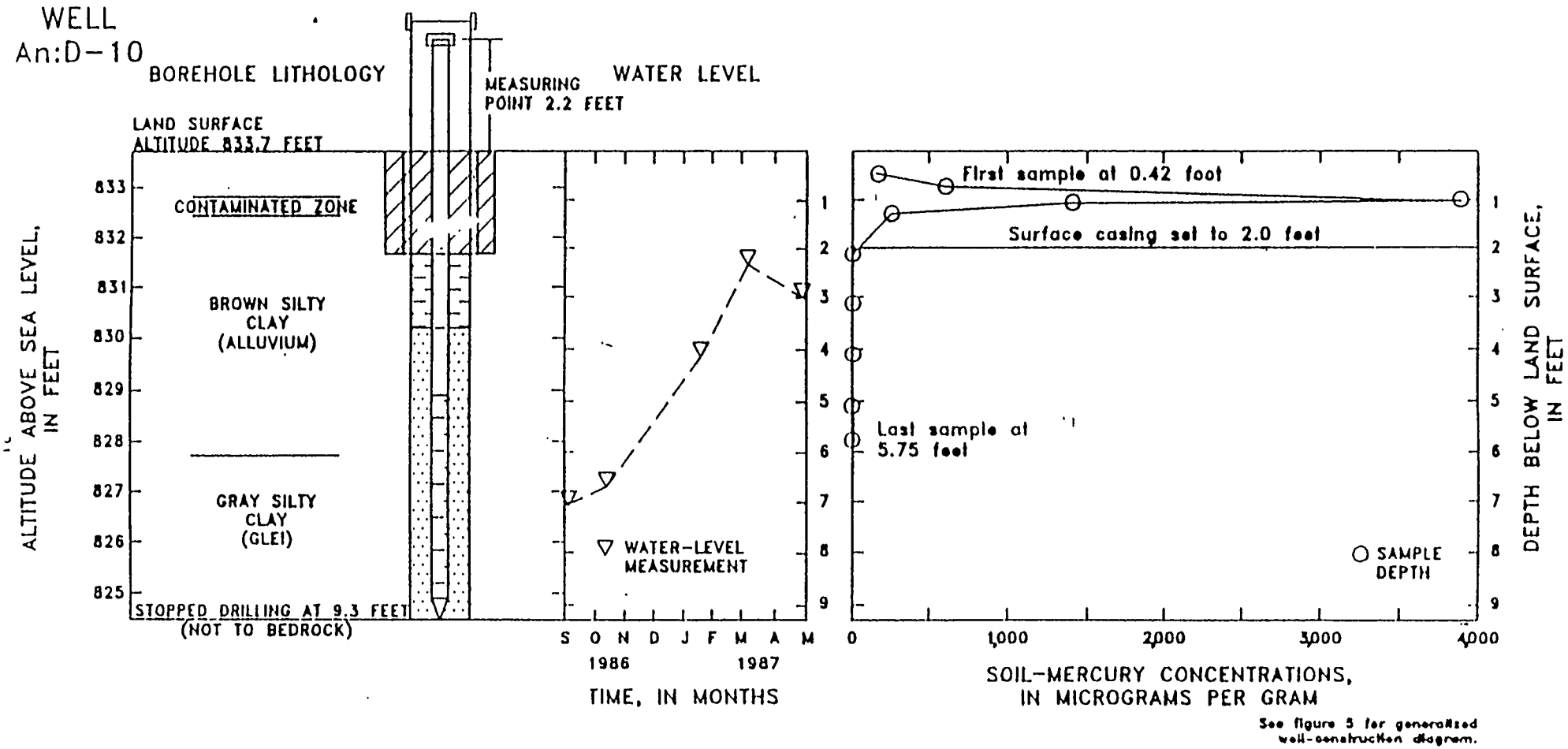


Figure 11.--Construction, lithology, soil-mercury concentrations, and water levels at site 2 well An:D-10.

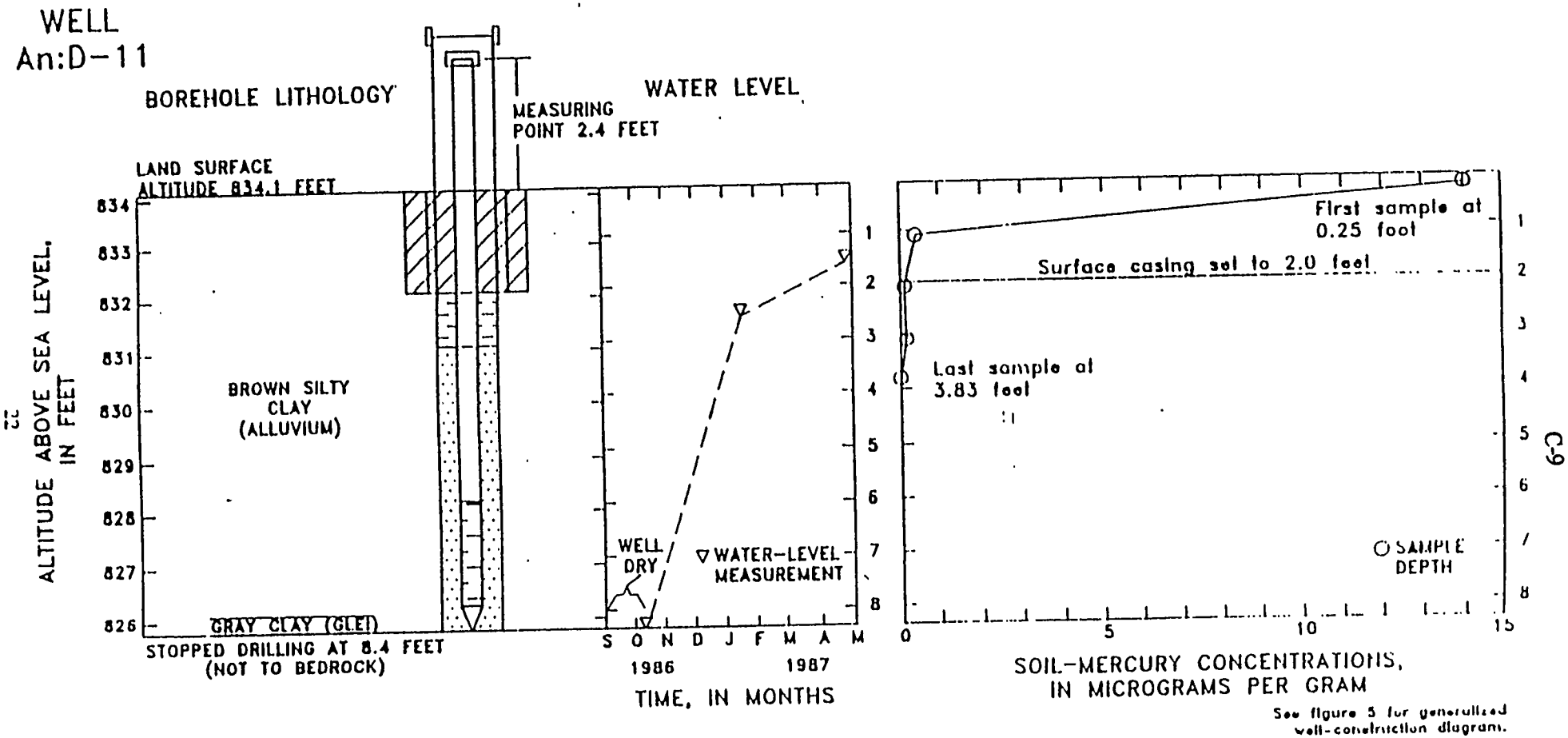


Figure 12.--Construction, lithology, soil-mercury concentrations, and water levels at site 2 well An:D-11.

BORING LOG	BORING/WELL NO.: AN:E-1	Page 1 of 2
Installation: EAST FORK POPLAR CREEK		Site: HARRY LANE MERCURY
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/24/90 (11:08 a m)	Drlg Ended: 10/24/90 (2:00 p m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: D. BUNN/D. OAKLEY	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
		WF0101011	Y			TIME OUT: 11:23 AM (3 IN. SPOON) WF0101011 RECOVERY: 1.2/1.5 FT. 0.0-0.4 SILT, some clay; gr. brn. 5YR 3/2; dry; trace pebbles; very stiff. 0.4-1.0 SILT AND CLAY; gr. brn. 5YR 3/2; dry; very stiff; trace gravel; trace fine sand. 1.0-1.2 CLAY, some silt; mod. yel. brn. 10YR 5/4; dry; stiff; trace gravel.	M L C L C L					
1.0												
2.0		WF0101023	Y			TIME OUT: 11:42 AM (3 IN. SPOON) WF0101023, WF0101035(DUP) RECOVERY: 1.5/1.5 FT. 2.0-2.3 CLAY; trace fine sand and gravel; mod. yel. brn. 5YR 4/4; dry. 2.3-3.5 CLAY; trace fine sand and silt; olive 5Y 5/2; light; very moist; soft.	C H					
3.0												
4.0		WF0101047	Y			TIME OUT: 11:50 WF0101047 RECOVERY: 1.4/2.0 FT. 4.0-5.4 CLAY, trace fine sand/silt; olive gr. 5Y 3/2; moist: soft.	C H 2					
5.0												
6.0												

U = Thin Wall Tube R = Rock Coring ____ Field G/C(Make/Mod.) ____
S = Split spoon(tube) O = Other ____ G/C Oper.: ____
C = Cuttings Notes: ____

0131.002

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-1	Page 2 of 2
Installation: EAST FORK POPLAR CREEK		Site: HARRY LANE MERCURY
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/24/90 (11:08 a m)	Drlg Ended: 10/24/90 (2:00 p m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: D. BUNN/D. OAKLEY	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	Hdsp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
6.0		WF0101059	Y			TIME OUT: 1:20 PM RECOVERY: 2.0/2.0 FT. 6.0-7.6 CLAY; trace fine sand/silt, olive gr. 5Y 3/2; soft; moist; organics. 7.6-8.0 CLAY AND GRAVEL; trace sand/silt; mod. brn. 5YR 4/4; very moist; soft.					ALL SAMPLES SCREENED WITH HNU AND GEIGER COUNTER. NO HITS DETECTED	
7.0												
8.0			N			TIME OUT: 1:31 PM NO SAMPLE RECOVERY: 0.6/2.0 FT. 8.0-8.3 CLAY; trace gravel, fine sand/silt; olive gr. 5Y 3/2; moist, soft. 8.3-8.9 CLAY AND GRAVEL; trace sand and silt; mod. brn. 5YR 4/4; very moist; soft.						
9.0												
10.0												
11.0						TOTAL DEPTH: 11.0 FT. NO SAMPLE; VERY UNCONSOLIDATED CLAY AND GRAVEL. BEDROCK/AUGER REFUSAL AT 11.0 FT.						

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

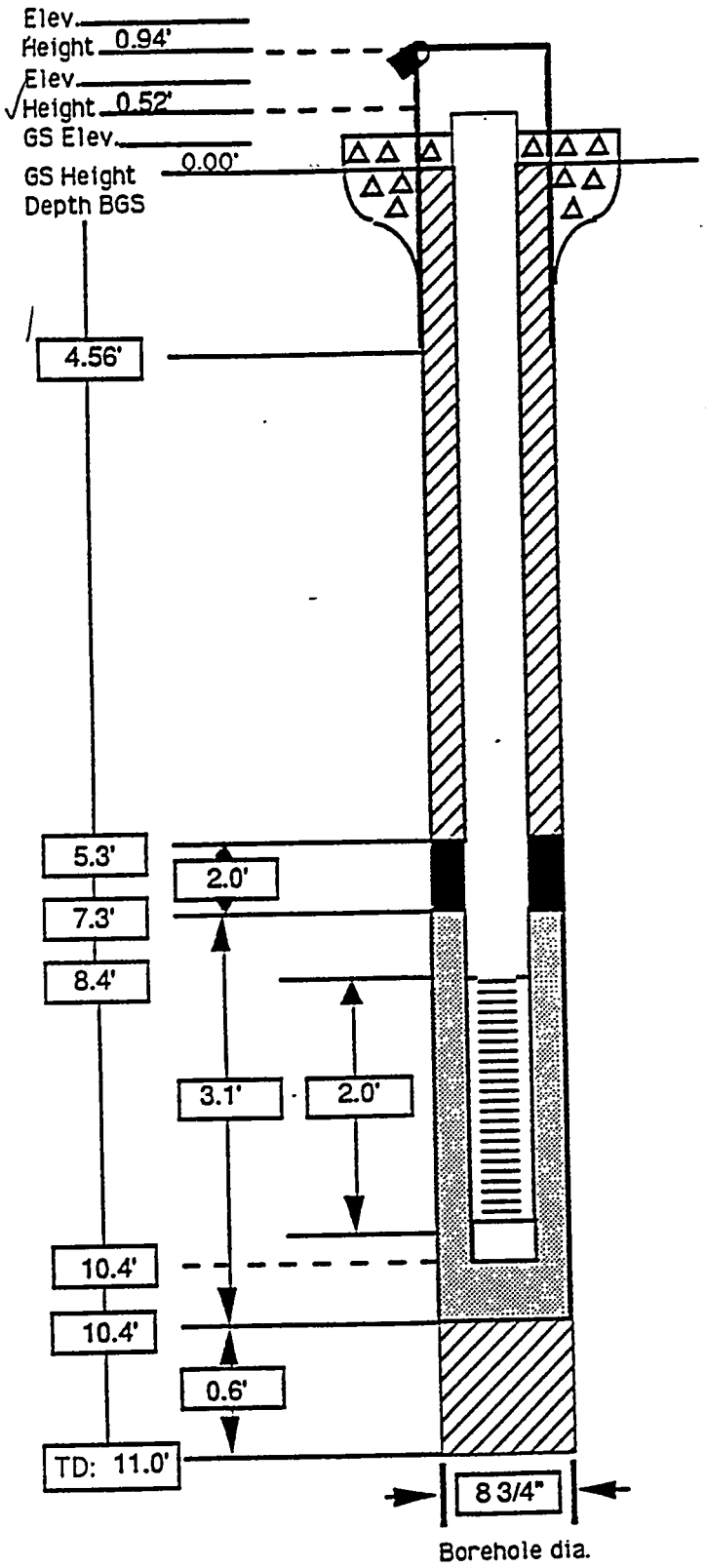
R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN:E-1	Installation: EAST FORK POPLAR CREEK	Site: BEHIND LANE MERC
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/24/90 (11 08 A m)		Comp. End: 10/24/90 (3: 45 P m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 7 INCH
Depth BGS 4.56 FT Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS) 8.90 FT
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 1/3 BAG QUICK GEL: 6 CU FT CEMENT (4 BAGS)
Tremied (Y / N)
Interval BGS 0-5.3 FT

CENTRALIZERS (Y / N)
Depth(s) _____

SEAL
Type BENTONITE PELLETS (1/4 INCH), 1/2 BUCKET
Source PEL PLUG
Setup/Hydration time 30 MIN Vol. Fluid Added 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 1 BAG
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, NEW JERSEY
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 2 INCH (2 FT LENGTH)
Slot Size & Type 0.010 INCH, SLOTTED
Interval BGS 8.4 FT - 10.4 FT

SUMP (Y / N)
Interval BGS _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material BENTONITE PELLETS (1/4 INCH)
Setup/Hydration time 30 MIN
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-1	Page 1 of 2
Installation: EAST FORK POPLAR CREEK	Site: BEHIND LANE MERCURY	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (9: 55 a.m.) 11/12/90	Dev. End: (1 51 p.m.) 11/14/90	Csg Dia.: 2 INCH (INNER CSG)
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 4.34 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 4.1 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, becoming cloudy yellow brown, then murky brown. Very low recharge.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/12	9:55 a	1 bail			Clr.				1st bailing clear; clean; full bail.
	9:56 a	0.50 gal			Clr./cldy. yel. brn.	17°	6.73	640 µMhos	Clear; slightly cloudy yellow brown.
	10:00 a	1.00 gal			murky brn.	18°	6.87	580 µMhos	Murky brown.
	10:05 a	1.25 gal			very brn.	19°	6.78	540 µMhos	High solids content; hot chocolate appear.; purged well dry.
	3:20 p	1.50 gal			Clr.	17°	8.08	490 µMhos	1st bailing clear except for bottom 5" of bailer: murky brown.
	3:25 p	1.50 gal			murky				2nd bailing about 1' column; well purged dry.

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-1	Page 2 of 2
Installation: EAST FORK POPLAR CREEK	Site: BEHIND LANE MERCURY	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (9: 55 a.m.) 11/12/90	Dev. End: (1 51 p.m.) 11/14/90	Csg Dia.: 2 INCH (INNER CSG)
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 4.34 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 4.1 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, becoming cloudy yellow brown, then murky brown. Very low recharge.

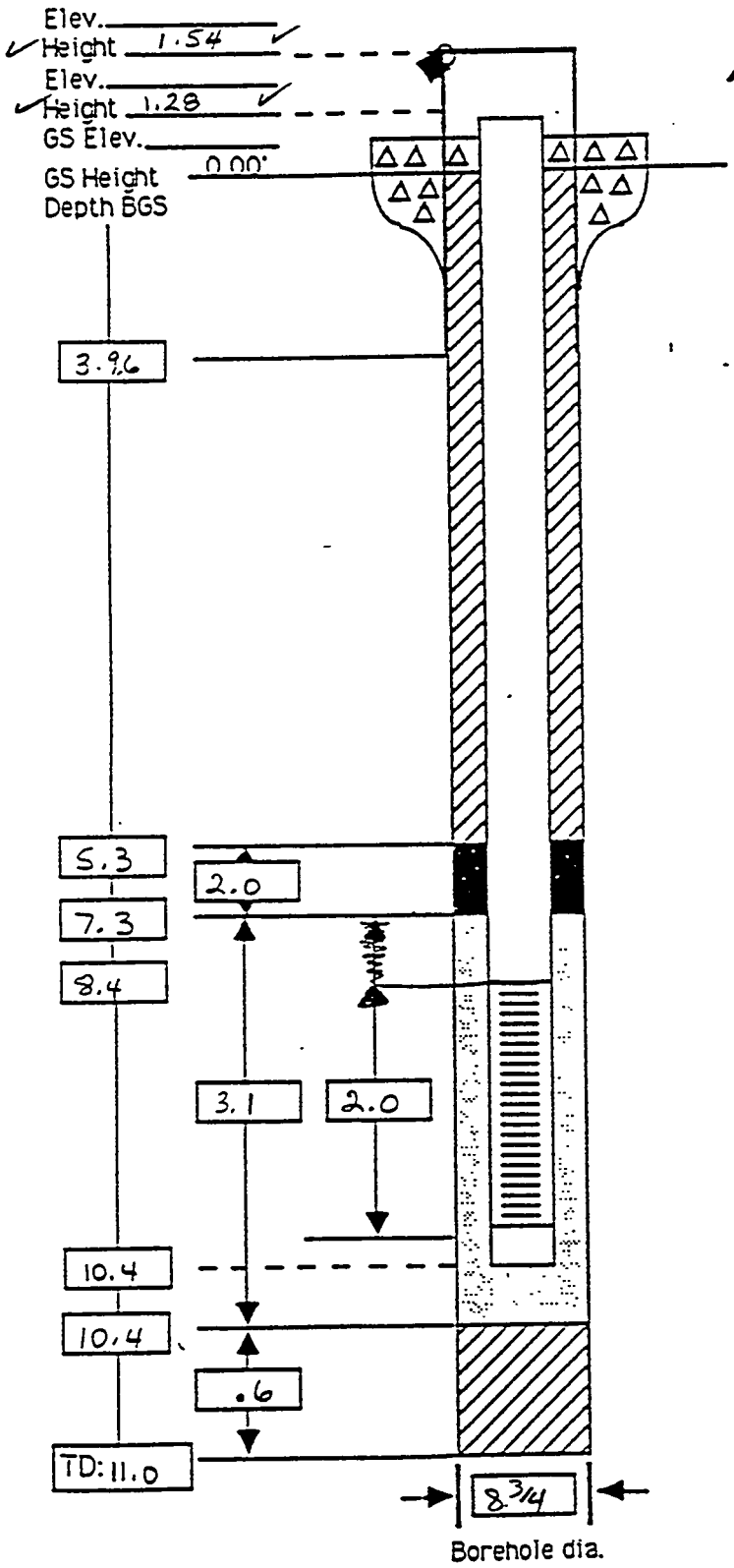
	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/13	9:18 a	1.75 gal			lt. yel. brn.		7.15	500 µMhos	Lost temp. meter.
	9:23 a	2.50 gal			yel. brn.		7.50	490 µMhos	Well purged dry.
	3:16 a	3.00 gal			clr./yel. brn.		7.66	540 µMhos	1st bail clear except bottom 5": yel. brn.; well purged dry.
11/14	1:40 p	3.50 gal			clr./cldy.		7.67	560 µMhos	1st bailing clear & full.
	1:46 p	3.63 gal			clr./cldy.		7.73	560 µMhos	Clear to cloudy.
	1:51 p	4.10 gal			cldy.		7.70	560 µMhos	Well purged dry.
									WELL DEVELOPED

DRAFT

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN: E-1	Installation: E. FORK POAR CREEK	Site: BEHNO LANE MERC.
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/24/90 (11 :08 A m)		Comp. End: 10/24/90 (3:45 P m)
Built By: HIGHLAND /		Well Coord.:



PROTECTIVE CSG
Material / Type: Cast Iron
Diameter: 7"
Depth BGS: 4' Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size: NA

RISER PIPE
Type: STAINLESS STEEL
Diameter: 2"
Total Length (TOC to TOS): 10'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions: Quick gel 1/3 bag; 6 cubic feet cement on 4 BAGS CEMENT
Tremied (Y / N)
Interval BGS: 0 - 5.3'

CENTRALIZERS (Y / N)
Depth(s) _____

SEAL
Type: BENTONITE PELLETS (1/4") - 5 BUCKET
Source: Del Plug
Setup/Hydration time: 20 min Vol. Fluid Added: 1.5 gal
Tremied (Y / N)

FILTER PACK
Type: SAND
Amt. Used: 1 BAG
Tremied (Y / N)
Source: Morie Industrial Sand. N.J.
Gr. Size Dist.: 20/40

SCREEN
Type: STAINLESS STEEL
Diameter: 2" 2' IN LENGTH
Slot Size & Type: .010" SLOTTED
Interval BGS: 8.4 to 10.4

SUMP (Y / N)
Interval BSG _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material: BENTONITE PELLETS (1/4")
Setup/Hydration time: 20 MIN
Tremied (Y / N)

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN : E1	Page 2 of 2
Installation:		Site:
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor:	Driller: DONALD KAY
Drlg Started: 10/24/90 (11:08 A m)	Drlg Ended: 10/24/90 (2:00 P m)	Borehole dia(s):
Drlg Method/Rig Type:		
Logged by:	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
6.0					TIME OUT 1:20 PM WF0101059							
					0.0 - 1.6 : CLAY, TRACE FINE SAND/SILT, OLIVE GREY 5Y 3/2, SOFT, MOIST ORGANICS							
7.0		WF0101059	Y	2.0/2.0	1.6 - 2.0 : CLAY + GRAVEL, TRACE SAND/SILT MODERATE BROWN 5YR 4/4, VERY MOIST, SOFT							
8.0					TIME OUT 1:37 NO SAMPLE							
					0.0 - 0.3 CLAY, TRACE GRAVEL FINE SAND/SILT OLIVE GREY 5Y 3/2, MOIST, SOFT							
9.0			N	.6 - 2.0	.3 - .6 CLAY + GRAVEL, TRACE SAND SILT MODERATE BROWN 5YR 4/4, VERY MOIST, SOFT							
10.0												
11.0					TD 11.0' NO SAMPLE, VERY UNCONSOLIDATED CLAY + GRAVEL							
					BEDROCK / AUGER REFUSAL @ 11.0							
12.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring _____
O = Other _____

Field G/C(Make/Mod.) _____
G/C Oper.: _____

Notes: _____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: BN: E1	Page 1 of 2
Installation:		Site: HARRY LANE MERCURY
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor:	Driller: DONALD KEY
Drlg Started: 10/24/90 (11:08 AM m)	Drlg Ended: 10/24/90 (2:00 P m)	Borehole dia(s): 8 3/4"
Drlg Method/Rig Type: HOLLOW STEM AUGER W/ BACKHOE DRIVE		
Logged by: D. BUNN / D. OAKLEY	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ndsp)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0		WF0101011	Y	1.2/1.5	TIME OUT 11:23 AM (3" SPOON) WF0101011 0.0-0.4 : SILT, SOME CLAY ; GREYISH BROWN 5YR 3/2 DRY, TRACE PEBBLES VERY STIFF 0.4-1.0 : SILT & CLAY, G VERY STIFF, TN 1.0-1.2 CLAY SOME SILT 10 YR 5/4, DI	ML L					
1.0					FIELD ORIG						
2.0		WF0101023 ; WF0101035	Y	1.5/1.5	TIME OUT : 11:42 SAMPLE # WF0101023 WF0101035 (DUP) 0.0-0.3 CLAY, TRACE FINE SAND + GRAVEL, MODERATE YELLOWISH BROWN 5YR 4/4, DRY .3-1.5 CLAY, TRACE FINE SAND + SILT, LIGHT SOFT, OLIVE 5Y 5/2, VERY MOIST.	CH					
3.0											
4.0		WF0101047	Y	1.4/2.0	TIME OUT 11:50 WF0101047 0.0-1.4 CLAY, TRACE FINE SAND/SILT, OLIVE GREY 5Y 3/2, SOFT, MOIST,	CH2					
5.0											
6.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

380.910131.003

BORING LOG	BORING/WELL NO.: AN:E-2 (SHALLOW)	Page 1 of 2
Installation: EAST FORK POPLAR CREEK		Site:S. SIDE EFPC H. LANE MERCURY
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL	Driller: D. KEY
Drlg Started: 10/25/90 (1: 25 Pm)	Drlg Ended: 10/25/90 (2 30 P m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: D. BUNN/B. WILDER	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0		WF0201013	Y			TIME OUT: 1:29 PM NO RECOVERY TIME OUT RETRY: 2:27 PM MOVED 1 FT. OVER RECOVERY: 0.9/1.5 FT. 3 INCH SPOON WF0201013 0.0-0.6 CLAY, silty; mod. yel. brn. 10YR 5/4; damp; loose; soft; organic debris roots leaves. 0.6-0.9 CLAY, silty, sandy, 50% clay, 50% silt/sand;brn. black 5YR 2/1; damp; loose; soft.						
1.0												
2.0		WF0201025	Y			TIME OUT: 1:40 PM WF0201025, WF0201037(DUP) RECOVERY: 1.5/1.5 FT. 2.0-2.2 CLAY, sandy; brn. black 5YR 2/1; damp; very unconsolidated; loose; soft. 2.2-3.5 CLAY, silty, gravel; mod. yel. brn. 10YR 5/4; damp; loose; soft.					100 CNTS/MIN OVER ENTIRE CORE 2-3.5 FT. 3-3.5 FT. HNU HITS - 15 TO 50 PPM.	
3.0												
4.0			N			TIME OUT: 2:02 PM NO SAMPLE TAKEN. RECOVERY: 0.45/2.0 FT. 4.0-4.45 SILT, gravel; mod. yel. brn. 10YR 5/4; wet, loose, soft.					NO HITS. WATER IN 4-6 FT INTERVAL.	
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-2 (SHALLOW)	Page 2 of 2
Installation: EAST FORK POPLAR CREEK		Site: S. SIDE EFPC H. LANE MERCURY
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/25/90 (1: 25 Pm)	Drlg Ended: 10/25/90 (2 30 P m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: D. BUNN/B. WILDER	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y / N)	( )	hdsp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
6.0						TIME OUT: 2:15 PM. NO SAMPLE TAKEN. RECOVERY: 0.5/0.5 FT. Some bedrock in tube, brn., 5YR 3/4. TOTAL DEPTH 6.8 FT. AUGER APPROX, 0.3 FT. LOWER					NO HITS ON HNU OR PANCAKE COUNTER	
7.0												
8.0												

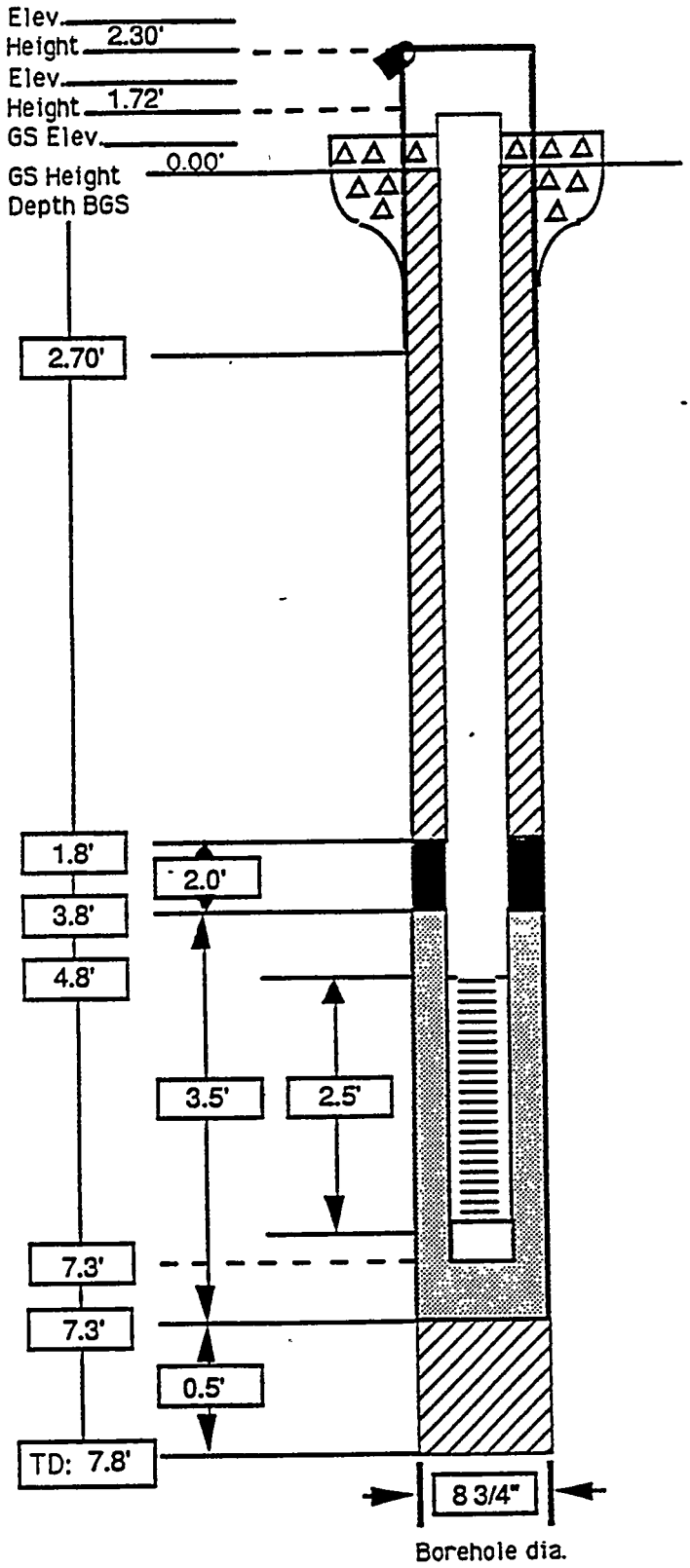
U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Standard		
WELL NO.: AN:E-2	Installation: EAST FORK POPLAR CREEK	Site: BEHIND LANE MERCURY
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/25/90 (2:50 p m)		Comp. End: 10/25/90 (3 40 p m)
Built By: HIGHLAND DRILLING/ D. BUNN, B. WILDER		Well Coord.:



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 7 INCH (5 FT LENGTH)
Depth BGS 2.70 FT Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS) 6.50 FT
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 1 94 LB BAG CEMENT; 1/2 BAG BENTONITE QUICK GEL
Tremied (Y / N)
Interval BGS 0-1.8 FT

CENTRALIZERS (Y / N)
Depth(s) _____

SEAL
Type 1/4 INCH BENTONITE PELLETS (1/2 BUCKET)
Source PEL PLUG
Setup/Hydration time 1/2 HR Vol. Fluid Added 1 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 1 100 LB BAG
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, NEW JERSEY
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 2 INCH
Slot Size & Type 0.010, CONTINUOUS WIRE-WRAP
Interval BGS 4.8 FT - 7.3 FT

SUMP (Y / N)
Interval BGS _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material _____
Setup/Hydration time APPROX 15 MIN
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-2	Page 1 of 1
Installation: EAST FORK POPLAR CREEK	Site: BEHIND LANE MERCURY	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (10 10 a.m.) 11/12/90	Dev. End: (10 27 a.m.) 11/12/90	Csg Dia.: 2 INCH (INNER CSG)
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 4.69 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 3.25 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, rapidly becoming murky brown. Good recharge.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/12	10:15 a	2 bails			Clr. to murky				1st bailing clean, clear, full column. 2nd bail. murky brn. High TDS.
	10:18 a	0.50 gal			Murky/ brn.	15°	6.50	780 µMhos	Hot chocolate appear.
	10:20 a	1.00 gal			Murky/ brn.	14°	6.74	720 µMhos	
	10:22 a	1.50 gal			Murky/ brn.	13°	6.75	720 µMhos	
	10:24 a	2.00 gal			Murky/ brn.	14°	6.91	780 µMhos	
	10:26 a	2.60 gal			Murky/ brn.	13°	6.74	760 µMhos	Good recharge.
	10:27 a	3.25 gal			Murky/ brn.	13°	6.76	770 µMhos	Readings stable; good recharge; bailings full.

WELL DEVELOPED

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-2 (Shallow)	Page 1 of 1
Installation: Y-12 E. Fork Poplar Creek		Site: S side of EFPC - Harry Lane Ford/Clearwy
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland	Driller: D Key & Steve
Drlg Started: 10-25-90 (1:25 P.m)	Drlg Ended: 10-25-90 (2:30 P m)	Borehole dia(s): 8 3/4"
Drlg Method/Rig Type: Hollow Stem Auger - Backhoe driven		
Logged by: D. Bunn / B. Wilder	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0					Time Out: 1:28 pm Sample No: WF0201013 No Recovery 1st try						
					Retry Time Out: 2:27 pm. - moved over ~ 1'						
		WF0201013	Y	0.9'/1.5'	0.0 - 0.6' - CLAY - SILTY - Mod yell Brn. 10yR5/4, Damp, loose, soft - organic debris roots leaves	3" split tube					
1.0					0.6' - 0.9' - CLAY - SILTY SANDY - ~ 50% clay 50% silt/sand Brownish Black 5yR2/1, Damp loose, soft						
					Sample No: WF0201025 & WF0201037 (Dup) Sample No: Time Out: 1:40 pm. 100% Recovery						
2.0		WF0201025 & 37 (Dup)	Y	1.5'/1.5'	2.0' - 2.2' - CLAY SANDY - Brownish Black 5yR2/1 Damp, v. unconsol., loose, soft	3" split tube					
					2.2 - 3.5' - CLAY SILTY - @ gravel, mod yell. Brn., 10yR5/4, Damp, loose, soft	Bentonite				100 counts per min. over entire core 2'-3.5' ~3.0-3.5 Hnu hits - 15-50 ppm	
3.0											
4.0					No sample taken Sample Out: 2:02 pm.					No hits	
					SILT @ gravel, mod. yell Brn 10yR5/4, wet, loose, soft.					Water in 4'-6' interval	
5.0			N	0.45'/2.0							
6.0			N	0.5'/0.5'	Sample out: 2:15 pm. Attempted to push tube - refusal @ ~ 6.5'					No hits on thru or Pancake counter.	
					No Samples for Lab Analysis Some Bedrock in plug - Brown Sandstone 5yR3/4 pebbles.						
					TD - BR @ 6.8' - 2:20 pm. Auger ~ 0.3' lower to rock						
7.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

7.3 Bent. Plug

7.5

DRAFT

REV. DATE: MAY 1990

Shallow

MONITORING WELL CONSTRUCTION LOG -- Standard

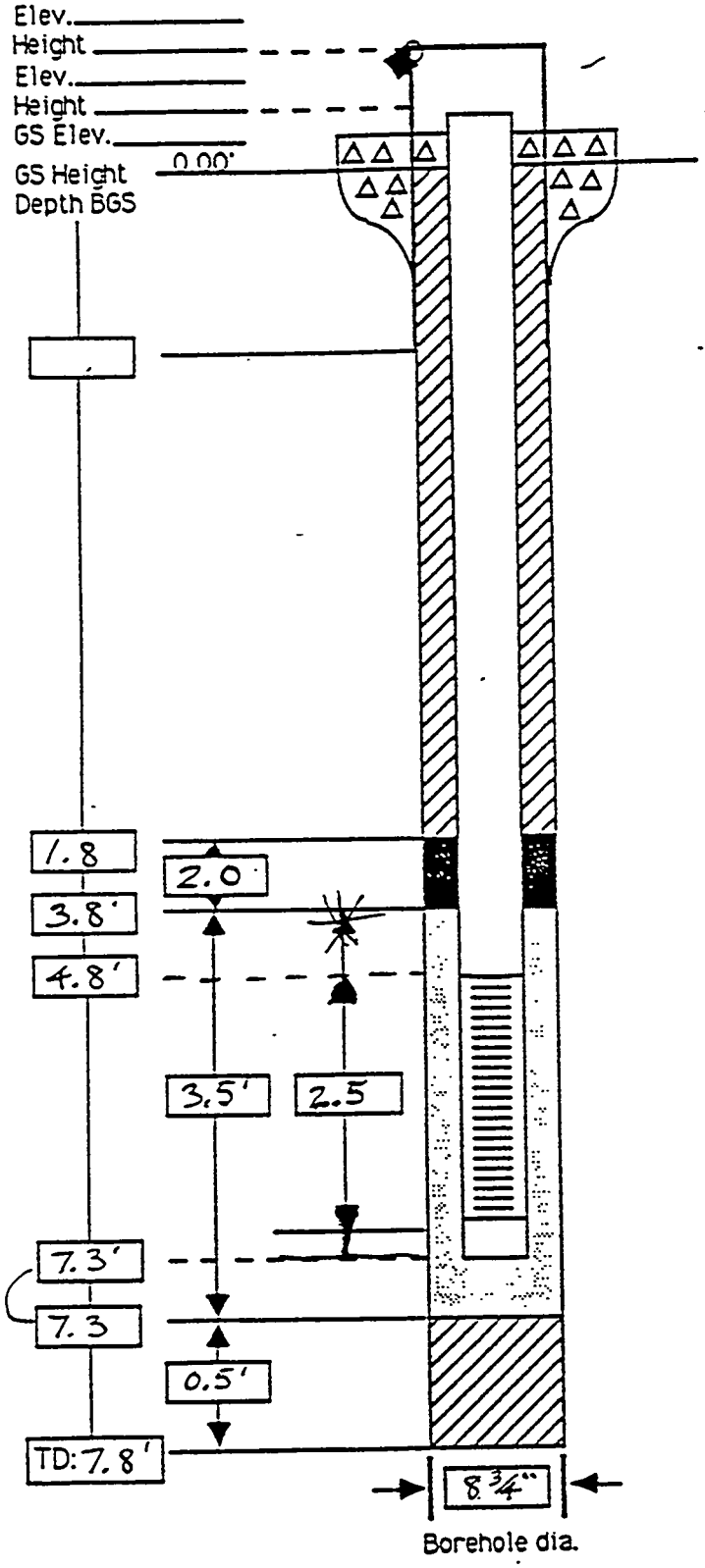
WELL NO.: AN: E-2 | Installation: Y-12 E Fk Poplar Creek | Site: S side of Creek - Haul Road

Project No.: | Client/Project: Y-12

HAZWRAP Contractor: HAZWRAP | Drlg Contractor: Highland

Comp. Start: 10-25-90 (2 : 50 P m) | Comp. End: 10-25-90 (3 : 40 P m)

Built By: D. Bunn B. Wilder (HAZWRAP) / D. Key & Steve (Highland) | Well Coord.:



PROTECTIVE CSG
Material / Type Cast Iron
✓ Diameter ~~2"~~ 7" - 4.5' long
Depth BGS _____ Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size _____

RISER PIPE
Type St. Steel
Diameter 2"
Total Length (TOC to TOS) 7.0'
Ventilated Cap (Y) N)

GROUT
Composition & Proportions Baroid Quick Gel Cement
Tremied (Y / (N)
Interval BGS 0 - 1.8'

CENTRALIZERS (Y / (N))
Depth(s) _____

SEAL
Type Bentonite Pellets - 1/4"
✓ Source PEL PLUG
Setup/Hydration time 0.5 hr. Vol. Fluid Added 1 gal.
Tremied (Y / (N)

FILTER PACK
Type Morie Sand
Amt. Used ~1 - 100 lb bag
Tremied (Y (N)
✓ Source MORIE INDUSTRIAL SAND
✓ Gr. Size Dist. 20/40

SCREEN
Type St. Steel
Diameter 2"
✓ Slot Size & Type ~~0.01"~~ 0.01" CONT. WIRE WOUND
Interval BGS 4.8' - 7.3'

SUMP (Y / (N)
Interval BSG _____ B. Cap. Length ~0.3'
Bottom Cap (Y) N)

BACKFILL PLUG
Material - 1/4" Bentonite Pellets - 0.5' thick
Setup/Hydration time ~15 hours
Tremied (Y / (N)

REV. DATE: NOV 1990

380.910131.004

BORING LOG	BORING/WELL NO.: AN:E-3	Page 1 of 4
Installation: EAST FORK POPLAR CREEK		Site: CARDEN APTS
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: DONALD KEY
Drlg Started: 10/26/90 (1: 30 P m)	Drlg Ended: 11/07/90 (12 30 Pm)	Borehole dia(s):
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	Hosp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0												
		WE0101019	Y			TIME OUT: 1:42 PM (3 IN. SPOON) WE0101019 RECOVERY: 0.9/1.5 FT. 0.0-0.9 SILTY CLAY; dk. yel. brn. 10YR 4/2; soft; damp; some roots.						
1.0												
2.0												
		WE0101033	Y			TIME OUT: 1:56 PM (3 IN. SPOON) WE0101033 RECOVERY: 1.1/1.5 FT. 2.0-3.1 CLAY; some silt and sand; dk. yel. brn. 10YR 4/2; soft; moist; some shale fragments; some roots.						
3.0												
4.0												
			N			TIME OUT: 2:04 PM (2 IN. SPOON) NO SAMPLE; SPOON OBVIOUSLY WET. RECOVERY: 0.5/2.0 FT. 4.0-4.3 CLAY; some silt and sand; lt. brn. 5YR 5/6; soft; moist; some gravel. 4.3-4.5 SANDY CLAY; coarse-grained to fine; sub-rounded; poorly-sorted.						
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-3	Page 2 of 4
Installation: EAST FORK POPLAR CREEK		Site: CARDEN APTS
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: DONALD KEY
Drlg Started: 10/26/90 (1 : 30 P m)	Drlg Ended: 11/07/90 (12: 30 Pm)	Borehole dia(s):
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	Hdsp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth &	Remarks	Elev. (ft)
6.0						TIME OUT: 2:22 PM (3 IN. SPOON)							
						NO SAMPLE; SPOON REFUSAL AT 8.5 FT.							
						RECOVERY: 0.3-2.0 FT.							
						6.0-6.3 CLAY; some silt; pale yel. brn. 10YR 6/2; soft; moist; loose.							
7.0		N				Hit ledge at 7.0 ft.; auger walked.							
8.0						BEDROCK BORING LOG STARTS ON PAGE 3 OF 4.							
9.0													
10.0													
11.0													
12.0													
13.0													

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-3		Page 3 of 4
Installation: EAST FORK POPLAR CREEK		Site: CARDEN APTS	
Project No.: 70502	Client/Project: Y-12		
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: DONALD KEY	
Drlg Started: 10/26/90 (1 : 30 P m)	Drlg Ended: 11/07/90 (12 30 Pm)	Borehole dia(s):	
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY			
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D	

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	Hdsp (	Lithologic Description	USCS	Blows / 6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
						ALL CUTTINGS CONTAINERIZED - BLOWN DIRECTLY INTO LARGE BIN. NO CUTTINGS AVAILABLE FOR LITHOLOGIC DESCRIPTION.					DRILLED OUT OF SURFACE CASING AT 5.0 FT.	
5.0											LEE WAN MONITORING VAPORS.	
						TWO FOOT BREAK FROM 5.5 FT TO 7.5 FT.						
6.0												
7.0												
8.0						SMOOTH DRILLING FROM 8.5 FT TO 10.5 FT.						
9.0												
10.0						TWO FOOT BREAK FROM 10.5 FT TO 12.5 FT.						
11.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-3	Page 4 of 4
Installation: EAST FORK POPLAR CREEK		Site: CARDEN APTS.
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: DONALD KEY
Drlg Started: 10/26/90(1: 30 P m)	Drlg Ended: 11/07/90(12 30 P m)	Borehole dia(s):
Drlg Method/Rig Type: HOLLOW STEM W/BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	Recovery (ft) / hdsp ( )	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
12.0											
					SMOOTH DRILLING FROM 12.5 FT TO 14.0 FT.						
13.0											
14.0					ONE FOOT BREAK FROM 14.0 FT TO 15.0 FT.						
15.0											
					SMOOTH DRILLING						
16.0											
17.0										WELL CAVED IN AT TD. LOST APPROX. 2 FT OF HOLE.	
					TD. CHECK FOR WATER 1 HOUR AFTER ACHIEVING TD. WATER 0.6 FT BGS. WILL SET WELL.						
18.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

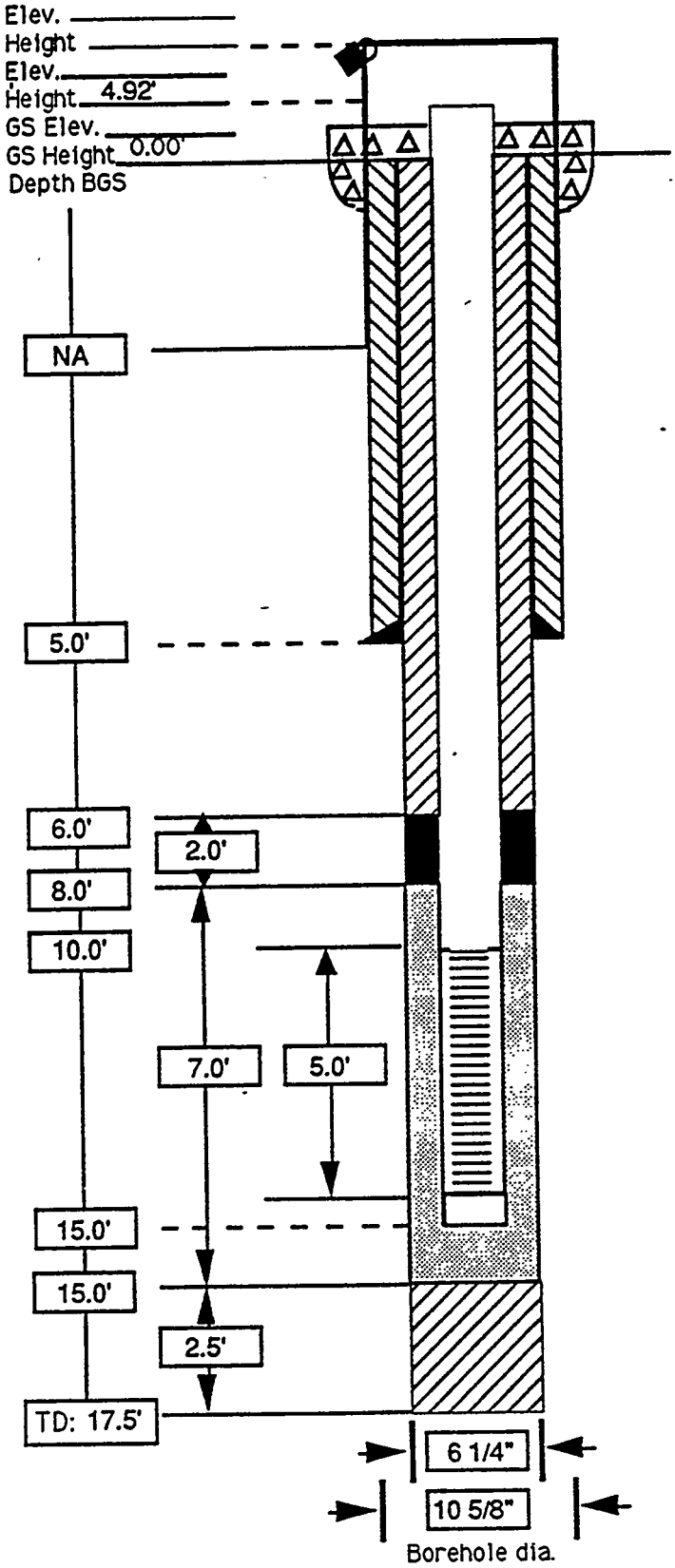
R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased

WELL NO.: AN:E-3	Installation: EAST FORK POPLAR CREEK	Site: CARDEN APTS
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/26/90 (1:30 P m)		Comp. End: 11/08/90 (1:00 P m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type N/A
Diameter
Depth BGS Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

INTERMEDIATE CSG
Type CAST IRON
Diameter 7 INCH Total Length 8.50 FT

GROUT: Setup/Hydration Time 44 HRS FOR 7 IN
Composition & Proportions 4 BAGS CEMENT, 1/2 BAG BENTONITE POWDER
Tremied (Y / N)

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS) 14.92 FT.
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 4 BAGS CEMENT, 1/2 BAG BENTONITE GEL
Tremied (Y / N)
Interval BGS 0 - 6.0 FT

CENTRALIZERS (Y / N)
Depth(s) BOTTOM END 6.0 FT BGS

SEAL
Type 1/4 INCH BENTONITE PELLETS
Source PEL PLUG
Setup/Hydration time 1/2 HR Vol. Fluid Added 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 50 LBS (6 BAGS)
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, N. J.
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 2 INCH (5 FT LENGTH)
Slot Size & Type 0.010 CONTINUOUS WIRE-WRAP

SUMP (Y / N)
Interval BGS Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-3	Page 1 of 3
Installation: EAST FORK POPLAR CREEK	Site: CARDEN APARTMENTS	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (11: 15 a.m.) 11/12/90	Dev. End: (3: 10 pm) 11/12/90	Csg Dia.: 2 INCH
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 2.21 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 64 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, rapidly becoming cloudy brown, then murky orange brown. Good recharge.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/12	11:45 a	2 gal			Clr./cldy. brn.				1st bailings very clear; After 2 gallons, began getting cloudy brown.
	11:50 a	4 gal			Muddy/ brn. or.	17°	9.97	370 µMhos	Muddy brown orange color.
	12:03 p	8 gal			Murky/ or. brn.	17°	9.66	310 µMhos	Recalibrated pH meter; Very murky or. brn.
	12:10 p	12 gal			Murky/ or. brn.	17°	9.49	330 µMhos	Very murky or. brn.
	12:18 p	16 gal			Murky/ or. brn.	16°	9.42	340 µMhos	
	12:25 p	20 gal			Murky/ or. brn.	17°	9.36	340 µMhos	Good recharge
	12:32 p	24 gal			Murky/	17°	9.35	340 µMhos	

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-3	Page 2 of 3
Installation: EAST FORK POPLAR CREEK	Site: CARDEN APARTMENTS	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (11: 15 a.m.) 11/12/90	Dev. End: (3: 10 pm) 11/12/90	Csg Dia.: 2 INCH
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 2.21 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 64 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, rapidly becoming cloudy brown, then murky orange brown. Good recharge.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/12	12:40 p	28 gal			Murky/ brn. or.	16°	9.30	340 µMhos	
	12:45 p	31 gal							Rope broke; dropped bailer; began fishing.
	12:53 p	31 gal							Caught bailer.
	12:58 p	32 gal			Murky/ brn. or.	17°	9.13	310 µMhos	Good recharge.
	1:04 p	36 gal			Murky/ or. brn.	17°	9.34	340 µMhos	Good recharge.
	1:10 p	39 gal			Murky/ or. brn.	17°	9.44	320 µMhos	3 well columns purged.
	2:15 p	39 gal							1st bail after lunch: clear; 2nd bail: or. brn.
	2:20 p	40 gal			Or. brn.	17°	9.14	290 µMhos	Similar to 1st readings.

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-3	Page 3 of 3
Installation: EAST FORK POPLAR CREEK	Site: CARDEN APARTMENTS	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (11: 15 a.m.) 11/12/90	Dev. End: (3: 10 p.m.) 11/12/90	Csg Dia.: 2 INCH
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 2.21 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 64 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, rapidly becoming cloudy brown, then murky orange brown. Good recharge.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/12	2:26 p	44 gal			Murky/ or. brn.	16°	9.40	320 µMhos	
	2:33 p	48 gal			Murky/ brn. or.	17°	9.45	330 µMhos	
	2:42 p	52 gal			Murky/ brn. or.	17°	9.40	330 µMhos	
	2:50 p	56 gal			Murky/ brn. or.	17°	9.35	330 µMhos	
	3:00 p	60 gal			Murky/ brn. or.	17°	9.33	330 µMhos	
	3:10 p	64 gal			Murky/ brn. or.	17°	9.32	330 µMhos	5 water columns purged; readings stable and consistent. WELL DEVELOPED

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-3	Page 1 of 2
Installation: EAST FORK POPLAR CREEK		Site: CARON APTS.
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND	Driller: DONALD KEY
Drlg Started: 10/26/90 (1:30 P m)	Drlg Ended: 11/07/90 (1230 P m)	Borehole dia(s):
Drlg Method/Rig Type: HOLLOW STEM w/ BACKHOE DRIVE ; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0		WE0101019	Y	.9/1.5	TIME OUT 1:42 PM WE0101019 3" SPOON 0-0.9 silty clay - dark yellowish brown 10YR 4/2 soft, damp, had some roots						
1.0											
2.0		WE0101033	Y	1.1/1.5	TIME OUT 1:56 PM WE0101033 3" SPOON 2-3.1 clay w/silt & sand - some shale fragments, moist, soft. dark yellowish brown 10YR 4/2 had some roots						
3.0											
4.0			N	0.6/2.0	TIME OUT 2:04 NO SAMPLE 2" SPOON SPOON OBVIOUSLY WET 0-0.3 Clay w/silt & sand light brown 5YR 5/6 moist, soft, some gravel 0.3-0.5 clay sand coarse-grained to fine, sub-rounded, poorly-sorted						
5.0											
6.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN : E-3	Page 2 of 2
Installation:		Site: CARDEN APTS
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND	Driller: DONALD KEY
Drlg Started: (: m)	Drlg Ended: (: m)	Borehole dia(s):
Drlg Method/Rig Type: HOLLOW STEM w/BACKHOE DRIVE		
Logged by: D. BUNN	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
5.0					TIME OUT 2:22 PM SPOON REFUSAL AT 8.5 FT							
7.0	N			0.3/7.0	0-0.3 clay w/silt Pale yellowish brown 10YR 6/2 loose, soft, moist Hit ledge at 7.0' auger walked							
10.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-3	Page 3 of 4
Installation: EAST POPLAR CREEK		Site: CARDEN APTS.
Project No.: 70502	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor:	Driller: DONALD KEY
Drlg Started: 10/26/90 (1:30 P m)	Drlg Ended: 10/26/90 (2:45 P m)	Borehole dia(s):
Drlg Method/Rig Type: HOLLOW STEM W/BACKHOE DRIVE ; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level:

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
					ALL CUTTINGS CONTAINERIZED - BLOWN DIRECTLY INTO LARGE BIN. NO CUTTINGS AVAILABLE FOR LITHOLOGIC DESCRIPTION					DRILLED OUT OF SURFACE CASING @ 5.0'	
5.0											
					TWO FOOT BREAK FROM 5.5' TO 7.5'					LEE WAN MONITORING VAPORS.	
6.0											
7.0											
					SMOOTH DRILLING FROM 8.5' TO 10.5'						
8.0											
9.0											
10.0											
					TWO FOOT BREAK FROM 10.5' TO 12.5'						

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

FILL IN

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN-E-3	Page 4 of 4
Installation:		Site:
Project No.:	Client/Project:	
HAZWRAP Contractor:	Drlg Contractor:	Driller:
Drlg Started: (: m)	Drlg Ended: (: m)	Borehole dia(s):
Drlg Method/Rig Type:		
Logged by:	E-Log (Y / N) From ____ to ____	Protection Level:

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
12.0					SMOOTH DRILLING FROM 12.5' TO 14.0'						
13.0											
14.0					ONE FOOT BREAK FROM 14.0' TO 15.0'						
15.0					SMOOTH DRILLING.						
16.0											
17.0					TD CHECK FOR WATER. 1 HOUR AFTER REACHING TD. WATER .6' BGS. WILL SET WELL.					WELL CAVED IN @ TD. LOST APPROX. 2' OF HOLE.	
18.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

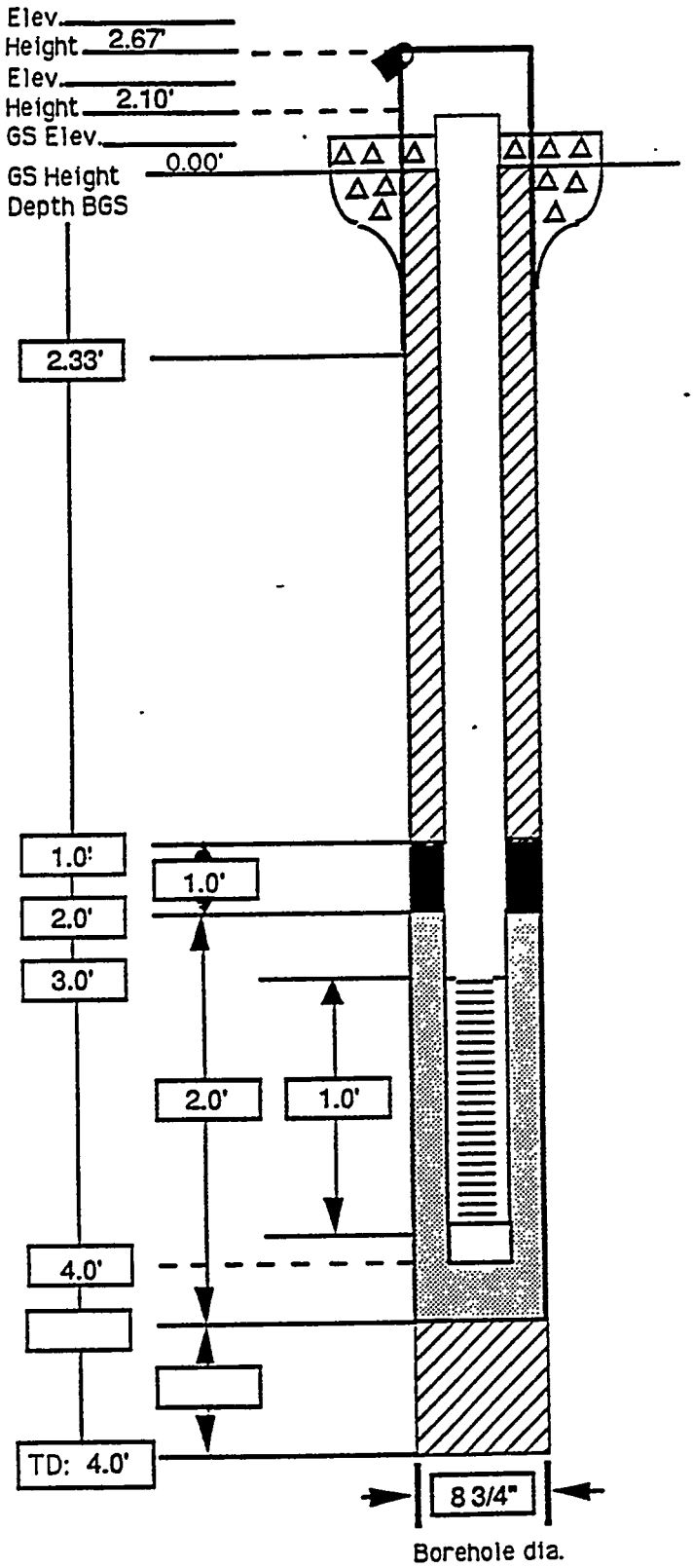
R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN:E-4	Installation: EAST FORK POPLAR CREEK	Site: PRIME SIRLOIN
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/18/90 (8 : 30 A m)		Comp. End: 10/18/90 (9: 20 A m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 7 INCH
Depth BGS 2.33 FT Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS) 4.1 FT
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 1.30 CU FT CEMENT (1 SACK)
Tremied (Y / N)
Interval BGS

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type 1/4 INCH BENTONITE PELLETS (1/2 BUCKET)
Source PEL PLUG
Setup/Hydration time 1/2 HR Vol. Fluid Added 1 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 1 100 LB BAG
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, NEW JERSEY
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 2 INCH
Slot Size & Type 0.010, CONTINUOUS WIRE-WRAP
Interval BGS 3.0 FT - 4.0 FT

SUMP (Y / N)
Interval BGS Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

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BORING LOG	BORING/WELL NO.: AN:E-4	Page 1 of 1
Installation: EAST FORK POPLAR CREEK		Site: N.SIDE EFPC BEHIND PRIME-SIRLOIN
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/17/90 (3:45 Pm)	Drlg Ended: 10/17/90 (4 45P m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C. WALLEN/B. WILDER	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	Hdsp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0												
	W					TIME OUT: 3:50 PM						
	D					WD0101017 RECOVERY: 1.5/1.5 FT.					ALL SAMPLES	
	0					0.0-0.2 TOPLSOIL; silty; organic debri, roots.					SCREENED	
	1					0.2-0.7 SILT, clayey; mod. yel. brn. 10YR 5/4 to dk. yel.					WITH HNU	
	0	Y				brn. 10YR 4/2; med. dense; dry.					AND GEIGER	
1.0	1					0.7-1.5 SILT, sandy; mod. yel. brn. 10YR 5/4; med.					CTR. NO HITS	
	0					dense, dry.					UNLESS	
	1										NOTED.	
	7											
2.0												
	W					TIME OUT: 4:20 PM						
	D	Y				WD0101029, WD0101031 DUP						
	0					RECOVERY: 1.5/1.5 FT.						
	1					2.0-3.0 SILT, sandy; mod. yel. brn. 10YR 5/4; dense; dry.						
	0					3.0-3.5 CLAY, silty; dk. yel. brn. 10YR 6/2;; med. dense;						
3.0	1					loose; damp to moist; sandstone pebble 2 cm. at						
	0					bottom.						
	2											
	9											
4.0												
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

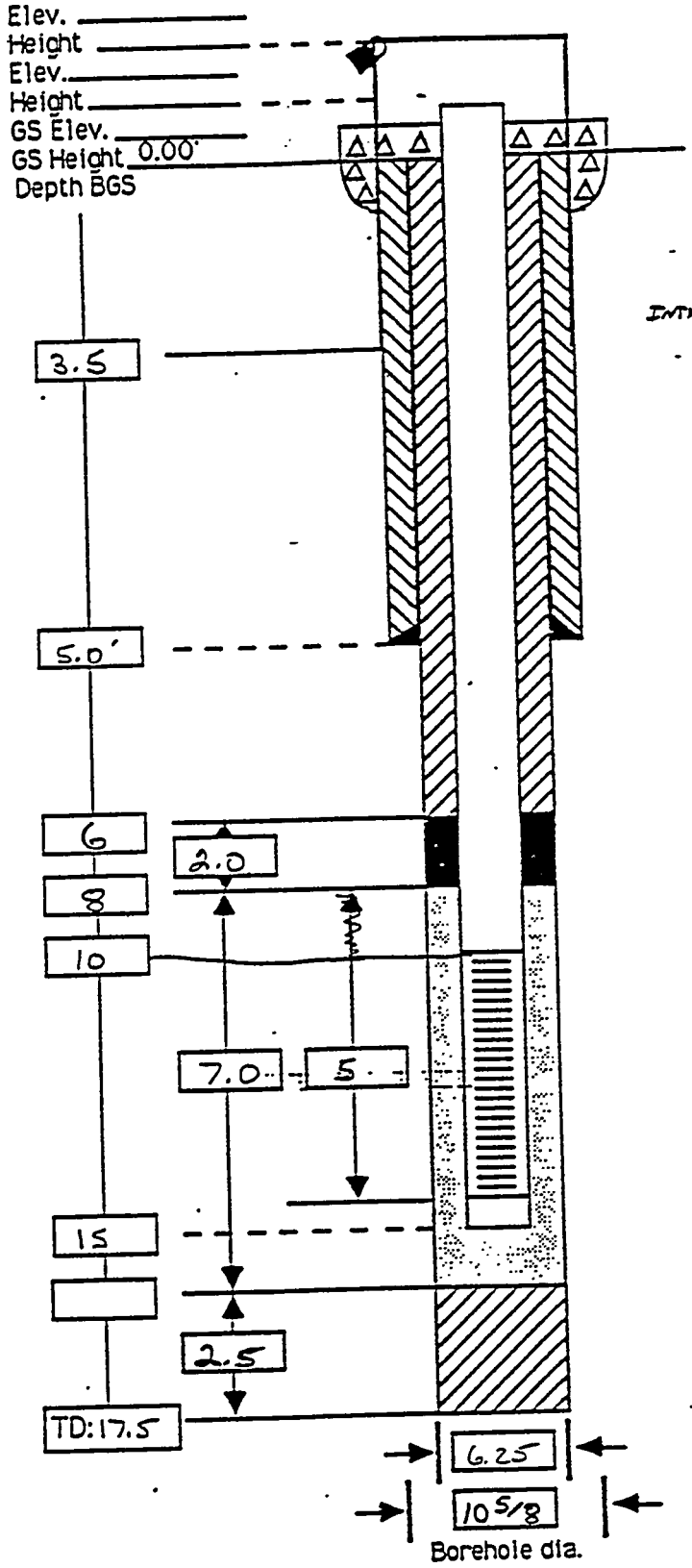
Field G/C(Make/Mod.) ____
G/C Oper.: ____

DRAFT

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased

WELL NO.: AN: E-3	Installation: Y-12 E FORK POPLAR CREEK	Site: GARDEN APTS.
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND
Comp. Start: 10/26/90 (1:30 PM m)		Comp. End: 11/08/90 (1:00 PM m)
Built By: DON. KEY HIGHLAND		Well Coord.:



SURFACE ~~PROTECTIVE~~ CSG
Material / Type CAST IRON
Diameter 11.75" 5' IN LENGTH
Depth BGS 3.5 Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size RIP RAP, CRUSH & RUN

INTERMEDIATE ~~SURFACE~~ CSG
Type CAST IRON
Diameter 7" Total Length 8.5

GROUT: Setup/Hydration Time 44 HOURS FOR 7"
Composition & Proportions 4 BAGS CEMENT
1/2 BAG BENTONITE POWER
Tremied (Y / N)

RISER PIPE
Type S.S.
Diameter 2" IN LENGTH
Total Length (TOC to TOS)
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 4 BAGS CEMENT +
1/2 BAG BENTONITE GEL
Tremied (Y / N)
Interval BGS 0 - 6.0'

CENTRALIZERS (Y / N)
Depth(s) BOTTOM @ 6' BGS

SEAL
Type BENTONITE (1/4" PELLETS)
Source PEL PLUG
Setup/Hydration time 30 MIN Vol. Fluid Added 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 6 BAGS (50 lb)
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND
Gr. Size Dist. 20/40

SCREEN
Type S.S. (5')
Diameter 2"
Slot Size & Type .010 CONT. WIRE WOUND

SUMP (Y / N)
Interval BSG Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-4	Page 1 of 2
Installation: EAST FORK POPLAR CREEK	Site: BEHIND PRIME SIRLOIN	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (10 04 a.m.) 11/13/90	Dev. End: (2 30 p.m.) 11/13/90	Csg Dia.: 2 INCH (INNER CSG)
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 1.60 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 1.75 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, becoming cloudy yellow brown, sometimes with a slight blue hue (oil sheen). Purge water is relatively clear compared to all other wells developed (except for AN:E-6). Poor recharge.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/13	10:15 a	2 bails							1st bailing: clean, clr.; 2nd bailing: clean, clr.
	10:16 a	0.50 gal			cldy./ yel. brn.		6.92	930 µMhos	Oil sheen on surface of sampling beaker and disposal bucket.
	10:18 a	0.75 gal			cldy./ yel. brn.		6.90	930 µMhos	No oil sheen on surface of sampling beaker.
	10:20 a	1.00 gal			cldy./ yel. brn.		6.85	920 µMhos	No oil sheen.
	10:23 a	1.25 gal			cldy./ yel. brn.		6.89	950 µMhos	Recharge rate poor; well purged near dry.
	10:26 a	1.25 gal							Allowed 5 min recharge
	10:31 a	1.30 gal							Water column 1" in bailer; slight blue hue in water sample.

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-4	Page 2 of 2
Installation: EAST FORK POPLAR CREEK	Site: BEHIND PRIME SIRLOIN	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (10 04 a m) 11/13/90	Dev. End: (2 30 pm) 11/13/90	Csg Dia.: 2 INCH (INNER CSG)
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 1.60 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 1.75 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, becoming cloudy yellow brown, sometimes with a slight blue hue (oil sheen). Purge water is relatively clear compared to all other wells developed (except for AN:E-6). Poor recharge.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/13	10:34 a	1.30 gal							Well purged dry; allowed for recovery.
	10:43 a	1.50 gal			Cldy./ yel. brn.		7.02	960 µMhos	Slight blue hue to water. Well purged dry
	2:30 p	1.75 gal			Cldy./		7.09	990 µMhos	Well purged dry; low recharge; readings generallyconsistent; relatively clear water: little sediment in water; Purge volume = 5 WC. WELL DEVELOPED

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-4	Page 1 of ___
Installation: E. Fork Poplar Creek		Site: N side E.F. Pop. Cr. behind Prime Sir.
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drlg.	Driller: D. Key
Drlg Started: 10-17-90 (3:45 P m)	Drlg Ended: 4:45 - 10-17-90 P m)	Borehole dia(s): 8"
Drlg Method/Rig Type: Hollow Stem Auger - backhoe driven		
Logged by: C. Wallen / B. Wilder	E-Log (Y / (N)) From ___ to ___	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft.)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
0					WD0101017 Time Out: 3:50pm 100% Recovery							
	WD0101017	Y		1.5'/1.5'	0.0-0.2 - Topsoil - Org. debris, roots Silty	3" split tube					All soil samples screened @ HNu & Geiger Ctr. No Hits unless noted	
1					0.2-0.7 - SILT - Clayey; mod. yellowish Brn, 10yr 5/4 to Dk, yell brn. 10yR4/2, Med Dense, Dry,							
					0.7-1.5 - SILT - Sandy, Mod yell brn. 10yr 5/4, Med. Dense, Dry							
2	WD0101029 & 031 (Dup)	Y & Dupl.		1.5'/1.5'	Time Out 4:20pm. 100% 2.0-3.0 - SILT - as above but - Denser							
					3.0-3.5 - CLAY - Silty, Dk yell Brn 10yr 4/2 to Pale yell brn 10yr 6/2, Med Dense - loose, Damp - Moist							
3					Sandstone Pebble - Subangular - 2cm L @ bottom							
					Bedrock hit @							
4												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ___
O = Other ___
Field G/C(Make/Mod.) ___
G/C Oper.: ___
Notes: 3" Split Tube down to 4 ft. 2" Split Tube below 4 ft.

DRAFT

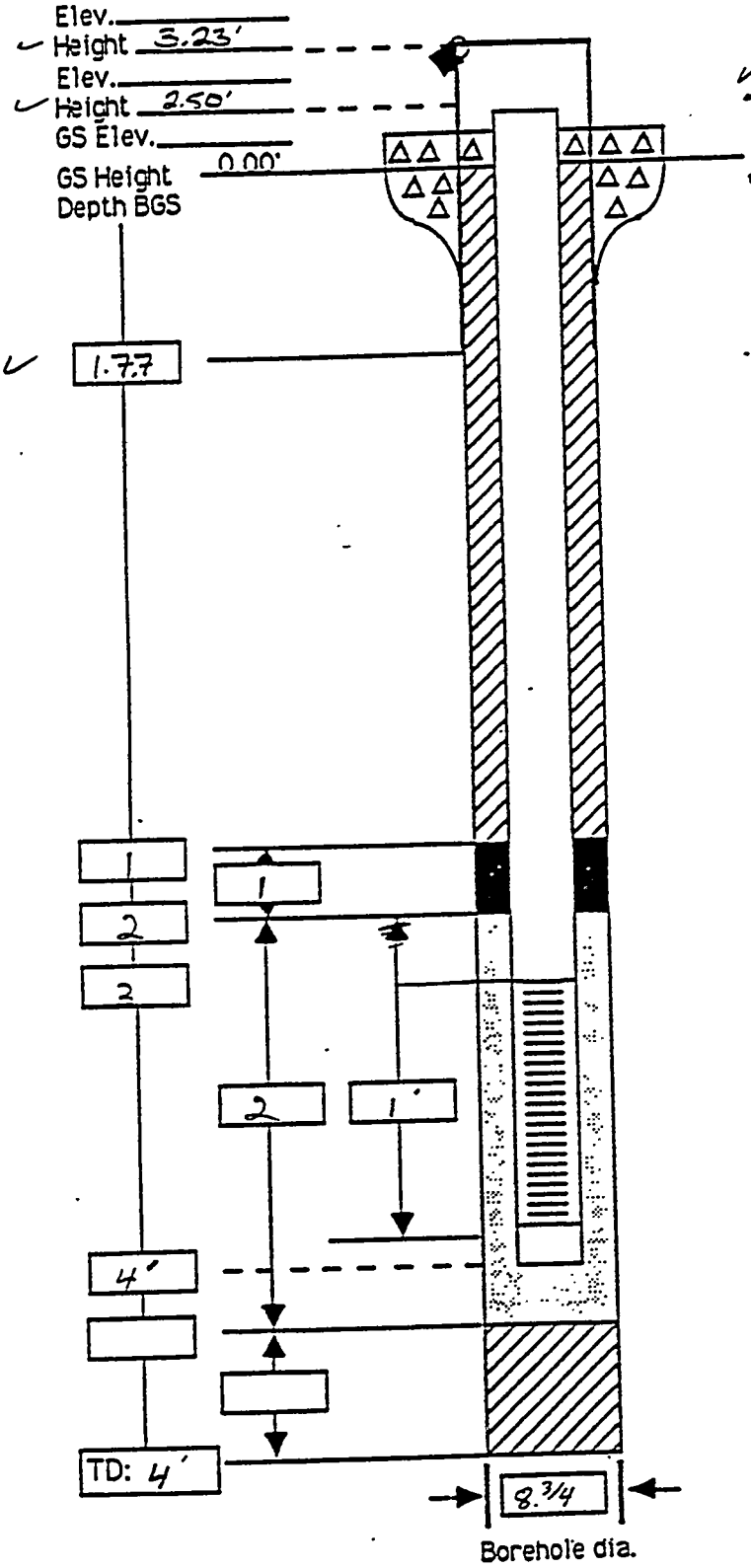
D-35

DRAFT

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN-E-4	Installation: EAST FORK POPLAR CREEK
Site: EFPC BEHIND PUMPHOUSE	
Project No.:	Client/Project: Y-12
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND
Comp. Start: 10/18/90 (: m)	Comp. End: 10/18/90 (: m)
Built By: HIGHLAND	Well Coord.:



PROTECTIVE CSG
Material / Type: CAST IRON
Diameter: 7"
Depth BGS: 1.77 Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size: NA

RISER PIPE
Type: SS.
Diameter: 2'
Total Length (TOC to TOS): 5 ft.
Ventilated Cap (Y / N)

GROUT
Composition & Proportions: 1 SACK OF CEMENT (1.30 FT³)
Tremied (Y / N)
Interval BGS

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type: BENTONITE (1/4" PELLETS) - 5 BUCKETS
Source: PEL PLUG
Setup/Hydration time: 30 min Vol. Fluid Added
Tremied (Y / N)

FILTER PACK
Type: SAND
Amt. Used: 1 BAG
Tremied (Y / N)
Source: MORIE INDUSTRIAL SAND
Gr. Size Dist.: 20/40

SCREEN
Type: S.S. (1')
Diameter: 2"
Slot Size & Type: .010 CONT. WIRE WOUND SS
Interval BGS: 3' - 4'

SUMP (Y / N)
Interval BSG Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-5	Page 1 of 1
Installation: EAST FORK POPLAR CREEK		Site: BEHIND K-MART
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/22/90 (10:15 a m)	Drlg Ended: 10/22/90 (11:11 a m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: D. BUNN/B. STANLEY	E-Log (Y / (N)) From ____ to ____	Protection Level: D

380.910 . 006

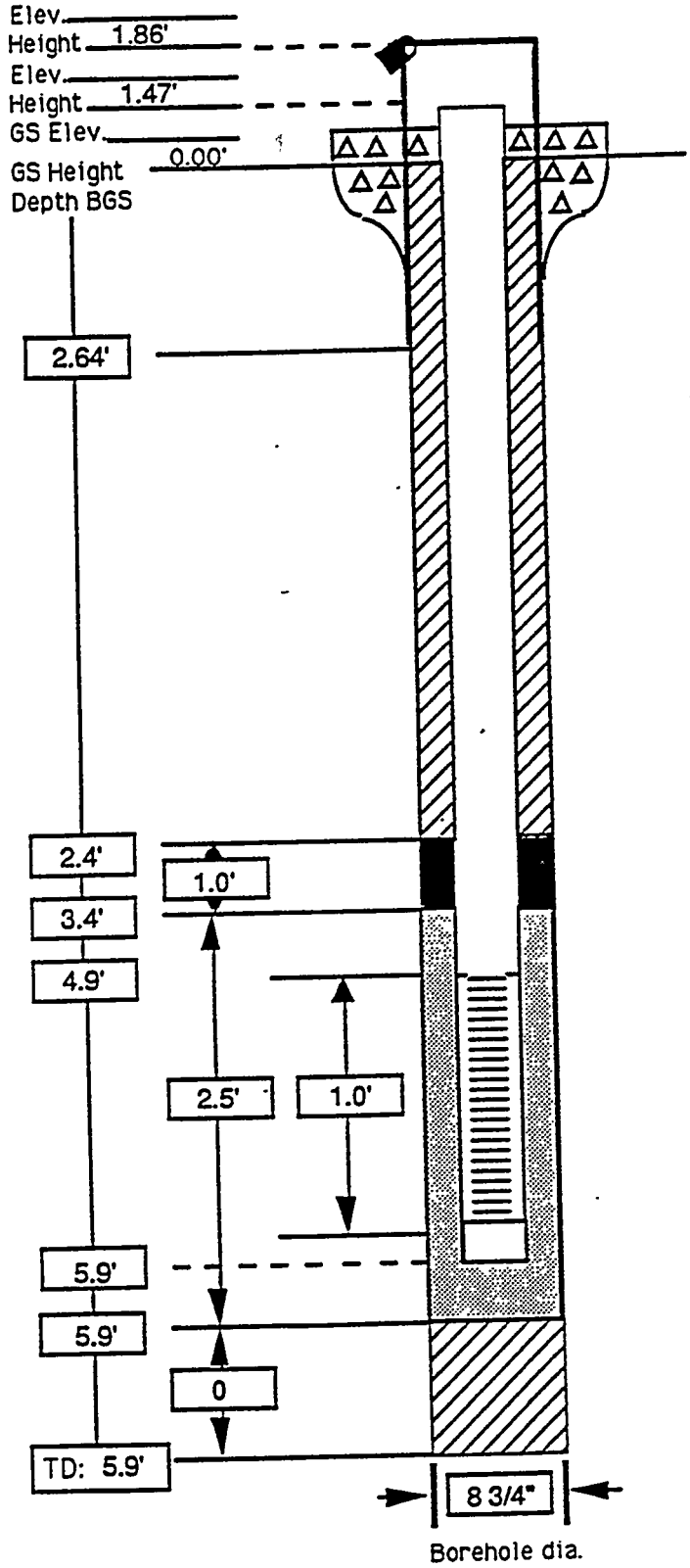
Depth (ft)	Sample	Sample No.	Lab Anal (Y / N)	( )	hosp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0						TIME OUT: 10:34 PM WC0201017 RECOVERY: 1.5/1.5 FT. 0.0-0.6 TOP SOIL, SILT AND CLAY; gr. brn. 5YR 3/2; med. stiff; loose; wet/damp; occasional roots, organic debris. 0.6-1.1 CLAY, silty; lt. brn. 5 YR 4/4; med. stiff; loose; moist to dry; occasional small gravel. 1.1-1.5 SILT; mod. yel. brn. 10YR 5/4; loose to crumbly; dry to damp; occasional sandy particles.					ALL SAMPELS SCREENED WITH HNU AND GEIGER COUNTER. NO HITS DETECTED.	
1.0												
2.0						TIME OUT: 10:51 AM WC0201029 RECOVERY: 1.5/1.5 FT. 2.0-3.2 SILT; mod. yel. brn 10YR 5/4; loose to crumbly; dry to damp; occ. sand particles. 3.2-3.5 CLAY; brn gry.; soft to med. stiff; damp; less than 5% mottles and occ. silty grains; very pliable.						
3.0												
4.0						TIME OUT: 11:04 AM SAMPLE NOT TAKEN. RECOVERY: 0.1 FT. 4.0-4.1 SILT SAND CLAY; gr. brn 5YR 3/2; soft; med. stiff; v. loose/crumbly; decomposed roots, organic debris; sand particles and gravel. SPLIT SPOON REFUSAL AT 4.3 FT. AT 11:11 AM.						
5.0												
6.0												

U = Thin Wall Tube R = Rock Coring ____ Field G/C(Make/Mod.) ____
S = Split spoon(tube) O = Other ____ G/C Oper.: ____
C = Cuttings Notes: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN:E-5	Installation: EAST FORK POPLAR CREEK	Site: BEHIND K-MART
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/22/90 (10:15 A m)		Comp. End: 10/22/90 (2:00 P m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type: CAST IRON
Diameter: 7 INCH (4.5 FT LENGTH)
Depth BGS: 2.64 FT Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size: CONCRETE (2.8' X 2.8' X 0.5')

RISER PIPE
Type: STAINLESS STEEL
Diameter: 2 INCH
Total Length (TOC to TOS): 6.37 FT
Ventilated Cap (Y / N)

GROUT
Composition & Proportions: 1.30 CU FT CEMENT (1 SACK)
Tremied (Y / N)
Interval BGS: 0 - 2.4 FT

CENTRALIZERS (Y / N)
Depth(s): _____

SEAL
Type: 1/4 INCH BENTONITE PELLETS (1/2 BUCKET)
Source: PEL PLUG
Setup/Hydration time: 1/2 HR Vol. Fluid Added: 1 GAL
Tremied (Y / N)

FILTER PACK
Type: SAND
Amt. Used: 1/2 100 LB BAG
Tremied (Y / N)
Source: MORIE INDUSTRIAL SAND, NEW JERSEY
Gr. Size Dist.: 20/40

SCREEN
Type: STAINLESS STEEL
Diameter: 2 INCH (1 FT)
Slot Size & Type: 0.010, CONTINUOUS WIRE-WRAP
Interval BGS: 4.9 FT - 5.9 FT

SUMP (Y / N)
Interval BGS _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material _____
Setup/Hydration time _____
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-5	Page 1 of 1
Installation: EAST FORK POPLAR CREEK	Site: BEHIND K-MART	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (3:12 p m) 11/7/90	Dev. End: (3: 43 pm) 11/7/90	Csg Dia.: 2 INCH (INNER CSG)
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 3.76 FT BGS Maximum drawdown during pumping N/A ft at _____ gpm

Range and Average Discharge rate N/A

Total quantity of material bailed 2 GALLONS

Total quantity of water discharged by pumping N/A

Disposition of discharge water Initially clear, rapidly becoming dark brown (mocha coffee color). Good recharge.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/7	3:27 p	0.5 gal			Cldy./ dk. brn.	16°	6.60	750 µMhos	1st bailing: clear, except bottom of bail; mocha coffee color.
	3:35 p	1.0 gal			Cldy/ dk. brn.	17°	6.64	760 µMhos	Good recharge; mocha coffee color.
	3:40 p	1.5 gal			Cldy./ dk. brn.	17°	6.54	685 µMhos	Good recharge; mocha coffee color.
	3:43 p	2.0 gal			Cldy./ dk. brn.	17°	6.58	740 µMhos	5.7 water columns purged. WELL DEVELOPED

REV. DATE: MAY 1990

Page 1 of 1

BORING LOG	BORING/WELL NO.: AN: E-5	Site:
Installation:		
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND DRILLING	Driller: MARK COPEMAN
Drlg Started: 10/22/90 (10:15 A m)	Drlg Ended: 10/22/90 (11:11 A m)	Borehole dia(s): 8 3/4"
Drlg Method/Rig Type: HOLLOW STEM AUGER w/ BACKHOE DRIVE		
Logged by: D. BUNN / B. STANLEY	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
0.0	S	WC0201017		1.5/1.5	SAMPLE WC0201017 TIME OUT 10:34 AM RECOVERY 1.5/1.5 0.0 - 0.6 TOP SOIL, SILT & CLAY GRY. BROWN (5YR 3/2) MED. STIFF AND LOOSE, WET/DAMP OCC. ROOTS / ORGANIC DEBRIS 0.6 - 1.1 CLAY W/SILT, LT BROWN (5YR 4/4) MED. STIFF - LOOSE, MOIST TO DRY OCC. SMALL GRAVEL 1.1 - 1.5 SILT, MOD. YLW. BRWN (10 YR 5/4) LOOSE TO CRUMBLY, DRY TO DAMP OCC. SANDY PARTICLES							
1.0												
2.0		WC0201029		1.5/1.5	SAMPLE WC0201029 (WC0201031 DUP) TIME OUT 10:51 AM RECOVERY 1.5/1.5 0.0 - 1.2 SILT, MOD - YELLOW BROWN (10 YR 5/4) LOOSE TO CRUMBLY, DRY TO DAMP, OCC. SANDY PARTICLES 1.2 - 1.5 CLAY, BROWNISH GREY, SOFT TO MED STIFF, DAMP, LESS THAN 5% MOTTLES. AND OCC. SILTY GRAINS, VERY PLIABLE							
3.0												
4.0					SAMPLE NOT TAKEN SAMPLE WC02010 TIME OUT 11:04 RECOVERY Ø.1 SILT SAND CLAY GRAYISH BROWN (5 YR 3/2), SOFT MED. STIFF, VERY LOOSE / CRUMBLEY DECOMPOSED ROOTS, ORGANIC DEBRIS SAND PARTICLES & GRAVEL							
5.0					SPLIT SPOON REFUSAL @ 4.3' @ 11:11 TOTAL DEPTH AFTER AUGERING = 5.9' ?							
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____

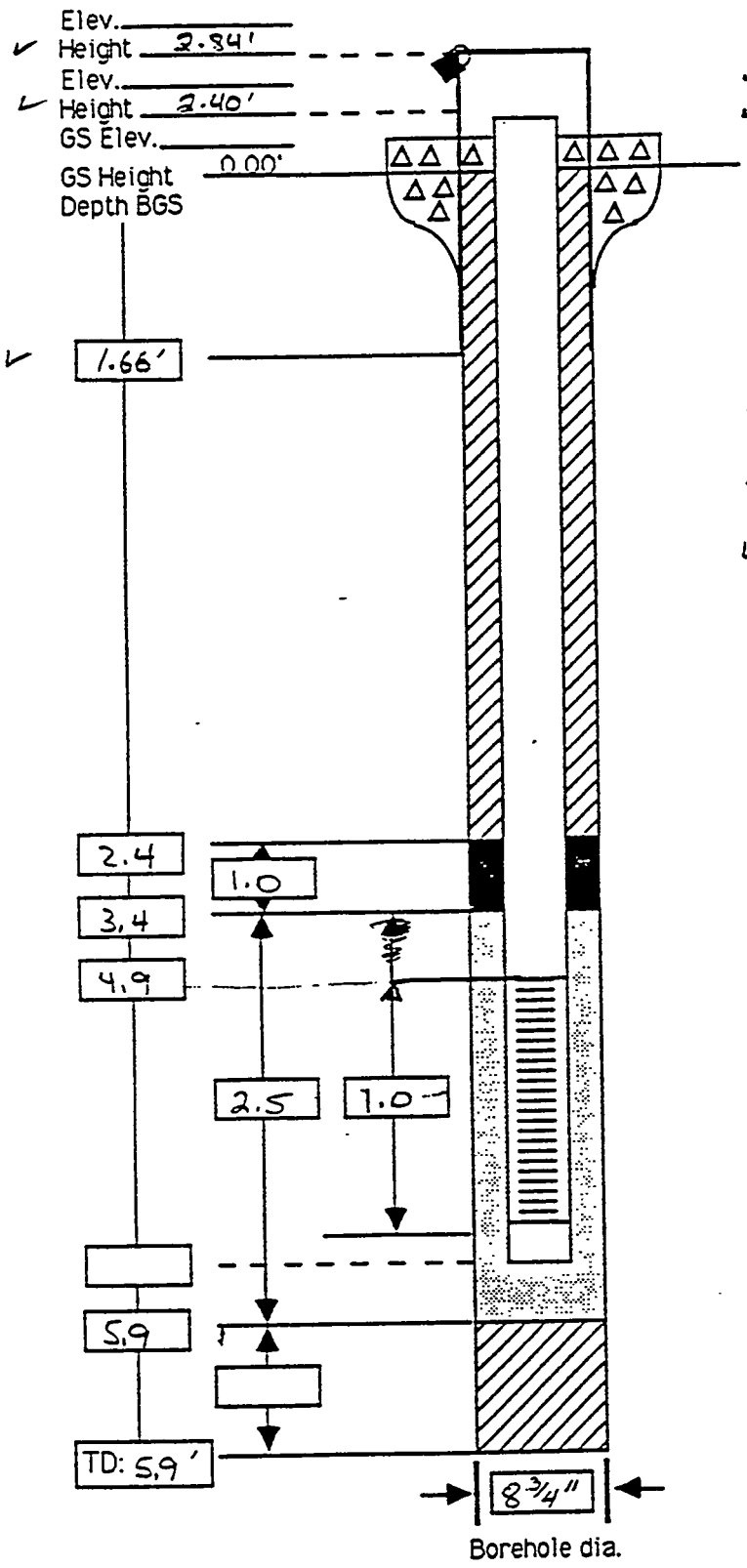
Field G/C(Make/Mod.) ____
G/C Oper.: ____

Notes: ____

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN:E-5	Installation: EAST FORK POPLAR CREEK	Site:
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND	
Comp. Start: 10/22/90 (10:15 AM m)	Comp. End: 10/22/90 (2:00 PM m)	
Built By:	Well Coord.:	



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 7" (4.5')
Depth BGS 1.66 Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size NA

RISER PIPE
Type SS
Diameter 2"
Total Length (TOC to TOS)
Ventilated Cap (Y N)

GROUT
Composition & Proportions 1 SACK OF CEMENT (1.30 FT³)
Tremied (Y / N)
Interval BGS 0-2.4

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type BENTONITE (1/4" PELLETS) .5 BUCKET
Source PEL PLUG
Setup/Hydration time 30 MIN Vol. Fluid Added
Tremied (Y N)

FILTER PACK
Type SAND
Amt. Used 1/2 BAG
Tremied (Y / N)
Source MORIE IND SAND
Gr. Size Dist. 20/40

SCREEN
Type SS
Diameter 2" (1')
Slot Size & Type .010 CONT WIRE WOUND
Interval BGS 4.9'- 5.9'

SUMP (Y / N)
Interval BSG Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: MAY 1990

WELL DEVELOPMENT LOG

Well No.: AN/E:5 | Page ____ of ____

Site:- Behind K-mart across creek

Installation:

Project No.: | Client/Project:

HAZWRAP Contractor: | Dev. Contractor:

Dev. Start (: ____m) | Dev. End: (: ____m) | Csg Dia.: 2"

Dev. Rig (Y / N)

Developed by:

Dev. Method hand - bailer (disposable 1" PVC)

Equipment

Pre-Dev. SWL 3.76 ft Maximum drawdown during pumping ____ ft at ____ gpm

Range and Average Discharge rate ____ gpm

Total quantity of material bailed 2 gal

Total quantity of water discharged by pumping

Disposition of discharge water

Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
3:27p	.5			dark brown (mocha coffee)	16	6.60	750 µmhos	
3:35	1			dark br. (coffee)	17	6.64	760 µmhos	good recharge
3:40	1.5			dark br. (coffee)	17	6.54	785 µmhos	good recharge
3:43	2			dark brown	17	6.58	740 µmhos	well developed 5.7 columns purged

REV. DATE: NOV 1990

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BORING LOG	BORING/WELL NO.: AN:E-6	Page 1 of 5
Installation: EAST FORK POPLAR CREEK		Site: N. SIDE EFPC (BEHIND K-MART)
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY/ S. BROWN
Drlg Started: 10/18/90(2: 00 P m)	Drlg Ended: 10/18/90(2 : 35 P m)	Borehole dia(s): 8.75 INCH
Drlg Method/Rig Type: HOLLOW STEM W/BACKHOE DRIVE; AIR ROTARY		
Logged by: C. WALLEN/ K. WALTER	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp ( ) Recovery (ft)	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0		WC0101015	Y			TIME OUT: 2:04 PM (3 IN. SPOON) WC0101015 RECOVERY: 1.5/1.5 FT. 0.0-0.3 TOP SOIL; dk.; organic; roots. 0.3-0.7 CLAY; silty; mod. brn. 5YR 4/4; dry; med. dense; dry. 0.7-1.5 CLAY; mod. brn. 5YR 4/4; dense; dry; minor chert fragments; pale yel or. 10YR8/6; sandstone fragments; dk. yel. brn. 10YR 4/2; iron staining.					ALL SOIL SAMPLES SCREENED WITH HNU AND GEIGER CNTR. NO HITS UNLESS NOTED.	
1.0												
2.0		WC0101039	Y			TIME OUT: 2:19 PM (3 IN. SPOON) WC0101039 (DUP WC0101041) RECOVERY:1.5/1.5 FT. 2.0-2.5 CLAY; mod. brn. 5YR 4/4; dense; dry; minor chert fragments; pale yel. or. 10YR 8/6; sandstone\ fragments; dk. yel. brn. 10YR 4/2; iron staining. 2.5-3.5 SILT; trace of clay; pale yel. brn. 10YR 6/2; dense; dry; minor iron staining.						
3.0												
4.0			N			(2 INCH SPOON) NO SAMPLE RECOVERY: 0.2/1.5 FT. 3.5-3.7 SILT; trace of clay; pale yel brn. 10YR 6/2; considerable chert fragments; pale or. 10YR 8/2; sandstone fragments; dk. yel. brn. 10YR 4/2. HOLE OFFSET APPROX. 3 FT.; WATER IN BOTTOM OF BORING; BEDROCK AT 5.5 FT.						
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-6	Page 2 of 5
Installation: EAST FORK POPLAR CREEK		Site: N. SIDE EFPC (BEHIND K-MART
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY/ S. BROWN
Drlg Started: 10/18/90(2: 00 P m)	Drlg Ended: 10/18/90(2: 35 P m)	Borehole dia(s): 8.75 INCH
Drlg Method/Rig Type: HOLLOW STEM W/BACKHOE DRIVE; AIR ROTARY		
Logged by: C. WALLEN/ K. WALTER	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N) ( )	Recovery (ft) hdsp ( )	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth &	Remarks	Elev. (ft)
3.0												
					CONTINUATION OF PAGE 1 LOG BUT HOLE OFFSET BY APPROXIMATELY 3 FT.							
4.0					3.5-3.7 SILT; trace clay; pale yel. brn. 10YR 6/2; thin layer (0.1 inch) silt; dusky yel brn. 10YR 2/2; chert fragments; sandstone fragments.							
5.0												
					BEDROCK AT 5.5 FT.							
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-6	Page 3 of 5
Installation: EAST FORK POPLAR CREEK		Site: N. SIDE EFPC (BEHIND K-MART)
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND DRILL.	Driller: D. KEY/ S. BROWN
Drlg Started: 10/18/90(2 00 P m)	Drlg Ended: 10/18/90(2 : 35 P m)	Borehole dia(s): 8.75 INCH
Drlg Method/Rig Type: HOLLOW STEM W/BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N) ( )	Recovery (ft) hdsp ( )	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
					ALL CUTTINGS CONTAINERIZED-BLOWN DIRECTLY INTO LARGE BIN. NO CUTTINGS AVAILABLE FOR LITHOLOGIC DESCRIPTION.					BEDROCK DRILLING MONITORED FOR EXCESS VAPORS. NONE DETECTED.	
14.0					DRILLED OUT OF 7 INCH CASING. SMOOTH DRILLING ALL THE WAY TO TOTAL DEPTH. NO VISIBLE DRILLING BREAKS.						
15.0											
16.0											
17.0											
18.0											
19.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-6	Page 4 of 5
Installation: EAST FORK POPLAR CREEK		Site: N. SIDE EFPC (BEHIND K-MART)
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY/ S. BROWN
Drlg Started: 10/18/90 (2:00 p m)	Drlg Ended: 10/18/90 (2:35 p m)	Borehole dia(s): 8.75 INCH
Drlg Method/Rig Type: HOLLOW STEM W/BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y / N)	( )	Recovery (ft	hdsp ( )	Lithologic Description	USCS	Blows / 6 inch.	Graphic Log	Well data	Water depth &	Remarks	Elev. (ft)
20.0														
21.0														
22.0														
23.0														
24.0														
25.0														
26.0														

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-6	Page 5 of 5
Installation: EAST FORK POPLAR CREEK		Site: N. SIDE EFPC (BEHIND K-MART)
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND DRILL.	Driller: D. KEY/ S. BROWN
Drlg Started: 10/18/90(2 00 P m)	Drlg Ended: 10/18/90(2: 35 P m)	Borehole dia(s): 8.75 INCH
Drlg Method/Rig Type: HOLLOW STEM W/BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N) ( )	Recovery (ft) Hdsp ( )	Lithologic Description	USCS	Blows / 6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
27.0											
28.0											
29.0											
30.0					TOTAL DEPTH: 30.9 FT. SEAL ASSOCIATED WITH SEVEN INCH CASING FAILED. WATER ENTERING HOLE. COULD NOT DETERMINE IF BEDROCK AQUIFER WAS ENCOUNTERED. DECIDED TO COMPLETE WELL AS OPEN HOLE.						
31.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

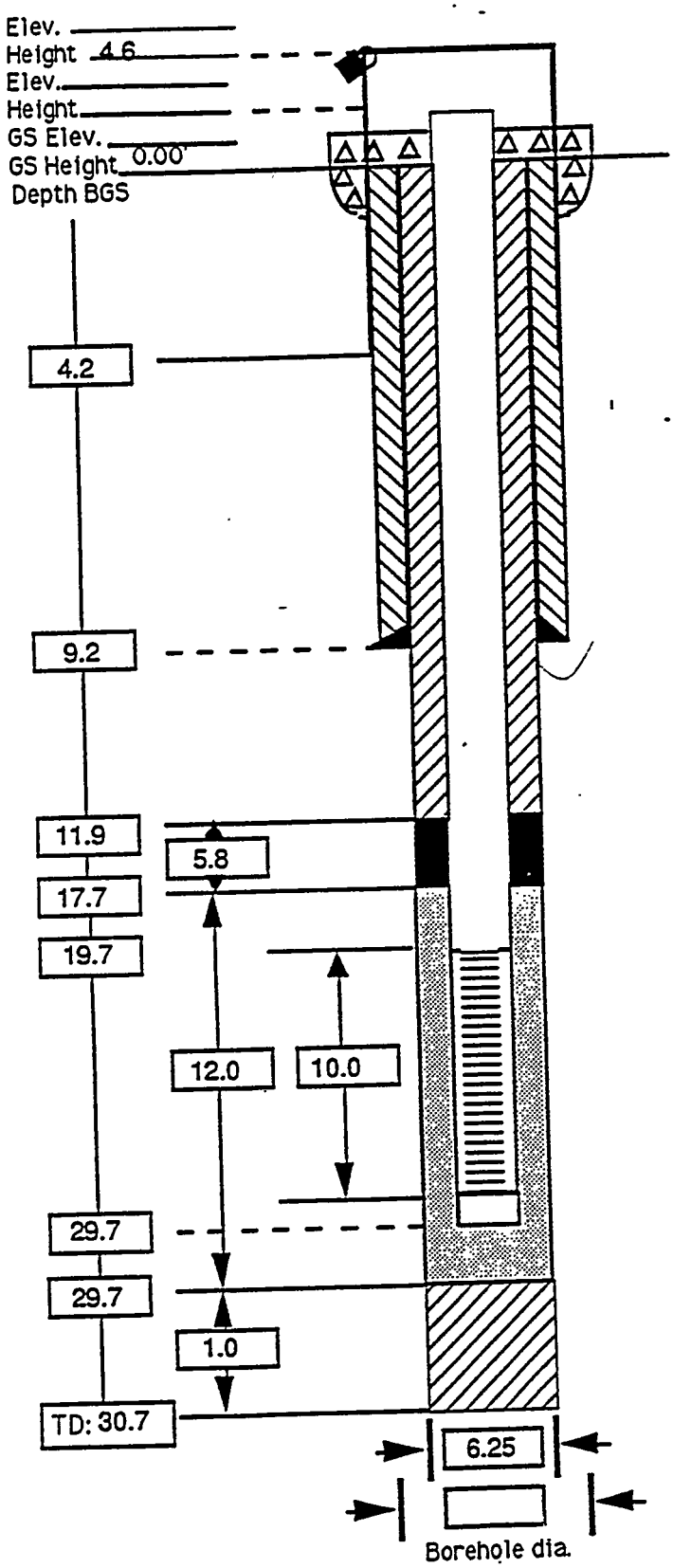
R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased

WELL NO.: AN:E-6	Installation: EAST FORK POPLAR CREEK	Site: BEHIND K MART
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 1/9/91 (9 : 00 A m)		Comp. End: 1/9/91 (9 : 00 A m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type
Diameter
Depth BGS Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size CONCRETE (2.8'X2.8'X0.5')

INTERMEDIATE CSG
Type CAST IRON
Diameter 7 INCH Total Length 16.9 FT.

GROUT: Setup/Hydration Time 45 HOURS
Composition & Proportions 6 BAGS 94 LB CEMENT AND 0.5 BAG BENTONITE POWDER.
Tremied (Y / N)

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS)
Ventilated Cap (Y / N)

GROUT
Composition & Proportions CEMENT AND BENTONITE POWDER
Tremied (Y / N)
Interval BGS

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type BENTONITE PELLETS
Source
Setup/Hydration time 24 HRS Vol. Fluid Added NA
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 4 BAGS
Tremied (Y / N)
Source
Gr. Size Dist.

SCREEN
Type STAINLESS STEEL
Diameter 2 INCH
Slot Size & Type 0.010 INCH WIRE WOUND

SUMP (Y / N)
Interval BGS Length
Bottom Cap (Y / N)

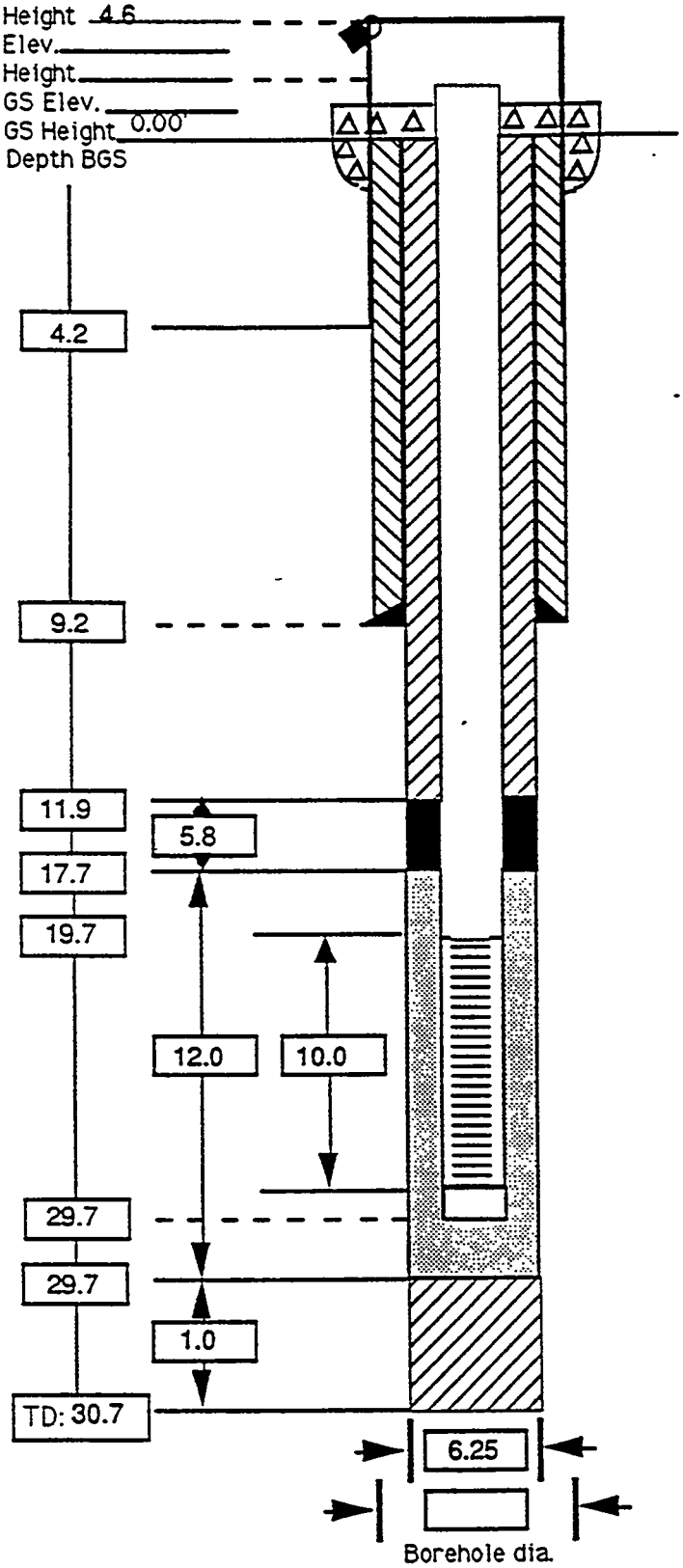
BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased

WELL NO.: AN:E-6	Installation: EAST FORK POPLAR CREEK	Site: BEHIND K MART
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND DRILLING	
Comp. Start: 1/9/91 (9 : 00 A m)	Comp. End: 1/9/91 (9 : 00 A m)	
Built By: HIGHLAND DRILLING	Well Coord.:	

Elev. _____
Height 4.6
Elev. _____
Height _____
GS Elev. _____
GS Height 0.00'
Depth BGS



PROTECTIVE CSG
Material / Type _____
Diameter _____
Depth BGS _____ Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size CONCRETE (2.8'X2.8'X0.5')

INTERMEDIATE CSG
Type CAST IRON
Diameter 7 INCH Total Length 16.9 FT.

GROUT: Setup/Hydration Time 45 HOURS
Composition & Proportions 6 BAGS 94 LB CEMENT AND 0.5 BAG BENTONITE POWDER.
Tremied (Y / (N))

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS) _____
Ventilated Cap (Y / N)

GROUT
Composition & Proportions _____
Tremied (Y / N)
Interval BGS _____

CENTRALIZERS (Y / (N))
Depth(s) _____

SEAL
Type BENTONITE PELLETS
Source _____
Setup/Hydration time 24 HRS Vol. Fluid Added NA
Tremied ((Y) / N)

FILTER PACK
Type SAND
Amt. Used 4 BAGS
Tremied ((Y) / N)
Source _____
Gr. Size Dist. _____

SCREEN
Type STAINLESS STEEL
Diameter 2 INCH
Slot Size & Type 0.010 INCH WIRE WOUND

SUMP (Y / (N))
Interval BGS _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material _____
Setup/Hydration time _____
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-6	Page 1 of 1
Installation: EAST FORK POPLAR CREEK	Site: BEHIND K-MART	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (1:50 p.m) 1/17/91	Dev. End: (4:45 p.m) 1/17/91	Csg Dia.: 2 INCH
Developed by: M. GUNDERSON		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 6.85 FT BTOC Maximum drawdown during pumping NA ft at _____ gpm

Range and Average Discharge rate NA

Total quantity of material bailed 30 GALLONS

Total quantity of water discharged by pumping NA

Disposition of discharge water CLEAR

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
1/17	2:00	0.1			CLEAR		7.08	1200 µMhos	
	2:26	5			CLEAR		7.08	1000 µMhos	
	3:00	10			CLEAR		6.65	900 µMhos	
	3:19	15			CLEAR		6.40	900 µMhos	
	3:42	18			CLEAR		6.82	870 µMhos	
	4:00	20			CLEAR		6.95	860 µMhos	10 well volumes purged.
	4:09	23			CLEAR		6.98	860 µMhos	Water level remained
	4:19	25			CLEAR		6.98	850 µMhos	constant throughout
	4:36	30			CLEAR		7.02	860 µMhos	development.
									WELL CONSIDERED DEVELOPED.

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-6	Page 1 of 1
Installation: EAST FORK POPLAR CREEK	Site: BEHIND K-MART	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (9:15 a m) 11/14/90	Dev. End: (3: 47 pm) 11/14/90	Csg Dia.: 7 INCH (OPEN HOLE)
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method AIR SURGE SYSTEM WITH CHECK VALVE AT BOTTOM OF TREMIE PIPE: Coleman Powermate 54 Series generator, hooked up to a Pneumotive (100 PSIG Max, 23 PSIG avg) electric air compressor. Air line inside tremie with outflow end near check valve. Rubber tubing hooked up into outer (outside of well) end of tremie, with purge water outflow directly into 55 gallon stainless steel drums.

Equipment Powermate 54 Series gas-powered generator; Pneumotive electric air compressor; 30' of tremie pipe; 20' of rubber hosing; air line hosing.

Pre-Dev. SWL 3.44 FT BGS Maximum drawdown during pumping 0.02 ft at 1.0 gpm

Range and Average Discharge rate Range: 0.60 gpm - 1.0 gpm; Average:0.67 gpm

Total quantity of material bailed

Total quantity of water discharged by pumping 245 gallons, or 5.05 water columns; water column: 48.5 gallons.

Disposition of discharge water

Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks

REV. DATE: MAY 1990

Page 1 of 2

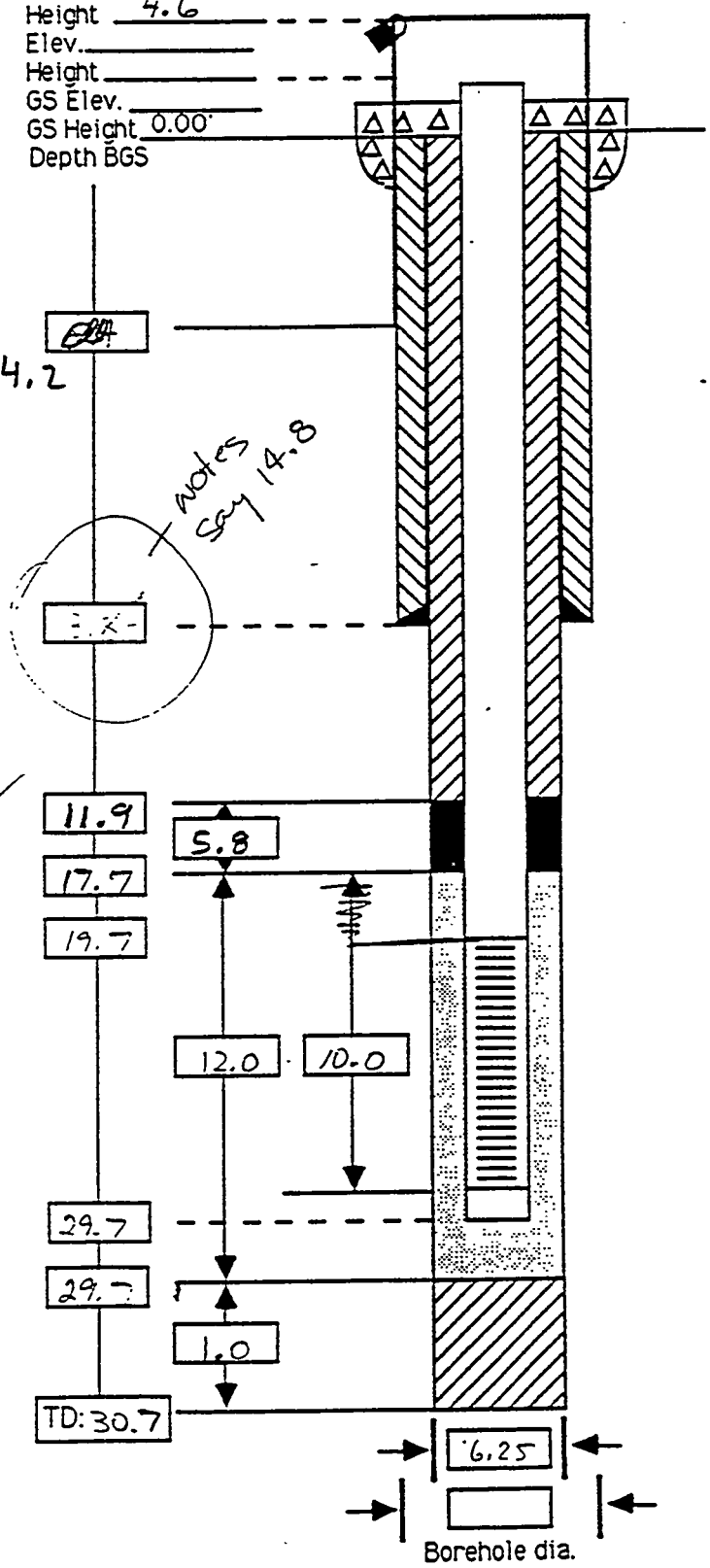
BORING LOG	BORING/WELL NO.: ANE-6	Site: N. side Ef Poplar Cr. (behind K mart)
Installation: E. Fork Poplar Creek		
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drlg.	Driller: D. Key & S. Brown
Drlg Started: 10/18/90 (14:00 P m)	Drlg Ended: 10/18/90 (2:35 P m)	Borehole dia(s): 8"
Drlg Method/Rig Type: Hollow Stem auger-backhoe driven		
Logged by: Wallen / Walter	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (hdsp)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0		WC01Ø15	Y	1.5/1.5 (14:04)	0.0 - -0.3 Top Soil dark, organic, roots 0.3 - 0.7 clay; silty; mod. brn., 5yr 4/4, med. dense, dry 0.7 - 1.5 clay; mod. brn., 5yr 4/4; dense; dry; minor chert frags.; pale yellowish orange 10yr 8/6; Snd. Stone frag.; drk. yel. brn. 10yr 4/2; iron staining		3" split tube			All soil samples screened with Hnu + Geiger No Hits unless noted.	
1.5											
2'		WC01Ø1Ø39	X and 41 (dup)	1.5/1.5 (14:19)	2.0 - 2.5 same as above 2.5 - 3.5 silt; trace clay, pale yel brn 10YR 6/2; dense; dry; minor iron staining						
3.5					3.5 - 3.7 silt; trace clay, pale yel brn 10YR 6/2; considerable chert frags., pale orng. 10YR 8-2; SS frags., drk. yel brn 10YR 4/2 ~~bedrock hit at 3.7~~ water in bottom of bore		2" split tube				

U = Thin Wall Tube
S = Split spoon (tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased		
WELL NO.:	Installation: AN E-6	Site: ~~[illegible]~~
Project No.:	Client/Project:	BEHIND K MART
HAZWRAP Contractor:		Drlg Contractor:
Comp. Start: (: m)		Comp. End: (: m)
Built By:		Well Coord.:



PROTECTIVE CSG
Material / Type ~~CAST IRON~~
Diameter ~~[illegible]~~
Depth BGS ~~[illegible]~~ Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size CONCRETE (2.8' x 2.8' x 0.5')

SURFACE CSG
Type CAST IRON
Diameter 7" Total Length 16.9

GROUT: Setup/Hydration Time 45 HRS
Composition & Proportions 6 BAGS 94 lb CEMENT AND .5 BAG BENTONITE POWDER
Tremied (Y / N)

RISER PIPE
Type S.S.
Diameter 2"
Total Length (TOC to TOS)
Ventilated Cap (Y / N)

GROUT
Composition & Proportions
Tremied (Y / N)
Interval BGS

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type BENTONITE PELLETS
Source
Setup/Hydration time 24 HRS Vol. Fluid Added NA
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 4 BAGS
Tremied (Y / N)
Source
Gr. Size Dist.

SCREEN
Type SS
Diameter 2"
Slot Size & Type .010 WIRE WOUND

SUMP (Y / N)
Interval BSG Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-7	Page 1 of 2
Installation: EAST FORK POPLAR CREEK		Site:ACROSS FROM ROCKY TOP MKT
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL	Driller: D. KEY
Drlg Started: 10/10/90 (3:20 p m)	Drlg Ended: 10/10/90 (4:40 P m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C. WALLEN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

380.910131.008

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0	S	WB0101013	Y			TIME OUT: 3:34 PM WB0101013 RECOVERY: 1.8/2.0 FT. 0.0-0.3 CLAY, silty; dk. yel. brn. 10YR 4/2; med. dense; dry; minor coal. 0.3-0.7 CLAY, silty; mod. yel. brn. 10YR 5/4; med. dense; dry. 0.7-1.5 SILT; dk. yel. brn. 10YR 4/2 to dusky yel. brn. 10YR 2/2; minor chert, v. pale or. 10YR 8/2; dry; minor coal. 1.5-1.8 CLAY; mod. yel. brn. 10YR 5/4 to pale yel. brn. 10YR 6/2; med. dense; dry.					ALL SAMPLES SCREENED WITH HNU AND GEIGER CTR. NO HITS UNLESS	
1.0												
2.0	S	WB0101025	Y			TIME OUT: 3:53 PM WB0101025 RECOVERY: 1.2/2.0 FT/ 2.8-3.3 CLAY, silty; mod. yel. brn. 10YR 5/4; med dense;dry; minor coal. 3.3-3.55 SAND, cherty; gr. or. 10YR 5/4 to dk. yel. or. 10YR 6/6; minor silt, mod. yel brn 10YR 5/4; damp. 3.55-4.0 CLAY, silty; dk. yel. or. 10YR 6/6 to mod. yel. brn.10YR 5/4; med. dense; dry; minor coal.						
3.0												
4.0	S	WB0101037	Y			TIME OUT: 3:59 PM WB0101037 RECOVERY: 1.6/2.0 FT. 4.6-5.0 CLAY, v. silty; dusky yel. brn. 10YR 2/2; loose, damp; minor chert grains, v. pale or. 10YR 8/2. 5.0-6.0 SILT, mod. clay; lt. olive gray 5Y 5/2; loose; damp.						
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-7	Page 2 of 2
Installation: EAST FORK POPLAR CREEK		Site ACROSS FROM ROCKY TOP MKT
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/10/90 (3:20 P m)	Drlg Ended: 10/10/90 (4:40 P m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C. WALLEN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp (	Lithologic Description	USCS	Blows / 6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
6.0		WB0101049 S				TIME OUT: 4:10 PM WB0101049 RECOVERY: 1.8/2.0 FT. 6.2-7.4 CLAY, silty; lt. olive gr. 5Y 5/2 to lt. olive brn. 5Y 5/6; med. dense; damp; minor chert grains; v. pale or. 10YR 8/2. 7.4-7.7 SAND, v. silty; chert sand grains; v. pale or. 10YR 8/2; silt mod . dk. gr. N4. 7.7-7.8 COAL; gr. black to black N2. 7.8-8.0 SAND, v. silty; chert sand grains; v. pale or. 10YR 8/2; silt med. dk. gr N4.						
7.0												
8.0		WB0101051 S				TIME OUT: 4:33 PM WB0101051 RECOVERY 1.3/1.4 FT. 8.1-8.8 ORGANIC MATTER, woody; minor silt; gr. black N2; loose; damp. 8.8-9.4 CLAY, green. gry. 5G 6/1 to med. bl. gry 5B 5/1; dense to med. dense; dry; plastic.						
9.0												
10.0												

This log is for the original borehole that was drilled. A second boring was [illegible] and the [illegible] [illegible]. The original boring was [illegible]. [illegible]

CAB 5-26-92

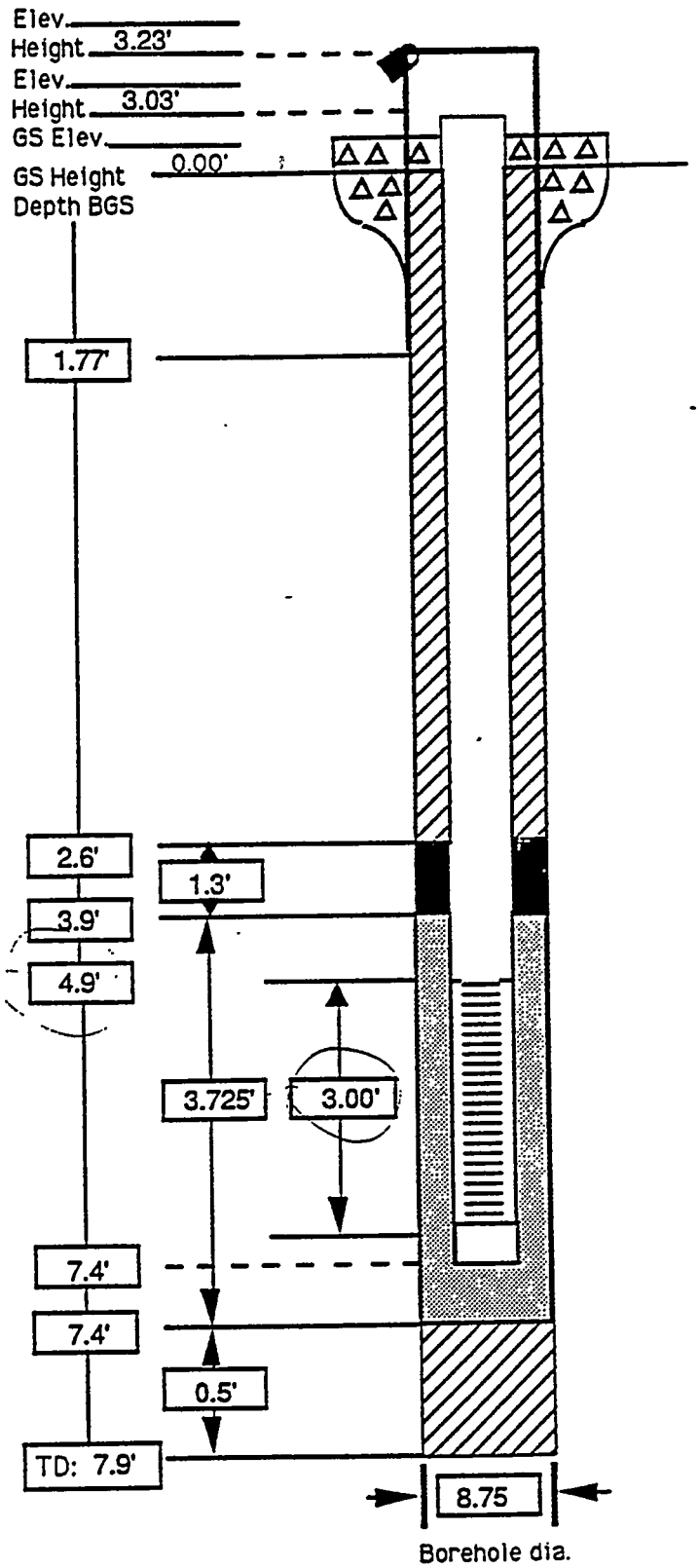
U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Standard		
WELL NO.: AN:E-7	Installation: EAST FORK POPLAR CREEK	Site: ROCKY TOP
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/11/90 (3 :20 P m)		Comp. End: 10/22/90 (5: 40 Pm)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 7 INCH (5.0 FT LENGTH)
Depth BGS 1.77 FT. Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS) 7.90 FT
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 1.65 CU FT CEMENT: 2 LBS QUICK GEL
Tremied (Y / N)
Interval BGS _____

CENTRALIZERS (Y / N)
Depth(s) _____

SEAL
Type 1/4 INCH BENTONITE PELLETS
Source PEL PLUG
Setup/Hydration time 1/2 HR Vol. Fluid Added 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 3/4 100 LB BAG
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, NEW JERSEY
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 2 INCH (3 FT)
Slot Size & Type 0.010, CONTINUOUS WIRE-WRAP
Interval BGS 4.9 FT - 7.4 FT

SUMP (Y / N)
Interval BGS _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material 1/4 INCH BENTONITE PELLETS
Setup/Hydration time 1/2 HR
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG		Well No.: AN: E-7	Page 1 of 1
Installation: EAST FORK POPLAR CREEK		Site: ACROSS FROM ROCKY TOP	
Project No.: 70502	Client/Project: Y-12		
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND		
Dev. Start (11: 43 A m) 11/7/91	Dev. End: (1 42 Pm) 11/7/90	Csg Dia.: 2 INCH	
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)	

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 7.71 FT BTOC Maximum drawdown during pumping NA ft at _____ gpm

Range and Average Discharge rate NA

Total quantity of material bailed 4.5 GALLONS

Total quantity of water discharged by pumping _____

Disposition of discharge water MURKY BROWN

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/7	12:05	1			MURKY BROWN	16	NA	830 µMhos	
	12:15	2			MURKY BROWN	16	6.56	880 µMhos	
	12:22	3			MURKY BROWN	15	6.11	870 µMhos	
	1:30	3.5			MURKY BROWN	16	6.70	860 µMhos	
	1:36	4.0			MURKY BROWN	16	6.40	810 µMhos	APPROX. 9 WELL VOLUMES PURGED.
	1:42	4.5			MURKY BROWN	16	6.73	840 µMhos	

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-7	Page 1 of ___
Installation:	Site:	
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drilling	Driller: Don Key
Drlg Started: 10-10-90 (3:20 a m)	Drlg Ended: (4:40 p m)	Borehole dia(s):
Drlg Method/Rig Type: Hollow stem auger with backhoe drive		
Logged by:	E-Log (Y / N) From ___ to ___	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
0.6	S	WB0101013	Y	1.8/2.0	Sample: WB0101013 Time out: 3:34pm Recovery: 1.8/2.0 ~~0.2~~ 0.0-0.3 CLAY, silty, dk. yel. brn. (10YR 4/2), med. dense, dry, minor Coal 0.3-0.7 CLAY, silty, mod. yel. brn (10YR 5/4), med. dense, dry. 0.7-1.5 SILT, dk yel. brn (10YR 4/2) dusky yel. brn. (10YR 2/2), minor chert, very pale orange (10YR 8/2), dry, minor coal 1.5-1.8 CLAY, mod. yel. brn. (10YR 5/4), to pale yel brn (10YR 6/2), med. dense, dry.							
1.0												
2.0												
3.0	S	WB0101025	Y	1.2/2.0	Sample: WB0101025 Time out: 3:53 pm Recovery: 1.2/2.0 2.8-3.3 CLAY, silty, mod. yel brn (10YR 5/4) med. dense, dry, minor coal. 3.3-3.55 SAND, cherty, gray. orange (10YR 7/4) to dk. yel. orange (10YR 6/6), minor silt, mod. yel. brn (10YR 5/4), damp. 3.55-4.0 CLAY, silty, dk yel. orange (10YR 6/6) to mod. yel. brn. (10YR 5/4), med. dense, dry, minor coal.							
4.0												
5.0	S	WB0101037	Y	1.4/2.0	Time out: 3:59 pm Sample: WB0101037 Recovery: 1.4/2.0 4.6-5.0 CLAY, very silty, dusky yel. brn (10YR 2/2), loose, damp, minor chert grains, very pale orange (10YR 8/2) 5.0-6.0 SILT, mod. clay, lt. olive gray (5Y 5/2) loose, damp.					10-11-90 1:40 pm ▽ 5.65 ft.		
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ___
O = Other ___
Notes: ___
Field G/C(Make/Mod.) ___
G/C Oper.: ___

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-7	Page 2 of ____
Installation:		Site:
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drilling	Driller: Don Key
Drlg Started: 10-10-90 (3:20 p m)	Drlg Ended: (: m)	Borehole dia(s):
Drlg Method/Rig Type: Hollow stem auger with backhoe drive		
Logged by: Chris Waller	E-Log (Y / N) From ____ to ____	Protection Level: D

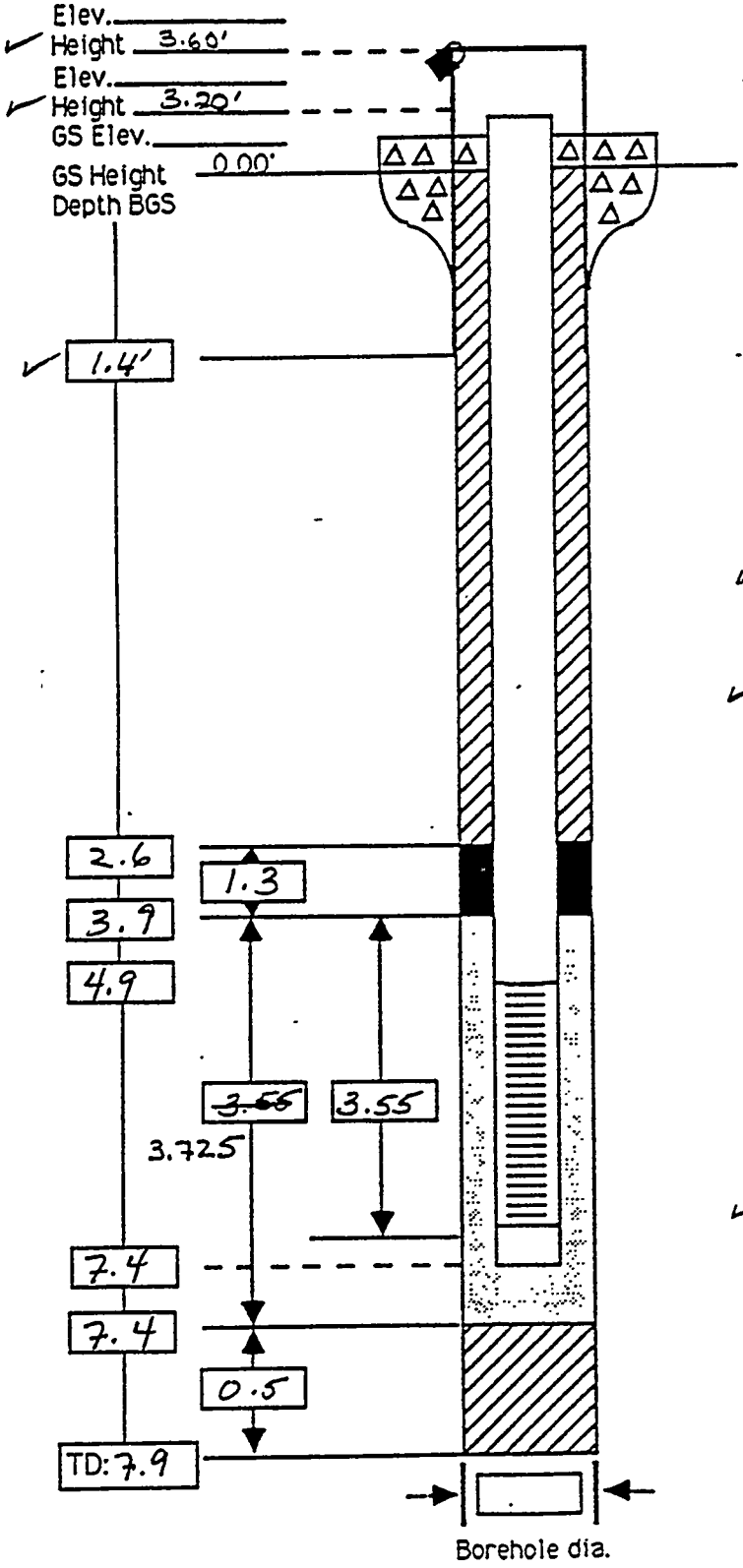
Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
6.0					Sample: WB0101049 Time out: 4:10pm Recovery: 1.8/2.0							
	S	WB0101049		1.8/2.0	6.2-7.4 CLAY, silty, lt. olive gray (5Y, 5/2), to lt. olive brn. (5Y, 5/6), med. dense, damp, minor chert grains, v. pale orange (10YR 8/2).							
7.0					7.4-7.7 SAND, very silty, chert sand grains, very pale orange (10YR 8/2), silt med. dk. gray (N4)							
					7.7-7.8 COAL, grayish black to black (N2)							
8.0					7.8-8.0 SAND, very silty, chert sand grains, very pale orange (10 YR 8/2), silt med. dk. gray (N4).							
	S	WB0101051		1.3/1.4	Sample: WB0101051 Time out: 4:33pm Recovery: 1.3/1.4							
					8.1-8.8 ORGANIC MATTER, woody, minor silt, grayish black (N2), loose, damp.							
					8.8-9.4 CLAY, greenish gray (5G, 6/1) to med. bluish gray (5B 5/1), dense to med. dense, dry, plastic							

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN-E-7	Installation: EAST FORK POPLAR CREEK	Site:
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: Highland Drilling
Comp. Start: 10-11-90 (3:20 p m)		Comp. End: (: m)
Built By:		Well Coord.:



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 7" (5')
Depth BGS _____ Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size _____

RISER PIPE
Type Howard Smith Screen Company Environmental
Diameter 2 inch stainless steel
Total Length (TOC to TOS) 8.275 feet.
Ventilated Cap (Y / N)

GROUT
Composition & Proportions
1.65 CU. FT CEMENT, 2 LB GEL
Tremied (Y / N)
Interval BGS _____

CENTRALIZERS (Y / N)
Depth(s) _____

SEAL
Type Bentonite 1/4 inch pellets
Source Pel Plug
Setup/Hydration time 30 min. Vol. Fluid Added 1.5 gal
Tremied (Y / N)

FILTER PACK
Type 20/40 Silica sand
Amt. Used 3/4 sack
Tremied (Y / N)
Source Morie Industrial Silica Sand
Gr. Size Dist. 20/40

SCREEN
Type Howard Smith Screen Company Environmental
Diameter 2 inch (3')
Slot Size & Type 0.010 cont wire wound stainless st
Interval BGS 4.9 - 7.4

SUMP (Y / N)
Interval BSG _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material Bentonite 1/4 inch pellets
Setup/Hydration time 30 min.
Tremied (Y / N)

ict. hole CRS. 5-26-92

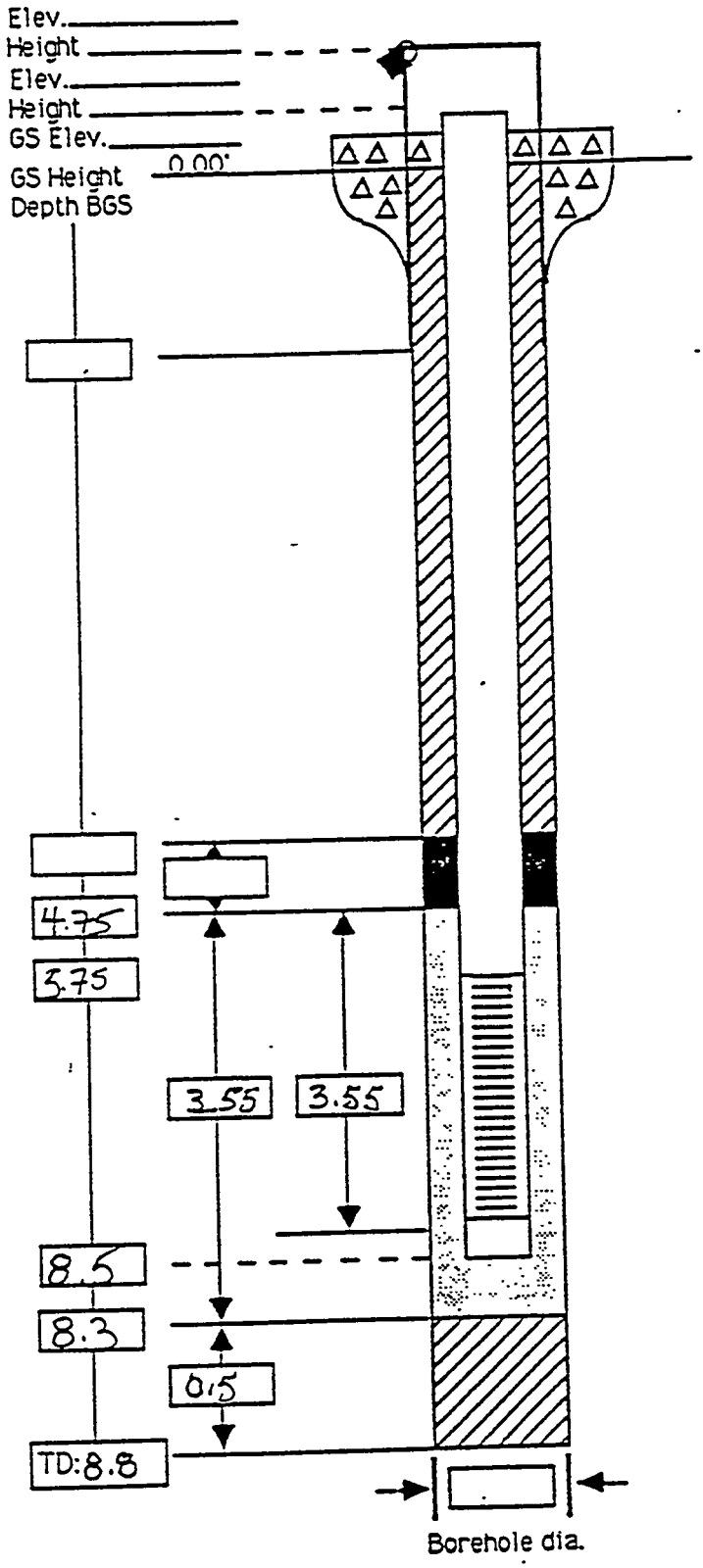
D-60

CASING REMOVED AND HOLE ABANDONED

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.:	Installation:	Site:
Project No.:	Client/Project:	
HAZWRAP Contractor:		Drlg Contractor:
Comp. Start: (: m)		Comp. End: (: m)
Built By:		Well Coord.:



PROTECTIVE CSG
Material / Type
Diameter
Depth BGS Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size

RISER PIPE
Type Howard Smith Screen Company Environmental
Diameter 2" stainless steel
Total Length (TOC to TOS) 8.275 ft.
Ventilated Cap (Y / N)

GROUT
Composition & Proportions
Tremied (Y / N)
Interval BGS

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type Bentonite 1/4 inch pellets
Source Pel Plug
Setup/Hydration time 30 min. Vol. Fluid Added 0
Tremied (Y / N)

FILTER PACK
Type 20/40 Silica Sand
Amt. Used
Tremied (Y / N)
Source Morie Industrial Silica Sand
Gr. Size Dist. 20/40

SCREEN
Type Howard Smith Screen Company Environmental
Diameter 2" stainless steel cont. wire wound 2.55'/lin.
Slot Size & Type 0.10 stainless steel cont. wire wound
Interval BGS

SUMP (Y / N)
Interval BSG Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

380.910131.009

BORING LOG	BORING/WELL NO.: AN:E-8	Page 1 of 2
Installation: EAST FORK POPLAR CREEK		Site: 200 YDS S. ROCKY TOP ON TURNPIKE
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/15/90 (10: 50 a m)	Drlg Ended: 10/15/90 (3: 00 pm)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C.W. STANLEY, G. COOLEY	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	Recovery (ft ndsp)	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0	S	WB0201015	Y			TIME OUT: 10:50 AM WB0201015 RECOVERY: 1.5/1.5 FT. 0.0-0.2 TOP SOIL; gr. brn., silt, gry. brn.; med. dense; damp; v. fine aphanitic; assorted roots through out. 0.2-0.8 CLAY; mod. brn 5YR 3/4; med. stiff; damp to dry; silty clay; assorted roots thoughout. 0.8-1.2 SILTY CLAY; dusky brn. 5YR 2/2; med. stiff to soft; silty particles throughout; (slick feel). 1.2-1.5 CLAY; lt. brn. 5YR 5/6; med. stiff to stiff; dry to damp. 1.5-2.0 NO SAMPLE						
1.0												
2.0	S	WB0201027	Y			TIME OUT:11:10 AM WB0201027, WB0201039 DUP RECOVERY: 1.5/1.5 FT. 2.0-2.4 CLAY; mod. brn. 5YR 3/4; med. stiff; dry to damp;silty to clay part. size, may be material from bottom of hole. 2.4-2.85 SILTY CLAY; dusky brn. 5YR 2/2; soft to med. stiff; damp to dry; silt to fn. sand partilce size. 2.85-3.15 CLAY; mod. brn. 5YR 4/4; mixed with 15% silt as above; med. stiff; soft; med. dense; silt size particles. 3.15-3.5 CLAY; mod. brn. 5YR 4/4; dk. yel or. mottles; stiff to v. stiff; med. dense; dry. 3.5-4.0 NO SAMPLE.						
3.0												
4.0	S	WB0201041	Y			TIME OUT: 11:20 AM RECOVERY: 1.5/2.0 FT WB0201041 4.0-6.0 CLAY; mod. brn. 5YR 4/4; yel. or. mottles throughout; med. stiff to stiff throughout; dry to damp; less than 2% iron stains; silty particles.						
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-8	Page 2 of 2
Installation: EAST FORK POPLAR CREEK		Site: 200 YDS S. ROCKY TOP ON TURNPIKE
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/15/90 (10 50 a m)	Drlg Ended: 10/15/90 (3: 00 p m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C.W. STANLEY, G. COOLEY	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	Recovery (ft) hdsp	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth &	Remarks	Elev. (ft)
6.0	S	WB0201053	Y			TIME OUT: 11:36 AM WB0201053 RECOVERY: 1.7/2.0 FT. 6.0-6.3 CLAY; mod. brn. 5YR 4/4; yel. or. mottles throughout; med. stiff to stiff throughout; dry to damp; less than 2% iron stains; silty particles. 6.3-6.5 CLAY; mod. brn. 5YR 3/4; mottled yel. clay throughout; med. stiff to stiff; silt to clay size; dry to damp. 6.5-6.95 CLAY; gry. brn. 5YR 3/2; med. stiff; dry to damp; silty particles throughout. 6.95-7.35 CLAY; mod. brn. 5YR 3/4; med. stiff; damp to dry; approx. 15% silt. 7.35-8.0 SILT; dusky brn.; fine sands throughout; med. stiff to soft; damp to dry; less than 5% clays/fine sands.							
7.0													
8.0						TIME OUT: 12:02 PM NO SAMPLE RECOVERY: 0.2/2.0 FT. 8.0-8.15 CLAY (material from bottom of hole). 8.15-8.2 GLEI; gry. grn. 10G 4/2; med. stiff; dry; v. thin; discontinuous. 8.,2-10.0 NO RECOVERY.							
9.0			N										
10.0													

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

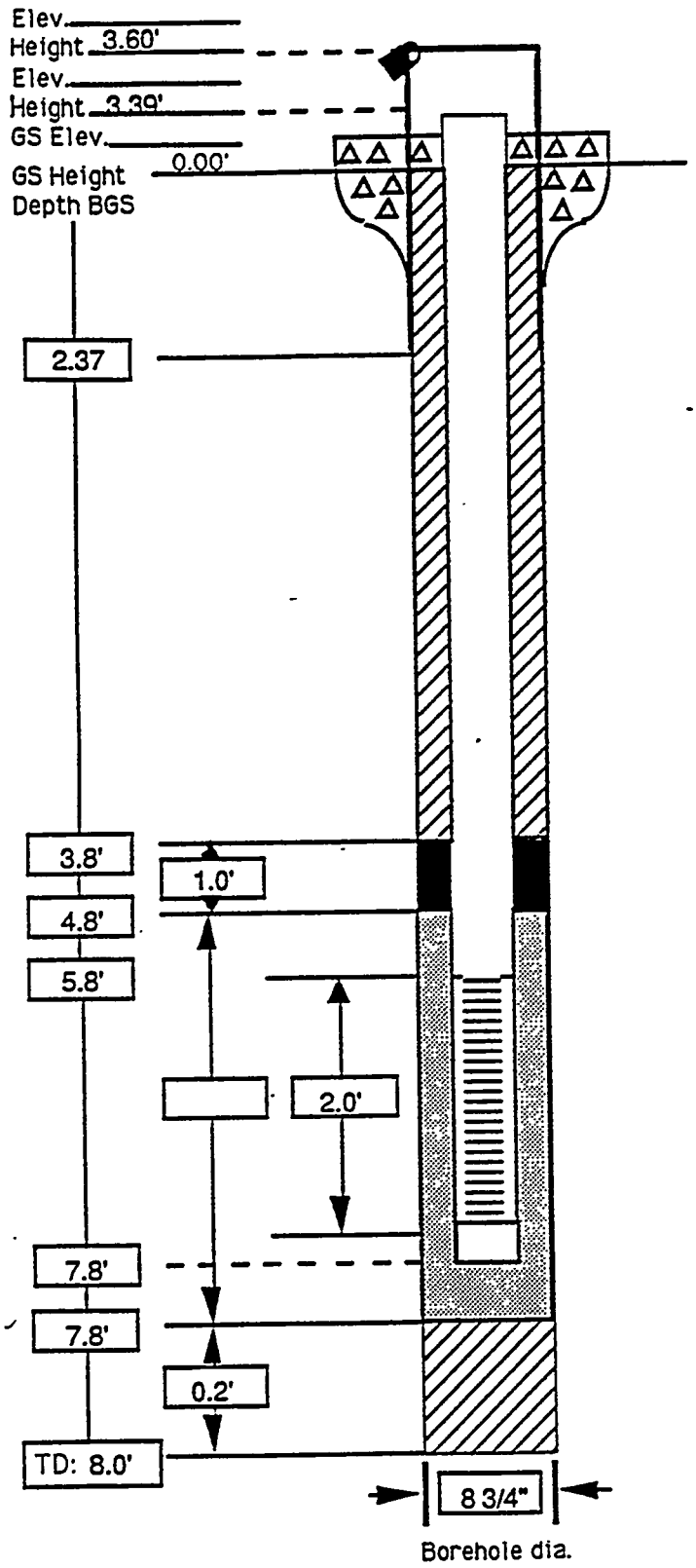
R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN-E-8	Installation: EAST FORK POPLAR CREEK	Site: ROCKY TOP
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/15/90 (9 : 30 A m)		Comp. End: 10/15/90 (2 : 30 P m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type
Diameter
Depth BGS 2.37 FT Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS) 8.0'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 4 BAGS CEMENT, 1/2 BAG BENTONITE GEL
Tremied (Y / N)
Interval BGS 0 - 3.8 FT

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type 1/4 INCH BENTONITE PELLETS
Source PEL PLUG
Setup/Hydration time 1/2 HR Vol. Fluid Added 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 1 BAG)
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, N. J.
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 2 INCH (2 FT LENGTH)
Slot Size & Type 0.010 CONTINUOUS WIRE-WRAP
Interval BGS

SUMP (Y / N)
Interval BGS Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN: E-8	Page 1 of 1
Installation: EAST FORK POPLAR CREEK	Site: ADJACENT TO ROCKY TOP MRKT.	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (2 00 pm) 11/07/90	Dev. End: (2 17 pm) 11/07/90	Csg Dia.: 2 INCH
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 6.93 BGS Maximum drawdown during pumping NA ft at _____ gpm

Range and Average Discharge rate NA

Total quantity of material bailed 1.0 GALLONS

Total quantity of water discharged by pumping NA

Disposition of discharge water LIGHT YELLOW, CLEAR TO SLIGHTLY CLOUDY.

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/07	2:00	.25			LIGHT YELLOW (CLEAR)	15	6.35	510 µMhos	
	2:05	.5			LIGHT YELLOW (CLEAR)	16	6.46	480 µMhos	
	2:09	.75			LIGHT YELLOW (CLEAR)	15	6.72	530 µMhos	
	2:13	1			LIGHT YELLOW (CLEAR)	14	6.82	520 µMhos	BAILER PULLING APPROX. 2-3 INCHES OF WATER. BAILED MINIMUM OF 5 COLUMNS.
	2:17	1.25			LIGHT YELLOW CLEAR TO SLIGHTLY CLOUDY	16	6.76	580 µMhos	BAILED DRY. PURGED 6 WATER COLUMNS. READINGS STABLE. WELL DEVELOPED.

2 copies please
Bill Stanley

1990

BORING LOG	BORING/WELL NO.: AN: E-8	Si
Installation: Shallow well		
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland	
Drlg Started: (: m)	Drlg Ended: (: m	
Drlg Method/Rig Type: Hollow Stem Auger w/ Backhoe		
Logged by: Stanley / Cooley	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft.)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
0.0		WB0201015	Y	1.5/1.5	Sample: WB0201015 Time out: 10:50 am Recovery: 100% 0.0-0.2 Top soil, grayish-brn, silt, gry-brn, med. dense, damp, very fine aphanitic, assorted roots throughout 0.2-0.8 Clay, mod. brn (5YR3/4), med stiff, damp to dry, silty clay, assorted roots throughout. 0.8-1.2 SILTY CLAY, dusky brn (5YR2/2), med. stiff to soft silty particles Throughout (slick feel) 1.2-1.5 CLAY, lgt. Brown (5YR5/6), med stiff to stiff, dry to damp (1.5-2.0 no sample)							
1.0												
2.0		WB0201027/WB0201039(dup)	Y	1.5/1.5	Sample: WB0201027 WB0201039 (dup) Time out: 11:10 am Recovery: 100% 2.0-2.4 - CLAY, mod brown (5YR 3/4), med stiff, dry to damp, silty to clay part. size, may be material from bottom of hole 2.4-2.85 SILTY CLAY, dusky Brown (5YR2/2), soft - med stiff damp-dry, silt-fine sandy part. size 2.85-3.15 CLAY, mod brown, (5YR 4/4) mixed w/ 15% silt as above, med stiff-soft, med dense, silt size particles 3.15-3.5 CLAY, mod brown (5YR 4/4), dark yell. orange mottles, stiff - very stiff, med dense, dry (3.5-4 no sample)							
3.0												
4.0		WB0201041	Y	1.5/2.0	Sample: WB0201041 Time out: 11:20 am Recovery: 1.5/2.0 4.0-6.0 CLAY, mod brn (5YR 4/4), yell-org mottles throughout, med stiff - stiff Throughout, dry - damp, <2% iron stains, silty particles							
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-8	Page 2 of ___
Installation: Shallow well		Site: ≈200 yds S. of OR Turnpike
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland	Driller: Don Key
Drlg Started: (: ___ m)	Drlg Ended: (: ___ m)	Borehole dia(s):
Drlg Method/Rig Type: Hollow Stem Auger w/ Backhoe		
Logged by: Stanley / Cooley	E-Log (Y / N) From ___ to ___	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
6.0					Sample: WB0201053 Time out: 11:36 am Recovery: 1.7/2.0 6.0-6.3 CLAY, mod brn (5YR 4/4), yell-org. mods throughout, med stiff-stiff throughout, dry-damp, <1% iron stains, silty particles							
7.0		WB0201053	Y	1.7/2.0	6.3-6.5 CLAY, mod brn (5YR 3/4), moduled yell. clay throughout, med stiff-stiff, silt-clay size, dry-damp 6.5-6.95 CLAY, gry-brn (5YR 3/2), med stiff, dry-damp, silty particles through out 6.95-7.35 CLAY, mod brn (5YR 3/4), med stiff, damp-dry, silt % ≈ 15%							
8.0			N		7.35-8.0 SILT, dusky brn, fine sands throughout med stiff-soft, damp-dry, <5% clays/fine sands							
				0.2/2.0	Sample: none Time out: 12:02 pm Recovery: 0.2/2.0 8.0-8.15 GLC 10/15/90 Clay (material from bottom of hole) 8.15-8.2 gLei, ~~Blank~~ GLC 10/15/90 grayish grn (10G 4/2), med stiff, dry, very thin, dis continuous 8.2-10.0 no recovery							
9.0												
10.0												

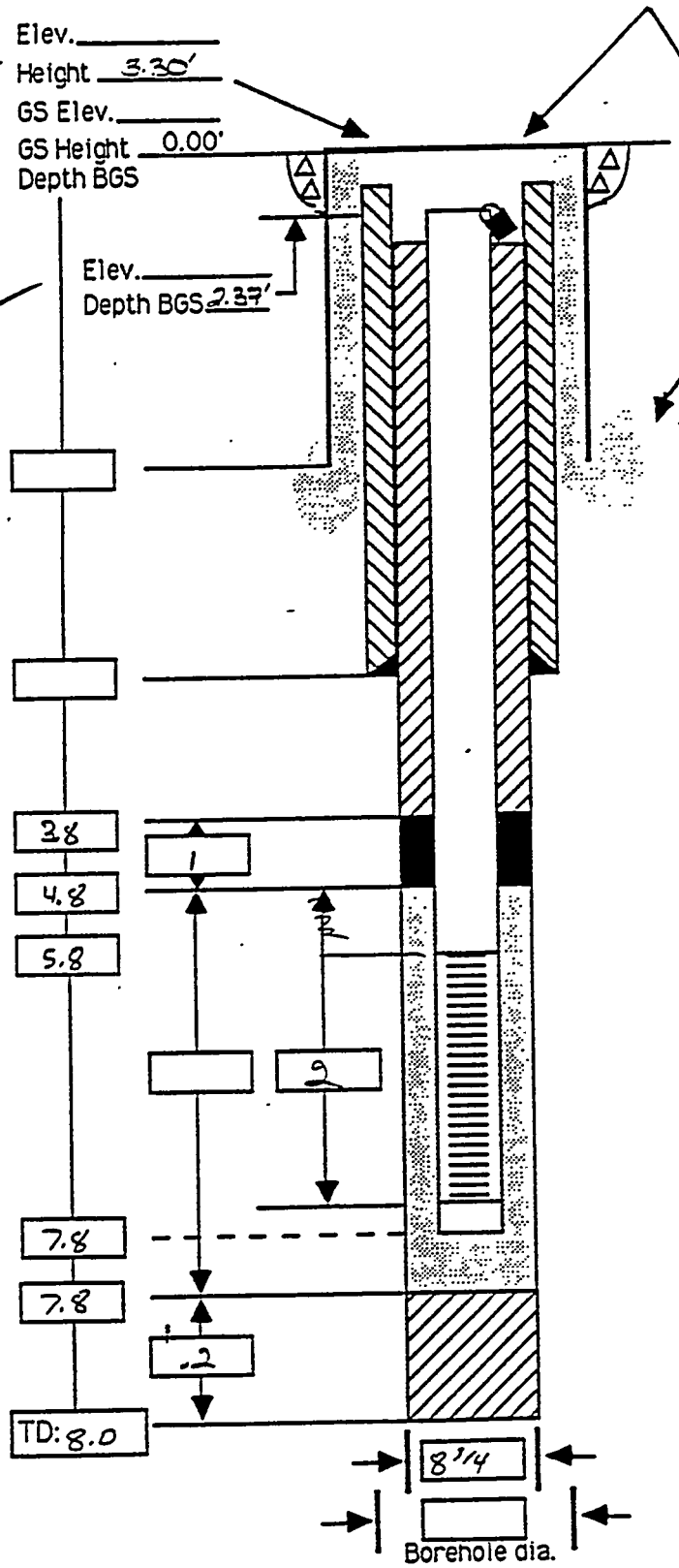
U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ___
O = Other ___
Notes: ___
Field G/C(Make/Mod.) ___
G/C Oper.: ___

DRAFT

D-67

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased Flush Mount		
WELL NO.: AN: E-8	Installation: EAST FORK POPLAR CREEK	Site:
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor:		Drlg Contractor: HIGHLAND
Comp. Start: 10/15 (: m)		Comp. End: 10/15 (: m)
Built By:		Well Coord.:



PROTECTIVE CSG
Material / Type
Diameter
Depth BGS
Watertight O-Ring (Y / N)

SURFACE PAD
Composition & Size
Breathes with Vadose Zone (Y / N)

SURFACE CSG
Type STEEL
Diameter Total Length 3-30'

GROUT: Setup/Hydration Time
Composition & Proportions
Tremied (Y / N)

RISER PIPE
Type S.S.
Diameter 2"
Total Length (TOC to TOS) 8'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions
1.25 QUART CEMENT
Tremied (Y / N)
Interval BGS 0 - 3.8

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type BENTONITE (1/4" PELLETS) .5 MILE
Source PEL PLUG
Setup/Hydration time 30 MIN Vol. Fluid Added 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 1 BAG
Tremied (Y / N)
Source MORIE IND. SAND
Gr. Size Dist. 20/40

SCREEN
Type S.S. (2')
Diameter 2"
Slot Size & Type 0.01" CONT WIRE WOUND

SUMP (Y / N)
Interval BSG Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-9	Page 1 of 5
Installation: EAST FORK POPLAR CREEK		Site: BRUNERS SHOPPING
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/23/90 (9:40 a m)	Drlg Ended: 10/23/90 (12 10 p m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0		BR0101014	Y		TIME OUT: 9:50 AM BR0101014 RECOVERY: 1.5/1.5 FT. 0.0-0.8 CLAY; dk. yel. brn. 10YR 4/2; moist; med. stiff; roots at top. 0.8-1.5 CLAY; mod. yel. brn. 10YR 5/4; med. stiff; damp; trace cherty gravel.	CL CL				HNU 10 PPM BETA/GAMMA BGD	
1.0											
2.0		BR0101038	Y		TIME OUT: 10:08 AM BR0101038, BR0101040 (DUP) RECOVERY: 1.5/1.5 FT. 2.0-3.4 CLAY; dk. yel. brn. 10YR 4/2; damp; mod. stiff; tr. limestone, gravel, tr. organics. 3.4-3.5 CLAY; dk. yel. brn. 10YR 4/2 with mottled gray; damp; mod. stiff.	CL CL				HNU 100 PPM BETA/GAMMA 100 CPM 3 IN. SPOON	
3.0											
4.0		BR0101052	Y		TIME OUT: 10:51 PM BR0101052 RECOVERY: 1.7/2.0 FT. 4.0-5.3 SILT AND CLAY; mod. yel. brn. 10YR 4/2; stiff; damp. 5.3-5.7 CLAY; mod. yel. brn. 10Y/R 5/4, mottled gray; stiff; damp.	CL CL				HNU 25 PPM BETA/GAMMA 50 CPM	
5.0											
6.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-9	Page 2 of 5
Installation: EAST FORK POPLAR CREEK		Site: BRUNERS SHOPPING
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/23/90 (9:40 a m)	Drlg Ended: 10/23/90 (12 10 p m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	( )	Recovery (ft)	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
6.0							TIME OUT: 11:05 AM RECOVERY: 0.5/2.0 FT.					HNU 25 PPM	
							6.0-6.5 CLAY; tr. limestone, gravel, some silt; dk. yel. or. 10YR 6/6; mottled gray; stiff; damp.	CL				BETA/GAMMA 50 CPM	
7.0													
8.0		BR0101064	Y				TIME OUT: 11:05 AM BR0101064 RECOVERY: 1.6/1.6 FT.						
							7.0-8.3 CLAY; mod. yel. brn. 10YR 5/4; v. stiff; damp; organics throughout.	CL				HNU 25 PPM BETA/GAMMA 100 CPM	
							8.3-8.6 CLAY; lt. olive gr. 5Y 5/2; with limestone, gravel; v. stiff; damp.	CL					
9.0													
10.0							TIME OUT: RECOVERY: 0.9/0.9 FT.	CL				HNU 150 PPM BETA/GAMMA 75 CPM	
							9.0-9.9 CLAY; lt. olive gray 5Y5/2 with limestone, gravel; v. stiff; damp; pesticide odor.						

U = Thin Wall Tube R = Rock Coring ____ Field G/C(Make/Mod.) ____
S = Split spoon(tube) O = Other ____ G/C Oper.: ____
C = Cuttings Notes: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-9	Page 3 of 5
Installation: EAST FORK POPLAR CREEK		Site: BRUNERS SHOPPING
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/23/90 (9:40 a m)	Drlg Ended: 10/23/90 (12 10 p m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N) ( )	Recovery (ft) hdsp ( )	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth &	Remarks	Elev. (ft)
					ALL CUTTINGS CONTAINERIZED - BLOWN DIRECTLY INTO LARGE BIN. NO CUTTINGS AVAILABLE FOR LITHOLOGIC DESCRIPTION.							
8.0					8.5 FT TO 10.5 FT. BIT BOUNCING -							
9.0												
10.0					10.5 FT TO 12.0 FT SMOOTH DRILLING. ODOR DETECTED. STOPPED DRILLING WHILE VAPORS MONITORED. NO DETECT. CONTINUED DRILLING.							
11.0												
12.0					12.0 FT TO 14.0 FT. BIT BOUNCING.							
13.0												
14.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-9	Page 4 of 5
Installation: EAST FORK POPLAR CREEK		Site: BRUNERS SHOPPING
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL	Driller: D. KEY
Drlg Started: 10/23/90 (9:40 a m)	Drlg Ended: 10/23/90 (12 10 p m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE: AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y / N)	hdsp ( ) / Recovery (ft)	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
					14.0 FT - 15.0 FT. BREAK IN DRILLING.						
15.0					15.0 FT - 16.0 FT. BREAK IN DRILLING						
16.0					16.0 FT TO 23.0 FT RATTY DRILLING.						
17.0											
18.0											
19.0											
20.0											
21.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-9	Page 5 of 5
Installation: EAST FORK POPLAR CREEK		Site: BRUNERS SHOPPING
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/23/90 (9:40 a m)	Drlg Ended: 10/23/90 (12 10 p m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
22.0											
23.0					TD 23.0 FT. CHECKED FOR WATER. APPROXIMATELY 4 FT OF WATER AFTER 15 MINUTES. SET WELL.						
24.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

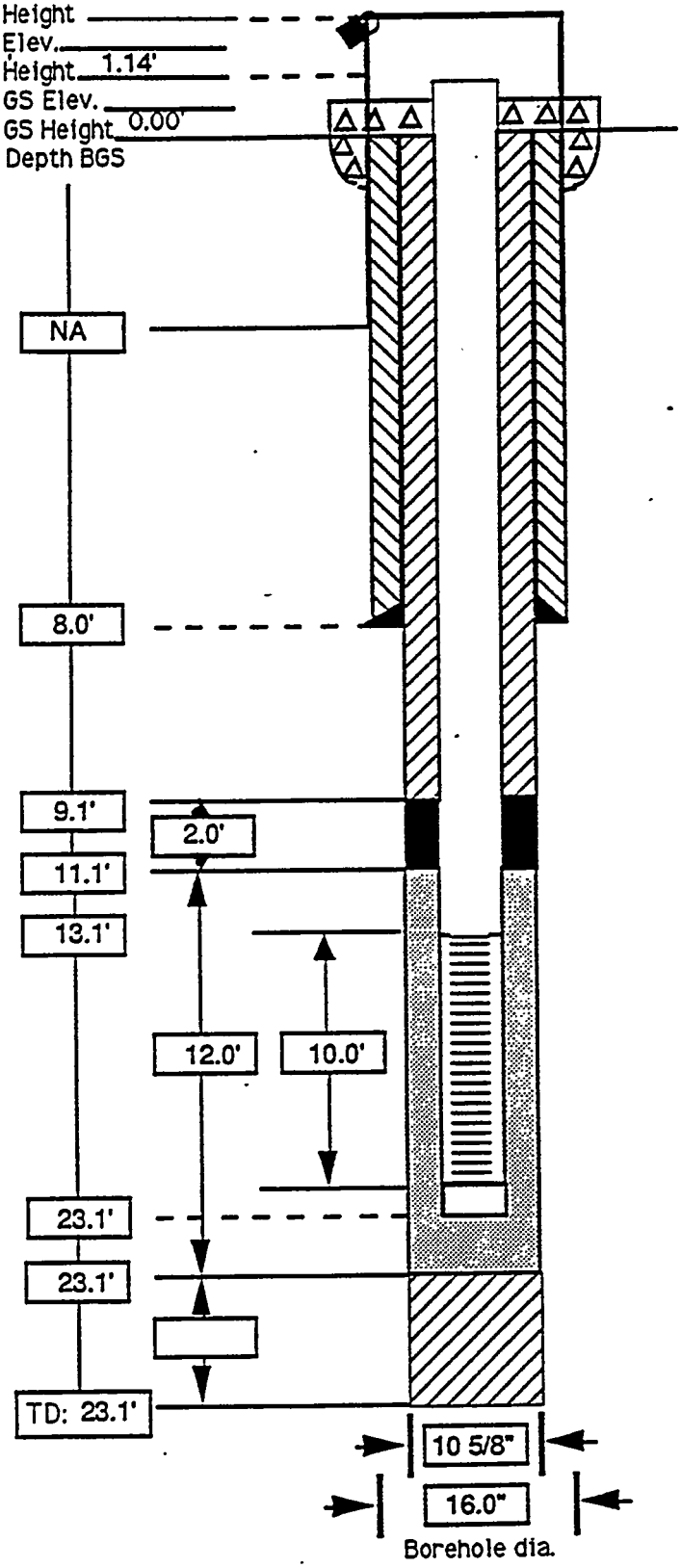
Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased

WELL NO.: AN:E-9	Installation: EAST FORK POPLAR CREEK	Site: BRUNERS
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/26/90 (11: 30 A m)		Comp. End: 10/26/90 (3 · 30 P m)
Built By: HIGHLAND DRILLING		Well Coord.:

Elev. _____
Height _____
Elev. _____
Height 1.14'
GS Elev. _____
GS Height 0.00'
Depth BGS



PROTECTIVE CSG
Material / Type N/A
Diameter
Depth BGS: Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

INTERMEDIATE CSG
Type CAST IRON
Diameter 11 INCH Total Length 10.50 FT

GROUT: Setup/Hydration Time 69 HRS
Composition & Proportions 3 CU FT CEMENT, 1/5 BAG BENTONITE GEL
Tremied (Y / N)

RISER PIPE
Type STAINLESS STEEL
Diameter 4 INCH
Total Length (TOC to TOS) 14.2'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 7.5 CU FT CEMENT, 1/2 BAG BENTONITE GEL
Tremied (Y / N)
Interval BGS 0 - 3.8 FT

CENTRALIZERS (Y / N)
Depth(s) BOTTOM END OF 8 FT BGS

SEAL
Type 1/4 INCH BENTONITE PELLETS
Source PEL PLUG
Setup/Hydration time 1/4 HR Vol. Fluid Added 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 2 BAGS (3 CU FT)
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, N. J.
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 4 INCH (10 FT LENGTH)
Slot Size & Type 0.010 CONTINUOUS WIRE-WRAP

SUMP (Y / N)
Interval BGS Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG		Well No.: AN: E-9	Page 1 of 1
Installation: EAST FORK POPLAR CREEK		Site: BRUNERS	
Project No.: 70502	Client/Project: Y-12		
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND		
Dev. Start (2 20 p m) 11/06/90	Dev. End: (3 45 pm) 11/06/90	Csg Dia.: 4 INCH	
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)	

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 4.98 BGS Maximum drawdown during pumping NA ft at _____ gpm

Range and Average Discharge rate NA

Total quantity of material bailed 40.0 GALLONS

Total quantity of water discharged by pumping NA

Disposition of discharge water FAIRLY CLEAR

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/06	3:00	10			CLEAR TO CLOUDY BROWN		6.31	540 µMhos	FAIRLY CLEAR WATER.
	3:15	20			CLOUDY BROWN		6.21	540 µMhos	
	3:28	28			CLOUDY BROWN		6.15	540 µMhos	
	3:39	36			CLOUDY BROWN		6.25	530 µMhos	
	3:45	40			CLOUDY BROWN		6.34	520 µMhos	WELL DEVELOPED.

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-9	Page 1 of ____
Installation:		Site:
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND DRLNG	Driller: DONALD KEY
Drlg Started: 10/23/90 (: ___ m)	Drlg Ended: (: ___ m)	Borehole dia(s): 8 3/4"
Drlg Method/Rig Type: HOLLOW STEM AUGER w/ BACKHOE DRIVE		
Logged by: D. BUNN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
		B20101014		1.5/1.5	0.0-0.8 CLAY DK. YELLOWISH-BROWN (10YR 4/2) MOIST. MEDIUM STIFF ROOTS @ TOP	CL					HNU-10PPM OVA-BKGD 3" SPOON	
1.0					0.8-1.5 CLAY [illegible] BROWN (10YR 5/4) MEDIUM STIFF, DAMP TRACE LIGHT GRAVEL. TIME OUT 9:50	CL						
2.0		B20101038	B20101036-DUP	1.5/1.5	TIME OUT 10:05 0.0-1.4 CLAY DK. YELLOWISH BROWN (10YR 4/2) DAMP MEDIUM STIFF TR. LIGHT GRAVEL [illegible]	CL					HNU-100PPM OVA-100 [illegible]	
3.0					1.4-1.5 CLAY [illegible] DAMP.	CL						
4.0				1.7/2.0	TIME OUT 10:51 0.0-1.3 SILT AND CLAY MODERATE YELLOWISH-BROWN (10YR 4/2) STIFF, DAMP	CL					HNU-25PPM OVA-50PPM 2" SPOON	
5.0		B20101052			1.3-1.7 CLAY MODERATE YELLOWISH BROWN 10YR 5/4 - MOTTLED GRAY STIFF, DAMP TIME OUT 1:05	CL						
6.0				0.5/2.0	0.0-0.5 CLAY, TR. LIGHT GRAVEL, [illegible] DK YELLOWISH BROWN 10YR 6/6 - MOTTLED GRAY. STIFF, DAMP	CL					HNU [illegible] OVA [illegible] 2" SPOON	

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

Notes: ____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-9	Page 2 of ___
Installation:		Site:
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor:	Driller: [illegible]
Drlg Started: 10/23/96 (: __ m)	Drlg Ended: (: __ m)	Borehole dia(s): 8 3/4"
Drlg Method/Rig Type: HSA w/ BACKHOE DRIVE		
Logged by: D. BOWN	E-Log (Y /(N)) From ___ to ___	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev.
7.0		B12010/064		1.6/1.6	0.0 - 1.3 CLAY TIMEOUT 11:05 MODERATE YELLOWISH BROWN (10YR 5/4) VERY STIFF, DAMP. ORGANICS THROUGHOUT.	CL					HNU - 25PPM BZ - 100CPM	
8.0					1.3-1.6 CLAY LIGHT OLIVE GRAY (5Y 5/2) W/LST. GRAVEL, VERY STIFF, DAMP.	CL						
9.0				.9/.9	0.0-0.9 CLAY LIGHT OLIVE GRAY (5Y 5/2 W/LST GRAVEL. VERY STIFF, DAMP PESTICIDE ODOR.	CL					HNU - 150PPM BZ - 75CPM	
0												
.0												
1.0												
1.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ___
O = Other ___
Notes: ___
Field G/C(Make/Mod.) ___
G/C Oper.: ___

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN : E-9		Page 3 of 5
Installation:		Site:	
Project No.:	Client/Project:		
HAZWRAP Contractor:	Drlg Contractor:		Driller:
Drlg Started: (: m)	Drlg Ended: (: m)		Borehole dia(s):
Drlg Method/Rig Type:			
Logged by:	E-Log (Y / N) From ____ to ____		Protection Level:

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth S	Remarks	Elev. (ft)
					ALL CUTTINGS CONTAINERIZED - BLOWN DIRECTLY INTO LARGE BIN. NO CUTTINGS AVAILABLE FOR LITHOLOGIC DESCRIPTION							
8.0					8.5' - 10.5' BIT BOUNCING							
9												
10					10.5 - 12.0' SMOOTH DRILLING. ODOR DETECTED. STOPPED DRILLING WHILE VAPORS MONITORED. NO DETECT. CONTINUED DRILLING.							
11												
12					12.0 - 14.0 BIT BOUNCING							
13												
14												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring _____
O = Other _____
Notes: _____

Field G/C(Make/Mod.) _____
G/C Oper.: _____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.:		Page 4 of 5
Installation:		Site:	
Project No.:	Client/Project:		
HAZWRAP Contractor:	Drlg Contractor:		Driller:
Drlg Started: (: m)	Drlg Ended: (: m)		Borehole dia(s):
Drlg Method/Rig Type:			
Logged by:	E-Log (Y / N) From ____ to ____		Protection Level:

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
					14.0 - 15.0 - BREAK IN DRILLING							
15					15.0 - 16.0 BREAK IN DRILLING.							
16					16.0 TO 23.0' RATTY DRILLING.							
17												
18												
19												
20												
21												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

Notes: ____

REV. DATE: MAY 1990

Page 5 of 5

BORING LOG	BORING/WELL NO.:		Site:
Installation:			
Project No.:	Client/Project:		
HAZWRAP Contractor:	Drlg Contractor:		Driller:
Drlg Started: (: m)	Drlg Ended: (: m)		Borehole dia(s):
Drlg Method/Rig Type:			
Logged by:	E-Log (Y / N) From ____ to ____		Protection Level:

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
22											
23					TD 23.0' CHECKED FOR WATER. APPROXIMATELY 4' OF WATER AFTER						
24					15 MINUTES. SET WELL.						

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

Notes: ____

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased

WELL NO.: ANE-9 | Installation: EAST FORK POPLAR CREEK | Site: ACROSS ST/BRUNERS

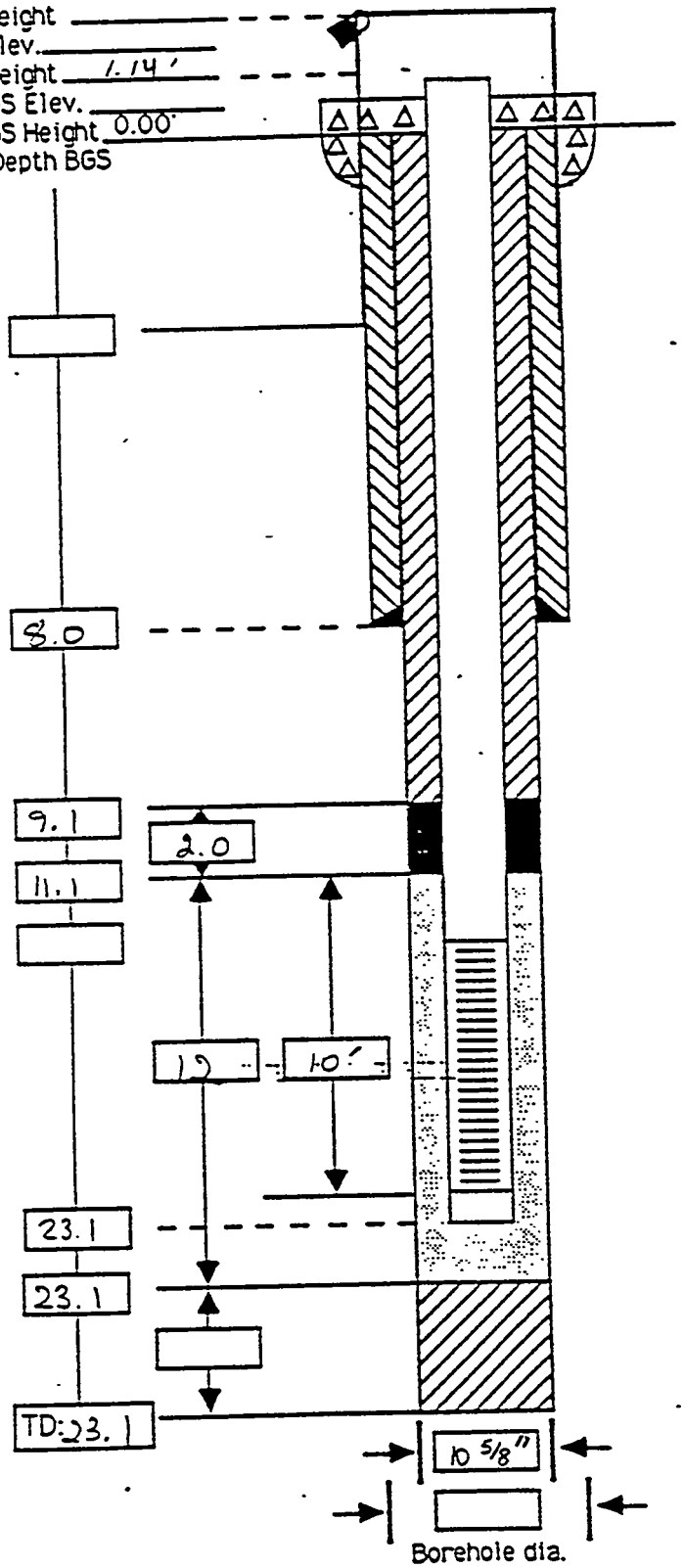
Project No.: | Client/Project: Y-12

HAZWRAP Contractor: HAZWRAP | Drlg Contractor: HIGHLAND

Comp. Start: 10/26/90 (11:30 AM m) | Comp. End: 10/26/90 (3:30 PM m)

Built By: M. BAKER HIGHLAND - DDUNN (HAZWRAP) | Well Coord.:

Elev.
Height
Elev.
Height 1.14'
GS Elev.
GS Height 0.00'
Depth BGS



PROTECTIVE CSG
Material / Type
Diameter
Depth BGS Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size CRUSH & RUN

SURFACE CSG
Type CAST IRON
Diameter 11" Total Length 10.5'

GROUT: Setup/Hydration Time 69 HOURS
Composition & Proportions
3 CU.FT CEMENT + 1/5 BAG BENTONITE GEL
Tremied (Y / N)

RISER PIPE
Type STAINLESS ST.
Diameter 4"
Total Length (TOC to TOS) 15'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 7.5 CU. FT. CEMENT
1/2 BAG BENTONITE GEL
Tremied (Y / N)
Interval BGS

CENTRALIZERS (Y / N)
Depth(s) BOTTOM @ 8' BGS.

SEAL
Type BENTONITE (1/4" PELLETS)
Source PEL PLUG
Setup/Hydration time 15 MIN. Vol. Fluid Added 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 2 SACKS 3 CUBIC FT
Tremied (Y / N)
Source MORIE IND. SAND
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 4" (10')
Slot Size & Type .010 CONT WIRE WOUND

SUMP (Y / N)
Interval BSG Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-10	Page 1 of 2
Installation: EAST FORK POPLAR CREEK		Site: APPROX. 300 YDS. S. FIRE ST.
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/08/90 (3:10 p m)	Drlg Ended: (: m)	Borehole dia(s): 8.75 IN.
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C. WALLEN	E-Log (Y / (N)) From ____ to ____	Protection Level: D

380.910131.011

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp (	Lithologic Description	USCS	Blows / 6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0	S	WA020101	Y			TIME OUT: 3:24 PM WA020101 RECOVERY: 1.5/2.0 FT. 0.0-0.4 CLAY, silty; dk. yel. brn. to mod yel. brn. 10YR 4/2; med. stiff; dry. 0.4-1.5 CLAY, silty; mod. yel. brn 10YR 5/4; med. dense; dry.					ALL SAMPLES SCREENED WITH HNU AND GEIGER CTR. NO HITS UNLESS NOTED.	
1.0												
2.0	S	WA020101	Y			TIME OUT: 3:40 PM WAO20101 RECOVERY: 1.4/2.0 FT. 2.6-3.4 CLAY, silty; lt. brn to mod. yel. brn. 5YR 5/6; med. dense; dry; minor siltstone; iron stained. 3.4-4.0 CLAY, silty/sandy; yel. gr. 5Y 7/2; med. dense; dry; ;minor light brn clay streaks 5YR 5/6.						
3.0												
4.0	S	WA020104	Y			TIME OUT: 4:05 PM WA020104 RECOVERY: 1.0/2.0 FT. 5.0-5.8 SAND, silty; mod. yel. brn. 10YR 5/4; minor chert; yel. gr. 5Y7/2; soft; wet; iron stained. 5.8-6.0 CLAY, minor silt; dk. brn. 10YR 4/2: dense to mod. dense; dry; plastic. DUPLICATE SAMPLE COLLECTED FOR ANALYSIS AT 4:15 PM.					10/9/90 9:00 AM 6.10 FT.	
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-10	Page 2 of 2
Installation: EAST FORK POPLAR CREEK		Site: APPROX. 300 YDS. S. FIRE ST.
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/08/90 (3:10 p m)	Drlg Ended: 10/08/90 (5:40 p m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C. WALLEN	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp (	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
6.0						ATTEMPED TO SAMPLE 6.0-8.0 FT. INTERVAL BUT ENCOUNERED WHAT APPEARED TO BE BEDROCK AT 7.0 FEET. AUGERED THROUGH THIS INTERVAL - MUST HAVE BEEN WEATHERED BEDROCK.					10/08/90 4:15 PM 6.66 FT.	
7.0						ATTEMPED SAMPLING OF 6.0 - 8.0 INTERVAL AT 4:40 PM.						
						TOTAL DEPTH OF BOREHOLE: 9.4 FT. ✓						
8.0						BOREHOLE BACKFILLED TO 6.8 FT WITH BENTONITITE.						
9.0												
10.0												

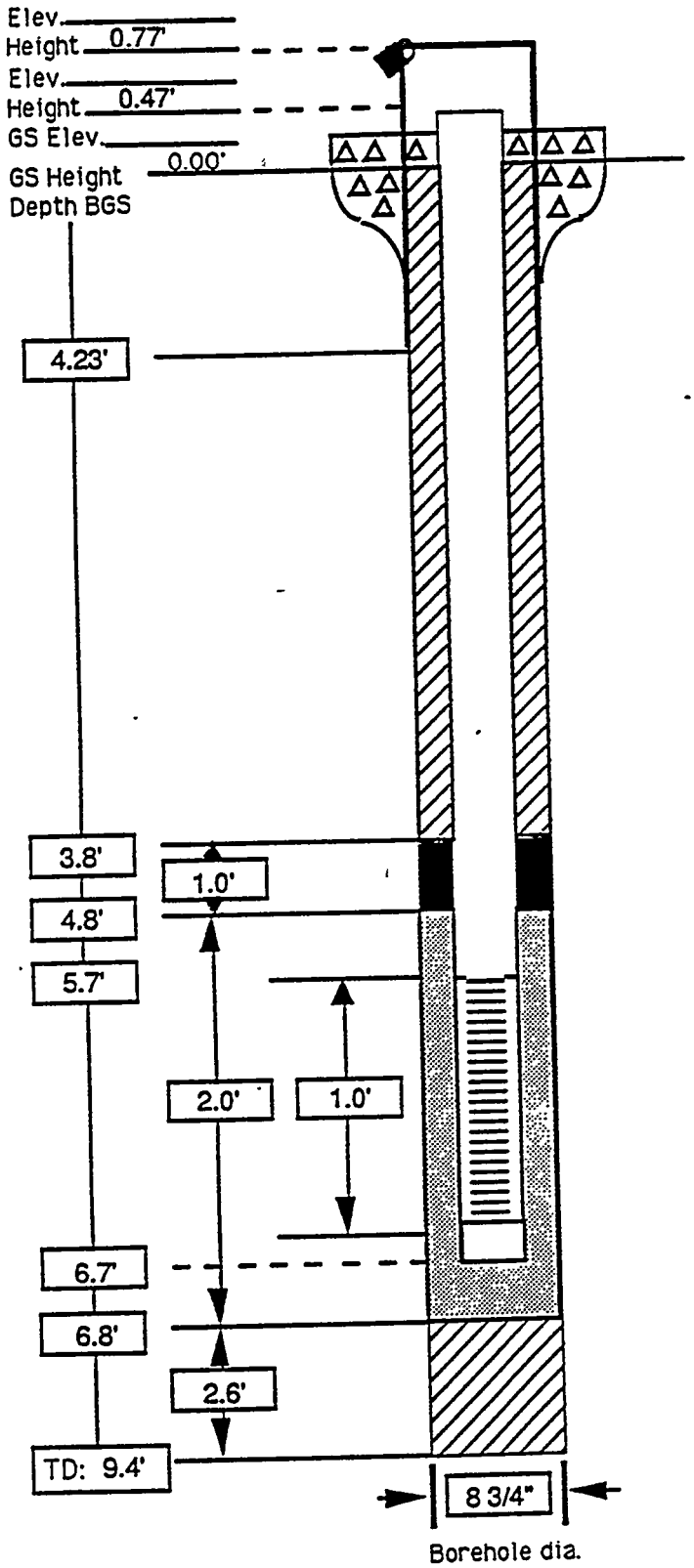
U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Standard		
WELL NO.: AN:E-10	Installation: EAST FORK POPLAR CREEK	Site: FIRE STATION
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/9/90 (1:00 P m)		Comp. End: 10/10/90 (10 50 A m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 7 INCH (5 FT LENGTH)
Depth BGS 4.23 FT Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

RISER PIPE
Type STAINLESS STEEL
Diameter 2 INCH
Total Length (TOC to TOS) 6 FT
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 1.25 CU FT CEMENT
Tremied (Y / N)
Interval BGS _____

CENTRALIZERS (Y / N)
Depth(s) _____

SEAL
Type 1/4 INCH BENTONITE PELLETS
Source PEL PLUG
Setup/Hydration time 1/2 HR Vol. Fluid Added 2 GAL
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 3/4 100 LB BAG
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, NEW JERSEY
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL (JOHNSON)
Diameter 2 INCH (1 FT)
Slot Size & Type 0.010, CONTINUOUS WIRE-WRAP
Interval BGS 5.7 FT - 6.7 FT

SUMP (Y / N)
Interval BGS _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material 1/4 INCH BENTONITE PELLETS
Setup/Hydration time 1/2 HR
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN:E-10	Page 1 of 1
Installation: EAST FORK POPLAR CREEK	Site: BEHIND FIRE STATION	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (1: 40 p m) 11/06/90	Dev. End: (11 10 p m)	Csg Dia.: 2 INCH
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 5.82 BGS Maximum drawdown during pumping NA ft at _____ gpm

Range and Average Discharge rate NA

Total quantity of material bailed 3.0 GALLONS

Total quantity of water discharged by pumping _____

Disposition of discharge water _____

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11-06	1:40	1			CLOUDY MURKY BROWN		5.95	490 µMhos	pH STABLE
11-07	9:50	2.5			MURKY BROWN		6.19	540 µMhos	PURGED NEAR DRY. WILL WAIT FOR RECHARGE.
	10:36	3			MURKY BROWN	13	6.33	520 µMhos	
	10:43	3			MURKY BROWN	13	6.45	510 µMhos	
	11:10	3			MURKY BROWN	14	6.17	530 µMhos	2.17 WELL VOLUMES PURGED. WELL CONSIDERED DEVELOPED.

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: ~~AN:E-11~~ AN:E-10	Page 1 of 2
Installation:		Site: ~300 yards south of fire station
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drilling	Driller: Don Key
Drlg Started: 10/8/90 (3:10 pm)	Drlg Ended: (: ___ m)	Borehole dia(s): 8 3/4"
Drlg Method/Rig Type: Hollow Stem Auger with Backhoe Drive		
Logged by: C. Wallen	E-Log (Y / N) From ___ to ___	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
0.0	S	WA020101	Y	1.5/2.0	Sample WA020101 Time out 3:24 pm Recovery 1.5'/2.0' 0-0.4 CLAY, silty, Dark yellowish brown/ Moderate yellow brown (10YR 4/2), Medium stiff, dry. 0.4-1.5 CLAY, ~~M~~ silty; Moderate yellowish brown (10YR 5/4) Med. dense, dry							
1.0												
2.0	S	WA020102	Y	1.4/2.0	Sample WA020102 Time Out: 3:40 pm Recovery 1.4'/2.0' 2.6-3.4 CLAY, silty Lt. brown to Mod. Yellow brown (5YR 5/6), Med. Dense, ~~Mino~~ Dry, Minor Siltstone, iron stained. 3.4-4.0 CLAY, silty/Sandy, Yellowish gray (5Y 7/2), Med. dense, dry, Minor light brown clay streaks (5YR 5/6)							
3.0												
4.0	S	WA020103		~~0.4/2.0~~ 1.0/2.0	Sample WA020103 Time Out: 4:05 pm Recovery: ~~0.8'/2.0'~~ ~~0.4'/2.0~~ 1.0/2.0 5.0-5.8 SAND, silty, Mod. Yellowish Brn. (10YR 5/4), Minor chert yellowish gray (5Y 7/2), Soft, Wet, iron stained. 5.8-6.0 CLAY, Minor silt, dk. brn. (10YR 4/2) dense to med. dense, dry, plastic. Duplicate sample collected for analysis at 4:15 pm							
5.0												
6.0					Lithologic Description continued on page 2.							

10/9/90 9:00 am ▽ 6.10

Water level 10/8/90 ▽ 6.66' 4:15 pm

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ___
O = Other ___
Notes: ___
Field G/C(Make/Mod.) ___
G/C Oper.: ___

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: ~~AN:E-11~~ AN:E-10	Page 2 of 2
Installation:		Site:
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drilling	Driller: Don Key
Drlg Started: 10/8/90 (3:10 pm)	Drlg Ended: (: m)	Borehole dia(s):
Drlg Method/Rig Type: Hollow stem auger with backhoe drive		
Logged by: C. Wallen	E-Log (Y / N) From ____ to ____	Protection Level: D

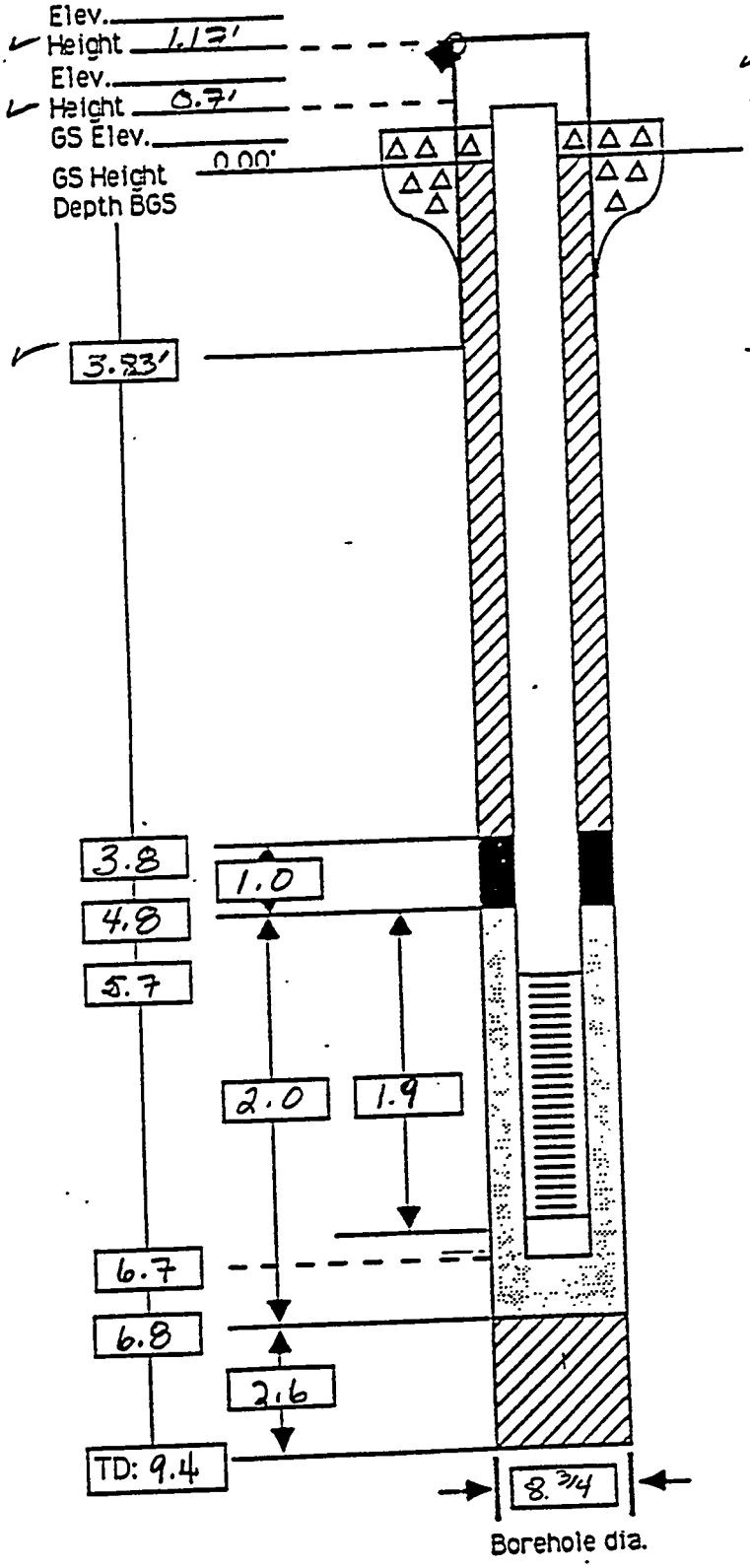
Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery / nasp	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
.0					Attempted to sample 6.0-8.0 interval but encountered what appeared to be bedrock at 7.0'. Augered through this interval - rock must have been weathered bedrock. Attempted sampling of 6.0-8.0 was at 4:40 pm.				10/9/90 9:00 am	▽ 6.10	
0										Water level 10/8/90 ≈4:15 pm ▽ 6.66	
3.0					Total depth: 9.4' Well backfilled to 6.8' with bentonite.						
9.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN: E-10	Installation: EAST FORK POPLAR CREEK	Site: Approx. 300 yds so. Lin station
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drilling	
Comp. Start: 10-9-90 (1:00 p m)	Comp. End: 10/9/90 (: m)	
Built By: HIGHLAND / WALLIEN	Well Coord.:	



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 7" (5')
Depth BGS 3.83 Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size RIP RAP, CRUSH & RUN

RISER PIPE
Type STAINLESS STEEL
Diameter 2"
Total Length (TOC to TOS) 6'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions
1.25 CU. FT CEMENT
Tremied (Y / N)
Interval BGS

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type Bentonite (1/4 inch pellets)
Source Pel Plug
Setup/Hydration time 30 minutes/cl. Fluid Added 2 gal.
Tremied (Y / N)

FILTER PACK
Type 20/40 Silica sand
Amt. Used 3/4 sack
Tremied (Y / N)
Source Morie Industrial Sand
Gr. Size Dist. 20/40

SCREEN
Type Johnson
Diameter 2 inch (1')
Slot Size & Type 0.010 Continuous wire wound
Interval BGS 5.7 - 6.7 feet

SUMP (Y / N)
Interval BSG Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material Bentonite (1/4 inch pellets)
Setup/Hydration time 30 minutes
Tremied (Y / N)

REV. DATE: MAY 1990

WELL DEVELOPMENT LOG	Well No.: AN-F-10	Page 1 of 1
Installation:	Site: Across creek from	
Project No.:	Client/Project:	
HAZWRAP Contractor:	Dev. Contractor:	
Dev. Start (: m)	Dev. End: (: m)	Csg Dia.:
Developed by:		Dev. Rig (Y / N)

Dev. Method Bailing w/ disposable bailer

Equipment

Pre-Dev. SWL 5.92 Maximum drawdown during pumping ft at gpm

Range and Average Discharge rate gpm

Total quantity of material bailed

Total quantity of water-discharged by pumping

Disposition of discharge water

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/6	1:40 p	1 gal			cloudy to murky brown		5.95	490 µmhos	pH stable
11/7	9:50 am	~~[illegible]~~ 2.5 gal			murky brown		6.19	540 µmhos	purged near dry, will wait for recharge
	10:36	3 gal			murky brn	13°	6.33	520 µmhos	
	10:43	~~3.25~~			murky brn	13°	6.45	510 µmhos	
	11:10	3.50			murky brn	14°	6.17	530 µmhos	20.6 well volumes purged, well considered developed

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-11 (DEEP)	Page 1 of 3
Installation: EAST FORK POPLAR CREEK		Site: EFPC OR TPKE FIRE ST. N. OF CREEK
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/09/90 (2:00 P m)	Drlg Ended: 10/24/90 (5: 10 p m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: C. WALLEN	E-Log (Y / N) From ____ to ____	Protection Level: D

380.910131.012

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp ( )	Recovery (ft)	Lithologic Description	USCS	Blows / 6 inch.	Graphic Log	Well data.	Water depth & Remarks	Elev. (ft)
0.0		WA0101011 S	Y				TIME OUT: 2:25 PM WA0101011 RECOVERY: 2.0/2.0 FT. 0.0-0.5 CLAY, silty; dk. yel. brn. 10YR 4/2; loose to med. dense; dry. 0.5-2.0 CLAY, v. silty; mod. yel. brn. 10YR 5/4 to dk. yel. brn 10YR 6/6;dense; dry.					ALL SAMPLES SCREENED WITH HNU AND GEIGER CTR. NO HITS UNLESS NOTED.	
1.0													
2.0		WA0101023 S	Y				TIME OUT: 2:50 PM WA0101023 RECOVERY: 1.6/2.0 FT. 2.4-4.0 CLAY, silty; dk. yel. or. 10YR 6/6 / yel. gr. 5Y 7/2; med. dense; dry; streaks of dk. yel. or.						
3.0													
4.0		WA0101047 S	Y				TIME OUT: 3:12 PM WA0101047 RECOVERY: 1.1/2.0 FT. 4.9-5.1 CLAY, silty; yel. gray 5Y7/2; med. dense; dry; streaks of dk. yel. or. 10YR 6/6; clay. 5.1-5.95 SAND, silty; mod. yel. brn. 10YR 5/4; minor chert, yel. gray 5Y 7/2; soft; wet; iron stained. 5.95-6.0 CLAY, tr. silt; dusky yel. brn. 10YR 2/2 to dk. yel. brn. 10YR 4/2; med. dense; plastic; dry. DUP. SAMPLE TAKEN AT 3:32 PM FOR GEOTECHNICAL ANALYSIS. TOTAL DEPTH 6.3 FT. REACHED AT 3:50 PM.						
5.0													
6.0													
.0													

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-11 (DEEP)	Page 2 of 3
Installation: EAST FORK POPLAR CREEK		Site: EFPC OR TPKE FIRE ST. N. OF CREEK
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: M. BAKER
Drlg Started: 10/09/90 (2:00 P m)	Drlg Ended: 10/24/90 (5: 10 p m)	Borehole dia(s): 10 5/8 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: C.W. STANLEY W. WILDER	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y / N)	( )	Recovery (ft / hdsp)	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
7.0						ALL CUTTINGS CONTAINERIZED - BLOWN DIRECTLY INTO LARGE BIN. NO CUTTINGS AVAILABLE FOR LITHOLOGIC DESCRIPTION.					DRILLING OUT OF SURFACE CASING AT 7.0 BGS. ALL CUTTINGS CONTAINER-IZED. ONLY DRILLING CHATTER ETC. LOGGED.	
						7.0 FT. - DRILL SMOOTH.						
8.0												
9.0												
10.0						0.5 FT. DROP AT 10.0 FT.						
						10.5 FT. - BIT BOUNCED, RATTY						
11.0						11.0 FT. - DRILL SMOOTH						
12.0												
13.0												
14.0						14.0 FT. - BIT BOUNCE						

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-11 (DEEP)	Page 3 of 3
Installation: EAST FORK POPLAR CREEK		Site: EFPC OR TPKE FIRE ST. N. OF CREEK
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND DRILL	Driller: M. BAKER
Drlg Started: 10/09/90 (2:00 p m)	Drlg Ended: 10/24/90 (5: 10 p m)	Borehole dia(s): 10 5/8 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE; AIR ROTARY		
Logged by: C.W. STANLEY W. WILDER	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y / N) ( )	Recovery (ft) hdsp ( )	Lithologic Description	USCS	Blows / 6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
14.0					NO VISUAL LOGGING. ALL CUTTINGS CONTAINERIZED IN TRUCK-MOUNTED BIN. 14.5 FT. - SMOOTH DRILLING					W. L. AT 5:05 PM 10-24-90 AT APPROX. 14 FT. DURING BLOWOUT TEST. NOT MEASURED. W.L. INDICATED HEARD BY AIR FLOW WHEN WATER HIT. AFTER APPROX. 0.5 HR STANDBY: MUDDY. WATER IS BLOWN INTO 5 GA. BUCKET AND APPROX. 1 GAL MORE WATER WAS BLOWN INTO BIN ON TRUCK.	
15.0											
16.0											
17.0											
18.0											
19.0											
20.0					4:25 PM STOP DRILLING AT 21.0 FT. TO CHECK FOR WATER. STOP AIR AT 4:33 PM AND LET WATER ACCUMULATE.						
21.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

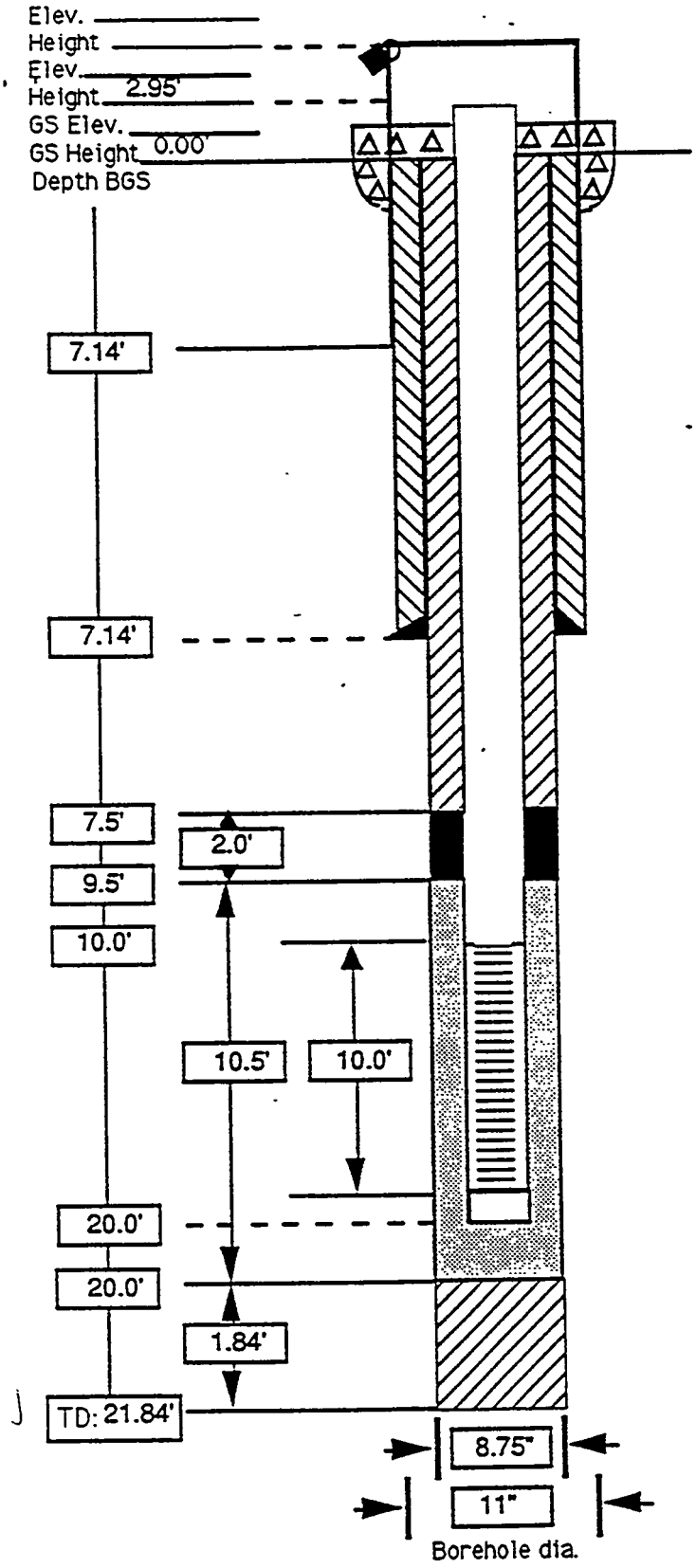
R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased

WELL NO.: AN:E-11	Installation: EAST FORK POPLAR CREEK	Site: BRUNERS
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/25/90 (9 : 10 A m)		Comp. End: 10/25/90 (12 00 P m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type N/A
Diameter
Depth BGS 7.14 FT Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. Type

SURFACE PAD
Composition & Size CONCRETE (2.8' X 2.8' X 0.5')

INTERMEDIATE CSG
Type STEEL
Diameter 11 INCH Total Length 7.14 FT

GROUT: Setup/Hydration Time
Composition & Proportions
Tremied (Y / N)

RISER PIPE
Type STAINLESS STEEL
Diameter 4 INCH
Total Length (TOC to TOS) 12.95'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions 7.0 CU FT CEMENT, 1/2 BAG BENTONITE GEL
Tremied (Y / N)
Interval BGS 0 - 7.5 FT

CENTRALIZERS (Y / N)
Depth(s) ~~5.88'-6.88'~~ BELOW TOP OF INNER CASING 5.60'-6.60' BGS

SEAL
Type 1/4 INCH BENTONITE PELLETS
Source PEL PLUG
Setup/Hydration time 1 HR Vol. Fluid Added NONE
Tremied (Y / N)

FILTER PACK
Type SAND
Amt. Used 3-4 100 LB BAGS
Tremied (Y / N)
Source MORIE INDUSTRIAL SAND, N. J.
Gr. Size Dist. 20/40

SCREEN
Type STAINLESS STEEL
Diameter 4 INCH (10 FT LENGTH)
Slot Size & Type 0.010 CONTINUOUS WIRE-WRAP

SUMP (Y / N)
Interval BGS Length 0.3'
Bottom Cap (Y / N)

BACKFILL PLUG
Material FILTER PACK SAND, 1 100 LB BAG
Setup/Hydration time N/A
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN:E-11	Page 1 of 2
Installation: EAST FORK POPLAR CREEK	Site: 300 YDS S. OF FIRESTATION	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (10: 45 a m) 11/6/90	Dev. End: (10 30 a m) 11/7/90	Csg Dia.: 4 INCH
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 6.2 BGS Maximum drawdown during pumping NA ft at _____ gpm

Range and Average Discharge rate NA

Total quantity of material bailed 40.5 GALLONS

Total quantity of water discharged by pumping NA

Disposition of discharge water NA

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11-6	10:45	10			CLOUDY BROWN		6.70	450 µMhos	pH DID NOT STABILIZE. AT 12 GAL. BAILED, DROPPED BAILER INTO AT 10:50. RECOVERED BAILER AT 10:56.
	11:20	20			CLOUDY BROWN		6.40	450 µMhos	pH NOT STABILIZED.
	12:38	24			CLOUDY BROWN		6.38	410 µMhos	pH NOT STABLE.
	1:00	28			CLEARER		NA	410 µMhos	pH METER NOT STABLE. WILL RECALIBRATE THE pH METER.
	1:40	29			LIGHT BROWN		5.93	390 µMhos	pH STABLE.

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG	Well No.: AN:E-11	Page 2 of 2
Installation: EAST FORK POPLAR CREEK	Site: 300 YDS S. OF FIRESTATION	
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND	
Dev. Start (10 45 a m) 11/6/90	Dev. End: (10 30 a m) 11/7/90	Csg Dia.: 4 INCH
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 6.2 BGS Maximum drawdown during pumping NA ft at _____ gpm

Range and Average Discharge rate NA

Total quantity of material bailed 40.5 GALLONS

Total quantity of water discharged by pumping NA

Disposition of discharge water _____

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11-7	10:25	39			CLOUDY CLEAR BROWN		NA	420 µMhos	pH STABLE.
	10:30	40.5			CLOUDY		6.38	400 µMhos	pH STABLE, CONSIDERED DEVELOPED. TOTAL OF 6 WELL VOLUMES.

REV. DATE: MAY 1990

Page 1 of ____

BORING LOG	BORING/WELL NO.: AN:E - 11	Site: Approx 300 yds so. of fire station
Installation:		
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drilling	Driller: Don Key
Drlg Started: 10-9-90 (2:00 pm)	Drlg Ended: (: ___ m)	Borehole dia(s):
Drlg Method/Rig Type: Hollow stem auger with backhoe drive		
Logged by: C. Wallen	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (ft)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0.0	S	WA0101011	Y	2.0/2.0	Sample WA0101011 Time Out: ~~2:25 pm~~ 2:25 pm Recovery: 2.0/2.0 0-0.5 ~~SILT~~ CLAY, silty, dk. yellowish brn. (10YR 4/2), loose to med. dense, dry. 0.5-2.0 CLAY, very silty, mod. yel. brn. to dk. yel. brn. (10 YR 5/4), ~~(10YR 6/6)~~ (10YR 6/6), dense, dry.						
1.0											
2.0	S	WA0101023		1.6/2.0	Sample WA0101023 Time Out: 2:50 pm Recovery: 1.6/2.0 2.4-4.0 CLAY, silty, dk. yel. orange (10 YR 6/6) / yel. gray (5Y 7/2) med. dense, dry, streaks of dk. yel. orange						
3.0											
4.0	S	WA0101047		1.1/2.0	Sample WA0101~~035~~47 Time out: 3:12 pm Recovery: 1.1/2.0 4.9-5.1 CLAY, silty, yel. gray (5Y 7/2), med. dense, dry, streaks of dk. yell. ~~brn~~ orange (10 YR 6/6) clay 5.1-5.95 SAND, silty, Mod. Yel. brn (10 YR 5/4), Minor chert yel. gray (5Y 7/2), soft, wet, iron stained. 5.95-6.0 CLAY, trace silt, dusky yel. brn. (10 YR 2/2) to dk yel. brn (10 YR 4/2), med. dense, plastic, dry. Duplicate sample for geotechnical analysis taken at 3:32 pm						
5.0											
6.0											

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-11	Page 2 of ____
Installation:		Site:
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drilling	Driller: Don Key
Drlg Started: 10-9-90 (2:00 a m)	Drlg Ended: (: m)	Borehole dia(s):
Drlg Method/Rig Type: Hollow stem auger with backhoe drive		
Logged by: C. Wallen	E-Log (Y / N) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
6.0					Total depth 6.3' reached at 3:50 pm							

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-~~10~~ 11 - WL-W Bedrock Well	Page 1 of 2
Installation: RCRA Fac. Inv. - Y-12 E. Fork Poplar Creek		Site: EFP Creek Behind Fire Dot OR7Pke Not Creek
Project No.:	Client/Project: Y-12	Driller: M. Baker & Mark
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland Drilling	Borehole dia(s): 10 5/8"
Drlg Started: 10-24-90 (4:05 p.m)	Drlg Ended: 10-24-90 (5:10 p.m)	
Drlg Method/Rig Type: Air Rotary @ Cuttings Directly containerized		Protection Level: D
Logged by: C.W. Stanley / W.L. Wilder	E-Log (Y / (N)) From ____ to ____	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (hdsp)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth	Remarks	Elev. (ft)
7.0					All cuttings containerized - blown directly into large bin. - No Cuttings Available for lithologic description							
					7.0' - Drill Smooth						Drilling out of Surf. Casing @ 7.0' BS.	
8											All Cuttings containerized	
											Only drilling chatter, etc. logged	
9												
10.0					- 6" drop @ 10.0'							
					- 10.5' - ~~6"~~ WPV - Bit Bounce - Rotty							
11					- 11.0' - Drill Smooth							
12												
13												
14					14.0' - Bit Bounce							

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

BORING LOG	BORING/WELL NO.: AN: E-~~10~~ 11 Bedrock Well	Page 2 of 2
Installation: RFI - EFPC.		Site: EFPCrk - Fire Dept. ORTPKe - Nod - OTC
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland	Driller: M. Baker & Mark
Drlg Started: 10-24-90 (4:05 P.m)	Drlg Ended: 10-24-90 (5:10 P.m)	Borehole dia(s): 15 5/8"
Drlg Method/Rig Type: Air Rotary		
Logged by: C.W. Stanley / W.L. Wilder	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (hdsp)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth S	Remarks	Elev. (ft)
14.0'					No visual logging - All Cuttings Containerized in truck mounted bin.							
					14.5' - Smooth drilling							
15.0'												
16												
17												
18												
19												
20												
21.0												

▽ - 5:05 pm 10-24-90

W.L. @ ≈14' during blowout test not measured @ wat Lev. Ind. heard by air flow when water hit.

After ~½ hr standby

5:05 pm Muddy water is blown out into 5 gal. bucket ~1 gal. more water was blown into bin on truck

4:25 pm. Stop Drilling @ 21.0' To check for H_2O stop air @ 4:35 pm & let H_2O accumulate

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C(Make/Mod.) ____
G/C Oper.: ____

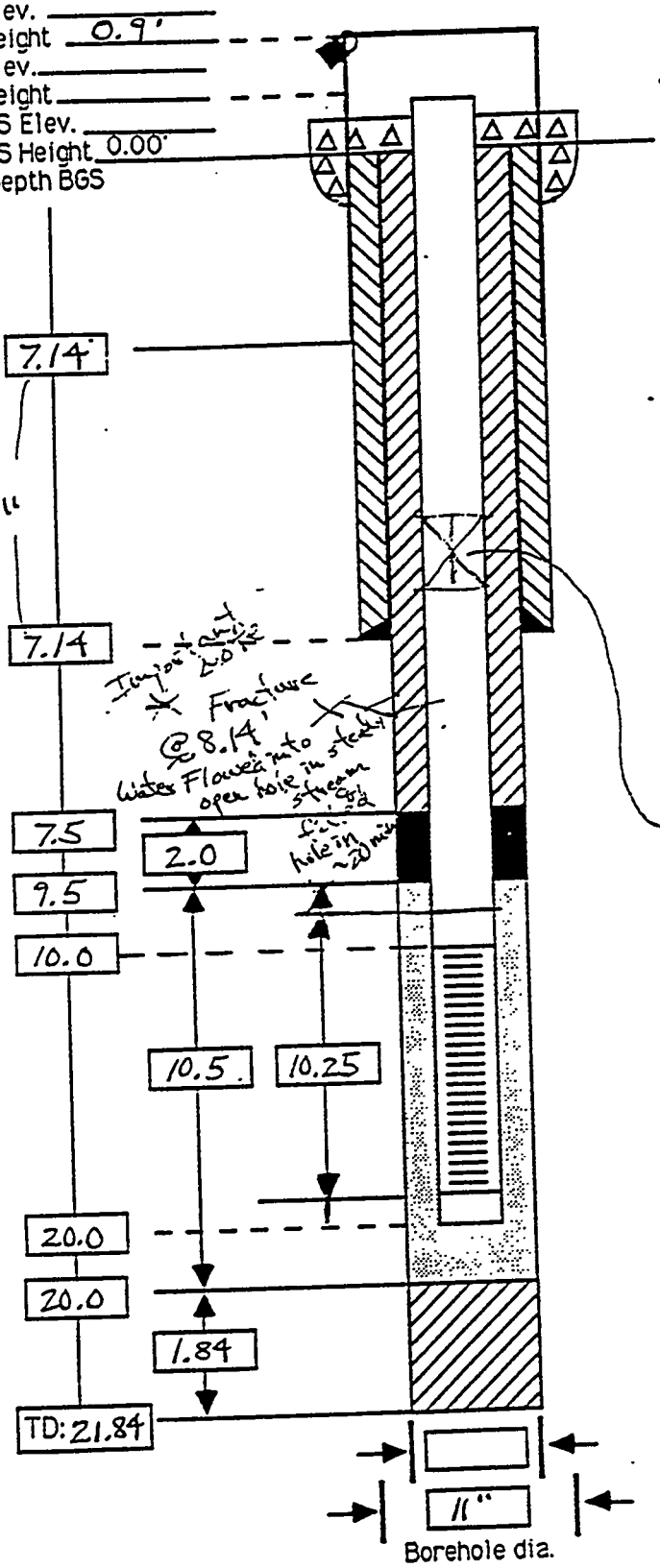
REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Double Cased

Bedrock

WELL NO.: AN: E-11	Installation: Y-12 E. Fork Poplar Creek	Site: Behind Firehouse on OR Tpke N side of creek
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: Highland
Comp. Start: 10-25-90 (9 : 10 a m)		Comp. End: 10-25-90 (12 : 00 P m)
Built By: M. Baker (Highland) Wilder / Bunn (HAZWRAP)		Well Coord.:

Elev. ____
Height 0.9'
Elev. ____
Height ____
GS Elev. ____
GS Height 0.00'
Depth BGS



PROTECTIVE CSG
Material / Type CAST IRON
Diameter 11"
Depth BGS 7.14' Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. ____ Type ____

SURFACE PAD
Composition & Size ____

SURFACE CSG = Protective Csg.
Type ____
Diameter 11" Total Length 7.14'

GROUT: Setup/Hydration Time ____
Composition & Proportions ____
Tremied (Y / N)

RISER PIPE
Type St. Steel
Diameter 4"
Total Length (TOC to TOS) 10.0'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions Baroid Quick Gel Cement
Tremied (Y / N)
Interval BGS 0.0' - 7.5'

CENTRALIZERS (Y / N)
Depth(s) One from 5.88' - 6.88' ~~BGS~~ Below Top of inner casing ~5.6 - 6.6' BGS

SEAL
Type 1/4" Bentonite Pellets - Pel Plug
Source El Dorado, Ark - Polymer Drilling Systems
Setup/Hydration time ~1 hr. Vol. Fluid Added None
Tremied (Y / N)

FILTER PACK
Type Morie Sand
Amt. Used ~3-4 100 lb. bags
Tremied (Y / N)
Source New Jersey
Gr. Size Dist. 20/40

SCREEN
Type St. Steel; length from bottom cap to joint = 10.25'
Diameter 4"
Slot Size & Type 0.01"

SUMP (Y / N) B. Cap Length ~0.3'
Interval BSG ____
Bottom Cap (Y / N)

BACKFILL PLUG
Material Filter Pack Sand as above ~1 100 lb. bag
Setup/Hydration time NA
Tremied (Y / N)

REV. DATE: MAY 1990

WELL DEVELOPMENT LOG	Well No.: AH-E-11	Page 1 of 1
	Site: ~300 YDS S. OF FIRE STATION	
Installation:		
Project No.:	Client/Project:	
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND DRILLING	Csg Dia.: 4"
Dev. Start (: m)	Dev. End: (: m)	Dev. Rig (Y/N)
Developed by:		

Dev. Method BAILING WITH DISPOSABLE BAILER

Equipment

Pre-Dev. SWL 6.2 Maximum drawdown during pumping ft at gpm

Range and Average Discharge rate gpm

Total quantity of material bailed

Total quantity of water discharged by pumping

Disposition of discharge water

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/6	10:45	10			cloudy brown		6.70	450 µmhos	pH DID NOT STABILIZE
									AT 12 GAL DROPPED BAILER INTO WELL 10:50 RECOVERED BAILER AT 10.56
	11:20	20			cloudy brown		6.40	450 µmhos	pH NOT STABILIZING
	12:38	24			cloudy brown		6.38	410 µmhos	pH not stable
	1:00 pm	28			clearer		6.?	410 µmhos	pH not stable, will recalibrate pH meter
	1:40	29			light brown		5.93	390 µmhos	pH stable
11/7	10:25	39			cloudy to clear brn		?	420 µmhos	pH not stable
	10:30	40.5			cloudy brn	14.5	6.38	400 µmhos	pH stable, considered developed total of 6 well volumes

REV. DATE: NOV 1990

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BORING LOG	BORING/WELL NO.: AN:E-12 (SHALLOW)	Page 1 of 2
Installation: EAST FORK POPLAR CREEK		Site:EFPC BEHIND FIRE ST.OR TPIKE S. SIDE OF EFPC
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg ContractorHIGHLAND DRILL	Driller: D. KEY
Drlg Started: 10/16/90 (10:30 A m)	Drlg Ended: 10/16/90 (11:45 A m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C.W. STANLEY B. WILDER	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well dsts.	Water depth & Remarks	Elev. (ft)
0.0	S	WA0301015	Y			TIME OUT: 10:35 AM WA0301015 RECOVERY: 1.5/1.5 FT. TOP SOIL CLAY; mod. brn 5YR 4/4;med. stiff;med. dense; dry; damp ; yel. orange mottles throughout.					ALLSAMPLES SCREENED WITH HNU AND GEIGER CTR. NO HITS UNLESS NOTED.	
1.0												
2.0	S	WA0301027	Y			TIME OUT: 10:55 AM WA0301027, WA0301039 RECOVERY: 1.5/1.5 FT. CLAY; mod. brn 5YR 3/4; med. stiff; med. dense; dry/damp; yel. or. and red mottles throughout; slightly more plastic than above.						
3.0												
4.0	S	WA0301041	Y			TIME OUT: 11:11 AM WA0301041 RECOVERY: 1.7/2.0 FT. CLAY; mod. brn. 5YR 3/4; med. stiff; med. dense; dry/damp; yel. or. and red mottles throughout; slightly more plastic than above.					B. WILDER 10/17/90 10:30 AM 5.04 FT. BGS W.L. BTOC INNER 7.14 FT W.L. BTOC OUTER 8.30 FT OUTER CSG. STICKUP 3.26 FT. 2.53 FT WATER IN WELL	
5.0												
6.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

BORING LOG	BORING/WELL NO.: AN:E-12 (SHALLOW)	Page 2 of 2
Installation: EAST FORK POPLAR CREEK		Site: S. SIDE OF EFPC
Project No.: 70502	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP	Drlg Contractor HIGHLAND DRILL.	Driller: D. KEY
Drlg Started: 10/16/90 (10: 30 A m)	Drlg Ended: 10/16/90 (11: 45 A m)	Borehole dia(s): 8.75 INCHES
Drlg Method/Rig Type: HOLLOW STEM WITH BACKHOE DRIVE		
Logged by: C.W. STANLEY B. WILDER	E-Log (Y / (N)) From ____ to ____	Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal (Y/N)	( )	hdsp	Lithologic Description	USCS	Blows / 6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
6.0	S	WA0301053	Y			TIME OUT: 11:25 AM WA0301053 RECOVERY: 1.4/2.0 FT. CLAY; lt. brn. 5YR 5/6 to mod. brn. 5YR 4/4; med. stiff; med. dense; dry to damp; relatively plastic; red, yellow and gray mottles of clay throughout.						
7.0												
8.0	S	WA0301065	Y			TIME OUT: 11:35 AM WA0301065 RECOVERY: 0.9/0.9 FT. TUBE PUSHED 8-10 INCHES BEFORE BEDROCK HIT. CLAY; lt. brn. 5YR 5/6 to mod. brn. 5YR 4/4; med. stiff; med. dense; dry to damp; more plastic than previous interval; red, yellow and gray mottles of clay throughout. TOTAL DEPTH: 8.9 FT.					NO WATER TABLE DURING DRILLING. APPROX. 1 FT. OF WATER AT 1:30 PM - 10/16/90.	
9.0												

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

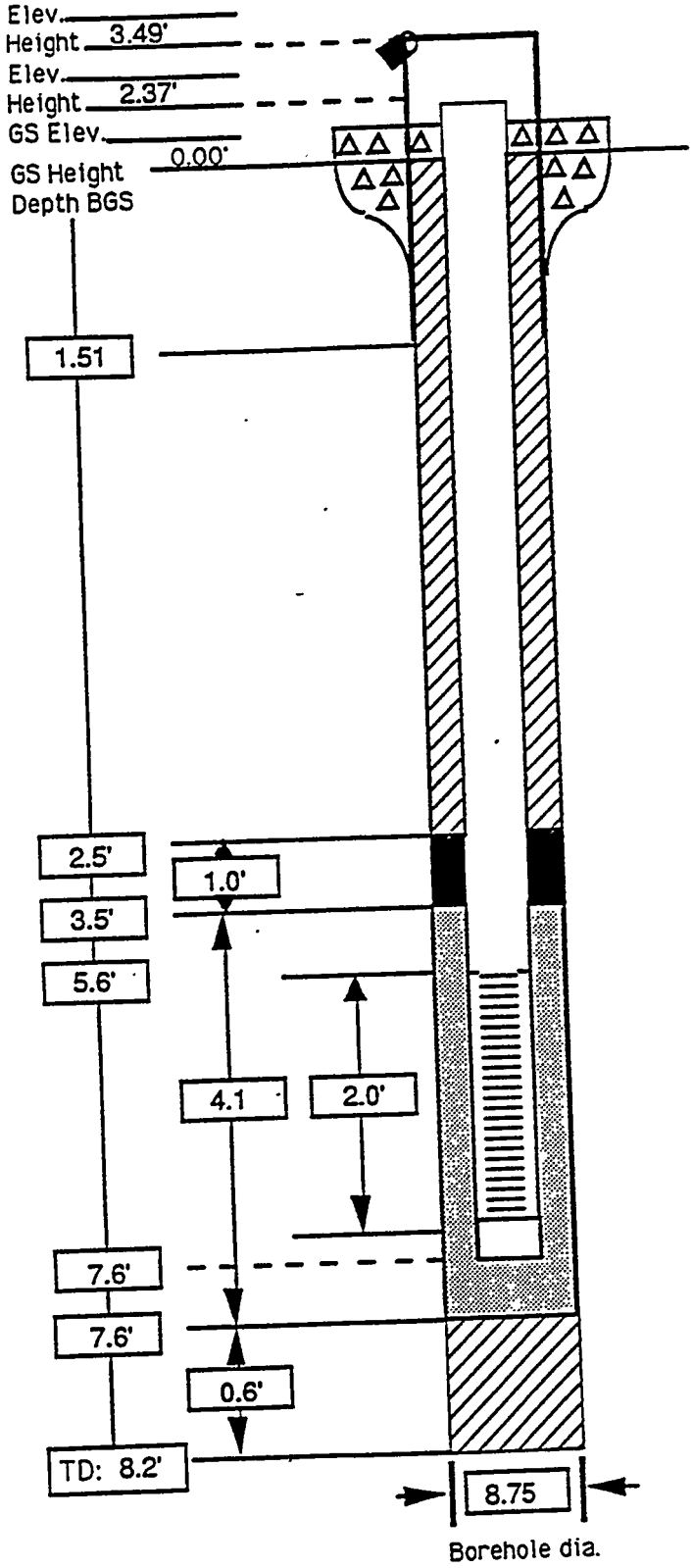
R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: NOV 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN:E-12	Installation: EAST FORK POPLAR CREEK	Site: FIRE STATION
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND DRILLING
Comp. Start: 10/16/90 (10:30 A m)		Comp. End: 10/16/90 (11:45 A m)
Built By: HIGHLAND DRILLING		Well Coord.:



PROTECTIVE CSG
Material / Type: CAST IRON
Diameter: 7 INCH
Depth BGS: 1.51 FT Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. _____ Type _____

SURFACE PAD
Composition & Size: N/A

RISER PIPE
Type: STAINLESS STEEL
Diameter: 2 INCH
Total Length (TOC to TOS): 8.0 FT
Ventilated Cap (Y / N)

GROUT
Composition & Proportions: 2.60 CU FT CEMENT (2 SACKS)
Tremied (Y / N)
Interval BGS _____

CENTRALIZERS (Y / N)
Depth(s) _____

SEAL
Type: 1/4 INCH BENTONITE PELLETS (1/2 BUCKET)
Source: PEL PLUG
Setup/Hydration time: 1/2 HR Vol. Fluid Added: 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type: SAND
Amt. Used: 1/2 100 LB BAG
Tremied (Y / N)
Source: MORIE INDUSTRIAL SAND, NEW JERSEY
Gr. Size Dist.: 20/40

SCREEN
Type: STAINLESS STEEL
Diameter: 2 INCH (2 FT)
Slot Size & Type: 0.010, CONTINUOUS WIRE-WRAP
Interval BGS: 5.6 FT - 7.6 FT

SUMP (Y / N)
Interval BGS _____ Length _____
Bottom Cap (Y / N)

BACKFILL PLUG
Material _____
Setup/Hydration time _____
Tremied (Y / N)

REV. DATE: NOV 1990

WELL DEVELOPMENT LOG		Well No.: AN:E-12	Page 1 of 1
Installation: EAST FORK POPLAR CREEK		Site: 300 YDS S. OF FIRE STATION	
Project No.: 70502	Client/Project: Y-12		
HAZWRAP Contractor: HAZWRAP	Dev. Contractor: HIGHLAND		
Dev. Start (1:10 p.m.) 11/06/90	Dev. End: (10: 55 am) 11/07/90	Csg Dia.: 2 INCH	
Developed by: J. YOUNG, C. WEAVER		Dev. Rig (Y / N)	

Dev. Method HAND BAIL

Equipment DISPOSABLE 1 INCH DIAMETER, 3 FOOT LENGTH CLEAR PVC BAILER

Pre-Dev. SWL 7.68 BGS Maximum drawdown during pumping NA ft at _____ gpm

Range and Average Discharge rate NA

Total quantity of material bailed 2.7 GALLONS

Total quantity of water discharged by pumping NA

Disposition of discharge water _____

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
11/06	1:10	2.5			CLOUDY BROWN		6.06	470 µMhos	WELL PURGED DRY.
	1:10	2.6			CLOUDY BROWN		6.15	410 µMhos	LITTLE TO NO RECHARGE. WILL CONTINUE PURGING TOMORROW.
11/07	10:55	2.7			CLOUDY BROWN		6.39	580 µMhos	5.9 WELL VOLUMES PURGED WELL DRY, CONSIDERED DEVELOPED.

REV. DATE: MAY 1990

Page 1 of 2

BORING LOG	BORING/WELL NO.: AN-E-12	Site: SFDC Behind Fire Dept OR Toke on S side of Crk.
Installation: Shallow Well		
Project No.:	Client/Project: T-12	Driller: D. KEY
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: HIGHLAND	Borehole dia(s): 8"
Drlg Started: 10:30 (10/16/90 : am)	Drlg Ended: 11:45 am (10-16-90 m)	
Drlg Method/Rig Type: Hollow STEM Auger @ Backhoe Drive		Protection Level: D
Logged by: CWS / Bill Wilder	E-Log (Y / N) From ____ to ____	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (hdsp)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0–1	WA0301015	Y		1.5/1.5	WA0301015 Time Out 10:35 am Recovery - 100% Top Soil CLAY - mod. brown 5yr 4/4 Med stiff Med dense Dry-Damp yellowish orange - mottles throughout	All backhoe pushed					
1–2					Time Out: 10:55 am.						
2–3	WA0301027+39	Y		1.5/1.5	Recovery 100% CLAY - mod. brown 5yr 3/4 Med stiff to stiff, Med. Dense Dry-Damp, yellowish orange mottled Med-Red mottled throughout Occasional sand & gravels < 5%						
3–4					Time Out: 11:11 am.						
4–5	WA0301041			1.7/2.0	CLAY - mod. Brn 5yr 3/4 med stiff, med. dense dry/damp, yellowish orge & red mottles throughout, slightly more plastic than above					B. Wilder 10-17-90 10:30 am ▽ - 5.04' Below Gr. Surf. W.L. BTOC inner = 7.14' W.L. BTOC outer = 8.30'	
5–6					Time Out: 11:25 am.						
6–7	WA0301053			1.7/2.0	6-8' CLAY - Lt Brn 5yr 5/6 to mod. Brn 5yr 4/4 Med stiff - med. dense, Dry-Damp, relatively plastic, Red yellow & gray mottles of clay throughout					Out Csg - Stickup = 3.26' @ cap off 2.53' water in well	

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings
R = Rock Coring ____
O = Other ____
Notes: ____
Field G/C(Make/Mod.) ____
G/C Oper.: ____

REV. DATE: MAY 1990

Page 2 of 2

BORING LOG	BORING/WELL NO.: AN-E-12	Site: EFPC Behind Fire Dept. OR Tpke on S side of Creek
Installation: Shallow Well		
Project No.:	Client/Project: Y-12	Driller: D. Key
HAZWRAP Contractor: HAZWRAP	Drlg Contractor: Highland	Borehole dia(s): 8"
Drlg Started: 10-16-90 (10:30 a m)	Drlg Ended: 10-16-90 (11:45 a m)	
Drlg Method/Rig Type: Hollow Stem Auger @ Backhoe drive		Protection Level: D
Logged by: Stanley / Wilder (logging / writing)	E-Log (Y / N) From ____ to ____	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Recovery (hdsp)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
7					6-8' - See Above						
8		WA0301065		0.9'/0.9'	Tube only pushed ~8"-10" before Bedrock hit. Time Out: 11:35 am. CLAY - as above but bottom 0.1' more plastic - Some rock in end of tube. No water - dry/damp					No WT during drilling	
9					TD = 8.9'					~1 ft. of water at ~1:30pm 10-16-90	

U = Thin Wall Tube
S = Split spoon(tube)
C = Cuttings

R = Rock Coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

DRAFT 1

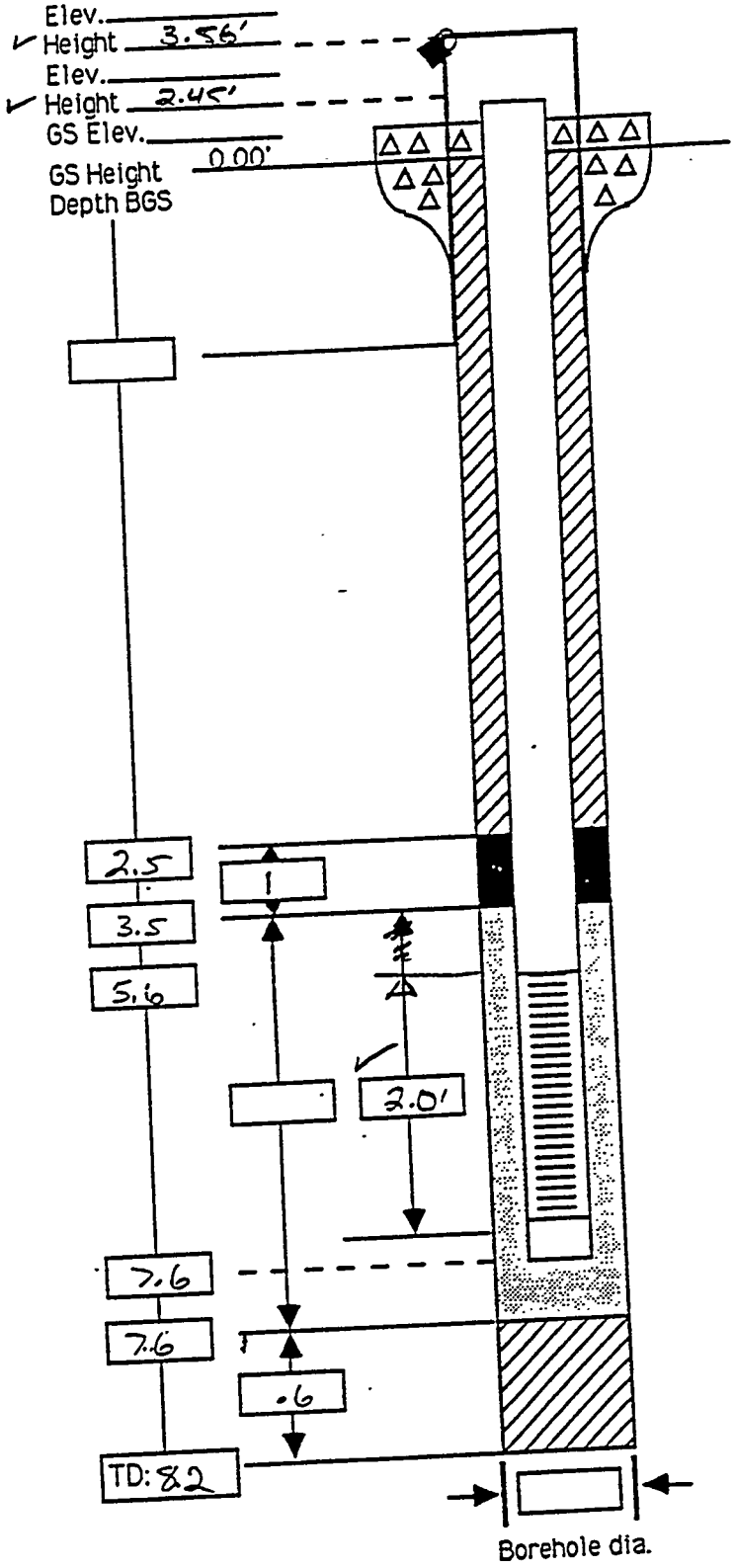
D-107

DRAFT

REV. DATE: MAY 1990

MONITORING WELL CONSTRUCTION LOG -- Standard

WELL NO.: AN: E-12	Installation: EAST FORK POPLAR CREEK	Site:
Project No.:	Client/Project: Y-12	
HAZWRAP Contractor: HAZWRAP		Drlg Contractor: HIGHLAND
Comp. Start: 10/17/90 (: m)		Comp. End: 10/17/90 (: m)
Built By:		Well Coord.:



PROTECTIVE CSG
Material / Type
Diameter
Depth BGS — Weep Hole (Y / N)

GUARD POSTS (Y / N)
No. — Type

SURFACE PAD
Composition & Size

RISER PIPE
Type: S.S.
Diameter: 2"
Total Length (TOC to TOS): 7.9'
Ventilated Cap (Y / N)

GROUT
Composition & Proportions: 2.6 CU FT CEMENT
Tremied (Y / N)
Interval BGS

CENTRALIZERS (Y / N)
Depth(s)

SEAL
Type: BENTONITE (1/2 BUCKET 1/4" PELLETS) 1/4 SK GE.
Source: PEL PLUG (BENTONITE)
Setup/Hydration time: 30 MIN — Vol. Fluid Added: 1.5 GAL
Tremied (Y / N)

FILTER PACK
Type: SAND
Amt. Used: 1/2 BAG
Tremied (Y / N)
Source: MORIE IND. SAND, N.J.
Gr. Size Dist.: 20/40

SCREEN
Type: S.S.
Diameter: 2" (2')
Slot Size & Type: .010 CONT. WIRE WOUND
Interval BGS: 5.6 - 7.6

SUMP (Y / N)
Interval BSG — Length
Bottom Cap (Y / N)

BACKFILL PLUG
Material
Setup/Hydration time
Tremied (Y / N)

REV. DATE: MAY 1990

WELL DEVELOPMENT LOG	Well No.: ANXE 1B	Page 1 of 1
Installation:	Site: 300 yds S of fire station	
Project No.:	Client/Project:	
HAZWRAP Contractor:	Dev. Contractor:	Csg Dia.: 2"
Dev. Start (: m)	Dev. End: (: m)	Dev. Rig (Y / N)
Developed by:		

Dev. Method

Equipment

Pre-Dev. SWL 7.68 ft Maximum drawdown during pumping ft at gpm

Range and Average Discharge rate gpm

Total quantity of material bailed

Total quantity of water discharged by pumping

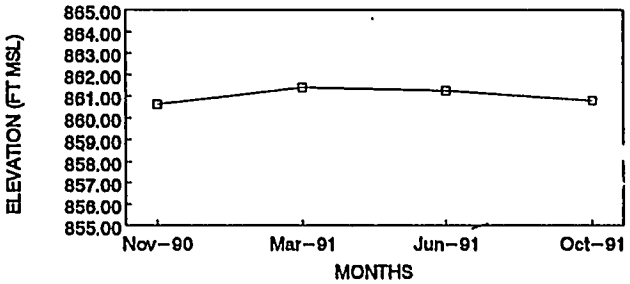
Disposition of discharge water

	Time	Volume Removed (gals)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp °C	pH	Conductivity	Remarks
	1:10	2.5			cloudy brown		6.06	470 µ/mhos	well purged dry
	1:50	2.5 gal + 1 pint			cloudy brown		6.15	410 µ mhos	little to no recharge will cont. purge tomorrow
11/6 / 11/7	10:55am	2.5 gal + 1 pint + 150 mL (2.7 gallons)			cloudy brn	16°	6.39	580 µ mhos	5.9 well volumes purged well dry, considered developed

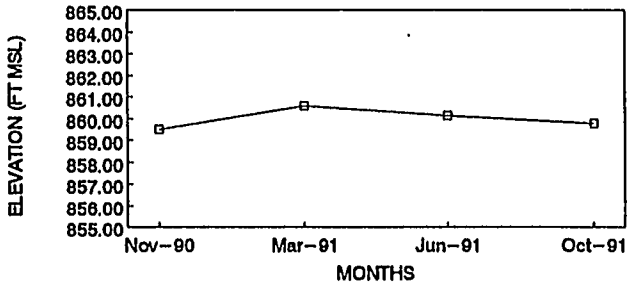
WELL IDENTIFICATION	DATE MEASURED	ELEVATION M.P. (FT, MSL)	WATER LEVEL BELOW M.P. (FT)	WATER LEVEL ELEVATION (FT, MSL)
AN:D-01	Nov-90	863.29	2.69	860.60
AN:D-01	Mar-91	863.29	1.90	861.39
AN:D-01	Jun-91	863.29	2.04	861.25
AN:D-01	Oct-91	863.29	2.50	860.79
AN:D-02	Nov-90	865.30	5.77	859.53
AN:D-02	Mar-91	865.30	4.71	860.59
AN:D-02	Jun-91	865.30	5.14	860.16
AN:D-02	Oct-91	865.30	5.50	859.80
AN:D-03	Nov-90	865.29	5.37	859.92
AN:D-03	Mar-91	865.29	4.74	860.55
AN:D-03	Jun-91	865.29	4.97	860.32
AN:D-03	Oct-91	865.29	5.40	859.89

HYDROGRAPHS

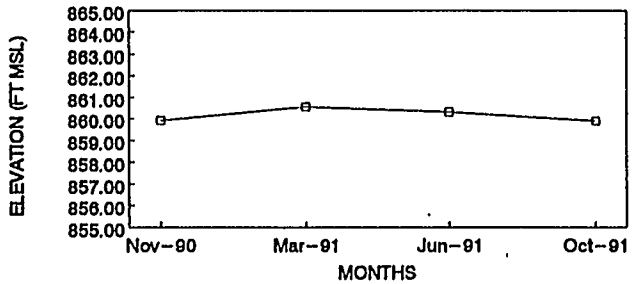
GROUNDWATER MONITORING WELL AN:D-1



GROUNDWATER MONITORING WELL AN:D-2

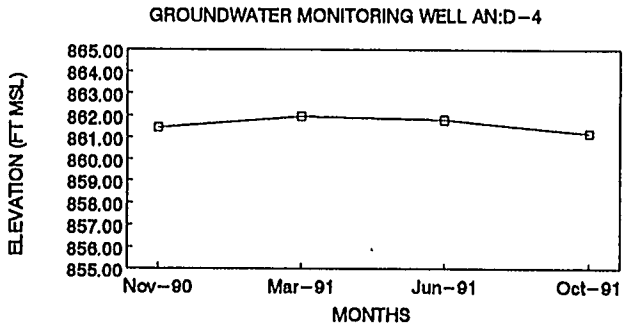


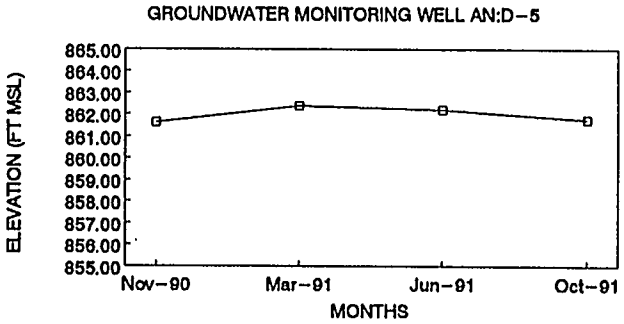
GROUNDWATER MONITORING WELL AN:D-3

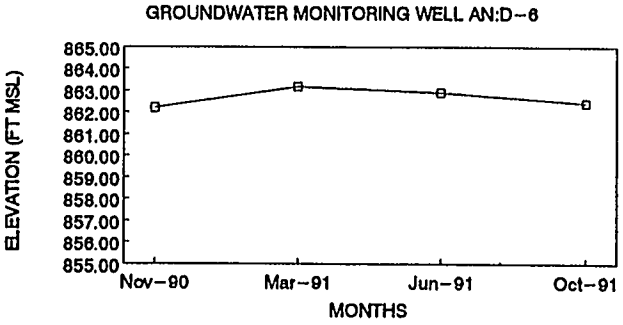


WELL IDENTIFICATION	DATE MEASURED	ELEVATION M.P. (FT, MSL)	WATER LEVEL BELOW M.P. (FT)	WATER LEVEL ELEVATION (FT, MSL)
AN:D-04	Nov-90	864.80	3.35	861.45
AN:D-04	Mar-91	864.80	2.83	861.97
AN:D-04	Jun-91	864.80	3.00	861.80
AN:D-04	Oct-91	864.80	3.60	861.20
AN:D-05	Nov-90	865.24	3.62	861.62
AN:D-05	Mar-91	865.24	2.88	862.36
AN:D-05	Jun-91	865.24	3.07	862.17
AN:D-05	Oct-91	865.24	3.50	861.74
AN:D-06	Nov-90	865.17	2.96	862.21
AN:D-06	Mar-91	865.17	2.00	863.17
AN:D-06	Jun-91	865.17	2.27	862.90
AN:D-06	Oct-91	865.17	2.75	862.42

HYDROGRAPHS



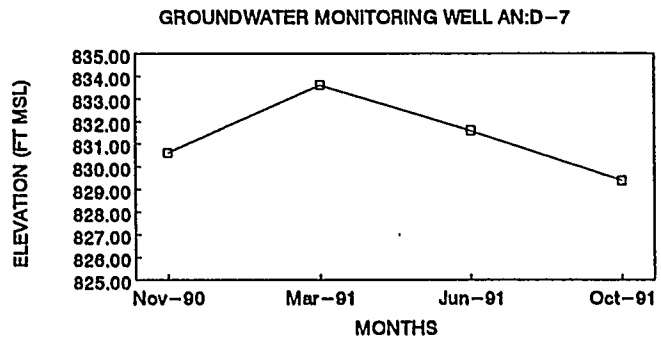


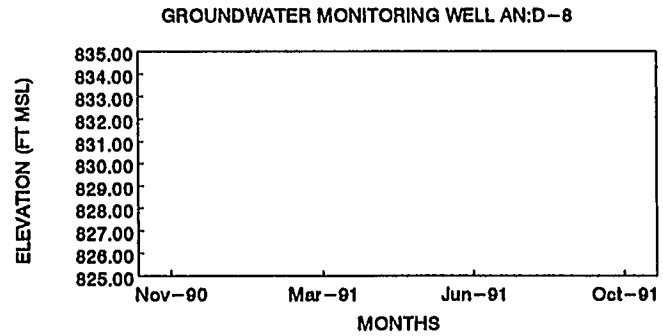


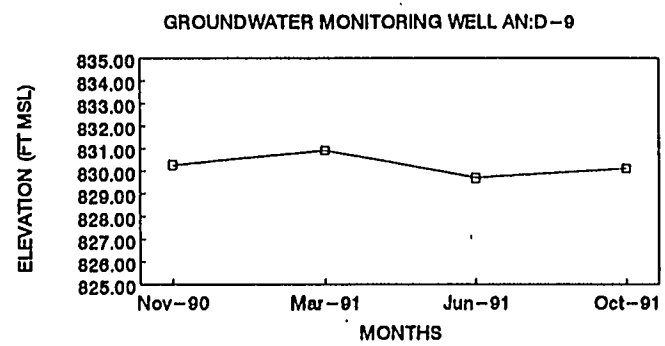
WELL IDENTIFICATION	DATE MEASURED	ELEVATION M.P. (FT, MSL)	WATER LEVEL BELOW M.P. (FT)	WATER LEVEL ELEVATION (FT, MSL)
AN:D-07	Nov-90	837.60	6.99	830.61
AN:D-07	Mar-91	837.60	4.00	833.60
AN:D-07	Jun-91	837.60	6.00	831.60
AN:D-07	Oct-91	837.60	8.20	829.40
AN:D-08	Nov-90	837.00	#	-
AN:D-08	Mar-91	837.00	#	-
AN:D-08	Jun-91	837.00	#	-
AN:D-08	Oct-91	837.00	#	-
AN:D-09	Nov-90	836.20	5.95	830.25
AN:D-09	Mar-91	836.20	5.30	830.90
AN:D-09	Jun-91	836.20	6.51	829.69
AN:D-09	Oct-91	836.20	6.10	830.10

Water level measurements not taken due to obstruction in well.

HYDROGRAPHS

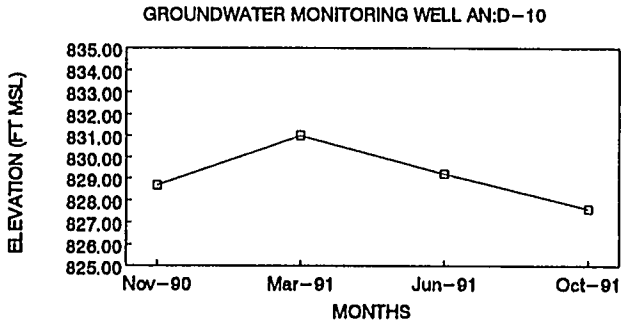


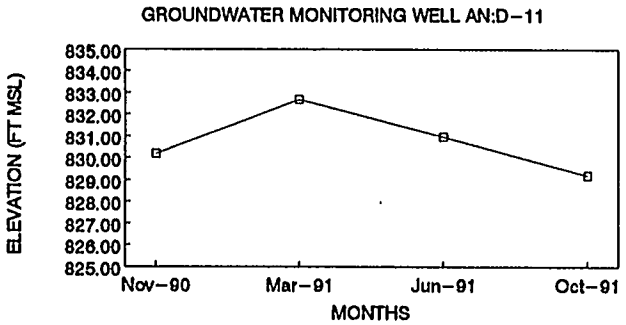




WELL IDENTIFICATION	DATE MEASURED	ELEVATION M.P. (FT, MSL)	WATER LEVEL BELOW M.P. (FT)	WATER LEVEL ELEVATION (FT, MSL)
AN:D-10	Nov-90	835.90	7.23	828.67
AN:D-10	Mar-91	835.90	4.88	831.02
AN:D-10	Jun-91	835.90	6.69	829.21
AN:D-10	Oct-91	835.90	8.30	827.60
AN:D-11	Nov-90	836.50	6.33	830.17
AN:D-11	Mar-91	836.50	3.85	832.65
AN:D-11	Jun-91	836.50	5.53	830.97
AN:D-11	Oct-91	836.50	7.30	829.20

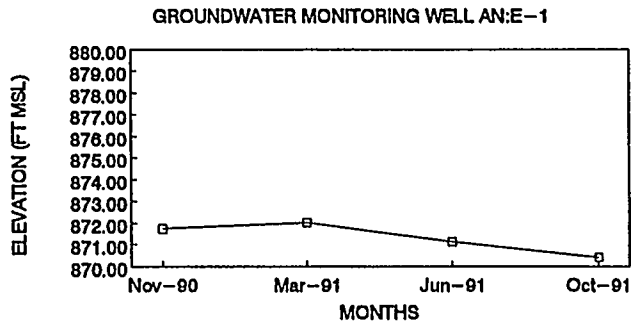
HYDROGRAPHS

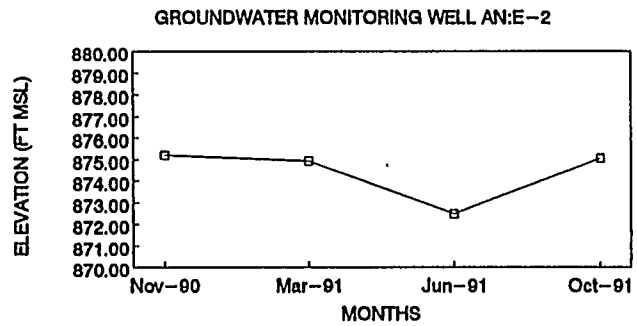


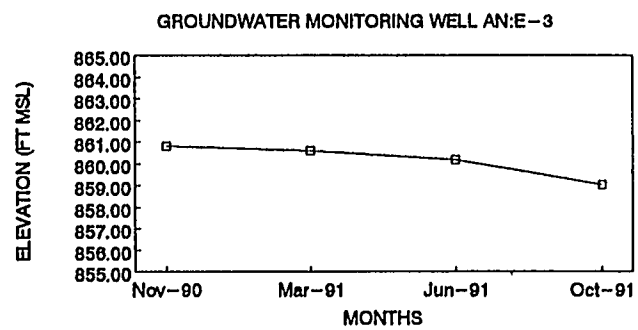


WELL IDENTIFICATION	DATE MEASURED	ELEVATION M.P. (FT, MSL)	WATER LEVEL BELOW M.P. (FT)	WATER LEVEL ELEVATION (FT, MSL)
* AN:E-01	Nov-90	878.21	6.47	871.74
* AN:E-01	Mar-91	878.21	6.20	872.01
* AN:E-01	Jun-91	878.21	7.09	871.12
* AN:E-01	Oct-91	878.21	7.80	870.41
AN:E-02	Nov-90	880.94	5.75	875.19
AN:E-02	Mar-91	880.94	6.00	874.94
AN:E-02	Jun-91	880.94	8.47	872.47
AN:E-02	Oct-91	880.94	5.90	875.04
* AN:E-03	Nov-90	865.75	4.95	860.80
* AN:E-03	Mar-91	865.75	5.16	860.59
* AN:E-03	Jun-91	865.75	5.57	860.18
* AN:E-03	Oct-91	865.75	6.70	859.05

HYDROGRAPHS

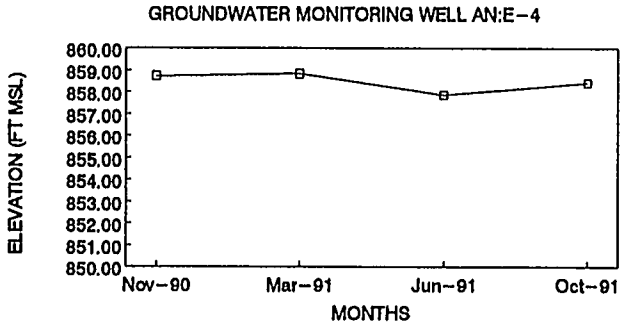


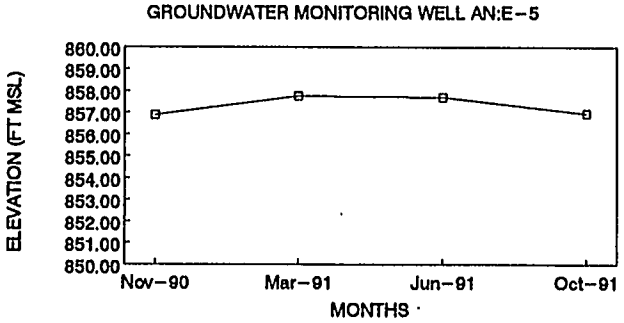


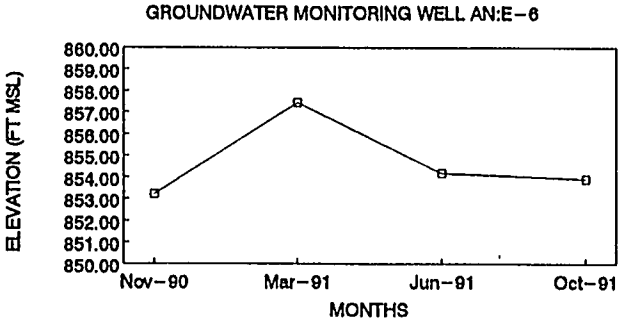


WELL IDENTIFICATION	DATE MEASURED	ELEVATION M.P. (FT, MSL)	WATER LEVEL BELOW M.P. (FT)	WATER LEVEL ELEVATION (FT, MSL)
AN:E-04	Nov-90	863.64	4.90	858.74
AN:E-04	Mar-91	863.64	4.81	858.83
AN:E-04	Jun-91	863.64	5.78	857.86
AN:E-04	Oct-91	863.64	5.20	858.44
* AN:E-05	Nov-90	862.44	5.55	856.89
* AN:E-05	Mar-91	862.44	4.70	857.74
* AN:E-05	Jun-91	862.44	4.76	857.68
* AN:E-05	Oct-91	862.44	5.50	856.94
* AN:E-06	Nov-90	862.52	9.30	853.22
* AN:E-06	Mar-91	862.52	5.10	857.42
* AN:E-06	Jun-91	862.52	8.35	854.17
* AN:E-06	Oct-91	862.52	8.60	853.92

HYDROGRAPHS

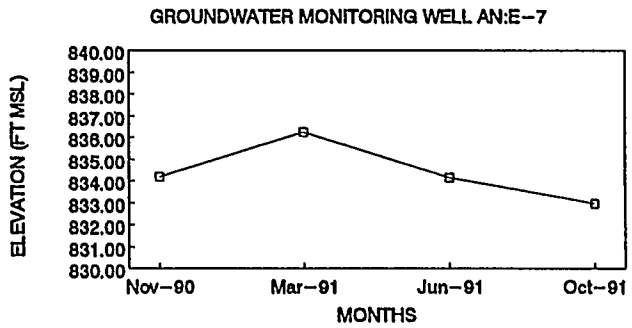


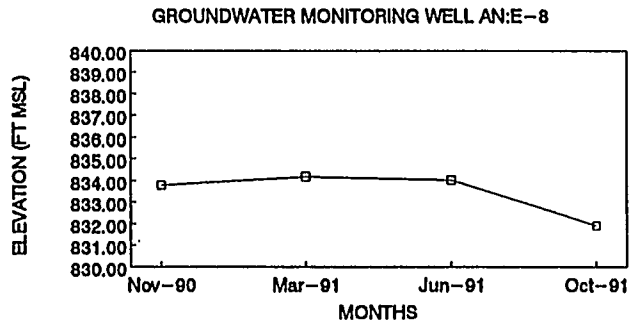


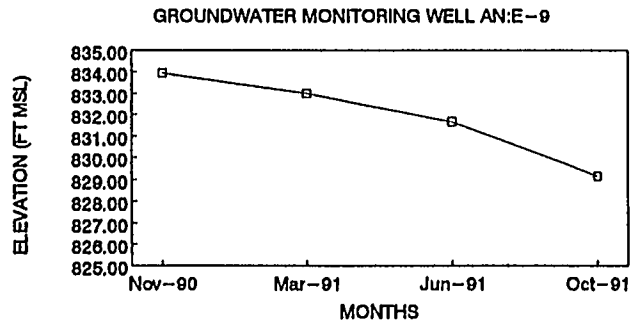


WELL IDENTIFICATION	DATE MEASURED	ELEVATION M.P. (FT, MSL)	WATER LEVEL BELOW M.P. (FT)	WATER LEVEL ELEVATION (FT, MSL)
* AN:E-07	Nov-90	840.86	6.66	834.20
* AN:E-07	Mar-91	840.86	4.62	836.24
* AN:E-07	Jun-91	840.86	6.71	834.15
* AN:E-07	Oct-91	840.86	7.90	832.96
AN:E-08	Nov-90	840.10	6.32	833.78
AN:E-08	Mar-91	840.10	5.92	834.18
AN:E-08	Jun-91	840.10	6.08	834.02
AN:E-08	Oct-91	840.10	8.20	831.90
* AN:E-09	Nov-90	839.14	5.19	833.95
* AN:E-09	Mar-91	839.14	6.15	832.99
* AN:E-09	Jun-91	839.14	7.47	831.67
* AN:E-09	Oct-91	839.14	10.00	829.14

HYDROGRAPHS





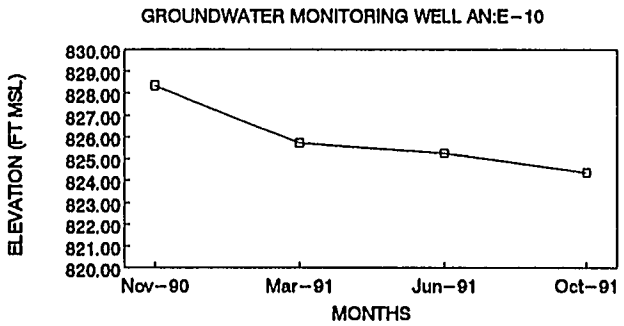


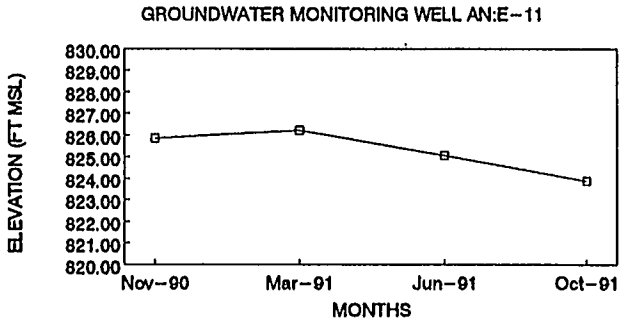
WELL IDENTIFICATION	DATE MEASURED	ELEVATION M.P. (FT, MSL)	WATER LEVEL BELOW M.P. (FT)	WATER LEVEL ELEVATION (FT, MSL)
* AN:E-10	Nov-90	833.36	5.01	828.35
* AN:E-10	Mar-91	833.36	7.62	825.74
* AN:E-10	Jun-91	833.36	8.11	825.25
* AN:E-10	Oct-91	833.36	9.00	824.36
* AN:E-11	Nov-90	833.76	7.91	825.85
* AN:E-11	Mar-91	833.76	7.56	826.20
* AN:E-11	Jun-91	833.76	8.70	825.06
* AN:E-11	Oct-91	833.76	9.90	823.86
AN:E-12	Nov-90	832.62	9.29	823.33
AN:E-12	Mar-91	832.62	3.66	828.96
AN:E-12	Jun-91	832.62	5.47	827.15
AN:E-12	Oct-91	832.62	7.00	825.62

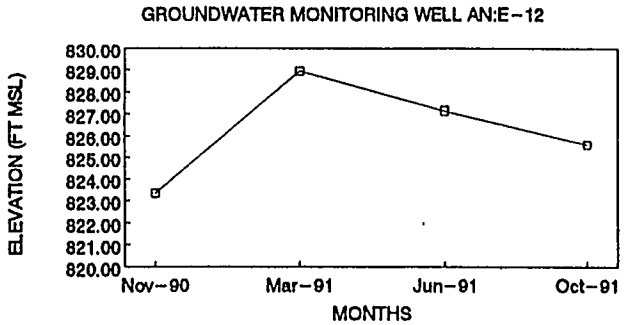
Note: Measuring point elevations were obtained by adding the reported stick-up to the groundsurface elevation

* The measuring point elevations and subsequent water level elevations are incorrect for these monitoring wells due to errors in measuring stick-up.

HYDROGRAPHS







380.921103.007

MEMORANDUM

TO: Doug Combs

FROM: Rick Arnseth Rick

DATE: 3 November 1992

SUBJECT: Geochemical equilibrium modeling results for LEFPC groundwaters

I have attatched copies of the three sample model runs I performed on Lower East Fork Poplar Creek groundwater samples. The model used was MINTEQA2, an equilibrium geochemical model developed and distributed by the EPA lab in Athens, GA.

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 11:20:50

EFPC well AN:D-10 mercury calculation.

Temperature (Celsius): 18.90
Units of concentration: MG/L
Ionic strength to be computed.
Carbonate concentration represents carbonate alkalinity.
Automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed for all solids in the thermodynamic database and
the print option for solids is set to: 1
The maximum number of iterations is: 100
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	1.752E-04	-6.76
150	1.540E+02	-2.42
460	1.620E+01	-3.18
410	4.160E+00	-3.97
500	9.810E+00	-3.37
180	1.220E+01	-3.46
732	6.850E+01	-3.15
730	2.200E+00	-4.18
360	4.320E-02	-6.97
281	6.680E+01	-2.92
471	4.280E+00	-4.11
30	2.900E+01	-2.97
140	2.334E+02	-6.12

H2O has been inserted as a COMPONENT

3 1
330 6.7600 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.738E-07	-6.760	1.752E-04
150	Ca+2	3.802E-03	-2.420	1.540E+02
460	Mg+2	6.607E-04	-3.180	1.620E+01
410	K+1	1.072E-04	-3.970	4.160E+00
500	Na+1	4.266E-04	-3.370	9.810E+00
180	Cl-1	3.467E-04	-3.460	1.220E+01
732	SO4-2	7.079E-04	-3.150	6.850E+01
730	HS-1	6.607E-05	-4.180	2.200E+00
360	Hg2+2	1.072E-07	-6.970	4.320E-02
281	Fe+3	1.202E-03	-2.920	6.680E+01
471	Mn+3	7.762E-05	-4.110	4.280E+00
30	Al+3	1.072E-03	-2.970	2.900E+01
140	CO3-2	7.586E-07	-6.120	2.334E+02
2	H2O	1.000E+00	0.000	0.000E-01

CHARGE BALANCE: UNSPECIATED

SUM OF CATIONS= 1.661E-02 SUM OF ANIONS = 9.621E-03

PERCENT DIFFERENCE = 2.663E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
0	SO4-2	7.135E-04	7.851E-03	-3.15000
1	Fe+3	1.197E-03	5.123E+11	-3.09609
2	Fe+3	1.197E-03	8.708E+12	-3.27218
3	Fe+3	1.197E-03	2.580E+12	-3.44827
4	Fe+3	1.197E-03	7.645E+11	-3.62437
5	Fe+3	1.197E-03	2.265E+11	-3.80046
6	Fe+3	1.197E-03	6.711E+10	-3.97655
7	Fe+3	1.197E-03	1.989E+10	-4.15264
8	Fe+3	1.197E-03	5.892E+09	-4.32873
9	Fe+3	1.197E-03	1.746E+09	-4.50482
10	Fe+3	1.197E-03	5.173E+08	-4.68091
11	Fe+3	1.197E-03	1.533E+08	-4.85700
12	Fe+3	1.197E-03	4.541E+07	-5.03310
13	Fe+3	1.197E-03	1.346E+07	-5.20919
14	Fe+3	1.197E-03	3.987E+06	-5.38529
15	Fe+3	1.197E-03	1.181E+06	-5.56139
16	Fe+3	1.197E-03	3.500E+05	-5.73751
17	Fe+3	1.197E-03	1.037E+05	-5.91367
18	Fe+3	1.197E-03	3.074E+04	-6.08992
19	Fe+3	1.197E-03	9.114E+03	-6.26635
20	Fe+3	1.197E-03	2.704E+03	-6.44320
21	Fe+3	1.197E-03	8.035E+02	-6.62102
22	Fe+3	1.197E-03	2.396E+02	-6.80101
23	Fe+3	1.197E-03	7.201E+01	-6.98597
24	Fe+3	1.197E-03	2.197E+01	-7.18257
25	Fe+3	1.197E-03	6.869E+00	-7.40771
26	Fe+3	1.197E-03	1.433E+00	-7.70994
27	Fe+3	1.197E-03	1.472E-02	-9.73524

```
    28    Mn+3              7.795E-05  -1.067E-05    -4.65541
    29    Mn+3              7.795E-05  -9.364E-07    -4.59148
    30    Mn+3              7.795E-05  -3.821E-08    -4.58624
PC MINTEQA2 v3.00   DATE OF CALCULATIONS: 15-OCT-92  TIME: 11:24: 7

ITERATIONS=  31:  SOLID MANGANITE    PRECIPITATES
```

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 11:24:11

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
31	Hg2+2	1.077E-07	-4.167E-08	-7.17997
32	Mg+2	6.667E-04	3.608E-04	-3.23565
33	SO4-2	7.135E-04	2.508E-05	-3.45792
34	Hg2+2	1.077E-07	-7.654E-11	-7.17807

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 11:24:34

ITERATIONS= 35: SOLID HEMATITE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 11:24:38

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
35	Hg2+2	1.077E-07	-4.134E-08	-7.17776
36	Mg+2	6.667E-04	3.527E-04	-3.23569
37	SO4-2	7.135E-04	2.441E-05	-3.45629
38	Hg2+2	1.077E-07	-7.416E-11	-7.17441

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 11:25: 1

ITERATIONS= 39: SOLID Hg2S PRECIPITATES

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 11:25: 6

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
39	Ca+2	3.845E-03	-1.360E-03	-2.65608
40	Mg+2	6.667E-04	3.525E-04	-3.23576
41	SO4-2	7.135E-04	2.432E-05	-3.45635
42	Ca+2	3.845E-03	-2.372E-06	-2.65634

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 11:25:29

ITERATIONS= 43: SOLID DIASPORE PRECIPITATES

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
43	Ca+2	3.845E-03	-1.360E-03	-2.65608
44	Mg+2	6.667E-04	3.508E-04	-3.23576
45	SO4-2	7.135E-04	2.410E-05	-3.45599
46	Ca+2	3.845E-03	-2.394E-06	-2.65558

ID	NAME	ANAL MOL	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DIFF FXN
140	CO3-2	1.025E-02	2.549E-06	1.588E-06	-5.79928	0.622769	0.2057	-3.646E-08
150	Ca+2	3.845E-03	3.551E-03	2.211E-03	-2.65532	0.622769	0.2057	-6.864E-08
460	Mg+2	6.667E-04	6.119E-04	3.811E-04	-3.41899	0.622769	0.2057	-1.186E-08
410	K+1	1.065E-04	1.062E-04	9.436E-05	-4.02519	0.888345	0.0514	-5.098E-10
500	Na+1	4.270E-04	4.250E-04	3.776E-04	-3.42302	0.888345	0.0514	-2.038E-09
180	Cl-1	3.443E-04	3.443E-04	3.059E-04	-3.51445	0.888345	0.0514	-1.649E-09
732	SO4-2	7.135E-04	5.458E-04	3.399E-04	-3.46865	0.622769	0.2057	-1.038E-08
730	HS-1	6.656E-05	2.524E-05	2.242E-05	-4.64930	0.888345	0.0514	-1.086E-10
30	Al+3	1.075E-03	2.710E-13	9.338E-14	-13.02975	0.344537	0.4628	-1.855E-19
281	Fe+3	1.197E-03	2.600E-22	8.959E-23	-22.04775	0.344537	0.4628	3.430E-19
471	Mn+3	7.795E-05	8.809E-21	3.035E-21	-20.51781	0.344537	0.4628	

0.000E-01							
360	Hg2+2	1.077E-07	1.456E-14	9.070E-15	-14.04241	0.622769	0.2057
-5.421E-20							
2	H2O	-4.414E-24	-4.102E-03	9.998E-01	-0.00009	1.000000	0.0001
-7.367E-25							
330	H+1	1.739E-07	1.956E-07	1.738E-07	-6.76000	0.888345	0.0514
-2.168E-19							

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DH
330	H+1	1.956E-07	0.0000002	-6.76000	0.888345	0.051	0.000
150	Ca+2	3.551E-03	0.0022115	-2.65532	0.622769	0.206	0.000
460	Mg+2	6.119E-04	0.0003811	-3.41899	0.622769	0.206	0.000
410	K+1	1.062E-04	0.0000944	-4.02519	0.888345	0.051	0.000
500	Na+1	4.250E-04	0.0003776	-3.42302	0.888345	0.051	0.000
180	Cl-1	3.443E-04	0.0003059	-3.51445	0.888345	0.051	0.000
732	SO4-2	5.458E-04	0.0003399	-3.46865	0.622769	0.206	0.000
730	HS-1	2.524E-05	0.0000224	-4.64930	0.888345	0.051	0.000
360	Hg2+2	1.456E-14	0.0000000	-14.04241	0.622769	0.206	0.000
281	Fe+3	2.600E-22	0.0000000	-22.04775	0.344537	0.463	0.000
471	Mn+3	8.809E-21	0.0000000	-20.51781	0.344537	0.463	0.000
30	Al+3	2.710E-13	0.0000000	-13.02975	0.344537	0.463	0.000
140	CO3-2	2.549E-06	0.0000016	-5.79928	0.622769	0.206	0.000

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DH
3307300	H2S AQ	4.121E-05	0.0000413	-4.38360	1.003172	7.024	-5.300
3307301	S -2	1.634E-11	0.0000000	-10.99254	0.622769	-12.898	12.100
3300020	OH-	4.065E-08	0.0000000	-7.44239	0.888345	-14.151	13.345
4603300	MgOH +	2.358E-09	0.0000000	-8.67883	0.888345	-11.968	15.935
4601400	MgCO3 AQ	5.241E-07	0.0000005	-6.27924	1.003172	2.938	2.022

4601401	MgHCO3 +	3.245E-05	0.0000288	-4.54026	0.888345	11.489	-2.430
4607320	MgSO4 AQ	2.186E-05	0.0000219	-4.65906	1.003172	2.227	1.399
1503300	CaOH +	2.165E-09	0.0000000	-8.71593	0.888345	-12.769	14.535
1501400	CaHCO3 +	1.442E-04	0.0001281	-3.89245	0.888345	11.374	1.790
1501401	CaCO3 AQ	4.387E-06	0.0000044	-5.35645	1.003172	3.097	4.030
1507320	CaSO4 AQ	1.449E-04	0.0001454	-3.83747	1.003172	2.285	1.470
5001400	NaCO3 -	9.135E-09	0.0000000	-8.09072	0.888345	1.183	8.911
5001401	NaHCO3 AQ	1.248E-06	0.0000013	-5.90230	1.003172	10.079	0.000
5007320	NaSO4 -	6.960E-07	0.0000006	-6.20881	0.888345	0.734	1.120
4107320	KSO4 -	2.276E-07	0.0000002	-6.69422	0.888345	0.851	2.250
303300	AlOH +2	5.803E-12	0.0000000	-11.44201	0.622769	-4.966	11.899
303301	Al(OH)2 +	2.764E-10	0.0000000	-9.60993	0.888345	-10.049	0.000
303302	Al(OH)4 -	2.437E-10	0.0000000	-9.66464	0.888345	-23.623	44.060
307320	AlSO4 +	3.468E-14	0.0000000	-13.51131	0.888345	3.039	2.150
307321	Al(SO4)2 -	9.139E-16	0.0000000	-15.09052	0.888345	4.928	2.840
303303	Al(OH)3 AQ	1.773E-09	0.0000000	-8.75003	1.003172	-16.001	0.000
2813300	FeOH +2	3.704E-18	0.0000000	-17.63705	0.622769	-2.144	10.399
2817320	FeSO4 +	2.484E-22	0.0000000	-21.65626	0.888345	3.912	3.910
2811800	FeCl +2	1.091E-24	0.0000000	-24.16794	0.622769	1.600	5.600
2811801	FeCl2 +	1.273E-27	0.0000000	-26.94666	0.888345	2.181	0.000
2811802	FeCl3 AQ	3.448E-32	0.0000000	-31.46111	1.003172	1.129	0.000
2813301	FeOH2 +	7.136E-15	0.0000000	-14.19794	0.888345	-5.619	0.000
2813302	FeOH3 AQ	4.272E-16	0.0000000	-15.36803	1.003172	-13.601	0.000
2813303	FeOH4 -	2.775E-17	0.0000000	-16.60812	0.888345	-21.549	0.000
2817321	Fe(SO4)2 -	2.606E-24	0.0000000	-23.63547	0.888345	5.401	4.600
2813304	Fe2(OH)2+4	1.231E-33	0.0000000	-33.73237	0.150421	-2.334	13.500
2813305	Fe3(OH)4+5	4.602E-45	0.0000000	-45.62255	0.051825	-5.233	14.300
3301400	HCO3 -	7.584E-03	0.0067371	-2.17153	0.888345	10.439	-3.617
3301401	H2CO3 AQ	2.482E-03	0.0024895	-2.60388	1.003172	16.714	-2.247
3307320	HSO4 -	5.457E-09	0.0000000	-8.31443	0.888345	1.966	4.910

Type III - SPECIES WITH FIXED ACTIVITY (fixed pH, fixed pe, infinite solids, gases, etc.)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-4.102E-03	-2.387	0.000	0.000
330	H+1	-5.715E-03	-2.243	6.760	0.000

Type IV - FINITE SOLIDS (present at equilibrium)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2047100	MANGANITE	7.795E-05	-4.108	0.238	0.000
3028100	HEMATITE	5.984E-04	-3.223	3.536	30.845
1036000	Hg2S	1.080E-07	-6.967	11.932	-16.670
2003002	DIASPORE	1.075E-03	-2.968	-7.250	24.630

Type V - UNDERSATURATED SOLIDS (not present at equilibrium)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
6041001	ALUNITE	8.198E-09	-8.086	1.406	-3.918
6015000	ANHYDRITE	2.853E-02	-1.545	4.579	3.769
5015000	ARAGONITE	6.724E-01	-0.172	8.282	2.615
5046000	ARTINITE	6.954E-10	-9.158	-10.040	28.742
2003001	BOEHMITE	1.743E-02	-1.759	-9.009	28.130
2046000	BRUCITE	8.189E-08	-7.087	-17.188	25.840
5015001	CALCITE	9.680E-01	-0.014	8.440	2.585
6041000	ALUM K	1.937E-19	-18.713	5.281	-7.220
5015002	DOLOMITE	1.586E-01	-0.800	16.873	8.290
6046000	EPSOMITE	1.972E-05	-4.705	2.183	-2.820
2028100	FERRIHYDRITE	2.193E-07	-6.659	-4.891	0.000
4128100	FEOH)2.7CL.3	1.548E-02	-1.810	3.040	0.000
6028100	FE2(SO4)3	0.000E-01	-58.987	-4.485	59.120
2003003	GIBBSITE (C)	1.352E-02	-1.869	-9.119	22.800
3003000	Al2O3	3.313E-09	-8.480	-22.980	0.000
2028102	GOETHITE	3.239E-03	-2.490	-0.722	14.480
6015001	GYPSUM	5.344E-02	-1.272	4.852	-0.261
4150000	HALITE	3.123E-09	-8.505	-1.568	-0.918
6003000	ALOHSO4	3.101E-07	-6.508	3.230	0.000
5015003	HUNTITE	2.912E-07	-6.536	29.574	25.760
5046001	HYDRMAGNESIT	1.563E-19	-18.806	7.967	52.210
6050000	JAROSITE NA	5.035E-26	-25.298	10.646	36.180
6041002	JAROSITE K	5.954E-23	-22.225	14.321	31.280
6028101	JAROSITE H	9.430E-29	-28.026	11.256	55.150

3028101	MAGHEMITE	1.197E-10	-9.922	-6.386	0.000
5046002	MAGNESITE	5.203E-02	-1.284	7.935	6.169
6050001	MIRABILITE	1.228E-09	-8.911	1.405	-18.987
3050000	NATRON	8.050E-12	-11.094	1.552	-15.745
5046003	NESQUEHONITE	2.060E-04	-3.686	5.532	5.789
6050002	THENARDITE	7.171E-11	-10.144	0.170	0.572
5050001	THERMONATR	1.537E-13	-12.813	-0.168	2.802
3047100	BIXBYITE	7.974E-01	-0.098	0.378	15.245
2003000	ALOH3(A)	2.857E-04	-3.544	-10.794	27.045
6047100	MN2(SO4)3	0.000E-01	-46.329	5.113	39.060
2015000	LIME	2.287E-23	-22.641	-33.505	46.265
2015001	PORTLANDITE	5.244E-13	-12.280	-23.145	30.690
2046001	PERICLASE	1.091E-12	-11.962	-22.063	36.135
3046000	SPINEL	8.021E-14	-13.096	-37.697	89.089
3046001	MAG-FERRITE	6.025E-12	-11.220	-17.785	66.639
3028102	LEPIDOCROCIT	7.262E-04	-3.139	-1.371	0.000
5036000	Hg2CO3	1.309E-06	-5.883	13.959	0.000
4136000	Calomel	1.350E-03	-2.870	18.202	-23.444
2036000	Hg2(OH)2	1.649E-06	-5.783	-5.260	0.000
6003001	AL4(OH)10SO4	2.049E-11	-10.689	-22.700	0.000
6036000	Hg2SO4	4.485E-12	-11.348	6.163	-0.230

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	7.062E-02	-1.151	18.168	-0.530
3601800	HgCl (g)	2.241E-32	-31.650	-21.114	40.098

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG TYPE I and TYPE II (dissolved and adsorbed) species

```
CO3-2
                    1.4     PERCENT BOUND IN SPECIES #1501400    CaHCO3 +
   74.0     PERCENT BOUND IN SPECIES #3301400    HCO3 -
   24.2     PERCENT BOUND IN SPECIES #3301401    H2CO3 AQ

Ca+2
                   92.4     PERCENT BOUND IN SPECIES #    150    Ca+2
    3.8     PERCENT BOUND IN SPECIES #1501400    CaHCO3 +
    3.8     PERCENT BOUND IN SPECIES #1507320    CaSO4 AQ

Mg+2
                   91.8     PERCENT BOUND IN SPECIES #    460    Mg+2
    4.9     PERCENT BOUND IN SPECIES #4601401    MgHCO3 +
    3.3     PERCENT BOUND IN SPECIES #4607320    MgSO4 AQ

K+1
                   99.8     PERCENT BOUND IN SPECIES #    410    K+1

Na+1
                   99.5     PERCENT BOUND IN SPECIES #    500    Na+1

Cl-1
                  100.0     PERCENT BOUND IN SPECIES #    180    Cl-1

SO4-2
                   76.5     PERCENT BOUND IN SPECIES #    732    SO4-2
    3.1     PERCENT BOUND IN SPECIES #4607320    MgSO4 AQ
   20.3     PERCENT BOUND IN SPECIES #1507320    CaSO4 AQ

HS-1
                   38.0     PERCENT BOUND IN SPECIES #    730    HS-1
   62.0     PERCENT BOUND IN SPECIES #3307300    H2S AQ

Al+3
                   12.0     PERCENT BOUND IN SPECIES # 303301    Al(OH)2 +
   10.6     PERCENT BOUND IN SPECIES # 303302    Al(OH)4 -
   77.1     PERCENT BOUND IN SPECIES # 303303    Al(OH)3 AQ
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Fe+3                    94.0     PERCENT BOUND IN SPECIES #2813301   FeOH2 +
          5.6     PERCENT BOUND IN SPECIES #2813302   FeOH3 AQ

Mn+3                   100.0     PERCENT BOUND IN SPECIES #    471   Mn+3

Hg2+2                  100.0     PERCENT BOUND IN SPECIES #    360   Hg2+2

H2O                     78.1     PERCENT BOUND IN SPECIES #3300020   OH-
          4.5     PERCENT BOUND IN SPECIES #4603300   MgOH +
          4.2     PERCENT BOUND IN SPECIES #1503300   CaOH +
          1.1     PERCENT BOUND IN SPECIES # 303301   Al(OH)2 +
          1.9     PERCENT BOUND IN SPECIES # 303302   Al(OH)4 -
         10.2     PERCENT BOUND IN SPECIES # 303303   Al(OH)3 AQ

H+1                      1.1     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
         59.4     PERCENT BOUND IN SPECIES #3301400   HCO3 -
         38.9     PERCENT BOUND IN SPECIES #3301401   H2CO3 AQ
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---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
140	CO3-2	1.025E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	3.845E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	6.667E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.065E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	4.270E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	3.443E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	7.135E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
730	HS-1	6.645E-05	99.8	0.000E-01	0.0	1.080E-07	0.2
30	Al+3	2.299E-09	0.0	0.000E-01	0.0	1.075E-03	100.0
281	Fe+3	7.595E-15	0.0	0.000E-01	0.0	1.197E-03	100.0
471	Mn+3	8.809E-21	0.0	0.000E-01	0.0	7.795E-05	100.0
360	Hg2+2	1.456E-14	0.0	0.000E-01	0.0	1.080E-07	100.0
2	H2O	5.202E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.277E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

CHARGE BALANCE: SPECIATED

SUM OF CATIONS = 9.034E-03 SUM OF ANIONS 9.051E-03

PERCENT DIFFERENCE = 9.477E-02 (ANIONS - CATIONS)/(ANIONS + CATIONS)

NON-CARBONATE ALKALINITY = -1.556E-07

EQUILIBRIUM IONIC STRENGTH (m) = 1.375E-02

EQUILIBRIUM pH = 6.760

DATE ID NUMBER: 921015
TIME ID NUMBER: 11260489

			(6.000) 2				
6028101	JAROSITE H	-28.026	(-5.000)330	(3.000)281	(2.000)732	(7.000) 2	
3028101	MAGHEMITE	-9.922	(-6.000)330	(2.000)281	(3.000) 2		
5046002	MAGNESITE	-1.284	(1.000)460	(1.000)140			
6050001	MIRABILITE	-8.911	(2.000)500	(1.000)732	(10.000) 2		
3050000	NATRON	-11.094	(2.000)500	(1.000)140	(10.000) 2		
5046003	NESQUEHONITE	-3.686	(1.000)460	(1.000)140	(3.000) 2		
6050002	THENARDITE	-10.144	(2.000)500	(1.000)732			
5050001	THERMONATR	-12.813	(2.000)500	(1.000)140	(1.000) 2		
3047100	BIXBYITE	-0.098	(-6.000)330	(2.000)471	(3.000) 2		
2047100	MANGANITE	0.000	(-3.000)330	(1.000)471	(2.000) 2		
6047100	MN2(SO4)3	-46.329	(2.000)471	(3.000)732			
2015000	LIME	-22.641	(-2.000)330	(1.000)150	(1.000) 2		
2015001	PORTLANDITE	-12.280	(-2.000)330	(1.000)150	(2.000) 2		
2046001	PERICLASE	-11.962	(-2.000)330	(1.000)460	(1.000) 2		
3046000	SPINEL	-13.096	(-8.000)330	(1.000)460	(2.000) 30	(4.000) 2	
3046001	MAG-FERRITE	-11.220	(-8.000)330	(1.000)460	(2.000)281	(4.000) 2	
3028102	LEPIDOCROCIT	-3.139	(-3.000)330	(1.000)281	(2.000) 2		
5036000	Hg2CO3	-5.883	(1.000)360	(1.000)140			
4136000	Calomel	-2.870	(1.000)360	(2.000)180			
2036000	Hg2(OH)2	-5.783	(1.000)360	(2.000) 2	(-2.000)330		
1036000	Hg2S	0.000	(1.000)360	(1.000)730	(-1.000)330		
6036000	Hg2SO4	-11.348	(1.000)360	(1.000)732			

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:13:50

EFPC well AN:D-9 mercury calculation - using total analyses.

Temperature (Celsius): 9.40
Units of concentration: MG/L
Ionic strength to be computed.
Carbonate concentration represents carbonate alkalinity.
Automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed for all solids in the thermodynamic database and
the print option for solids is set to: 1
The maximum number of iterations is: 100
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	1.157E-04	-6.94
150	2.020E+02	-2.30
460	2.050E+01	-3.07
410	2.790E+00	-4.15
500	1.160E+01	-3.30
180	1.100E+01	-3.51
732	6.500E+01	-3.17
492	4.800E-01	-5.11
730	1.200E+01	-3.44
360	2.430E+02	-3.22
281	5.660E+01	-2.99
471	1.230E+01	-3.65
30	2.040E+01	-3.12
140	3.204E+02	-5.76

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
0	SO4-2	6.773E-04	5.334E-03	-3.17000
1	Fe+3	1.014E-03	7.239E+11	-3.16609
2	Fe+3	1.014E-03	1.524E+13	-3.34218
3	Fe+3	1.014E-03	4.515E+12	-3.51827
4	Fe+3	1.014E-03	1.338E+12	-3.69437
5	Fe+3	1.014E-03	3.964E+11	-3.87046
6	Fe+3	1.014E-03	1.174E+11	-4.04655
7	Fe+3	1.014E-03	3.480E+10	-4.22264
8	Fe+3	1.014E-03	1.031E+10	-4.39873
9	Fe+3	1.014E-03	3.055E+09	-4.57482
10	Fe+3	1.014E-03	9.051E+08	-4.75091
11	Fe+3	1.014E-03	2.682E+08	-4.92701
12	Fe+3	1.014E-03	7.946E+07	-5.10310
13	Fe+3	1.014E-03	2.354E+07	-5.27919
14	Fe+3	1.014E-03	6.976E+06	-5.45529
15	Fe+3	1.014E-03	2.067E+06	-5.63140
16	Fe+3	1.014E-03	6.125E+05	-5.80752
17	Fe+3	1.014E-03	1.815E+05	-5.98369
18	Fe+3	1.014E-03	5.380E+04	-6.15996
19	Fe+3	1.014E-03	1.595E+04	-6.33644
20	Fe+3	1.014E-03	4.733E+03	-6.51342
21	Fe+3	1.014E-03	1.407E+03	-6.69151
22	Fe+3	1.014E-03	4.201E+02	-6.87212
23	Fe+3	1.014E-03	1.265E+02	-7.05853
24	Fe+3	1.014E-03	3.875E+01	-7.25857
25	Fe+3	1.014E-03	1.216E+01	-7.49250
26	Fe+3	1.014E-03	1.947E+00	-7.82033
27	SO4-2	6.773E-04	2.966E-03	-3.07672

28	SO4-2	6.773E-04	6.399E-04	-3.26346
29	Mn+3	2.241E-04	-1.231E-05	-4.21672
30	Mn+3	2.241E-04	-9.497E-07	-4.19219
31	Mn+3	2.241E-04	-4.558E-08	-4.19034

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:17:15

ITERATIONS= 32: SOLID MANGANITE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:17:19

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
32	Hg2+2	6.063E-04	-2.577E-04	-3.45762
33	Mg+2	8.440E-04	5.269E-04	-3.13766
34	SO4-2	6.773E-04	2.679E-05	-3.51144
35	Hg2+2	6.063E-04	-5.101E-07	-3.45294

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:17:43

ITERATIONS= 36: SOLID Hg2S PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:17:47

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
36	HS-1	-2.431E-04	5.889E-04	-3.89639
37	HS-1	-2.431E-04	2.793E-04	-4.89639
38	HS-1	-2.431E-04	2.467E-04	-5.89639
39	HS-1	-2.431E-04	2.435E-04	-6.89639
40	HS-1	-2.431E-04	2.431E-04	-7.89639
41	HS-1	-2.431E-04	2.431E-04	-8.89639
42	HS-1	-2.431E-04	2.431E-04	-9.89639
43	HS-1	-2.431E-04	2.431E-04	-10.89639
44	HS-1	-2.431E-04	2.430E-04	-11.89639
45	HS-1	-2.431E-04	2.424E-04	-12.89639
46	HS-1	-2.431E-04	2.363E-04	-13.89639
47	HS-1	-2.431E-04	1.748E-04	-14.89639
48	HS-1	-2.431E-04	-4.501E-04	-15.89639
49	HS-1	-2.431E-04	-1.747E-04	-15.67909
50	HS-1	-2.431E-04	-5.062E-05	-15.52736
51	HS-1	-2.431E-04	-7.166E-06	-15.45830
52	HS-1	-2.431E-04	-1.525E-07	-15.44604

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:19:13

ITERATIONS= 53: SOLID HEMATITE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:19:18

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
53	HS-1	-2.431E-04	1.003E-04	-15.44577
54	HS-1	-2.431E-04	-5.654E-04	-15.97250
55	HS-1	-2.431E-04	-2.384E-04	-15.74223
56	HS-1	-2.431E-04	-7.751E-05	-15.56755
57	HS-1	-2.431E-04	-1.467E-05	-15.47352
58	HS-1	-2.431E-04	-6.980E-07	-15.44948

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:19:52

ITERATIONS= 59: SOLID Calomel PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:19:57

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
59	Cl-1	-1.756E-04	4.480E-04	-3.56500
60	Cl-1	-1.756E-04	2.065E-04	-4.56500
61	Cl-1	-1.756E-04	1.787E-04	-5.56500
62	Cl-1	-1.756E-04	1.686E-04	-6.56500
63	Cl-1	-1.756E-04	-5.634E-04	-7.56500
64	Cl-1	-1.756E-04	-2.102E-04	-7.42476
65	Cl-1	-1.756E-04	-6.222E-05	-7.32016
66	Cl-1	-1.756E-04	-1.025E-05	-7.26679
67	Cl-1	-1.756E-04	-3.844E-07	-7.25499

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:20:44

ITERATIONS= 68: SOLID Hg2CO3 PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:20:50

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
68	Ca+2	5.045E-03	-1.931E-03	-2.55390
69	Mg+2	8.440E-04	4.959E-04	-3.13775
70	SO4-2	6.773E-04	2.457E-05	-3.50753
71	Ca+2	5.045E-03	-3.568E-06	-2.55304

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:21:13

ITERATIONS= 72: SOLID DIASPORE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:21:20

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
72	Ca+2	5.045E-03	-1.923E-03	-2.55274
73	Mg+2	8.440E-04	4.956E-04	-3.13768
74	SO4-2	6.773E-04	2.445E-05	-3.50747
75	Ca+2	5.045E-03	-3.575E-06	-2.55283

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:21:44

ITERATIONS= 76: SOLID CALCITE PRECIPITATES

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:21:51

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
76	SO4-2	6.773E-04	-2.702E-04	-3.52096
77	SO4-2	6.773E-04	2.646E-04	-3.31656
78	Mg+2	8.440E-04	3.638E-05	-3.29150
79	Mg+2	8.440E-04	3.253E-06	-3.30934
80	Mg+2	8.440E-04	3.450E-07	-3.31097

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:22:19

ITERATIONS= 81: SOLID Hg2(OH)2 PRECIPITATES

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
86	CO3-2	7.591E-03	1.162E-02	-5.33913
87	SO4-2	6.773E-04	3.355E-04	-3.28787
88	SO4-2	6.773E-04	3.088E-05	-3.44536
89	Mg+2	8.440E-04	3.139E-06	-3.30954
90	Mg+2	8.440E-04	3.310E-07	-3.31111

ID	NAME	ANAL MOL	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DIFF FXN
492	NO3-1	7.749E-06	7.749E-06	6.912E-06	-5.16037	0.892048	0.0496	8.812E-11
732	SO4-2	6.773E-04	5.410E-04	3.426E-04	-3.46526	0.633219	0.1984	2.453E-08
460	Mg+2	8.440E-04	7.712E-04	4.883E-04	-3.31128	0.633219	0.1984	3.559E-08
410	K+1	7.142E-05	7.129E-05	6.360E-05	-4.19656	0.892048	0.0496	8.122E-10
500	Na+1	5.051E-04	5.029E-04	4.486E-04	-3.34810	0.892048	0.0496	5.728E-09
140	CO3-2	1.264E-02	3.447E-06	2.183E-06	-5.66098	0.633219	0.1984	-2.990E-08
30	Al+3	7.568E-04	3.137E-13	1.122E-13	-12.95004	0.357681	0.4465	1.006E-19
730	HS-1	3.632E-04	2.388E-11	2.130E-11	-10.67163	0.892048	0.0496	0.000E-01
471	Mn+3	2.241E-04	2.448E-21	8.755E-22	-21.05777	0.357681	0.4465	0.000E-01
281	Fe+3	1.014E-03	1.765E-22	6.314E-23	-22.19971	0.357681	0.4465	-4.066E-20

180	Cl-1	3.106E-04	9.197E-06	8.204E-06	-5.08598	0.892048	0.0496
0.000E-01							
330	H+1	1.149E-07	1.287E-07	1.148E-07	-6.94000	0.892048	0.0496
0.000E-01							
360	Hg2+2	6.063E-04	3.793E-09	2.402E-09	-8.61947	0.633219	0.1984
0.000E-01							
2	H2O	2.134E-19	-3.668E-03	9.997E-01	-0.00012	1.000000	0.0001
0.000E-01							
150	Ca+2	5.045E-03	2.848E-03	1.803E-03	-2.74389	0.633219	0.1984
0.000E-01							

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DH
330	H+1	1.287E-07	0.0000001	-6.94000	0.892048	0.050	0.000
150	Ca+2	2.848E-03	0.0018035	-2.74389	0.633219	0.198	0.000
460	Mg+2	7.712E-04	0.0004883	-3.31128	0.633219	0.198	0.000
410	K+1	7.129E-05	0.0000636	-4.19656	0.892048	0.050	0.000
500	Na+1	5.029E-04	0.0004486	-3.34810	0.892048	0.050	0.000
180	Cl-1	9.197E-06	0.0000082	-5.08598	0.892048	0.050	0.000
732	SO4-2	5.410E-04	0.0003426	-3.46526	0.633219	0.198	0.000
492	NO3-1	7.749E-06	0.0000069	-5.16037	0.892048	0.050	0.000
730	HS-1	2.388E-11	0.0000000	-10.67163	0.892048	0.050	0.000
360	Hg2+2	3.793E-09	0.0000000	-8.61947	0.633219	0.198	0.000
281	Fe+3	1.765E-22	0.0000000	-22.19971	0.357681	0.447	0.000
471	Mn+3	2.448E-21	0.0000000	-21.05777	0.357681	0.447	0.000
30	Al+3	3.137E-13	0.0000000	-12.95004	0.357681	0.447	0.000
140	CO3-2	3.447E-06	0.0000022	-5.66098	0.633219	0.198	0.000

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DH
3307300	H2S AQ	3.661E-11	0.0000000	-10.43514	1.003020	7.175	-5.300

3307301	S -2	1.146E-17	0.0000000	-17.13929	0.633219	-13.209	12.100
3300020	OH-	2.828E-08	0.0000000	-7.59816	0.892048	-14.488	13.345
4603300	MgOH +	1.879E-09	0.0000000	-8.77569	0.892048	-12.355	15.935
4601400	MgCO3 AQ	7.982E-07	0.0000008	-6.09659	1.003020	2.874	2.022
4601401	MgHCO3 +	4.603E-05	0.0000411	-4.38655	0.892048	11.575	-2.430
4607320	MgSO4 AQ	2.603E-05	0.0000261	-4.58316	1.003020	2.192	1.399
1503300	CaOH +	1.147E-09	0.0000000	-8.99021	0.892048	-13.137	14.535
1501400	CaHCO3 +	1.020E-04	0.0000910	-4.04095	0.892048	11.354	1.790
1501401	CaCO3 AQ	4.285E-06	0.0000043	-5.36674	1.003020	3.037	4.030
1507320	CaSO4 AQ	1.094E-04	0.0001097	-3.95964	1.003020	2.248	1.470
5001400	NaCO3 -	8.870E-09	0.0000000	-8.10169	0.892048	0.957	8.911
5001401	NaHCO3 AQ	1.348E-06	0.0000014	-5.86908	1.003020	10.079	0.000
5007320	NaSO4 -	7.779E-07	0.0000007	-6.15868	0.892048	0.704	1.120
4107320	KSO4 -	1.288E-07	0.0000001	-6.93974	0.892048	0.772	2.250
303300	AlOH +2	5.209E-12	0.0000000	-11.48169	0.633219	-5.273	11.899
303301	Al(OH)2 +	7.574E-10	0.0000000	-9.17028	0.892048	-10.050	0.000
303302	Al(OH)4 -	1.191E-10	0.0000000	-9.97352	0.892048	-24.733	44.060
307320	AlSO4 +	3.692E-14	0.0000000	-13.48231	0.892048	2.983	2.150
307321	Al(SO4)2 -	9.421E-16	0.0000000	-15.07550	0.892048	4.855	2.840
303303	Al(OH)3 AQ	7.384E-09	0.0000000	-8.13039	1.003020	-16.001	0.000
2813300	FeOH +2	2.127E-18	0.0000000	-17.87065	0.633219	-2.412	10.399
2817320	FeSO4 +	1.401E-22	0.0000000	-21.90320	0.892048	3.811	3.910
2811800	FeCl +2	1.466E-26	0.0000000	-26.03231	0.633219	1.452	5.600
2811801	FeCl2 +	6.426E-31	0.0000000	-30.24167	0.892048	2.180	0.000
2811802	FeCl3 AQ	4.689E-37	0.0000000	-36.32765	1.003020	1.129	0.000
2813301	FeOH2 +	1.147E-14	0.0000000	-13.98995	0.892048	-5.620	0.000
2813302	FeOH3 AQ	1.044E-15	0.0000000	-14.98006	1.003020	-13.601	0.000
2813303	FeOH4 -	1.022E-16	0.0000000	-16.04017	0.892048	-21.550	0.000
2817321	Fe(SO4)2 -	1.423E-24	0.0000000	-23.89638	0.892048	5.283	4.600
2813304	Fe2(OH)2+4	5.995E-34	0.0000000	-34.01597	0.160773	-2.703	13.500
2813305	Fe3(OH)4+5	3.327E-45	0.0000000	-45.71829	0.057506	-5.638	14.300
3301400	HCO3 -	8.800E-03	0.0078503	-2.10511	0.892048	10.545	-3.617
3301401	H2CO3 AQ	1.697E-03	0.0017020	-2.76905	1.003020	16.771	-2.247
3307320	HSO4 -	2.808E-09	0.0000000	-8.60114	0.892048	1.854	4.910

Type III - SPECIES WITH FIXED ACTIVITY (fixed pH, fixed pe, infinite solids, gases, etc.)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-3.668E-03	-2.436	0.000	0.000
330	H+1	-5.809E-03	-2.236	6.940	0.000

Type IV - FINITE SOLIDS (present at equilibrium)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2047100	MANGANITE	2.241E-04	-3.650	0.238	0.000
1036000	Hg2S	3.632E-04	-3.440	12.351	-16.670
3028100	HEMATITE	5.072E-04	-3.295	2.760	30.845
4136000	Calomel	1.507E-04	-3.822	18.791	-23.444
2036000	Hg2(OH)2	9.241E-05	-4.034	-5.260	0.000
2003002	DIASPORE	7.568E-04	-3.121	-7.870	24.630
5015001	CALCITE	1.981E-03	-2.703	8.405	2.585

Type V - UNDERSATURATED SOLIDS (not present at equilibrium)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
5036000	Hg2CO3	4.766E-01	-0.322	13.959	0.000
2003001	BOEHMITE	1.424E-02	-1.847	-9.716	28.130
2046000	BRUCITE	5.380E-08	-7.269	-17.838	25.840
5015000	ARAGONITE	6.329E-01	-0.199	8.206	2.615
6015000	ANHYDRITE	1.885E-02	-1.725	4.484	3.769
5015002	DOLOMITE	1.938E-01	-0.713	16.665	8.290
6046000	EPSOMITE	2.998E-05	-4.523	2.254	-2.820
2028100	FERRIHYDRITE	5.357E-07	-6.271	-4.891	0.000
4128100	FEOH)2.7CL.3	1.128E-02	-1.948	3.040	0.000
6028100	FE2(SO4)3	0.000E-01	-60.768	-5.972	59.120
2003003	GIBBSITE (C)	1.503E-02	-1.823	-9.693	22.800
3003000	Al2O3	5.749E-08	-7.240	-22.980	0.000
2028102	GOETHITE	3.420E-03	-2.466	-1.086	14.480
6015001	GYPSUM	4.458E-02	-1.351	4.859	-0.261
4150000	HALITE	1.050E-10	-9.979	-1.545	-0.918
6003001	AL4(OH)10SO4	2.713E-09	-8.567	-22.700	0.000
5015003	HUNTITE	4.017E-07	-6.396	28.926	25.760

5046001	HYDRMAGNESIT	2.149E-19	-18.668	6.653	52.210
6050000	JAROSITE NA	3.144E-26	-25.503	9.736	36.180
6041002	JAROSITE K	2.801E-23	-22.553	13.534	31.280
6028101	JAROSITE H	1.091E-29	-28.962	9.868	55.150
3028101	MAGHEMITE	7.149E-10	-9.146	-6.386	0.000
5046002	MAGNESITE	6.413E-02	-1.193	7.779	6.169
6050001	MIRABILITE	5.245E-09	-8.280	1.882	-18.987
3050000	NATRON	3.889E-11	-10.410	1.948	-15.745
5046003	NESQUEHONITE	2.595E-04	-3.586	5.387	5.789
6050002	THENARDITE	9.872E-11	-10.006	0.156	0.572
5050001	THERMONATR	2.537E-13	-12.596	-0.238	2.802
3047100	BIXBYITE	3.297E-01	-0.482	-0.006	15.245
2003000	ALOH3(A)	2.484E-04	-3.605	-11.474	27.045
6047100	MN2(SO4)3	0.000E-01	-48.381	4.130	39.060
2015000	LIME	2.929E-24	-23.533	-34.669	46.265
2015001	PORTLANDITE	1.655E-13	-12.781	-23.917	30.690
2046001	PERICLASE	3.947E-13	-12.404	-22.972	36.135
3046000	SPINEL	2.344E-14	-13.630	-39.938	89.089
3046001	MAG-FERRITE	2.224E-12	-11.653	-19.462	66.639
3028102	LEPIDOCROCIT	1.774E-03	-2.751	-1.371	0.000
6041001	ALUNITE	1.468E-07	-6.833	1.505	-3.918
6041000	ALUM K	2.419E-19	-18.616	5.462	-7.220
5046000	ARTINITE	6.804E-10	-9.167	-10.763	28.742
6003000	ALOHSO4	5.683E-07	-6.245	3.230	0.000
6036000	Hg2SO4	1.213E-06	-5.916	6.169	-0.230

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	4.371E-02	-1.359	18.181	-0.530
3601800	HgCl (g)	3.031E-32	-31.518	-22.123	40.098

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG TYPE I and TYPE II (dissolved and adsorbed) species

NO3-1		100.0	PERCENT BOUND IN SPECIES # 492	NO3-1
SO4-2		79.9	PERCENT BOUND IN SPECIES # 732	SO4-2
	3.8	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	16.2	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2		91.4	PERCENT BOUND IN SPECIES # 460	Mg+2
	5.5	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	3.1	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
K+1		99.8	PERCENT BOUND IN SPECIES # 410	K+1
Na+1		99.6	PERCENT BOUND IN SPECIES # 500	Na+1
CO3-2		82.6	PERCENT BOUND IN SPECIES #3301400	HCO3 -
	15.9	PERCENT BOUND IN SPECIES #3301401	H2CO3 AQ	
Al+3		9.2	PERCENT BOUND IN SPECIES # 303301	Al(OH)2 +
	1.4	PERCENT BOUND IN SPECIES # 303302	Al(OH)4 -	
	89.3	PERCENT BOUND IN SPECIES # 303303	Al(OH)3 AQ	
HS-1		39.5	PERCENT BOUND IN SPECIES # 730	HS-1
	60.5	PERCENT BOUND IN SPECIES #3307300	H2S AQ	
Mn+3		100.0	PERCENT BOUND IN SPECIES # 471	Mn+3
Fe+3		90.9	PERCENT BOUND IN SPECIES #2813301	FeOH2 +
	8.3	PERCENT BOUND IN SPECIES #2813302	FeOH3 AQ	

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Cl-1                        100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

H+1                          71.3     PERCENT BOUND IN SPECIES #3301400   HCO3 -
                  27.5     PERCENT BOUND IN SPECIES #3301401   H2CO3 AQ

Hg2+2                       100.0     PERCENT BOUND IN SPECIES #    360   Hg2+2

H2O                          51.0     PERCENT BOUND IN SPECIES #3300020   OH-
                   3.4     PERCENT BOUND IN SPECIES #4603300   MgOH +
                   2.1     PERCENT BOUND IN SPECIES #1503300   CaOH +
                   2.7     PERCENT BOUND IN SPECIES # 303301   Al(OH)2 +
                  39.9     PERCENT BOUND IN SPECIES # 303303   Al(OH)3 AQ

Ca+2                         93.0     PERCENT BOUND IN SPECIES #    150   Ca+2
                   3.3     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
                   3.6     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
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PART 5 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 15-OCT-92 TIME: 12:23:37

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
492	NO3-1	7.749E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	6.773E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	8.441E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	7.142E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	5.051E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.066E-02	84.3	0.000E-01	0.0	1.981E-03	15.7
30	Al+3	8.266E-09	0.0	0.000E-01	0.0	7.568E-04	100.0
730	HS-1	6.048E-11	0.0	0.000E-01	0.0	3.632E-04	100.0
471	Mn+3	2.448E-21	0.0	0.000E-01	0.0	2.241E-04	100.0
281	Fe+3	1.262E-14	0.0	0.000E-01	0.0	1.014E-03	100.0
180	Cl-1	9.197E-06	3.0	0.000E-01	0.0	3.014E-04	97.0
330	H+1	1.234E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
360	Hg2+2	3.793E-09	0.0	0.000E-01	0.0	6.063E-04	100.0
2	H2O	5.545E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	3.064E-03	60.7	0.000E-01	0.0	1.981E-03	39.3

CHARGE BALANCE: SPECIATED

SUM OF CATIONS = 7.961E-03 SUM OF ANIONS 9.907E-03

PERCENT DIFFERENCE = 1.089E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

NON-CARBONATE ALKALINITY = -1.029E-07

EQUILIBRIUM IONIC STRENGTH (m) = 1.310E-02

EQUILIBRIUM pH = 6.940

DATE ID NUMBER: 921015
TIME ID NUMBER: 12233762

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry (in parentheses) of each component			
2003000	ALOH3(A)	-3.605	(1.000) 30	(3.000) 2	(-3.000)330	
6003000	ALOHSO4	-6.245	(-1.000)330	(1.000) 30	(1.000)732	(1.000) 2
6003001	AL4(OH)10SO4	-8.567	(-10.000)330	(4.000) 30	(1.000)732	(10.000) 2
6041000	ALUM K	-18.616	(1.000)410	(1.000) 30	(2.000)732	(12.000) 2
6041001	ALUNITE	-6.833	(1.000)410	(3.000) 30	(2.000)732	(6.000) 2
			(-6.000)330			
6015000	ANHYDRITE	-1.725	(1.000)150	(1.000)732		
5015000	ARAGONITE	-0.199	(1.000)150	(1.000)140		
5046000	ARTINITE	-9.167	(-2.000)330	(2.000)460	(1.000)140	(5.000) 2
2003001	BOEHMITE	-1.847	(-3.000)330	(1.000) 30	(2.000) 2	
2046000	BRUCITE	-7.269	(1.000)460	(2.000) 2	(-2.000)330	
5015001	CALCITE	0.000	(1.000)150	(1.000)140		
2003002	DIASPORE	0.000	(-3.000)330	(1.000) 30	(2.000) 2	
5015002	DOLOMITE	-0.713	(1.000)150	(1.000)460	(2.000)140	
6046000	EPSOMITE	-4.523	(1.000)460	(1.000)732	(7.000) 2	
2028100	FERRIHYDRITE	-6.271	(-3.000)330	(1.000)281	(3.000) 2	
4128100	FEOH)2.7CL.3	-1.948	(-2.700)330	(1.000)281	(2.700) 2	(0.300)180
6028100	FE2(SO4)3	-60.768	(2.000)281	(3.000)732		
2003003	GIBBSITE (C)	-1.823	(-3.000)330	(1.000) 30	(3.000) 2	
3003000	Al2O3	-7.240	(2.000) 30	(3.000) 2	(-6.000)330	
2028102	GOETHITE	-2.466	(-3.000)330	(1.000)281	(2.000) 2	
6015001	GYPSUM	-1.351	(1.000)150	(1.000)732	(2.000) 2	
4150000	HALITE	-9.979	(1.000)500	(1.000)180		
3028100	HEMATITE	0.000	(-6.000)330	(2.000)281	(3.000) 2	
5015003	HUNTITE	-6.396	(3.000)460	(1.000)150	(4.000)140	
5046001	HYDRMAGNESIT	-18.668	(5.000)460	(4.000)140	(-2.000)330	(6.000) 2
6050000	JAROSITE NA	-25.503	(-6.000)330	(1.000)500	(3.000)281	(2.000)732
			(6.000) 2			
6041002	JAROSITE K	-22.553	(-6.000)330	(1.000)410	(3.000)281	(2.000)732

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:30:23

EFPC well AN:D-10 mercury calculation.
Assume reduced forms of iron, manganese, and mercury. Include sulfide.

Temperature (Celsius): 18.90
Units of concentration: MG/L
Ionic strength to be computed.
Carbonate concentration represents carbonate alkalinity.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed for all solids in the thermodynamic database and
the print option for solids is set to: 1
The maximum number of iterations is: 100
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	1.752E-04	-6.76
140	2.334E+02	-6.12
150	1.540E+02	-2.42
460	1.620E+01	-3.18
410	4.160E+00	-3.97
500	9.810E+00	-3.37
180	1.220E+01	-3.46
732	6.850E+01	-3.15
30	2.900E+01	-2.97
730	2.200E+00	-4.18
360	4.320E-02	-6.97
280	6.680E+01	-2.92
470	4.280E+00	-4.11

H2O has been inserted as a COMPONENT

3 1
330 6.7600 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.738E-07	-6.760	1.752E-04
140	CO3-2	7.586E-07	-6.120	2.334E+02
150	Ca+2	3.802E-03	-2.420	1.540E+02
460	Mg+2	6.607E-04	-3.180	1.620E+01
410	K+1	1.072E-04	-3.970	4.160E+00
500	Na+1	4.266E-04	-3.370	9.810E+00
180	Cl-1	3.467E-04	-3.460	1.220E+01
732	SO4-2	7.079E-04	-3.150	6.850E+01
30	Al+3	1.072E-03	-2.970	2.900E+01
730	HS-1	6.607E-05	-4.180	2.200E+00
360	Hg2+2	1.072E-07	-6.970	4.320E-02
280	Fe+2	1.202E-03	-2.920	6.680E+01
470	Mn+2	7.762E-05	-4.110	4.280E+00
2	H2O	1.000E+00	0.000	0.000E-01

CHARGE BALANCE: UNSPECIATED

SUM OF CATIONS= 1.533E-02 SUM OF ANIONS = 9.621E-03

PERCENT DIFFERENCE = 2.289E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:30:45

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
0	SO4-2	7.135E-04	1.558E-03	-3.15000
1	HS-1	6.656E-05	2.547E-03	-4.45073
2	HS-1	6.656E-05	6.199E-04	-4.74942
3	HS-1	6.656E-05	1.709E-04	-4.89722
4	HS-1	6.656E-05	3.169E-05	-5.10530
5	HS-1	6.656E-05	2.521E-06	-5.19286
6	HS-1	6.656E-05	2.229E-08	-5.20216

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:31:26

ITERATIONS= 7: SOLID Hg2S PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:31:30

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
7	Fe+2	1.197E-03	-4.539E-04	-3.16504
8	Mn+2	7.795E-05	4.418E-05	-4.17875
9	HS-1	6.645E-05	-6.478E-06	-5.23105
10	HS-1	6.645E-05	1.182E-07	-5.20212

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:31:53

ITERATIONS= 11: SOLID DIASPORE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:31:58

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
11	Fe+2	1.197E-03	-4.539E-04	-3.16502
12	Mn+2	7.795E-05	4.401E-05	-4.17875
13	HS-1	6.645E-05	-6.444E-06	-5.23117
14	HS-1	6.645E-05	1.173E-07	-5.20242

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:32:21

ITERATIONS= 15: SOLID MACKINAWITE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:32:26

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
15	Ca+2	3.845E-03	-1.437E-03	-2.66780
16	Mn+2	7.795E-05	4.388E-05	-4.17882
17	SO4-2	7.135E-04	2.437E-05	-3.48616
18	Fe+2	1.130E-03	-6.884E-07	-3.18015

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:32:49

ITERATIONS= 19: SOLID SIDERITE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:32:55

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
19	Ca+2	3.845E-03	-1.434E-03	-2.66736
20	SO4-2	7.135E-04	2.714E-04	-3.37836
21	SO4-2	7.135E-04	2.488E-05	-3.45770
22	Mg+2	6.667E-04	-4.038E-07	-3.41574

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:33:18

ITERATIONS= 23: SOLID RHODOCHROSIT PRECIPITATES

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
23	Mn+2	-9.029E-03	3.489E-03	-4.35612
24	Mn+2	-9.029E-03	-6.535E-03	-4.75652
25	Mn+2	-9.029E-03	-1.880E-03	-4.60803
26	Mn+2	-9.029E-03	-2.528E-04	-4.53993
27	Ca+2	3.845E-03	-6.053E-06	-2.65266

ID	NAME	ANAL MOL	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DIFF FXN
470	Mn+2	7.795E-05	4.741E-05	2.963E-05	-4.52820	0.625002	0.2041	1.232E-07
732	SO4-2	7.135E-04	5.420E-04	3.388E-04	-3.47010	0.625002	0.2041	-4.168E-08
150	Ca+2	3.845E-03	3.566E-03	2.229E-03	-2.65198	0.625002	0.2041	-2.792E-07
460	Mg+2	6.667E-04	6.151E-04	3.845E-04	-3.41515	0.625002	0.2041	-4.831E-08
410	K+1	1.065E-04	1.062E-04	9.445E-05	-4.02481	0.889140	0.0510	-2.067E-09
500	Na+1	4.270E-04	4.251E-04	3.780E-04	-3.42249	0.889140	0.0510	-8.269E-09
180	Cl-1	3.443E-04	3.443E-04	3.061E-04	-3.51412	0.889140	0.0510	-6.687E-09
30	Al+3	1.075E-03	2.689E-13	9.338E-14	-13.02975	0.347323	0.4593	0.000E-01
730	HS-1	6.656E-05	1.826E-07	1.624E-07	-6.78954	0.889140	0.0510	0.000E-01
360	Hg2+2	1.077E-07	2.004E-12	1.253E-12	-11.90217	0.625002	0.2041	0.000E-01

2	H2O	-4.414E-24	-2.151E-03	9.998E-01	-0.00009	1.000000	0.0001
0.000E-01							
330	H+1	1.739E-07	1.954E-07	1.738E-07	-6.76000	0.889140	0.0510
0.000E-01							
280	Fe+2	1.197E-03	3.852E-05	2.407E-05	-4.61846	0.625002	0.2041
0.000E-01							
140	CO3-2	1.024E-02	2.260E-06	1.413E-06	-5.84997	0.625002	0.2041
0.000E-01							

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DH
330	H+1	1.954E-07	0.0000002	-6.76000	0.889140	0.051	0.000
140	CO3-2	2.260E-06	0.0000014	-5.84997	0.625002	0.204	0.000
150	Ca+2	3.566E-03	0.0022285	-2.65198	0.625002	0.204	0.000
460	Mg+2	6.151E-04	0.0003845	-3.41515	0.625002	0.204	0.000
410	K+1	1.062E-04	0.0000944	-4.02481	0.889140	0.051	0.000
500	Na+1	4.251E-04	0.0003780	-3.42249	0.889140	0.051	0.000
180	Cl-1	3.443E-04	0.0003061	-3.51412	0.889140	0.051	0.000
732	SO4-2	5.420E-04	0.0003388	-3.47010	0.625002	0.204	0.000
30	Al+3	2.689E-13	0.0000000	-13.02975	0.347323	0.459	0.000
730	HS-1	1.826E-07	0.0000002	-6.78954	0.889140	0.051	0.000
360	Hg2+2	2.004E-12	0.0000000	-11.90217	0.625002	0.204	0.000
280	Fe+2	3.852E-05	0.0000241	-4.61846	0.625002	0.204	0.000
470	Mn+2	4.741E-05	0.0000296	-4.52820	0.625002	0.204	0.000

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DH
3307300	H2S AQ	2.984E-07	0.0000003	-6.52384	1.003116	7.024	-5.300
3307301	S -2	1.179E-13	0.0000000	-13.13278	0.625002	-12.899	12.100
3300020	OH-	4.061E-08	0.0000000	-7.44239	0.889140	-14.151	13.345
4603300	MgOH +	2.377E-09	0.0000000	-8.67499	0.889140	-11.969	15.935

4601400	MgCO3 AQ	4.705E-07	0.0000005	-6.32607	1.003116	2.938	2.022
4601401	MgHCO3 +	2.910E-05	0.0000259	-4.58710	0.889140	11.489	-2.430
4607320	MgSO4 AQ	2.198E-05	0.0000220	-4.65667	1.003116	2.227	1.399
1503300	CaOH +	2.180E-09	0.0000000	-8.71259	0.889140	-12.769	14.535
1501400	CaHCO3 +	1.292E-04	0.0001149	-3.93979	0.889140	11.373	1.790
1501401	CaCO3 AQ	3.934E-06	0.0000039	-5.40379	1.003116	3.097	4.030
1507320	CaSO4 AQ	1.456E-04	0.0001460	-3.83559	1.003116	2.285	1.470
5001400	NaCO3 -	8.131E-09	0.0000000	-8.14088	0.889140	1.183	8.911
5001401	NaHCO3 AQ	1.112E-06	0.0000011	-5.95246	1.003116	10.079	0.000
5007320	NaSO4 -	6.939E-07	0.0000006	-6.20974	0.889140	0.734	1.120
4107320	KSO4 -	2.269E-07	0.0000002	-6.69529	0.889140	0.851	2.250
303300	AlOH +2	5.782E-12	0.0000000	-11.44201	0.625002	-4.968	11.899
303301	Al(OH)2 +	2.761E-10	0.0000000	-9.60993	0.889140	-10.049	0.000
303302	Al(OH)4 -	2.434E-10	0.0000000	-9.66464	0.889140	-23.623	44.060
307320	AlSO4 +	3.454E-14	0.0000000	-13.51277	0.889140	3.038	2.150
307321	Al(SO4)2 -	9.070E-16	0.0000000	-15.09343	0.889140	4.928	2.840
303303	Al(OH)3 AQ	1.773E-09	0.0000000	-8.75003	1.003116	-16.001	0.000
2803300	FeOH +	3.093E-08	0.0000000	-7.56062	0.889140	-9.651	13.199
2803301	FeOH3 -1	1.772E-16	0.0000000	-15.80261	0.889140	-31.413	30.300
2807320	FeSO4 AQ	1.290E-06	0.0000013	-5.88801	1.003116	2.199	3.230
2803302	FeOH2 AQ	7.811E-13	0.0000000	-12.10596	1.003116	-21.009	28.565
2807300	Fe(HS)2 AQ	5.638E-10	0.0000000	-9.24754	1.003116	8.949	0.000
2807301	Fe(HS)3 -	1.124E-14	0.0000000	-14.00007	0.889140	11.038	0.000
4701800	MnCl +	4.128E-08	0.0000000	-7.43533	0.889140	0.658	0.000
4701801	MnCl2 AQ	3.042E-12	0.0000000	-11.51545	1.003116	0.040	0.000
4701802	MnCl3 -	4.737E-16	0.0000000	-15.37557	0.889140	-0.254	0.000
4703300	MnOH +	2.967E-09	0.0000000	-8.57873	0.889140	-10.759	14.399
4703301	Mn(OH)3 -1	1.006E-19	0.0000000	-19.04848	0.889140	-34.749	0.000
4707320	MnSO4 AQ	1.687E-06	0.0000017	-5.77153	1.003116	2.225	2.170
4701400	MnHCO3 +	3.257E-06	0.0000029	-5.53817	0.889140	11.651	0.000
3301400	HCO3 -	6.742E-03	0.0059950	-2.22221	0.889140	10.439	-3.617
3301401	H2CO3 AQ	2.208E-03	0.0022153	-2.65457	1.003116	16.714	-2.247
3307320	HSO4 -	5.434E-09	0.0000000	-8.31589	0.889140	1.965	4.910

Type III - SPECIES WITH FIXED ACTIVITY (fixed pH, fixed pe, infinite solids, gases, etc.)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH

2	H2O	-2.151E-03	-2.667	0.000	0.000
330	H+1	-8.030E-03	-2.095	6.760	0.000

Type IV - FINITE SOLIDS (present at equilibrium)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
1036000	Hg2S	1.077E-07	-6.968	11.932	-16.670
2003002	DIASPORE	1.075E-03	-2.968	-7.250	24.630
1028002	MACKINAWITE	6.597E-05	-4.181	4.648	0.000
5028000	SIDERITE	1.091E-03	-2.962	10.468	5.328
5047000	RHODOCHROSIT	2.567E-05	-4.591	10.378	2.079

Type V - UNDERSATURATED SOLIDS (not present at equilibrium)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
6015000	ANHYDRITE	2.866E-02	-1.543	4.579	3.769
5015000	ARAGONITE	6.030E-01	-0.220	8.282	2.615
5046000	ARTINITE	6.299E-10	-9.201	-10.040	28.742
2003001	BOEHMITE	1.743E-02	-1.759	-9.009	28.130
2046000	BRUCITE	8.262E-08	-7.083	-17.188	25.840
5015001	CALCITE	8.680E-01	-0.061	8.440	2.585
6003000	ALOHSO4	3.091E-07	-6.510	3.230	0.000
5015002	DOLOMITE	1.277E-01	-0.894	16.873	8.290
6046000	EPSOMITE	1.983E-05	-4.703	2.183	-2.820
1028000	FES PPT	1.849E-01	-0.733	3.915	0.000
2003003	GIBBSITE (C)	1.352E-02	-1.869	-9.119	22.800
3003000	Al2O3	3.313E-09	-8.480	-22.980	0.000
6015001	GYPSUM	5.367E-02	-1.270	4.852	-0.261
4150000	HALITE	3.129E-09	-8.505	-1.568	-0.918
5015003	HUNTITE	1.889E-07	-6.724	29.574	25.760
5046001	HYDRMAGNESIT	1.025E-19	-18.989	7.967	52.210
6003001	AL4(OH)10SO4	2.042E-11	-10.690	-22.700	0.000
5046002	MAGNESITE	4.671E-02	-1.331	7.935	6.169
6028000	MELANTERITE	2.658E-06	-5.575	2.514	-2.860
6050001	MIRABILITE	1.227E-09	-8.911	1.405	-18.987

3050000	NATRON	7.181E-12	-11.144	1.552	-15.745
5046003	NESQUEHONITE	1.849E-04	-3.733	5.532	5.789
6041000	ALUM K	1.926E-19	-18.715	5.281	-7.220
6050002	THENARDITE	7.164E-11	-10.145	0.170	0.572
5050001	THERMONATR	1.371E-13	-12.863	-0.168	2.802
2047003	PYROCROITE	3.612E-07	-6.442	-15.434	22.590
6041001	ALUNITE	8.150E-09	-8.089	1.406	-3.918
4147000	MNCL2, 4H2O	9.983E-15	-14.001	-2.444	-17.380
1047000	MNS GREEN	3.578E-09	-8.446	-3.889	5.790
6047000	MNSO4	1.247E-11	-10.904	-2.906	15.480
2015000	LIME	2.305E-23	-22.637	-33.505	46.265
2015001	PORTLANDITE	5.284E-13	-12.277	-23.145	30.690
2028000	WUSTITE	1.199E-03	-2.921	-12.067	24.846
2046001	PERICLASE	1.100E-12	-11.958	-22.063	36.135
3028001	HERCYNITE	1.097E-05	-4.960	-28.362	78.360
3046000	SPINEL	8.093E-14	-13.092	-37.697	89.089
5036000	Hg2CO3	1.609E-04	-3.794	13.959	0.000
4136000	Calomel	1.867E-01	-0.729	18.202	-23.444
2036000	Hg2(OH)2	2.277E-04	-3.643	-5.260	0.000
2003000	ALOH3(A)	2.857E-04	-3.544	-10.794	27.045
6036000	Hg2SO4	6.174E-10	-9.209	6.163	-0.230

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	6.284E-02	-1.202	18.168	-0.530
3601800	HgCl (g)	2.636E-31	-30.579	-21.114	40.098

PART 4 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:33:58

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG TYPE I and TYPE II (dissolved and adsorbed) species

Mn+2	90.5	PERCENT BOUND IN SPECIES #	470	Mn+2
	3.2	PERCENT BOUND IN SPECIES #4707320	MnSO4 AQ	
	6.2	PERCENT BOUND IN SPECIES #4701400	MnHCO3 +	
SO4-2	76.0	PERCENT BOUND IN SPECIES #	732	SO4-2
	3.1	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	20.4	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Ca+2	92.8	PERCENT BOUND IN SPECIES #	150	Ca+2
	3.4	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	3.8	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2	92.3	PERCENT BOUND IN SPECIES #	460	Mg+2
	4.4	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	3.3	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
K+1	99.8	PERCENT BOUND IN SPECIES #	410	K+1
Na+1	99.6	PERCENT BOUND IN SPECIES #	500	Na+1
Cl-1	100.0	PERCENT BOUND IN SPECIES #	180	Cl-1
Al+3	12.0	PERCENT BOUND IN SPECIES #	303301	Al(OH)2 +
	10.6	PERCENT BOUND IN SPECIES # 303302	Al(OH)4 -	
	77.1	PERCENT BOUND IN SPECIES # 303303	Al(OH)3 AQ	
HS-1	37.9	PERCENT BOUND IN SPECIES #	730	HS-1
	61.9	PERCENT BOUND IN SPECIES #3307300	H2S AQ	

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Hg2+2                    100.0     PERCENT BOUND IN SPECIES #    360   Hg2+2

H2O                       47.3     PERCENT BOUND IN SPECIES #3300020   OH-
          2.8     PERCENT BOUND IN SPECIES #4603300   MgOH +
          2.5     PERCENT BOUND IN SPECIES #1503300   CaOH +
          1.1     PERCENT BOUND IN SPECIES # 303302   Al(OH)4 -
          6.2     PERCENT BOUND IN SPECIES # 303303   Al(OH)3 AQ
         36.0     PERCENT BOUND IN SPECIES #2803300   FeOH +
          3.5     PERCENT BOUND IN SPECIES #4703300   MnOH +

H+1                        1.1     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
         59.5     PERCENT BOUND IN SPECIES #3301400   HCO3 -
         39.0     PERCENT BOUND IN SPECIES #3301401   H2CO3 AQ

Fe+2                      96.7     PERCENT BOUND IN SPECIES #    280   Fe+2
          3.2     PERCENT BOUND IN SPECIES #2807320   FeSO4 AQ

CO3-2                      1.4     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
         73.9     PERCENT BOUND IN SPECIES #3301400   HCO3 -
         24.2     PERCENT BOUND IN SPECIES #3301401   H2CO3 AQ
```

PART 5 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 16:33:59

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	5.240E-05	67.1	0.000E-01	0.0	2.567E-05	32.9
732	SO4-2	7.135E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	3.844E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	6.667E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.065E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	4.270E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	3.443E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
30	Al+3	2.298E-09	0.0	0.000E-01	0.0	1.075E-03	100.0
730	HS-1	4.821E-07	0.7	0.000E-01	0.0	6.608E-05	99.3
360	Hg2+2	2.004E-12	0.0	0.000E-01	0.0	1.077E-07	100.0
2	H2O	8.592E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.132E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	3.984E-05	3.3	0.000E-01	0.0	1.157E-03	96.7
140	CO3-2	9.120E-03	89.1	0.000E-01	0.0	1.117E-03	10.9

CHARGE BALANCE: SPECIATED

SUM OF CATIONS = 9.227E-03 SUM OF ANIONS 8.176E-03

PERCENT DIFFERENCE = 6.034E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

NON-CARBONATE ALKALINITY = -1.564E-07

EQUILIBRIUM IONIC STRENGTH (m) = 1.351E-02

EQUILIBRIUM pH = 6.760

DATE ID NUMBER: 930323
TIME ID NUMBER: 16335941

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry (in parentheses) of each component				
2003000	ALOH3(A)	-3.544	(1.000) 30	(3.000) 2	(-3.000)330		
6003000	ALOHSO4	-6.510	(-1.000)330	(1.000) 30	(1.000)732	(1.000)	2
6003001	AL4(OH)10SO4	-10.690	(-10.000)330	(4.000) 30	(1.000)732	(10.000)	2
6041000	ALUM K	-18.715	(1.000)410	(1.000) 30	(2.000)732	(12.000)	2
6041001	ALUNITE	-8.089	(1.000)410	(3.000) 30	(2.000)732	(6.000)	2
			(-6.000)330				
6015000	ANHYDRITE	-1.543	(1.000)150	(1.000)732			
5015000	ARAGONITE	-0.220	(1.000)150	(1.000)140			
5046000	ARTINITE	-9.201	(-2.000)330	(2.000)460	(1.000)140	(5.000)	2
2003001	BOEHMITE	-1.759	(-3.000)330	(1.000) 30	(2.000) 2		
2046000	BRUCITE	-7.083	(1.000)460	(2.000) 2	(-2.000)330		
5015001	CALCITE	-0.061	(1.000)150	(1.000)140			
2003002	DIASPORE	0.000	(-3.000)330	(1.000) 30	(2.000) 2		
5015002	DOLOMITE	-0.894	(1.000)150	(1.000)460	(2.000)140		
6046000	EPSOMITE	-4.703	(1.000)460	(1.000)732	(7.000) 2		
1028000	FES PPT	-0.733	(-1.000)330	(1.000)280	(1.000)730		
2003003	GIBBSITE (C)	-1.869	(-3.000)330	(1.000) 30	(3.000) 2		
3003000	Al2O3	-8.480	(2.000) 30	(3.000) 2	(-6.000)330		
6015001	GYPSUM	-1.270	(1.000)150	(1.000)732	(2.000) 2		
4150000	HALITE	-8.505	(1.000)500	(1.000)180			
5015003	HUNTITE	-6.724	(3.000)460	(1.000)150	(4.000)140		
5046001	HYDRMAGNESIT	-18.989	(5.000)460	(4.000)140	(-2.000)330	(6.000)	2
1028002	MACKINAWITE	0.000	(-1.000)330	(1.000)280	(1.000)730		
5046002	MAGNESITE	-1.331	(1.000)460	(1.000)140			
6028000	MELANTERITE	-5.575	(1.000)280	(1.000)732	(7.000) 2		
6050001	MIRABILITE	-8.911	(2.000)500	(1.000)732	(10.000) 2		
3050000	NATRON	-11.144	(2.000)500	(1.000)140	(10.000) 2		
5046003	NESQUEHONITE	-3.733	(1.000)460	(1.000)140	(3.000) 2		
5028000	SIDERITE	0.000	(1.000)280	(1.000)140			

6050002	THENARDITE	-10.145	(2.000)	500	(1.000)	732					
5050001	THERMONATR	-12.863	(2.000)	500	(1.000)	140	(1.000)	2			
2047003	PYROCROITE	-6.442	(-2.000)	330	(1.000)	470	(2.000)	2			
5047000	RHODOCHROSIT	0.000	(1.000)	470	(1.000)	140					
4147000	MNCL2, 4H2O	-14.001	(1.000)	470	(2.000)	180	(4.000)	2			
1047000	MNS GREEN	-8.446	(-1.000)	330	(1.000)	470	(1.000)	730			
6047000	MNSO4	-10.904	(1.000)	470	(1.000)	732					
2015000	LIME	-22.637	(-2.000)	330	(1.000)	150	(1.000)	2			
2015001	PORTLANDITE	-12.277	(-2.000)	330	(1.000)	150	(2.000)	2			
2028000	WUSTITE	-2.921	(-2.000)	330	(0.947)	280	(1.000)	2			
2046001	PERICLASE	-11.958	(-2.000)	330	(1.000)	460	(1.000)	2			
3028001	HERCYNITE	-4.960	(-8.000)	330	(1.000)	280	(2.000)	30	(4.000)	2	
3046000	SPINEL	-13.092	(-8.000)	330	(1.000)	460	(2.000)	30	(4.000)	2	
5036000	Hg2CO3	-3.794	(1.000)	360	(1.000)	140					
4136000	Calomel	-0.729	(1.000)	360	(2.000)	180					
2036000	Hg2(OH)2	-3.643	(1.000)	360	(2.000)	2	(-2.000)	330			
1036000	Hg2S	0.000	(1.000)	360	(1.000)	730	(-1.000)	330			
6036000	Hg2SO4	-9.209	(1.000)	360	(1.000)	732					

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:52:54

EFPC well AN:D-10 mercury calculation.
Assume no dissloved sulfide and oxidized form of mercury.

Temperature (Celsius): 18.90
Units of concentration: MG/L
Ionic strength to be computed.
Carbonate concentration represents carbonate alkalinity.
Automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed for all solids in the thermodynamic database and
the print option for solids is set to: 1
The maximum number of iterations is: 100
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	1.752E-04	-6.76
140	2.334E+02	-19.09
150	1.540E+02	-2.42
460	1.620E+01	-3.18
410	4.160E+00	-3.97
500	9.810E+00	-3.37
180	1.220E+01	-3.46
732	6.850E+01	-3.15
361	4.320E-02	-6.73
281	6.680E+01	-2.92
471	4.280E+00	-4.11
30	2.900E+01	-2.97

H2O has been inserted as a COMPONENT
3 1

330 6.7600 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.738E-07	-6.760	1.752E-04
140	CO3-2	8.128E-20	-19.090	2.334E+02
150	Ca+2	3.802E-03	-2.420	1.540E+02
460	Mg+2	6.607E-04	-3.180	1.620E+01
410	K+1	1.072E-04	-3.970	4.160E+00
500	Na+1	4.266E-04	-3.370	9.810E+00
180	Cl-1	3.467E-04	-3.460	1.220E+01
732	SO4-2	7.079E-04	-3.150	6.850E+01
361	Hg(OH)2	1.862E-07	-6.730	4.320E-02
281	Fe+3	1.202E-03	-2.920	6.680E+01
471	Mn+3	7.762E-05	-4.110	4.280E+00
30	Al+3	1.072E-03	-2.970	2.900E+01
2	H2O	1.000E+00	0.000	0.000E-01

CHARGE BALANCE: UNSPECIATED

SUM OF CATIONS= 1.661E-02 SUM OF ANIONS = 9.555E-03

PERCENT DIFFERENCE = 2.696E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:53:16

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
0	SO4-2	7.135E-04	7.851E-03	-3.15000
1	Fe+3	1.197E-03	5.123E+11	-3.09609
2	Fe+3	1.197E-03	8.692E+12	-3.27218
3	Fe+3	1.197E-03	2.575E+12	-3.44827
4	Fe+3	1.197E-03	7.631E+11	-3.62437
5	Fe+3	1.197E-03	2.261E+11	-3.80046
6	Fe+3	1.197E-03	6.699E+10	-3.97655
7	Fe+3	1.197E-03	1.985E+10	-4.15264
8	Fe+3	1.197E-03	5.881E+09	-4.32873
9	Fe+3	1.197E-03	1.743E+09	-4.50482
10	Fe+3	1.197E-03	5.163E+08	-4.68091
11	Fe+3	1.197E-03	1.530E+08	-4.85700
12	Fe+3	1.197E-03	4.533E+07	-5.03310
13	Fe+3	1.197E-03	1.343E+07	-5.20919
14	Fe+3	1.197E-03	3.979E+06	-5.38529
15	Fe+3	1.197E-03	1.179E+06	-5.56139
16	Fe+3	1.197E-03	3.494E+05	-5.73751
17	Fe+3	1.197E-03	1.035E+05	-5.91367
18	Fe+3	1.197E-03	3.069E+04	-6.08992
19	Fe+3	1.197E-03	9.097E+03	-6.26635
20	Fe+3	1.197E-03	2.699E+03	-6.44320
21	Fe+3	1.197E-03	8.021E+02	-6.62102
22	Fe+3	1.197E-03	2.392E+02	-6.80102
23	Fe+3	1.197E-03	7.188E+01	-6.98600
24	Fe+3	1.197E-03	2.194E+01	-7.18264
25	Fe+3	1.197E-03	6.857E+00	-7.40788
26	Fe+3	1.197E-03	1.435E+00	-7.71038
27	Fe+3	1.197E-03	1.544E-02	-9.71632

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    28    Mn+3            7.795E-05  -1.121E-05    -4.65869
    29    Mn+3            7.795E-05  -9.361E-07    -4.59129
    30    Mn+3            7.795E-05  -3.654E-08    -4.58604
PC MINTEQA2 v3.00   DATE OF CALCULATIONS: 23-MAR-93  TIME: 12:56:10

ITERATIONS=  31:  SOLID MANGANITE    PRECIPITATES
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PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:56:14

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
31	Ca+2	3.845E-03	-1.391E-03	-2.66131
32	Mg+2	6.667E-04	3.606E-04	-3.23565
33	SO4-2	7.135E-04	2.506E-05	-3.45789
34	Ca+2	3.845E-03	-2.471E-06	-2.65958

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:56:38

ITERATIONS= 35: SOLID HEMATITE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:56:42

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
35	Ca+2	3.845E-03	-1.379E-03	-2.65930
36	Mg+2	6.667E-04	3.525E-04	-3.23569
37	SO4-2	7.135E-04	2.439E-05	-3.45626
38	Ca+2	3.845E-03	-2.392E-06	-2.65627

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:57: 5

ITERATIONS= 39: SOLID DIASPORE PRECIPITATES

PART 3 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:57:10

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
39	Ca+2	3.845E-03	-1.359E-03	-2.65600
40	Mg+2	6.667E-04	3.507E-04	-3.23576
41	SO4-2	7.135E-04	2.408E-05	-3.45596
42	Ca+2	3.845E-03	-2.394E-06	-2.65551

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:57:34

ITERATIONS= 43: SOLID HgCO3 PRECIPITATES

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY
43	Hg(OH)2	-1.025E-02	1.024E-02	-6.81906
44	Hg(OH)2	-1.025E-02	1.012E-02	-7.81906
45	Hg(OH)2	-1.025E-02	8.920E-03	-8.81906
46	Hg(OH)2	-1.025E-02	-3.241E-03	-9.81906
47	Hg(OH)2	-1.025E-02	-6.022E-04	-9.72598
48	Ca+2	3.845E-03	-1.281E-05	-2.65680
49	Ca+2	3.845E-03	-9.251E-07	-2.65534

ID	NAME	ANAL MOL	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DIFF FXN
361	Hg(OH)2	1.842E-07	1.983E-10	1.989E-10	-9.70140	1.003169	-0.0014	1.171E-08
732	SO4-2	7.135E-04	5.457E-04	3.399E-04	-3.46860	0.622889	0.2056	-3.342E-09
150	Ca+2	3.845E-03	3.551E-03	2.212E-03	-2.65524	0.622889	0.2056	-2.208E-08
460	Mg+2	6.667E-04	6.119E-04	3.811E-04	-3.41891	0.622889	0.2056	-3.817E-09
410	K+1	1.065E-04	1.062E-04	9.437E-05	-4.02517	0.888388	0.0514	-1.640E-10
500	Na+1	4.270E-04	4.250E-04	3.776E-04	-3.42300	0.888388	0.0514	-6.556E-10
180	Cl-1	3.443E-04	3.443E-04	3.059E-04	-3.51443	0.888388	0.0514	-5.303E-10
140	CO3-2	1.025E-02	2.549E-06	1.588E-06	-5.79927	0.622889	0.2056	0.000E-01
30	Al+3	1.075E-03	2.709E-13	9.338E-14	-13.02975	0.344686	0.4626	0.000E-01

471	Mn+3	7.795E-05	8.806E-21	3.035E-21	-20.51782	0.344686	0.4626
0.000E-01							
281	Fe+3	1.197E-03	2.599E-22	8.959E-23	-22.04776	0.344686	0.4626
0.000E-01							
2	H2O	0.000E-01	-4.102E-03	9.998E-01	-0.00009	1.000000	0.0001
0.000E-01							
330	H+1	1.739E-07	1.956E-07	1.738E-07	-6.76000	0.888388	0.0514
0.000E-01							

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DH
330	H+1	1.956E-07	0.0000002	-6.76000	0.888388	0.051	0.000
140	CO3-2	2.549E-06	0.0000016	-5.79927	0.622889	0.206	0.000
150	Ca+2	3.551E-03	0.0022119	-2.65524	0.622889	0.206	0.000
460	Mg+2	6.119E-04	0.0003811	-3.41891	0.622889	0.206	0.000
410	K+1	1.062E-04	0.0000944	-4.02517	0.888388	0.051	0.000
500	Na+1	4.250E-04	0.0003776	-3.42300	0.888388	0.051	0.000
180	Cl-1	3.443E-04	0.0003059	-3.51443	0.888388	0.051	0.000
732	SO4-2	5.457E-04	0.0003399	-3.46860	0.622889	0.206	0.000
361	Hg(OH)2	1.983E-10	0.0000000	-9.70140	1.003169	-0.001	0.000
281	Fe+3	2.599E-22	0.0000000	-22.04776	0.344686	0.463	0.000
471	Mn+3	8.806E-21	0.0000000	-20.51782	0.344686	0.463	0.000
30	Al+3	2.709E-13	0.0000000	-13.02975	0.344686	0.463	0.000

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK	DH
3613303	Hg(OH)3-1	1.276E-18	0.0000000	-17.94569	0.888388	-14.953	0.000
3617320	HgSO4 (aq)	6.308E-20	0.0000000	-19.19872	1.003169	7.490	0.000
3300020	OH-	4.064E-08	0.0000000	-7.44239	0.888388	-14.151	13.345
4603300	MgOH +	2.359E-09	0.0000000	-8.67875	0.888388	-11.968	15.935
4601400	MgCO3 AQ	5.242E-07	0.0000005	-6.27915	1.003169	2.938	2.022

4601401	MgHCO3 +	3.245E-05	0.0000288	-4.54017	0.888388	11.489	-2.430
4607320	MgSO4 AQ	2.186E-05	0.0000219	-4.65893	1.003169	2.227	1.399
1503300	CaOH +	2.165E-09	0.0000000	-8.71585	0.888388	-12.769	14.535
1501400	CaHCO3 +	1.442E-04	0.0001281	-3.89236	0.888388	11.374	1.790
1501401	CaCO3 AQ	4.388E-06	0.0000044	-5.35636	1.003169	3.097	4.030
1507320	CaSO4 AQ	1.450E-04	0.0001454	-3.83734	1.003169	2.285	1.470
5001400	NaCO3 -	9.135E-09	0.0000000	-8.09069	0.888388	1.183	8.911
5001401	NaHCO3 AQ	1.248E-06	0.0000013	-5.90227	1.003169	10.079	0.000
5007320	NaSO4 -	6.961E-07	0.0000006	-6.20874	0.888388	0.734	1.120
4107320	KSO4 -	2.276E-07	0.0000002	-6.69415	0.888388	0.851	2.250
303300	AlOH +2	5.802E-12	0.0000000	-11.44201	0.622889	-4.967	11.899
303301	Al(OH)2 +	2.764E-10	0.0000000	-9.60993	0.888388	-10.049	0.000
303302	Al(OH)4 -	2.436E-10	0.0000000	-9.66464	0.888388	-23.623	44.060
307320	AlSO4 +	3.468E-14	0.0000000	-13.51127	0.888388	3.038	2.150
307321	Al(SO4)2 -	9.140E-16	0.0000000	-15.09043	0.888388	4.928	2.840
303303	Al(OH)3 AQ	1.773E-09	0.0000000	-8.75002	1.003169	-16.001	0.000
2813300	FeOH +2	3.703E-18	0.0000000	-17.63705	0.622889	-2.144	10.399
2817320	FeSO4 +	2.484E-22	0.0000000	-21.65622	0.888388	3.912	3.910
2811800	FeCl +2	1.091E-24	0.0000000	-24.16792	0.622889	1.600	5.600
2811801	FeCl2 +	1.273E-27	0.0000000	-26.94662	0.888388	2.181	0.000
2811802	FeCl3 AQ	3.448E-32	0.0000000	-31.46105	1.003169	1.129	0.000
2813301	FeOH2 +	7.136E-15	0.0000000	-14.19794	0.888388	-5.619	0.000
2813302	FeOH3 AQ	4.272E-16	0.0000000	-15.36803	1.003169	-13.601	0.000
2813303	FeOH4 -	2.775E-17	0.0000000	-16.60813	0.888388	-21.549	0.000
2817321	Fe(SO4)2 -	2.606E-24	0.0000000	-23.63538	0.888388	5.401	4.600
2813304	Fe2(OH)2+4	1.230E-33	0.0000000	-33.73237	0.150536	-2.334	13.500
2813305	Fe3(OH)4+5	4.596E-45	0.0000000	-45.62255	0.051888	-5.234	14.300
3301400	HCO3 -	7.584E-03	0.0067372	-2.17152	0.888388	10.439	-3.617
3301401	H2CO3 AQ	2.482E-03	0.0024896	-2.60387	1.003169	16.714	-2.247
3307320	HSO4 -	5.458E-09	0.0000000	-8.31438	0.888388	1.966	4.910
3613300	Hg+2	1.781E-17	0.0000000	-16.95490	0.622889	6.472	-11.060
3611800	HgCl+1	1.465E-14	0.0000000	-13.88565	0.888388	12.901	0.000
3611801	HgCl2 (aq)	9.308E-12	0.0000000	-11.02978	1.003169	19.219	0.000
3811802	HgCl3-1	2.567E-14	0.0000000	-13.64191	0.888388	20.174	0.000
3611803	HgCl4-2	2.887E-17	0.0000000	-16.74514	0.622889	20.739	0.000
3611805	HgClOH (aq)	3.396E-11	0.0000000	-10.46765	1.003169	9.507	-12.482
3613302	HgOH+1	1.939E-14	0.0000000	-13.76391	0.888388	2.749	0.000

Type III - SPECIES WITH FIXED ACTIVITY (fixed pH, fixed pe, infinite solids, gases, etc.)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-4.102E-03	-2.387	0.000	0.000
330	H+1	-5.675E-03	-2.246	6.760	0.000

Type IV - FINITE SOLIDS (present at equilibrium)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2047100	MANGANITE	7.795E-05	-4.108	0.238	0.000
3028100	HEMATITE	5.984E-04	-3.223	3.536	30.845
2003002	DIASPORE	1.075E-03	-2.968	-7.250	24.630
5036100	HgCO3	1.957E-07	-6.708	29.020	-22.130

Type V - UNDERSATURATED SOLIDS (not present at equilibrium)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
6041001	ALUNITE	8.200E-09	-8.086	1.406	-3.918
6015000	ANHYDRITE	2.854E-02	-1.545	4.579	3.769
5015000	ARAGONITE	6.726E-01	-0.172	8.282	2.615
5046000	ARTINITE	6.957E-10	-9.158	-10.040	28.742
2003001	BOEHMITE	1.743E-02	-1.759	-9.009	28.130
2046000	BRUCITE	8.191E-08	-7.087	-17.188	25.840
5015001	CALCITE	9.682E-01	-0.014	8.440	2.585
6003001	AL4(OH)10SO4	2.049E-11	-10.689	-22.700	0.000
5015002	DOLOMITE	1.586E-01	-0.800	16.873	8.290
6046000	EPSOMITE	1.973E-05	-4.705	2.183	-2.820
2028100	FERRIHYDRITE	2.193E-07	-6.659	-4.891	0.000
4128100	FEOH)2.7CL.3	1.548E-02	-1.810	3.040	0.000
6028100	FE2(SO4)3	0.000E-01	-58.986	-4.485	59.120
2003003	GIBBSITE (C)	1.352E-02	-1.869	-9.119	22.800
3003000	Al2O3	3.313E-09	-8.480	-22.980	0.000
2028102	GOETHITE	3.239E-03	-2.490	-0.722	14.480
6015001	GYPSUM	5.345E-02	-1.272	4.852	-0.261
4150000	HALITE	3.123E-09	-8.505	-1.568	-0.918

6003000	ALOHSO4	3.101E-07	-6.508	3.230	0.000
5015003	HUNTITE	2.914E-07	-6.535	29.574	25.760
5046001	HYDRMAGNESIT	1.565E-19	-18.806	7.967	52.210
6050000	JAROSITE NA	5.036E-26	-25.298	10.646	36.180
6041002	JAROSITE K	5.956E-23	-22.225	14.321	31.280
6028101	JAROSITE H	9.432E-29	-28.025	11.256	55.150
3028101	MAGHEMITE	1.197E-10	-9.922	-6.386	0.000
5046002	MAGNESITE	5.204E-02	-1.284	7.935	6.169
6050001	MIRABILITE	1.228E-09	-8.911	1.405	-18.987
3050000	NATRON	8.051E-12	-11.094	1.552	-15.745
5046003	NESQUEHONITE	2.060E-04	-3.686	5.532	5.789
6050002	THENARDITE	7.172E-11	-10.144	0.170	0.572
5050001	THERMONATR	1.537E-13	-12.813	-0.168	2.802
3047100	BIXBYITE	7.974E-01	-0.098	0.378	15.245
2003000	ALOH3(A)	2.857E-04	-3.544	-10.794	27.045
6047100	MN2(SO4)3	0.000E-01	-46.328	5.113	39.060
2015000	LIME	2.288E-23	-22.641	-33.505	46.265
2015001	PORTLANDITE	5.245E-13	-12.280	-23.145	30.690
2046001	PERICLASE	1.091E-12	-11.962	-22.063	36.135
3046000	SPINEL	8.023E-14	-13.096	-37.697	89.089
3046001	MAG-FERRITE	6.026E-12	-11.220	-17.785	66.639
3028102	LEPIDOCROCIT	7.262E-04	-3.139	-1.371	0.000
6041000	ALUM K	1.938E-19	-18.713	5.281	-7.220
4136100	HgCl2	8.977E-09	-8.047	22.203	-27.264
2036100	Montroydite	1.065E-06	-5.973	3.729	-5.115
2036101	Hg(OH)2	6.236E-07	-6.205	3.496	0.000
6036100	HgSO4	6.065E-18	-17.217	9.473	-3.510

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	7.062E-02	-1.151	18.168	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG TYPE I and TYPE II (dissolved and adsorbed) species

Hg(OH)2		82.1	PERCENT BOUND IN SPECIES # 361	Hg(OH)2
	3.9	PERCENT BOUND IN SPECIES #3611801	HgCl2 (aq)	
	14.1	PERCENT BOUND IN SPECIES #3611805	HgClOH (aq)	
SO4-2		76.5	PERCENT BOUND IN SPECIES # 732	SO4-2
	3.1	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	20.3	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Ca+2		92.4	PERCENT BOUND IN SPECIES # 150	Ca+2
	3.8	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	3.8	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2		91.8	PERCENT BOUND IN SPECIES # 460	Mg+2
	4.9	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	3.3	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
K+1		99.8	PERCENT BOUND IN SPECIES # 410	K+1
Na+1		99.5	PERCENT BOUND IN SPECIES # 500	Na+1
Cl-1		100.0	PERCENT BOUND IN SPECIES # 180	Cl-1
CO3-2		1.4	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +
	74.0	PERCENT BOUND IN SPECIES #3301400	HCO3 -	
	24.2	PERCENT BOUND IN SPECIES #3301401	H2CO3 AQ	
Al+3		12.0	PERCENT BOUND IN SPECIES # 303301	Al(OH)2 +
	10.6	PERCENT BOUND IN SPECIES # 303302	Al(OH)4 -	

```
                77.1     PERCENT BOUND IN SPECIES # 303303   Al(OH)3 AQ

Mn+3                       100.0     PERCENT BOUND IN SPECIES #    471   Mn+3

Fe+3                        94.0     PERCENT BOUND IN SPECIES #2813301   FeOH2 +
                 5.6     PERCENT BOUND IN SPECIES #2813302   FeOH3 AQ

H2O                         78.2     PERCENT BOUND IN SPECIES #3300020   OH-
                 4.5     PERCENT BOUND IN SPECIES #4603300   MgOH +
                 4.2     PERCENT BOUND IN SPECIES #1503300   CaOH +
                 1.1     PERCENT BOUND IN SPECIES # 303301   Al(OH)2 +
                 1.9     PERCENT BOUND IN SPECIES # 303302   Al(OH)4 -
                10.2     PERCENT BOUND IN SPECIES # 303303   Al(OH)3 AQ

H+1                          1.1     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
                59.6     PERCENT BOUND IN SPECIES #3301400   HCO3 -
                39.0     PERCENT BOUND IN SPECIES #3301401   H2CO3 AQ
```

PART 5 of OUTPUT FILE

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:58:23

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
361	Hg(OH)2	2.416E-10	0.1	0.000E-01	0.0	1.957E-07	99.9
732	SO4-2	7.135E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	3.845E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	6.667E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.065E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	4.270E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	3.443E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.025E-02	100.0	0.000E-01	0.0	1.957E-07	0.0
30	Al+3	2.299E-09	0.0	0.000E-01	0.0	1.075E-03	100.0
471	Mn+3	8.806E-21	0.0	0.000E-01	0.0	7.795E-05	100.0
281	Fe+3	7.595E-15	0.0	0.000E-01	0.0	1.197E-03	100.0
2	H2O	5.197E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.273E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

CHARGE BALANCE: SPECIATED

SUM OF CATIONS = 9.034E-03 SUM OF ANIONS 9.026E-03

PERCENT DIFFERENCE = 4.621E-02 (ANIONS - CATIONS)/(ANIONS + CATIONS)

NON-CARBONATE ALKALINITY = -1.556E-07

EQUILIBRIUM IONIC STRENGTH (m) = 1.374E-02

EQUILIBRIUM pH = 6.760

DATE ID NUMBER: 930323
TIME ID NUMBER: 12582397

PC MINTEQA2 v3.00 DATE OF CALCULATIONS: 23-MAR-93 TIME: 12:58:25

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry (in parentheses) of each component			
2003000	ALOH3(A)	-3.544	(1.000) 30	(3.000) 2	(-3.000)330	
6003000	ALOHSO4	-6.508	(-1.000)330	(1.000) 30	(1.000)732	(1.000) 2
6003001	AL4(OH)10SO4	-10.689	(-10.000)330	(4.000) 30	(1.000)732	(10.000) 2
6041000	ALUM K	-18.713	(1.000)410	(1.000) 30	(2.000)732	(12.000) 2
6041001	ALUNITE	-8.086	(1.000)410	(3.000) 30	(2.000)732	(6.000) 2
			(-6.000)330			
6015000	ANHYDRITE	-1.545	(1.000)150	(1.000)732		
5015000	ARAGONITE	-0.172	(1.000)150	(1.000)140		
5046000	ARTINITE	-9.158	(-2.000)330	(2.000)460	(1.000)140	(5.000) 2
2003001	BOEHMITE	-1.759	(-3.000)330	(1.000) 30	(2.000) 2	
2046000	BRUCITE	-7.087	(1.000)460	(2.000) 2	(-2.000)330	
5015001	CALCITE	-0.014	(1.000)150	(1.000)140		
2003002	DIASPORE	0.000	(-3.000)330	(1.000) 30	(2.000) 2	
5015002	DOLOMITE	-0.800	(1.000)150	(1.000)460	(2.000)140	
6046000	EPSOMITE	-4.705	(1.000)460	(1.000)732	(7.000) 2	
2028100	FERRIHYDRITE	-6.659	(-3.000)330	(1.000)281	(3.000) 2	
4128100	FEOH)2.7CL.3	-1.810	(-2.700)330	(1.000)281	(2.700) 2	(0.300)180
6028100	FE2(SO4)3	-58.986	(2.000)281	(3.000)732		
2003003	GIBBSITE (C)	-1.869	(-3.000)330	(1.000) 30	(3.000) 2	
3003000	Al2O3	-8.480	(2.000) 30	(3.000) 2	(-6.000)330	
2028102	GOETHITE	-2.490	(-3.000)330	(1.000)281	(2.000) 2	
6015001	GYPSUM	-1.272	(1.000)150	(1.000)732	(2.000) 2	
4150000	HALITE	-8.505	(1.000)500	(1.000)180		
3028100	HEMATITE	0.000	(-6.000)330	(2.000)281	(3.000) 2	
5015003	HUNTITE	-6.535	(3.000)460	(1.000)150	(4.000)140	
5046001	HYDRMAGNESIT	-18.806	(5.000)460	(4.000)140	(-2.000)330	(6.000) 2
6050000	JAROSITE NA	-25.298	(-6.000)330	(1.000)500	(3.000)281	(2.000)732
			(6.000) 2			
6041002	JAROSITE K	-22.225	(-6.000)330	(1.000)410	(3.000)281	(2.000)732

			(	6.000)	2								
6028101	JAROSITE H	-28.025	(	-5.000)	330	(	3.000)	281	(	2.000)	732	(	7.000) 2
3028101	MAGHEMITE	-9.922	(	-6.000)	330	(	2.000)	281	(	3.000)	2		
5046002	MAGNESITE	-1.284	(	1.000)	460	(	1.000)	140					
6050001	MIRABILITE	-8.911	(	2.000)	500	(	1.000)	732	(	10.000)	2		
3050000	NATRON	-11.094	(	2.000)	500	(	1.000)	140	(	10.000)	2		
5046003	NESQUEHONITE	-3.686	(	1.000)	460	(	1.000)	140	(	3.000)	2		
6050002	THENARDITE	-10.144	(	2.000)	500	(	1.000)	732					
5050001	THERMONATR	-12.813	(	2.000)	500	(	1.000)	140	(	1.000)	2		
3047100	BIXBYITE	-0.098	(	-6.000)	330	(	2.000)	471	(	3.000)	2		
2047100	MANGANITE	0.000	(	-3.000)	330	(	1.000)	471	(	2.000)	2		
6047100	MN2(SO4)3	-46.328	(	2.000)	471	(	3.000)	732					
2015000	LIME	-22.641	(	-2.000)	330	(	1.000)	150	(	1.000)	2		
2015001	PORTLANDITE	-12.280	(	-2.000)	330	(	1.000)	150	(	2.000)	2		
2046001	PERICLASE	-11.962	(	-2.000)	330	(	1.000)	460	(	1.000)	2		
3046000	SPINEL	-13.096	(	-8.000)	330	(	1.000)	460	(	2.000)	30	(	4.000) 2
3046001	MAG-FERRITE	-11.220	(	-8.000)	330	(	1.000)	460	(	2.000)	281	(	4.000) 2
3028102	LEPIDOCROCIT	-3.139	(	-3.000)	330	(	1.000)	281	(	2.000)	2		
5036100	HgCO3	0.000	(	1.000)	361	(	1.000)	140	(	2.000)	330	(	-2.000) 2
4136100	HgCl2	-8.047	(	1.000)	361	(	2.000)	180	(	2.000)	330	(	-2.000) 2
2036100	Montroydite	-5.973	(	1.000)	361	(	-1.000)	2					
2036101	Hg(OH)2	-6.205	(	1.000)	361								
6036100	HgSO4	-17.217	(	1.000)	361	(	1.000)	732	(	2.000)	330	(	-2.000) 2

K/TCD-1055

EAST FORK POPLAR CREEK SOILS INVESTIGATION OF MERCURY FORM AND ASSOCIATION

DRAFT

December 1992

Prepared by the
Technical Division
Oak Ridge K-25 Site
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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ACRONYMS

BEI	backscattered electron images
CERCLA	Comprehensive Environmental Reponse Compensation and Liability Act
Colex	colum exchange
CRT	cathode ray tube
DOE	U.S. Department of Energy
EDS	energy dispersive spectrometer
EFPC	East Fork Poplar Creek
EPA	U.S. Environmental Protection Agency
FS	feasibility study
NPL	National Priorities List
ORR	Oak Ridge Reservation
QA	quality assurance
RI	remedial investigation
SAIC	Science Applications International Corporation
SEI	secondary electron image
SEM	scanning electron microscope
WDS	wavelength dispersive spectrometer

1. INTRODUCTION

Science Applications International Corporation (SAIC) is performing a Remedial Investigation (RI) of the lower East Fork Poplar Creek (EFPC) under the Technical Support Contract to the U.S. Department of Energy (DOE). A supportive investigation has been initiated which attempts to determine the form and association of mercury in the floodplain soils of the EFPC within DOE's Oak Ridge Reservation (ORR) and the city of Oak Ridge. SAIC solicited the assistance of Mr. Larry Harris who conducted earlier work on samples from the EFPC floodplain. Mr. Harris, in his capacity as a consultant to the Material Science Section at the Oak Ridge K-25 Site, agreed to expand on his earlier work of the petrographic and electron microscopy of mercury-contaminated soils. The research was supported by funding from the Oak Ride Y-12 Plant Environmental Restoration Division through an intercompany statement of work and work order (PKY 21600-209AG1). This report summarizes the findings of the investigation and will be incorporated into the Administrative Record in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Public Law 96-510).

1.1 SITE DESCRIPTION

EFPC is a tributary to the Clinch River system. The perennial stream originates within the DOE Y-12 Plant boundary and flows 23 km before meeting its confluence with the main branch of Poplar Creek. Creek flow is channelized within the plant boundary but spreads out as it enters the city of Oak Ridge. EFPC collects a significant portion of city drainage through a number of small tributaries. An associated floodplain ranges from 5 to more than 500 m in width and covers more than 670 acres of adjoining land along its length. Various land uses are encountered along the course of EFPC. After flowing 19 km, EFPC exits the city limits and re-enters the DOE reservation.

A second watershed, Bear Creek, also begins within the Y-12 Plant boundary and flows westward. Bear Creek then turns north and enters EFPC before the confluence of EFPC and Poplar Creek.

1.2 SITE HISTORY AND CONTAMINATION

Activities at the Y-12 Plant are associated with weapons component manufacturing which includes metal finishing, plating, uranium recovery, and facility cleaning operations. Machining and milling of uranium and other metals has been common throughout the plant's history. During the 1950s and early 1960s, millions of kilograms of mercury were used in a column exchange process (Colex) for the production of lithium enriched in the ^{6}Li isotope. The Colex process began in 1950, expanded in 1953, and ceased in 1963. During that time large-scale releases of mercury were attributed to spills, maintenance operations, and the discharge of a dilute waste stream into the creek. Of the 109,000 kg of mercury estimated to have been lost to the environment, approximately 91,000 kg were from the dilute waste stream. Retention basins that have been on line at the plant boundary since 1963 contain a portion

of the mercury. An unknown amount still resides in the soil and bedrock underlying the plant and within the plant-wide drainage system.

1.3 REMEDIAL INVESTIGATION

In 1989 the entire DOE ORR was placed on the U.S. Environmental Protection Agency's (EPA) National Priorities List (NPL) of Superfund sites, and in the autumn of 1990, an RI/feasibility study (FS) was initiated. Earlier studies analyzed areas of the floodplain for mercury concentration and performed miscellaneous multi-element soils analyses and biota contaminant concentrations. The earlier work provided the RI with a conceptual model of transport and distribution of metals within the floodplain. However, a more comprehensive investigation was needed to answer a number of questions in areas as diverse as site characterization, treatability studies, and human health risk assessment.

The major effort of the first phase of the RI was directed toward identifying the various affected media (i.e., groundwater, surface water, creek and tributary sediments, and floodplain soils) and defining the contaminants of concern for each medium. The medium with the highest concentrations of contaminants and the most widespread extent was determined to be the floodplain soil. Table 1.1 lists the contaminants of concern for metals derived from the first phase sampling results. Note that mercury constitutes 85% of the proportional toxicity for the various metals detected. As the primary contaminant, determining the occurrence, form, and association of mercury in the floodplain environment became crucial to the investigation. The form of mercury in the soils directly impacts the remedial treatment selection and the results of the human health baseline risk assessment.

Table 1.1. Toxicity scores based on average of contaminant concentrations in EFPC soil, ranked by toxicity[a]

Parameter	EFPC proportion detected	Average EFPC result	Measurement units	EFPC toxicity score	EFPC % of total toxicity	EPA toxicity measure	Background proportion detected	Average background result	Background toxicity score
Noncarcinogenic Hazard Scores									
Mercury	152/184	105.00	MG/KG	3.51E+05	85.04	3.00E−04	2/41	0.07	2.28E+02
Lead	145/145	37.80	MG/KG	2.70E+04	6.54	1.40E−03	41/41	12.80	9.14E+03
Chromium	146/147	30.70	MG/KG	6.14E+03	1.49	5.00E−03	41/41	24.50	4.90E+03
Cadmium	54/147	2.96	MG/KG	5.93E+03	1.43	5.00E−04	0/41	0.37	7.37E+02
Manganese	146/147	835.00	MG/KG	4.17E+03	1.01	2.00E−01	41/41	574.00	2.87E+03
Copper	141/147	72.20	MG/KG	1.95E+03	0.47	3.70E−02	41/41	10.20	2.76E+02
Nickel	136/147	27.90	MG/KG	1.39E+03	0.34	2.00E−02	41/41	19.10	9.54E+02
Silver	31/147	2.51	MG/KG	8.38E+02	0.20	3.00E−03	0/41	0.87	2.88E+02
Zinc	132/147	63.50	MG/KG	3.18E+02	0.08	2.00E−01	35/41	37.30	1.87E+02

[a]EPA toxicity measures were taken from the IRIS and HEAST tables as updated through January 1991. Results less than detection were set to 1/2 DL (except for radionuclides).

Source: EFPC Phase 1A Validated Data from File EFPC Soil on 17JAN92 at 10:37

2. OBJECTIVES

Several objectives have been established for this supportive investigation. They are to

- understand in what form the mercury presently exists (i.e., elemental, sulfide, oxide, or organo-mercury compound);
- determine the size of the discrete particles containing or being composed primarily of mercury;
- observe any strong association or paragenetic relationship between mercury and flyash, organic material, or soil structure;
- determine if the form and associations of mercury vary over the course of the floodplain; and
- note observable differences in the soil matrices or associations between areas of high and average mercury concentrations.

3. SAMPLE COLLECTION AND PREPARATION

3.1 SAMPLE COLLECTION

Twenty samples were collected March 2–4, 1992, with soil sampling equipment that extracted undisturbed cores with the dimensions of approximately 1 in. by 18 in. The sampling was conducted under the Quality Assurance (QA) Project Plan (LWA 1990a) and in accordance with Technical Procedure-303-8, *Soil Sampling with a JMC Backsaver Soil Sampler System*, (LWA 1990b). The soil cores were enclosed within an acetate liner that fits inside the JMC Zero Contamination Tube. Upon extraction, vinyl caps were placed on the ends of the acetate tubes and the cores were delivered to the investigators at the K-25 Site with full chain-of-custody documentation. Sections of the core of particular interest were marked, and all samples prepared for the investigation were taken from these sections. Areas of interest were stratigraphic horizons displaying unusual color and known to contain high mercury or sections containing roots, ash, or high organic materials.

The locations selected for the samples were identified throughout the EFPC floodplain in varying segments of the creek, but all were from areas of high mercury to maximize the success of the study. It was recognized that this would bias the selection and not represent a random sampling of the floodplain soils. The specific locations were sampled earlier during the second phase of the RI and the soils were analyzed by neutron activation analysis for eight analytes including mercury. At the time of the site selection only preliminary analytical data existed; it has since been revised. Some samples were found to contain less mercury than originally anticipated. Table 3.1 lists the sample number with the concentration of mercury and a geographic description of the location of the sample. The northing and easting coordinates are referenced to the Oak Ridge Administrative Coordinate Grid.

3.2 SAMPLE PREPARATION

Samples were prepared from the soil cores by cutting them into 2-in. long segments while still being retained in the acetate tubing. In this manner 60 2-in. segments were generated for analyses. The choice of 2-in. long segments for these samples was dictated by the maximum available sample size that could be used in the scanning electron microscope (SEM). The tubes were split lengthwise to allow moisture to escape while vacuum drying the segments. These 2-in. long core segments were next mounted in araldite epoxy and after curing were split down the middle so that the center of the cores was exposed for analyses. Subsequently, these samples were ground and polished.

Table 3.1. Location and mercury concentrations of samples for mercury soils study

#	Sample ID	Coordinates		Hg ppm	Location
		Northing	Easting		
1	FE 3210016	32155.8	63747.4	1170	Immediately downstream of Lake Reality at Y-12
2	FW 3310812	33140.2	63077.0	135	Immediately upstream of the NO study area
3	FE 3340213	33468.1	63100.0	1320	Within the baided stream of the NO study area
4	FW 3370616	33806.2	62369.5	20	Same as previous sample
5	FE 3671214	36749.0	61097.0	443	In the backwash areas where EFPC crosses Tulsa Road
6	FN 5470016	39835.6	54788.2	121	Within the BR study area of high mercury concentrations
7	FS 5410010	40008.3	54132.1	387	Within BR study area of high mercury concentrations
8	FS 5380015	40201.8	53804.0	470	Within BR study area-south side of stream
9	FN 5380015	40230.3	53804.0	589	Same as previous sample but on north side of stream
10	FN 5340011	40249.5	53475.9	898	Within BR study area

Table 3.1. Location and mercury concentrations of samples for mercury soils study (continued)

#	Sample ID	Coordinates		Hg ppm	Location
		Northing	Easting		
11	FS 5240019	40180.9	52491.7	293	Within WA study area
12	FN 5210016	40187.3	52163.7	352	Within WA study area
13	FN 5150018	40202.6	51507.4	298	Within WA study area immediately behind convenience store
14	FN 4420010	41497.0	44289.6	125	At sewage treatment plant
15	FS 3870012	40418.5	38712.2	95	At golf course across from Grand Cove development
16	FN 3770010	40221.1	37727.9	345	West edge of Grand Cove development
17	FS 3740017	40391.6	37400.1	191	Golf course across from west edge of Grand Cove development
18	FN 2820016	40576.0	28213.0	99	On DOE reservation near LB sampling station
19	FS 2230015	38878.9	22308.0	186	Immediately downstream of the confluence of Bear Creek with EFPC
20	FS 1960011	40701.4	19682.7	216	Slightly upstream of the confluence of EFPC with Poplar Creek

4. OPTICAL MICROSCOPY

4.1 METHODS OF INVESTIGATION

Characterization of all the polished core samples by optical microscopy was performed with a Zeiss Ultraphot microscope. Reflected light was used exclusively in these analyses, [i.e., the light is directed incident to the sample surface and is subsequently reflected back through the viewing assembly (objective lens and eye piece) to form an image of the surface]. The microscope was configured to do polarized and ultraviolet light (fluorescence) microscopy. The former technique employs a polarizing prism or polaroid (termed polarizer) for the incident light to pass through and a second polarizing prism or polaroid mounted in the viewing assembly (termed an analyzer) for the reflected light to pass through. For normal use, the vibration directions (i.e., the direction that light is constrained by the polaroid) in the polarizer and analyzer are 90° to each other. Conversely, ultraviolet light (fluorescence) microscopy makes use of a mercury lamp using exciter filters for selecting a specific wavelength from the mercury emission spectrum. Barrier filters are placed in the viewing assembly and serve to isolate the visible wavelength that is excited from the fluorescence of a specific material.

Polarized light microscopy is an important technique for identifying minerals and pyrolized organic material such as coke, which is a product of coal combustion. Typical soils in this region of the country consist of alumino-silicate minerals (various clays) quartz (SiO_2), and plant matter. A consequence of the present study has been the recognition of considerable quantities of ash and coal in these soil samples. The amounts of these materials in these soil samples vary from an estimated maximum of between 20 and 30 surface area percent to a low of perhaps a few surface area percent. These observations will be discussed more fully as each core sample is described.

Ash is formed during rapid heating and combustion of coal and included mineral matter. The resulting product can be divided into classes depending upon chemistry and shape. Hollow spheres of alumino-silicate glasses are termed "cenospheres" and are sometimes found packed with spheres or particles. Similarly, more irregular spheres formed from primarily carbonaceous material consist of coke. The third important ash constituent is the ferrosphere composed of iron oxides and formed primarily from the oxidation of pyrite clusters called "framboids" (i.e., French for raspberry and alludes to the fact that these clusters have a raspberry-like shape). Finally, there are the fragments of combusted coal that are present in the ash; these fragments are usually coke and retain the remnant structure of the coal.

Figures 4.1a–d of Appendix A serve as an aid to future discussions in this section by illustrating the appearances of the various constituents described herein. Figure 4.1a contains cross sections of a coke-sphere, and cenosphere, and some associated minerals. The coke appears as an elongated, thin, porous-walled, bright material, the grey regions within are epoxy fill. Above the coke is a cenosphere (identified in the micrograph) showing an irregular outline; this material is much darker than the coke and contains some cavities at the surface (black areas). Immediately above and continuous to the cenosphere is a region containing small (<20 μm) SiO_2 grains intermixed with clays. Figures 4.1b and 4.1c (Appendix A) are views of "ferrospheres" and the cross section of a root, respectively, whereas Fig. 4.1d (Appendix A) shows a larger (>500 μm) uncombusted coal fragment.

In addition to the ash, plant matter, and expected mineral assemblages, uncombusted coal fragments are also observed in these soil samples. In several instances, ultraviolet light (fluorescent) microscopy was used to confirm the nature of these coal fragments where they contained hydrogen-rich constituents (named exinite and derived in part from ancient spores) that give a distinctive look in ultraviolet-light fluorescence. This effect is illustrated in Fig. 4.2 (Appendix A) that shows the bright stringers of hydrogen-rich material going diagonally across the optical micrograph and confirms the presence of uncombusted coal.

Though the optical microscope was not used to identify mercury-bearing matter *per se* (it lacks the capability to do the necessary microchemistry), it nevertheless can help to distinguish textural and content variations between and within soil cores. Because knowledge about the mercury content of the cores was known from prior chemical analyses, it was theorized that optical analyses might correlate mercury content with features identified in the optical microscope.

4.2 OBSERVATIONS

The following is a discussion of the petrographic observations made for each core. They are ordered by geographic proximity to the Y-12 Plant and in general contain higher concentrations of mercury the closer to the plant.

1. Core Sample FE 32100016 (1170 ppm Hg)

Core sample FE 3210016 consists of two sections. In general, there appears to be more ash in the upper section of the core while there is more coal in the lower portion of the core. This sample contains large amounts of ash and coal fragments. (Note that these are estimates and not quantitative data because no point counts were performed on any of the sample analyses.) We observe quartz, clays, and organic material throughout. The ash consists of oxidized pyrite, coke, and cenospheres. The size range of these constituents is nearly identical to what was observed in FE 3340213.

2. Core Sample FW 3310812 (135 ppm Hg)

This sample was split into three sections, and all are very similar in appearance. The sections are highly porous, therefore reducing the amount of surface for analyses. The amounts of ash and coal are relatively small (approximately 5 surface area percent) in this sample. Much less ferrospheres, coke, and cenospheres were seen. The major constituent appears to be mineral grains (probably predominantly quartz) that range in size from under 10 μm to greater than 1000 μm.

3. Core Sample FE 3340213 (1320 ppm Hg)

Three specimens were obtained from this core sample. This core differed from the others in that the soil remained soft and had to be mixed with epoxy and then set as powder mounts. All specimens appear to be nearly identical with no observable differences from the top to the bottom of the core. Typical fields of observation consist of ash, coal, quartz, clays, and plant debris. The ash makes up a considerable quantity of the soil (perhaps up to 20%) and consists of oxidized pyrite (FeS_2), pyrolized coal, and

combusted inorganic materials. This sample seems rich in iron oxide and reflects the numerous oxidized pyrite structures that range in size from 10–60 μm with some very small crystals (2–6 μm). Interspersed with iron oxides are coke and cenospheres. The former is from combusted organic coal matter; the latter is from the mineral matter in coal as discussed earlier.

Closely associated with the ash are fragments of uncombusted coal ranging in size from 100–1000 μm. In many of these coal fragments, we can see the macerals (organic coal constituents). In several instances, we identified the exinitic macerals and found them to still fluoresce (see Fig. 4.2 Appendix A) when excited by ultraviolet light. Finally, we could identify some quartz grains and fine materials along with plant parts.

4. **Core Sample FW 3370616 (20 ppm Hg)**

Cut into three sections, this sample consists of a nearly uniform fine matrix. Grains of quartz (55 μm in diameter) and plant matter are dispersed throughout the sample. Very little ash or coal fragments are observed although we do see some ferrospheres.

5. **Core Sample FE 3671214 (443 pm Hg)**

Consisting of four sections, the upper section appears to contain several large root segments while the lower three sections contain large amounts of ash and coal fragments. Coke and converted pyrite are plentiful (approximately 10 surface area percent) as is plant matter. Quartz grains also are present in substantial amounts. We noted that considerable mineralization occurred in the vesicles (open pores) of the plant tissues.

6. **Core Sample FN 5470016 (121 ppm Hg)**

All three sections of this sample appear to be alike consisting of fines as defined in our samples (i.e., composed of clays, silt, and plant matter). We observe an increase in ash particles over the similar mercury-poor cores. Plant matter is abundant. The lower section is richer in ash and coal though very few ferrosphere are present. Several large coal fragments >200 μm are seen in this section.

7. **Core Sample FS 5410010 (387 ppm Hg)**

This sample was cut into five sections. The upper two sections appear to differ from the lower in that they contain much less ash and ferrospheres but have many large coal and quartz fragments (>2000 μm). Also found in the upper sections are extensive plant matter with mineralization in the pores. Meanwhile, the lower three sections appear more like some of the mercury-rich samples in that they contain considerable ash (coke and cenospheres) and ferrospheres (perhaps up to ~15%). Typically, the uncombusted coal fragments are smaller and of less quantity than in the upper sections. As in all soil samples, there is a matrix of a fine material.

8. **Core Sample FS 5380015 (470 ppm Hg)**

Cut into two sections, this sample contains a moderate amount of ash and coal particles (~10%) in the upper section. Ferrospheres are also observed along with some large plant sections >2000 μm across. The lower section differs from the upper section in that the amount of ferrospheres seems much less. The ash in both sections is composed of coke and cenospheres. Quartz and uncombusted coal fragments up to 1000 μm are fairly common. The matrix consists of fine material composed of minerals and organic matter (too fine to identify). Much of the plant parts have their vesicles filled with fine mineral matter.

9. **Core Sample FN 5380015 (589 ppm Hg)**

This sample was split into four sections. The upper two sections vary from the lower two in that there is less ash and coal in them while the lower sections are dominated by ash, coal, and oxidized pyrite. Also seen are some larger coal fragments (>500 μm).

10. **Core Sample FN 5340011 (898 ppm Hg)**

This sample was split into three sections. The upper two sections of this sample are alike. They contain ash (~10%) but differ from sample FE 3210016 in that almost no large coal fragments are present. The other constituents are fine quartz particles, clays, and root systems. Minerals fill the open pores of the plant material. There is an abundance of plant matter, much of which is larger than observed in previous core samples, and some of the cross sections are several millimeters across. The lower section contains lesser amounts of ash and very few coal fragments. Several rock fragments were identified by their appearance in polarized light.

11. **Core Sample FS 5240019 (293 ppm Hg)**

Cut into three sections, this primarily fine-grained material is largely composed of clays, silt, and macerated plant material. Coal and ash particles are dispersed throughout this core. All three sections appear to be the same, containing much less ash and coal.

12. **Core Sample FN 5210016 (352 ppm Hg)**

Cut into three sections, this sample is nearly identical to FN 3770010 with the exception that it contains more ash (such as coke and cenospheres) but very few ferrospheres. Large sections of plant matter (probably roots) as well as quartz grains dominate the sample.

13. **Core Sample FN 5150018 (298 ppm Hg)**

Cut into three sections, we observe a matrix of fine unidentified material (probably silt, clays, and plant debris). Large quartz grains (>300 μm) are dominant. Some ash, mostly coke, is seen along with a few ferrospheres. The middle section appears to be much richer in ash and ferrospheres. Also seen throughout this sample are several large coal pieces (>1 mm long).

14. **Core Sample FN 4420010 (125 ppm Hg)**

Cut into three sections, they contain fine-grained matrix material similar to our previous samples, but they appear to have more coke (ash) particles. The lower section of the core contains a large cross section of roots with some pores filled with optically active material, probably minerals. The largest of these cross sections is 6 mm in diameter with many smaller sections throughout. In general, this core seems to contain more plant matter than in the other cores we examined.

15. **Core Sample FS 3870012 (97 ppm Hg)**

Cut into two sections, this sample contains very few ash and ferrosphere particles. The matrix consists of fine material probably similar to previous samples in composition. Quartz grains are abundant but typically less than 100 μm in length. It appears that there is much less plant material in this sample.

16. **Core Sample FN 3770010 (345 ppm Hg)**

All three sections appear to be nearly identical. We do not see much ash and almost no uncombusted coal fragments. Plant matter (root sections) and quartz grains (some >2000 μm) are the dominant materials. Several large root cross sections (some >1 mm across) that contain mineralization in the open pores are observed. Numerous large, well-rounded quartz (infers transport) grains (>1 mm) are seen throughout the sample, whereas the matrix consists of smaller, more angular quartz grains mixed with unidentified fines (probably clays) and plant debris.

17. **Core Sample FS 3740017 (191 ppm Hg)**

Cut into three sections, this sample contains fine material as a matrix surrounding larger quartz grains. Not much ash or coal particles are seen. Plant matter also appears to be scarce.

18. **Core Sample FN 2820016 (99 ppm Hg)**

Cut into two sections, almost no ash or coal is present in this sample. It primarily contains quartz ranging from fines to particles >1000 μm. Several large metallic fragments (highly reflectant opaque material, metallic in appearance) are seen. Mineralization in vesicles of plant matter is observed for root cross sections.

19. **Core Sample FS 2230015 (186 ppm Hg)**

This sample, cut into three sections, is identical to FS 1960011. We see very small amounts of ash or coal and not too many recognizable organic fragments.

20. Core Sample FS 1960011 (216 ppm Hg)

The three sections of this predominantly fine-grained material are similar to FS5240019 in that they consist of clays, silt, and plant matter. Some large plant cross sections containing mineralization in their pores are observed. Several larger quartz grains (>100 μm) are seen, but very few ash or ferrosphere particles are observed.

5. SCANNING ELECTRON MICROSCOPY

5.1 METHODS OF INVESTIGATION

This section pertains to the imaging, detection, and microanalysis of mercury-bearing particles in the soil samples. The sample preparation and the methodology employed in their analyses are described. Though optical microscopy was useful in illuminating certain relationships between mercury and ash in these soils, it nevertheless cannot be used to do elemental analyses nor to resolve very small particles, for example, those less than 2 μm. Electron microscopy, which utilizes the very short wavelengths of electrons, can resolve particles in the submicrometer range down to less than 0.1 μm in a very rapid manner. In addition, with electron microscopy there are methods for performing microanalysis of any observed feature.

Like the optical microscope, the electron microscope generates images of the regions being surveyed that can be directly photographed to yield a photomicrograph. The electron microscope is also equipped with accessory analytical tools that are capable of doing elemental analyses of regions or specific particles down to less than .02 μm as well as plotting of elemental (dot) maps that are superimposed over features viewed on the cathode ray tube (CRT). Perhaps one of the most important functions of the instruments is their ability to be utilized for conducting quantitative multi-element analyses. Using these analytical and survey methods makes electron microscopy an ideal technique to search for trace elements such as mercury dispersed in a matrix of alumino-silicates (typical soil mineralogy) and plant debris.

A representative sample from each core was selected to undergo microanalysis. Because the soil samples are composed of nonconducting materials, it was necessary to coat their surfaces with a thin film of conducting material to prevent electrical charging of the sample surface and beam instability. The coating used in these analyses was carbon that was deposited upon the sample surfaces in a vacuum coater.

For completeness a brief description of the instruments used in these analyses and their operation is included. The microchemistry of these soil samples was performed almost exclusively with a JEOL-733 superprobe and a JEOL-840 SEM. The superprobe may be considered a dedicated microanalytical microscope because it has a special nontilting and nonrotatable stage thus assuring accurate registry and constancy between the beam axis and specimen surface. Both systems use high energy, small diameter (focused) electron beams that interact with the specimen surface. The microscopes require a vacuum (10^{-5} TORR) to prevent the beam from interacting with gas molecules and beam electrons thereby averting drifts in beam current.

The impingement of the electron beam on the sample surface produces secondary and backscattered electrons. The secondary electrons are derived from the electrons that lose energy from the interaction of the incident beams electrons with the electrons in the specimen. Therefore, secondary electrons have relatively low energies that range from a few electron volts to an arbitrary upper limit of 50 eV. The mean free path length in a typical material for secondary electron is about 0.001 μm. Therefore, only those electrons generated at shallow depths escape the specimen surface. These secondary electron images (SEI) provide surface topological information at the highest resolution and can be directly viewed on a CRT.

In contrast, backscattered electrons contain the original beams electrons that have been elastically (no energy loss) scattered back through the specimen surface. The interaction of those electrons is primarily with the specimen's atomic nuclei where there is little energy transferred from the electrons. Backscattered electrons are classified as having high energies (>50 eV) and an increase in yield with increasing average atomic number of the specimen. Thus backscattered electron images (BEI) show significant differences in the appearance of entities composed of high atomic number elements versus features composed of low atomic numbered elements. Like secondary electrons, backscattered electrons also can be imaged on a CRT to yield BEI.

In addition to the secondary and backscattered electrons, the interaction of the electron beam with the sample generates x-rays. When an electron in an inner atomic shell of an element is ejected by an incident electron, a transition from an outer energy level (shell) to the vacancy may occur with concomitant emission of an x-ray photon, the energy being determined by the initial and final electron energy levels. The letters K, L, M,... etc. (where K is the innermost shell followed by L, M,...etc.) are used in the notations for listing x-ray lines and refer to the shell initially ionized. These characteristic x-rays emitted under the effect of an electron beam yield data pertaining to the nature and number of elements present in the volume excited by the primary beam.

Analyses of the x-rays can be performed in the following two ways: with an energy dispersive spectrometer (EDS) and/or with a wavelength dispersive spectrometer (WDS). The former method uses a lithium-drifted silicon crystal detector in which the x-ray photon is converted into an electrical pulse. A voltage applied to the crystal collects the charges that are proportional to the energies of the x-rays. This pulse is further amplified and converted and then passed to a multichannel analyzer where the pulses are sorted out according to their energies for presentation on a CRT or plotted on a chart. Typical resolution of EDS is 150 eV which means that an overlap of lines exists such as for mercury $M\alpha_1$ = 2.195KeV, $M\alpha_2$ = 2.283KeV, and sulfur $K\alpha$ = 2.308KeV where the difference is approximately 25 eV.

In wavelength dispersive spectrometry, a crystal of a known atomic spacing separates x-rays according to Bragg's law $n\lambda = 2d \sin \Theta$ (where n is an integer, d is an interplanar spacing of the analyzing crystal, λ is the wavelength of the incident x-radiation, and Θ (theta) is half the angle between the incident and diffracted rays so that for a given angle theta (Θ) x-rays of a specific wavelength are detected. Several different crystals are required to cover the entire range of wavelengths. In the systems employed in this study, there are three WDSs mounted. X-rays obeying Bragg's law for a specific analyzing crystal are detected by a proportional counter. The x-rays thus being counted are treated in a manner similar to that reported for EDS. The resolution achieved with WDS is 10 eV or less and therefore is the technique of choice for discriminating between mercury and sulfur. In addition, WDS has a higher counting rate which means greater sensitivity and improved statistics.

5.2 OBSERVATIONS AND DISCUSSIONS

Mercury in core samples was observed to be present in several modes, such as discrete particles or globules, possible coating on mineral surfaces, and fillings in pore openings or fissures in plant matter. Detection of mercury in those core samples containing under 400 ppm mercury was more difficult because searching for mercury at lower concentrations was more time-consuming. However, the only difference in mercury occurrence regarding the soil cores appears to be in the concentrations but not in the mode or microchemistry.

Mercury-rich micrometer-sized particles are a common mode of occurrence for mercury in these soil samples. The particles are usually associated with fragments of plant matter and/or minerals. To date, no mercury-rich particles have been observed in association with ash even though the cenospheres contain an abundance of open pores and cracks. Figure 5.1 of Appendix A is an SEI photomicrograph that contains several mercury-bearing particles (shown by the arrows) along with such minerals as quartz (Q) and clays (C) as well as other unidentified matter. The BEI of this same area is shown in Fig. 5.2 (Appendix A) where the signals from the low atomic numbered elements have been suppressed to accent the mercury-bearing particles which range in size from <1 μm to 5 μm.

X-ray dot maps for Hg Mα, S Kα, and Ca Kα are shown in Figs. 5.3a–c (Appendix A). The superimposition of mercury and sulfur on the particle sites while calcium appears unrelated can be observed from these maps. Additional inspection of the sulfur map shows that the adhered to fragment is rich in sulfur. It should be noted that several observations were made of sulfur-rich matter that did not contain any of the elements detectable with EDS, [i.e., elements of atomic number 11 (sodium) or greater]. From these observations, it was assumed that the fragment was either sulfur or an organic sulfur compound; the latter choice appears more likely because it well known that coal contains organic sulfur compounds and that coal is a constituent of these soils.

The relationship of mercury and sulfur in all the mercury-rich particles observed to date is further illustrated in Appendix A, Fig. 5.4 which is an SEI of an approximate 1 μm particle atop a probable clay mineral. Figures 5.5a–b of Appendix A are the x-ray maps for mercury and sulfur that show the superimposition of those elements. The diffusion of the mercury and sulfur x-rays appears to be indicative of a thin coating of those elements on the substrate. The energy dispersion spectrum for the region surrounding the particle clearly shows aluminum and silicon to be the primary elements present with much lesser amounts of calcium, potassium, and iron supporting the thesis that the substrate is composed of clays.

Numerous additional instances of mercury and sulfur impositions on the particles throughout these core samples were observed and recorded. An attempt to establish whether possible relationships exist between these particles and other associated elements identified either in the substrates or in adjacent matter indicated a need for quantitative multi-element analyses. These analyses were performed on mercury-rich particles and their immediate surroundings using the JEOL electron probe microanalyzer. Data reduction and corrections for atomic number, absorption, and fluorescence (ZAF) were applied to raw data to yield atomic concentrations. Figure 5.6 is a BEI of one such particle which appears as a very bright spot (~1 μm long) located near the center of the micrograph. Microanalyses of the particle and surrounding matter were performed for the following elements: aluminum, calcium, iron, mercury, potassium, silicon, sulfur, and titanium. Table 5.1 lists these elements and their concentrations with respect to the particle (A and B) and its matrix (#1, 2, 3, 4). Substantial amounts of mercury, sulfur, and calcium were revealed in the particle probe. The presence of calcium where mercury and sulfur superimpose is not unique in these soil samples, but is relatively common as will be demonstrated by additional data. Present thinking is that some calcium may be due to fragments of plant matter because it is known that calcium is an invariable constituent of all plants, which contain it both as a structural constituent and as a physiological ion. In addition, sulfur is also one of the essential plant nutrients.

Analyses for a region identified by spots #1 and #2 in Table 5.1, located about 5 μm from the particle and lying in the adjacent grey, kidney-shaped feature just below the particle, contained no mercury, sulfur, calcium, or iron, but is rich in aluminum, silicon, and potassium, which suggests a mixed clay mineral. Closer to the particle, data from spots #3 and #4

Table 5.1. Atomic concentrations for a mercury-rich particle and matrix

Elements	A	B	#1	#2	#3	#4
Aluminum	9.41	7.26	21.94	20.42	28.34	28.62
Silicon	5.47	5.25	71.29	73.26	36.28	41.17
Sulfur	21.71	25.34	6.49	6.06	5.71	4.48
Iron	1.38	1.40	--	--	5.43	6.47
Mercury	23.42	26.61	--	--	2.92	1.67
Calcium	35.27	32.43	--	--	13.58	10.75
Titanium	0.40	0.24	--	--	0.47	0.20
Potassium	2.95	1.47	--	--	7.27	6.63

A and B - two locations upon bright spot in center of Fig. 5.6.
#1, 2, 3, & 4 - four locations upon matrix adjacent to bright spot in Fig. 5.6.

showed some mercury, sulfur, and calcium but was still primarily rich in the clay elements. It may be that the mercury signal is due to some overlap with the mercury-rich particle because the x-ray source volume is larger than the probe spot. This means that small particles (<1 μm) can display x-ray signals that originate from the matrix.

Probe analyses of a second mercury-rich region (A and B in Table 5.2) and its contiguous areas (#1, 2, 3, and 4 in Table 5.2) shown in Fig. 5.7 (Appendix A) resulted in the atomic concentration data listed in Table 5.2. The bright, wing-shaped region consists of a large grain ($\sim$5 μm) and several smaller associated particles. X-ray maps of Hg Mα and S Kα for the region are shown in Appendix A, Fig. 5.8a and Fig. 5.8b, respectively, and further serve to illustrate the superimposition of these elements in the soil samples. The relative ratios of sulfur to mercury in the particles are 0.91, 0.89, and 0.60, which may be compared to a ratio value of 0.98 computed for the mercury sulfur standard (the mineral cinnabar HgS). Though the sulfur-to-mercury rations of 0.91 and 0.89 approach a value of 0.98 computed from crystalline mercury sulfide (HgS, cinnabar), this does not confirm that mercury sulfide has been formed in the soil. In the absence of x-ray diffraction data the nature of the mercury sulfur mixture cannot be confirmed. The synthesis of mercury sulfide is normally carried out at mildly elevated temperatures that are not present in soils. The presence of regions with differing sulfur-to-mercury ratios, for example, the 0.60 ratio, may simply be due to the dynamics of the soil system and/or the availability of sulfur. Interestingly, in this specific area calcium is not significant nor does it correlate with mercury and sulfur. ?

Figure 5.9 of Appendix A shows an elongated structure (boxed area) that contains mercury and sulfur as shown by their respective x-ray maps in Figs. 5.10a–b (Appendix A). The structure appears to have form, perhaps even crystal faces and, indeed, was thought to possibly be a crystal. However, it would be unexpected for mercury to react with sulfur at ambient conditions to produce a crystal about 80 μm long. Indeed, it appears more likely that the mercury accumulated on the surface of a crystal as a coating. To explore that thesis, a simple series of experiments was devised to increase the probe current, resulting in a concomitant heat increase. In this way it was thought that the mercury/sulfur mixture would evaporate (especially in a vacuum) and reveal the nature of the substrate, assuming it was a coating. Figures 5.11a–c in Appendix A are EDS spectra for the as-received, after an increase in probe current, and after an additional increase in probe current, respectively. These spectra show that a change (as observed by the relative intensity of the combined mercury-sulfur peak as compared to the other peaks) occurred after the initial heating, but no subsequent changes occurred on the second heating. The changes included a twelvefold increase in the ratio of iron to mercury and a doubling of the calcium-to-mercury ratio. A possible explanation for the continued presence of mercury and sulfur is one previously discussed, specifically, the greater x-ray volume from which the x-rays originate compared to the probe diameter. This means that many x-rays are originating outside the probe spot so that elemental data from the immediate area around the probe spot are being recorded. Apparently, future work must be done to confirm or deny the coating thesis. However, these data do support that phenomena in a very limited way (e.g., the increase in calcium and iron).

As reported previously, some of the mercury appears to be associated with calcium-rich matter. Figure 5.12 in Appendix A is a BEI of just such a feature (the elliptically shaped structure designated by the letter "P") and is surrounded by a profusion of grains ranging in size from 100 to <1 μm. The identity of many of these grains was established by the following x-ray microanalysis. Figures 5.13a–f (Appendix A) are the x-ray maps for the elements identified by EDS. The superimposition of the mercury and sulfur x-ray maps within the

Table 5.2. Atomic concentrations for mercury-rich particles and matrix

Elements	A	B	#1	#2	#3	#4
Aluminum	24.46	24.19	25.95	27.51	28.18	31.48
Silicon	34.94	37.50	35.62	53.93	46.88	50.48
Sulfur	11.76	10.79	8.69	2.18	4.99	1.18
Iron	5.22	4.69	5.25	6.77	6.20	6.14
Mercury	12.82	12.13	14.48	0.66	0.06	0.00
Calcium	4.29	4.34	3.87	1.43	2.38	1.26
Titanium	0.53	0.24	0.29	0.76	2.75	0.63
Potassium	5.98	6.11	5.85	6.76	7.55	8.39

A and B - locations upon mercury-rich particle in Fig. 5.7.
#1, 2, 3, & 4 - locations in contiguous areas adjacent to mercury-rich particle in Fig. 5.7.

feature is almost in perfect register. Superimposed on these elements is calcium which appears to occupy additional areas within the feature not covered by mercury and sulfur. Because no calcium, mercury sulfide, or sulfate compound is reported in the literature, it may be that calcium is related to the feature itself. Aluminum, silicon, and iron x-ray maps define the chemistry of the adjacent matter surrounding the feature; for example, the super-imposition of these three elements identifies clay minerals while grains covered by silicon only must be quartz.

Plant matter containing pyrite (FeS_2) (Fig. 5.14, Appendix A) also contains mercury. These elemental relationships are illustrated by a series of x-ray maps for aluminum, calcium, iron, mercury, and sulfur (Figs. 5.15a–e, Appendix A). The plant cell wall is composed of calcium and aluminum, while within the cell, sulfur and iron are superimposed forming an iron sulfide (probably pyrite). The overall appearance of the iron and sulfur in this figure is reminiscent of a pyrite framboid. Though mercury is present, it appears to be diffuse over the inner cell surface. It may be that the mercury adheres to the pyrite surfaces because it has a strong affinity for sulfur.

Finally, it is worth noting that the floodplain soil is the repository for a host of foreign elements besides mercury that have been deposited over the years. In the course of these microanalyses many other high atomic number materials were imaged, most notably, uranium and thorium fragments that were identified and x-ray mapped. Figures 5.16a–b (Appendix A) are a BEI of uranium and its associated x-ray map. The uranium particle is about 5 μm as compared with the thorium particle which is 60 μm (see Figs. 5.17a–b, Appendix A, which are the BEI and thorium x-ray map, respectively). In addition to those materials, rare earths, zirconium, and stainless steel were relatively common.

6. SUMMARY

Common to all these soil samples is fine-grained micrometer to submicrometer-sized particles that consist of quartz clays and plant debris and constitute a matrix in most of the samples. In addition, optical microscopy revealed varying amounts of ash and coal particles (ranging from an estimated 20–30 surface area percent to less than a few surface area percent) dispersed throughout these core samples. The ash consists of coke (pyrolized organic material, probably coal that can be distinguished by its appearance in polarized light), cenospheres (hollow spheres composed of an alumino-silicate glass), and ferrospheres (iron oxides formed from oxidized pyrite).

Optical microscopy of the soil cores revealed variations in their content with respect to mercury concentrations. Ash and coal fragments were found to be more abundant in the mercury-rich cores and to be correspondingly less abundant in those cores that are poorer in mercury. There also appears to be greater amounts of ferrospheres in these mercury-rich soils. In contrast, those soil samples containing less than 300 ppm of mercury appear to be almost devoid of ash and ferrospheres (under 5 surface area percent). Additionally, within some cores we observed significant variations in texture and content. For example, when core sample FS 5410010 (388 ppm Hg) was cut into five sections, it showed extreme variations between the two upper sections and the three bottom sections. The bottom sections were rich in ash and coal appearing similar to the soils that are richer in mercury, whereas the top two sections contained significantly less ash and coal and fit the appearance of the mercury-poor samples.

Electron microscopy was employed to detect, image, and microanalyze the mercury-bearing matter in the soil samples. No physical or chemical relationship could be established between the mercury and ash. However, this observation does not negate the optical finding in the sense that these constituents may have traveled together without interacting so that ash-rich soils may still imply mercury enrichment.

Mercury was found to be present in several forms, such as, discrete particles or globules, possible coatings on mineral matter, and fillings in pores and/or fissures in plant debris. To date, mercury and sulfur were found to coexist in all the mercury-rich entities. These analyses further revealed that the mode of occurrence of mercury in the mercury-rich and mercury-poor cores is identical, i. e., the form and chemistry of the mercury matter is independent of its concentration in the soil.

The coexistence of mercury with sulfur does not imply the presence of a mercury sulfide compound (HgS) because conditions for its formation do not appear to be present in the soils. However, in the absence of conclusive evidence (e.g., x-ray diffraction analyses of a mercury concentrate) one must exercise caution. It is well known that mercury has a strong affinity for sulfur and that sulfur is available in these soils from several sources, including sulfates in the water, organic sulfur in coal, iron sulfides, and plant matter.

One may hypothesize a possible succession of events taking place in the soil with respect to mercury. A first step in these events could be the emplacement of mercury on either mineral or plant substrate. This mode might be governed by the ability of the mercury ion to substitute for the calcium ion and may indeed be one of the reasons for the association of

calcium with mercury that has been observed. In addition, sulfur may also be associated with these same substrates and act as an additional attraction for mercury attachment. Finally, the sulfate-rich waters that move through the soil could act to transport sulfur ions to coat and diffuse the mercury entities.

7. FUTURE WORK RECOMMENDATIONS

Several fresh approaches to help clarify the data described and discussed in the previous sections are suggested. The most important question that still remains unanswered is whether the mercury/sulfur mixtures are present as the crystalline compound (HgS). X-ray diffraction analyses of concentrates of mercury-rich particles should unequivocally answer this question. Of lesser importance, but still not truly understood, is whether mercury/sulfur mixtures are truly coatings on mineral surfaces. To address this problem, an auger spectrometer might be ideal because the surfaces can be sputtered in a controlled manner while analyzing that surface.

The optical microscopy of several of the soil cores revealed major intra-core differences with respect to ash and coal. It may be that mercury-rich layers are interspersed with mercury-poor soil such that the true nature of the mercury distribution is unclear. Careful electron microanalyses of these cores by segments would do much to clarify this situation.

8. REFERENCES

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LWA 1990b. *Environmental Restoration Program, Technical Support Contractor, Quality Assurance Technical Procedures Manual*, DOE/OR-933 and LWA/90-008.

APPENDIX A

FIGURES

FIGURES

Fig. 4.1 An optical micrograph of ash particles; (a) coke, cenospheres, and mineral matter,(b) ferrospheres, (c) cross-section of a root, and (d) uncombusted coal fragment.

Fig. 4.2 Ultraviolet light fluoresced hydrogen-rich constituent (extinite which is a coal entity) in uncombusted coal.

Fig. 5.1 SEI of mercury-rich particles (shown by arrows) with quartz (Q) and clay (C).

Fig. 5.2 BEI of same area shown in Fig. 5.1 where the bright spots are the mercury-rich particles.

Fig. 5.3 Elemental x-ray maps for (5.3a) mercury, (5.3b) sulfur, and (5.3c) calcium.

Fig. 5.4 SEI of a mercury-rich particle atop clay.

Fig. 5.5 Elemental x-ray maps for (5.5a) mercury and (5.5b) sulfur.

Fig. 5.6 BEI of mercury-rich particles in center of the field.

Fig. 5.7 BEI of a wing-shaped mercury-rich particle (see arrows).

Fig. 5.8 Elemental x-ray maps for (5.8a) mercury and (5.8b) sulfur.

Fig. 5.9 SEI showing an elongated structure (enclosed in the box) containing mercury and sulfur.

Fig. 5.10 Elemental x-ray maps of (5.10a) mercury and (5.10b) sulfur.

Fig. 5.11 EDS spectra for (5.11a) as-received material, (5.11b) after an increase in probe current (heating), and (5.11c) after an additional increase in probe current.

Fig. 5.12 BEI of an elliptically shaped feature (P), probably plant matter, surrounded by quartz and clay.

Fig. 5.13 Elemental x-ray maps for (5.13a) aluminum, (5.13b) calcium, (5.13c) iron, (5.13d) mercury, (5.13e) silicon, and (5.13f) sulfur.

Fig. 5.14 BEI of plant matter with a cluster of pyrite crystals.

Fig. 5.15 Elemental x-ray maps for (5.15a) aluminum, (5.15b) calcium, (5.15c) iron, (5.15d) mercury, and (5.15e) sulfur.

Fig. 5.16 A BEI of a uranium particle (5.16a) and its x-ray map (5.16b).

Fig. 5.17 A BEI of a thorium particle (5.17a) and its x-ray image map (5.17b).

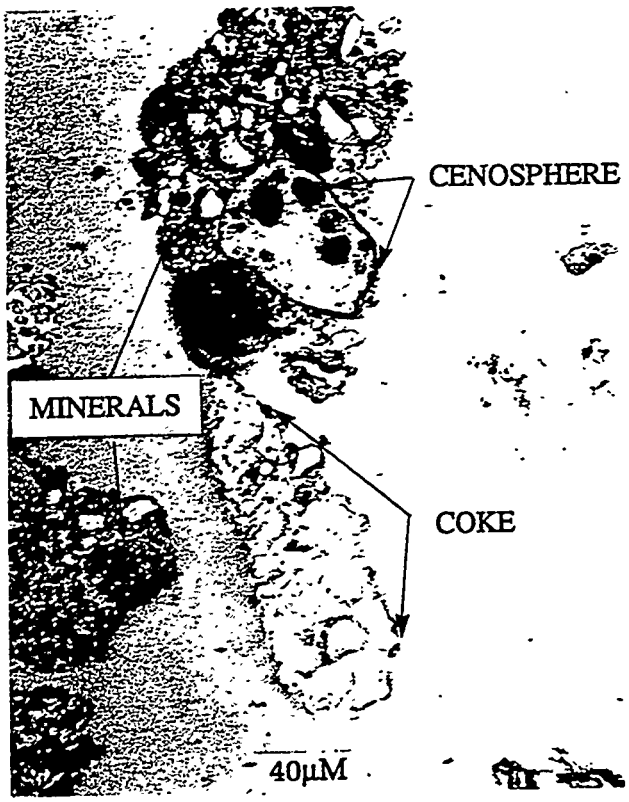
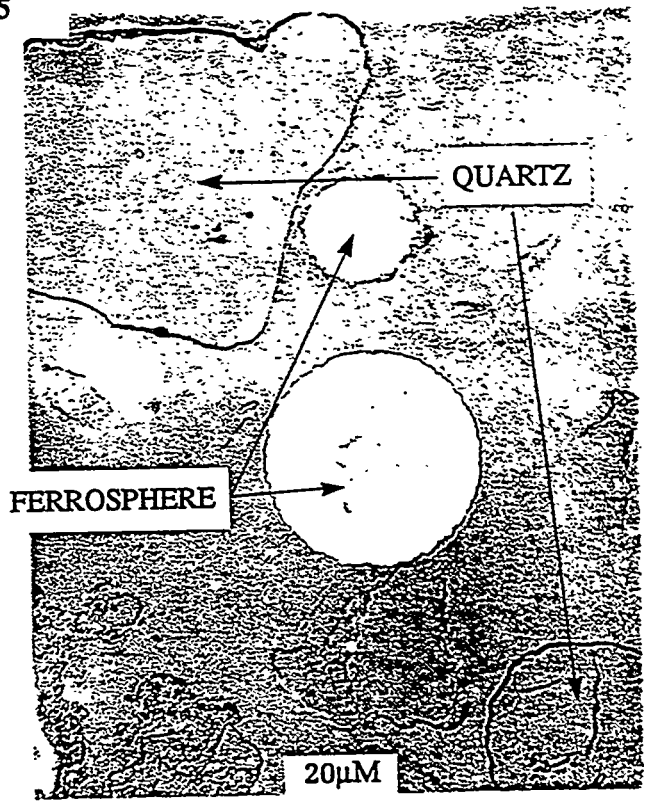


Fig. 4.1a



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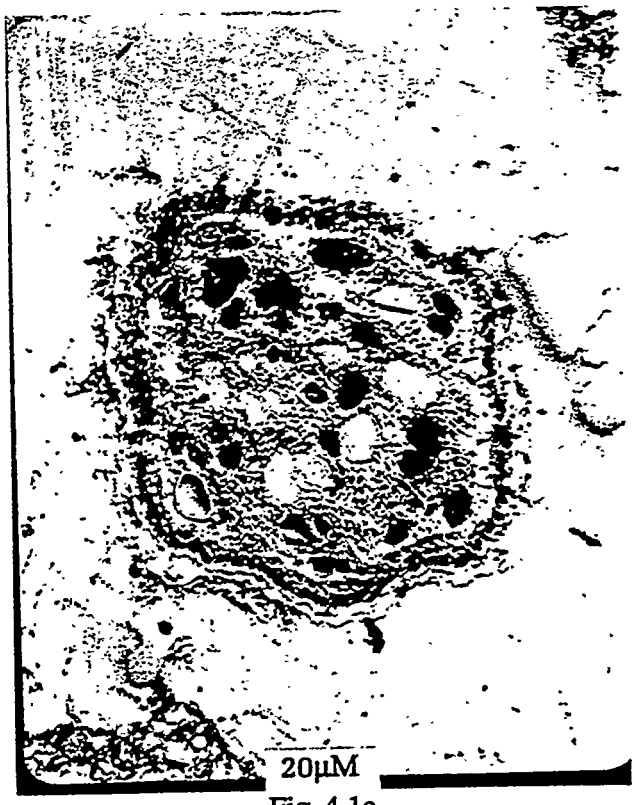
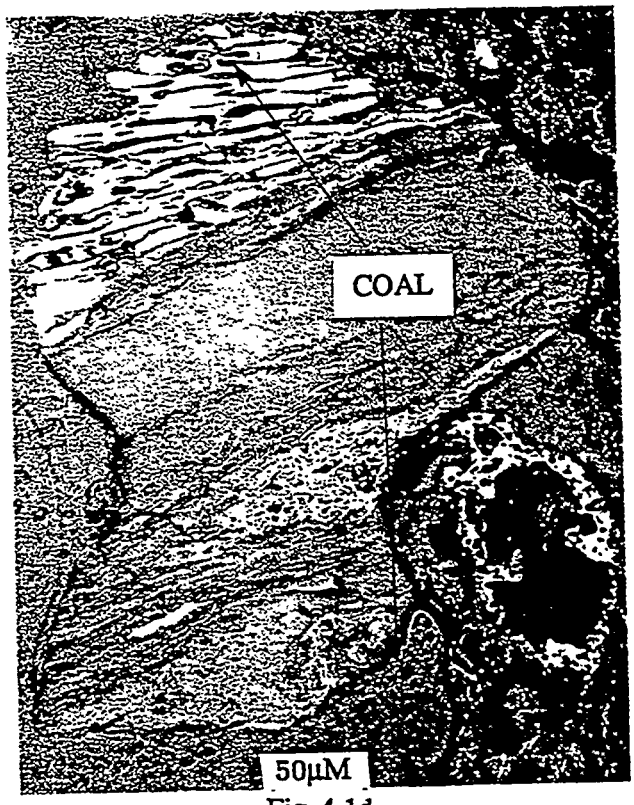


Fig. 4.1c



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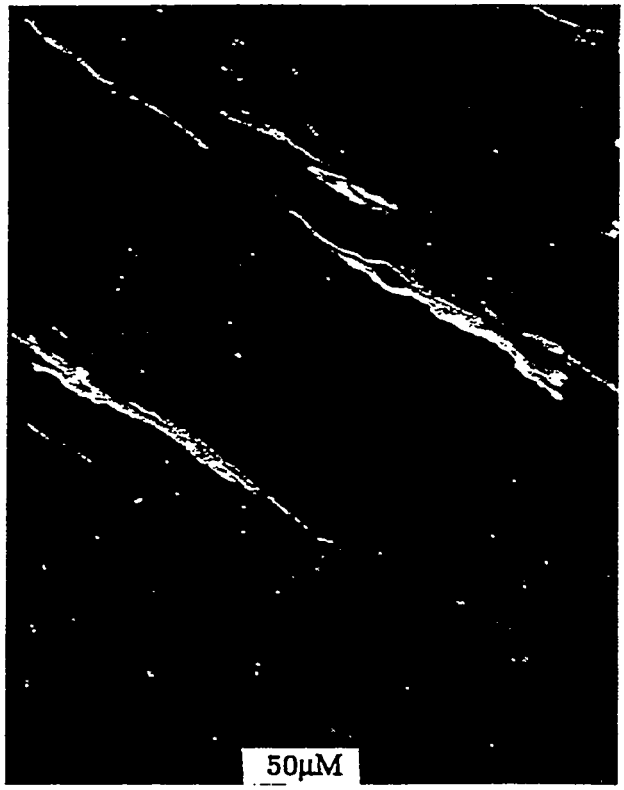


Fig. 4.2

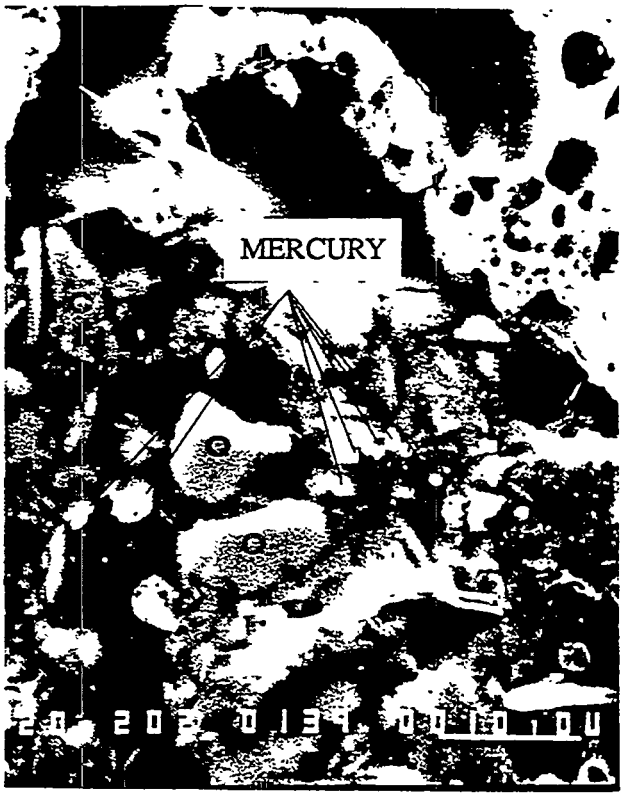
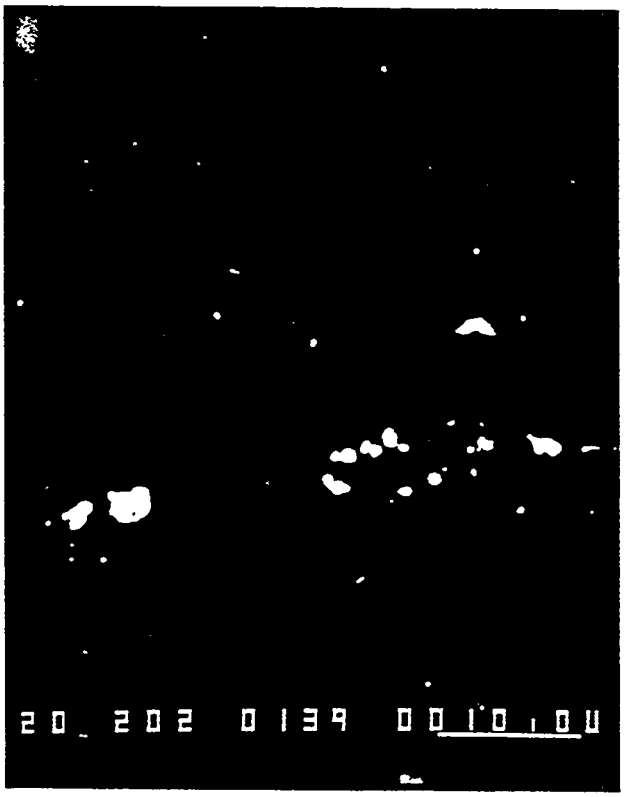


Fig. 5.1



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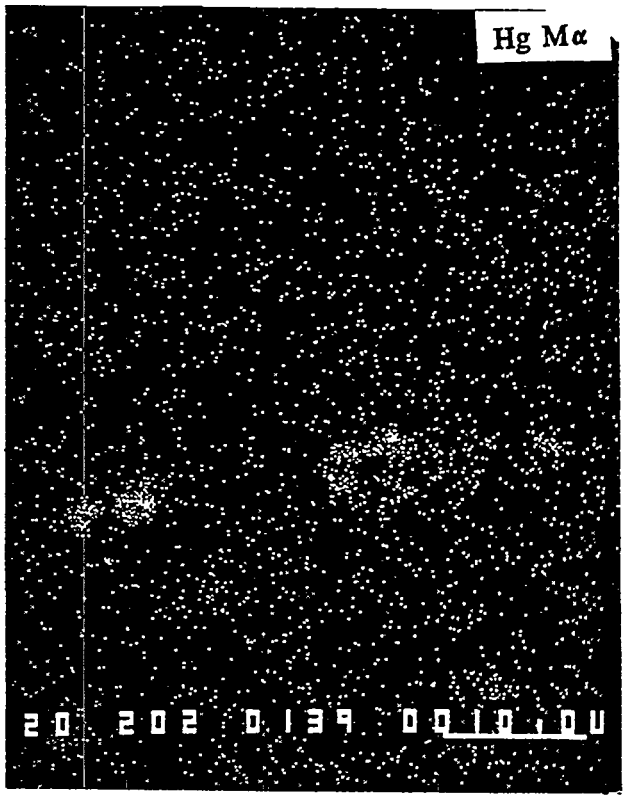

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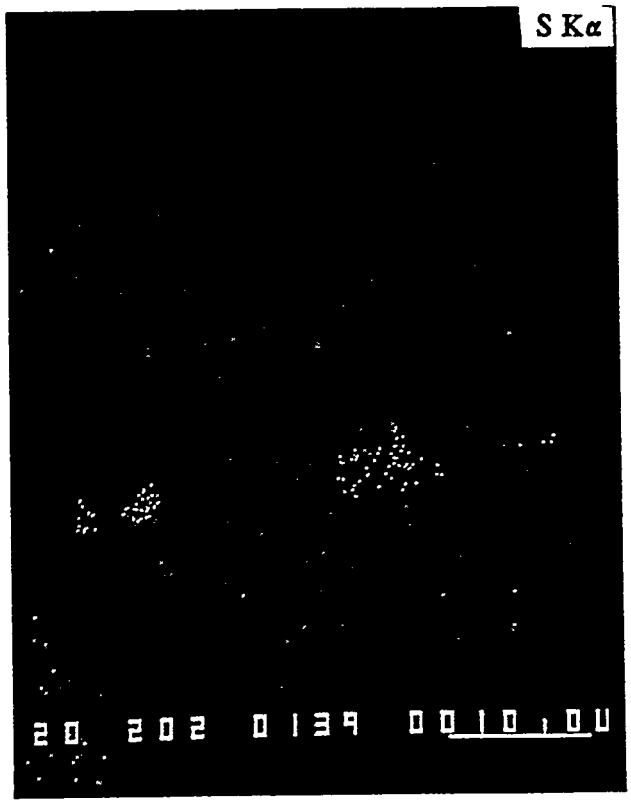


Fig. 5.3b

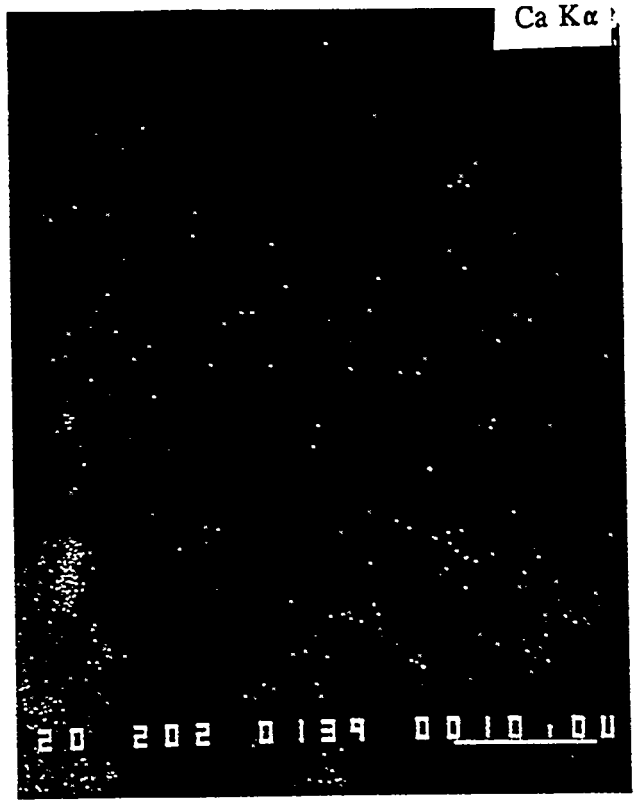
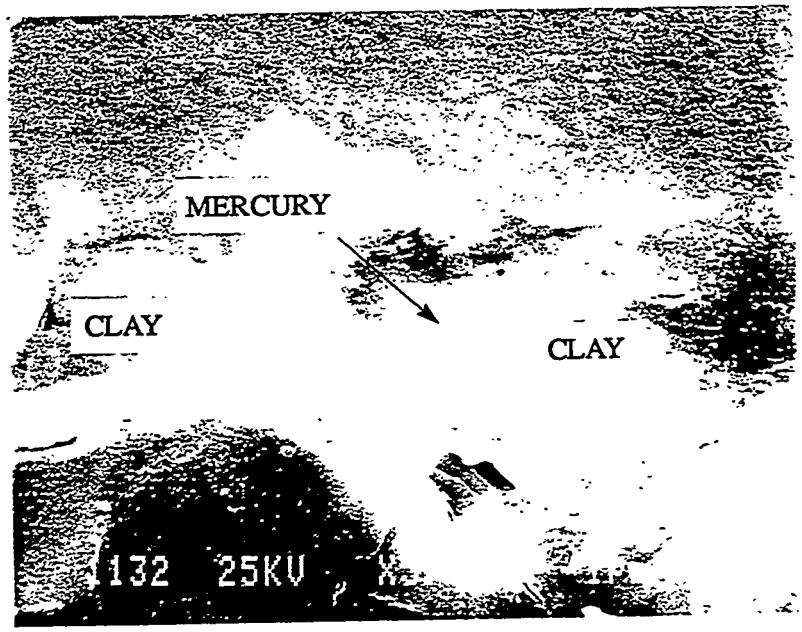


Fig. 5.3c



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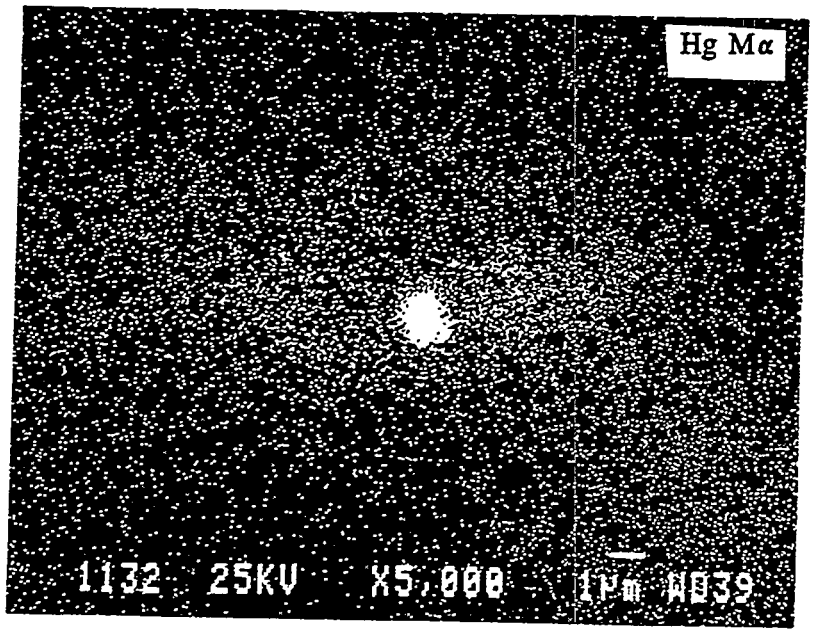


Fig. 5.5a

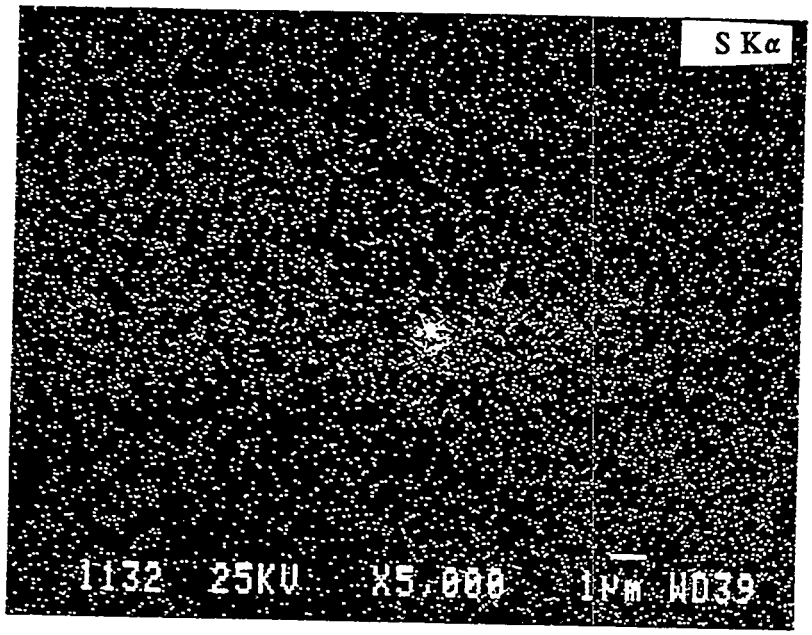


Fig. 5.5b

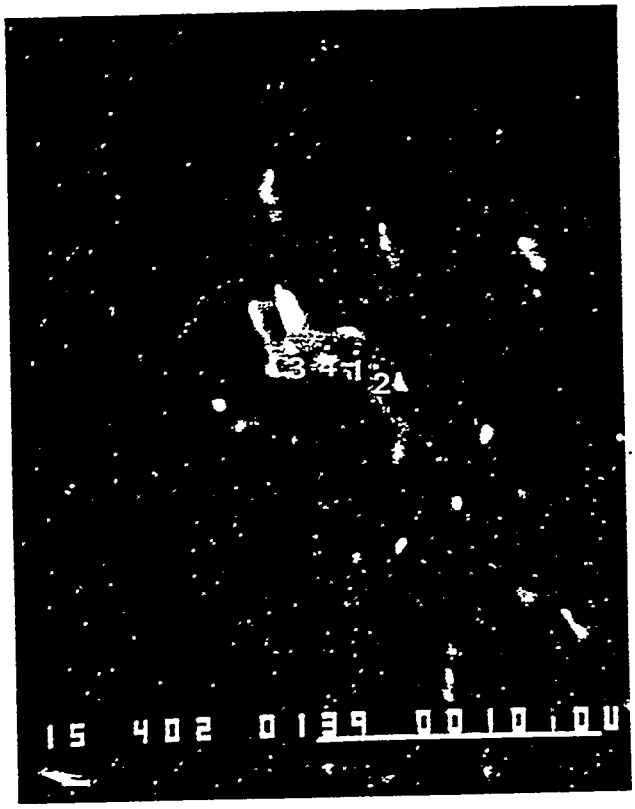
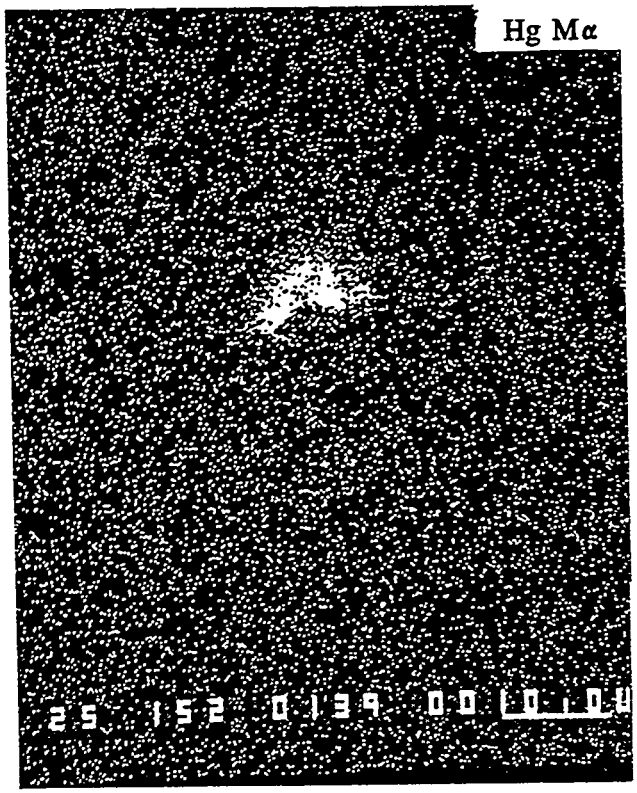


Fig. 5.6

Fig. 5.7



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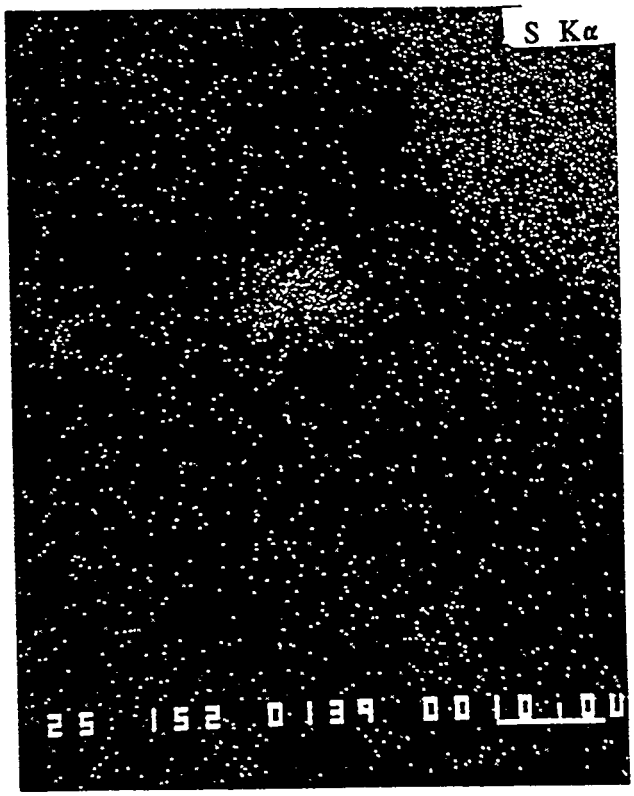
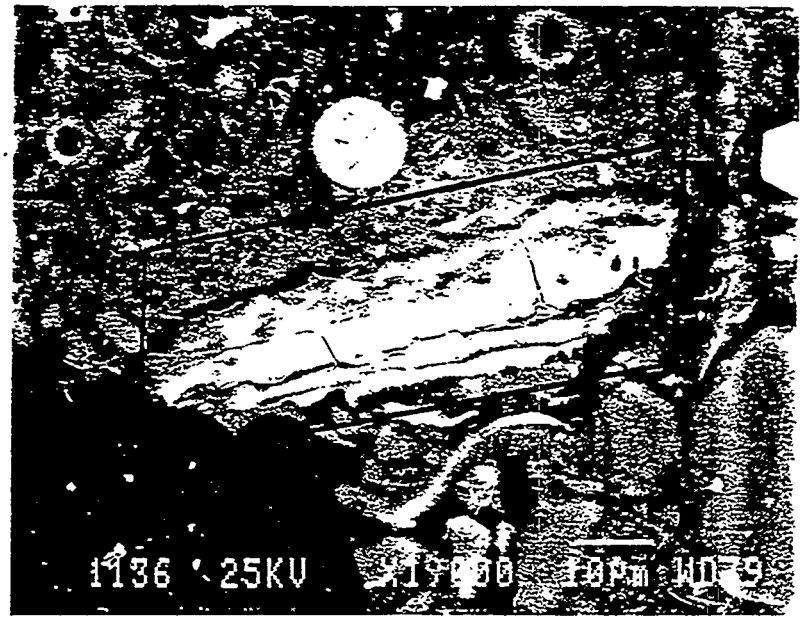


Fig. 5.8b



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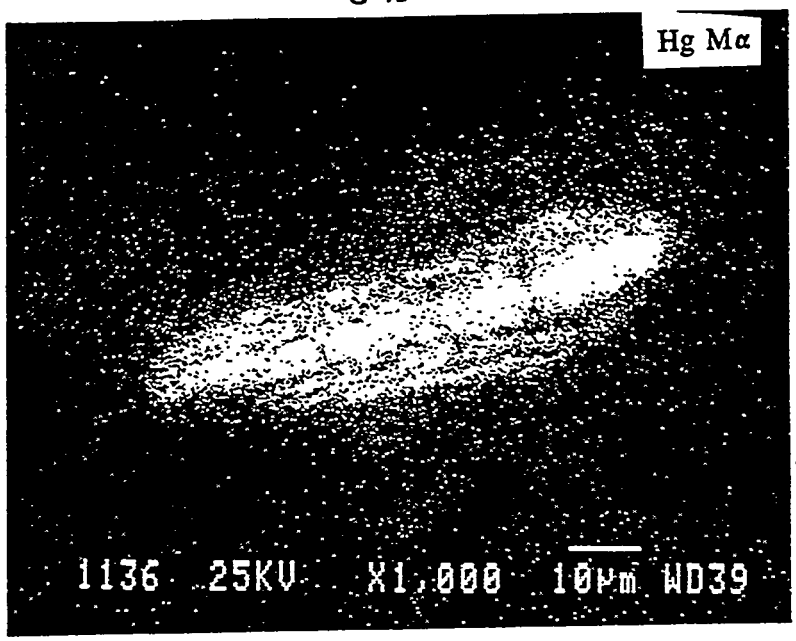

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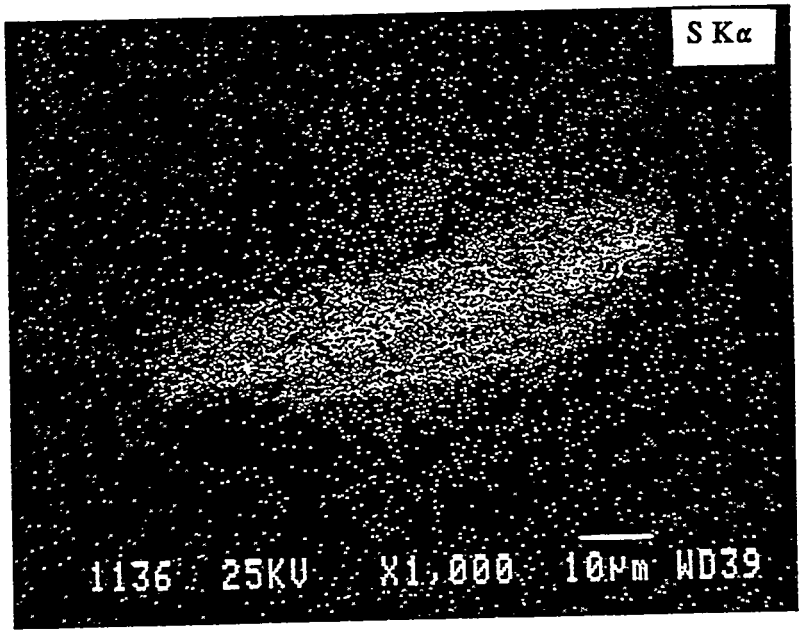

Fig. 5.10b

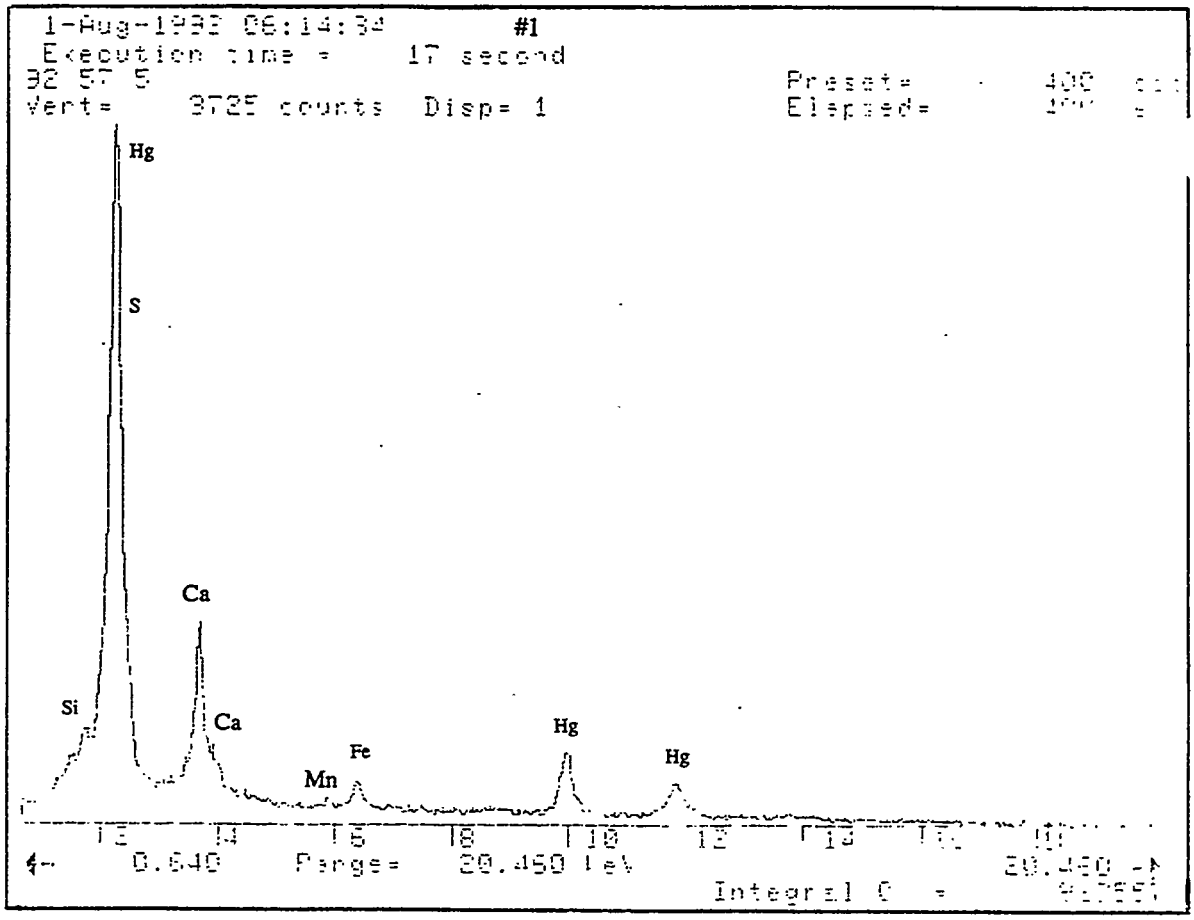

Fig. 5.11a

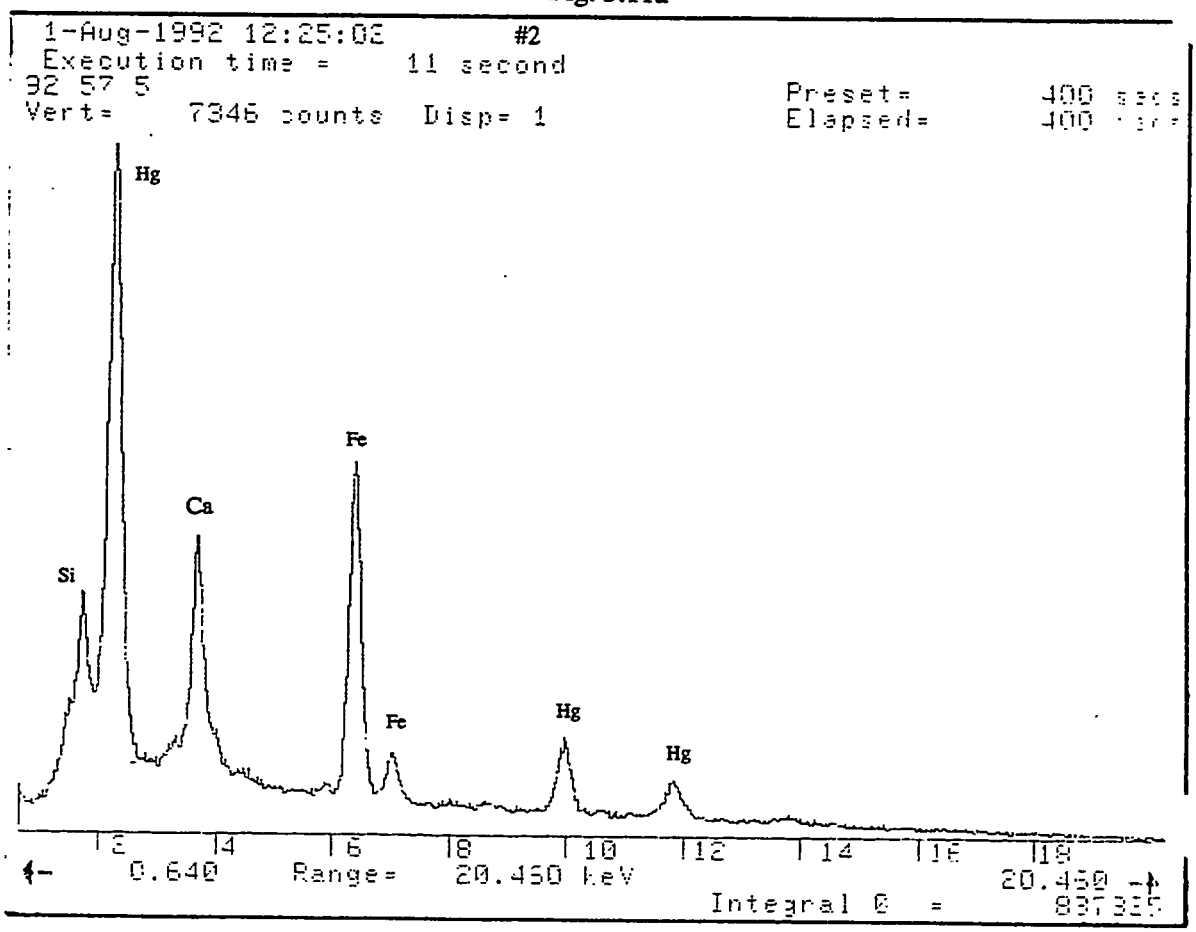

Fig. 5.11b

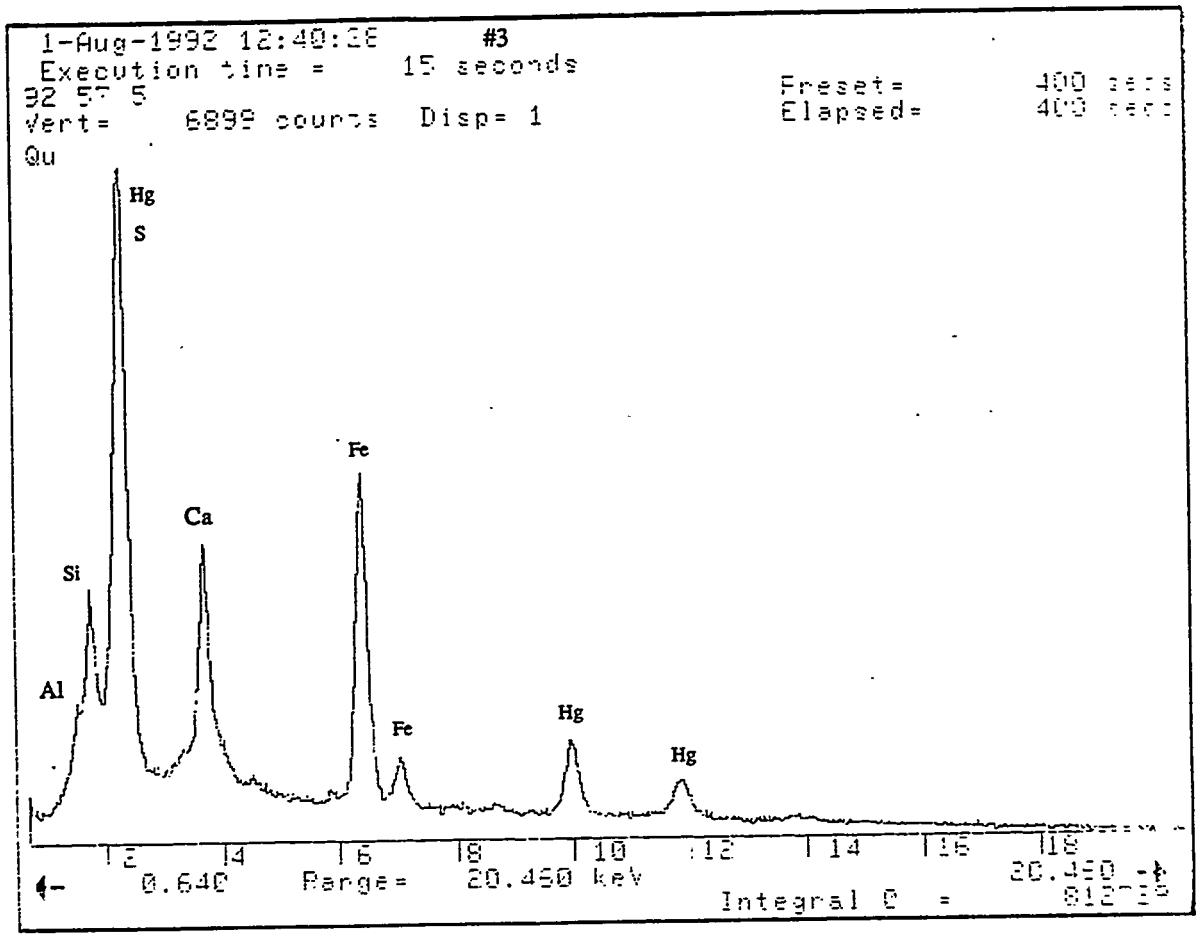
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Fig. 5.11c

Fig. 5.12

Fig. 5.13a

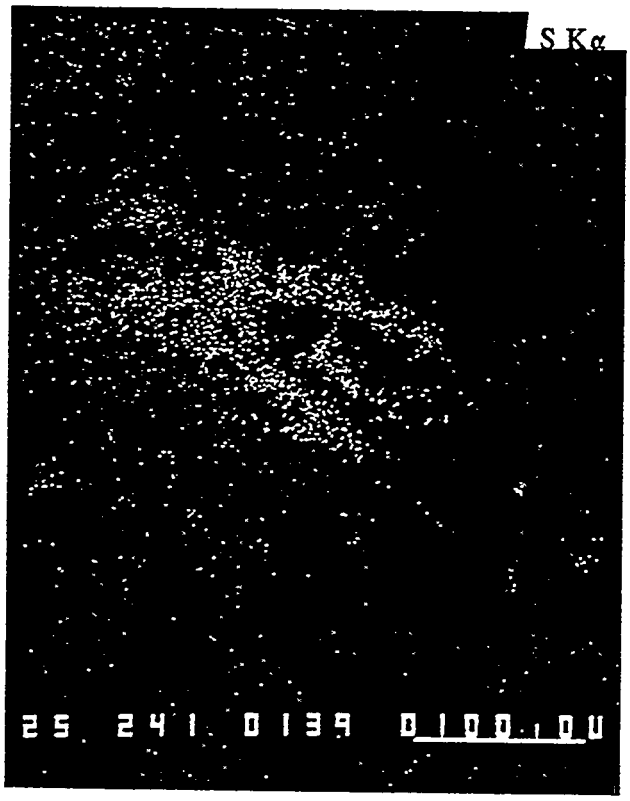


Fig. 5.13b

Fig. 5.13c

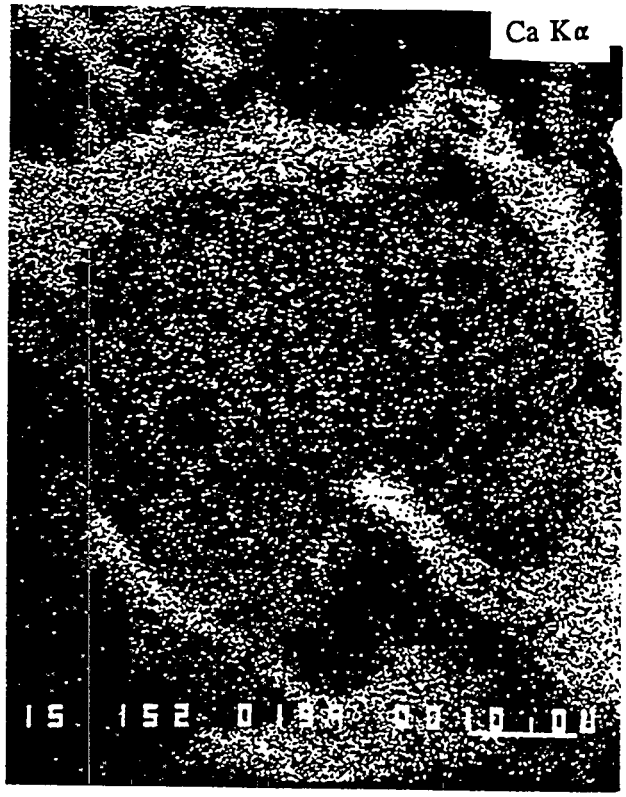
Fig. 5.13d

Fig.5.13e

Fig. 5.13f

Fig. 5.14

Fig. 5.15a



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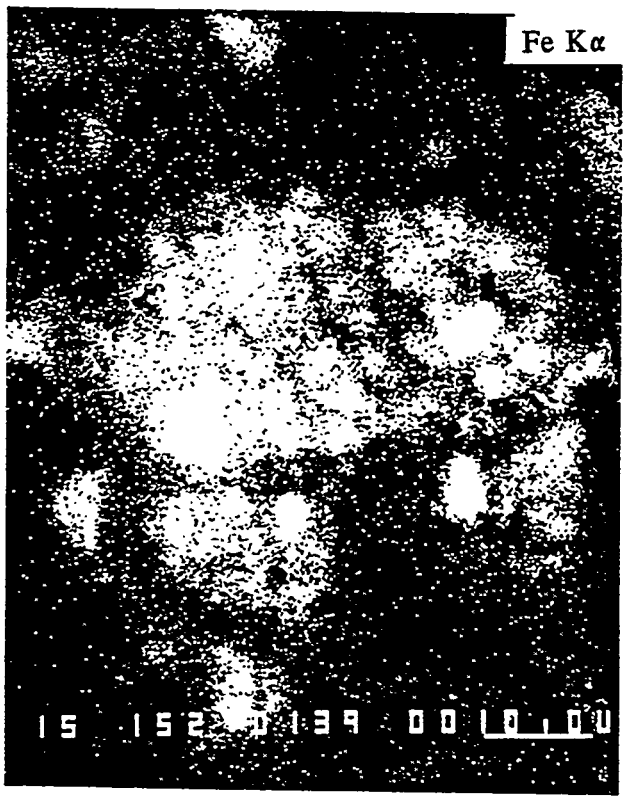

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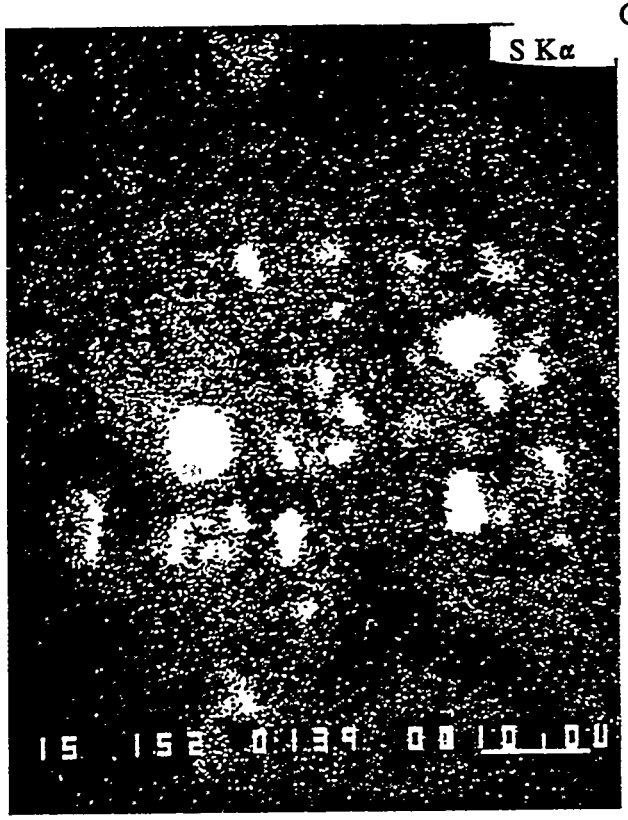
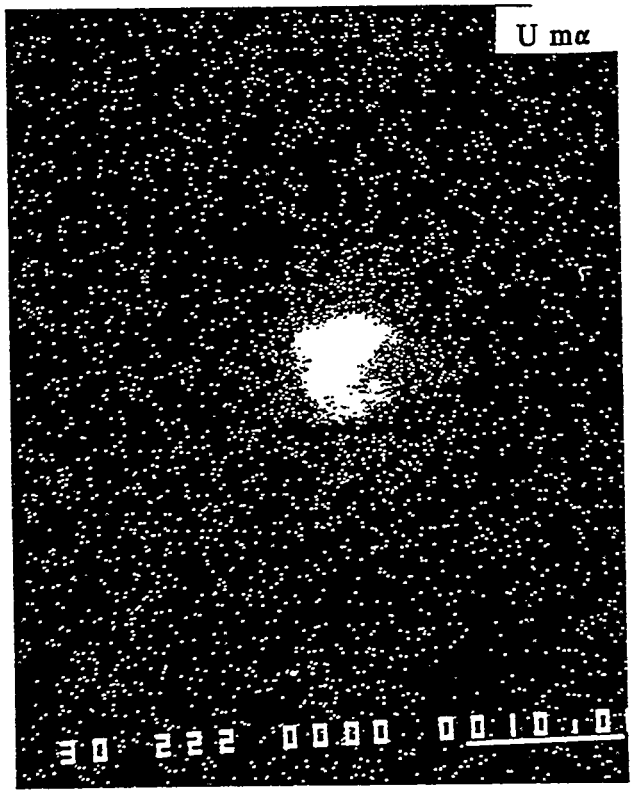


Fig. 5.15e

Fig. 5.16a



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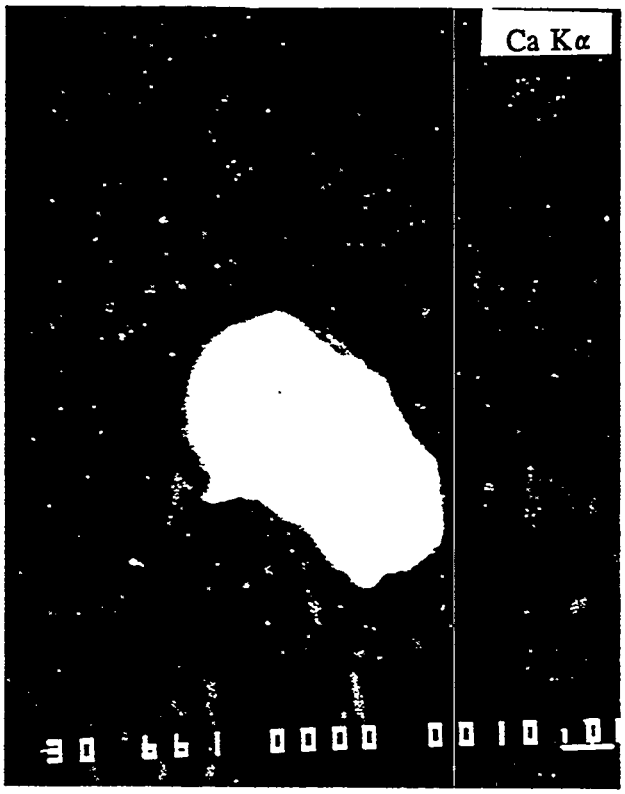

Fig. 5.17a

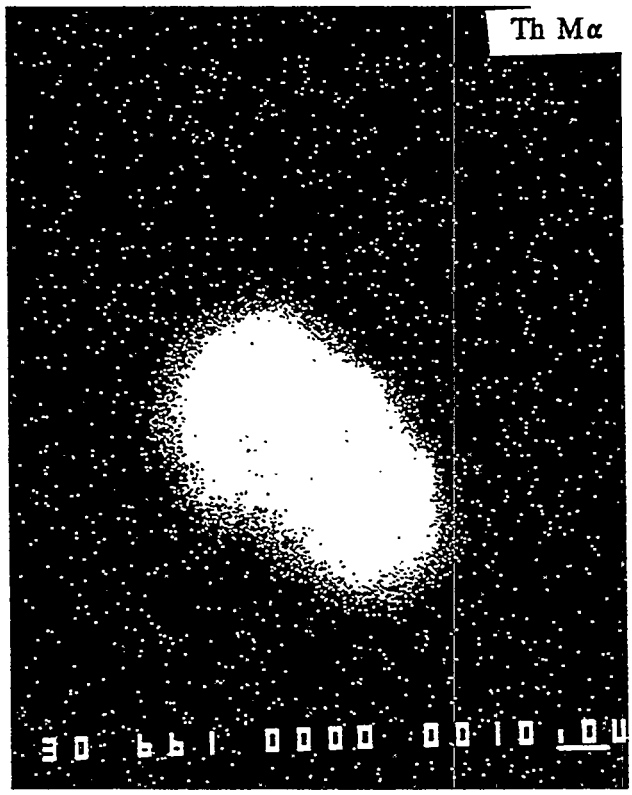

Fig. 5.17b

Mercury in Ambient Air Over Floodplain of East Fork Poplar Creek, Oak Ridge, Tennessee

Date Issued-July 1992

Prepared by

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Prepared for

U.S. Department of Energy
Office of Environmental Restoration and Waste Management
under budget and reporting code EW 20

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[1] Managed for the U.S. Department of Energy by Martin Marietta Energy Systems, Inc under Contract No. DE-AC05-84OR21400

SUMMARY

As part of a CERCLA Remedial Investigation, ambient air concentrations of mercury were measured at several locations (Figure 1) in the floodplain of East Fork Poplar Creek, Oak Ridge, Tennessee, during late summer, early fall of 1991, and spring of 1992. The monitoring sites were selected to represent proximity to areas of known high soil contamination (up to 3000 $\mu g/g$) with mercury. Two independent methods of trapping and analyzing mercury in ambient air were employed. The more sensitive method involves amalgamating mercury vapor in ambient air on a gold-coated quartz medium. Mercury absorbed to these traps is desorbed (released) by heating and passed through a highly sensitive atomic fluorescence spectrophotometer. The method is sufficiently sensitive that only small volumes of ambient air need to be passed over the absorber prior to analysis. These absorbers are used for short term monitoring (minutes to hours). The second method employs iodated activated charcoal as the mercury-trapping medium. This medium is more difficult to analyze but has the advantage that the charcoal can trap enormous quantities of mercury without significant breakthrough. The charcoal must be digested in acids and then analyzed by atomic absorption spectrophotometry. This type of trap is used for long-term monitoring (days to weeks) and thus yields an average value for mercury over the collection period.

Air samples were collected on one afternoon (August 23, 1991) using the gold absorbers at three floodplain sites and at a control site atop Chestnut Ridge (Walker Branch Watershed). In addition, two floodplain sites (designated "NOAA" and "Minit Chek" on Figure 1) were monitored continuously over a 10-week period (August 23 through November 12) using the iodated charcoal absorbers which were changed on a weekly cycle. Finally, the NOAA site was resampled at two elevations above the soil using the gold absorbers on March 17, 1992. All concentrations (range: 3.1 to 12.4 nanograms/cubic meter) were very similar to levels expected in air at uncontaminated soil sites and far below the threshold level ($\geq$1000 ng/m^3) of human health concern (Table 1, Figure 2). The time trends of weekly average concentrations showed no difference between the monitoring sites but revealed a strong dependence on average weekly air temperature (Figure 2). Comparative data for Walker Branch Watershed for a recent extended monitoring period are summarized in Figure 3. The strong seasonal pattern in ambient air mercury concentrations is obvious in this graph and reflects the important dependance of mercury volatilization on temperature. Lastly, Figure 4 summarizes mercury concentrations in air over Reality Lake in the headwaters of East Fork Poplar Creek. This graph also shows a strong seasonal dependance and illustrates that even upstream where one might expect mercury to be higher in air over the creek, the observed concentrations are low and much less than the threshold level of human health concern.

ACKNOWLEDGEMENTS

The cooperation of landowners and land occupants was essential to the success of this investigation. Mr. Mel Sturm granted permission for us to operate a monitoring station on his property behind the Minit Check market. Mr. Rick Powers, manager of the Minit Check market, allowed us egress to the monitoring station and kindly provided (gratis) electrical power for our air pump. Dr. Detlef Matt of the NOAA Atmospheric Turbulence and Diffusion Laboratory provided assistance and electrical power for our monitoring site located behind this facility.

All iodated activated charcoal absorbers were analyzed by staff in the ORNL Analytical Chemistry Division. The authors appreciate the continuing high quality analytical service and support provided by these staff, including Marion Ferguson, Stan Macintyre and John Oliver. Jim Owens of the Environmental Sciences Division loaned us low flow air pumps and performed the analysis of the gold absorbers. Jim Hendershot of the Y-12 Industrial Hygiene Department also loaned us several low flow air pumps.

TABLE 1

Results of EFPC Air Monitoring Using Gold-Coated Quartz Absorbers

Location	Date	Time	Height (m)	Air Temperature	Soil Temperature	Mercury (ng/m^3)
NOAA	8/23/91	1100-1600	0.5	25°C	-	10.9
Lysimeter	8/23/91	1100-1600	0.5	25°C	-	5.9
Minit Chek	8/23/91	1100-1600	0.5	25°C	-	5.9
Walker Branch Watershed	8/23/91	1100-1600	0.5	25°C	-	5.1
NOAA	3/17/92	1500-1600	0.17	25°C	12°C	8.1±0.4
NOAA	3/17/92	1500-1600	1.7	25°C	12°C	8.0±0.5

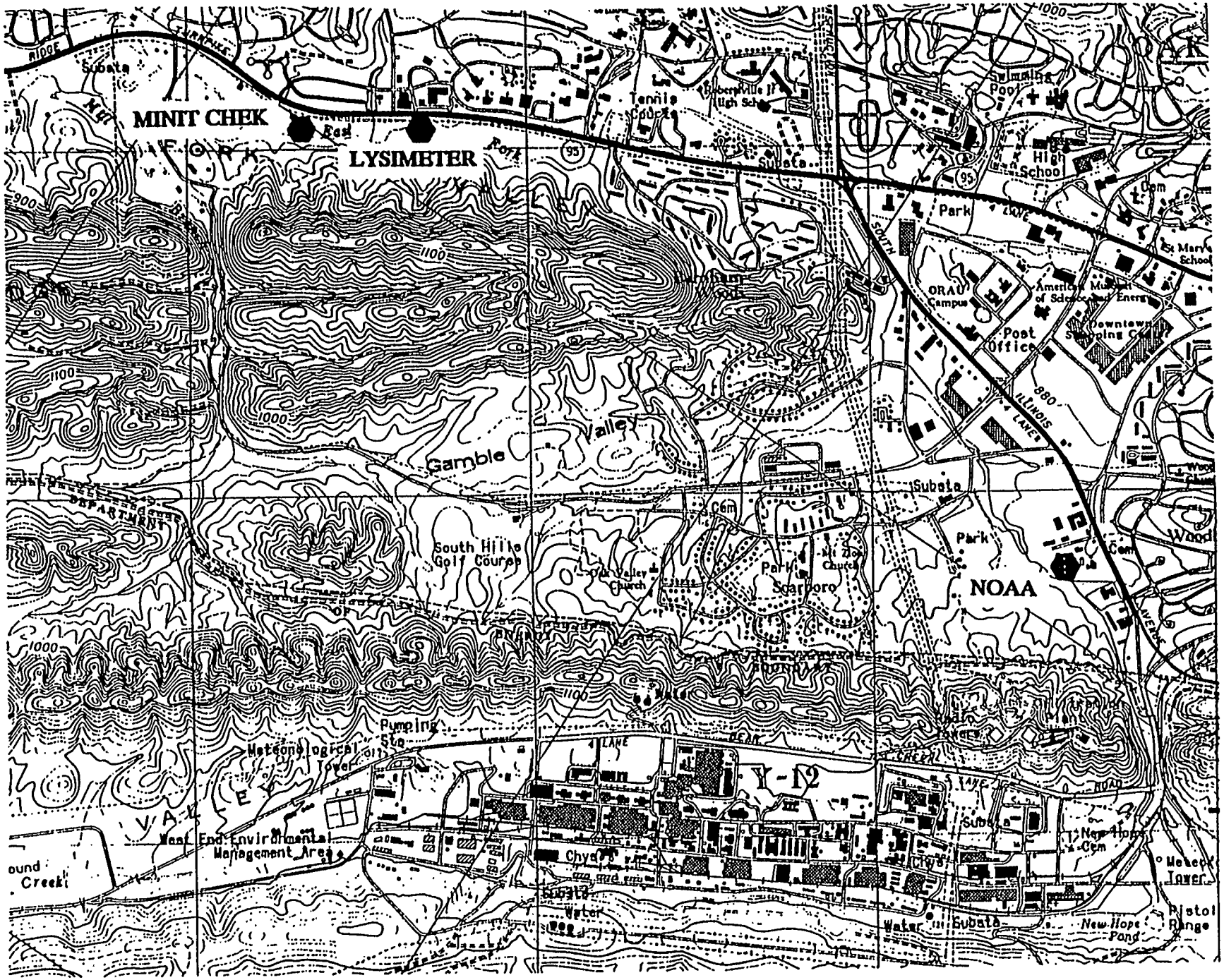

Figure 1 Locations of EFPC Floodplain Air Monitoring Sites

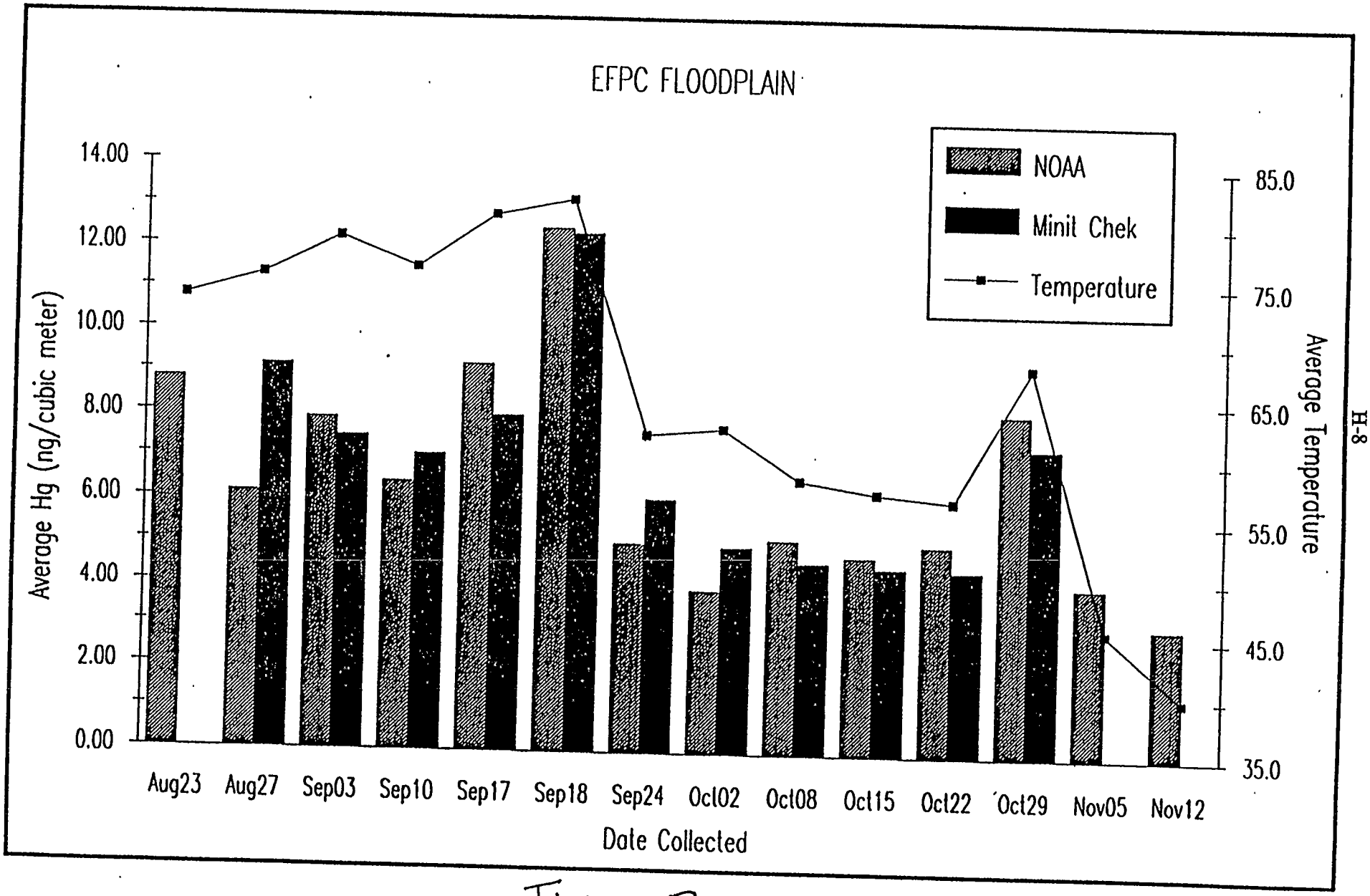
EFPC FLOODPLAIN
NOAA
Minit Chek
Temperature
Average Hg (ng/cubic meter)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Average Temperature
85.0
75.0
65.0
55.0
45.0
35.0
Aug23
Aug27
Sep03
Sep10
Sep17
Sep18
Sep24
Oct02
Oct08
Oct15
Oct22
Oct29
Nov05
Nov12
Date Collected

Figure 2

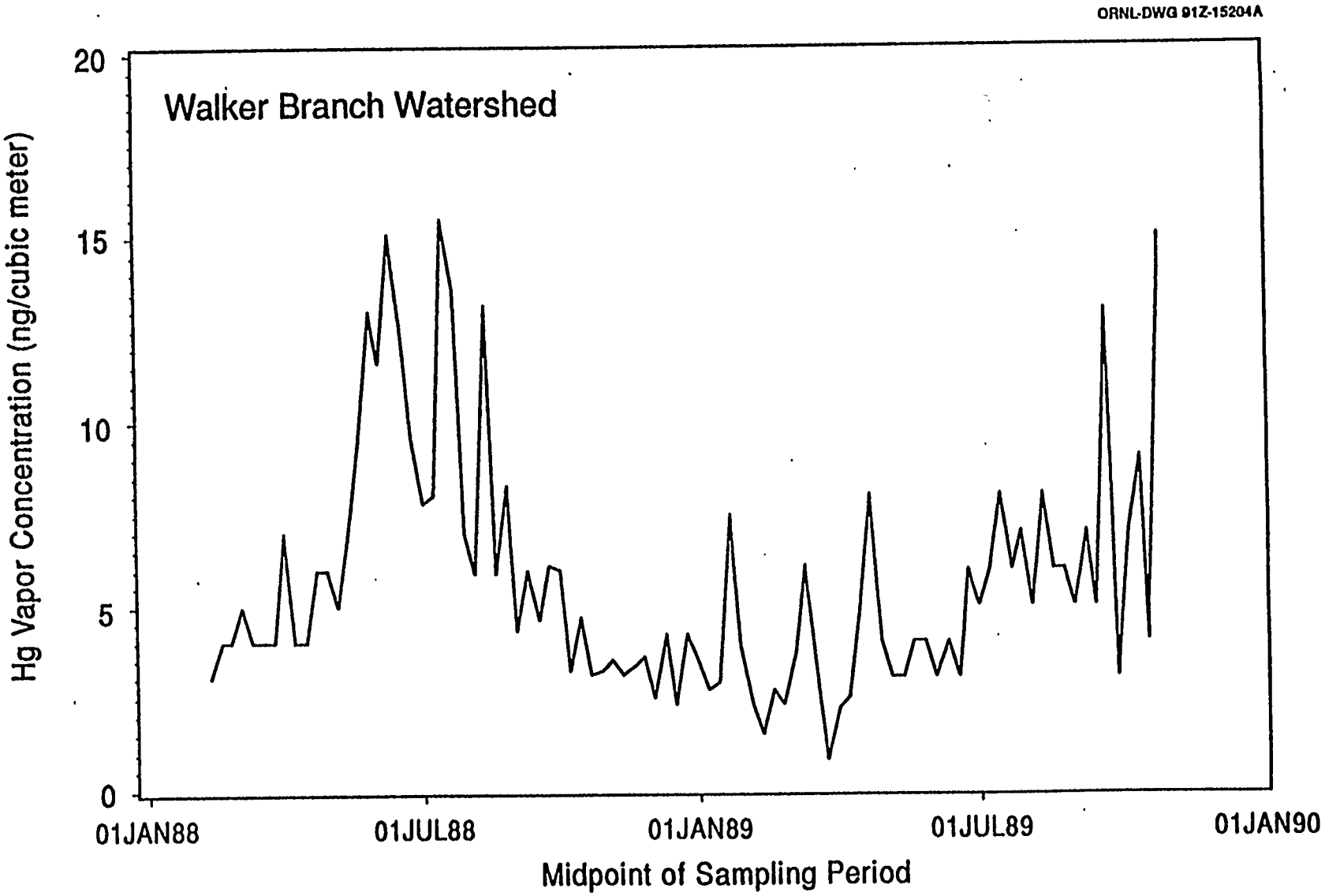
ORNL-DWG 91Z-15204A
Walker Branch Watershed
Hg Vapor Concentration (ng/cubic meter)
20
15
10
5
0
01JAN88
01JUL88
01JAN89
01JUL89
01JAN90
Midpoint of Sampling Period

Figure 3

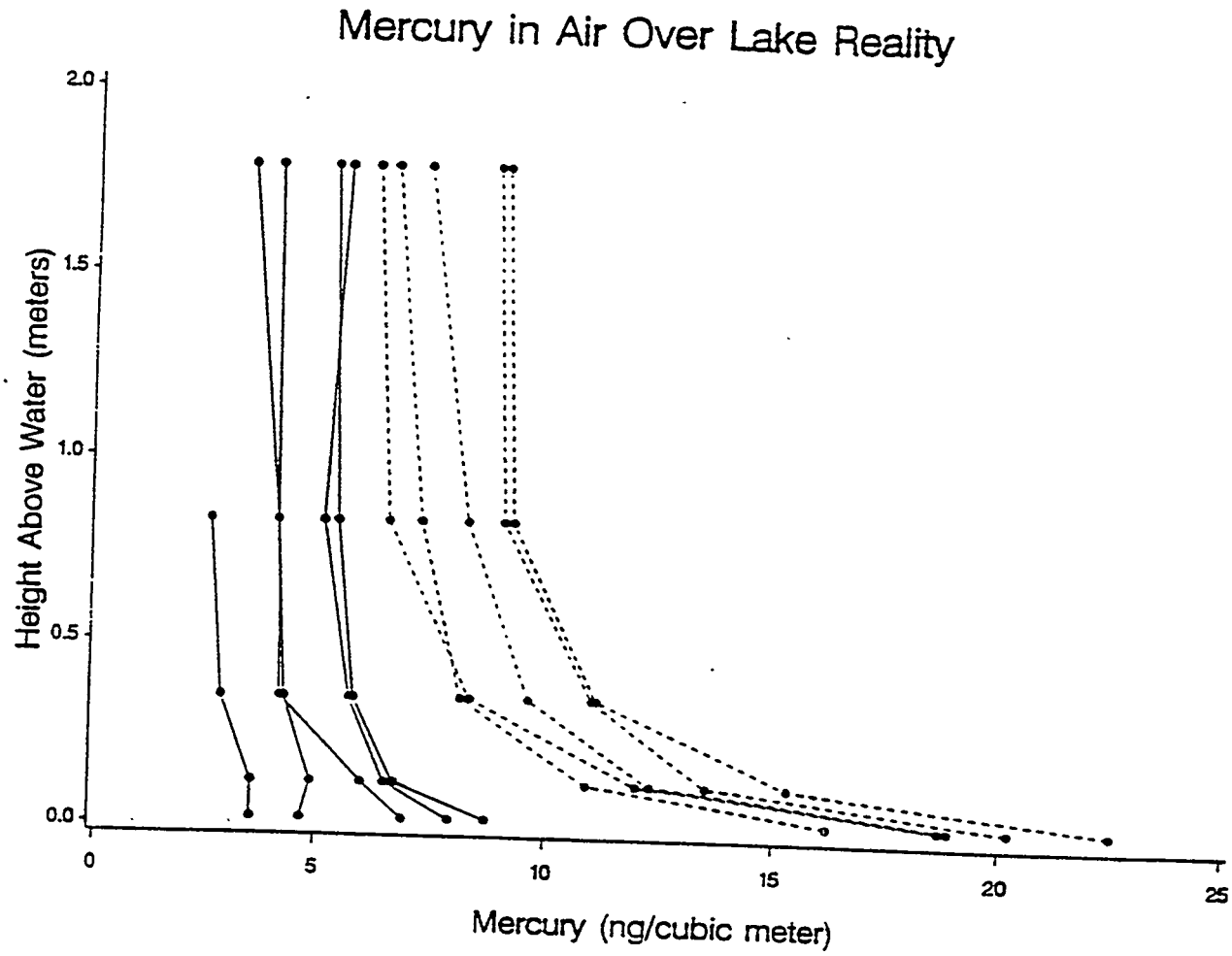

Fig. 4. Vertical concentration profiles in mercury in air over Reality Lake measured by sampling air at different heights over the lake using iodated activated charcoal absorbers. Each profile represents sampling over a 1-week period and thus integrates a variety of meterorological conditions. Profiles with solid lines were obtained between December, 1989 and February, 1990. Profiles with dashed lines were obtained between July and September 1990.

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COMPARISON OF NEUTRON ACTIVATION AND COLD VAPOR ATOMIC ABSORPTION FOR THE ANALYSIS OF MERCURY IN SOILS FROM EAST FORK POPLAR CREEK

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contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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ACRONYMS

ANOV	Analysis of Variance
BR	Bruner property
CCL	CompuChem Laboratory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CNAA	Comparative Neutron Activation Analysis
CV	coefficient of variation
CV-AA	cold vapor-atomic absorption
DOE	U.S. Department of Energy
DQO	data quality objective
EFPC	East Fork Poplar Creek
EMSL	Environmental Monitoring and Support Laboratory
EPA	U.S. Environmental Protection Agency
EPA-LV	U.S. Environmental Protection Agency-Las Vegas
GLM	General Linear Model
LCS	laboratory control sample
MDA	minimum detectable activity
MDL	method detection limit
NAA	neutron activation analysis
NCRP	National Council on Radiation Protection and Measurements
NIST	National Institute of Standards and Technology
NPL	National Priority List
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
R%	percent recovery
RCRA	Resource Conservation and Recovery Act
SAS	Statistical Analysis System
SOW	Statement of Work
XRF	X-ray fluorescence
WA	Sturm property

EXECUTIVE SUMMARY

The U.S. Department of Energy is performing a Remedial Investigation (RI) of East Fork Poplar Creek (EFPC) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priority List (NPL) for the entire Oak Ridge Reservation. As part of the RI, CERCLA requires a determination of the extent of contamination over the 670-acre area of EFPC and its floodplain. The sampling and analysis plan requires analysis of over 3000 soil/sediment samples and 1100 quality control samples. Current U.S. Environmental Protection Agency analytical methods require chemical separation and/or extraction. Losses can occur with these methods, and they are time consuming and expensive.

The proposed alternative method, neutron activation analysis (NAA), requires no chemical separation or extraction, has a higher volume capacity for throughput, and is more economical than the other methods.

The objectives of this study were to determine whether (1) NAA met specific data quality objectives (DQOs) for the analysis of total mercury (Hg) in EFPC soils, (2) NAA was equivalent to cold vapor-atomic absorption (CV-AA) for Hg analysis, and (3) the analytical method was a major source of variability in Hg concentrations measured in EFPC soils and sediments.

NAA was shown to be a sensitive technique for detecting Hg in soils, with a method detection limit of 6 μg/g, and was as accurate and precise as CV-AA for both standard and field samples. The greatest source of variability measured in the EFPC system is heterogeneity in the samples. Variability among laboratories and within laboratories was similar. The method of analysis used was the source of the least variability.

Based on the results of the analyses and tests performed on EFPC soils in this study, NAA for Hg meets all DQOs and is equivalent to CV-AA. Therefore, it is recommended that NAA be used, since it is also more economical and faster, and that more emphasis be placed on collecting additional field samples.

1. INTRODUCTION

The U.S. Department of Energy (DOE) Field Office, Oak Ridge, is performing a Remedial Investigation (RI) of East Fork Poplar Creek (EFPC), which is included on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priority List (NPL) for the entire DOE Oak Ridge Reservation (ORR). It is estimated that over 109,000 kg of mercury (Hg) were lost to the environment from operations at DOE's Y-12 Plant in Oak Ridge, Tennessee (Welch 1989). Most of the Hg was discharged to EFPC and now resides in the creek sediments and the floodplain soils. Other metals such as Zn, As, Se, Sb, Cd, and Cr and radionuclides such as ^{235}U and ^{238}U were released along with the Hg.

Determining the extent of contamination during the RI, as CERCLA requires, over the 670 acres of EFPC and its floodplain, is costly and time consuming. The sampling and analysis plan required that over 3000 soil/sediment samples and 1100 quality control samples be analyzed for these parameters. Current U.S. Environmental Protection Agency (EPA) methods for the analysis of these parameters in soils and sediments include cold vapor-atomic absorption (CV-AA) for Hg, graphite furnace-AA for As and Se, and inductively coupled plasma (ICP) for Zn, Sb, and Cd. Following chemical separation, uranium isotopes (^{235}U and ^{238}U) are most often analyzed by alpha spectroscopy.

Because these methods require chemical separation and/or extraction, some losses occur and the process is time-consuming. A typical cost for this suite of analyses is approximately $490 per sample. For 3000 samples, the cost would be about $1.5M.

An alternative analytical method, neutron activation analysis (NAA) is proposed for the EFPC samples. NAA requires no chemical separation or extraction, has a higher volume capacity for throughput, and is more economical ($184 per sample) than the other methods discussed above. This report will address only Hg, since it is the primary contaminant of concern in EFPC soils and sediments.

The purpose of this report is (1) to document how NAA meets our specific data quality objectives (DQOs) for the analysis of total Hg in EFPC soils and sediments, (2) to demonstrate that the method is equivalent to CV-AA for Hg analysis, and (3) to determine if the analytical method used is a major source of variability in Hg concentrations measured in EFPC soils and sediments.

EPA, in *Test Method Equivalency Petitions, A Guidance Manual* (EPA 1987) (herein referred to as the Guidance Manual), defines equivalency of methods as being "equal to or superior to" any of the test methods described in SW-846. This formal petition for equivalency is required under Resource Conservation and Recovery Act (RCRA) regulations, Sections 260.20 and 260.21. At CERCLA sites, EPA generally uses Contract Laboratory Program (CLP) methods for sample analysis rather than SW-846 methods used for RCRA investigations. Although the requirements of 40 *CFR* 260.21 do not specifically apply to CERCLA investigations, the Guidance Manual was used as a reference to demonstrate the equivalency of

NAA to CV-AA as described in Method 245.5 (CLP-M*) of the CLP Statement of Work (SOW) No. 7/88 (EPA January 1990) for analysis of Hg in soil/sediments.

The remaining sections of this report highlight the background for the use of NAA, identify the specific study objectives, provide an overview of NAA, address the methods and results of the study, and conclude with a summary and recommendations.

2. BACKGROUND

The primary focus of this portion of the RI was to determine both the horizontal and vertical extent of mercury contamination in EFPC and its floodplain. A field method that would roughly delineate the contaminated areas was required. Based on this delineation, samples would be collected and sent to the laboratory for more quantitative and sensitive measurements required for risk assessment.

Initially, the use of field portable techniques, such as the X-ray fluorescence (XRF), was examined to provide a screening-level determination of Hg concentrations. Experts from EPA's Environmental Monitoring and Support Laboratory (EMSL) in Las Vegas were brought in to test two different XRF instruments. A field test was performed at known areas of Hg contamination. The method did not prove viable for the moist and humid conditions in East Tennessee and the high clay content of the soils. The limitations of the more conventional EPA methods were also recognized: they were time-consuming, some losses could occur during extraction, there were problems with matrix interferences, they were costly, and it took a long time to obtain results.

Next, the NAA method was focused on because samples could be collected and analyzed as received without performing any extractions. There would be no problems with matrix interferences because it is a nuclear method rather than a chemical analysis. NAA would provide a quicker method and results could be obtained in just a few days. The detection limits available by NAA are more sensitive than the XRF, and with the quality control data, the results could be used for risk assessment.

3. OBJECTIVES OF THE STUDY

EPA defines equivalency of the method in terms of its sensitivity, accuracy, and precision (40 *CFR* 260.21). The Guidance Manual states that

> A literal interpretation of 40 *CFR* 260.21 is misleading; the proposed test method does not always have to be equal or superior (i.e., more accurate) to an EPA-approved test method — regardless of application — to be approved. Existing approved test methods are sometimes more accurate than needed for specific

[Agency] uses. In these cases, the DQOs should reflect the [Agency's] measurement needs rather than the capabilities of existing approved methods.

This is the case for measurement of Hg concentrations in EFPC soils and sediments. The CV-AA method for Hg has a Contract Required Quantitation Limit of 0.0002 μg/g, which is much lower than the specific requirements. The DQO for the sensitivity of Hg in soils was set at 12 μg/g. The State of Tennessee established a Hg guideline of 12 μg/g for risk assessment during the mid-1980s. Previous investigations identified areas of Hg contamination that were greater than or equal to 50 μg/g. Because a clean-up level for total Hg has not been identified, a detection limit of $\sim$12 μg/g based on the State's guideline has been selected.

For the two other measures of equivalency identified in the Guidance Manual (accuracy and precision) the objectives were for analysis of Hg in soils and sediments by NAA to be as accurate and precise as for the same analysis by CV-AA. These objectives are expressed in terms of both standard statistical measures and of requirements specified in the CLP SOW 7/88. Precision and accuracy will be measured using National Institute of Standards and Technology (NIST) standards as well as field samples collected from the EFPC floodplain.

3.1 DQOs FOR EFPC

The specific objectives for NAA to meet particular EFPC requirements as outlined in the EFPC Phase Ib Sampling and Analysis Plan (Radian 1992) and to demonstrate equivalency to CV-AA include:

1. **Sensitivity**

   - NAA method must be able to detect concentrations of at least 12 μg Hg/g in soil.

2. **Accuracy**

   - Accuracy of the NAA method is equivalent to or higher than that of CV-AA.
   - Accuracy of NAA measurements made of laboratory control samples (LCSs) is the same as for aqueous samples in the CLP program (80 - 120% recovery for concentrations exceeding the detection limit).
   - Accuracy of NAA measurements made of LCSs is within the 95% confidence limit of the true values.

3. **Precision**

   - Laboratory precision of NAA is equivalent to or higher than that of CV-AA.

- Laboratory replicates are within a control limit (2 standard deviations of the mean) of ±35%.
- Coefficient of variation (CV) is less than 20% for laboratory replicates.
- Overall precision of NAA is equivalent to or higher than that for CV-AA.

3.2 DEFINITIONS AND MEASUREMENT PROCESS

The definitions used throughout this report are provided below.

Equivalency - equal to or superior to corresponding CLP method in terms of:

- sensitivity (detection limits),
- accuracy, and
- precision.

Sensitivity - specification of the minimum detection limit for the method.

Accuracy - degree of closeness of the measurement to the true value. Accuracy is controlled primarily by the laboratory and is frequently reported as bias. Standards, spiked samples, and referee samples can be used to assess and control the accuracy of the results.

Precision - indicates the degree of variability in the measurements. Precision is usually measured by the standard deviation of the data. Co-located samples collected in the field may be used to indicate the overall precision of the entire measurement process. Either the field technician or the laboratory technician may further split the sample into smaller fractions. Each split is then analyzed as a measure of laboratory precision. Multiple samples may be prepared from NIST standards and measured for an estimate of precision.

Location - a tract of land adjacent to EFPC.

Station - a place established within a location.

Sampling Point - a specific point established within a station.

Sample - a representative portion of a population or area that will be used to determine quality or properties.

Aliquot - a portion or fraction of a sample.

4. THE NAA METHOD

4.1 DESCRIPTION OF NAA

The following summary of the method is taken from a paper by Philip A. Helmke, "Neutron Activation Analysis" (Helmke 1982). NAA is an analytical method that can be used for the analysis of more than 70 elements. It is useful for the measurement of total element concentrations in chemically complex materials such as soils, plants, and water because it is a nuclear technique and is not affected by the chemical state of the element of interest.

Besides being a multi-element technique, NAA has excellent sensitivity, ranging from 10^{-9} to 10^{-6} g for most elements. The results are highly accurate and precise even near the limits of detection. The method is relatively free from the effects of accidental contamination. The only time the samples are susceptible to contamination is during grinding and packaging for neutron irradiation. After the samples are irradiated, the contamination has no consequence, because only radioactive atoms are detected. Except for absorption of low-energy gamma rays by the sample, the method has few matrix effects or other interferences commonly encountered with other methods of trace element analysis.

NAA of the soil samples is carried out by the comparative neutron activation analysis (CNAA) method. In this method, an unknown sample and a standard are irradiated and radioassayed under the same conditions. The ratio of the count rates will be equal to the ratio of the masses of the element of interest. Concentrations in the unknown sample are computed by the following relationship:

$$W_x = W_s \times CR_x/CR_s = W_s/CR_s \times CR_x \quad , \tag{1}$$

where CR_x denotes the count-rate of a neutron-induced radioisotope determined for a sample containing an unknown amount W_x (μg) of the element being measured, and CR_s denotes the count-rate of the isotope determined for a standard containing a known weight W_s (μg). The quantity W_s/CR_s is a calibration factor relating to the count rate of the sample with the quantity of a given element in the sample. The calibration factor is determined by irradiation of a standard containing a known quantity of the elements of interest and measurement of the count rate of each element in the standard. The calibration standards are prepared by adding known quantities of elements to high purity silicon dioxide powder that has been shown to contain insignificant amounts of all elements determined by this method.

4.2 PROCEDURE FOR NAA OF EFPC SAMPLES

Appendix A of this report presents the actual procedure used. The method is summarized here. Samples are stored at 4°C ±2°C prior to irradiation. An entire sample is placed into a quart polyethylene bag; the moist soil is blended by being kneaded and folded in the bag. After several blendings, the sample is flattened into a pancake shape approximately 1/8 to 1/4 in. thick. The sample container (insert) is then fully loaded by being applied like a cookie cutter onto multiple portions of the flattened sample. Loaded samples are then weighed. One of the inserts is used to obtain a dry weight from which to calculate the percent solids. Field samples to be analyzed are grouped into batches of 20. In addition to these, the following seven additional quality control samples are prepared as described in the procedure in Appendix A.

1. Spiked sample
2. Duplicate sample
3. Laboratory control standard for mercury
4. Laboratory control standard for arsenic
5. Method blank
6. Laboratory control standard for initial calibration
7. Continuing calibration control sample

In addition to these quality control samples, three mercury standards in high purity silicon dioxide powder are used to provide an average for the comparative measure of Hg concentration as described in Eq. (1). Each batch of samples is irradiated for 60 s at the High Flux Isotope Reactor at Oak Ridge National Laboratory (ORNL) within 28 d after sample collection to comply with mercury holding times. The neutron flux is approximately 5×10^{13} neutrons/cm^2/s. During the reaction, gamma rays are emitted due to the capture of the free neutrons. Gamma ray spectroscopy is then used to measure the intensity of the radiation.

Following a decay period of 5 to 10 d, samples are placed in a germanium gamma-ray spectrometer for counting. Gamma spectra of each sample in each batch of samples are acquired for at least 1000 s. All samples of a given batch are counted on the same detector, and all samples are an equal distance from the center of the insert to the detector. Spectral analysis is then performed by experienced gamma-ray spectroscopists.

5. METHODS AND RESULTS

This section describes the methods, procedures, or tests used to address each of the DQOs.

5.1 SENSITIVITY

- **The method used must be able to detect concentrations of 12 μg Hg/g soil.**

Minimum detectable activities (MDAs) for Hg and the other elements were calculated as described in National Council on Radiation Protection and Measurements (NCRP) Report 58, *A Handbook of Radioactivity Measurements Procedures* (NCRP 1978). It will be briefly summarized here. Because counting intervals cannot be made indefinitely long (to reduce the background relative to the sample to zero), the counting time and background considerations determine the MDA, which is established based on probabilities of falsely detecting a signal (α) and falsely not detecting a signal (β). The assumption is made that the Poisson Law adequately describes the phenomenon of radioactive decay. For an $\alpha=\beta=0.05$, the derivation for the MDA in NCRP Report No. 58 is as follows:

$$MDA = 2.71 + 4.65\ (BG)^{1/2} \quad ,$$

where

MDA = the signal level such that a signal at or above this level is likely to be detected,
BG = the "true" background counts.

This formula assumes paired observations of total and background counts. Since the "true" background count, BG, is usually not known and an estimate is used, the computed value of the MDA is approximate for a given α and β. It should be noted that the MDA can be lowered by increasing the counting time. To obtain the desired MDA for EFPC, a counting time of 1000 s was used.

The MDA is converted to a concentration using the Neutron Activation Calculation below:

$$MDL(ppm) = \frac{A_t}{Oo(1-e^{-2t_1})(e^{-2t_2})} \times \frac{Atomic\ Wt \times 10^6}{6.02E23 \times Sample\ Wet\ Wt \times \%Solids} \quad , \qquad (2)$$

where

O	= neutron fluence rate = Flux = $n/cm^2 \cdot sec$,
n	= number of target atoms,
o	= cross section (cm^2) - barns $\times 10^{-24}$,
λ	= decay constant for product,
t_2	= decay time (count date and time - irradiation date and time),
t_1	= irradiation time,
A_t	= activity (Bq) at time of counting.

If

O = thermal flux = O_{Th},

then

o = $o_{Th} + R \times Io$,

where

R	= ratio of the thermal-to-epithermal flux,
I_o	= Resonance integral for the target element.

Examination of Eq. (2) reveals which factors affect the sensitivity of the measurement. Using this equation provides an estimate of the absolute concentration of Hg in the samples, but in practice, the comparative method shown in Eq. (1) is used. If the time between irradiation of comparative standards and samples is minimal, these other factors should be the same for the standards and the samples and, therefore, will not affect the results.

For EFPC samples, using the methods described for NAA, the method detection limits (MDLs) for each element are shown in Table 1. Because the MDL of Hg was 6 $\mu g/g$, the DQO of 12 $\mu g/g$ was achieved.

5.2 ACCURACY

- **The accuracy of the NAA method is equivalent to or higher than that of CV-AA.**

Two NIST standards were obtained for this study with known concentrations of 50 ± 2 $\mu g/g$ (NIST 8407) and 107 ± 2 $\mu g/g$ (NIST 8408). Portions of these dried and sieved standards were divided into 10 equal portions: 5 for NAA analysis; 5 for CV-AA analysis. Dried weights for each standard for NAA analysis ranged from 0.62 g to 0.71 g, while those for CV-AA ranged from 0.11 g to 0.25 g. The Student's T-Test was used to compare the accuracy of both the CV-AA and NAA measurements to the known standards and to compare the CV-AA results to the NAA results. Table 2 shows the results of both analyses.

Table 1. MDLs (μg/g) for elements

Element	NAA	Other standard method[a]
Cr	40	0.01
Zn	180[b]	0.02
As	10	0.01
Se	24	0.005
Sb	0.08	0.06
Cd	N/A[c]	0.005
Hg	6	0.0002
^{235}U	0.02	
^{238}U	8	

[a]Zn, Sb, Cd, Cr by ICP; Hg by CV-AA; As, Se by graphite furnace - AA; ^{235}U and ^{238}U by chemical separation and alpha spectroscopy.
[b]Will depend on the presence of Sc.
[c]Not possible to measure Cd with NAA as described.

Table 2. Comparison of NAA and CV-AA measurements to known standards

Standard	Analysis	Results (μg/g) of replicates					Mean	Standard deviation
NIST 8407	NAA	47.9	51.7	50.3	57.7	53.5	52	3.7
	CV-AA	50	41	46	49	49	47	3.7
	Standard						50	2
NIST 8408	NAA	91.5	89.8	106.3	94.1	105.5	97.4	7.9
	CV-AA	104	90	107	98	93	98	6.4
	Standard						107	2

For NIST 8407, the mean concentration as measured by NAA was 52 with a standard deviation of 3.7, while the mean for CV-AA was 47 with a standard deviation of 3.7. The mean concentration of NIST 8407 as measured using NAA was not significantly different from the true value. Based on the Student's T-test, it can be concluded that there is no significant difference between the mean concentration of Hg measured by NAA and CV-AA.

Comparisons of mean concentrations of NIST 8408 to the known value indicated that both the NAA and the CV-AA methods underestimated the true value. There were no significant differences between the mean concentrations as measured with NAA and CV-AA.

- **The accuracy of NAA measurements made of LCSs is the same as for aqueous samples in the CLP program (80 - 120% recovery for concentrations exceeding the detection limit).**

The Data Validation Guidelines for Inorganic Analysis (EPA July 1988) evaluate the percent recovery (R%) of LCSs. For aqueous solutions, the R% for CV-AA must be within 80 to 120% to be acceptable. No R% is given in the guideline for solid samples. The acceptable range of recovery of solid samples is given when the standard is sent from EPA-Las Vegas (EPA-LV). Because these standards came from NIST and not EPA-LV, there were no acceptable limits of R%. To determine whether the R%s observed for samples analyzed by both NAA and CV-AA were acceptable, the limits were set at those for aqueous solutions, 80 and 120%, which would be expected to be narrower bounds than those for solid samples. The bounds are narrower for aqueous samples because they are more homogeneous than solid samples. Much of the variability in the sample results for solid samples may be attributed to variability in the matrix. However, these control standards were dried and sieved and were relatively homogenous. The R% is calculated as follows:

$$R\% = Value/STD \times 100 ,$$

where STD is the known concentration (e.g., 50 μg/g) and Value is the measured value in an aliquot (e.g., 40). For this example the R% is 40/50 × 100 = 80%.

To be consistent with the CLP approach, the R% is calculated for each method for each aliquot shown in Table 2. These results are shown in Table 3.

Table 3. Percent recoveries in laboratory control standards for NAA and CV-AA

Standard	Range of R% for each method	
	NAA	CV-AA
NIST 8407	96-115	82-100
NIST 8408	84-99	84-100

For NIST 8407, the NAA R% ranged from 96 to 115%, while for CV-AA, it ranged from 82 to 100%. For NIST 8408, the NAA R% ranged from 84 to 99%, and the CV-AA R% ranged from 84 to 100%. All R%s were within the 80 to 120% control limit specified by the CLP data validation guidelines. From these results and the comparisons among the methods, it can be concluded that the accuracy of NAA is the same as that of CV-AA.

- **Accuracy of NAA measurements made of LCSs is within the 95% confidence limit of the true values.**

The Standard Operating Procedure for NAA analysis of mercury in soil requires the analysis of one NIST standard for the analysis of one NIST standard for every 20 field samples analyzed. For this program, 146 standards were analyzed: 73 NIST 8407 and 73 NIST 8408. Table 4 summarizes these results. For NIST 8407, the mean of the 73 samples was 50 μg/g and

Table 4. Comparison of laboratory control standards to known standards using NAA

Standard	Known Value (μg/g)	Number of Samples	Sample mean (μg/g)	Standard Deviation	Lower 95% confidence limit on mean	Upper 95% confidence limit on mean
NIST 8407	50	73	50	7	48	52
NIST 8408	107	73	97	12	94	100

the lower and upper 95% confidence limits on the mean were 48 μg/g and 52 μg/g, respectively. There were no significant differences in the Hg concentrations measured in NIST 8407 and the true value of 50 μg/g. For NIST 8408, the mean Hg concentration was 97 μg/g and the lower and upper confidence limits were 94 μg/g and 100 μg/g, respectively. This average Hg concentration is significantly lower than the true value of 107 μg/g. Based on these results, the NAA method is accurate at the lower concentration (50 μg/g) and biased low (about 9%) for the higher concentration (107 μg/g). However, results for the analysis of NIST 8408 using CV-AA were not significantly different than those using NAA (see Table 2). Other studies indicate that analysis of solid LCSs for Hg using CV-AA resulted in a negative bias of 26.4% (White 1986).

5.3 PRECISION

- **Laboratory precision of NAA is equivalent to or higher than that for CV-AA.**

Precision was measured using the five replicates (see Table 2) of the two NIST standards and on actual field samples. Results are shown in Tables 5 and 6.

Table 5. Estimates of laboratory precision for standards

Sample	Method	Mean	Standard deviation
NIST 8407	CV-AA	47	3.7
	NAA	52	3.7
	Known	50	2.0
NIST 8408	CV-AA	98	6.4
	NAA	97.4	7.9
	Known	107	2

Table 6. Estimates of laboratory precision for field samples

Sample[a]	Method	Results (μg/g) of replicates					Mean	Standard deviation
BR 02 E	NAA	240	260	183	280	227	238	37
	CV-AA	346	324	259	235	398	312	66
BR 02 W	NAA	17	12	6	20	9	12.8	5.7
	CV-AA	35	16	28	25	36	28	8
BR 05 N	NAA	472	460	459	450	477	464	11
	CV-AA	676	533	325	800	316	530	213

[a]See Fig. 2.

Precision estimates for NAA are the same as those for CV-AA for the 50 μg/g standard, but slightly higher for the 107 μg/g standard. These estimates indicate that the variability is similar for the two methods.

ORNL estimated the mean and standard deviation of 73 LCSs of NIST 8407 and 73 LCSs of NIST 8408 as part of the procedure for analyzing actual field samples. For the 50 μg/g standard, the standard deviation was 7 μg/g and for the 107 μg/g standard, the standard deviation was 12 μg/g (Table 4).

Use of the field samples may give a more representative indication of the precision that can be expected in the laboratory when wet, heterogeneous soil samples are collected. Table 6 provides the mean and standard deviation for field samples split into 10 replicates and analyzed by NAA and CV-AA methods.

For each sample analyzed, the precision of NAA was better (the standard deviation was smaller) than that of CV-AA. One of the advantages of the NAA method is that a larger sample is analyzed than in CV-AA. For NAA, a gram or more of the entire sample is irradiated and counted. For CV-AA, only 0.1 g is used. The sample is then extracted and the extract is analyzed for Hg. Losses due to extraction may occur. Although each sample represents only a fraction of the area of interest, the NAA sample analyzed is about 10 times larger than the CV-AA sample.

- **Laboratory replicates are within a control limit (2 standard deviations of the mean) of ±35%.**

Control limits as described by EPA for the CLP program (EPA July 1988) were calculated for the measurements on the five replicates (see Table 2) of the two NIST standards. Comparing all pairs of replicates, the range of the measured control limit went from 0 to 20% for CV-AA and from 2.7 to 19% for NAA for NIST 8407. Results were similar for NIST 8408, as shown in Table 7. All laboratory replicates were within the required control limit.

Table 7. Measured control limits for laboratory standards

Sample	Method	Range of measured control limit (%)	Required control limit (%)
NIST 8407	CV-AA	0 - 20	35
	NAA	2.7 - 19	35
NIST 8408	CV-AA	2.8 - 17	35
	NAA	0.76 - 17	35

- **CV is less than 20% for laboratory replicates.**

CV indicates the amount of variability in replicates relative to the mean. It is calculated as the standard deviation divided by the mean and multiplied by 100 [(Std dev/Mean) × 100]. Table 8 gives the CVs for the analysis of the NIST standards by both NAA and CV-AA. The CV was similar for both concentrations analyzed. They were similar for both CV-AA and NAA.

Table 8. CV for laboratory standards

Sample	Method	CV (%)
NIST 8407	CV-AA	7.8
	NAA	7.1
	Known	4
NIST 8408	CV-AA	7.3
	NAA	8.1
	Known	1.9

- **Overall precision of NAA is equivalent to or higher than that of CV-AA.**

To estimate concentrations of Hg in soils and sediments with any given precision, it is necessary to identify to all the sources of variability within the sampling program and estimate the contribution of each source. The sources of variability identified for EFPC are the same as those for any field program and include: (1) among locations, (2) within locations, (3) within stations, (4) among laboratories, (5) within a laboratory, and (6) among methods. Determination of variation among methods was the primary objective for this study. However, it was necessary to quantify all other sources so that the precision among methods could be determined.

Two **locations** [the Bruner (BR) and Sturm (WA) properties] on EFPC were selected for sample collection (Fig. 1). These areas were selected because samples were collected from transects at these locations during two previous studies, and estimates of Hg concentrations were available. These locations were also chosen because the Hg levels were above the MDL, and measurements could be made more precisely. (At or near the MDL, the variability in the measurements is large in proportion to the measurement.)

Within each **location**, two to three **stations** were selected along the transect for sample collection. Within each station, three or four **samples** were collected by offsetting the station 20 to 25 ft. This configuration is shown in Fig. 2. To provide sufficient sample volume, up to three

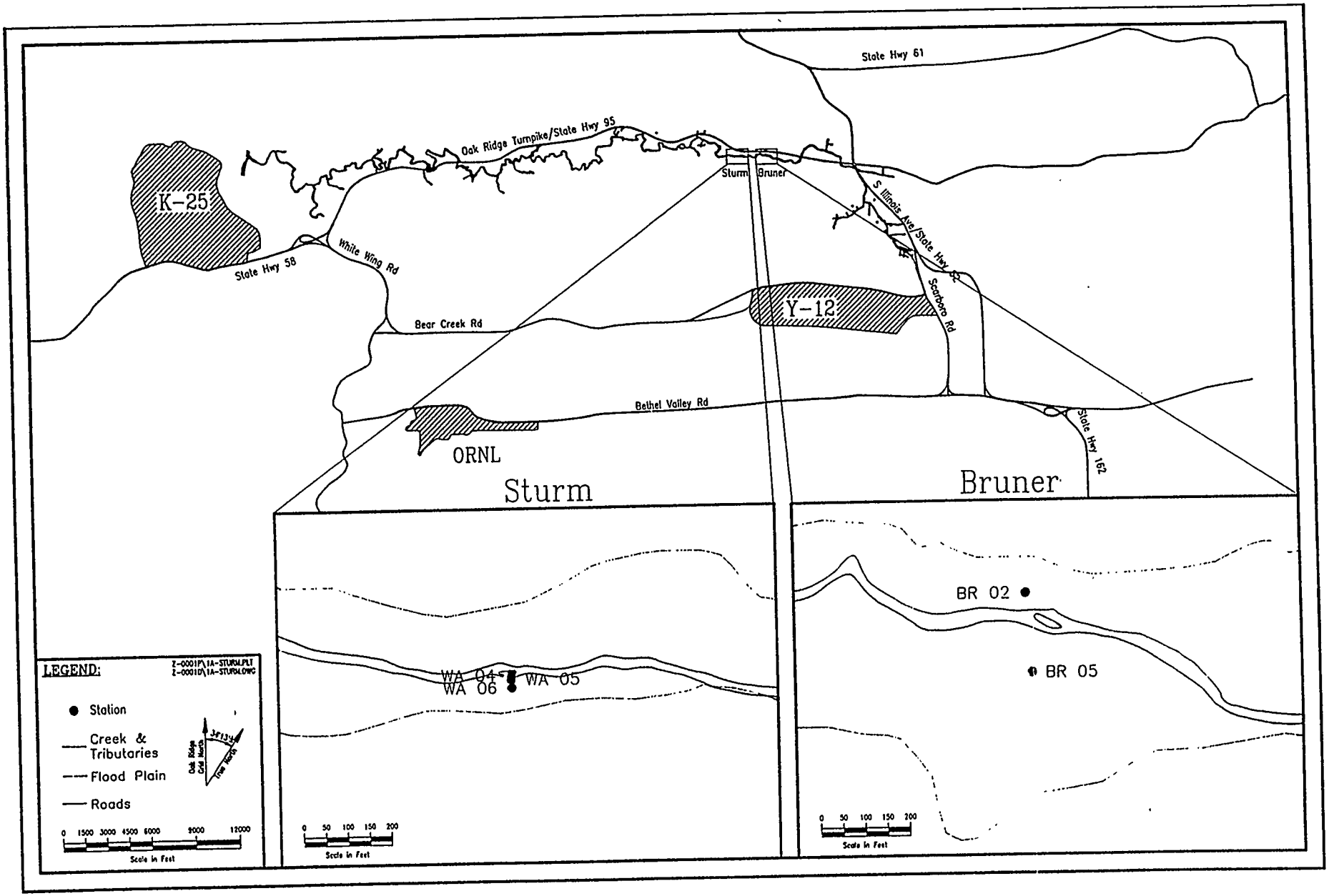

Fig. 1. EFPC soil sampling locations for Hg analysis.

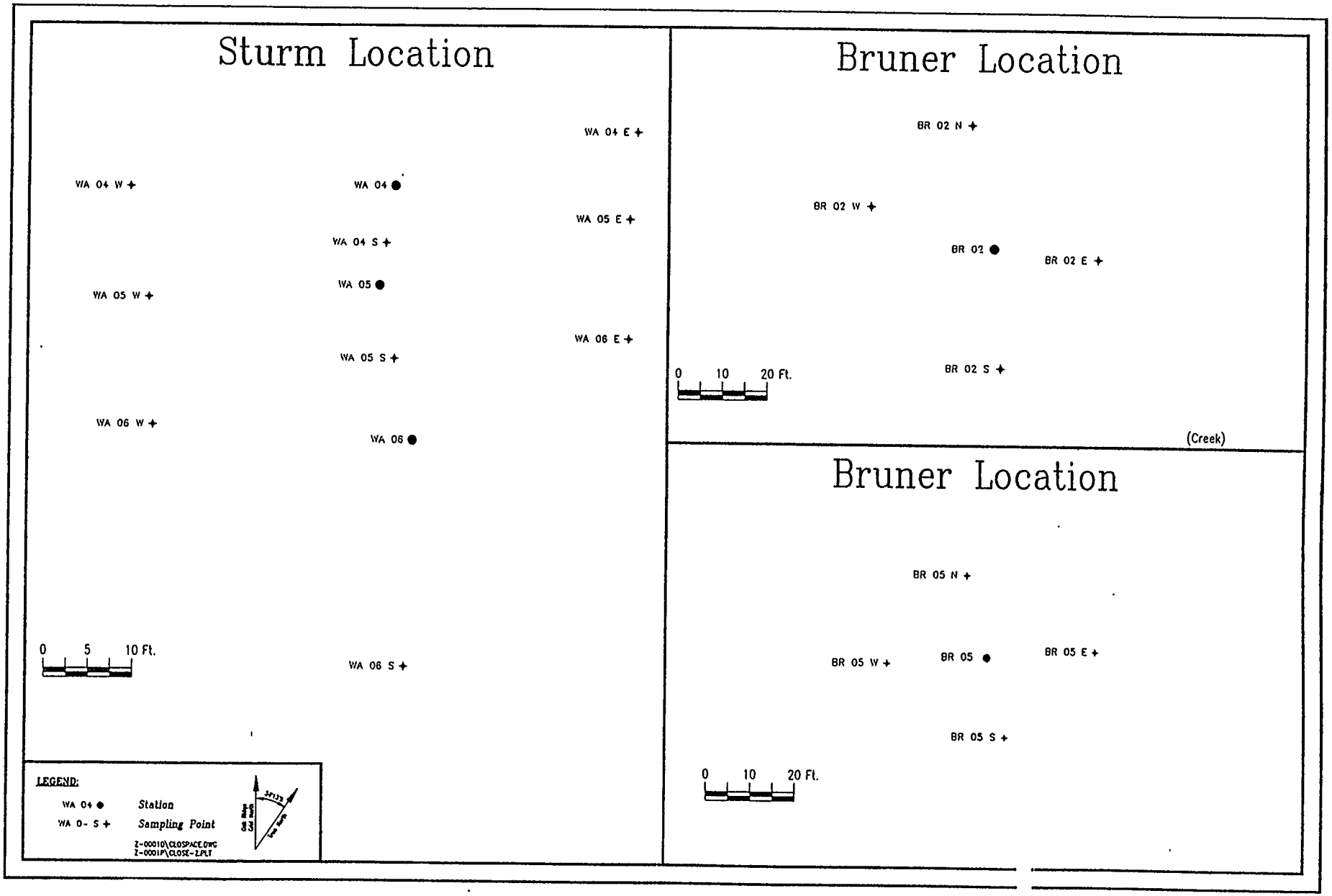

Fig. 2. Configuration of locations, stations, and sampling points for collection of EFPC soils for Hg analysis.

bucket augers were extracted from a depth of 1 ft at each sampling point. Following a standardized procedure, all samples from the sampling point were placed into a stainless steel bowl and homogenized with a stainless steel spoon. The homogenized sample was divided by the field team into nine approximately equal portions (subsamples), with each portion placed into a 500-mL plastic container. Five of the subsamples from each sampling point were distributed as follows: 2 to ORNL for CV-AA (34 total); 2 to CompuChem Laboratory (CCL) for CV-AA (34 total); and 1 to EPA-EMSL for CV-AA (17 total).

Aliquots were selected from each subsample by the laboratory and analyzed by CV-AA on an "as-received" basis, with no further preparation by ORNL and CCL. ORNL, CCL, and EPA used CLP-M* Method 245.5 from SOW No. 7/88 for Inorganic Analyses (EPA January 1990). The sample preparation by EPA differed from the other laboratories. EPA dried the sample for 72 h at room temperature, crushed it to < 2 mm, tumbled it for 1 h, and then homogenized it. One subsample was removed for CV-AA analysis. ORNL and CCL met the mercury holding times; EPA did not. These results were used to test for differences in Hg concentrations among laboratories using CV-AA.

From each 500-mL sample container, ORNL subsequently withdrew two more subsamples for NAA. Each of the subsamples was prepared as described in Sect. 4.1, "Description of NAA." The ORNL data on both the CV-AA and NAA results were used to test for differences between the methods used. Figure 3 shows the nested arrangement of samples.

Finally, from three of the BR sampling points, a sample was drawn and homogenized in the laboratory as described in Sect. 4.1. From the fully homogenized sample, 10 subsamples were withdrawn by ORNL, 5 of which were analyzed by CV-AA and 5 by NAA. Figure 4 shows the nested arrangement of these samples.

The tests were designed to measure the overall variability in the EFPC system, including that:

- among locations (two locations: BR and WA),
- within a location (stations within each location),
- within a station (multiple sampling points within a station),
- among analytical laboratories (ORNL, CCL, and EPA),
- within a laboratory (ORNL and CCL only), and
- among analytical methods (NAA and CV-AA).

The software employed was the Statistical Analysis System (SAS), Version 6.03, and the procedure used was the General Linear Model (GLM). Following the ANOV, a Duncan's Multiple Range Test was performed to determine where there were significant differences.

Test 1 looked at the differences among the laboratories in CV-AA results. It also determined the variability due to differences in locations, stations, and sampling points. The model used for this test was as follows:

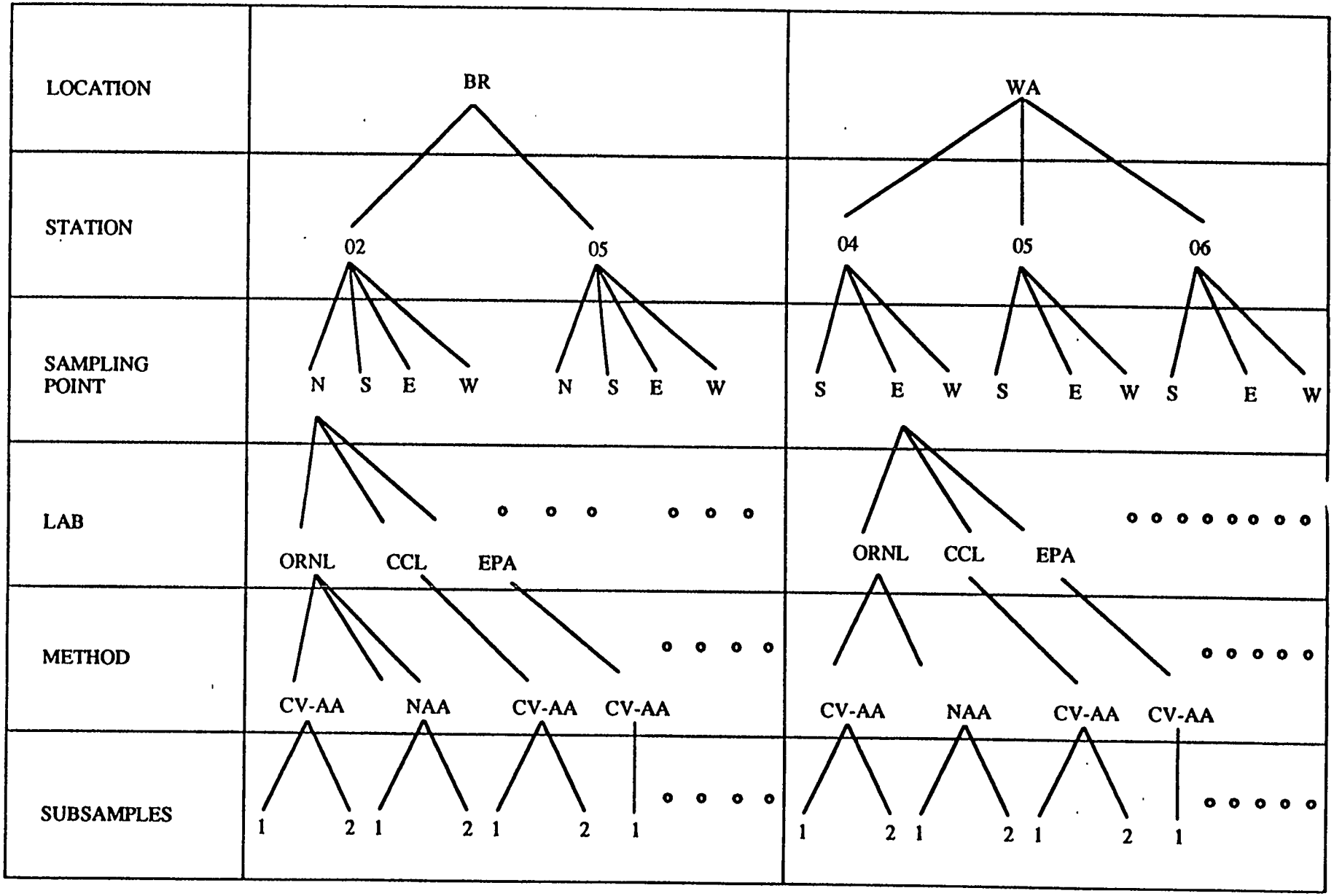

Fig. 3. Nested sampling design used for estimating Hg concentrations in EFPC soil samples.

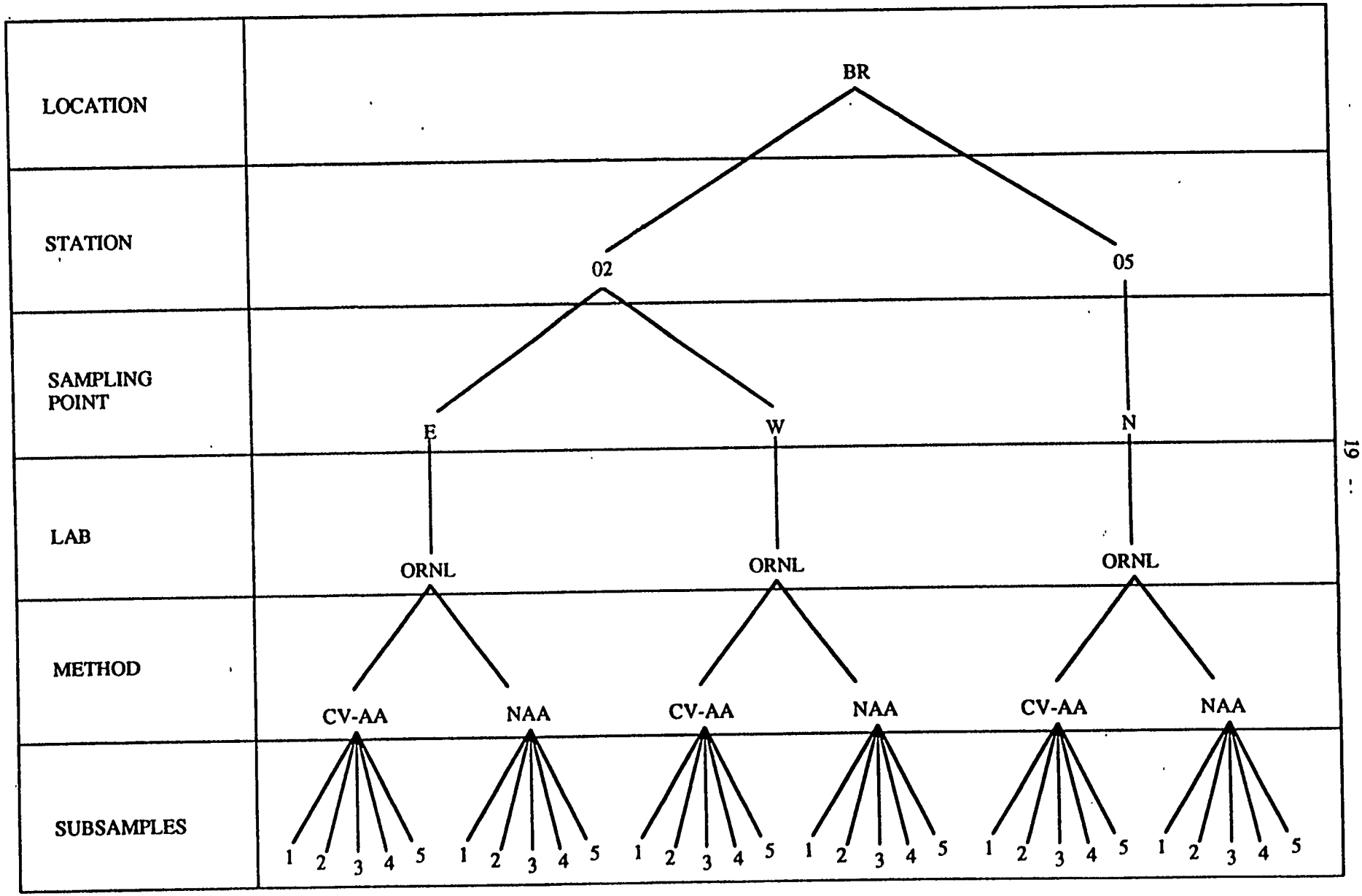

Fig. 4. Nested sampling design used for estimating Hg concentration in EFPC soils after further homogenization.

Hg conc = Location + Location (station) + Location*station (sample) + Lab.

[Read "location (station)" as "stations within location" for a nested arrangement and "location*station" as a "location-by-station interaction" in a factorial design.]

Test 2 looked at differences among the methods by comparing ORNL's results in the following model:

Hg conc = Location + Location (station) + Location*station (sample) + Method.

Test 3 determined the within-laboratory variability for each method in the following models:

Hg conc = Location + Location (station) + Location*station (sample).

This model was used for ORNL CV-AA (Test 3A), for CCL CV-AA (Test 3B), and for ORNL NAA (Test 3C).

Test 4 measured differences among the methods in samples that had the same level of homogenization. The data used were from the three sampling points at the BR location. The following model was employed:

Hg conc = Station Station (sample) Method.

Hg concentrations for the field samples used in Tests 1 to 3 are shown in Table 9. Data for the soils further homogenized and evaluated in Test 4 are shown in Table 10.

Hg concentrations from the BR and WA locations are shown graphically in Figs. 5 and 6, respectively.

One final test was to compare mercury concentrations as measured with CV-AA and NAA in actual field samples. After the NAA analysis of actual field samples, one sample was randomly selected out of each 5 batches of samples (one sample out of each 100 samples) and analyzed five aliquots from the selected sample by both NAA and CV-AA. The first sample found in which the original Hg concentration was equal to or greater than 10 mg/kg was selected. For each set of five batches, a random number between 1 and 5 was chosen to determine which batch to sample. Next a zero or one was selected: if a one was drawn the first sample was selected; if a zero were selected, then the search began with the sample at the end of the batch and worked backward.

Samples were prepared for analysis according to the procedure given in Appendix A of this report. Samples that were dry were shaken and small particles of soil picked randomly around the sample were added to the rabbit insert until it was full. Moist samples were massaged

Table 9. Hg concentrations in EFPC soils measured using NAA and CV-AA methods

Location	Station	Sample	Method	Lab	Subsample	Hg (μg/g)
BR	02	E	CV-AA	CCL	1	276.0
BR	02	E	CV-AA	CCL	2	432.0
BR	02	E	CV-AA	EPA	1	164.0
BR	02	E	CV-AA	ORNL	1	150.0
BR	02	E	CV-AA	ORNL	2	162.0
BR	02	E	NAA	ORNL	1	153.0
BR	02	E	NAA	ORNL	2	238.0
BR	02	N	CV-AA	CCL	1	63.0
BR	02	N	CV-AA	CCL	2	80.0
BR	02	N	CV-AA	EPA	1	55.0
BR	02	N	CV-AA	ORNL	1	65.0
BR	02	N	CV-AA	ORNL	2	85.4
BR	02	N	NAA	ORNL	1	95.0
BR	02	N	NAA	ORNL	2	101.0
BR	02	S	CV-AA	CCL	1	414.0
BR	02	S	CV-AA	CCL	2	620.0
BR	02	S	CV-AA	EPA	1	412.0
BR	02	S	CV-AA	ORNL	1	292.0
BR	02	S	CV-AA	ORNL	2	376.0
BR	02	S	NAA	ORNL	1	466.0
BR	02	S	NAA	ORNL	2	258.0
BR	02	W	CV-AA	CCL	1	24.0
BR	02	W	CV-AA	CCL	2	43.0
BR	02	W	CV-AA	EPA	1	22.0
BR	02	W	CV-AA	ORNL	1	14.9

Table 9 (continued)

Location	Station	Sample	Method	Lab	Subsample	Hg (μg/g)
BR	02	W	CV-AA	ORNL	2	26.0
BR	02	W	NAA	ORNL	1	38.0
BR	02	W	NAA	ORNL	2	13.0
BR	05	E	CV-AA	CCL	1	578.0
BR	05	E	CV-AA	CCL	2	586.0
BR	05	E	CV-AA	EPA	1	616.0
BR	05	E	CV-AA	ORNL	1	371.0
BR	05	E	CV-AA	ORNL	2	452.0
BR	05	E	NAA	ORNL	1	420.0
BR	05	E	NAA	ORNL	2	358.0
BR	05	N	CV-AA	CCL	1	382.0
BR	05	N	CV-AA	CCL	2	821.0
BR	05	N	CV-AA	EPA	1	720.0
BR	05	N	CV-AA	ORNL	1	526.0
BR	05	N	CV-AA	ORNL	2	527.0
BR	05	N	NAA	ORNL	1	464.0
BR	05	N	NAA	ORNL	2	1023.0
BR	05	S	CV-AA	CCL	1	480.0
BR	05	S	CV-AA	CCL	2	781.0
BR	05	S	CV-AA	EPA	1	739.0
BR	05	S	CV-AA	ORNL	1	347.0
BR	05	S	CV-AA	ORNL	2	638.0
BR	05	S	NAA	ORNL	1	677.0
BR	05	S	NAA	ORNL	2	596.0
BR	05	W	CV-AA	CCL	1	743.0

Table 9 (continued)

Location	Station	Sample	Method	Lab	Subsample	Hg (µg/g)
BR	05	W	CV-AA	CCL	2	1290.0
BR	05	W	CV-AA	EPA	1	698.0
BR	05	W	CV-AA	ORNL	1	314.0
BR	05	W	CV-AA	ORNL	2	344.0
BR	05	W	NAA	ORNL	1	721.0
BR	05	W	NAA	ORNL	2	560.0
WA	04	E	CV-AA	CCL	1	112.0
WA	04	E	CV-AA	CCL	2	151.0
WA	04	E	CV-AA	EPA	1	190.0
WA	04	E	CV-AA	ORNL	1	86.0
WA	04	E	CV-AA	ORNL	2	100.0
WA	04	E	NAA	ORNL	1	116.0
WA	04	E	NAA	ORNL	2	122.0
WA	04	S	CV-AA	CCL	1	68.0
WA	04	S	CV-AA	CCL	2	91.0
WA	04	S	CV-AA	EPA	1	115.0
WA	04	S	CV-AA	ORNL	1	42.5
WA	04	S	CV-AA	ORNL	2	98.0
WA	04	S	NAA	ORNL	1	50.0
WA	04	S	NAA	ORNL	2	83.0
WA	04	W	CV-AA	CCL	1	85.0
WA	04	W	CV-AA	CCL	2	101.0
WA	04	W	CV-AA	EPA	1	74.0
WA	04	W	CV-AA	ORNL	1	56.2
WA	04	W	CV-AA	ORNL	2	63.3

Table 9 (continued)

Location	Station	Sample	Method	Lab	Subsample	Hg (μg/g)
WA	04	W	NAA	ORNL	1	95.0
WA	04	W	NAA	ORNL	2	115.0
WA	05	E	CV-AA	CCL	1	75.0
WA	05	E	CV-AA	CCL	2	85.0
WA	05	E	CV-AA	EPA	1	90.0
WA	05	E	CV-AA	ORNL	1	50.1
WA	05	E	CV-AA	ORNL	2	78.8
WA	05	E	NAA	ORNL	1	80.0
WA	05	E	NAA	ORNL	2	81.0
WA	05	S	CV-AA	CCL	1	40.0
WA	05	S	CV-AA	CCL	2	294.0
WA	05	S	CV-AA	EPA	1	324.0
WA	05	S	CV-AA	ORNL	1	188.0
WA	05	S	CV-AA	ORNL	2	304.0
WA	05	S	NAA	ORNL	1	287.0
WA	05	S	NAA	ORNL	2	215.0
WA	05	W	CV-AA	CCL	1	34.0
WA	05	W	CV-AA	CCL	2	41.0
WA	05	W	CV-AA	EPA	1	33.0
WA	05	W	CV-AA	ORNL	1	32.6
WA	05	W	CV-AA	ORNL	2	50.7
WA	05	W	NAA	ORNL	1	16.0
WA	05	W	NAA	ORNL	2	44.0
WA	06	E	CV-AA	CCL	1	159.0
WA	06	E	CV-AA	CCL	2	230.0

Table 9 (continued)

Location	Station	Sample	Method	Lab	Subsample	Hg (μg/g)
WA	06	E	CV-AA	EPA	1	199.0
WA	06	E	CV-AA	ORNL	1	85.6
WA	06	E	CV-AA	ORNL	2	163.0
WA	06	E	NAA	ORNL	1	182.0
WA	06	E	NAA	ORNL	2	110.0
WA	06	S	CV-AA	CCL	1	1.2
WA	06	S	CV-AA	CCL	2	5.1
WA	06	S	CV-AA	EPA	1	3.0
WA	06	S	CV-AA	ORNL	1	2.6
WA	06	S	CV-AA	ORNL	2	6.2
WA	06	S	NAA	ORNL	1	3.0
WA	06	S	NAA	ORNL	2	0.0
WA	06	W	CV-AA	CCL	1	55.0
WA	06	W	CV-AA	CCL	2	124.0
WA	06	W	CV-AA	EPA	1	45.0
WA	06	W	CV-AA	ORNL	1	26.3
WA	06	W	CV-AA	ORNL	2	38.7
WA	06	W	NAA	ORNL	1	37.0
WA	06	W	NAA	ORNL	2	36.0

See Fig. 2 for soil collection locations, stations,and samples.
CV-AA = cold vapor atomic absorption
NAA = neutron activation analysis

Table 10. Hg concentrations in EFPC homogenized soils measured using NAA and CV-AA methods

Location	Station	Sample	Method	Hg (μg/g)
BR	02	E	CV-AA	346
BR	02	E	CV-AA	324
BR	02	E	CV-AA	259
BR	02	E	CV-AA	235
BR	02	E	CV-AA	398
BR	02	E	NAA	240
BR	02	E	NAA	260
BR	02	E	NAA	183
BR	02	E	NAA	280
BR	02	E	NAA	227
BR	02	W	CV-AA	35
BR	02	W	CV-AA	16
BR	02	W	CV-AA	28
BR	02	W	CV-AA	25
BR	02	W	CV-AA	36
BR	02	W	NAA	17
BR	02	W	NAA	12
BR	02	W	NAA	6
BR	02	W	NAA	20
BR	02	W	NAA	9
BR	05	N	CV-AA	676
BR	05	N	CV-AA	533
BR	05	N	CV-AA	325
BR	05	N	CV-AA	800
BR	05	N	CV-AA	316

Table 10 (continued)

Location	Station	Sample	Method	Hg (μg/g)
BR	05	N	NAA	472
BR	05	N	NAA	460
BR	05	N	NAA	459
BR	05	N	NAA	450
BR	05	N	NAA	477

See Fig. 2 for soil collection locations, stations,and samples.
CV-AA = cold vapor atomic absorption
NAA = neutron activation analysis

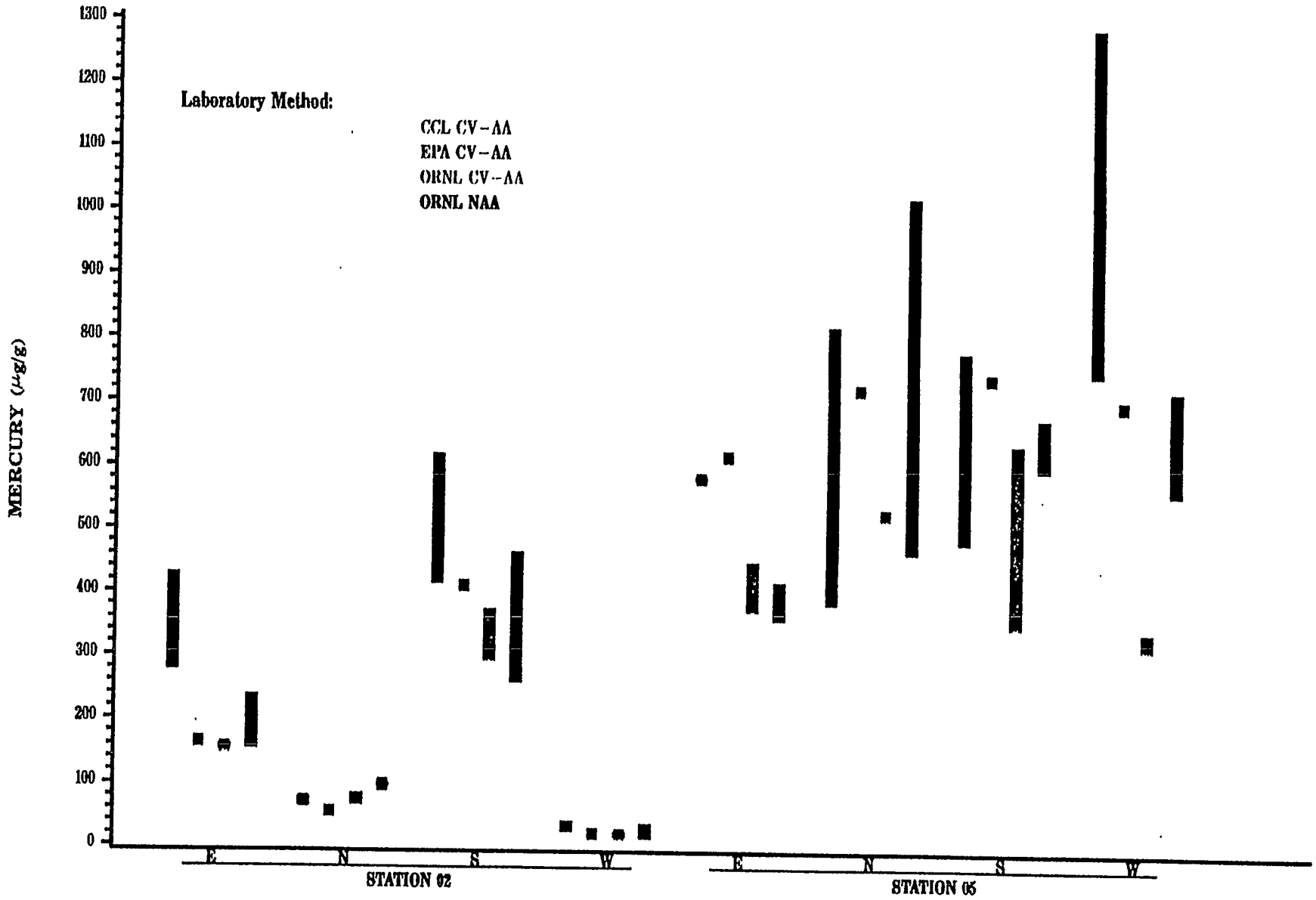

Fig. 5. Hg concentrations in soil samples collected from BR location and analyzed by NAA and CV-AA by three laboratories: ORNL, CCL, and EPA.

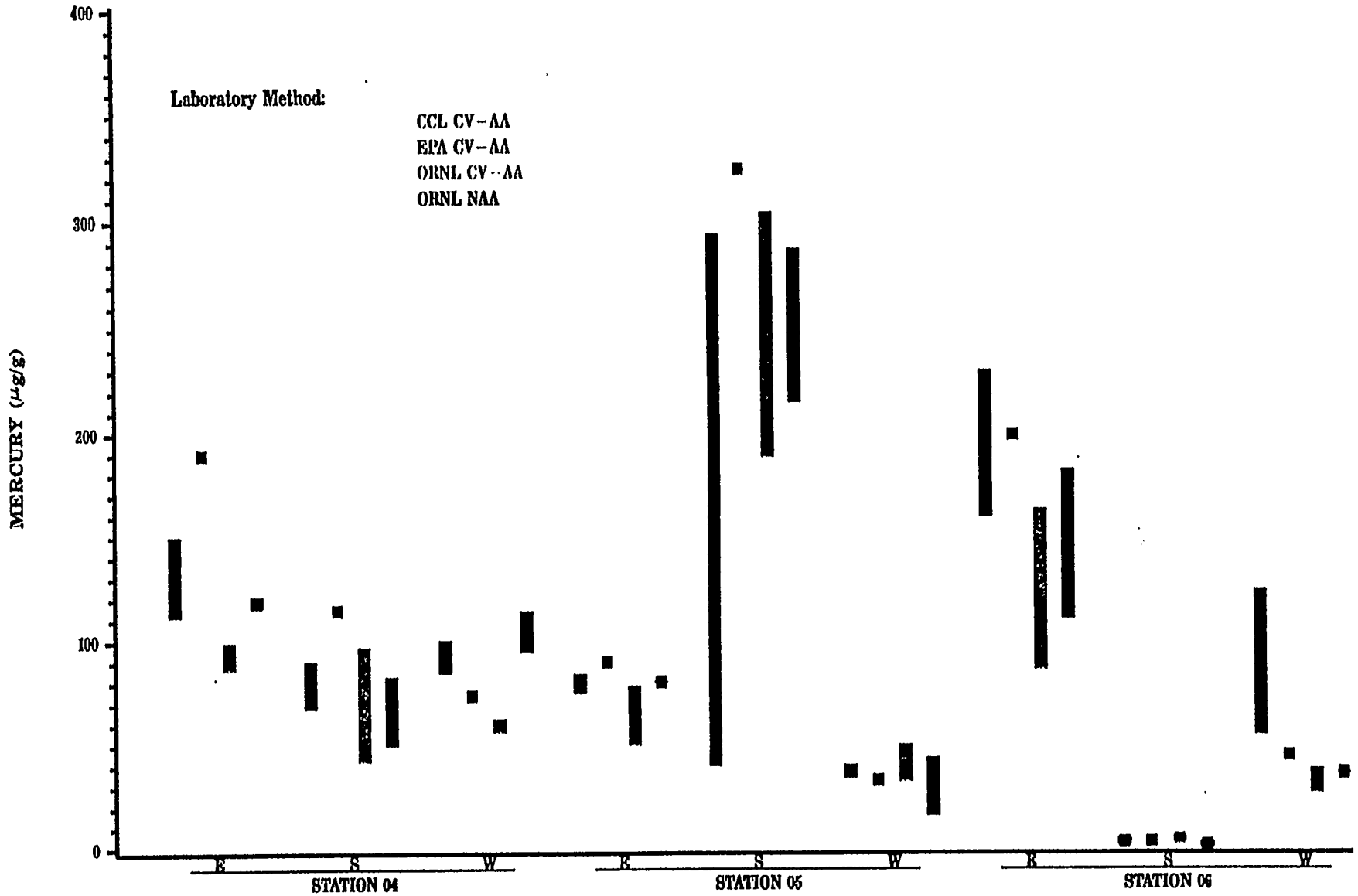

Fig. 6. Hg concentrations in soil samples collected from WA location and analyzed by NAA and CV-AA by three laboratories: ORNL, CCL, and EPA.

several times and then rolled into a pancake until the sample was about 3-4 mm thick at which time the insert was used as a cookie cutter at random locations around the pancake until the insert was full. Each of the 5 aliquots was then analyzed by NAA. Several grams from each of the five aliquots were selected and submitted for analysis by CV-AA.

Hg concentrations measured in the field samples by both methods are shown in Table 11. This table also provides the mean and standard deviation for each method and batch. Summary data for the two methods is shown in Fig. 7. Each bar on Fig. 7 shows the mean value for the method with a horizontal tic mark and the standard deviation. The standard deviation for each method within a batch is shown in Fig. 8. The standard deviation is measure of precision and indicates the within batch variability.

A summary of the results of all ANOV tests are provided here. Actual results of the ANOV (using the GLM procedure) and Duncan's Multiple Range Test are found for each test in Appendix B.

Test 1 was designed to compare the variability among the laboratories analyzing EFPC samples using the CV-AA method. The model used provided a measure of 82% of the total variability. Each of the model components accounted for the following percents of the model's variability:

Model component	Model variability (%)
Location	42
Location (station)	38
Station (sample)	16
Lab	4
TOTAL	100

The differences among the laboratories in the concentrations measured accounted for only 4% of the model variability. The remainder was due to "field" effects or heterogeneity in the samples collected. There were significant differences [probability (p) <0.05] among the laboratories in the Hg concentrations. Duncan's Multiple Range Test indicated that ORNL concentrations were significantly lower than those for either CCL or EPA-EMSL. There were no significant differences among CCL and EPA-EMSL in Hg concentrations.

Test 2 measured the differences among the methods (NAA and CV-AA) in the Hg concentrations obtained by ORNL. These differences in methods were $<2\%$ of the total model variability. Significant differences ($p < 0.05$) were detected among the methods. Duncan's Multiple Range Test showed that the average Hg concentration measured in the 34 samples using NAA was higher (231 μg/g) than that measured in 34 samples using CV-AA (181 μg/g).

These results and those of Test 1 suggest that ORNL's CV-AA measurements may have been biased low. A subsequent test was performed to compare the CV-AA results from CCL and

Table 11. Mercury concentrations measured using NAA and CV-AA methods in field aliquots, including the mean and standard deviation (Std) for each batch

Batch	Aliquot	Hg concentration (µg/g)	
		NAA	CV-AA
2.0	1.0	133.0	82.0
2.0	2.0	129.0	72.0
2.0	3.0	66.0	67.0
2.0	4.0	88.0	122.0
2.0	5.0	122.0	73.0
	Mean	107.6	83.2
	Std	29.3	22.3
7.0	6.0	206.0	185.0
7.0	7.0	209.0	164.0
7.0	8.0	169.0	137.0
7.0	9.0	212.0	142.0
7.0	10.0	275.0	172.0
	Mean	214.2	160.0
	Std	38.2	20.2
13.0	11.0	.	12.0
13.0	12.0	.	13.0
13.0	13.0	0.7	12.0
13.0	14.0	4.4	12.0
13.0	15.0	.	11.0
	Mean	2.55	12.0
	Std	2.62	0.71
17.0	16.0	8.6	7.0
17.0	17.0	3.2	7.0
17.0	18.0	12.4	6.5
17.0	19.0	7.2	7.5
17.0	20.0	6.2	7.0
	Mean	7.52	7.0
	Std	3.37	0.35

Table 11 (continued)

Batch	Aliquot	Hg concentration (µg/g)	
		NAA	CV-AA
22.0	21.0	18.0	30.0
22.0	22.0	11.0	33.0
22.0	23.0	14.0	18.0
22.0	24.0	13.0	16.0
22.0	25.0	11.0	13.0
	Mean	13.4	22.0
	Std	2.9	8.9
28.0	26.0	48.0	48.0
28.0	27.0	58.0	39.0
28.0	28.0	50.0	147.0
28.0	29.0	47.0	.
28.0	30.0	55.0	45.0
	Mean	51.6	44.8
	Std	4.7	4.0
31.0	31.0	24.0	20.0
31.0	32.0	21.0	21.0
31.0	33.0	25.0	20.0
31.0	34.0	27.0	21.0
31.0	35.0	25.0	18.0
	Mean	24.4	20.0
	Std	2.2	1.2
35.0	36.0	.	2.3
35.0	37.0	0.3	2.3
35.0	38.0	.	3.1
35.0	39.0	.	2.7
35.0	40.0	2.9	2.5
	Mean	1.6	2.6
	Std	1.8	0.33

Table 11 (continued)

Batch	Aliquot	Hg concentration (µg/g)	
		NAA	CV-AA
44.0	41.0	12.0	17.0
44.0	42.0	14.0	20.0
44.0	43.0	16.0	16.0
44.0	44.0	21.0	16.0
44.0	45.0	23.0	17.0
	Mean	17.2	17.2
	Std	4.7	1.6
47.0	46.0	40.0	28.0
47.0	47.0	21.0	27.0
47.0	48.0	32.0	26.0
47.0	49.0	59.0	27.0
47.0	50.0	37.0	28.0
	Mean	37.8	27.2
	Std	13.9	0.84
52.0	51.0	428.0	492.0
52.0	52.0	660.0	466.0
52.0	53.0	670.0	439.0
52.0	54.0	667.0	442.0
52.0	55.0	690.0	459.0
	Mean	643.0	459.6
	Std	65.2	21.4
58.0	56.0	31.0	43.0
58.0	57.0	36.0	35.0
58.0	58.0	29.0	37.0
58.0	59.0	22.0	50.0
58.0	60.0	41.0	36.0
	Mean	31.8	40.2
	Std	7.2	6.3

Table 11 (continued)

Batch	Aliquot	Hg concentration (μg/g)	
		NAA	CV-AA
62.0	61.0	85.0	65.0
62.0	62.0	87.0	74.0
62.0	63.0	29.0	62.0
62.0	64.0	84.0	68.0
62.0	65.0	76.0	70.0
	Mean	72.2	67.8
	Std	24.5	4.6
66.0	66.0	121.0	126.0
66.0	67.0	116.0	115.0
66.0	68.0	126.0	120.0
66.0	69.0	129.0	123.0
66.0	70.0	122.0	104.0
	Mean	122.8	117.6
	Std	5.0	8.6
74.0	71.0	142.0	130.0
74.0	72.0	152.0	136.0
74.0	73.0	156.0	145.0
74.0	74.0	141.0	127.0
74.0	75.0	158.0	125.0
	Mean	149.8	132.6
	Std	7.9	8.1
78.0	76.0	39.0	28.0
78.0	77.0	50.0	28.0
78.0	78.0	41.0	28.0
78.0	79.0	51.0	19.0
78.0	80.0	38.0	31.0
	Mean	43.8	26.8
	Std	6.2	4.5

Table 11 (continued)

Batch	Aliquot	Hg concentration (µg/g)	
		NAA	CV-AA
81.0	81.0	53.0	32.0
81.0	82.0	62.0	56.0
81.0	83.0	67.0	52.0
81.0	84.0	58.0	52.0
81.0	85.0	95.0	56.0
	Mean	67.0	49.6
	Std	16.5	10.0
87.0	86.0	82.0	94.0
87.0	87.0	97.0	104.0
87.0	88.0	117.0	104.0
87.0	89.0	106.0	95.0
87.0	90.0	72.0	84.0
	Mean	94.8	96.2
	Std	18.1	8.3
92.0	91.0	.	7.8
92.0	92.0	6.5	9.1
92.0	93.0	.	9.3
92.0	94.0	5.2	10.2
92.0	95.0	.	9.2
	Mean	5.9	9.2
	Std	0.92	0.86
98.0	96.0	9.5	16.0
98.0	97.0	9.7	14.0
98.0	98.0	13.0	20.0
98.0	99.0	15.5	15.0
98.0	100.0	.	20.0
	Mean	11.9	17.0
	Std	2.9	2.8

Table 11 (continued)

Batch	Aliquot	Hg concentration (μg/g)	
		NAA	CV-AA
100.0	101.0	8.5	19
100.0	102.0	23.4	21
100.0	103.0	6.5	21
100.0	104.0	.	20
100.0	105.0	7.4	24
	Mean	11.4	21
	Std	8.0	1.9
108.0	106.0	11.9	21
108.0	107.0	6.1	21
108.0	108.0	5.7	18
108.0	109.0	.	17
108.0	110.0	0.5	19
	Mean	6.2	19.2
	Std	4.7	1.8

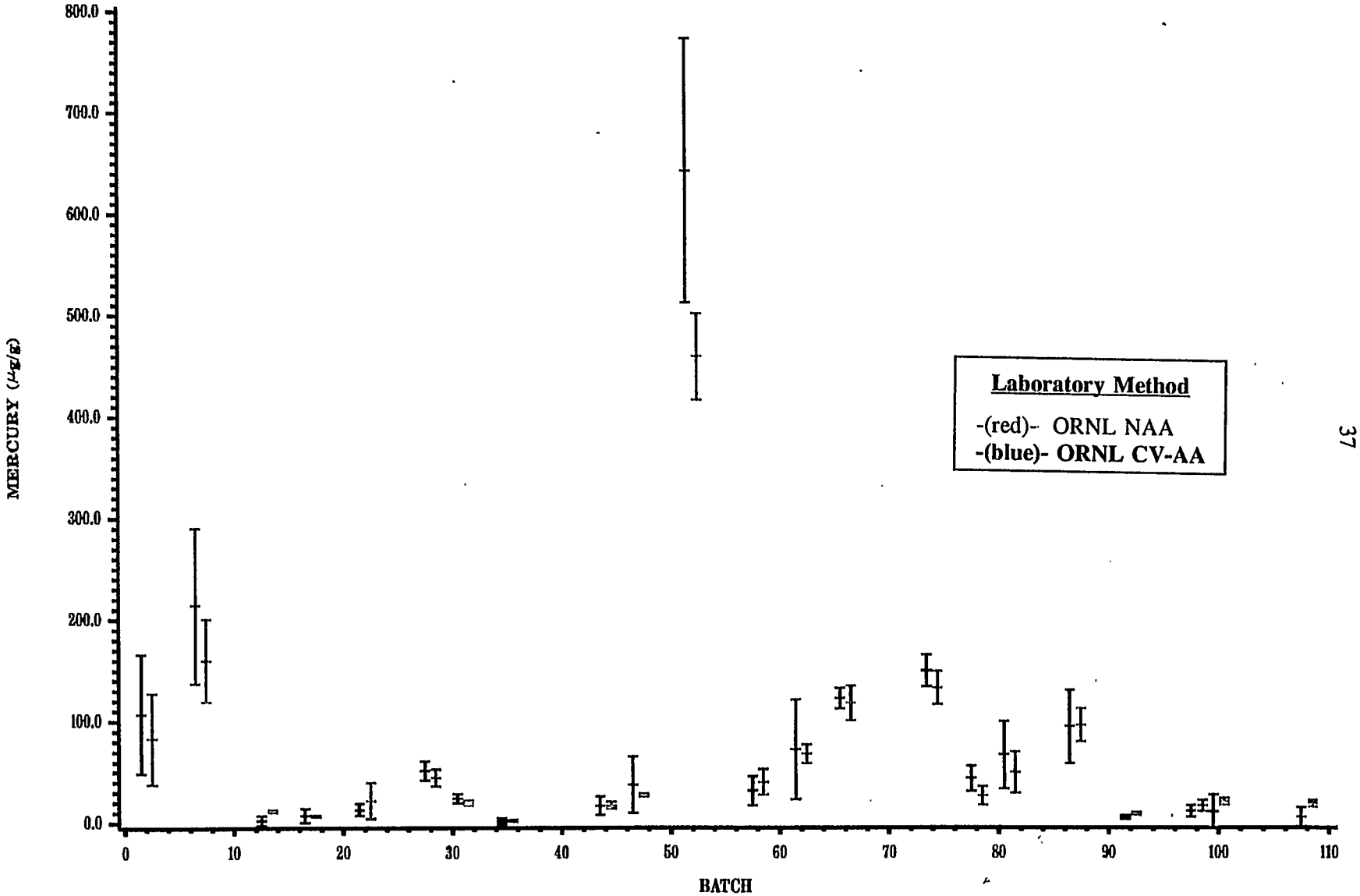

Fig. 7. Mean concentrations and standard deviations within a batch for samples analyzed by ORNL using NAA and CV-AA methods.

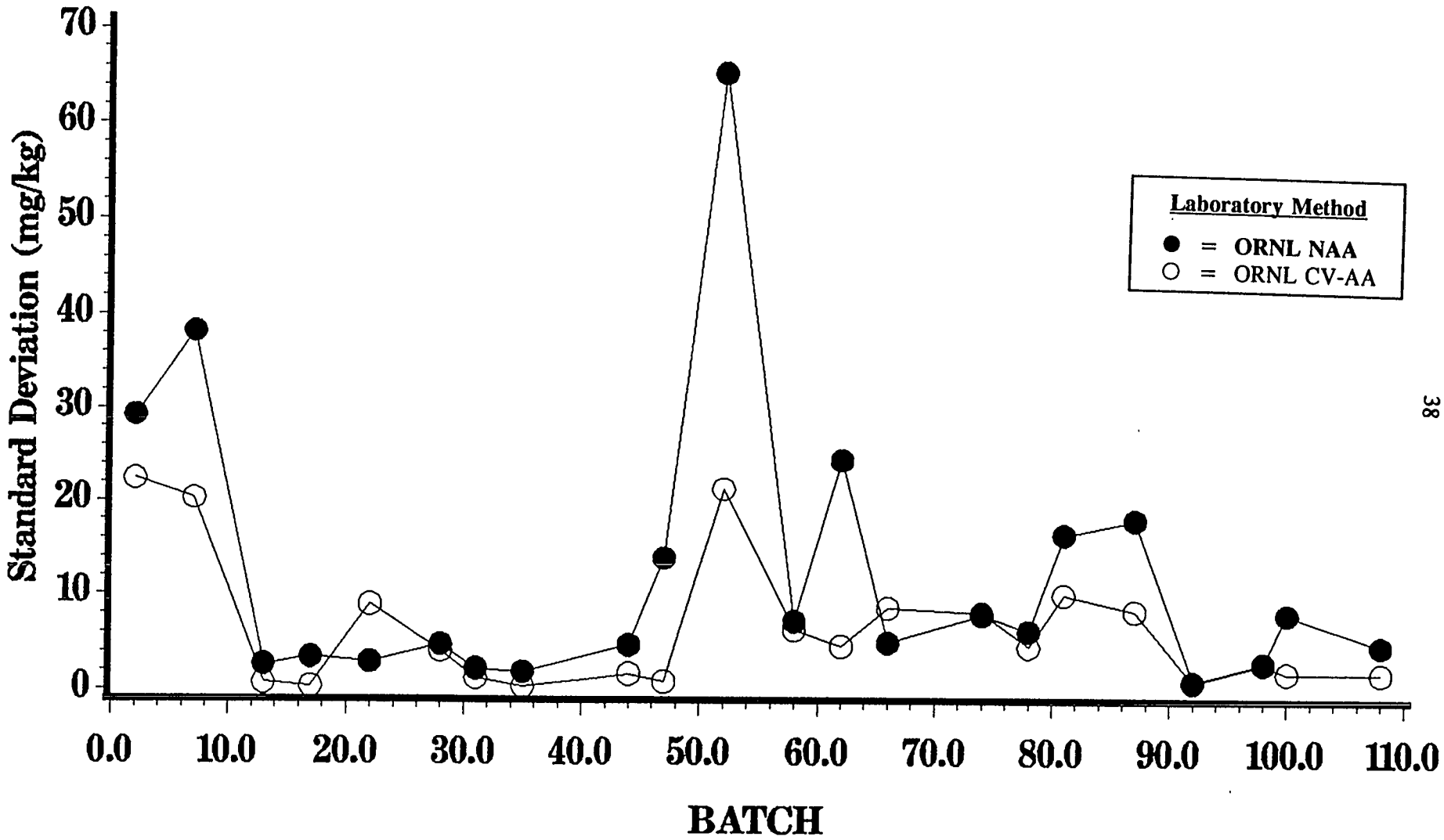

Fig. 8. Standard deviation within a batch for aliquots analyzed by ORNL using NAA and CV-AA methods.

EPA-EMSL with the NAA results of ORNL (Test 1B). In this test, the differences among the laboratories accounted for <1% of the model variability, and there were no significant differences among the laboratories. The mean concentrations (in $\mu g/g$) were as follows: CCL (CV-AA) - 275; EPA (CV-AA) - 265; and ORNL (NAA) - 231. Substituting the Hg concentrations measured by ORNL using NAA and comparing these results to the concentrations measured by EPA-EMSL and CCL using CV-AA showed no differences in the method.

Test 3 measured the variability within ORNL and CCL for CV-AA analyses of Hg. Because there were no replicates analyzed by EPA, this test could not be run. For CCL (Test 3A), the model accounted for about 94% of the total variability while the within-sample variance was about 5% of this. There were no significant differences in the Hg concentrations in the subsamples within the samples. The inability of the test to detect differences among subsamples may be due to the large variability of Hg concentrations at the BR location, Station 05, sample W with a mean of 1017 and a standard deviation of 387 $\mu g/g$. Individual subsample measurements were 1290 $\mu g/g$ and 743 $\mu g/g$ at this sampling point. For ORNL (Test 3B), the model accounted for 97% of the total variability with the subsample within sample variance contributing about 4% to this. There were significant differences ($p < 0.05$) in the subsamples within a sampling point.

Using the same type of evaluation, Test 3C measured the variability within ORNL for NAA analyses. The model explained 94% of the total variability, and the subsample within sample variance was about 5% of that. No significant differences in Hg concentrations were found within the subsamples. This may have been due to the large variability in the subsample values for the BR location, Station 05, and sample N. Measured Hg concentrations in each subsample were 1023 $\mu g/g$ and 464 $\mu g/g$. This, and the results of Tests 3A and 3B, suggest that at this particular station the soils are extremely heterogenous.

Because the previous tests were run on samples that were not further homogenized in the laboratory prior to CV-AA analysis, a subsequent investigation was performed on soils that were homogenized in the laboratory.

Test 4 compared the Hg concentrations in these soils measured by ORNL using CV-AA and NAA. The model accounted for about 85% of the total variability and the method contributed 2% to this. There were no significant differences among the methods in the Hg concentrations. The means were 290 $\mu g/g$ using CV-AA and 238 $\mu g/g$ using NAA. Duncan's Multiple Range Test could detect a difference of 68 $\mu g/g$ in the mean Hg concentrations.

Table 12 summarizes the variability in the models including location, station, sample, and other effects for Tests 1 to 3. Test 4 was not included in the summary because there was no effect due to location. Only one location, BR, was sampled.

From this summary, location and station account for most of the variability (38 to 43% and 30 to 40%, respectively) in the Hg concentration measurements, followed by sample (16 to 22%). The variability among labs (Lab) and within labs (Subsample) were similar (4 to 6% and

Table 12. Comparison of percent of variability for model effects

	% Variability						
Test	Location	Station	Sample	Subsample	Method	Lab	Model
1	42	38	16			4	82
2	39	39	19		1		87
1B	43	40	17			<1	86
3A	42	30	22	6			94
3B	38	36	22	4			97
3C	38	39	18	5			94
SUMMARY	38-43	30-40	16-22	4-6	1	<1-4	82-97

<1 to 4%, respectively). The variability among the methods as performed by ORNL contributed between 1% (Test 2) and 2% (Test 4).

For 19 out of 22 batches, the standard deviation was higher (and the precision was lower) using the NAA method rather than the CV-AA method. Comparing the standard deviations across batches (Fig. 8) indicates the same trend for the NAA as for the CV-AA method, except for batch 62. One of the Hg concentrations in one of the replicates was much lower than the other 4 using the NAA method (see Table 11). Differences in the precision may be due to the combination of the heterogeneity in the samples analyzed, the size of the aliquot analyzed, the sample preparation, and the size of the Hg particles. Because the CV-AA method uses only 0.1 g of sample for analysis, it may be more homogeneous than the approximately 1 g sample analyzed by NAA. It was demonstrated using the scanning electron microscope that the Hg particles are about 1 micron in diameter. Because of their small size, the larger sample may be more heterogeneous. For all batches, the standard deviation ranged from 0.9 to 65 with a mean of 12 for NAA and from 0.3 to 22 with a mean of 6.4 for CV-AA. Analysis of these field samples indicates that the precision of the CV-AA method was better than that for NAA.

Test 5 looked at the differences in the two methods (NAA and CV-AA) by comparing ORNL's results for every fifth batch of samples in the following model:

Hg conc = Batch + Method + Batch*method.

Using this model, there were statistically significant differences ($p < 0.05$) in the batch, method, and the interaction of batch with method (batch*method). The differences among batches was not important to this study, but was included in the model to remove the effects of the varying concentration levels in the batches. In testing for differences among the methods, the mean

mercury concentration over all batches was significantly higher ($p < 0.05$) at 88 μg/g as measured by the NAA method than that measured by the CV-AA method (66 μg/g). This difference of 33% is similar to that found in Test 2 (28%). Follow-on tests performed in Test 2 and the results of Test 1 may indicate that ORNL CV-AA results may be biased low.

There was also a significant interaction between the method and batch indicating that there were different responses among the batches, depending on the method. In some batches, the Hg concentrations measured by NAA were higher than those measured by CV-AA, while in other batches the opposite was true. To better visualize the method by batch interaction, mean Hg concentrations for each batch and method were plotted as shown in Fig. 9. This figure shows that for mercury concentrations below about 20 μg/g, the CV-AA measurements were generally higher than those made using NAA. For all Hg concentrations above about 20 μg/g, the values were higher using NAA rather than CV-AA. Figure 10 shows the same data on a concentration scale of from 0 to 100 μg/g. Partitioning these data into 2 fractions: those with mean batch concentrations less than 20 μg/g and those with mean batch concentrations greater than 20 and testing for differences among methods indicated significant differences among the methods. At the lower concentrations, Hg concentrations were significantly higher using CV-AA (14 μg/g) than those measured using NAA (9.9 μg/g). Above 20 μg/g, Hg concentrations were significantly higher in samples analyzed by NAA (128 μg/g) than by CV-AA (103 μg/g).

6. SUMMARY AND RECOMMENDATIONS

The NAA method has been shown to be a sensitive technique for detecting Hg in soils, with an MDL of approximately 6 μg/g. It is as accurate and precise as the CV-AA method for dried and homogenous standards. In analyses of actual field samples, the precision of the two methods is similar and in some cases, NAA is more precise than CV-AA while in others the opposite is true. The variability measured in the EFPC system is due primarily to the heterogeneity in the samples, both at short distances apart (less than 25 ft) and at greater distances (miles). The variability among laboratories and within a laboratory was similar. The least amount of variability in the system was due to the method used. Although differences in Hg concentrations were detected in the NAA and CV-AA methods as performed by ORNL, other tests indicate that the CV-AA measurements made by ORNL were biased low. Based on the results of all analyses and tests performed for EFPC soils, the NAA method for the analysis of Hg in soil meets all DQOs and is equivalent to the CV-AA method. For a given budget, it is recommended that more emphasis be placed on collecting additional field samples (the largest source of variability) and on using cheaper, faster, and equivalent analytical methods, such as NAA, rather than other chemical methods.

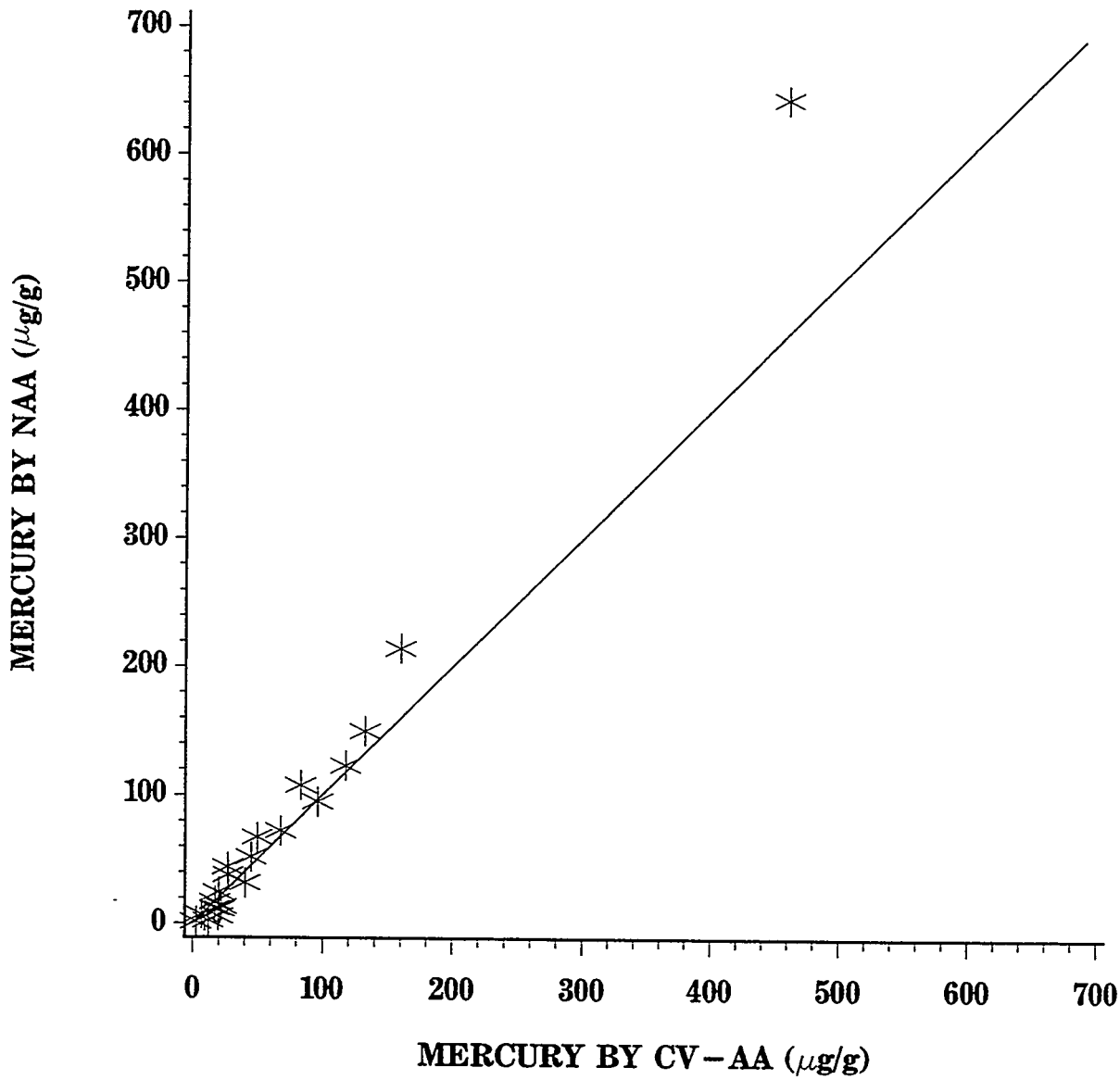

Fig. 9. Mean Hg concentrations within a batch analyzed by ORNL using NAA and CV-AA methods.

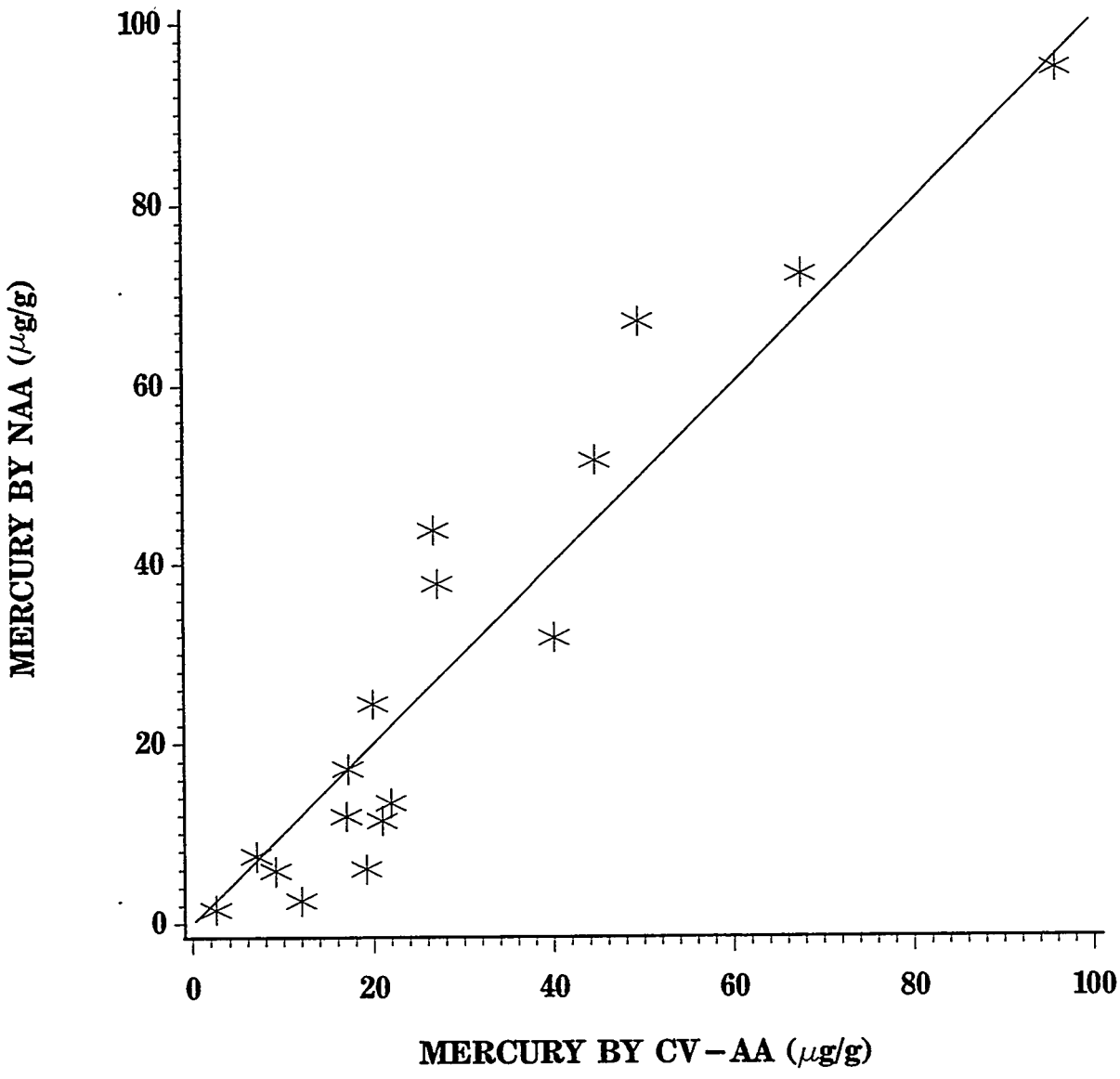

Fig. 10. Mean Hg concentrations within a batch for samples with concentrations ≤100 μg/g analyzed by ORNL using NAA and CV-AA methods.

ORNLCOMP 03DEC92

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APPENDIX A

ORNL'S PROCEDURE FOR NAA ANALYSIS OF EFPC SOILS

Oak Ridge National Laboratory
Analytical Chemistry Division

DOCUMENT CONTROL and TRANSMITTAL RECORD

From: J. R. Stokely

Date: 3/3/92

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Oak Ridge National Laboratory Analytical Chemistry Division	Procedure No. AC-MM-222002 Rev.
	Date of Issue 3/3/92
STANDARD ANALYTICAL METHOD	Page 1 of 28
For inclusion in ORNL Master Analytical Manual	Supersedes issue dated:

Title: NEUTRON ACTIVATION ANALYSIS OF EAST FORK POPLAR CREEK SAMPLES

Prepared by: J. W. Wade, F. F. Dyer, L. Robinson, N. A. Teasley, and J. R. Stokely

1 PURPOSE

This method describes procedures for handling and analysis of soil and sediment samples from the East Fork Poplar Creek characterization study.

2 SCOPE

The method was specifically designed for analysis of soils and sediments from the East Fork Poplar Creek floodplain located in Roane and Anderson Counties, Tennessee, but is applicable to other soils with similar chemical composition. The following items are covered by this method: sample receiving; chain-of-custody; sample preparation; neutron activation analysis for mercury, uranium-238, uranium-235, selenium, zinc, chromium, antimony, and arsenic; and data transfer and review. Quality assurance for this method is compatible with protocols established by the U. S. Environmental Protection Agency Contract Laboratory Program as specified in EPA CLP SOW-788.

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Approved By: Frank Fowler / Group Leader

Approved By: J. R. Stokely / 3-3-92 Section Head

Reviewed By: U M Laing Technical / Peer Reviewer

QA Concurrence: QA Specialist

Approved by: Larry Robinson Radiation Control Officer/Other

Oak Ridge National Laboratory
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Martin Marietta Energy Systems, Inc.

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4 RESPONSIBILITIES

The supervisor of the LLRAG is responsible for implementation of procedural requirements associated with sample receipt and chain-of-custody documentation, log in of samples, preparation of samples for NAA, preparation of quality control samples, and

transfer of NAA results to the computer data base (AnaLIS). Modifications of any of the procedural steps require explicit approval of the LLRAG supervisor. Procedural modifications will be documented in a sample handling and processing notebook kept by the LLRAG supervisor.

The supervisor of the NAA laboratory is responsible for procedural requirements for the NAA of field samples and quality control samples. The NAA supervisor has responsibility to assure that quality control requirements are met, and reviews data for any evidence of questionable analysis results.

Supervisors of the LLRAG and NAA laboratory and the section manager will sign data reporting sheets indicating adherence to this procedure and approval of analysis results on field and quality control samples.

5 DEFINITIONS

5.1 ACD: Analytical Chemistry Division

5.2 AccuSpec: Registered trademark denoting the PC based MCA system used for gamma-ray spectroscopy measurements.

5.3 AnaLIS: Acronym for the ACD data management system (analytical laboratory information system)

5.4 Autosequence: A batch file that operates in the AccuSpec environment and allows a series of user specified MCA functions and executable programs to run automatically.

5.5 CCV: Continuing calibration verification

5.6 COC: Chain of custody

5.7 DN: Delayed neutron

5.8 DNC: Delayed neutron counting

5.9 ICV: Initial calibration verification

5.10 LLRAG: Low Level Radiochemical Analysis Group

5.11 MCA: Multichannel analyzer

5.12 NAA: Neutron Activation Analysis

5.13 NIST: National Institute of Standards and Technology.

5.14 PROBAL: Software package that interfaces PC and laboratory balance.

5.15 SAM: Standard analytical method

5.16 SOP: Standard operating procedure

5.17 Rabbit: The polyethylene capsule (vial) in which rabbit inserts are irradiated.

5.18 Rabbit Insert: The polyethylene vial in which a sample is placed and loaded in a rabbit for irradiation.

5.19 RCRA: Resource Conservation and Recovery Act

5.20 Spectral configuration file: Binary file that consists of the spectral data, counting efficiency data, and header files that contain all numerical and descriptive data, such as sample weight and title, that is necessary and sufficient for analysis of the spectrum.

6 REQUIREMENTS

This procedure was designed to be compatible with quality control and data reporting requirements of the EPA Contract Laboratory Program as specified in EPA CLP SOW-788.

7 PRINCIPLE AND SUMMARY OF METHOD

Neutron activation analysis (NAA) of the soil samples is carried out by the comparative neutron activation analysis (CNAA) method. In the CNAA method, count rates determined for samples of unknown concentration are compared to count rates determined for standards containing known amounts of the desired element. Concentrations in the unknown sample are computed by the following relation:

$$W_x = W_s \times \frac{CR_x}{CR_s} = \frac{W_s}{CR_s} CR_x \qquad (1)$$

where, CR_x denotes the count-rate of a neutron-induced radioisotope determined for a sample containing an unknown amount W_x (micrograms) of the element being measured, and CR_s denotes the count-rate of the isotope determined for a standard containing a known weight W_s (micrograms). The quantity W_s/CR_s is a calibration factor which relates the count rate of the sample with the quantity of a given element in the sample. The calibration factor is determined by irradiation of a standard containing a known

quantity of the elements of interest and measurement of the count rate of each element in the standard. The calibration standards are prepared by adding known quantities of elements to high purity silicon dioxide powder that has been shown to contain insignificant amounts of all elements that are determined by this method. Irradiation and counting of standards and samples are made under the same experimental conditions.

Neutron irradiations are performed for 60 seconds in pneumatic tube number 2 (PT-2) in the Neutron Activation Analysis Laboratory at the High Flux Isotopes Reactor. The neutron flux is approximately 5×10^{13} n/cm^2/sec. Calibration factors are determined by irradiating calibration standards along with each batch of samples. To minimize errors caused by small variations in neutron flux during the irradiation of a batch, irradiations of these calibration standards are made at the beginning, middle, and end of the batch. Field and other samples from each batch are irradiated under the same conditions.

Gamma spectra are analyzed with Nuclear Data ACCUSPEC system software and two programs developed at ORNL. Details of the use of the Nuclear Data programs are described in Reference 4.7. Although this software system is far too complex to describe here in detail, some overview will be given. The ACCUSPEC system consists of the programs DEF, PARS, PEAK, SPLIN, NID, INTERF, MDA, and a number of additional utility programs.

The program DEF allows the user to establish the files pertaining to the analysis in a number of "logical units", e.g. logical unit 12 contains the name of the file of the spectrum to be analyzed. PARS allows input of numerical and descriptive parameters that contain all information about the spectrum to be analyzed, e.g. the sample weight. PARS writes this information to logical unit 8. PEAK finds full energy peaks (photopeaks) in the spectra and computes energies and count rates of photopeaks and errors associated with the peaks that are due to counting statistics. Peaks that partially merge together (multiplets) are resolved by a least squares routine. SPLIN computes counting efficiencies for the photopeaks. NID compares the energies and count rates of photopeaks in the spectra to gamma ray energies and intensities in a nuclide library file to identify radioisotopes as candidates that may be responsible for the photopeaks. INTERF corrects for interferences that result when two radioisotopes each have gamma rays whose energies are similar and their photopeaks overlap too much to be resolved. If one of the radioisotopes has a gamma ray whose photopeak is free from interference, this photopeak is used to quantify the radioisotope and then the interference to the other radioisotope can be computed and corrections made. MDA calculates minimum detectable quantities for those radionuclides whose gamma-ray intensities fail to meet the acceptance criteria of program PEAK.

The ACCUSPEC software does not compute results for neutron activation analysis; the programs, HGSOIL and PROCESS_NAA_DATA, developed at ORNL, perform this

function. HGSOIL makes use of the radioactivity values computed by NID, INTERF and MDA to form results files on a floppy disk that consist of data for elements of interest for all samples including all standards and field samples. These results are then used as input for the program PROCESS_NAA_DATA. Equation 1 is used to compute concentrations of elements by the comparative neutron activation analysis method.

The uranium-235 content of samples is determined by comparing the delayed neutron count rates of standards and samples, both irradiated and counted under the same conditions.

8 INTERFERENCES

Compared to chemical methods of analysis, neutron activation analysis is relatively free of interferences. Although there are several recognized sources of interferences in NAA, as described in Reference 3.9, only one appears to be of any significance in the analysis of the soil and sediment samples from East Fork Poplar Creek. This interference is due to overlap of gamma-ray photopeaks in the gamma-ray spectra of the irradiated samples and occurs in the measurement of mercury, uranium, and selenium. This interference is eliminated by the computer program INTERF which uses other gamma-ray spectral lines of the interfering element to correct for the spectral interferences.

9 APPARATUS/REAGENTS/STANDARDS

9.1 The pneumatic tube irradiation system at the HFIR in which the soil samples are irradiated is described in Reference 3.10.

9.2 The delayed neutron counting system is described in References 3.10 and 3.11.

9.3 The gamma-ray spectrometry system is described in References 3.6 and 3.7.

9.4 Rabbits and inserts are described in References 3.10 and 3.11.

9.5 Wet to dry ratio measurements are performed using clean and dry, 30 ml, flat bottom, screw-capped, glass vials. (Caps are placed on the bottles after weight measurements are made and prior to disposal of the samples.)

9.6 The following National Institute for Science and Technology (NIST) standard reference materials are used in this method: SRM 3133(Hg), SRM 3164(U), SRM 3149(Se), SRM 3168(Zn), SRM 3112(Cr), SRM 3102(Sb), SRM 3103(As), and SRM 1633a (Fly Ash). The following NIST Reference Materials are used: 8407(Hg) and 8408(Hg).

9.7 The following solution standards from SPEX Industries, Inc. are used in this method: PLCR2-3X(Cr), PLZN-3X(Zn), PLU2-3X(U), PLSB2-3X(Sb), PLSE2-3X(Se), PLHG4-3X(Hg), and PLAS2-3X(As). The metal concentration in these standards is 10 mg/ml.

9.8 A working solution is made from the SPEX Industries standard solutions in order to prepare NAA daily calibration standards. A known volume of SPEX standard solutions is pipetted into a 25 ml volumetric flask, and the solution is diluted to volume with 4 M nitric acid. The following volumes of the SPEX standard solutions are used:

Standard	Volume, ml
PLCR2-3X	2.50
PLZN2-3X	6.25
PLSB2-3X	0.250
PLU2-3X	0.625
PLSE2-3X	1.25
PLHG4-3X	1.25
PLAS2-3X	0.250

9.9 NAA calibration standards are prepared from the SPEX working solution. An irradiation insert is filled one third to one half full with high purity silica (Aldrich Chemical Company). A 0.200 ml aliquot of the SPEX working solution is added to the insert. The insert is then carefully filled with more silica, a lid is placed on the insert, and the insert is sealed using a soldering iron to melt the polyethylene at the lid-to-insert joint. Calibration standards prepared in this manner contain the following quantities (in micrograms) of metals: Hg (100), U (50), Se (100), Zn (500), Cr (200), Sb (20), and As (20).

9.10 Two working solutions are prepared from NIST SRM solutions (Section 9.6) for use in making calibration verification standards. Working solution A is prepared by accurately pipetting NIST SRM solutions into a 10 ml volumetric flask and diluting to volume with 1 M reagent grade hydrochloric acid. The following volumes of the 10 mg/ml NIST SRM solution are pipetted into the volumetric flask.

NIST SRM	Volume Pipetted
3168(Zn)	5.00
3112(Cr)	2.00
3102(Sb)	0.200
3103(As)	0.200

Working solution B is prepared in the same manner as solution A except that the following 1 mg/ml NIST SRMs are used and the solution is diluted to volume with reagent grade 4 M nitric acid:

NIST SRM	Volume Pipetted
3164(U)	1.00
3149(Se)	2.00
3133(Hg)	2.00

9.11 Calibration verification standards are prepared from the NIST working solutions A and B in the same manner that NAA calibration standard are prepared (Section 9.10). A 0.100 ml volume of the working solution A and 0.050 ml of working solution B is added to the irradiation insert. Inserts prepared in this manner contain the following quantities (in micrograms) of metals: Hg(100), U(50), Se(100), Zn(500), Cr(200), Sb(20), and As(20).

9.12 An efficiency check source is used for daily verification of counting efficiences of germanium gamma-ray detectors. This source was supplied by Amersham Corp., Arlington, Heights, IL and is identified as Cobalt Point Source No. 2U368 from Set 2128. The source is traceable to NIST.

10 SAFETY

10.1 Gloves shall be worn at all times when handling samples or loading samples into irradiation inserts. All other requirements of the Analytical Chemistry Division Chemical Hygiene Plan (Reference 3.1.2) shall be followed.

10.2 Operation of the HFIR pneumatic tube irradiation facility requires strict adherence to the operating procedure (Reference 3.5).

10.3 ORNL Health Physics guidelines and rules shall be followed in handling of irradiated samples.

10.4 After use all samples shall be treated as RCRA waste.

11 STORAGE, PRESERVATION, PREPARATION OF SAMPLES

Instructions on storage, preservation, and preparation of samples are included in Sections 14 and 15 of this method.

12 PREPARATION AND CALIBRATION OF APPARATUS

Instructions for preparation and calibration of equipment and instrumentation used for this method are described in Sections 14, 15, 16, and 17.

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13 ENVIRONMENTAL CONDITIONS

Samples are stored at $4^{o}C \pm 2^{o}C$ prior to loading in irradiation inserts. Unused samples are returned to storage at $4^{o}C$ in case that it becomes necessary to reanalyze any samples. If reanalysis is necessary, it must be done within the mercury holding time of 28 days required by EPA Statement of Work 788.

14 SAMPLE RECEIVING AND CHAIN OF CUSTODY

Upon receiving samples from field sampling personnel, the sample custodian shall perform the following operations:

14.1 Sign the field chain of custody (COC) form and record the date and time the samples are received. If the samples can be logged into the AnaLIS system during the working day, they can be kept in the cooler provided that it is not left open. Otherwise, they must be immediately transferred to the refrigerator and stored at 4°C.

14.2 Within 24 hours after sample receipt, verify document agreement between sample tags and the field chain of custody form and the request sheet (Attachment A). Any discrepancy must be resolved with the field sampling personnel before samples are logged into the AnaLIS system. The discrepancy and any corrective actions are documented on the COC form.

14.3 Retain a copy and return the original field COC form to Manager, East Fork Poplar Creek Project, Science Applications International Corporation, 301 Laboratory Road, Oak Ridge, TN 37830.

14.4 Group samples into batches of twenty for logging into the AnaLIS system. When AnaLIS prompts for the number of samples to log in, enter seven more than the batch total to allow for blanks standards, and controls. An ACD request number is assigned to each batch. This request number is a sequential number with the first number being HG1000.

14.5 Log the samples into the AnaLIS system, and enter the appropriate information such as series, sample ID, etc. when prompted by AnaLIS.

14.6 Complete the internal chain of custody form (Attachment B) and document any sample abnormalities on the form.

14.7 For the 20 samples in each batch, assign analyses to the samples by selecting the POPCREEK analysis from the log in menu. This selection will assign analyses

for CR, AS, SE, ZN, SB, HG, U-235, U-238, WEIGHT, % SOLIDS, and INSTRUMENT ID to each sample.

14.8 Beginning with sample 21 of the batch, the custodian shall proceed as follows:

14.8.1 Sample 21 is a spiked sample, enter SPK into the frequency field. The customer ID for this sample is the same as the first sample in the batch. Do not assign a % SOLIDS analysis to this sample.

14.8.2 Sample 22 is a duplicate sample, enter DUP into the frequency field. The customer ID for this sample is the same as the second sample in the batch.

14.8.3 Sample 23 will be a laboratory control sample for mercury. Alternate between the NIST 8407 and NIST 8408 controls. Enter STDA1 for NIST 8407 or STDB1 for NIST 8408 into the customer ID field. Do not assign a % SOLIDS analysis to this sample.

14.8.4 Sample 24 will be a laboratory control sample for arsenic. Enter STD2 into the customer ID field. Do not assign a % SOLIDS analysis to this sample.

14.8.5 Sample 25 is a method blank, enter MB as the customer ID. Do not assign a % SOLIDS or WEIGHT analysis for this sample.

14.8.6 Sample 26 is a laboratory control sample, enter ICV into the customer ID field. Do not assign a % SOLIDS or WEIGHT analysis for this sample.

14.8.7 Sample 27 is a CCV standard. Enter CCV in the customer ID field. Do not assign a % SOLIDS or WEIGHT analysis for this sample.

14.9 The custodian will store all samples in the COC room, Room F-48, 4500S, in a refrigerator at 4°C. The temperature of the refrigerator is inspected daily when in use and is recorded at least monthly in the project notebook. The supervisor of the LLRAG is notified if the temperature of the refrigerator deviates more than 2°C from 4°C. The chain of custody room is locked when not in use and only personnel in the LLRAG have access to the room.

14.10 The custodian shall place all documents related to the sample receipt and preparation in a green folder labelled with the batch number and AnaLIS sample number and store these in a secure area.

14.11 The custodian shall document on the internal COC form the transfer of samples to the sample custodian of the NAA laboratory. The laboratory identification numbers of the samples transferred, the signature of individuals releasing and accepting custody, and the date and time of the transaction shall be recorded.

14.12 Prepare a handwritten worksheet for the NAA lab that includes the AnaLIS sample numbers, corresponding rabbit numbers, and consecutive numbers within the batch. The worksheet is retained by the sample custodian at the NAA lab, and a copy is kept in the green folder in the LLRAG group.

15 SAMPLE PREPARATION AND PERCENT SOLIDS DETERMINATION

Samples will be prepared by LLRAG personnel and transferred to the NAA laboratory for analysis. The working area will be covered with blotter paper or Scott Wipe towels to contain any sample spillage. Samples and sample spillage and gloves and other materials contacting samples must be treated as RCRA waste and disposed of properly. Personnel will wear disposable gloves, and they will be changed after each sample is prepared. If samples, inserts, or loaded inserts need to be left on the bench for an extended period of time (> 15 min), cover them with a Kleenex to minimize the possibility of contamination. A Sample Prep Worksheet (Attachment C) is completed for each batch of samples. Beginning with the first sample in the batch, proceed as follows:

15.1 Tare 24 irradiation inserts on the balance using the PROBAL program as follows:

15.1.1 From the menu on the PC, select 5, "Weigh HG Samples for Activation".

15.1.2 Select 1 (for tares), and enter the request number, beginning rabbit number, and number of samples when the program asks for this information.

15.1.3 At this point, quality control weights must be weighed to verify that the balance is performing properly. This is required on a daily basis. If the daily balance quality control has not been performed, then proceed with the balance check by answering yes ("Y") when prompted by the program. Follow instructions on the balance display. Data obtained in this quality control step is automatically stored in computer files. The program will not allow weighing to proceed unless the accuracy of the balance is better than $\pm 0.06\%$. Contact the LLRAG supervisor if the program will not run.

15.1.4 At this point, the program will proceed automatically without further interaction from the keyboard. Weigh each insert by placing it in the center of the balance pan, closing the door, and depressing the mouse button on the Mettler balance. The program will wait for the balance to stabilize, record the weight into a file, and prompt for the next insert on the display of the balance. Proceed until all of the inserts have been tared, placing each in a block with sequentially numbered holes.

15.2 Working with one sample at a time, transfer the entire sample into a quart polyethylene bag. Blend the sample by kneading and folding the moist soil through the bag. Repeat this process several times to assure that the sample is well blended. During the blending operation, keep the polyethylene bag open to prevent the bag from rupturing due to pressure created by the mixing of the sample. After blending, flatten the sample into a pancake of approximately 1/8-1/4 inch thickness.

15.3 Beginning with the first tared insert, fully load the insert by using the insert like a cookie cutter on the flattened sample. A clean and dry spatula is used to assist in loading the insert.

15.4 Wipe excess sample from the outside of the insert with a paper tissue and place the loaded insert back into its numbered position in the block.

15.5 Proceed loading the samples until all twenty have been prepared. (Sections 15.2, 15.3, 15.4)

15.6 Load the spike sample by selecting the first sample in the batch and preparing it as described in Section 15.2 into insert 21. (The spike may be prepared when the first sample is loaded, but care must be taken that the inserts are returned to the proper position in the block)

15.7 Prepare a duplicate sample by selecting the second sample in the batch and preparing it as described in Section 15.2. Load the sample as described in Section 15.3-15.4 into insert 22. (The duplicate may be prepared when the second sample from the batch is loaded, but care must be taken to assure the insert is returned to the proper position in the block.)

15.8 Fully load insert 23 with either NIST 8407 or NIST 8408 (Mercury in Tennessee River Sediment Standard) and return it to the block. The use of these two standards is alternated with each batch.

15.9 Fully load insert 24 with NIST 1633a Fly Ash and return it to the block.

15.10 Weigh the loaded samples by repeating steps 15.1.1 - 15.1.4 except enter 2, (Gross Weight) when the program asks for this information.

15.11 Prepare a method blank by snapping the lid onto an empty insert and returning it to position 25 in the block.

15.12 Pipet 0.100 ml of NIST standard solution A and 0.050 of NIST standard solution B into the insert containing the sample to be spiked (position 21 on insert storage block).

15.13 Snap a lid onto each of the loaded inserts and seal them with a small soldering iron. Take care to move the iron in a upward motion so that the seal with the lid and insert body can be made as smooth as possible.

15.14 Place the inserts into sequentially numbered rabbits and screw a lid onto each. Place the 25 rabbits along with two rabbits containing ICV and CCV calibration verification standards (Section 9.12) into a quart polyethylene bag for transfer to the NAA Laboratory.

15.15 Complete all pertinent information on the Sample Prep Worksheet (Attachment C) and be sure to include the first and last rabbit numbers on the form so that the NAA Lab will be able to cross reference sample numbers when the data is ready to be transferred to AnaLIS.

15.16 Percent solids is determined for each of the 20 samples and the duplicate. Proceed as follows:

15.16.1 Label twenty-one 20 ml glass vials (Section 9.5) with sequential numbers, starting with one. Write the batch number on each vial.

15.16.2 Determine the tare weights of each vial on the balance using the PROBAL program. From the menu on the PC, select 6, "Wet/Dry Ratio".

15.16.3 Select 1 (for tares) and enter the request number and number of vials when the program asks for this information. Check the balance quality control by performing step 15.1.3.

15.16.4 At this point, the program will proceed automatically without further interaction from the keyboard. Weigh each 20 ml glass vial by placing it in the center of the balance pan, closing the door, and depressing the mouse button on the Mettler balance. The program will wait for the balance to stabilize, record the weight into a file, and prompt for the next vial on the display of the balance. Proceed until all of the vials have been tared.

15.16.5 Beginning with the first sample in the batch and tared vial number one, remove a 5-10 gram portion of the sample from the polyethylene bag and transfer to the vial.

15.16.6 Processing one sample at a time, transfer 5-10 gram portions to the tared vials. Be certain that the vial number matches the sample position in the batch.

15.16.7 After all samples from a batch have been placed into vials, weigh the vials using PROBAL as in 15.6.2 and 15.6.3 except select 2 (for wet gross weight) when the program asks for this information.

15.16.8 Check to be certain the drying oven temperature is between 103-105°C, and place the vials in the oven for 15-24 hours. Contact the LLRAG supervisor if the oven temperature is not correct. (Note: At least monthly, verify the oven thermometer calibration by checking it against a NIST calibrated thermometer. Enter the thermometer calibration in the project logbook.)

15.16.9 At the end of the drying time, place the samples into a desiccator filled with indicating Drierite, and allow them to cool to room temperature.

15.16.10 Reweigh the dried samples using PROBAL as in 15.16.2 and 15.16.3 (except select 3 for dry gross weights) to allow the percent solids in the sample to be determined.

15.16.11 At least once each week, transfer the weight files to a floppy disk and give the disk to the AnaLIS system mangers for transfer to the ACD VAX.

16 NEUTRON IRRADIATIONS

Samples must be irradiated within 28 days after sampling to comply with mercury holding time requirements specified in EPA CLP SOW 788. Neutron irradiations of all samples are made for 60 seconds which is equivalent to a neutron fluence of about 3×10^{15} n/cm^2. When the irradiation is complete, a decay timer is started automatically by the system for 15 seconds, and the irradiated rabbit is returned to the delayed neutron counting (DNC) system for measurement of ^{235}U. An arrival detector at the entrance to the DNC detects the arrival of the rabbit. When the decay time of 15 seconds is complete, the counter that records neutron counts is started. When the counting period of 40 seconds elapses, the rabbit is ejected to the "dump tank" where it remains overnight to allow short-lived activities to decay.

16.1 Acquire three background counts on the DNC for 400 seconds each. Record the number of counts for each background measurement in the irradiation log book. Compute the average of the three background counts. If this average value exceeds 2,000 counts of if one value differs from any other value by more than 15%, contact the NAA laboratory supervisor.

16.2 Place the ^{241}Am-Be neutron source in the standard-test port of the DNC and count the source three times for 400 seconds. Record each count in the DNC log book. Compute and record in the log book the average number of counts for the three measurements. If the average is below 280,000, or above 360,000, or one value differs from another by more than 2%, discontinue measurements and inform the NAA laboratory supervisor.

NOTE: The delayed neutron counting system has three sets of detectors and sometimes is operated with either one, two, or three of the sets. The range given above pertains to the use of three sets of detectors; if only one or two sets are used, obtain an acceptable range for the instrument from the NAA laboratory supervisor.

16.3 Irradiate three empty rabbits containing empty inserts; record the counts for each in the irradiation log book. The average of these counts is used as a blank (subtracted from) for neutron counts for all samples and standards. Inform the NAA laboratory supervisor if any of the counts for a blank are less than 50 or greater than 150.

16.4 Select a batch of samples to be irradiated, and arrange the order of the samples as indicated in table shown in Attachment D. As indicated in the table, add to the list the calibration standards, designated as CNAA. Label the CNAA standards as standards 1, 2, and 3 for the first batch to be irradiated on a given day.

16.5 Irradiate the samples listed in Attachment D in the order given. For each sample record in the irradiation log book the rabbit number, the date and time that the irradiation ended, and the neutron counts.

16.6 Repeat steps 16.4 and 16.5 for one to three additional batches of samples for a single day.

Note: On a given day, the last CNAA standard of the preceeding batch is used as the first CNAA standard of the next batch, thus making it necessary to prepare only two CNAA standards per batch except the first where three are needed.

16.7 Label the middle and last CNAA standards of batch two as standards 4 and 5. Likewise label these standards 6 and 7 for batch three and 8 and 9 for batch four.

16.8 The following day, retrieve all rabbits from the DNC dump tank, remove inserts containing samples from rabbits, place in labeled counting vials and arrange sequentially in a sample holding block for counting.

16.9 Counting from the day of irradiations, store samples for at least 5 and less than 10 days prior to gamma-ray spectroscopy measurements.

16.10 Enter delayed neutron counting data into a spreadsheet and calculate uranium-235 results for each sample. Store the file as Hg####.U35, where Hg#### is the batch number.

17 GAMMA-RAY SPECTROSCOPY MEASUREMENTS

Following a decay period of 5-10 days, gamma spectra of each sample in each batch of samples are acquired for at least 1000 seconds. All samples of a given batch are counted on the same detector. Samples are counted on plastic spacers such that the distance from the center of the insert to the detector end cap is constant for all samples counted during a run. Samples are counted in numerical order rather than in the order of irradiataion listed in Attachment D.

17.1 Place the energy calibration standard on each detector and aquire a spectrum. Calibrate the energy scale if any of the principle gamma-rays are not within the energy tolerance of ±2 Kev. If the detector cannot be calibrated to this tolerance, contact the laboratory supervisor.

17.2 Place the efficiency check source (Section 9.13) at the designated geometry for that particular detector. Accumulate and analyze spectra for the standard by starting the Autosequence "COSTD" which prompts the user for the appropriate detector number and generates an activity report. If the Co-60 activity is not within 5% of the certified value, contact the laboratory supervisor before continuing.

17.3 Select a calibration standard (CNAA) from a sample batch, place on a plastic spacer on a detector and begin spectrum acquisition by starting the autosequence "HGON#", where # represents the detector number. The autosequence prompts the operator for the sample number and runs the Canberra/Nuclear Data program "PARS" which allows the operator to enter the sample's irradiation date and time. Enter D#S*** when prompted for a sample number. All other relevant sample parameters are updated automatically by the autosequence.

Note: Spectral configuration files of CNAA samples are stored on the system fixed disk as HGD#S***.DAT, where the asterisks denote a unique three digit sample number entered by the operator.

17.4 Check the analyzer dead time. If the dead time exceeds five percent, notify the laboratory supervisor.

17.5 Record the sample ID, irradiation date, detector number, and the spectral configuration file name in the gamma spectroscopy log book.

17.6 Repeat Steps 17.3 through 17.5 for other CNAA samples until all CNAA samples for all sample batches have been completed.

17.7 Select a sample of a batch and count as described in Step 17.3 through 17.4 using the autosequence "HGON#". Enter the sample number from the counting vial and other information as described in Step 17.3.

Note: Spectral configuration files of field samples and associated quality control samples are stored on the system fixed disk as HG****.DAT, where the asterisks denote the rabbit number entered by the operator.

17.8 Enter the log book information for this sample as described in Step 17.5.

17.9 Repeat Steps 17.7 and 17.8 for all samples to be counted.

17.10 Copy the spectral configuration files for all samples in a batch to a floppy disk labeled with the batch number and place disk in safe for archival storage.

18 ANALYSIS OF GAMMA-RAY SPECTRA

Due to the complexity of gamma-ray spectra obtained in this project, only experienced gamma-ray spectroscopists are allowed to perform spectra analysis. For example, due to coincidence counting losses and characteristics of detectors that vary among detectors, it is necessary for the spectroscopists to adjust some analysis parameters based on empirical observations. Whereas these parameters may vary from batch to batch, it is emphasized that all field samples in a particular batch are analyzed under the same set of conditions. All parameters used in the processing of gamma-ray spectra are stored in the computer files containing the spectra.

18.1 First check each data file for energy calibration and header parameters by using the autosequence "CHECK" which prompts the users for the sample numbers to be checked. If a sample spectrum indicates an energy for the 1595 Kev gamma-

ray outside the energy tolerance of ±2 Kev then the sample energy scale must be recalibrated by selecting unambiguous peaks in the spectrum. Sample paramaters can be updated individually with the "CHECK" autosequence or automatically with the autosequence "UPDATE#", where # denotes the detector number.

18.2 Analyze a batch of samples by running the autosequence "HGAUTO#", where # denotes the detector number. Enter the first and last sample numbers when prompted.

Note: "HGAUTO#" also runs the neutron activation analysis program HGSOIL# which generates activities for the elements in the sample. Results are stored in files named HG****.res, where the astericks denote the rabbit number.

18.3 Start the autosequence "HGSTD#", where # denotes the detector number, to analyze the set of calibration standards that correspond to the batch of samples analyzed in section 18.2. This autosequence will prompt the operator for the first and last standard numbers as indicated in section 18.2. However, standard result files are stored as HGD#S***.RES, where # denotes the detector number and the astericks represent the standard number.

18.4 Merge each individual sample result file for the batch analyzed in section 18.2 by using the the DOS copy command as follows: Type "copy HG*.RES HG####.RES", where HG#### is the batch number.

18.5 Repeat step 18.4 for the standards for the batch by typing "copy HG*.STD HG####.STD", where HG#### is the batch number.

18.6 Copy both files HG####.RES and HG####.STD to floppy disks and transfer them to the AnaLIS System Manager.

19 DATA HANDLING AND REPORTING

The computer program PROBAL writes the appropriate weight data to data files on the PC's hard disk. This process is automatic once PROBAL is initiated and the user inputs the correct request number for the batch being weighed. Five files are created during the weighing process with the prefix of each file name being the request number. The suffix of the file name will be the following: TAR contains the tare weight of the insert, GRS contains gross weight of the wet sample loaded in the insert, WDT contains the wet/dry tare, WET contains the gross wet weight before drying, and DRY contains the gross dry weight after drying in the oven.

The results obtained by NAA of the samples are written in ASCII format to a floppy disk as described in Sect. 18.6. Floppy disks containing NAA results (Hg####.RES),

uranium-235 results (Hg####.U35), and calibration standard data (Hg####.STD) are delivered to the AnaLIS System Manager who transfers the data files to the ACD VAX computer. Once all appropriate data files have been transferred to the VAX, the AnaLIS System Manager runs a FORTRAN program, "PROCESS_NAA_DATA" that reads the weights and analytical results for each sample, corrects for percent solids, and outputs this data to a file in the proper format for electronic transfer into AnaLIS.

19.1 Transfer the five weight files, the NAA results file, the uranium-235 result file, and the calibration standard file to the ACD VAX using ETHERNET file transfer.

19.2 Log on to the ACD VAX and run the program that processes the data for transfer into AnaLIS by typing PND (runs "PROCESS_NAA_DATA"). Enter the request number and the first sample number of the samples to be processed when the program prompts for them.

19.3 When the program finishes, transfer the data to AnaLIS by typing FILE_DATA.

19.4 A preliminary data report is automatically generated by the AnaLIS data management system. Both the NAA and LLRAG supervisors shall review and approve this preliminary data. Calculation and typographical errors are identified and corrected prior to release to SAIC.

19.5 Transfer the preliminary data electronically to SAIC by running AnaLIS and deleting the HOLD analysis.

19.6 Log on to STC10 VAX and generate the NAA Data Report forms by using the SAS package developed by SAIC and ORNL.

19.7 Both the NAA and LLRAG supervisor will review the NAA Data Reporting forms for completeness, accuracy, and adherence to project quality control requirements (Section 23). For each batch of samples, the NAA supervisor with assistance from the LLRAG supervisor will prepare a narrative summary of the work on the batch of samples. This summary will identify and document procedural deviations and/or problems, quality control failures with potential impact on reliability of results, unusual sample behavior, and any other information pertinent to the analysis of the batch of samples. The NAA and LLRAG supervisors and the section manager will sign the Cover Page of the NAA Data Package (Section 21) and the narrative summary indicating their acceptance and approval of the documents.

19.8 Mail the signed and completed forms to: Manager, East Fork Poplar Creek Project, Science Applications International Corporation, 301 Laboratory Rd., Oak Ridge, TN 37830. A copy of the report package is retained in the analysis file of the LLRAG.

20 CALCULATIONS

All calculations are performed by computer programs following instructions in Sections 16, 17, 18, and 19. The basis for the calculations and the computer programs that are used are described in Section 7. The functional operations of these programs have been checked to be certain that they perform properly as described in Section 23.

21 REPORTS

Reporting of results for this method is designed to be as compatible with EPA CLP SOW 788 requirement as possible. The following forms are generated for each batch of samples:

Cover Page	-	NAA Data Package
1	-	NAA Data Sheet
2A	-	Initial and Continuing Calibration Verification
3	-	Blanks
5A	-	Spike Sample Recovery
6	-	Duplicates
7	-	Laboratory Control Sample
10	-	Instrument Detection Limits
13	-	Preparation Log

Other CLP reporting forms (2B, 4, 5B, 8, 9, 11A, 11B, 12) are designed for inductively coupled plasma spectrometry or atomic absorption analysis and are not used in this work. All raw data for analysis by this procedure are retained by the analytical laboratory and copies are made available to SAIC on request. This includes computer files as well as laboratory work sheets and notebooks.

22 PRECISION AND BIAS

Tables 1 and 2 in Attachment E summarize data that relate to the precision and bias obtained in this study for each of the trace elements measured in approximately 120 samples. Table 1 lists data for the Laboratory Control Sample (LCS), and Table 2 lists data for the Continuing Calibration Standard (CCV). As described in Section 14, the LCS for mercury consists of two NIST Research Material soil samples containing either 50 ± 2 or 107 ± 2 ug of mercury per gram of soil. The LCS for arsenic consists of fly ash as the NIST SRM 1633a containing 145 ± 15 ug arsenic per gram of sample. The other trace elements for the LCS and the CCV were spiked into high-purity SiO_2 in known total quantity and are expressed as total micrograms, not micrograms per gram.

Title:

NEUTRON ACTIVATION ANALYSIS OF EAST FORK POPLAR CREEK SAMPLES

The data consists of the means, standard deviations, 95 percent confidence intervals for the means, along with the number of samples from which the data were obtained. The standard deviations, s, were computed by the usual expression, as given by Eq. 2, where x is the measured value of the analyte, $\bar{x}$ is the mean, and n is the number of samples measured. Eq. 3 indicates how the 95% confidence interval was computed, where t is the students "t" statistic obtained from tables of the statistic at the 95 percent confidence level for the degrees of freedom corresponding to the number of samples measured.

$$s=\sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} \qquad (2)$$

$$95\%\,Conf.Interval=\bar{x}\pm\frac{t\times s}{\sqrt{n}} \qquad (3)$$

The sample standard deviation shows the overall precision of the method at the levels of the analytes in the LCS and the CCV. Although they are not listed in the table, the relative standard deviations, expressed as a percentage of the mean, varies from 0.6 percent for ^{235}U (in both data sets) to about 12 percent for arsenic in the CCV data set. In the case of the LCS samples, none of the relative standard deviations exceed 8 percent.

Were it not for the fact that the known quantities of analytes have some uncertainty associated with them, possible biases in the measurements would be indicated by whether or not the known amount of analyte lies within the 95 percent confidence interval. As can be seen for the LCS data set, the trace elements whose known values lie within the 95% confidence intervals are Hg (50 ug/g sample), ^{238}U, Cr, and Sb. Although the known concentration (107 ug/g) for the other mercury sample does not lie within the 95% CL, there is overlap when the uncertainty of ±2 ug/g is taken into account. Similar comments can be made about arsenic in the LCS data set, where the uncertainty is ±15 µg/g, as well as all the other trace elements in both the LCS and the CCV samples. Pipetting errors of about ±3% would be expected for those samples prepared by spiking trace elements into high-purity SiO_2. When pipetting errors of this size are taken into account and superimposed on the known value, the resulting intervals for the known values overlap the 95% confidence intervals, and as a result,there does not seem to be

any evidence for bias for any trace element in either of the data sets.

23 QUALITY ASSURANCE/QUALITY CONTROL

Several computer programs are used for the experimental and data management operations of this method. The functional operation of these programs have been checked to be certain that they perform properly. Validation of the program PROBAL was carried out by observing that the weights of samples that were measured by the balance were identical to the weights recorded by the program. Validation of the program PROCESS_NAA_DATA was performed by manually calculating all results for a field sample and observing that these results were the same as those computed by the program. The programs described in Section 7 that are used to conduct neutron activation analysis are validated on a continuing basis by performance testing. Operation of the gamma spectrometer to determine valid results for radioactivity measurements is tested daily by analysis of a standard radioactive source as indicated in Step 17.2. This procedure validates the programs PEAK, SPLIN, and NID. The agreement within the required limits of ±20 percent of measured amounts of analytes in the laboratory control samples with the known values is taken as evidence that the operations of all the computer programs, including the programs HGSOIL and PROCESS_NAA_DATA are operating correctly. The SAS package for generation of CLP compatible data report packages was developed and validated by SAIC.

Quality assurance for this procedure is similar to requirements for the EPA Contract Laboratory Program as specified in EPA SOW 788. The following quality control (QC) samples are run as part of this procedure:

1. Internal quality control samples
2. External blind quality control samples
3. Analysis of spiked samples
4. Duplicate analysis of samples
5. Multiple analysis of selected samples to establish precision and bias.

Internal QC samples are made from standard reference materials and are analyzed at a rate of 1 QC sample per 20 field samples. External QC samples are submitted blind to the analysis laboratory at a rate of 1 sample per 40 field samples. (Results for external QC samples are reviewed by project management rather than the analytical laboratory). Spiked samples and duplicates are run at a rate of 1 spiked and duplicate sample for each 20 field samples. One laboratory blank sample (empty irradiation insert) is analyzed with each batch of 20 samples. Also, field blanks are submitted on a regular basis and are analyzed as samples by the laboratory.

Quality control results are routinely monitored during this work to be certain results are reliable and to establish an overall precision level for the results. Acceptable QC limits for internal and external QC samples is set at ±20%. The limit for spiked and duplicate quality control samples is set at ±35%. Blanks are acceptable if the quantity of each

element is less than two micrograms. The acceptable QC limit for the continuous calibration verification control is set at ±20% for all elements. Any quality control data exceeding these limits is documented in the case narrative by the analytical laboratory. An assessment is made by project management (SAIC) of the effect of any quality control failure on the validity of analysis results. If necessary, project management will specify corrective actions which may include taking additional field samples for analysis, repeating analyses on single or batches of samples, or rejection of selected results.

24 CERTIFICATION AND TRAINING

The functions and activities described in this procedure fall into two categories, technical and professional. The technical functions include Sample Receiving and Chain of Custody (Section 14), Sample Preparation (Section 15), Neutron Irradiations (Section 16), and Gamma-Ray Spectroscopy Measurements (Section 17). Professional functions include Analysis of Gamma-Ray Spectra (Section 18), Data Handling and Reporting (Section 19) and Reports (Section 21).

All of the technical functions of the procedure are done by staff members whose proficiencies are ascertained on the basis of performance based training. Supervisors of the LLRAG and NAA laboratory observe the trainee conduct each step until it is evident that the trainee can competently perform the procedures without oversight. A detailed training program (Reference 3.5) is required before technical staff are allowed to independently operate pneumatic tubes for neutron irradiations. Results from calibration standards are used to measure proficiency in performing gamma-ray spectroscopy measurements. Written records of training are maintained at each laboratory and are also provided to the section manager. The supervisors of the LLRAG and NAA laboratories certify that staff have been trained and are qualified to perform appropriate parts of the method. This certification consists of an internal memorandum to the section manager specifying the procedural operations each technician is qualified to perform. Recertification of technicians is required annually. All professional functions are done by scientists with experience in their respective fields. The AnaLIS System manager performs Sections 19 and 20, and the NAA laboratory supervisor performs Section 18. The section manager must consent to the capabilities of all professionals involved with this method.

Oak Ridge National Laboratory
Analytical Chemistry Division

STANDARD ANALYTICAL METHOD

Procedure No. AC-MM-222002 Rev.

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Attachment A

REQUEST FOR ORNL ANALYTICAL SERVICES

SEE REVERSE SIDE FOR INSTRUCTIONS

ACD REQUEST NO.

PAGE ____ OF

(4) CHAIN OF CUSTODY YES

(5) SAMPLE MATRIX

(8) DEADLINE (MM/DD/YY)

(7) PROJECT NO

(8) SERIES

(9) CUSTOMER NAME

BUILDING MAIL STOP

(10) CHARGE NO

(12) COST DEPT NO

(13) SAMPLED FROM

(18) FREQUENCY

(19) MATERIAL DESCRIPTION

COMMENTS:

NOTE Customers should pick up samples within 10 days of reporting results
Additional charges may result if ACD is required to dispose of samples

Compliance Sample* RCRA NPDES OTHER

If Other please specify in comments

ACD NUMBER	(15) CUSTOMER SAMPLE ID (16)	(17) SAMPLE DATE MM/DD/YY	TIME	(21) ANALYSIS (30)	METHOD ID (14)	DETECTION LIMITS

* [AnaLIS Field No] Field Name (No Char)

RECEIVED BY

SUBMITTED BY /PHONE

To arrange E-trans of data send E mail to STC . . NTJ or TEASLEYNAJH on OA VAX

UCN-16522
(3 5-88)

Attachment B

SAMPLE INTEGRITY AND CHAIN OF CUSTODY RECORD
ORNL ANALYTICAL CHEMISTRY DIVISION

ACD Request No:

Assigned:

Released by: _____

Received by: _____ on (date) _____ at (military time) _____

SHIPPING CONTAINER ID: N/A ____

AIR BILL COPY: ____ PRESENT ____ ABSENT ____
PACKING LIST: ____ PRESENT ____ ABSENT ____
TRAFFIC REPORT: ____ PRESENT ____ ABSENT ____

SAMPLE DOCUMENTATION:

CUSTODY SEAL: ____ PRESENT ____ ABSENT ____ INTACT ____ BROKEN
CUSTODY RECORD: ____ PRESENT ____ ABSENT
SAMPLE TAGS: ____ PRESENT ____ ABSENT
DO DOCUMENTS AGREE: ____ YES ____ NO

CONDITION OF SAMPLES UPON RECEIPT:

____ ALL INTACT ____ SOME BROKEN ____ SOME LEAKING

(DOCUMENT PROBLEMS ON BACK)

ACD Number	Transferred To (Initials)	Transfer Date/Time	Sample Location BLDG ROOM AREA	Reason for Transfer	Returned To BLDG ROOM AREA	Returned by:	Date/ Time	No. Broke	Sample State +

+ 1. Original Sample
2. Sub Sample
3. Extract
4. No. Sample Remaining

Oak Ridge National Laboratory Analytical Chemistry Division STANDARD ANALYTICAL METHOD	Procedure No. AC-MM-222002 Rev. Page 26 of 28

Attachment C

East Fork Poplar Creek Project
Sample Prep Worksheet

Prepped By:	Req. No.
	HG
Verified By:	

Rabbit #'s	W/D #	AnaLIS #'s

Comments

Spiked sample _____ with _____ ml's of _____.

Initial _____

Wet/Dry Determination

Drying Oven ID: _____

Date/Time In	Temp C	Date/Time Out	Temp C
_____	_____	_____	_____

Released by _____ Received by _____ on Date/time _____

Attachment D. Irradiation Sequence for Batch of Soil Samples.

SAMPLE	DESCRIPTION
CNAA-1	Calibration Standard for NAA (SiO_2 spiked with Cr, As, Sb, Se, Zn, Hg, and U)
1-5	Field Samples
26	Laboratory Control Sample for elements other than As and Hg: SiO_2 spiked with Cr, Sb, Se, U, Zn,
6-10	Field Samples
21	Spiked Field Sample
22	Duplicate of Field Sample
CNAA-2	Calibration Standard for NAA (SiO_2 spiked with Cr, As, Sb, Se, Zn, Hg, and U)
23	Laboratory Control Sample for Mercury: Either NIST RM 8407 or 8408.
24	Laboratory Control Sample for Arsenic: Fly Ash NIST SRM 1633a
25	Blank
11-15	Field Samples
27	CCV
16-20	Field Samples
CNAA-3	Calibration Standard for NAA (SiO_2 spiked with Cr, As, Sb, Se, Zn, Hg, and U)

Attachment E

Table 1. Summary of Data for NIST Standards for Precision and Bias Evaluation

Element	Known Value	Number Meas.	Obs. Mean (μg/g)	Sample Std. Dev. (μg/g)	95% Confidence Interval on Mean (μg/g)
Hg	50 μg/g	73	50	7	48-52
Hg	107 μg/g	73	97	12	94-100
As	145 μg/g	102	137	7	136-139

Table 2. Summary of Data for Continuing Calibration Standards for Precision and Bias Evaluation

Element	Known Value (μg)	Number Samples	Obs. Mean (μg)	Std. Dev. (μg)	95% Confidence Interval on Mean (μg)
Hg	100	292	103	14.6	101-104
^{238}U	50	283	49.1	4.32	48.6-49.6
^{235}U	0.36	311	0.35	0.02	0.35-0.36
Cr	200	289	207	15.2	205-209
Zn	500	293	506	41.8	502-511
As	20	206	20.2	1.55	20-20.4
Se	100	297	100	9.73	99.3-102
Sb	20	271	20.1	1.16	20-20.3

APPENDIX B

TEST RESULTS OF STATISTICAL ANALYSES FOR NAA/CV-AA

B-3

Test 1 - Comparisons of Hg Concentrations among labs analyzing by CV-AA

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCATION	2	BR WA
STATION	4	02 04 05 06
SAMPLE	4	E N S W
LAB	3	CCL EPA ORNL

Number of observations in data set = 85

B-4

Test 1 - Comparisons of Hg concentrations among labs analyzing by CV-AA

General Linear Models Procedure

Dependent Variable: VALUE Hg conc#(μg/g)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	18	4459906.6088	247772.5894	17.11	0.0001
Error	66	955908.3907	14483.4605		
Corrected Total	84	5415814.9995			

R-Square	C.V.	Root MSE	VALUE Mean
0.823497	51.08067	120.34725	235.6023529

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LOCATION	1	1877348.7798	1877348.7798	129.62	0.0001
STATION(LOCATION)	3	1682539.0296	560846.3432	38.72	0.0001
SAMPL(LOCATI*STATIO)	12	731372.3782	60947.6982	4.21	0.0001
LAB	2	168646.4213	84323.2106	5.82	0.0047

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCATION	1	1877348.7798	1877348.7798	129.62	0.0001
STATION(LOCATION)	3	1682539.0296	560846.3432	38.72	0.0001
SAMPL(LOCATI*STATIO)	12	731372.3782	60947.6982	4.21	0.0001
LAB	2	168646.4213	84323.2106	5.82	0.0047

Test 1 - Comparisons of Hg concentrations among labs analyzing by CV-AA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 66 MSE= 14483.46
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 42.35294

Number of Means 2
Critical Range 52.26

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	LOCATION
A	393.23	40	BR
B	95.49	45	WA

Level of STATION	Level of LOCATION	N	VALUE Mean	VALUE SD
02	BR	20	188.815000	178.637694
05	BR	20	597.650000	227.360200
04	WA	15	95.533333	37.368162
05	WA	15	114.680000	107.147483
06	WA	15	76.246667	78.908662

B-6

Test 1 - Comparisons of Hg concentrations among labs analyzing by CV-AA

General Linear Models Procedure

Level of SAMPLE	Level of LOCATION	Level of STATION	N	VALUE Mean	VALUE SD
E	BR	02	5	236.800000	120.487344
N	BR	02	5	69.680000	12.606030
S	BR	02	5	422.800000	120.810596
W	BR	02	5	25.980000	10.394806
E	BR	05	5	520.600000	104.593499
N	BR	05	5	595.200000	174.251829
S	BR	05	5	597.000000	181.583314
W	BR	05	5	677.800000	394.721674
E	WA	04	5	127.800000	42.357998
S	WA	04	5	82.900000	28.187763
W	WA	04	5	75.900000	17.771325
E	WA	05	5	75.780000	15.462923
S	WA	05	5	230.000000	118.608600
W	WA	05	5	38.260000	7.747774
E	WA	06	5	167.320000	54.079682
S	WA	06	5	3.620000	2.007984
W	WA	06	5	57.800000	38.442099

B-7

Test 1 - Comparisons of Hg concentrations among labs analyzing by CV-AA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 66 MSE= 14483.46
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 25.5

Number of Means	2	3
Critical Range	67.35	70.81

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	LAB
A	275.42	34	CCL
A			
A	264.65	17	EPA
B	181.26	34	ORNL

B-8

Test 1B - Comparisons of Hg concentrations among EPA and CCL analyzing by CV-AA and ORNL analyzing by NAA

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCATION	2	BR WA
STATION	4	02 04 05 06
SAMPLE	4	E N S W
LAB	3	CCL EPA ORNL

Number of observations in data set = 85

Test 1B - Comparisons of Hg concentrations among EPA and CCL analyzing by CV-AA and ORNL analyzing by NAA

General Linear Models Procedure

Dependent Variable: Value Hg conc#(μg/g)

Source	DF	Sum of Squares	Mean Square	F Value	PR > F
Model	18	5432879.4856	301826.6381	23.11	0.0001
Error	66	861807.8975	13057.6954		
Corrected Total	84	6294687.3831			

R-Square	C.V.	Root MSE	VALUE Mean
0.863090	44.72665	114.27027	255.4858824

Source	DF	Type I SS	Mean Square	F Value	PR > F
LOCATION	1	2314262.2373	2314262.2373	177.23	0.0001
STATION(LOCATION)	3	2166296.5618	722098.8539	55.30	0.0001
SAMPL(LOCATI*STATIO)	12	916948.5920	76412.3827	5.85	0.0001
LAB	2	35372.0945	17686.0473	1.35	0.2652

Source	DF	Type I SS	Mean Square	F Value	PR > F
LOCATION	1	2314262.2373	2314262.2373	177.23	0.0001
STATION(LOCATION)	3	2166296.5618	722098.8539	55.30	0.0001
SAMPL(LOCATI*STATIO)	12	916948.5920	76412.3827	5.85	0.0001
LAB	2	35372.0945	17686.0473	1.35	0.2652

B-10

Test 1B - Comparisons of Hg concentrations among EPA and CCL analyzing by CV-AA and ORNL analyzing by NAA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 66 MSE= 13057.7
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 42.35294

Number of Means 2
Critical Range 49.62

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	LOCATION
A	430.50	40	BR
B	99.92	45	WA

Level of STATION	Level of LOCATION	N	VALUE Mean	VALUE SD
02	BR	20	198.350000	181.991404
05	BR	20	662.650000	219.618155
04	WA	15	104.533333	34.379950
05	WA	15	115.933333	106.913494
06	WA	15	79.286667	80.996833

Test 1B - Comparisons of Hg concentrations among EPA and CCL analyzing by CV-AA and ORNL analyzing by NAA

General Linear Models Procedure

Level of SAMPLE	Level of LOCATION	Level of STATION	N	VALUE Mean	VALUE SD
E	BR	02	5	252.600000	112.600178
N	BR	02	5	78.800000	19.829271
S	BR	02	5	434.000000	129.884564
W	BR	02	5	28.000000	12.267844
E	BR	05	5	511.600000	114.920842
N	BR	05	5	682.000000	261.997137
S	BR	05	5	654.600000	119.917889
W	BR	05	5	802.400000	281.764618
E	WA	04	5	138.200000	32.744465
S	WA	04	5	81.400000	24.439722
W	WA	04	5	94.000000	15.588457
E	WA	05	5	82.200000	5.630275
S	WA	05	5	232.000000	114.549116
W	WA	05	5	33.600000	10.876580
E	WA	06	5	176.000000	45.072164
S	WA	06	5	2.460000	1.948846
W	WA	06	5	59.400000	36.909348

B-12

Test 1B - Comparisons of Hg concentrations among EPA and CCL analyzing by CV-AA and ORNL analyzing by NAA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 66 MSE= 13057.7
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 25.5

Number of Means	2	3
Critical Range	63.95	67.24

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	LAB
A	275.42	34	CCL
A			
A	264.65	17	EPA
A			
A	230.97	34	ORNL

B-13

Test 2 - Comparisons of Hg concentrations in soils measured by CV-AA and NAA

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCATION	2	BR WA
STATION	4	02 04 05 06
SAMPLE	4	E N S W
METHOD	2	CV NAA

Number of observations in data set = 68

B-14

Test 2 - Comparisons of Hg concentrations in soils measured by CV-AA and NAA

General Linear Models Procedure

Dependent Variable: VALUE Hg conc#(μg/g)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	2703250.3660	159014.7274	19.97	0.0001
Error	50	398207.3062	7964.1461		
Corrected Total	67	3101457.6722			

R-Square	C.V.	Root MSE	VALUE Mean
0.871606	43.29697	89.242065	206.1161765

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LOCATION	1	1079063.4575	1079063.4575	135.49	0.0001
STATION(LOCATION)	3	1075630.3803	358543.4601	45.02	0.0001
SAMPL(LOCATI*STATIO)	12	506550.0869	42212.5072	5.30	0.0001
METHOD	1	42006.4413	42006.4413	5.27	0.0259

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCATION	1	1079063.4575	1079063.4575	135.49	0.0001
STATION(LOCATION)	3	1075630.3803	358543.4601	45.02	0.0001
SAMPL(LOCATI*STATIO)	12	506550.0869	42212.5072	5.30	0.0001
METHOD	1	42006.4413	42006.4413	5.27	0.0259

B-15

Test 2 - Comparisons of Hg concentrations in soils measured by CV-AA and NAA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 50 MSE= 7964.146
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 33.88235

Number of Means 2
Critical Range 43.57

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	LOCATION
A	339.73	32	BR
B	87.35	36	WA

Level of STATION	Level of LOCATION	N	VALUE Mean	VALUE SD
02	BR	16	158.331250	134.489557
05	BR	16	521.125000	184.204551
04	WA	12	85.583333	27.063052
05	WA	12	118.933333	101.854641
06	WA	12	57.533333	63.466474

B-16

Test 2 - Comparisons of Hg concentrations in soils measured by CV-AA and NAA

General Linear Models Procedure

Level of SAMPLE	Level of LOCATION	Level of STATION	N	VALUE Mean	VALUE SD
E	BR	02	4	175.750000	41.812080
N	BR	02	4	86.600000	15.768323
S	BR	02	4	348.000000	92.994624
W	BR	02	4	22.975000	11.541339
E	BR	05	4	400.250000	43.622433
N	BR	05	4	635.000000	260.339522
S	BR	05	4	564.500000	148.724578
W	BR	05	4	484.750000	191.870399
E	WA	04	4	106.000000	16.248077
S	WA	04	4	68.375000	26.449244
W	WA	04	4	82.375000	27.524338
E	WA	05	4	72.475000	14.943756
S	WA	05	4	248.500000	55.812185
W	WA	05	4	35.825000	15.182528
E	WA	06	4	135.150000	44.937994
S	WA	06	4	2.950000	2.542309
W	WA	06	4	34.500000	5.579128

B-17

Test 2 - Comparisons of Hg concentrations in soils measured by CV-AA and NAA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 50 MSE= 7964.146

Number of Means 2
Critical Range 43.49

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	METHOD
A	230.97	34	NAA
B	181.26	34	CV

B-18

Test 3A - Evaluates within laboratory variability for Hg analyses by CV-A

----------Lab=CCL----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCATION	2	BR WA
STATION	4	02 04 05 06
SAMPLE	4	E N S W
SUBSAMP	2	1 2

Number of observations in by group = 34

B-19

Test 3A - Evaluates within laboratory variability for Hg analyses by CV-A

----------Lab=CCL----------

General Linear Models Procedure

Dependent Variable: VALUE Hg conc#(µg/g)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	20	2874254.4716	143712.7236	9.44	0.0001
Error	13	197977.9640	15229.0742		
Corrected Total	33	3072232.4356			

R-Square	C.V.	Root MSE	VALUE Mean
0.935559	44.80643	123.40613	275.4205882

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LOCATION	1	1213631.3086	1213631.3086	79.69	0.0001
STATION(LOCATION)	3	859941.7169	286647.2390	18.82	0.0001
SAMPL(LOCATI*STATIO)	12	635256.8050	52938.0671	3.48	0.0171
SUBSAMP(SAMPLE)	4	165424.6410	41356.1603	2.72	0.0764

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCATION	1	1300228.0142	1300228.0142	85.38	0.0001
STATION(LOCATION)	3	859941.7169	286647.2390	18.82	0.0001
SAMPL(LOCATI*STATIO)	9	528495.2648	58721.6961	3.86	0.0140
SUBSAMP(SAMPLE)	4	165424.6410	41356.1603	2.72	0.0764

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Test 3A - Evaluates within laboratory variability for Hg analyses by CV-A

----------Lab=CCL----------

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 13 MSE= 15229.07
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 16.94118

Number of Means 2
Critical Range 91.43

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	LOCATION
A	475.81	16	BR
B	97.29	18	WA

Level of STATION	Level of LOCATION	N	VALUE Mean	VALUE SD
02	BR	8	244.000000	225.230675
05	BR	8	707.625000	279.818787
04	WA	6	101.333333	28.514324
05	WA	6	94.833333	99.762551
06	WA	6	95.716667	91.257184

Test 3A - Evaluates within laboratory variability for Hg analyses by CV-A

----------Lab=CCL----------

General Linear Models Procedure

Level of SAMPLE	Level of LOCATION	Level of STATION	N	VALUE Mean	VALUE SD
E	BR	02	2	354.00000	110.308658
N	BR	02	2	71.50000	12.020815
S	BR	02	2	517.00000	145.663997
W	BR	02	2	33.50000	13.435029
E	BR	05	2	582.00000	5.656854
N	BR	05	2	601.50000	310.419877
S	BR	05	2	630.50000	212.839141
W	BR	05	2	1016.50000	386.787409
E	WA	04	2	131.50000	27.577164
S	WA	04	2	79.50000	16.263456
W	WA	04	2	93.00000	11.313708
E	WA	05	2	80.00000	7.071068
S	WA	05	2	167.00000	179.605122
W	WA	05	2	37.50000	4.949747
E	WA	06	2	194.50000	50.204581
S	WA	06	2	3.15000	2.757716
W	WA	06	2	89.50000	48.790368

Level of SUBSAMP	Level of SAMPLE	N	VALUE Mean	VALUE SD
1	E	5	240.000000	203.537466
2	E	5	296.800000	207.662467
1	N	2	222.500000	225.567063
2	N	2	450.500000	523.966125
1	S	5	200.640000	227.343018
2	S	5	358.220000	334.475772
1	W	5	188.200000	311.020417
2	W	5	319.800000	543.563888

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Test 3B - Evaluates within laboratory variability for Hg analyses by CV-A

----------Lab=ORNL----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCATION	2	BR WA
STATION	4	02 04 05 06
SAMPLE	4	E N S W
SUBSAMP	2	1 2

Number of observations in by group = 34

Test 3B - Evaluates within laboratory variability for Hg analyses by CV-A

----------Lab=ORNL----------

General Linear Models Procedure

Dependent Variable: VALUE Hg conc#(μg/g)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	20	997201.37629	49860.06881	24.51	0.0001
Error	13	26450.88400	2034.68338		
Corrected Total	33	1023652.26029			

R-Square	C.V.	Root MSE	VALUE Mean
0.974160	24.88526	45.107465	181.2617647

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LOCATION	1	378309.04314	378309.04314	185.93	0.0001
STATION(LOCATION)	3	357131.81340	119043.93780	58.51	0.0001
SAMPL(LOCATI*STATIO)	12	226224.49875	18852.04156	9.27	0.0002
SUBSAMP(SAMPLE)	4	35536.02100	8884.00525	4.37	0.0186

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCATION	1	313793.00139	313793.00139	154.22	0.0001
STATION(LOCATION)	3	357131.81340	119043.93780	58.51	0.0001
SAMPL(LOCATI*STATIO)	9	137473.41721	15274.82413	7.51	0.0007
SUBSAMP(SAMPLE)	4	35536.02100	8884.00525	4.37	0.0186

Test 3B - Evaluates within laboratory variability for Hg analyses by CV-A

----------Lab=ORNL----------

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 13 MSE= 2034.683
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 16.94118

Number of Means 2
Critical Range 33.42

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	LOCATION
A	293.14	16	BR
B	81.81	18	WA

Level of STATION	Level of LOCATION	N	VALUE Mean	VALUE SD
02	BR	8	146.412500	128.900409
05	BR	8	439.875000	115.148894
04	WA	6	74.333333	23.744108
05	WA	6	117.366667	107.203632
06	WA	6	53.733333	61.330764

Test 3B - Evaluates within laboratory variability for Hg analyses by CV-A

----------Lab=ORNL----------

General Linear Models Procedure

Level of SAMPLE	Level of LOCATION	Level of STATION	N	VALUE Mean	VALUE SD
E	BR	02	2	156.000000	8.485281
N	BR	02	2	75.200000	14.424978
S	BR	02	2	334.000000	59.396970
W	BR	02	2	20.450000	7.848885
E	BR	05	2	411.500000	57.275649
N	BR	05	2	526.500000	0.707107
S	BR	05	2	492.500000	205.768073
W	BR	05	2	329.000000	21.213203
E	WA	04	2	93.000000	9.899495
S	WA	04	2	70.250000	39.244426
W	WA	04	2	59.750000	5.020458
E	WA	05	2	64.450000	20.293965
S	WA	05	2	246.000000	82.024387
W	WA	05	2	41.650000	12.798633
E	WA	06	2	124.300000	54.730065
S	WA	06	2	4.400000	2.545584
W	WA	06	2	32.500000	8.768124

Level of SUBSAMP	Level of SAMPLE	N	VALUE Mean	VALUE SD
1	E	5	148.540000	129.473658
2	E	5	191.160000	150.512219
1	N	2	295.500000	325.976226
2	N	2	306.200000	312.258355
1	S	5	174.420000	150.597417
2	S	5	284.440000	247.965659
1	W	5	88.800000	126.790871
2	W	5	104.540000	134.577127

Test 3C - Evaluates within Laboratory (ORNL) Variability for Hg Analyses by NAA

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCATION	2	BR WA
STATION	4	02 04 05 06
SAMPLE	4	E N S W
SUBSAMP	2	1 2

Number of observations in data set = 34

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Test 3C - Evaluates within Laboratory (ORNL) Variability for Hg Analyses by NAA

General Linear Models Procedure

Dependent Variable: VALUE Hg conc#(µg/g)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	20	1922347.3206	96117.3660	11.01	0.0001
Error	13	113451.6500	8727.0500		
Corrected Total	33	2035798.9706			

R-Square	C.V.	Root MSE	VALUE Mean
0.944272	40.44614	93.418681	230.9705882

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LOCATION	1	729295.75531	729295.75531	83.57	0.0001
STATION(LOCATION)	3	757570.17361	252523.39120	28.94	0.0001
SAMPL(LOCATI*STATIO)	12	342610.54167	28550.87847	3.27	0.0217
SUBSAMP(SAMPLE)	4	92870.85000	23217.71250	2.66	0.0805

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCATION	1	572347.22222	572347.22222	65.58	0.0001
STATION(LOCATION)	3	757570.17361	252523.39120	28.94	0.0001
SAMPL(LOCATI*STATIO)	9	284403.85417	31600.42824	3.62	0.0179
SUBSAMP(SAMPLE)	4	92870.85000	23217.71250	2.66	0.0805

Test 3C - Evaluates within Laboratory (ORNL) Variability for Hg Analyses by NAA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 13 MSE= 8727.05
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 16.94118

Number of Means	2
Critical Range	69.21

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	LOCATION
A	386.31	16	BR
B	92.89	18	WA

Level of STATION	Level of LOCATION	N	VALUE Mean	VALUE SD
02	BR	8	170.250000	147.711833
05	BR	8	602.375000	210.621487
04	WA	6	96.833333	27.272086
05	WA	6	120.500000	106.419453
06	WA	6	61.333333	71.172092

Level of SAMPLE	Level of LOCATION	Level of STATION	N	VALUE Mean	VALUE SD
E	BR	02	2	195.500000	60.104076
N	BR	02	2	98.000000	4.242641
S	BR	02	2	362.000000	147.078210
W	BR	02	2	25.500000	17.677670
E	BR	05	2	389.000000	43.840620
N	BR	05	2	743.500000	395.272691
S	BR	05	2	636.500000	57.275649
W	BR	05	2	640.500000	113.844192
E	WA	04	2	119.000000	4.242641
S	WA	04	2	66.500000	23.334524
W	WA	04	2	105.000000	14.142136
E	WA	05	2	80.500000	0.707107
S	WA	05	2	251.000000	50.911688
W	WA	05	2	30.000000	19.798990

Test 3C - Evaluates within Laboratory (ORNL) Variability for Hg Analyses by NAA

General Linear Models Procedure

Level of SAMPLE	Level of LOCATION	Level of STATION	N	VALUE Mean	VALUE SD
E	WA	06	2	146.000000	50.911688
S	WA	06	2	1.500000	2.121320
W	WA	06	2	36.500000	0.707107

Level of SUBSAMP	Level of SAMPLE	N	VALUE Mean	VALUE SD
1	E	5	190.200000	134.079081
2	E	5	181.800000	115.213714
1	N	2	279.500000	260.922402
2	N	2	562.000000	651.952452
1	S	5	296.600000	283.065893
2	S	5	230.400000	228.841211
1	W	5	181.400000	303.069794
2	W	5	153.600000	230.359068

Test 4 - Comparisons of Hg concentrations in homogenized soils measured by CV-AA

General Linear Models Procedure
Class Level Information

Class	Levels	Values
STATION	2	02 05
SAMPLE	3	E N W
METHOD	2	CV NAA

Number of observations in data set = 30

Test 4 - Comparisons of Hg Concentrations in Homogenized Soils Measured by CV-AA

General Linear Models Procedure

Dependent Variable: VALUE Hg conc#(μg/g)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1156901.8667	385633.9556	47.54	0.0001
Error	26	210901.6000	8111.6000		
Corrected Total	29	1367803.4667			

R-Square	C.V.	Root MSE	VALUE Mean
0.845810	34.09809	90.064421	264.1333333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
STATION	1	812006.66667	812006.66667	100.10	0.0001
SAMPLE(STATION)	1	324615.20000	324615.20000	40.02	0.0001
METHOD	1	20280.00000	20280.00000	2.50	0.1259

Source	DF	Type III SS	Mean Square	F Value	Pr > F
STATION	1	812006.66667	812006.66667	100.10	0.0001
SAMPLE(STATION)	1	324615.20000	324615.20000	40.02	0.0001
METHOD	1	20280.00000	20280.00000	2.50	0.1259

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Test 4 - Comparisons of Hg Concentrations in Homogenized Soils Measured by CV-AA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate,
not the experimentwise error rate

Alpha= 0.05 df= 26 MSE= 8111.6
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes= 13.33333

Number of Means	2
Critical Range	71.64

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	STATION
A	496.80	10	05
B	147.80	20	02

Level of SAMPLE	Level of STATION	N	VALUE Mean	VALUE SD
E	02	10	275.200000	63.831027
W	02	10	20.400000	10.405127
N	05	10	496.800000	146.643028

Test 4 - Comparisons of Hg Concentrations in Homogenized Soils Measured by CV-AA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: VALUE

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 26 MSE= 8111.6

Number of Means	2
Critical Range	67.54

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	METHOD
A	290.13	15	CV
A			
A	238.13	15	NAA

Test 5 - Comparisons of mean Hg concentrations in field samples using CV-AA and NAA

General Linear Models Procedure Class Level Information

Class	Levels	Values
METHOD	2	CV NAA

Number of observations in data set = 44

Test 5 - Comparisons of mean Hg concentrations in field samples using CV-AA and NAA

General Linear Models Procedure

Dependent Variable: MEAN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1855.0371	1855.0371	0.13	0.7207
Error	42	601460.7647	14320.4944		
Corrected Total	43	603315.8018			

R-Square	C.V.	Root MSE	MEAN Mean
0.003075	165.0082	119.67	72.52261

Source	DF	Type I SS	Mean Square	F Value	Pr > F
METHOD	1	1855.0371	1855.0371	0.13	0.7207

Source	DF	Type III SS	Mean Square	F Value	Pr > F
METHOD	1	1855.0371	1855.0371	0.13	0.7207

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Test 5 - Comparisons of mean Hg concentrations in field samples using CV-AA and NAA

General Linear Models Procedure

Duncan's Multiple Range Test for variable: MEAN

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 42 MSE= 14320.49

Number of Means 2

Critical Range 72.82

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	METHOD
A	79.02	22	NAA
A			
A	66.03	22	CV

Test 5A - Comparisons of mean Hg concentrations in field samples where concentrations were below 20 μg/g

General Linear Models Procedure
Class Level Information

Class	Levels	Values
METHOD	2	CV NAA

Number of observations in data set = 18

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Test 5A - Comparisons of mean Hg concentrations in field samples where concentrations were below 20 μg/g

General Linear Models Procedure

Dependent Variable: MEAN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	136.42767	136.42767	3.74	0.0710
Error	16	583.386.04	36.46163		
Corrected Total	17	719.81371			

R-Square	C.V.	Root MSE	MEAN Mean
0.189532	53.11160	6.0383	11.36917

Source	DF	Type I SS	Mean Square	F Value	Pr > F
METHOD	1	136.42767	136.42767	3.74	0.0710

Source	DF	Type III SS	Mean Square	F Value	Pr > F
METHOD	1	136.42767	136.42767	3.74	0.0710

Test 5A - Comparisons of mean Hg concentrations in field samples where concentrations were below 20 μg/g

General Linear Models Procedure

Duncan's Multiple Range Test for variable: MEAN

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 16 MSE= 36.46163

Number of Means	2
Critical Range	6.024

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	METHOD
A	14.122	9	CV
A			
A	8.616	9	NAA

Test 5B - Comparisons of mean Hg concentrations in field samples where concentrations were above 20 μg/g

General Linear Models Procedure Class Level Information

Class	Levels	Values
METHOD	2	CV NAA

Number of observations in data set = 26

Test 5B - Comparisons of mean Hg concentrations in field samples where concentrations were above 20 μg/g

General Linear Models Procedure

Dependent Variable: MEAN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	4322.7909	4322.7909	0.21	0.6477
Error	24	484354.8392	20181.4516		
Corrected Total	25	488677.6301			

R-Square	C.V.	Root MSE	MEAN Mean
0.008846	123.6827	142.06	114.8596

Source	DF	Type I SS	Mean Square	F Value	Pr > F
METHOD	1	4322.7909	4322.7909	0.21	0.6477

Source	DF	Type III SS	Mean Square	F Value	Pr > F
METHOD	1	4322.7909	4322.7909	0.21	0.6477

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Test 5B - Comparisons of mean Hg concentrations in field samples where concentrations were above 20 μg/g

General Linear Models Procedure

Duncan's Multiple Range Test for variable: MEAN

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 24 MSE= 20181.45

Number of Means 2

Critical Range 114.9

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	METHOD
A	127.75	13	NAA
A			
A	101.97	13	CV

ALTERNATE PAGES MISSING

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Laboratory duplicate error ratio - water/location J-148
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Laboratory control samples - water J-150

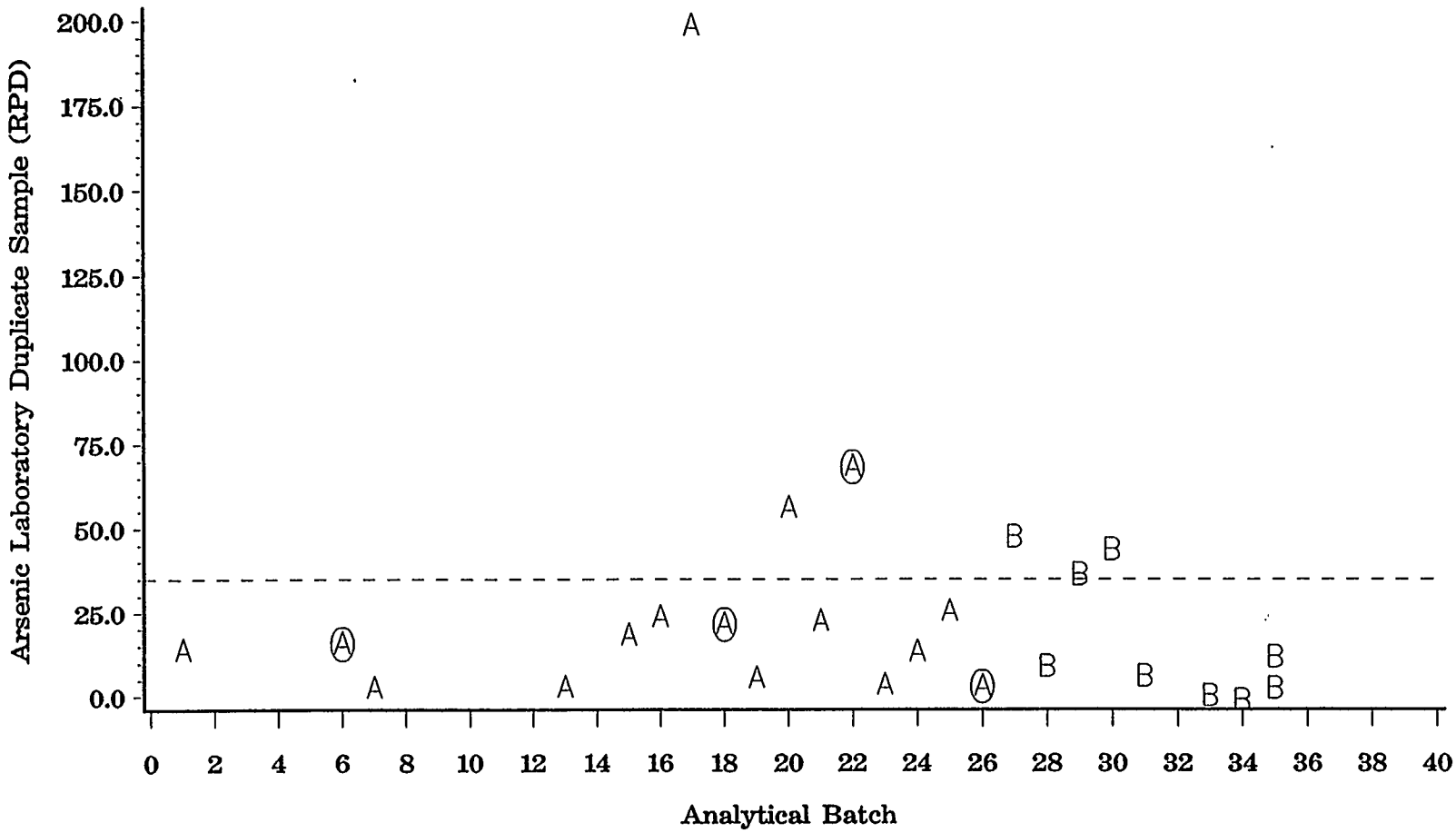


Fig. J.1. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Arsenic sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

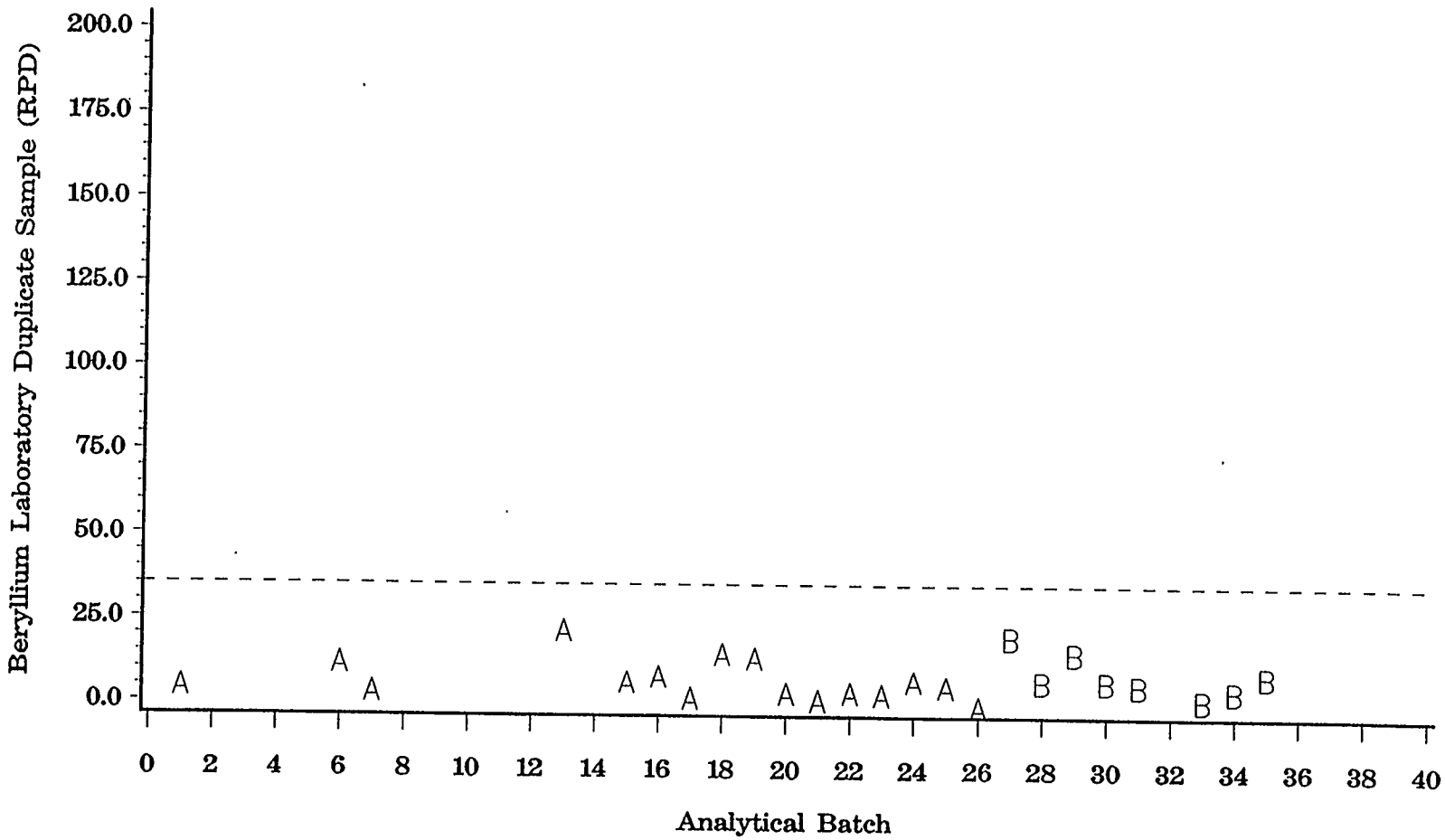


Fig. J.2. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Beryllium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

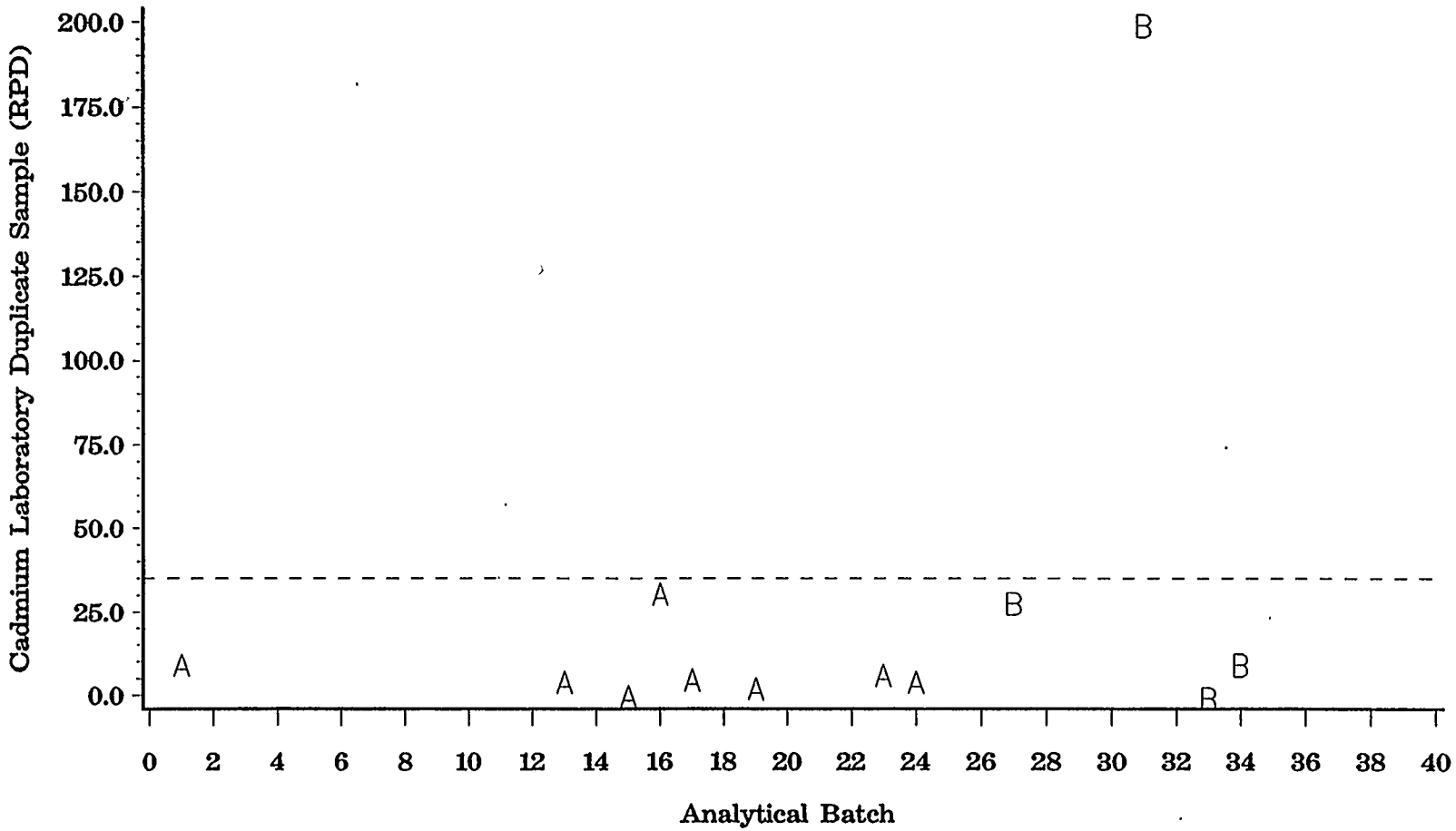


Fig. J.3. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Cadmium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

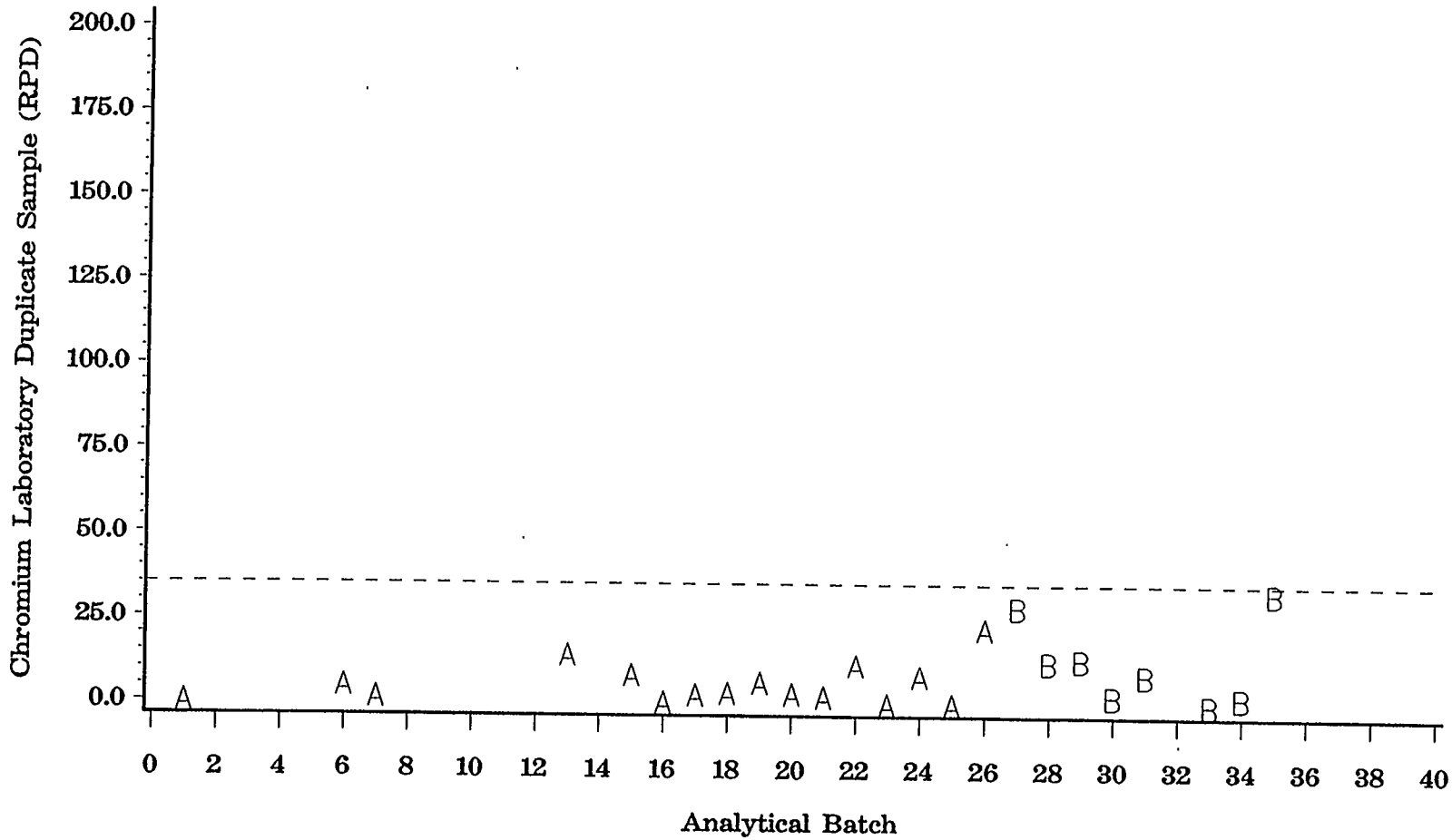


Fig. J.4. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Chromium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

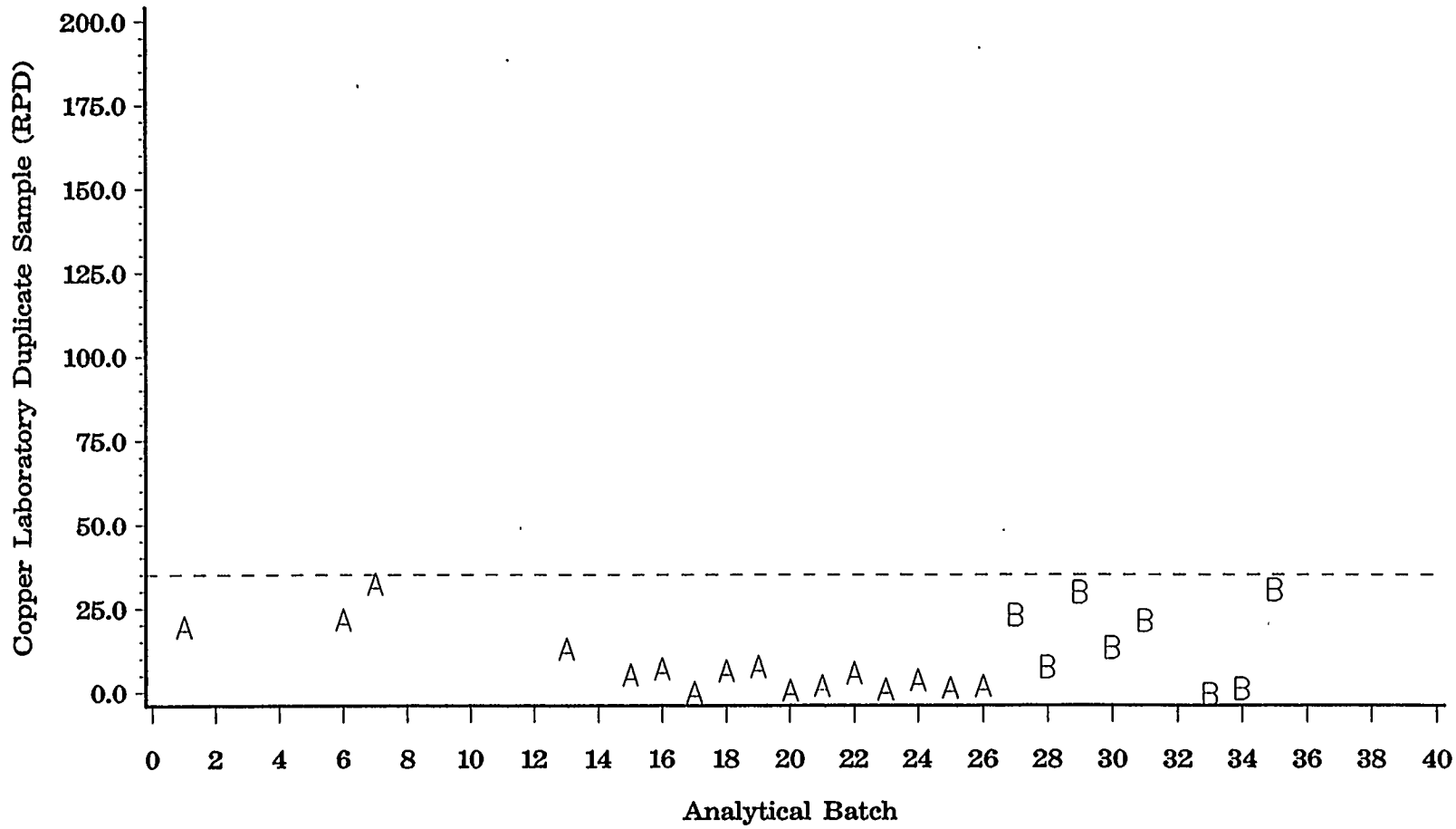


Fig. J.5. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Copper sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

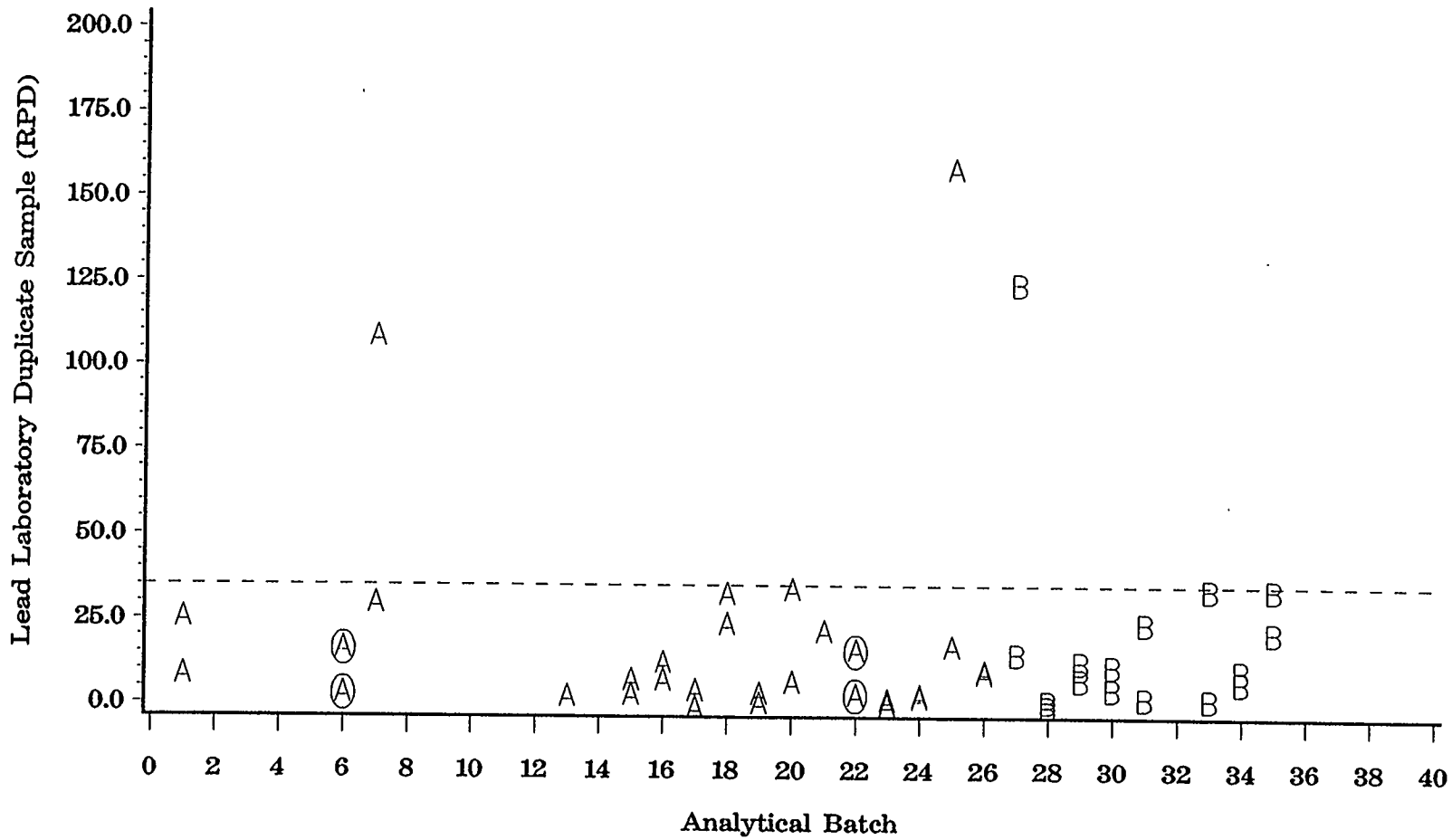


Fig. J.4. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Lead sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

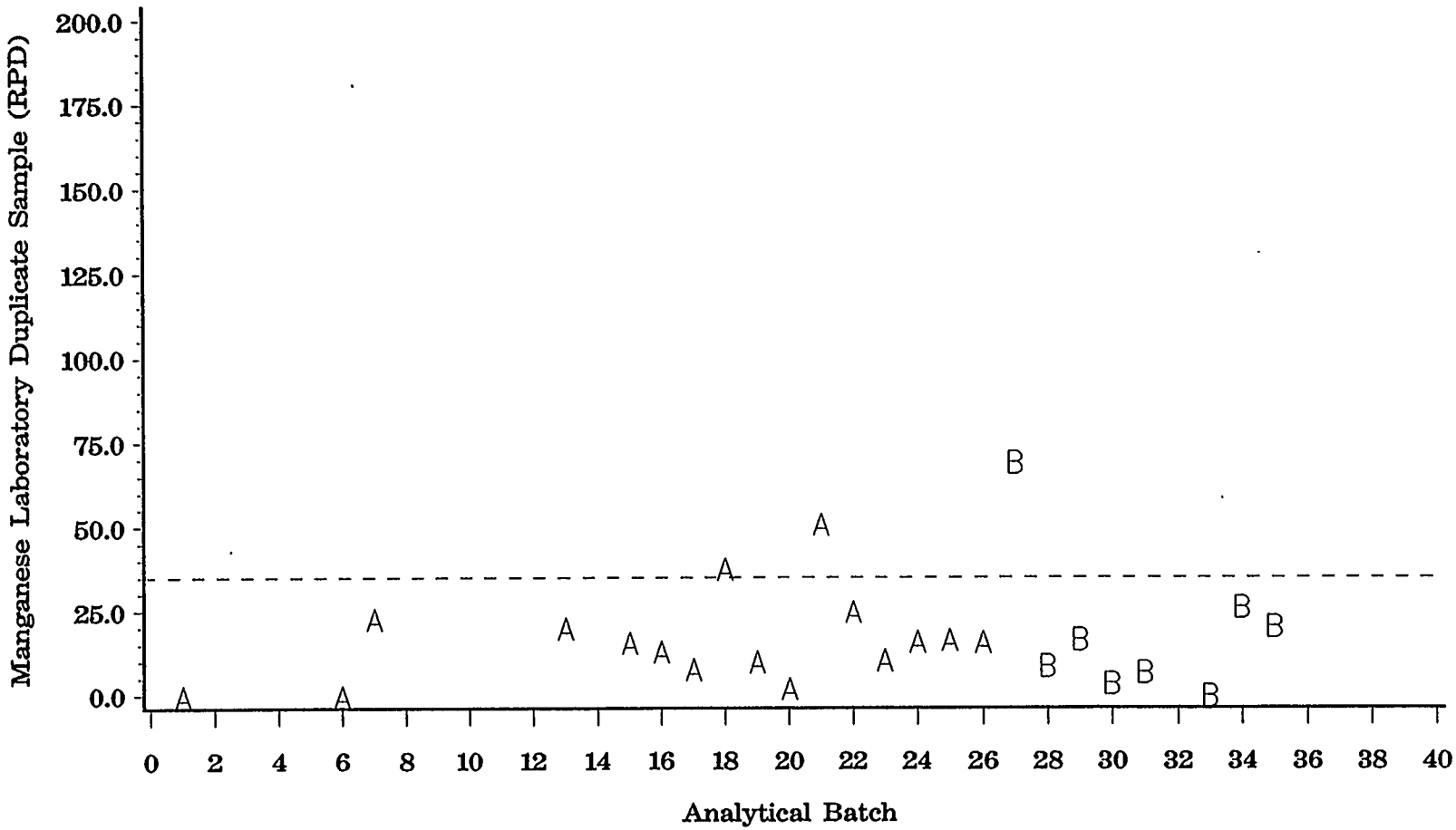


Fig.J.7. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Manganese sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

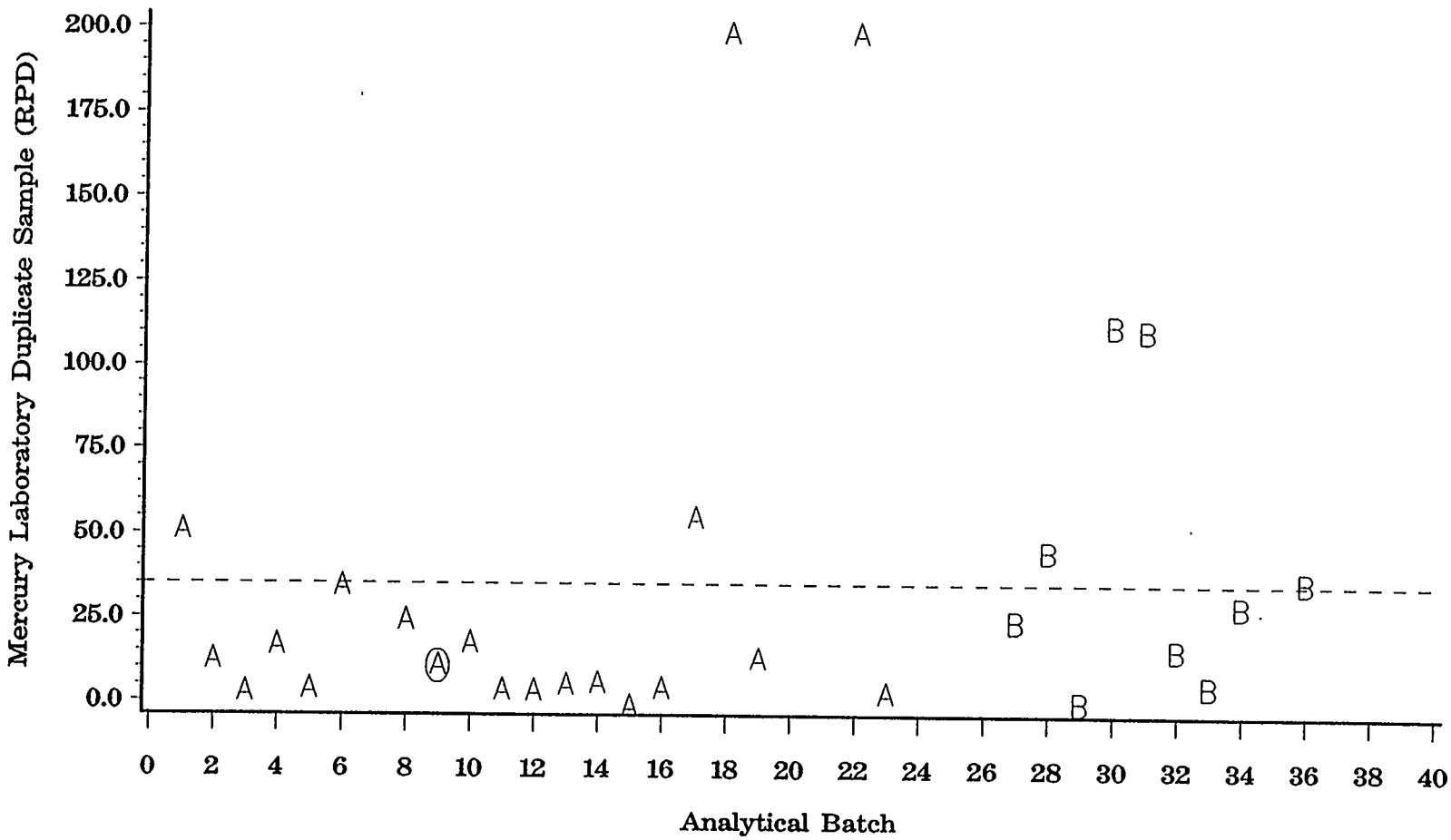


Fig. J.8. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Mercury sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

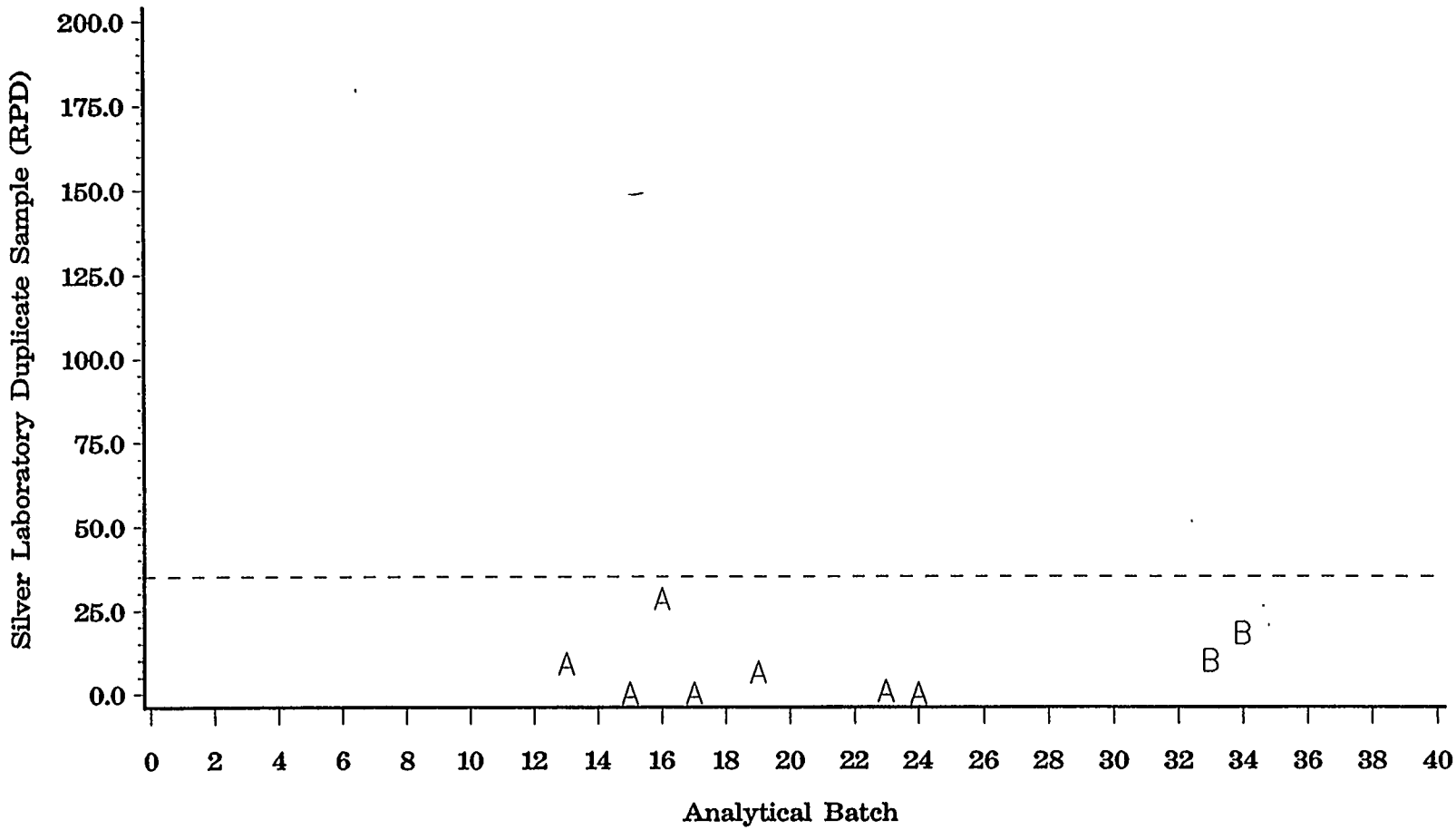


Fig. J.9. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Silver sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

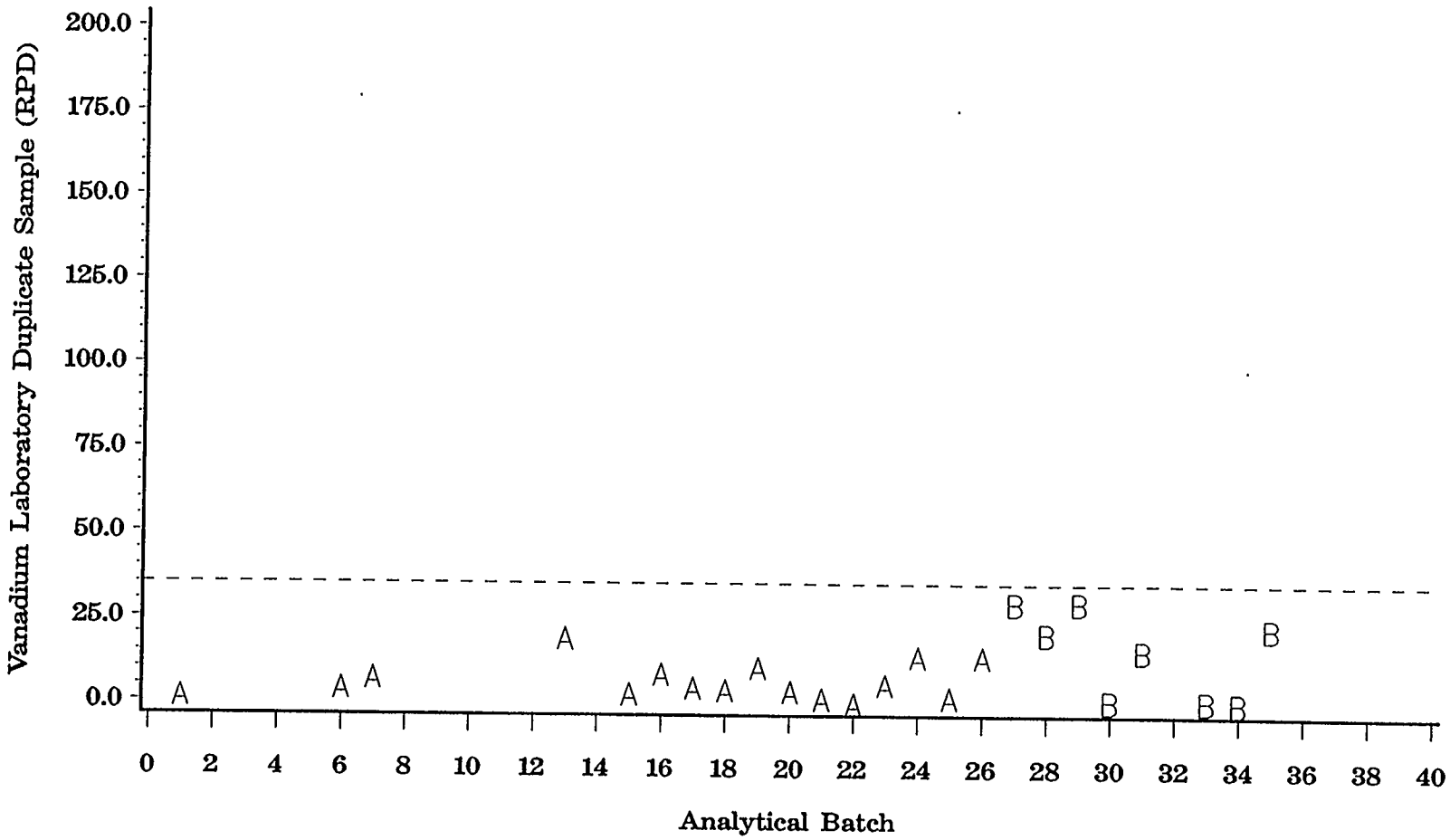


Fig. J.10. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Vanadium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

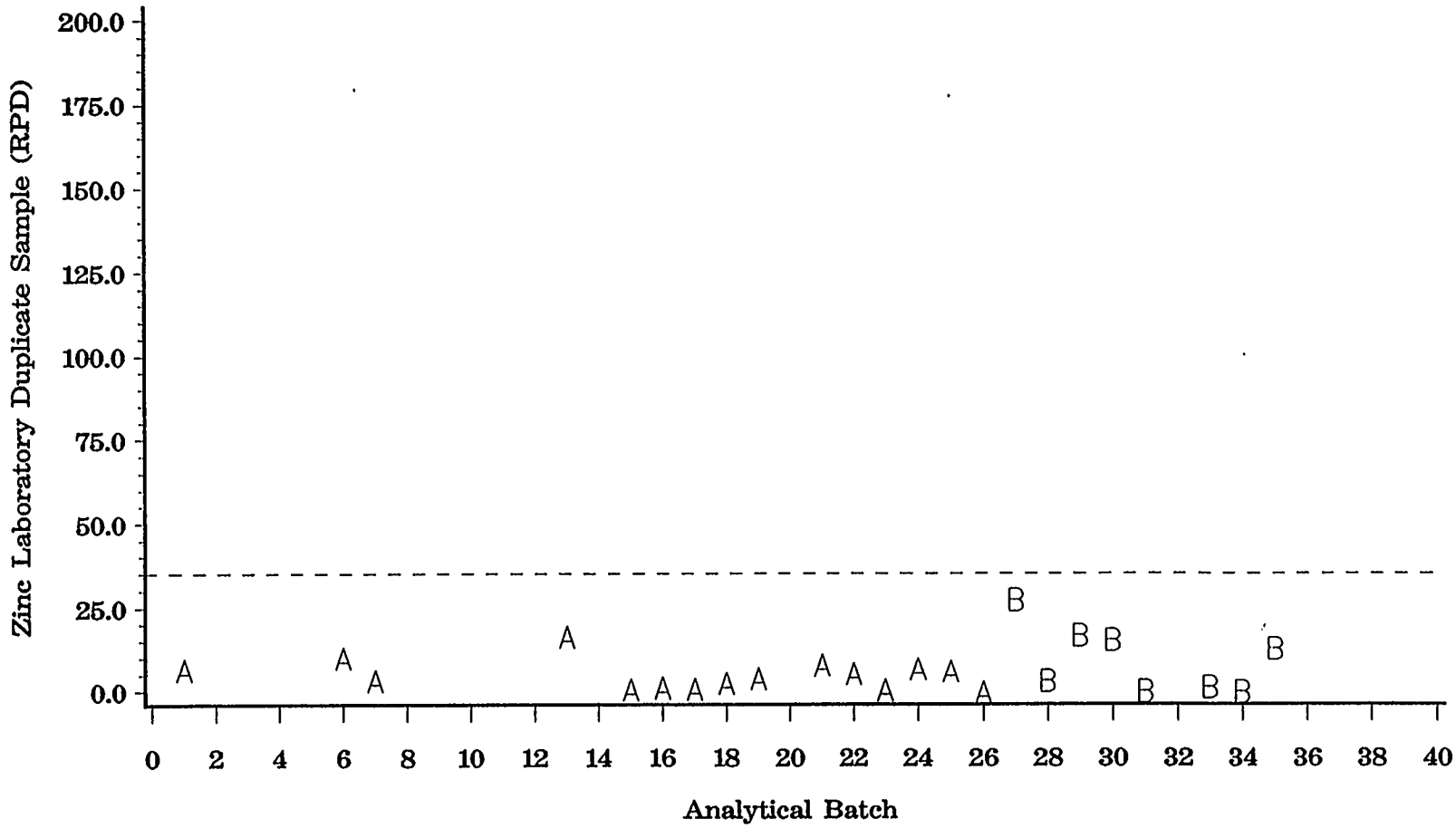


Fig. J.11. EPA CLP SOIL Laboratory Duplicate Sample recoveries for Zinc sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

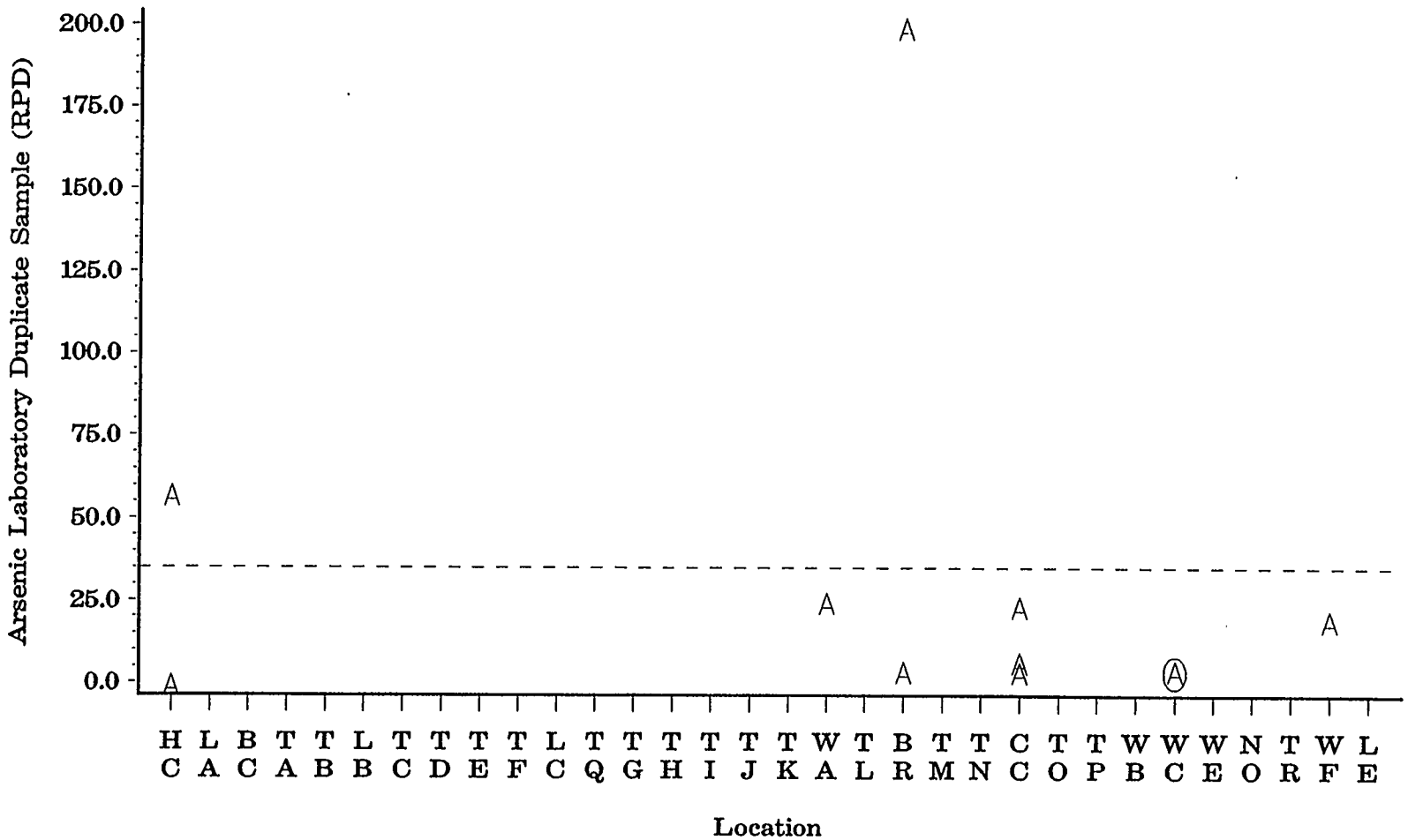


Fig. J.12 EPA CLP SOIL Laboratory Duplicate Sample RPDs for Arsenic sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

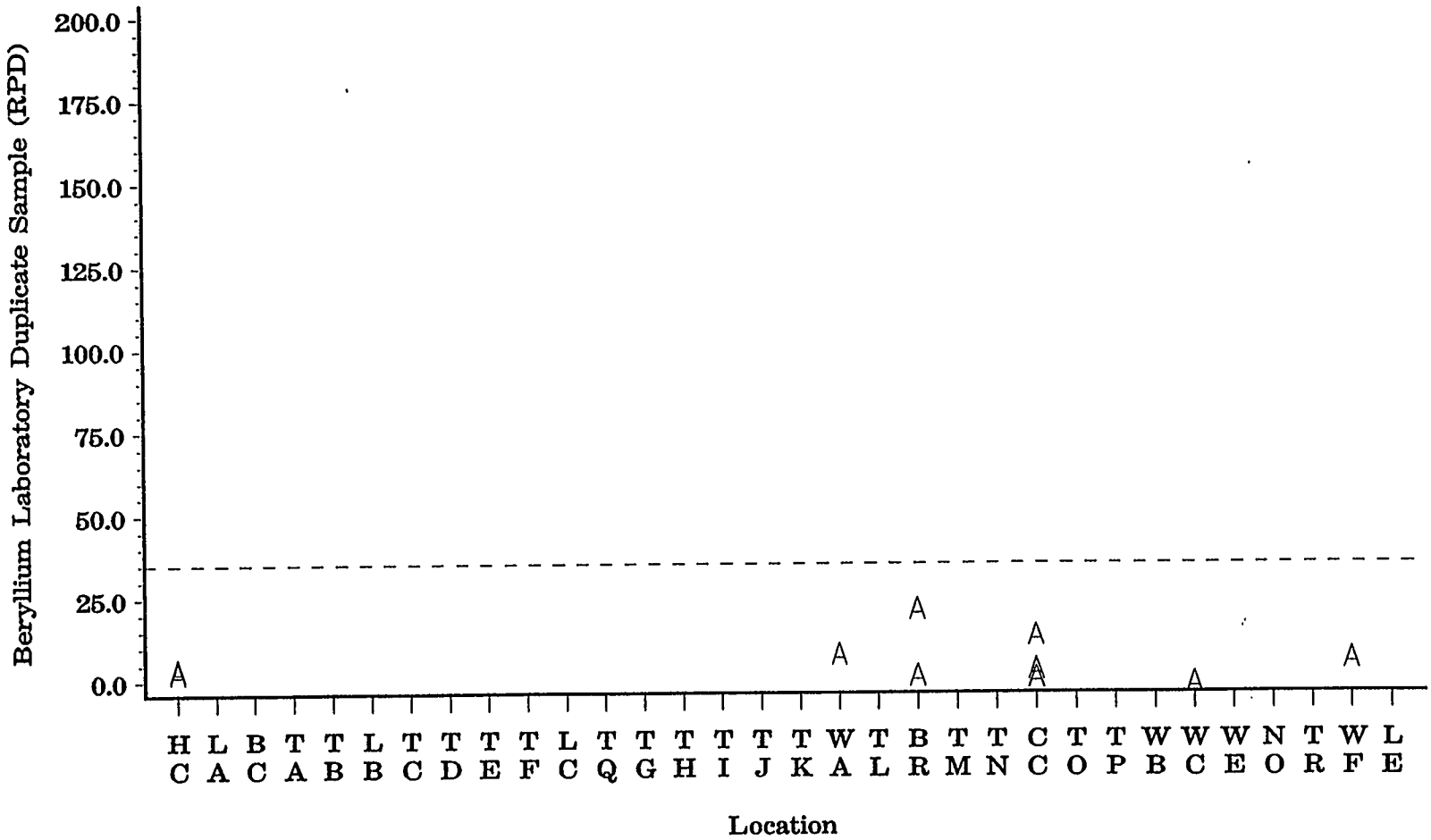


Fig.J.13. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Beryllium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

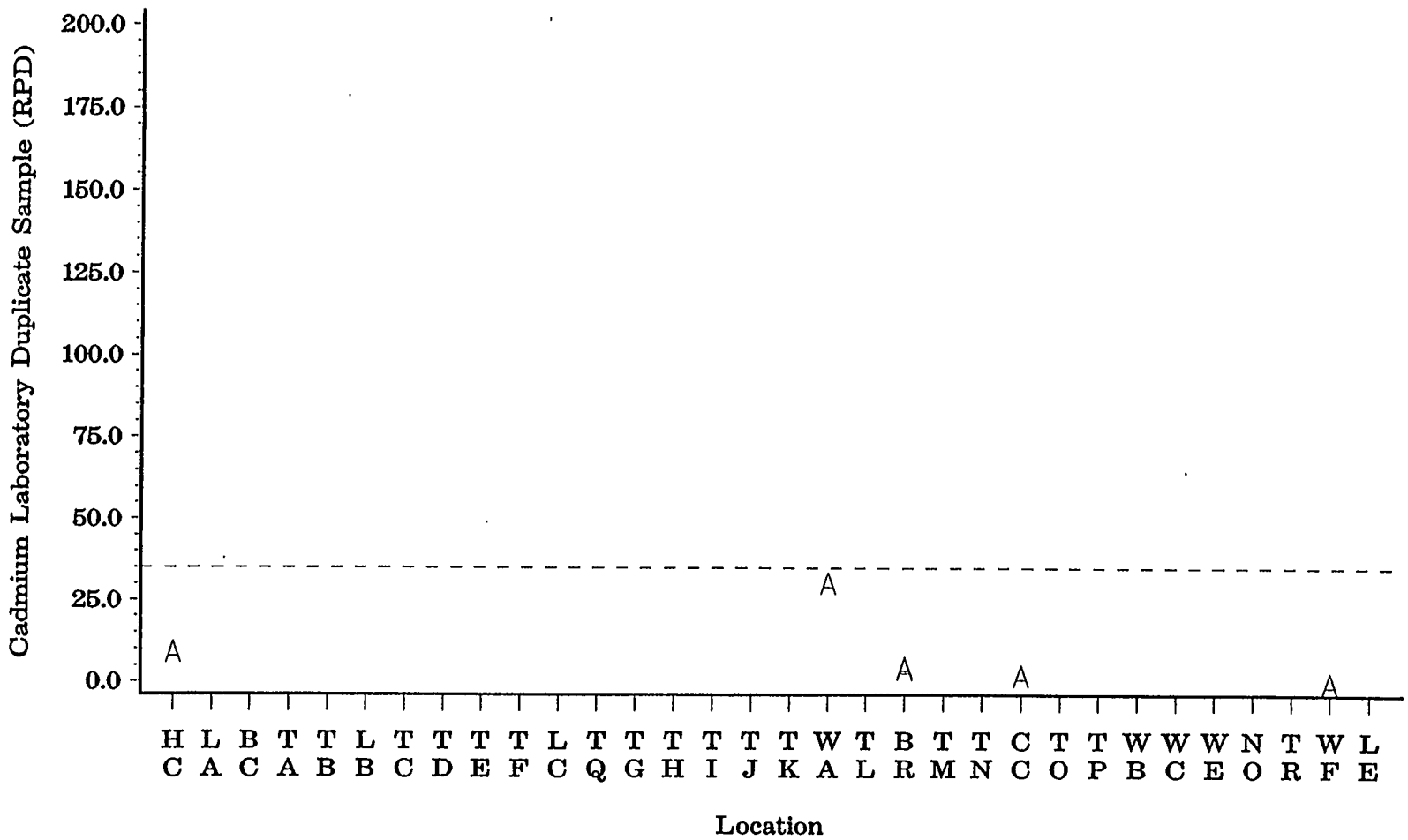


Fig. 3.14 EPA CLP SOIL Laboratory Duplicate Sample RPDs for Cadmium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

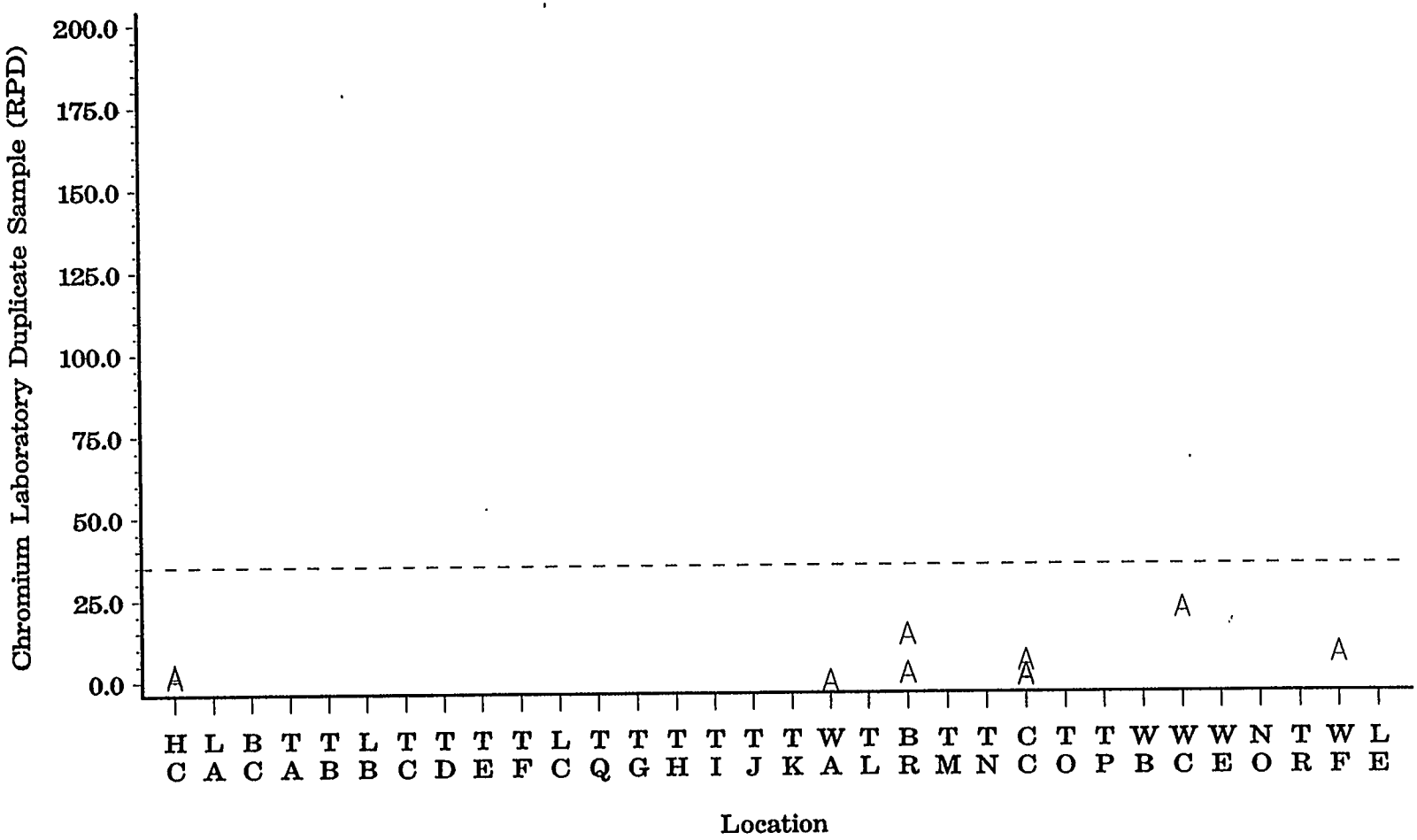


Fig. J.15. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Chromium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

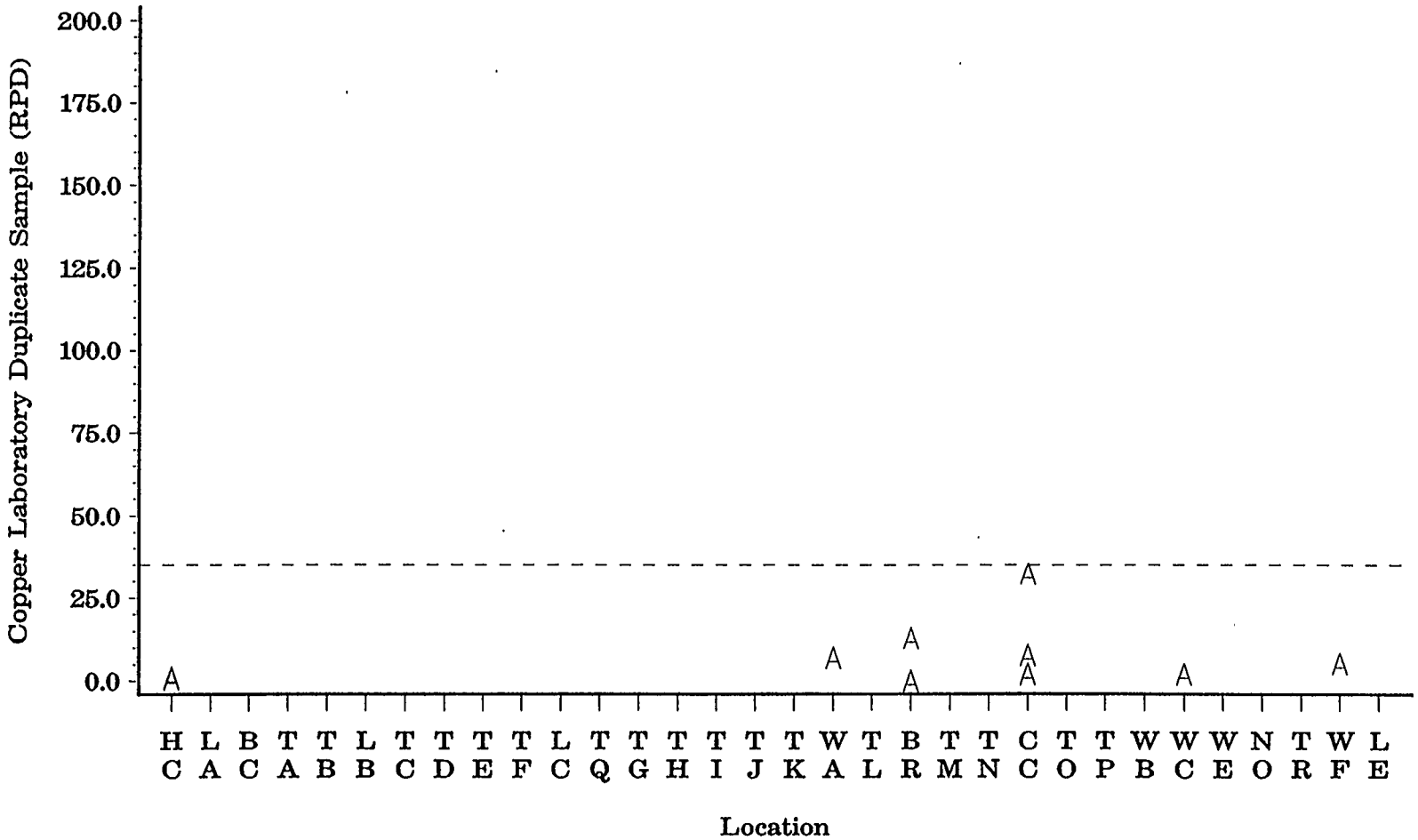


Fig. J.16. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Copper sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

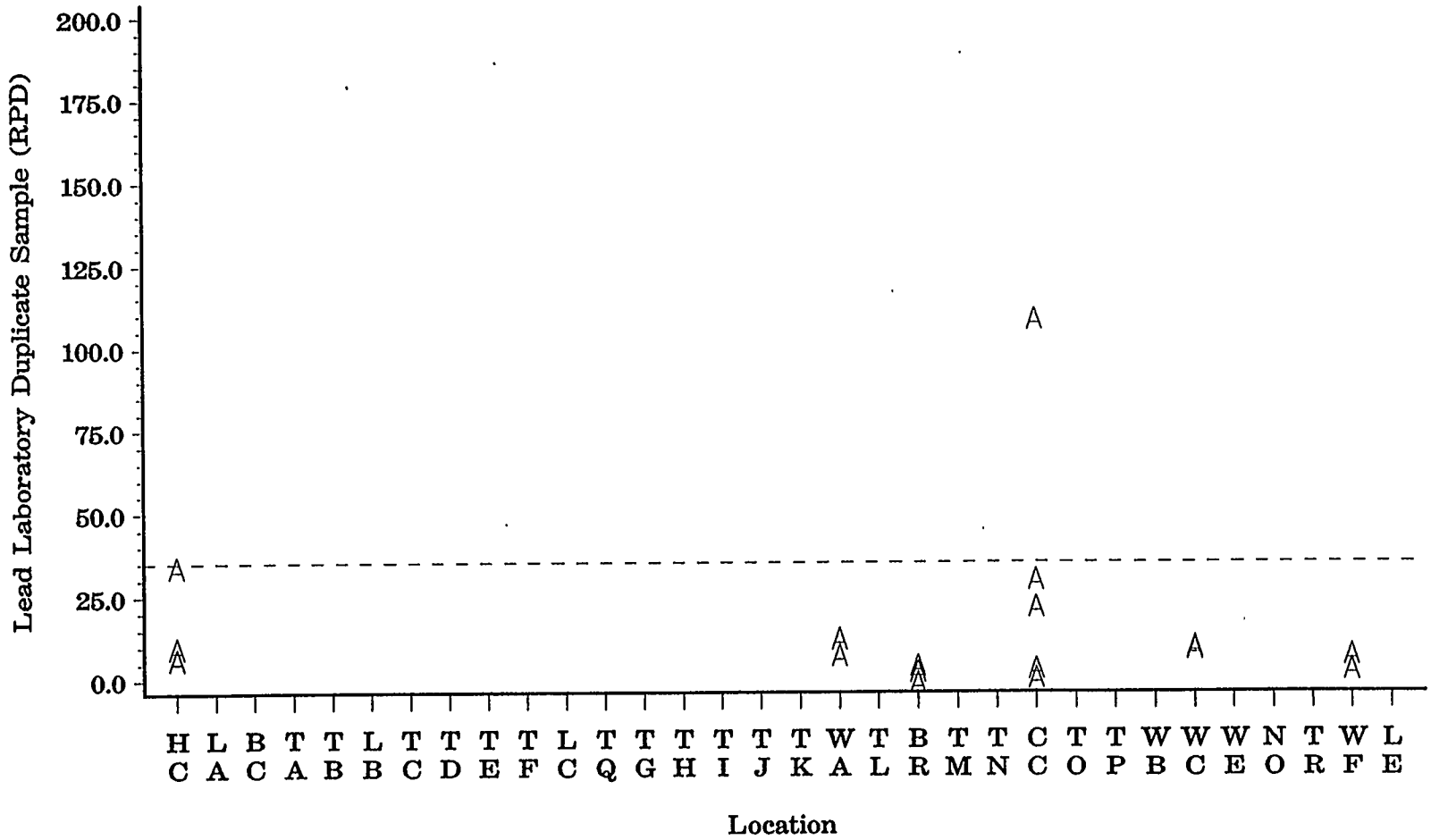


Fig. J.17. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Lead sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

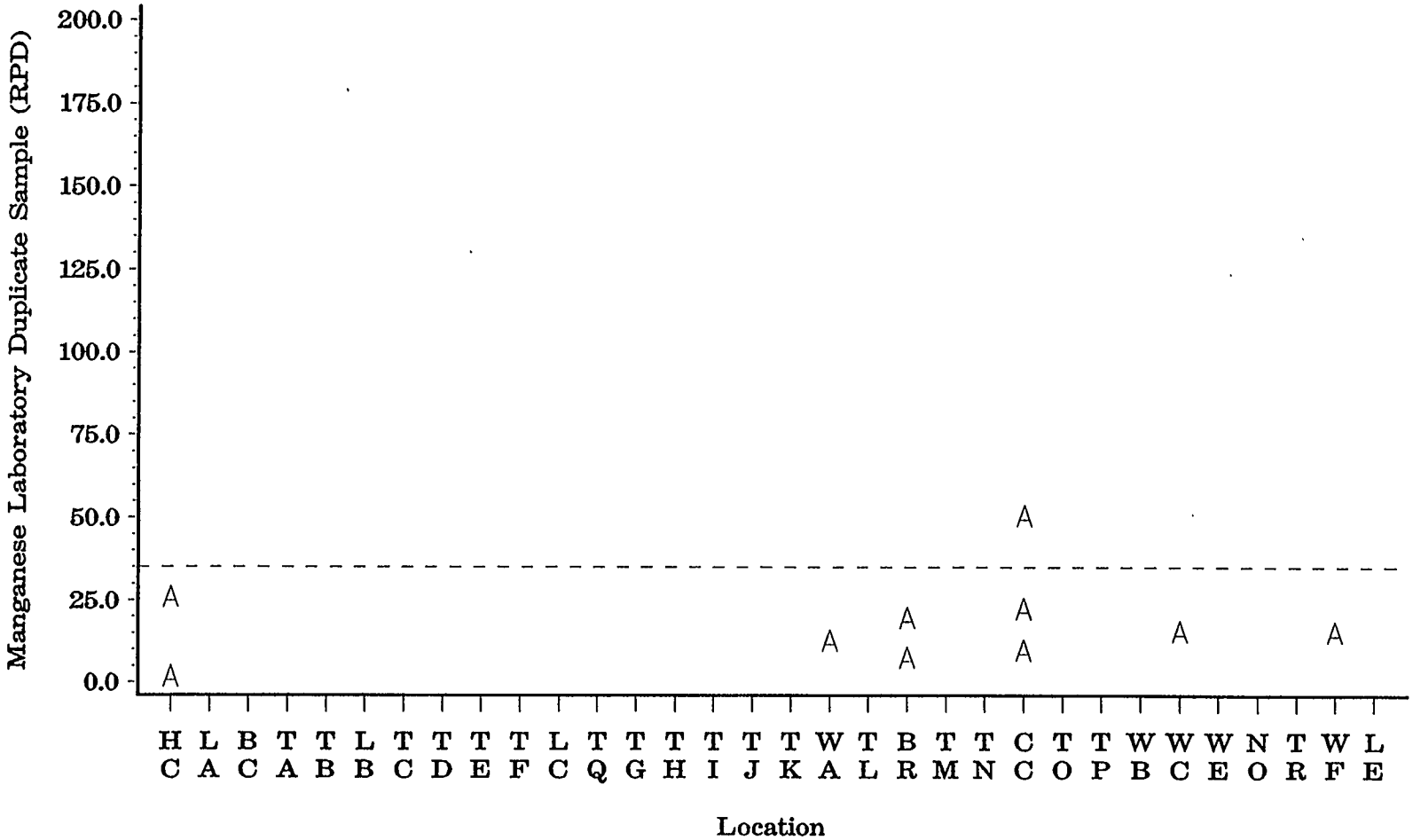


Fig. J.19. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Manganese sample analyses, for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

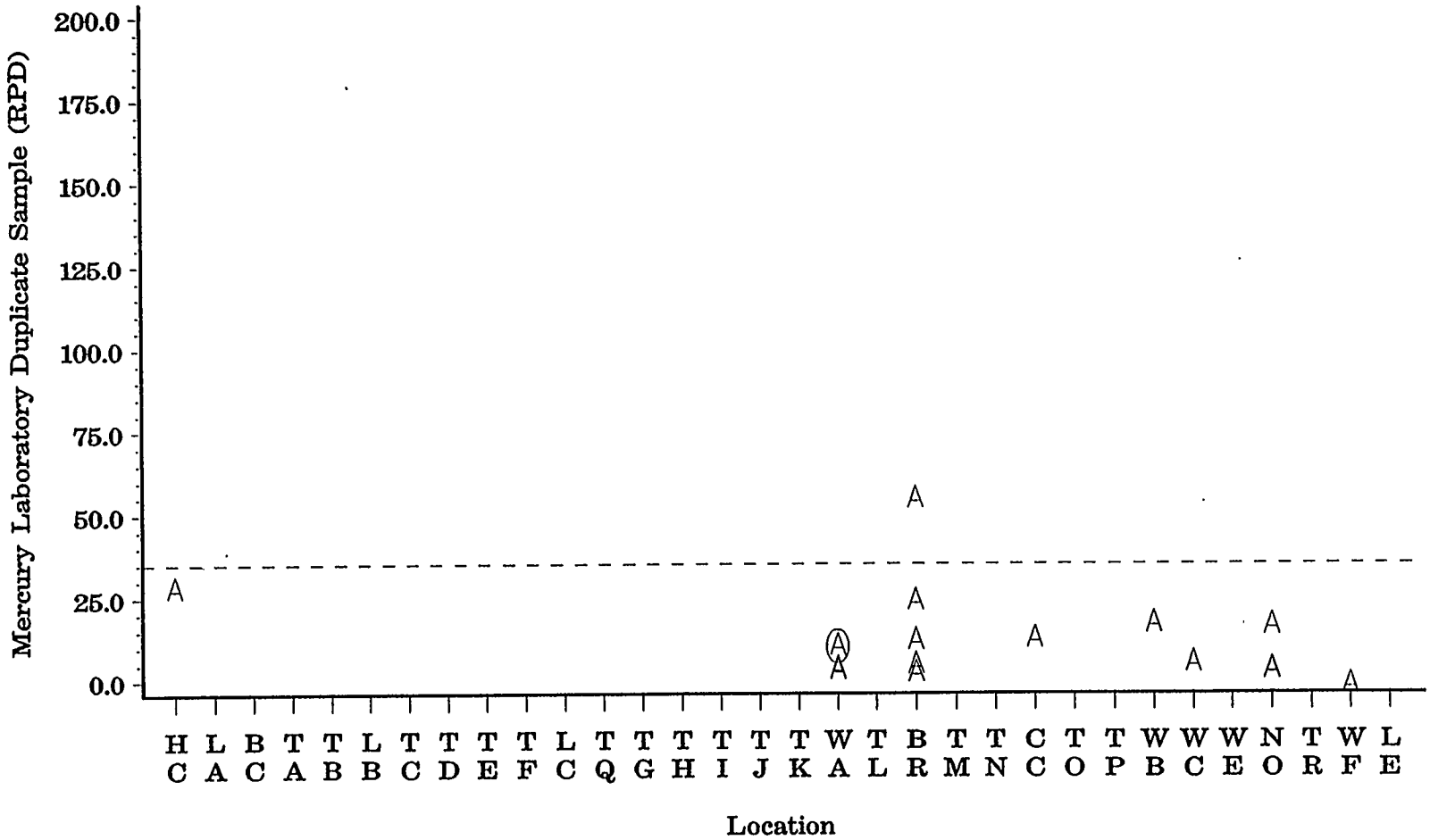


Fig. J.19. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Mercury sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

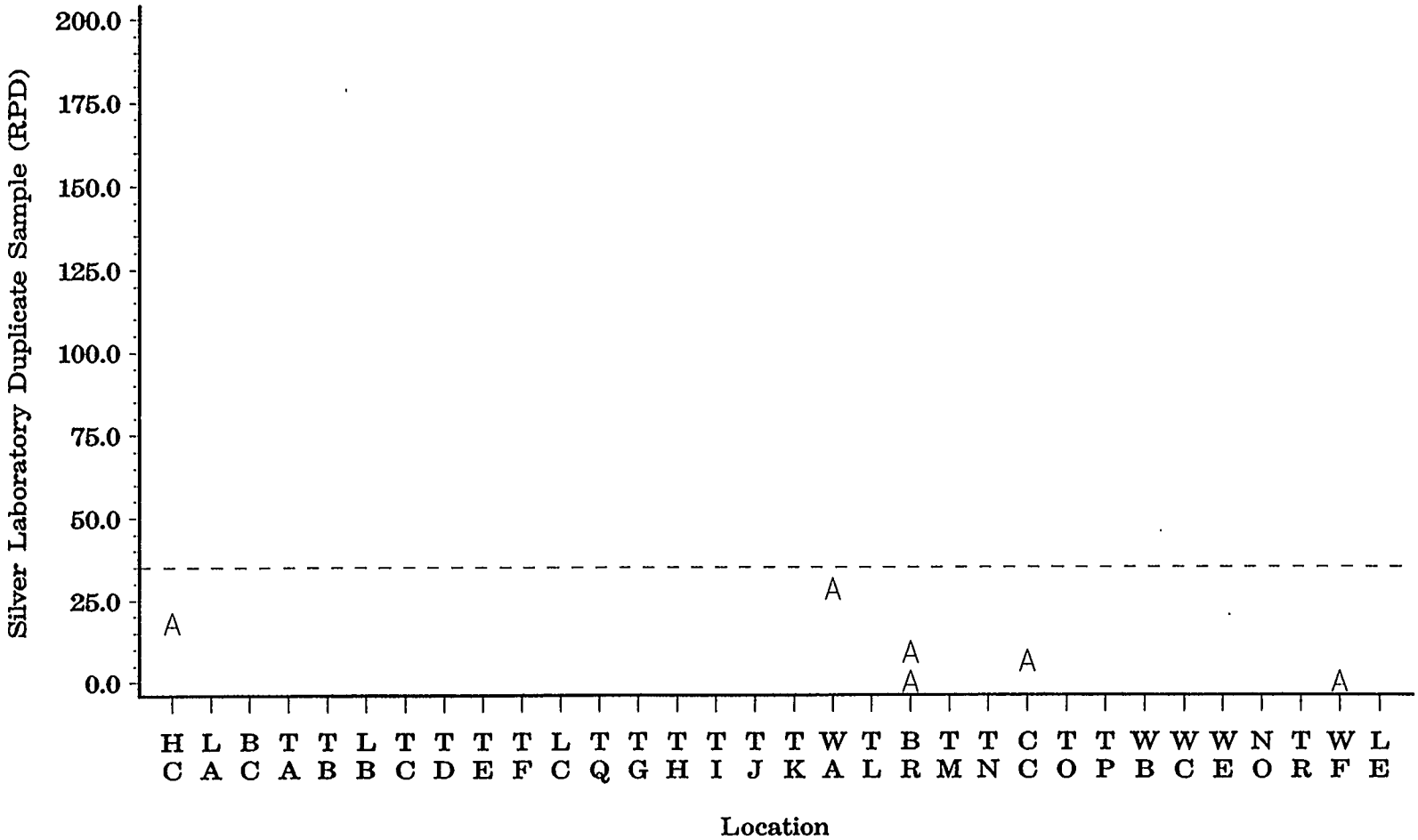


Fig. J.20. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Silver sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

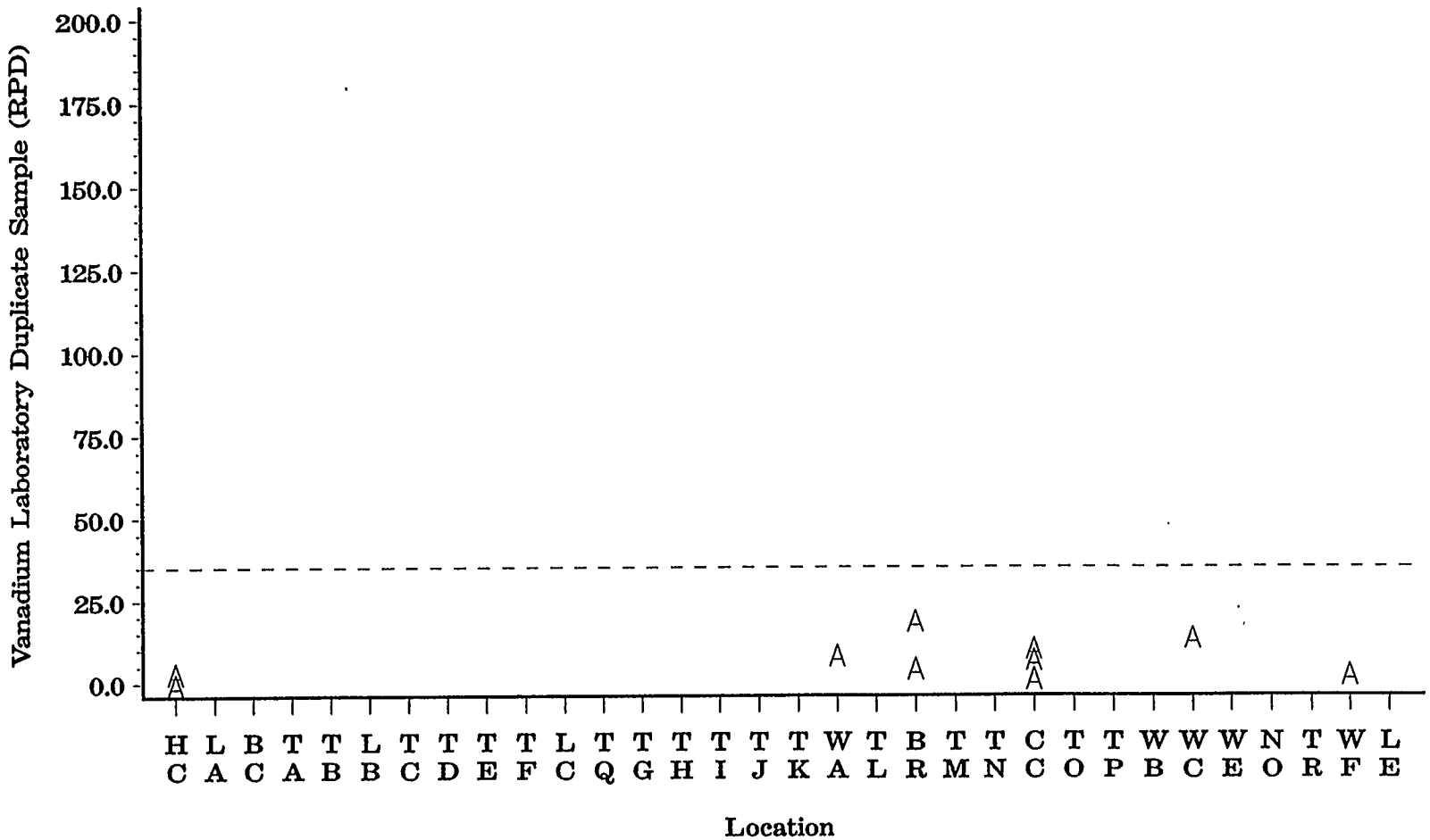


Fig. J.21. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Vanadium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

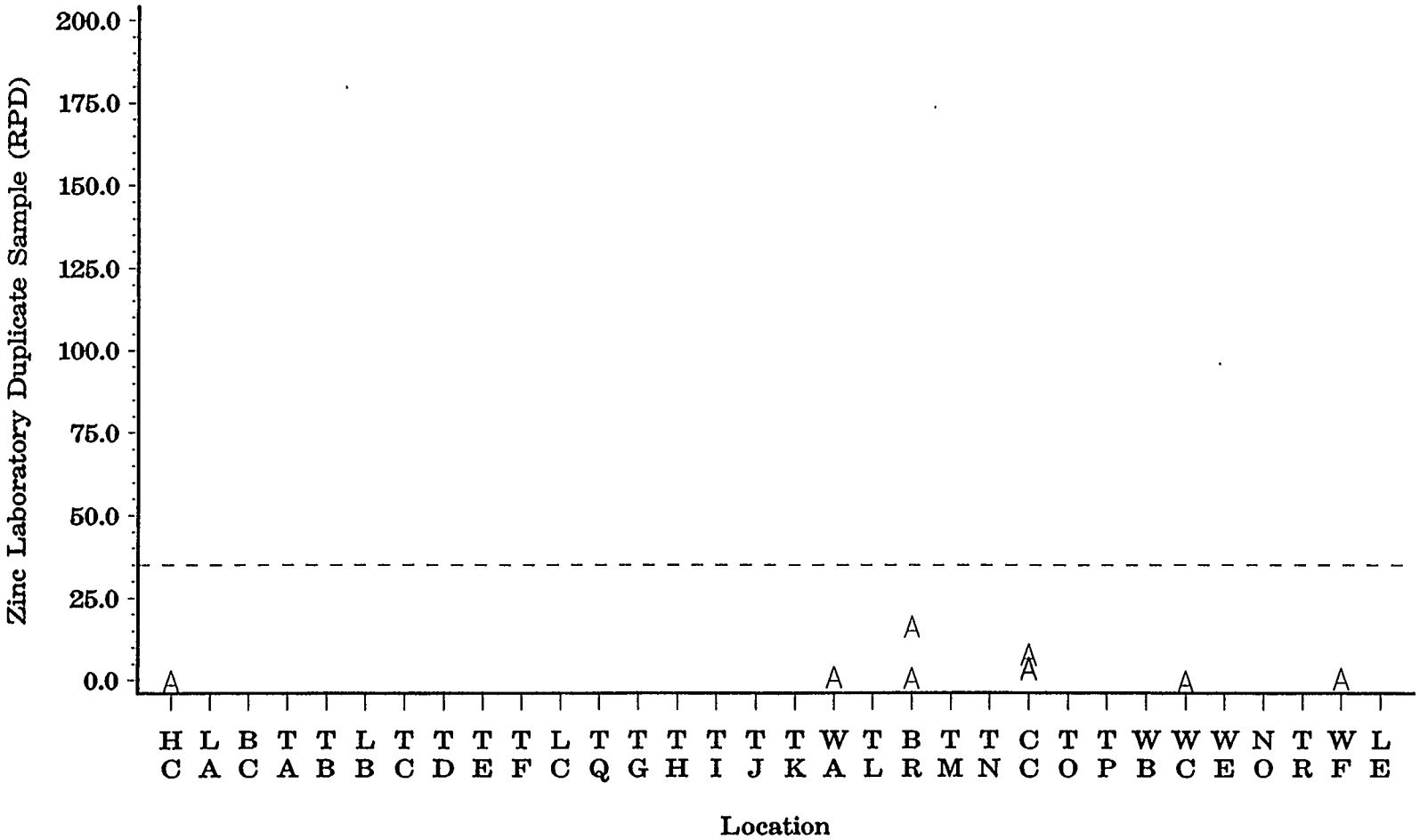


Fig. J.22. EPA CLP SOIL Laboratory Duplicate Sample RPDs for Zinc sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

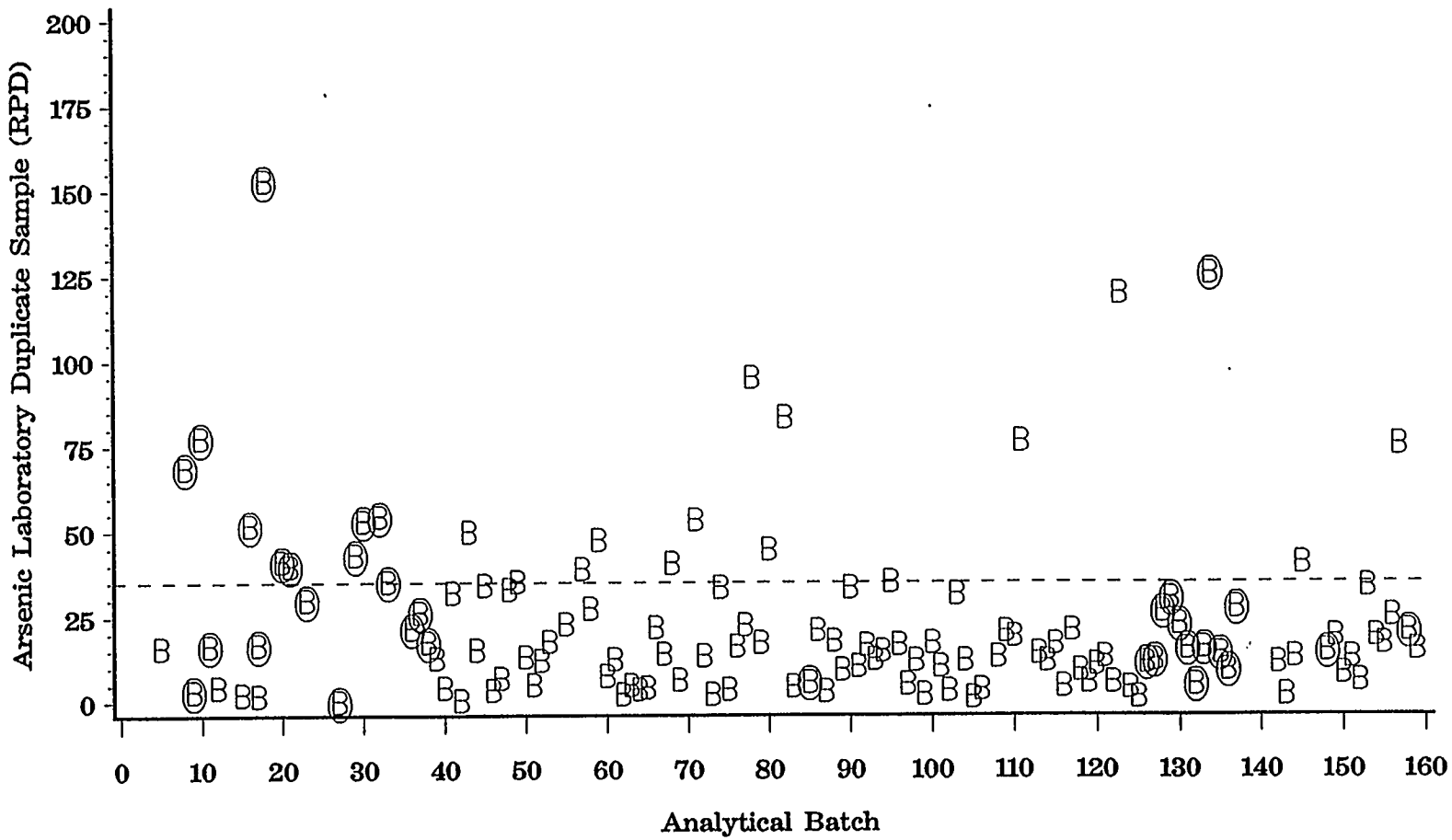


Fig. J.23. NAA SOIL Laboratory Duplicate Sample RPDs for Arsenic sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

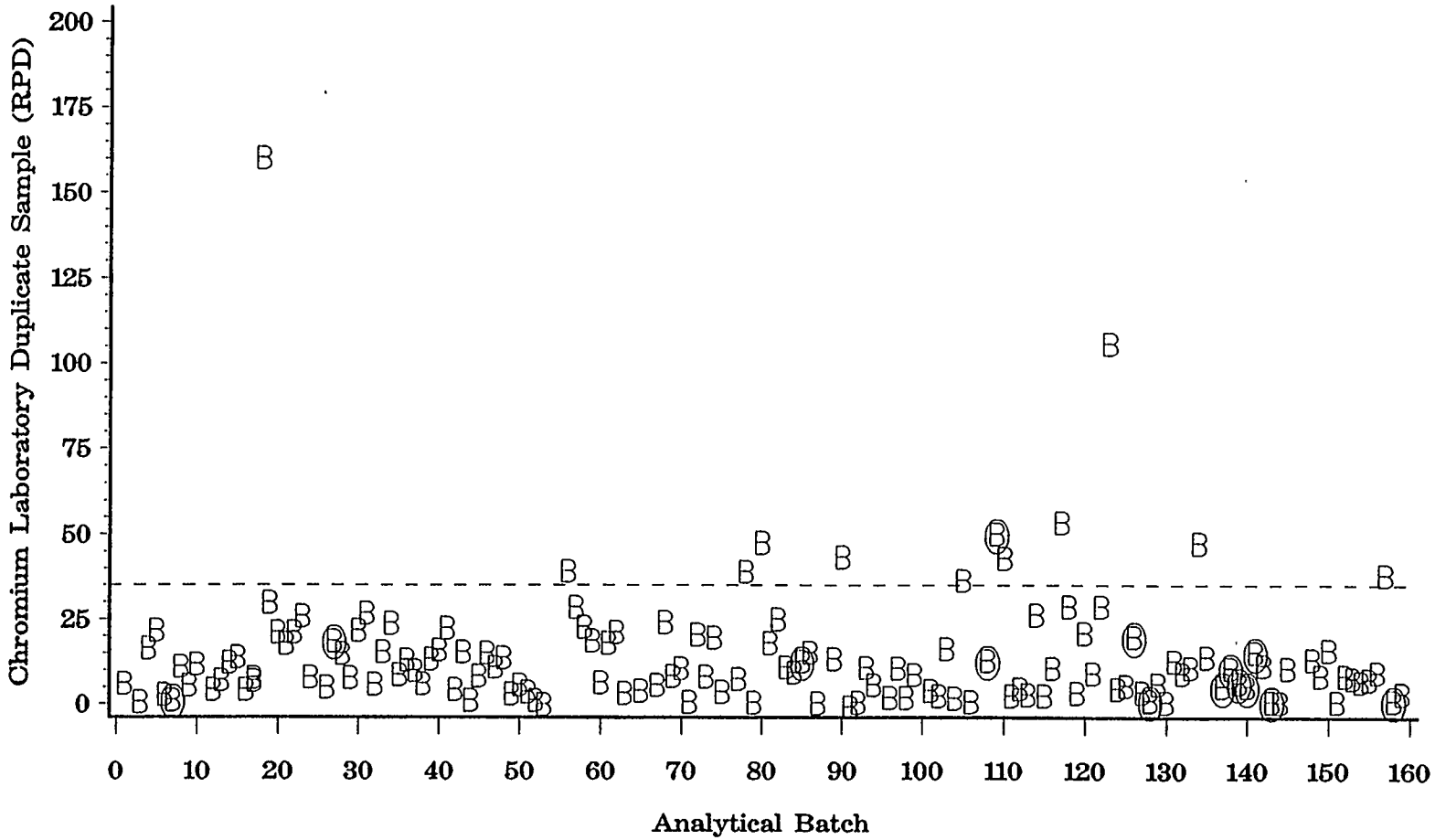


Fig. J.24 NAA SOIL Laboratory Duplicate Sample RPDs for Chromium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

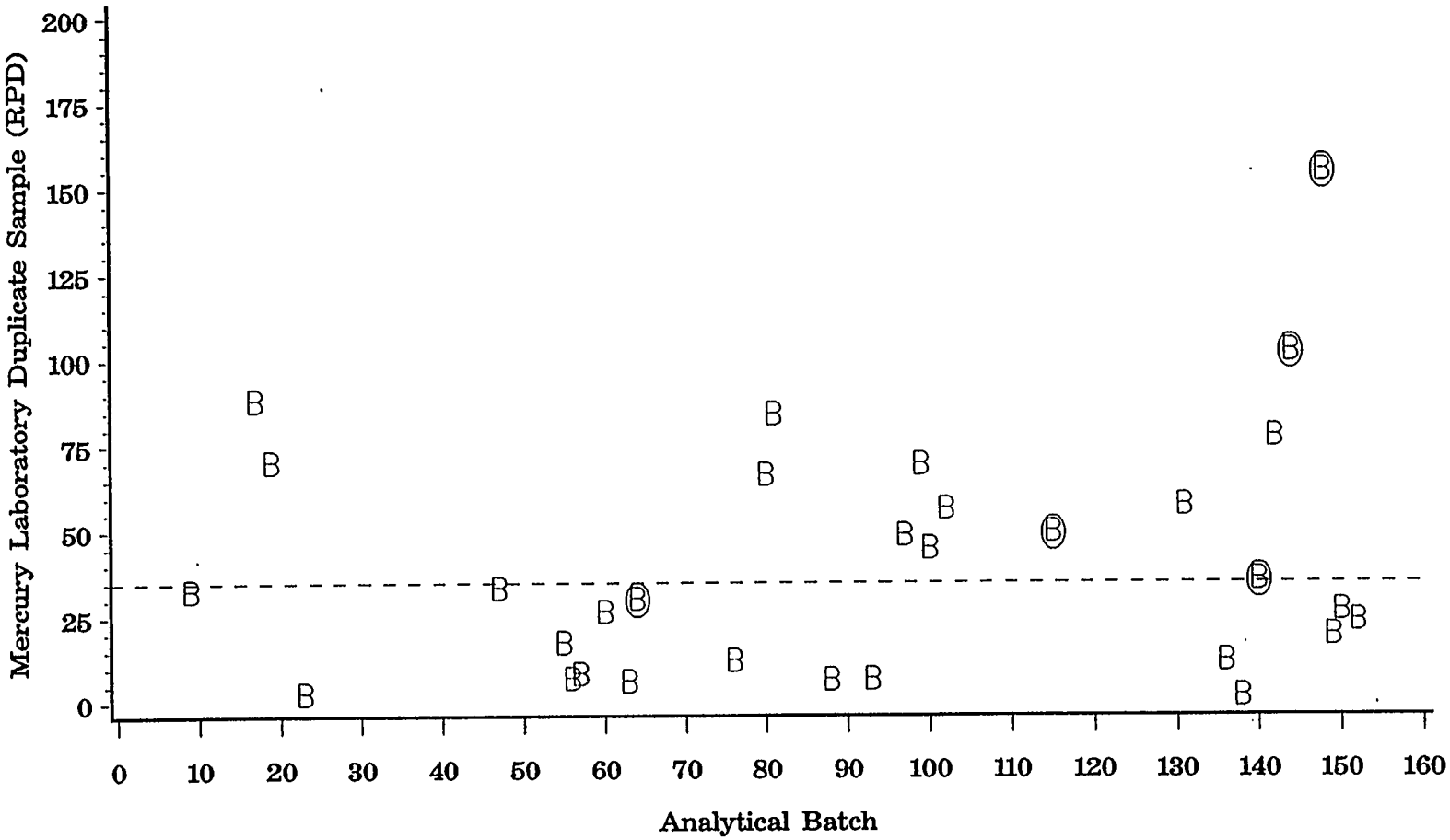


Fig. J.25. NAA SOIL Laboratory Duplicate Sample RPDs for Mercury sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

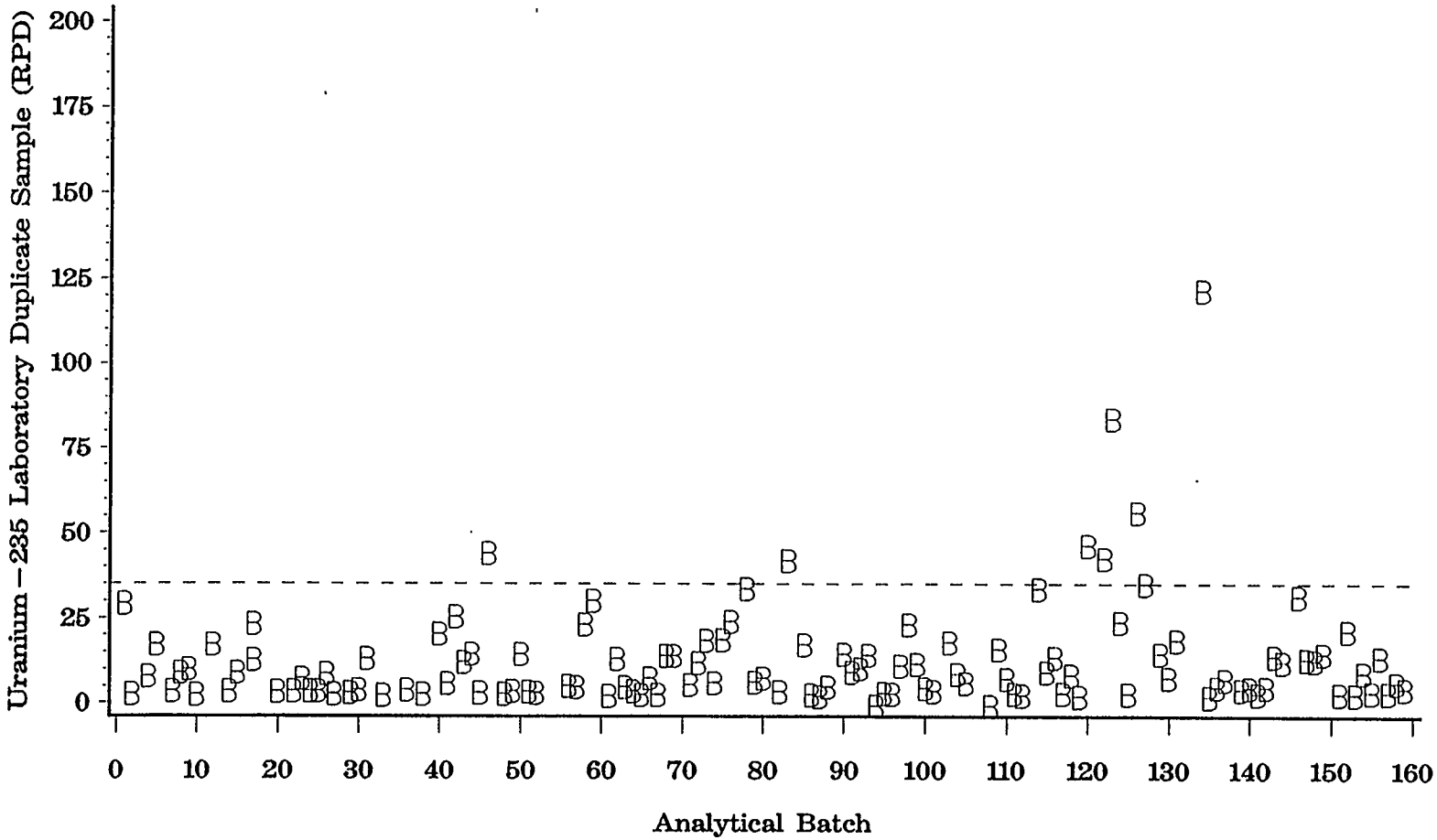


Fig. J.26. NAA SOIL Laboratory Duplicate Sample RPDs for Uranium-235 sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

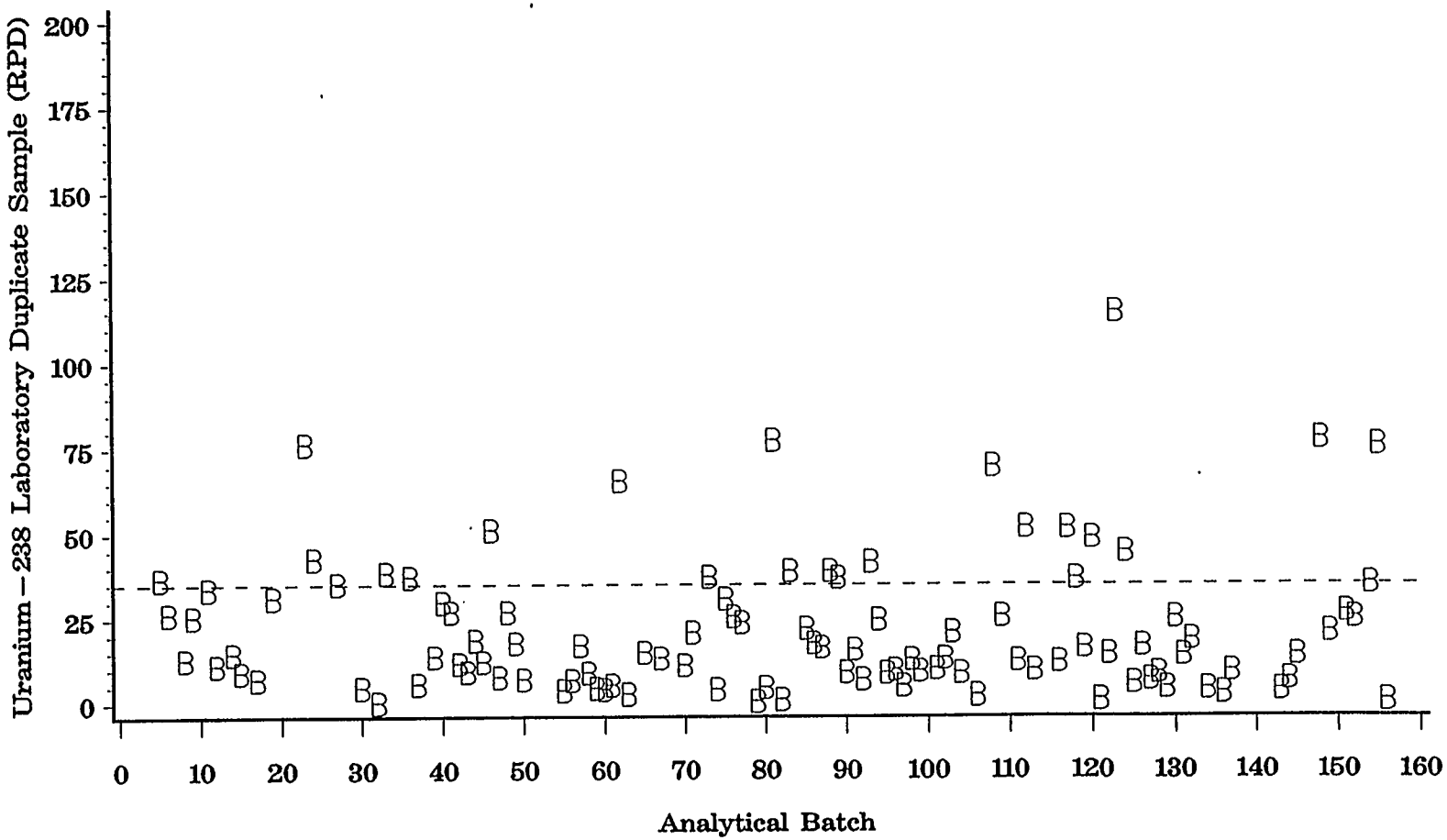


Fig. J.27. NAA SOIL Laboratory Duplicate Sample RPDs for Uranium – 238 sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

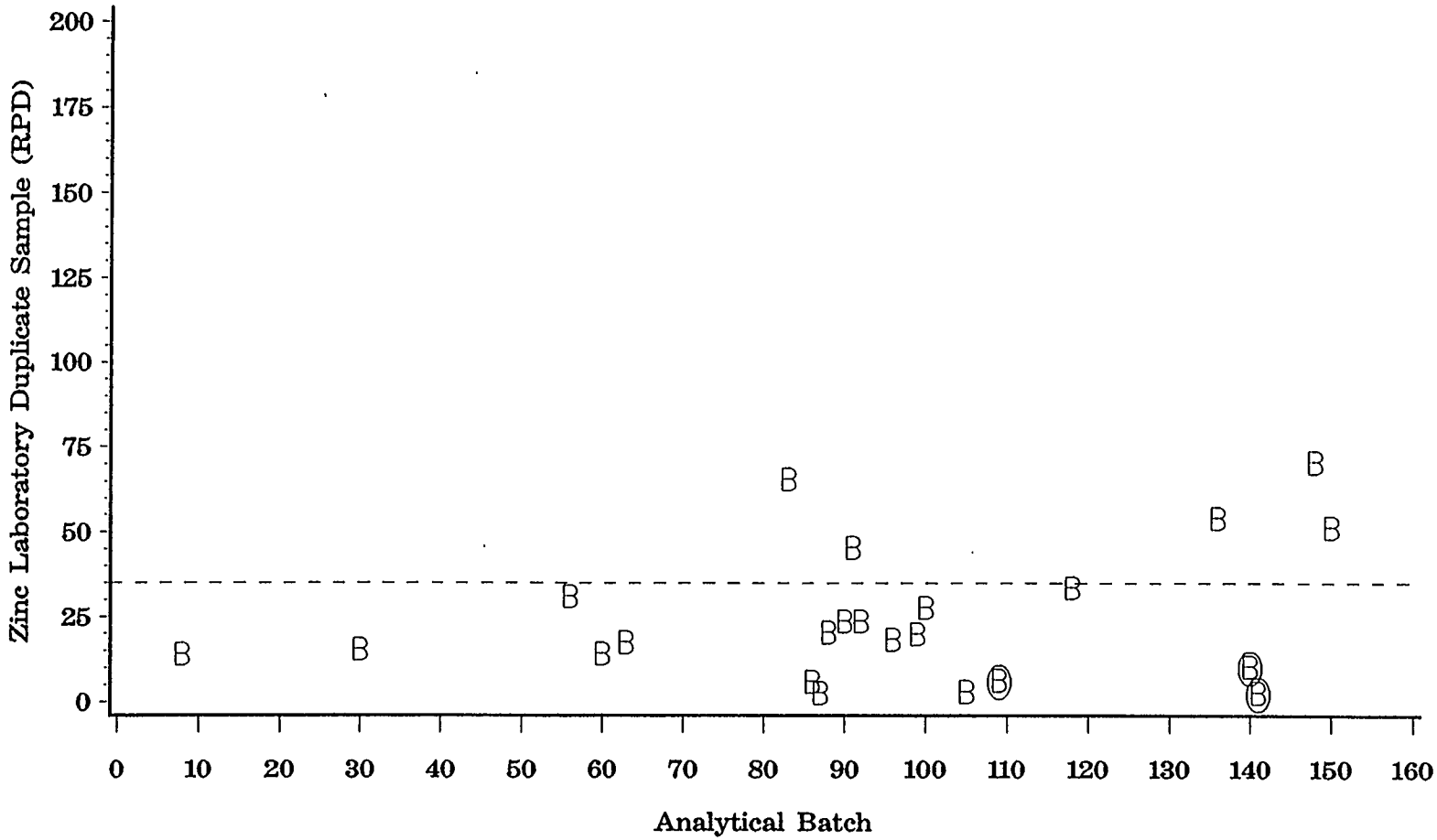


Fig. J.28. NAA SOIL Laboratory Duplicate Sample RPDs for Zinc sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

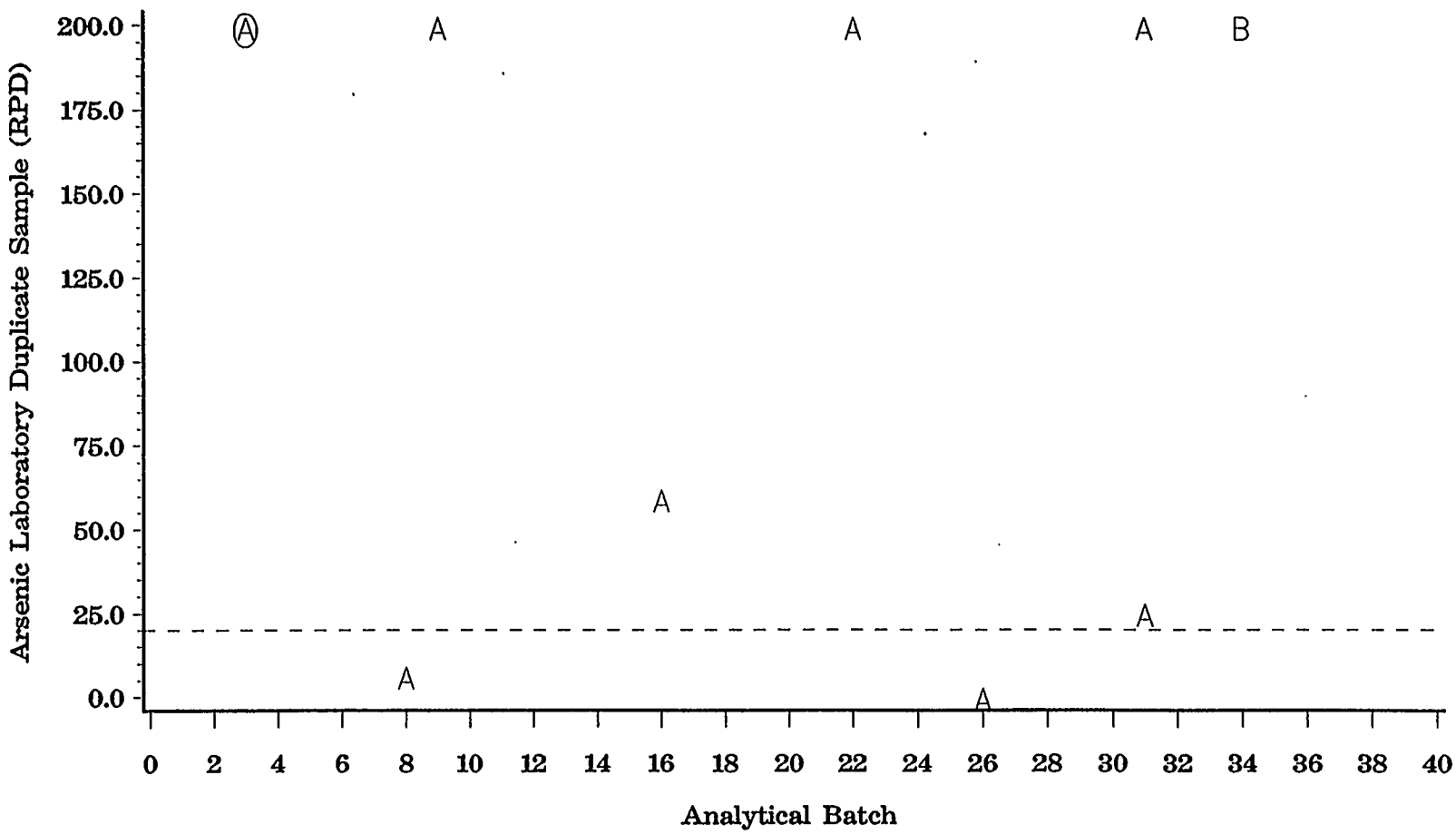


Fig. J.29. EPA CLP WATER Laboratory Duplicate Sample recoveries for Arsenic sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

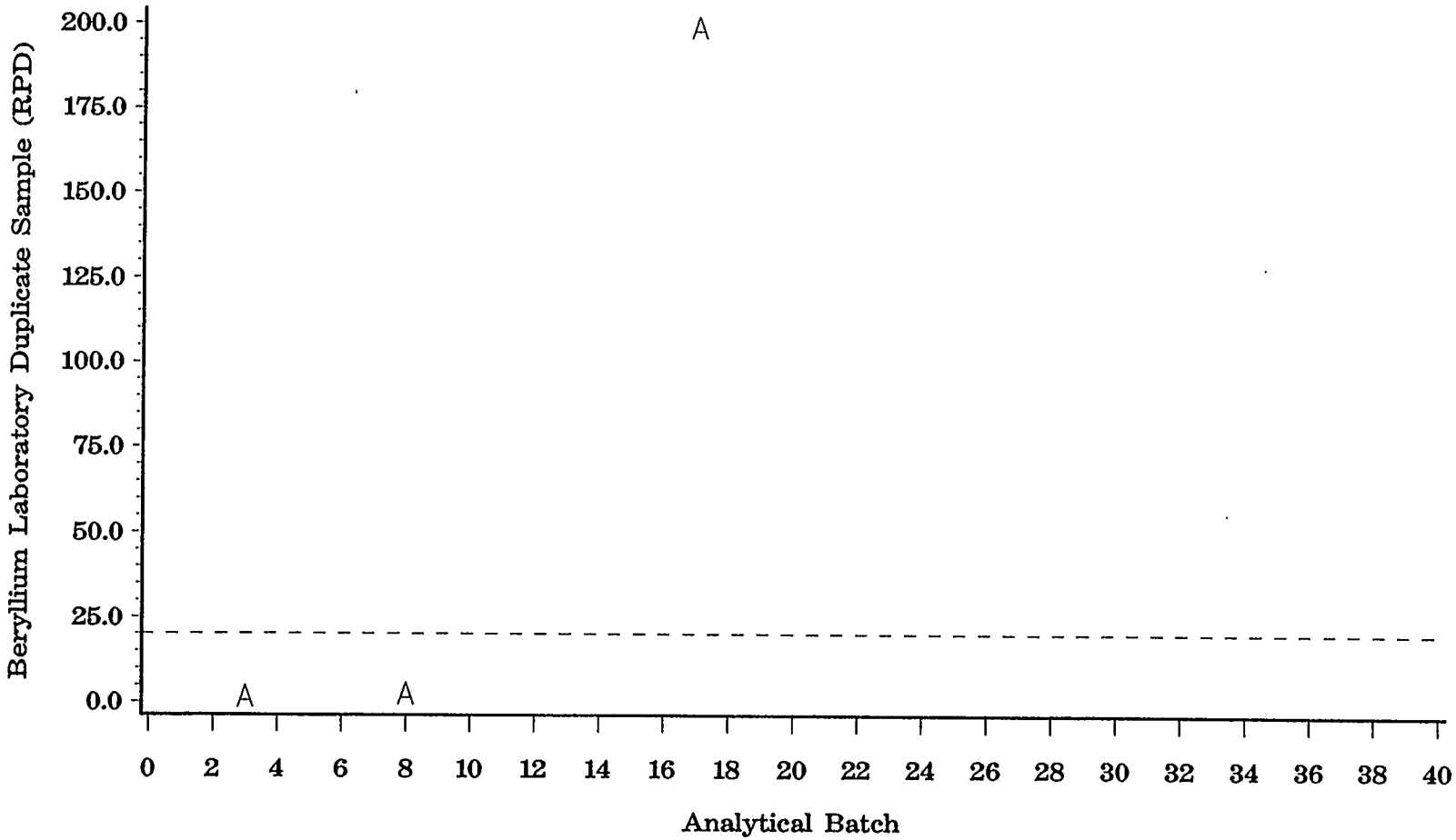


Fig. J.30. EPA CLP WATER Laboratory Duplicate Sample recoveries for Beryllium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

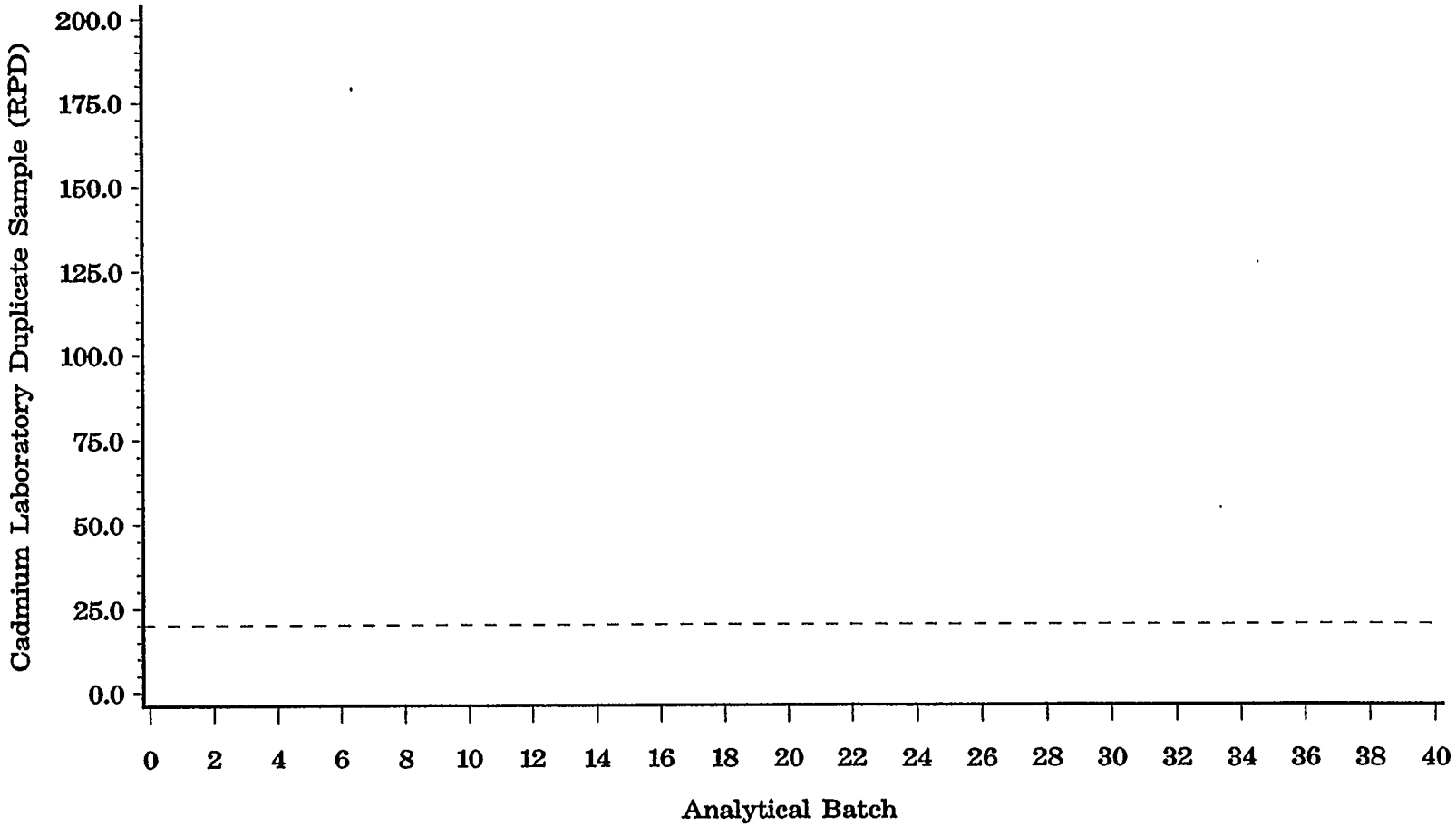


Fig. J.31. EPA CLP WATER Laboratory Duplicate Sample recoveries for Cadmium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

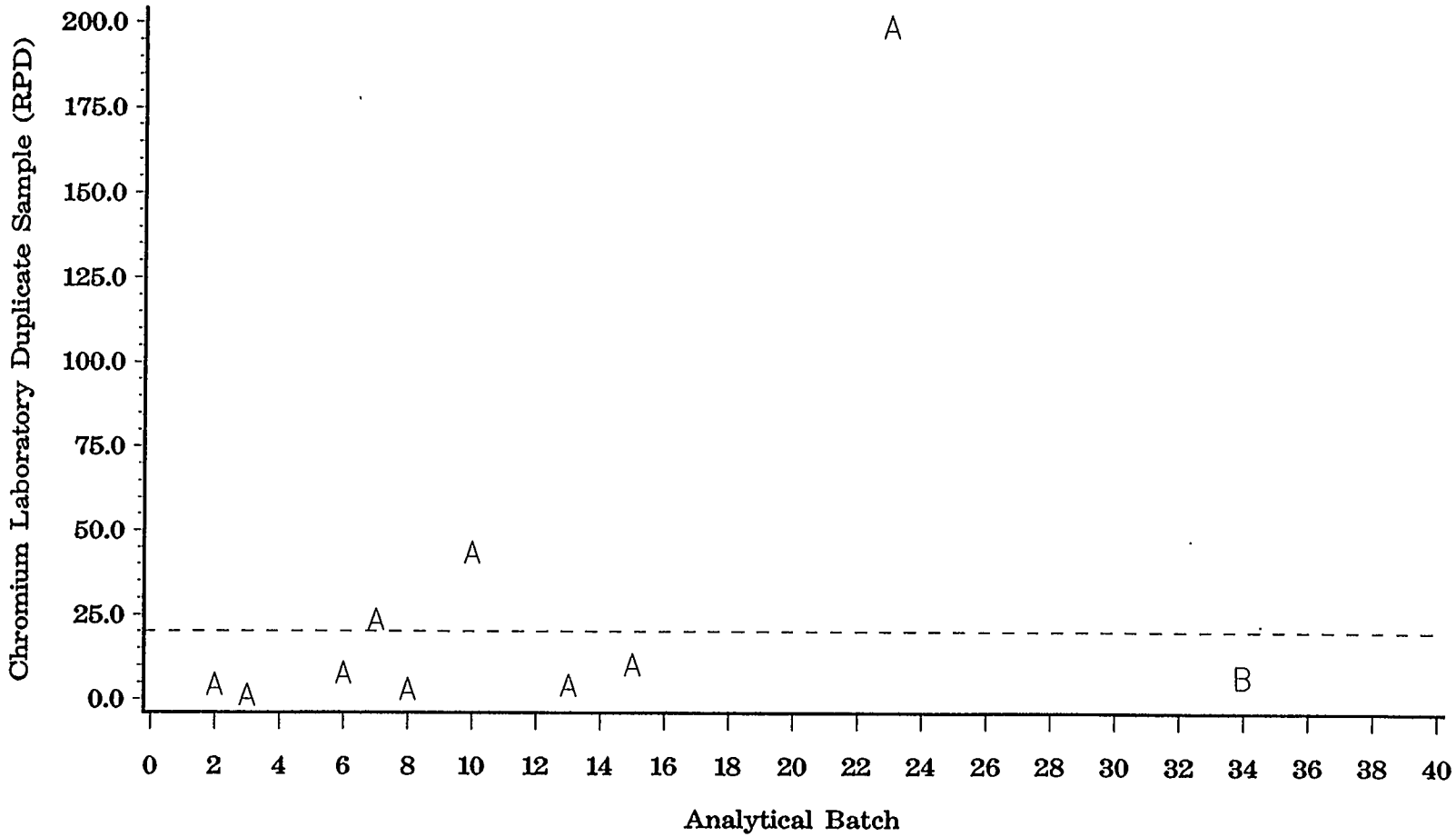


Fig. J.32. EPA CLP WATER Laboratory Duplicate Sample recoveries for Chromium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

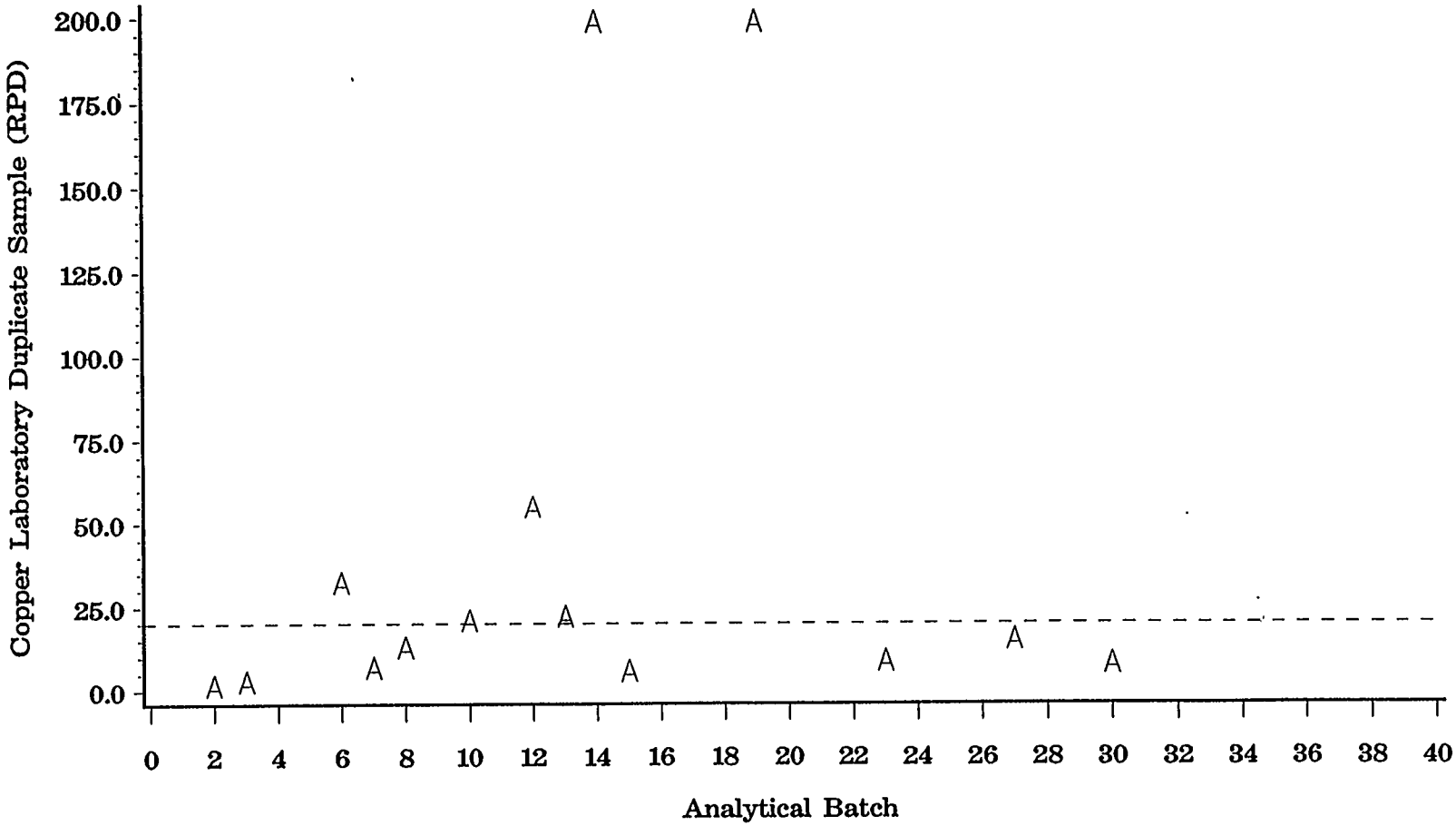


Fig. J.33. EPA CLP WATER Laboratory Duplicate Sample recoveries for Copper sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

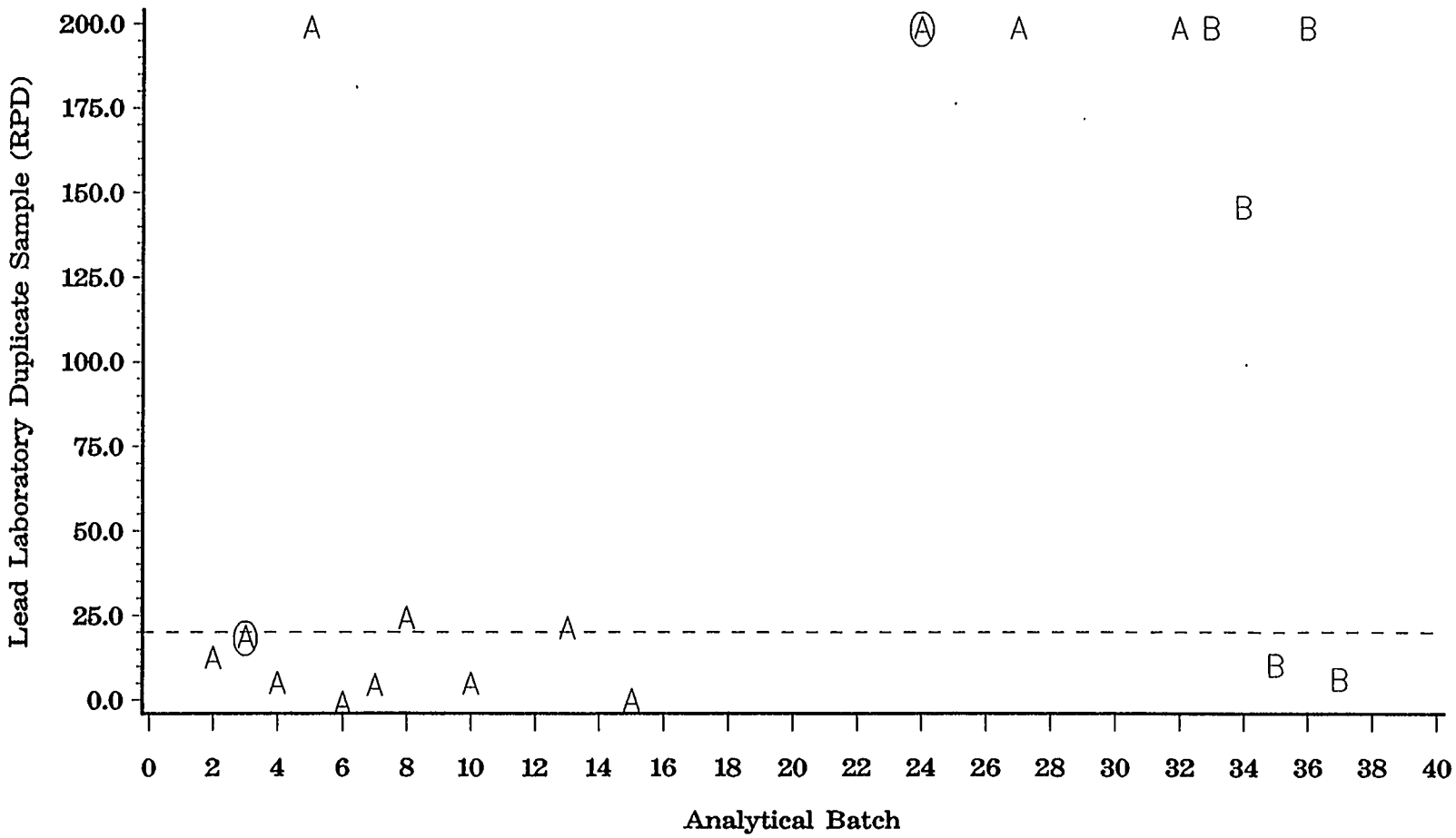


Fig. J.34 EPA CLP WATER Laboratory Duplicate Sample recoveries for Lead sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

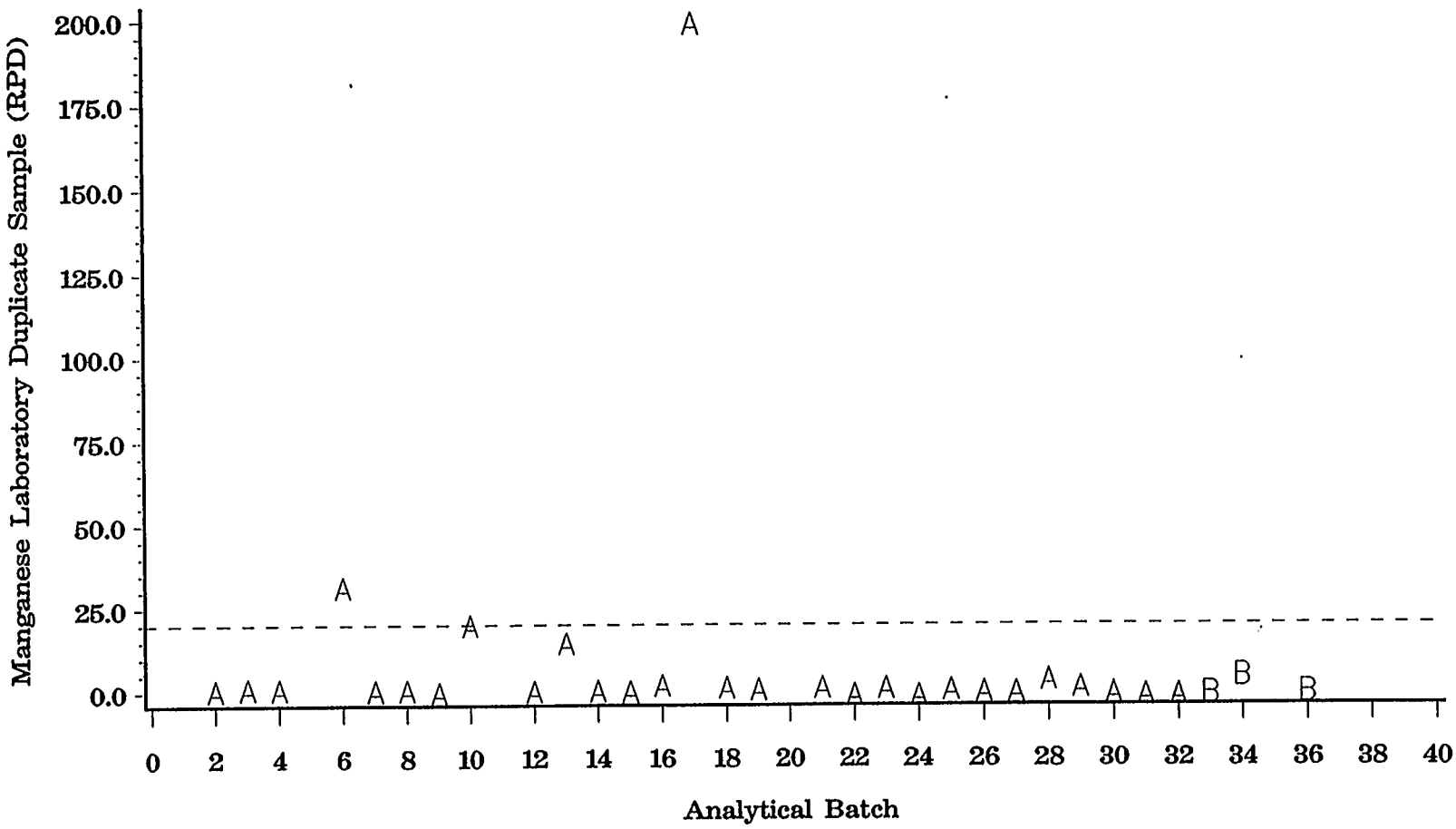


Fig. J.35 EPA CLP WATER Laboratory Duplicate Sample recoveries for Manganese sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

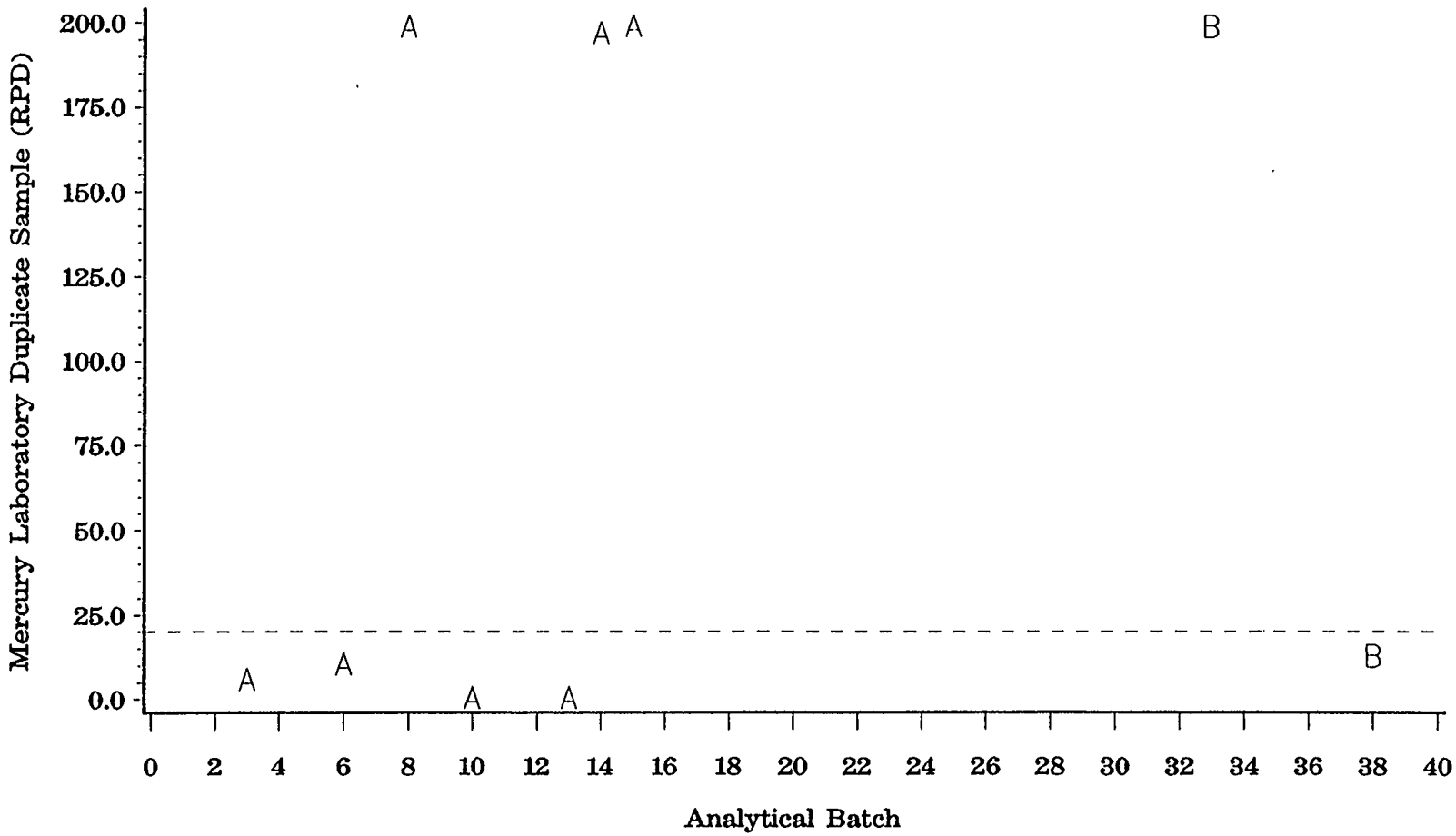


Fig. J.3b. EPA CLP WATER Laboratory Duplicate Sample recoveries for Mercury sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

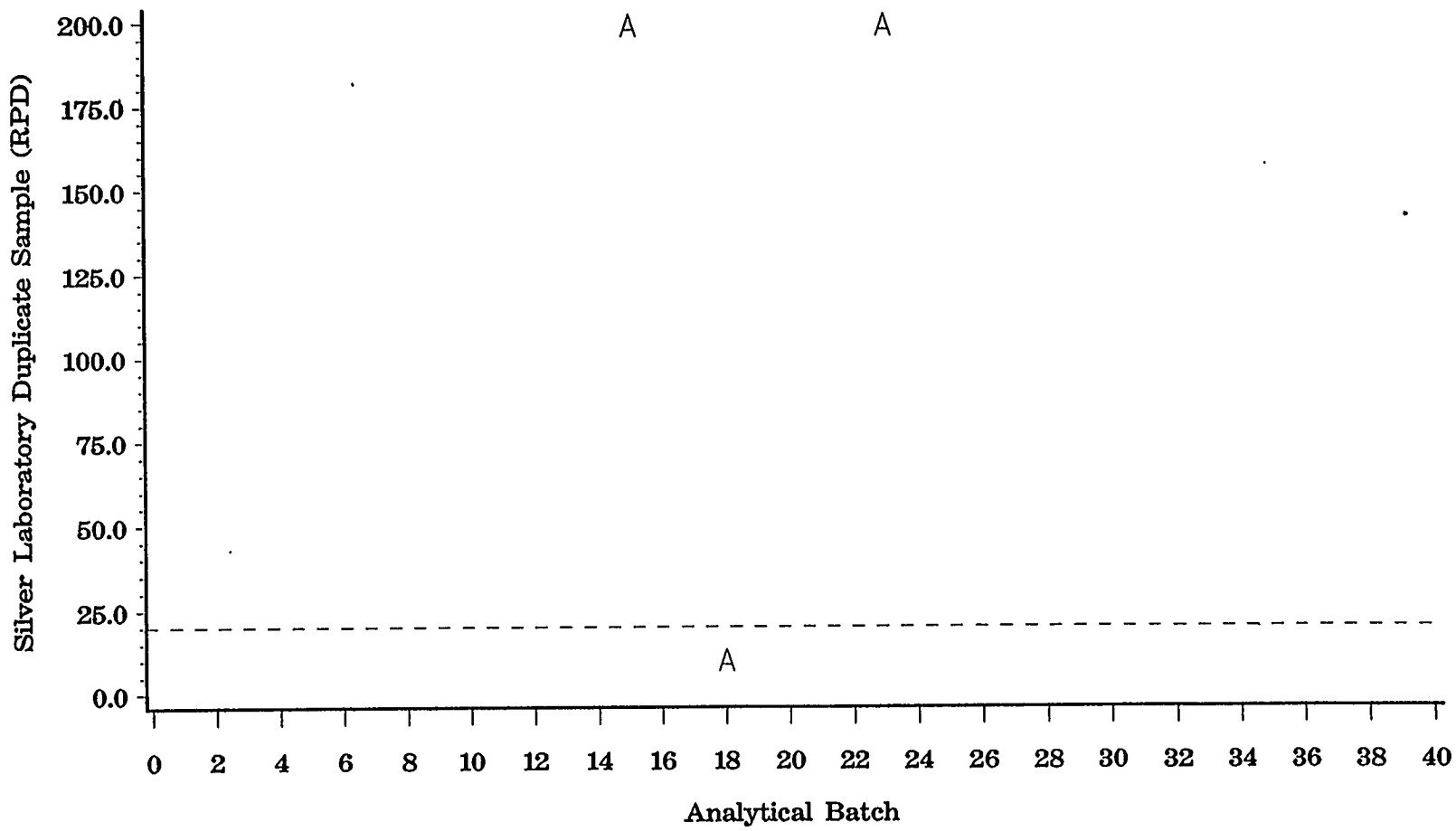


Fig. J.37. EPA CLP WATER Laboratory Duplicate Sample recoveries for Silver sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

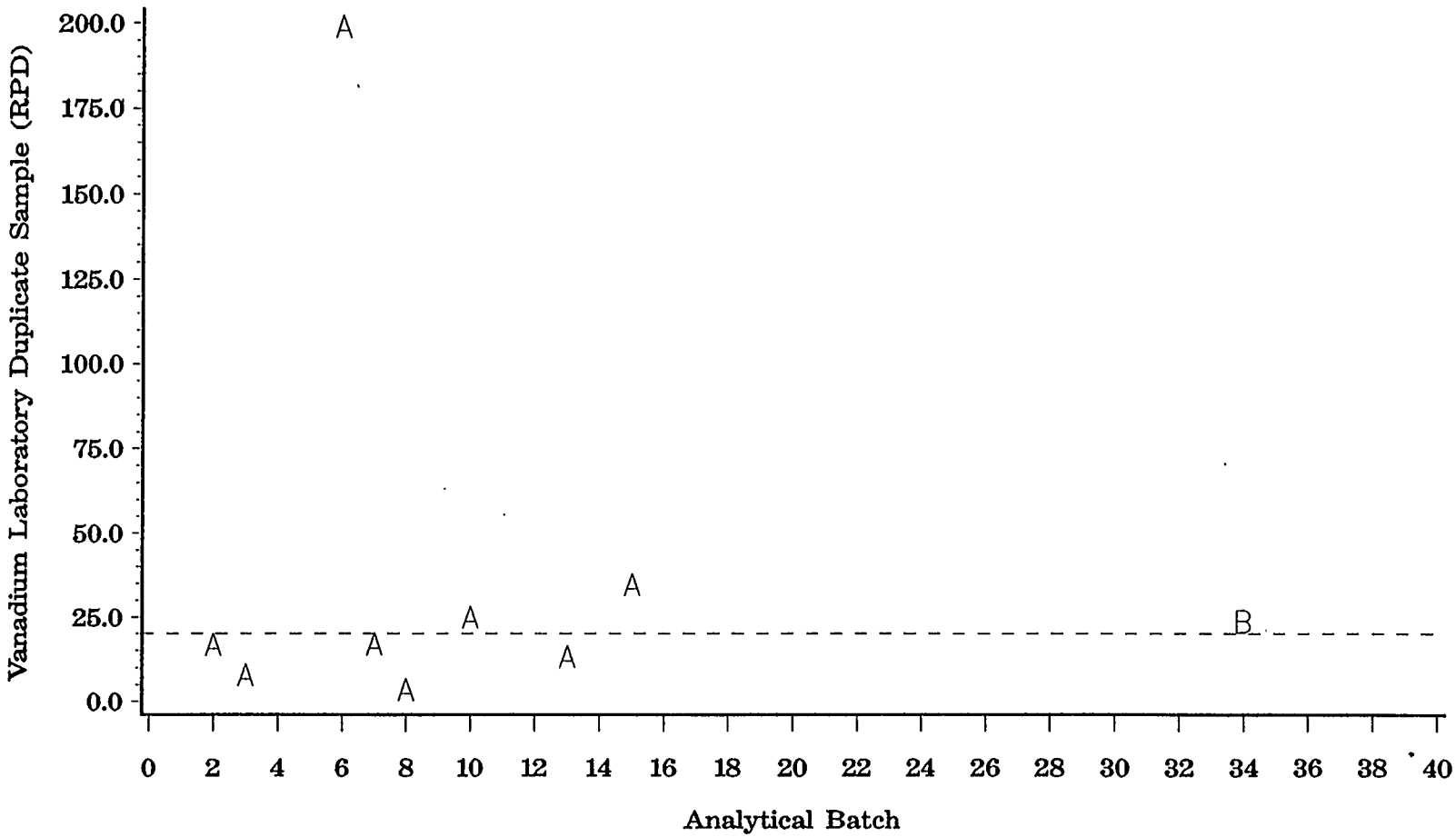


Fig. J.38. EPA CLP WATER Laboratory Duplicate Sample recoveries for Vanadium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

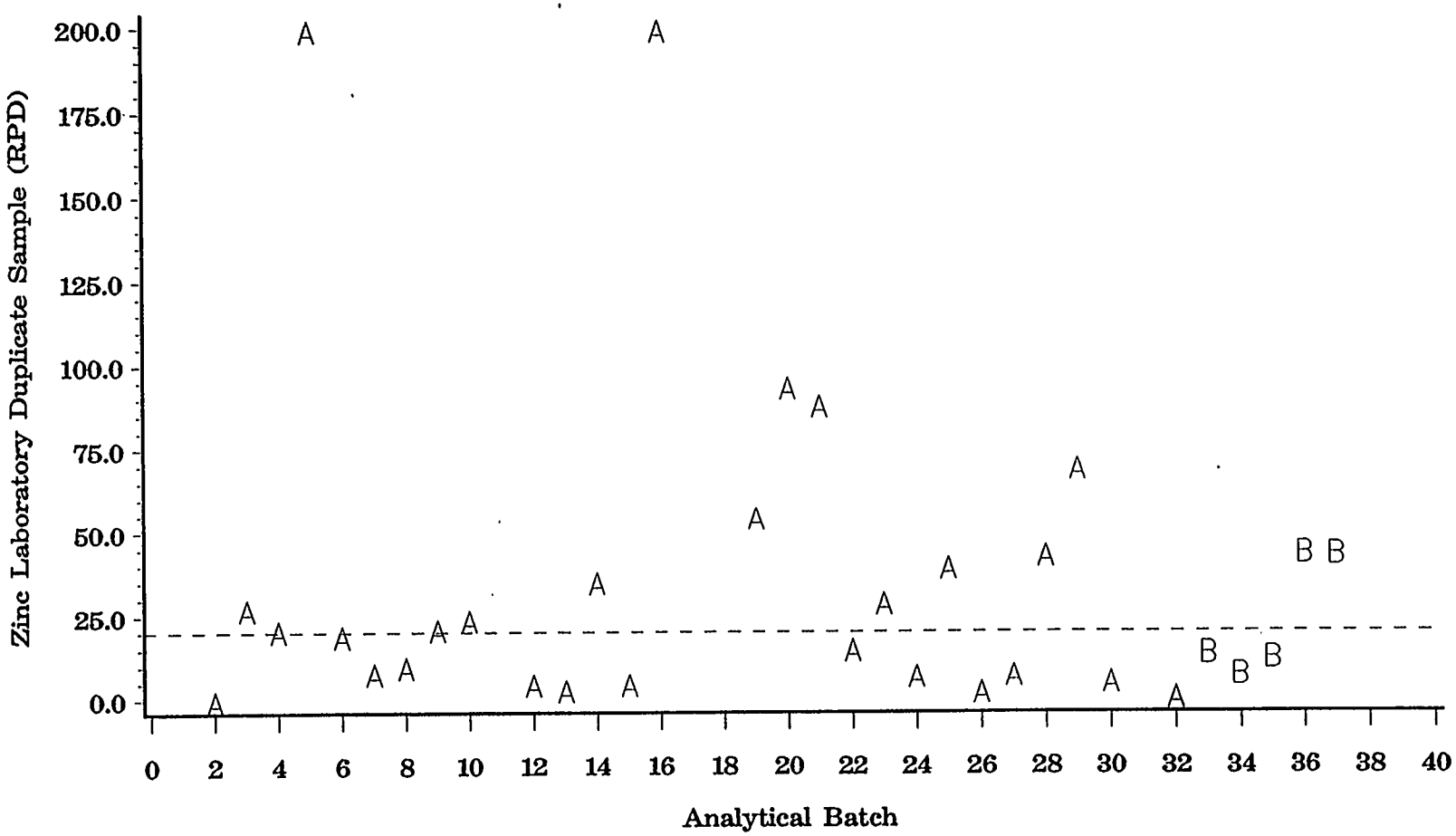


Fig. J.39. EPA CLP WATER Laboratory Duplicate Sample recoveries for Zinc sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

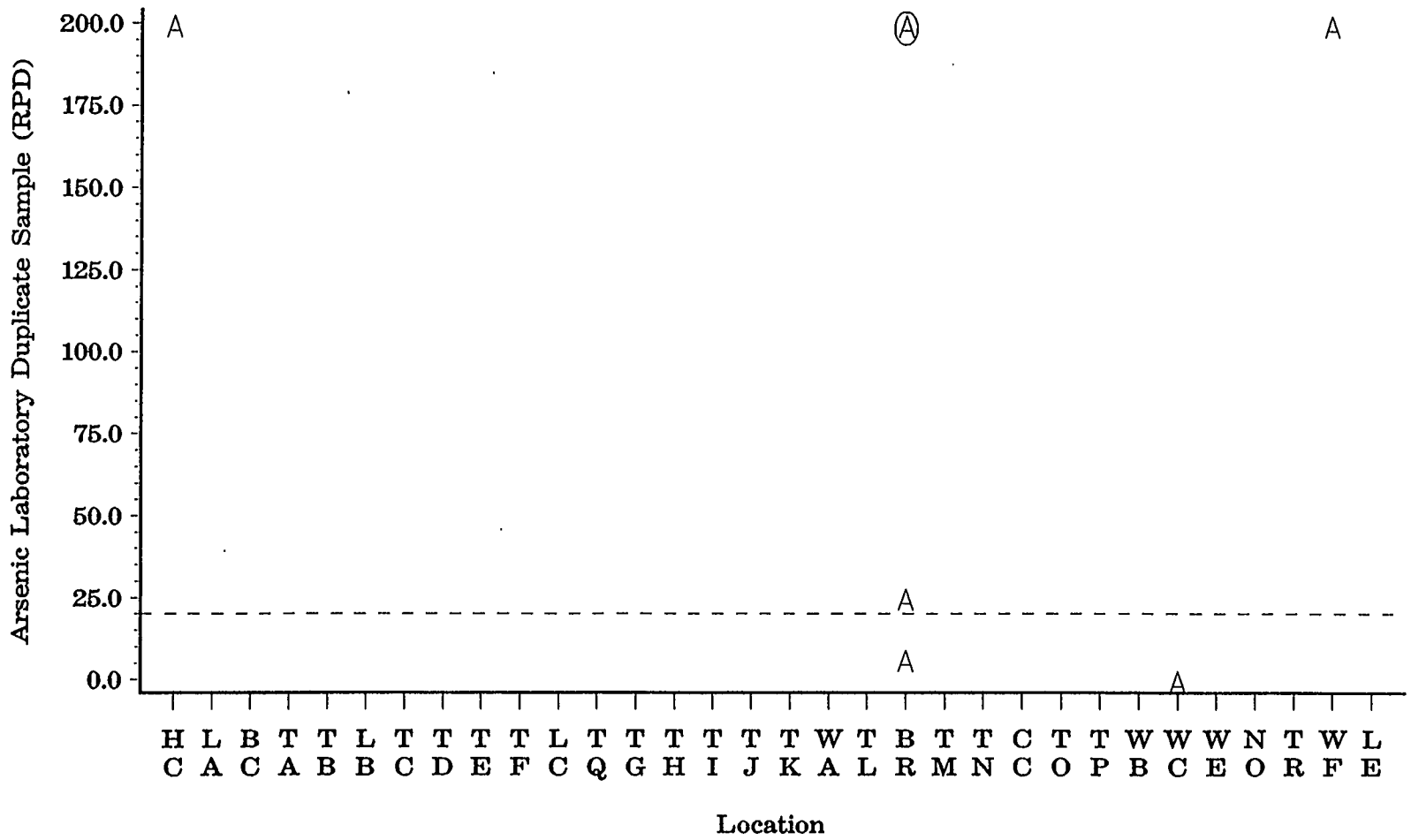


Fig. J.40. EPA CLP WATER Laboratory Duplicate Sample RPDs for Arsenic sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

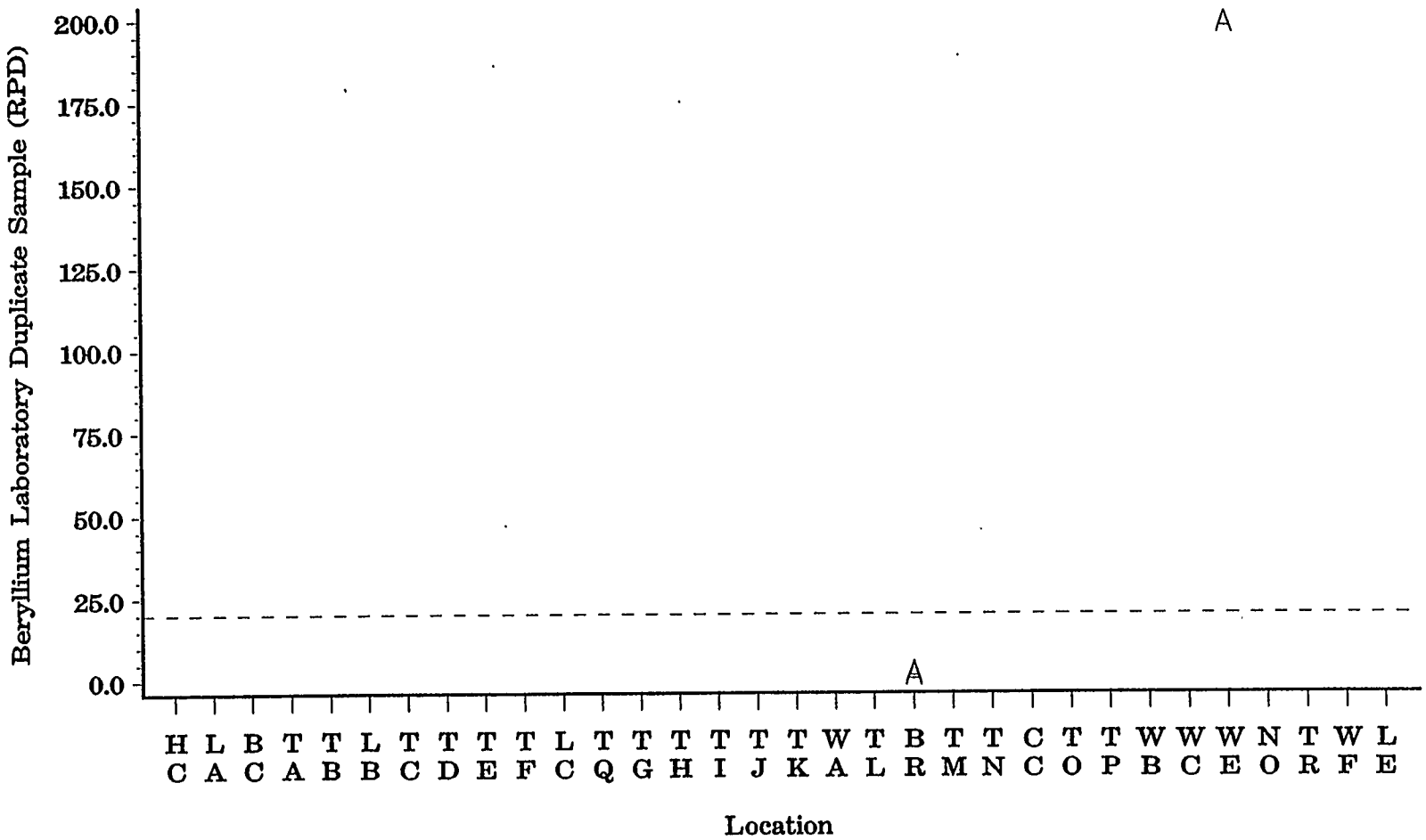


Fig. J.41. EPA CLP WATER Laboratory Duplicate Sample RPDs for Beryllium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

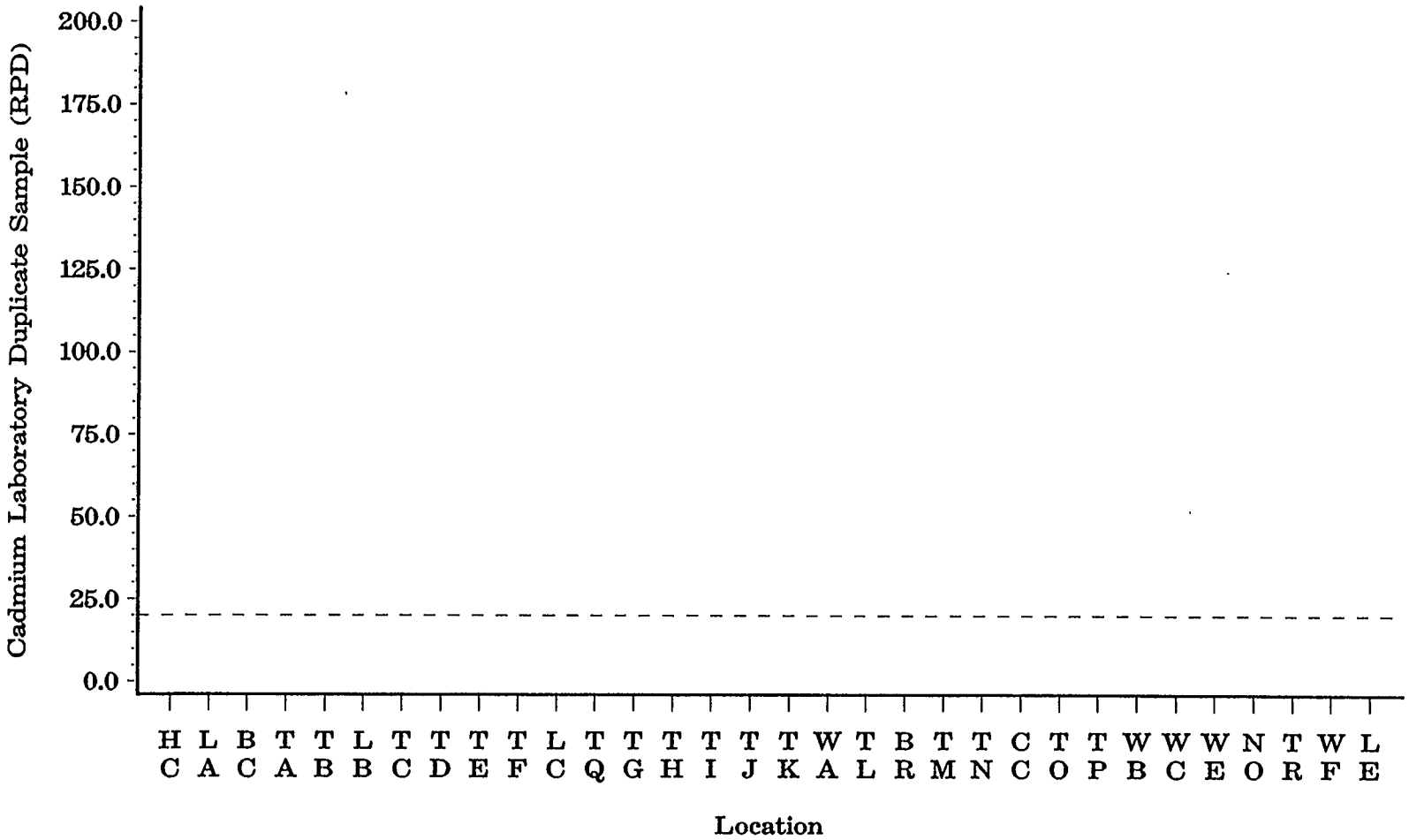


Fig. J.42. EPA CLP WATER Laboratory Duplicate Sample RPDs for Cadmium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

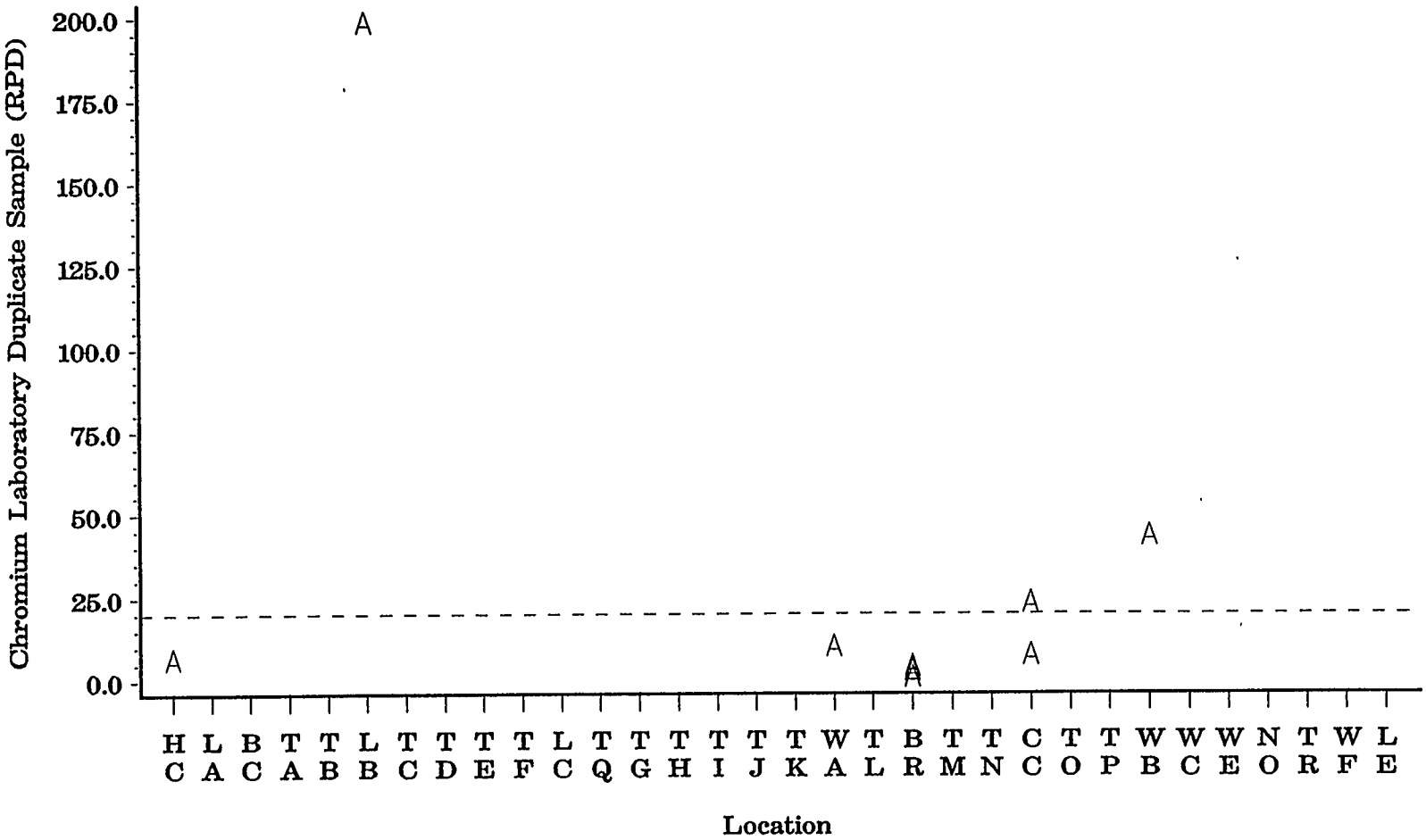


Fig.J.43. EPA CLP WATER Laboratory Duplicate Sample RPDs for Chromium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

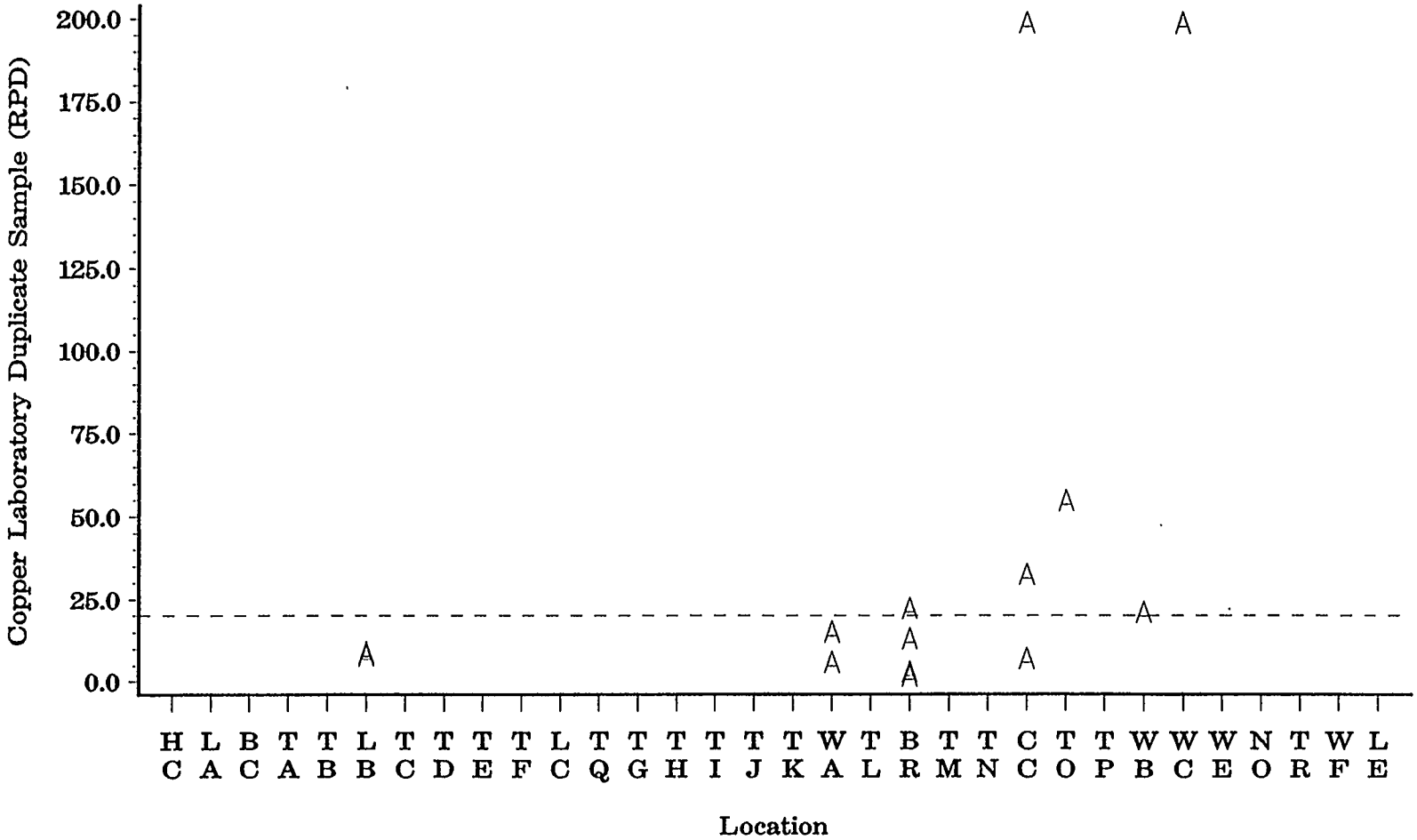


Fig. J.44. EPA CLP WATER Laboratory Duplicate Sample RPDs for Copper sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

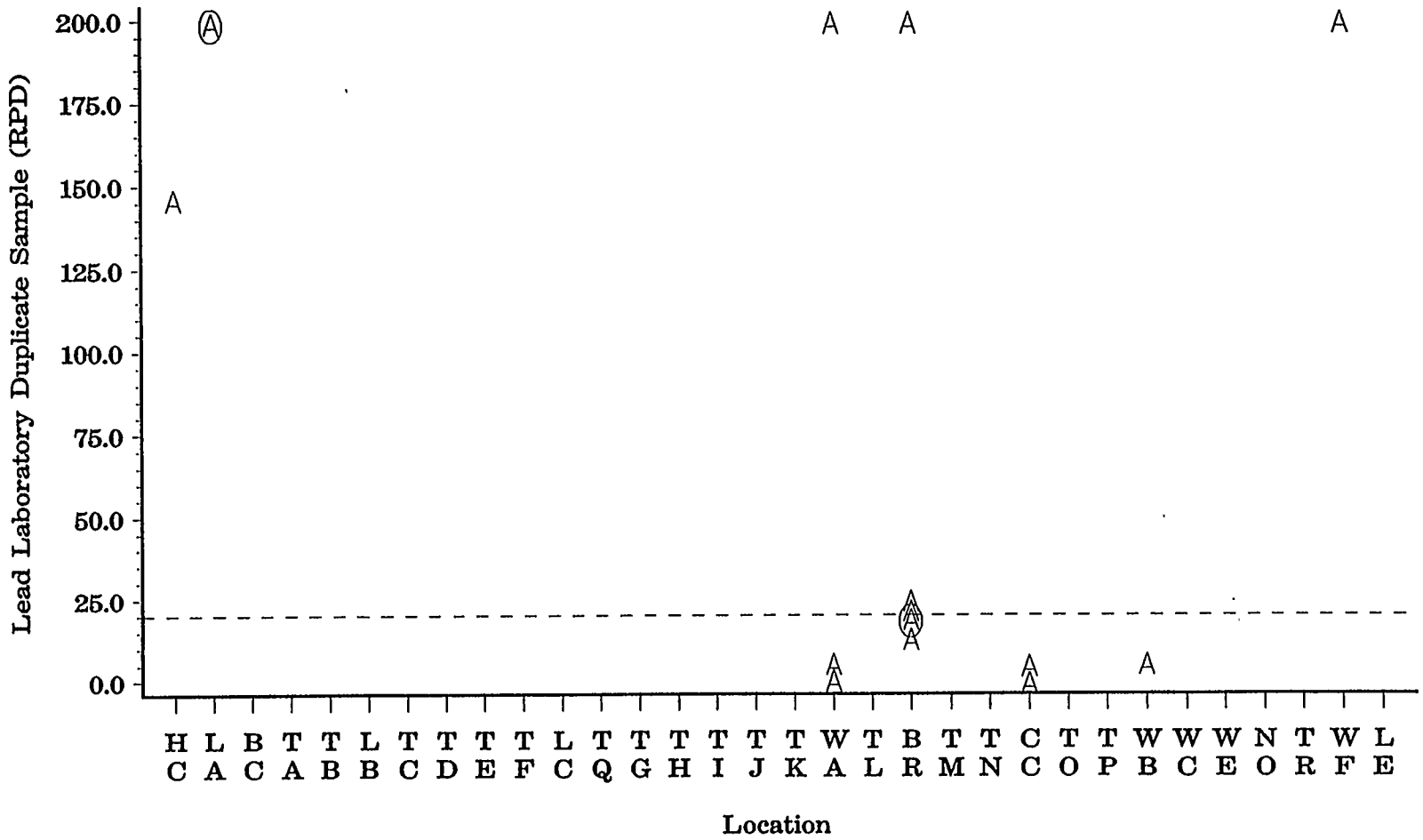


Fig. J.45. EPA CLP WATER Laboratory Duplicate Sample RPDs for Lead sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

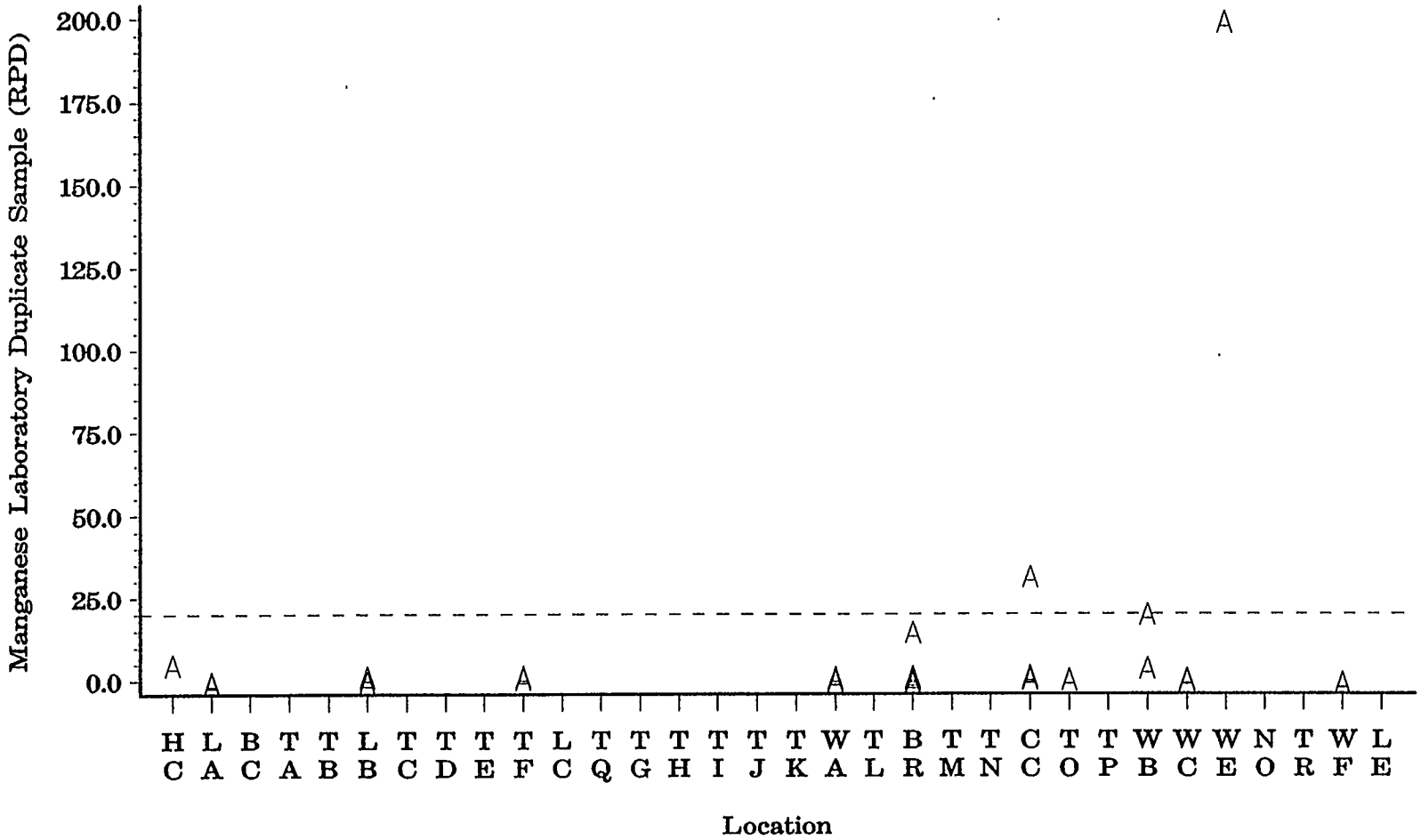


Fig. J.46. EPA CLP WATER Laboratory Duplicate Sample RPDs for Manganese sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

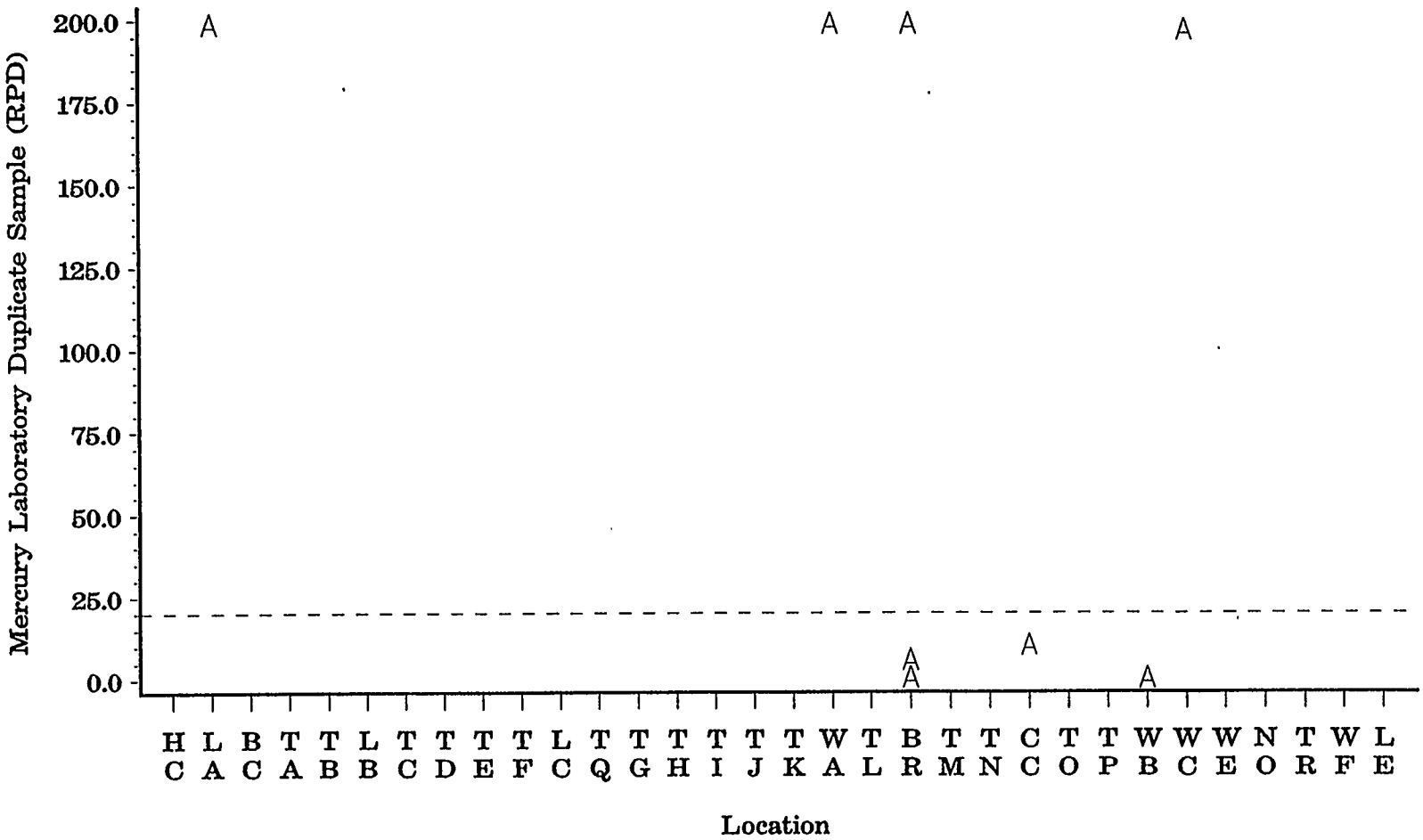


Fig. 3.47. EPA CLP WATER Laboratory Duplicate Sample RPDs for Mercury sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

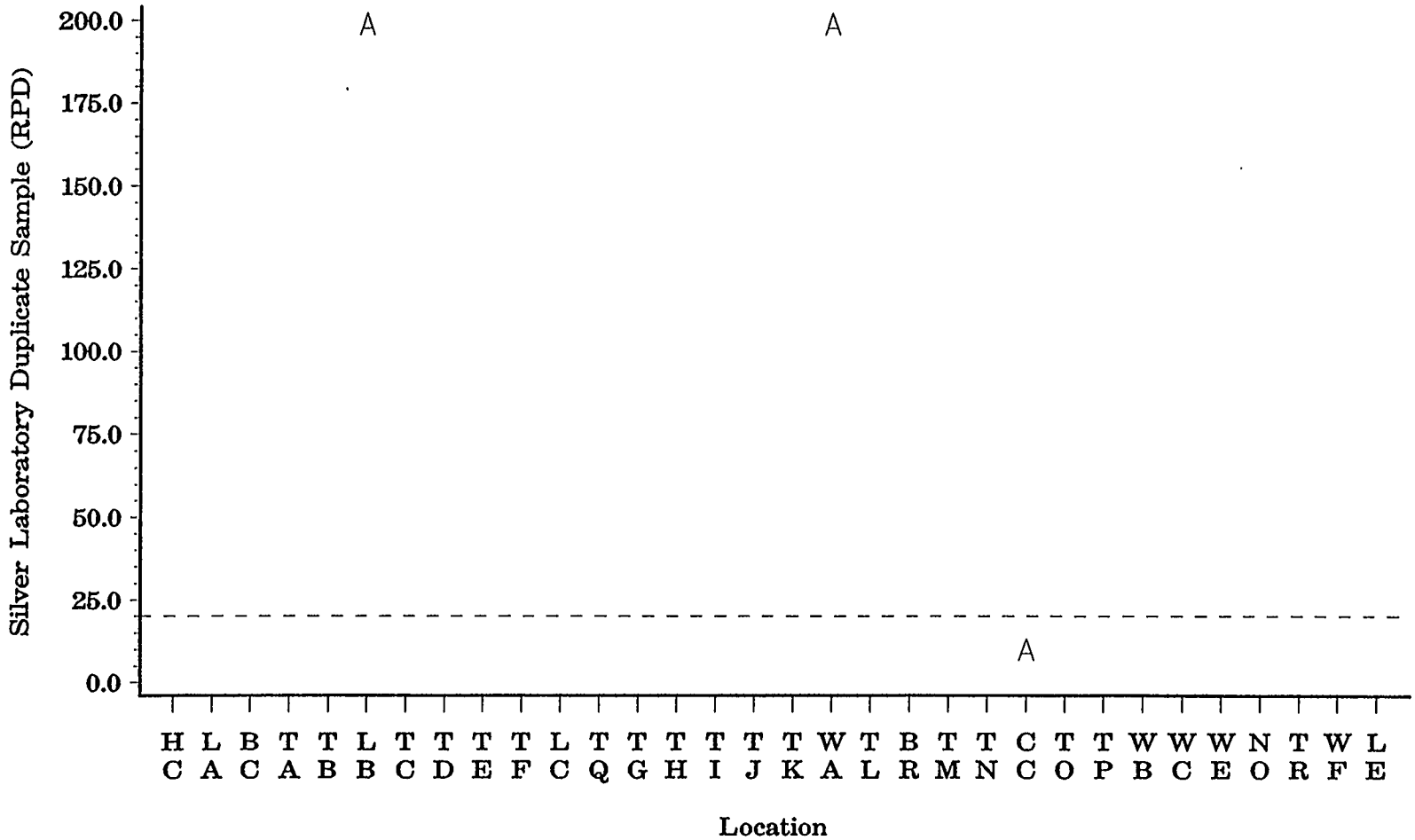


Fig. J.48. EPA CLP WATER Laboratory Duplicate Sample RPDs for Silver sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

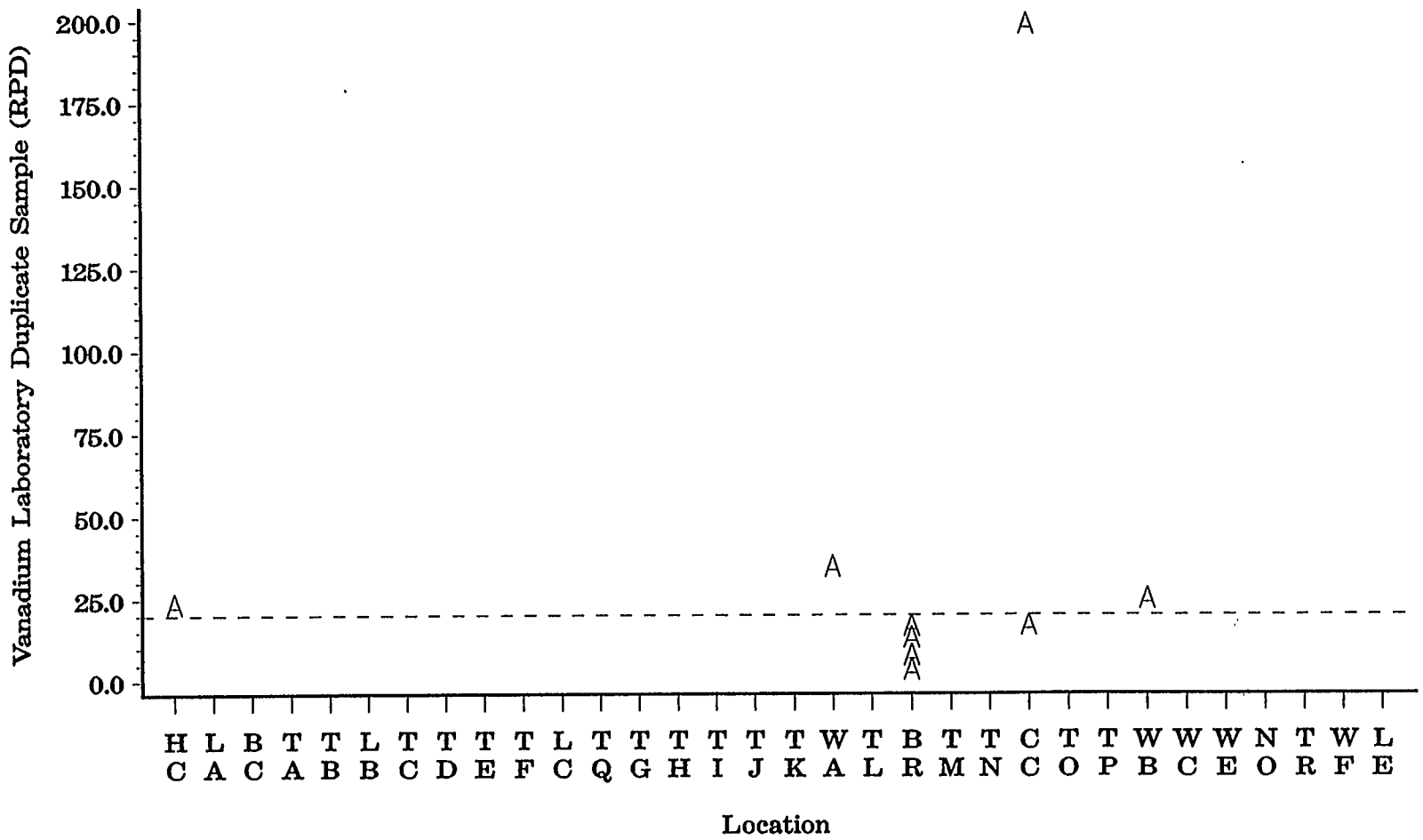


Fig.J.49. EPA CLP WATER Laboratory Duplicate Sample RPDs for Vanadium sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

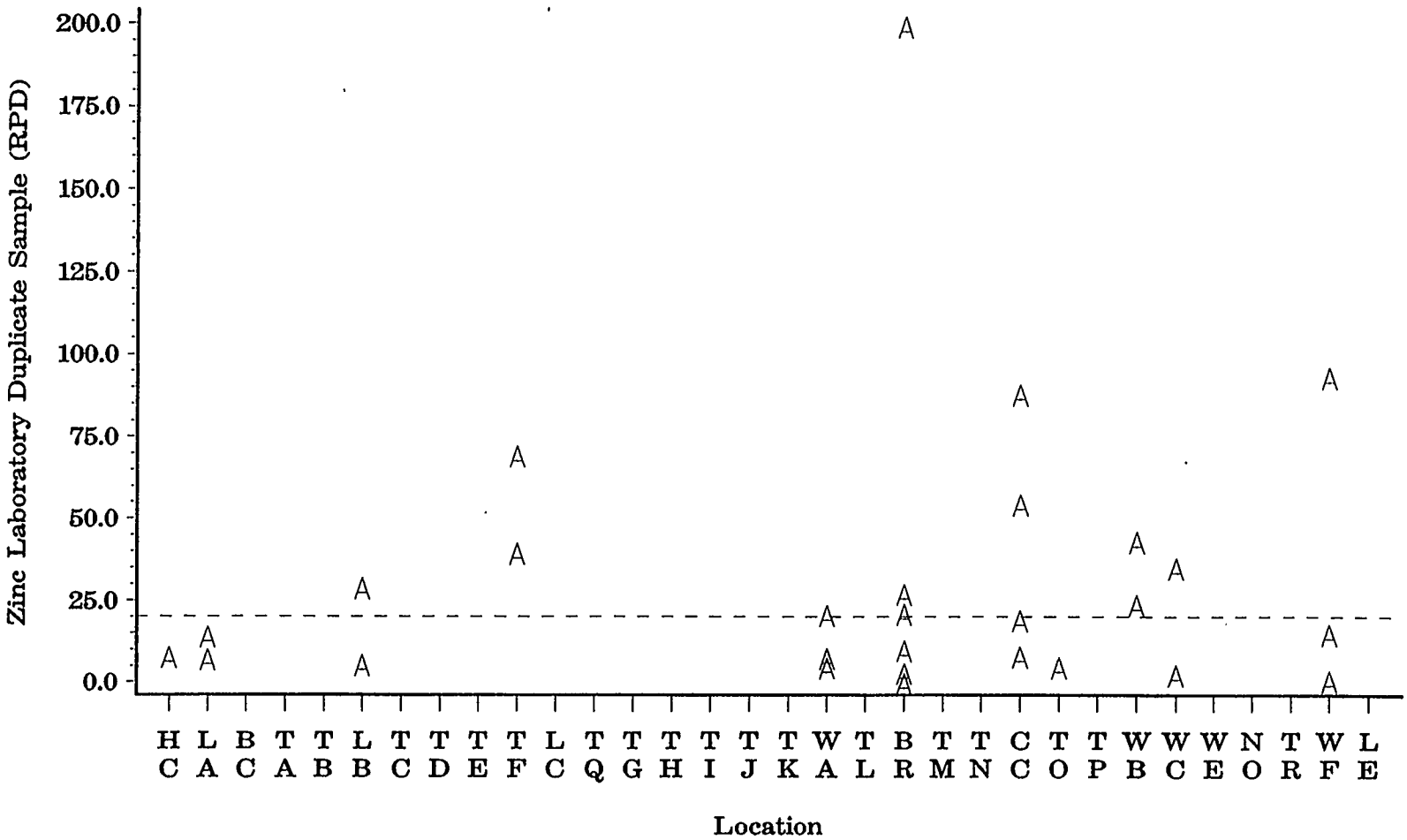


Fig. J.50. EPA CLP WATER Laboratory Duplicate Sample RPDs for Zinc sample analyses. for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP duplicate RPD guidance. Circled points indicate rejected data from the data validation process.

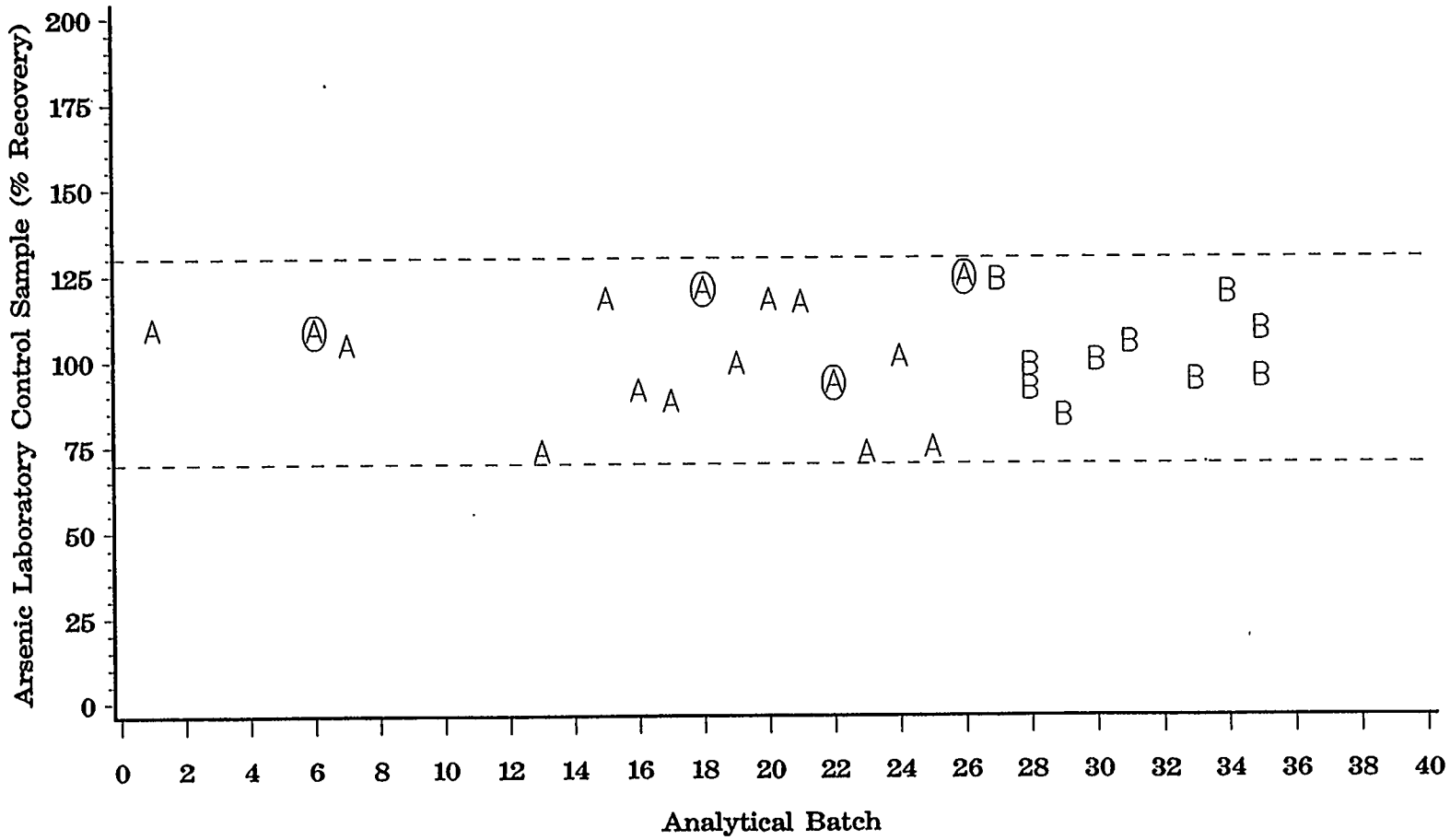


Fig. 3.51. EPA CLP SOIL Laboratory Control Sample recoveries for Arsenic sample analyses. Circled points indicate rejected data from the data validation process.

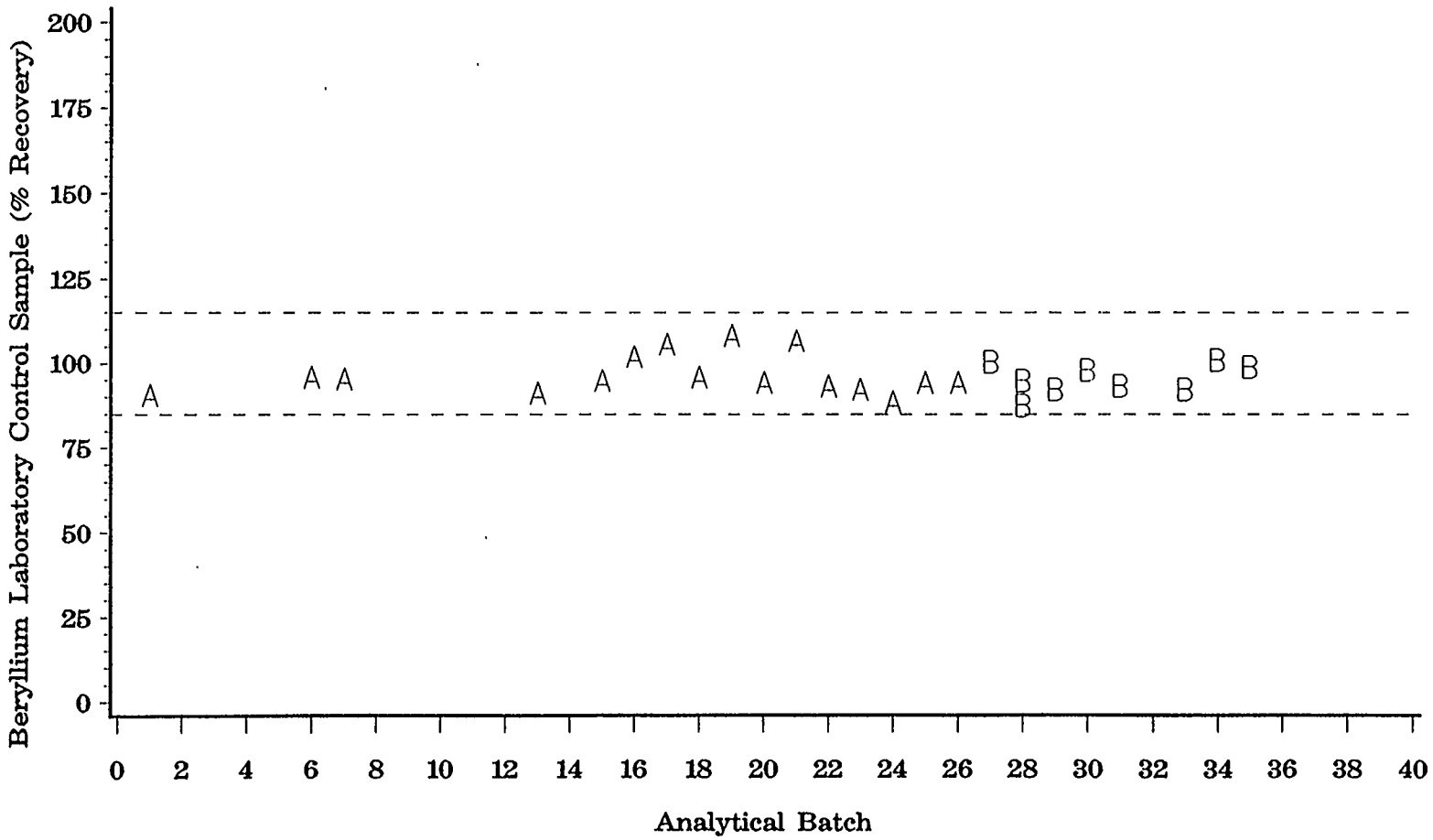


Fig. J.52. EPA CLP SOIL Laboratory Control Sample recoveries for Beryllium sample analyses. Circled points indicate rejected data from the data validation process.

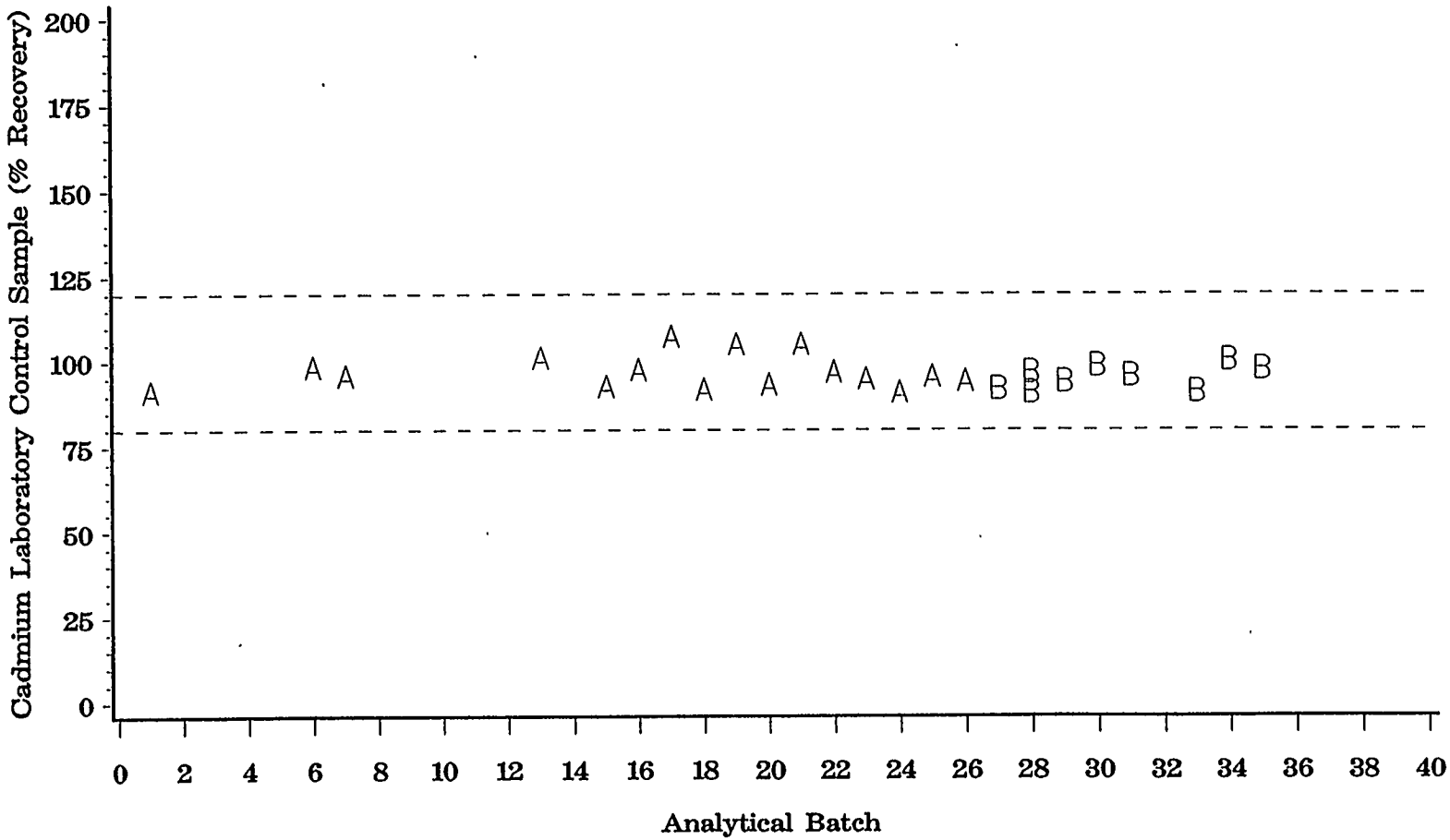


Fig. J.53. EPA CLP SOIL Laboratory Control Sample recoveries for Cadmium sample analyses. Circled points indicate rejected data from the data validation process.

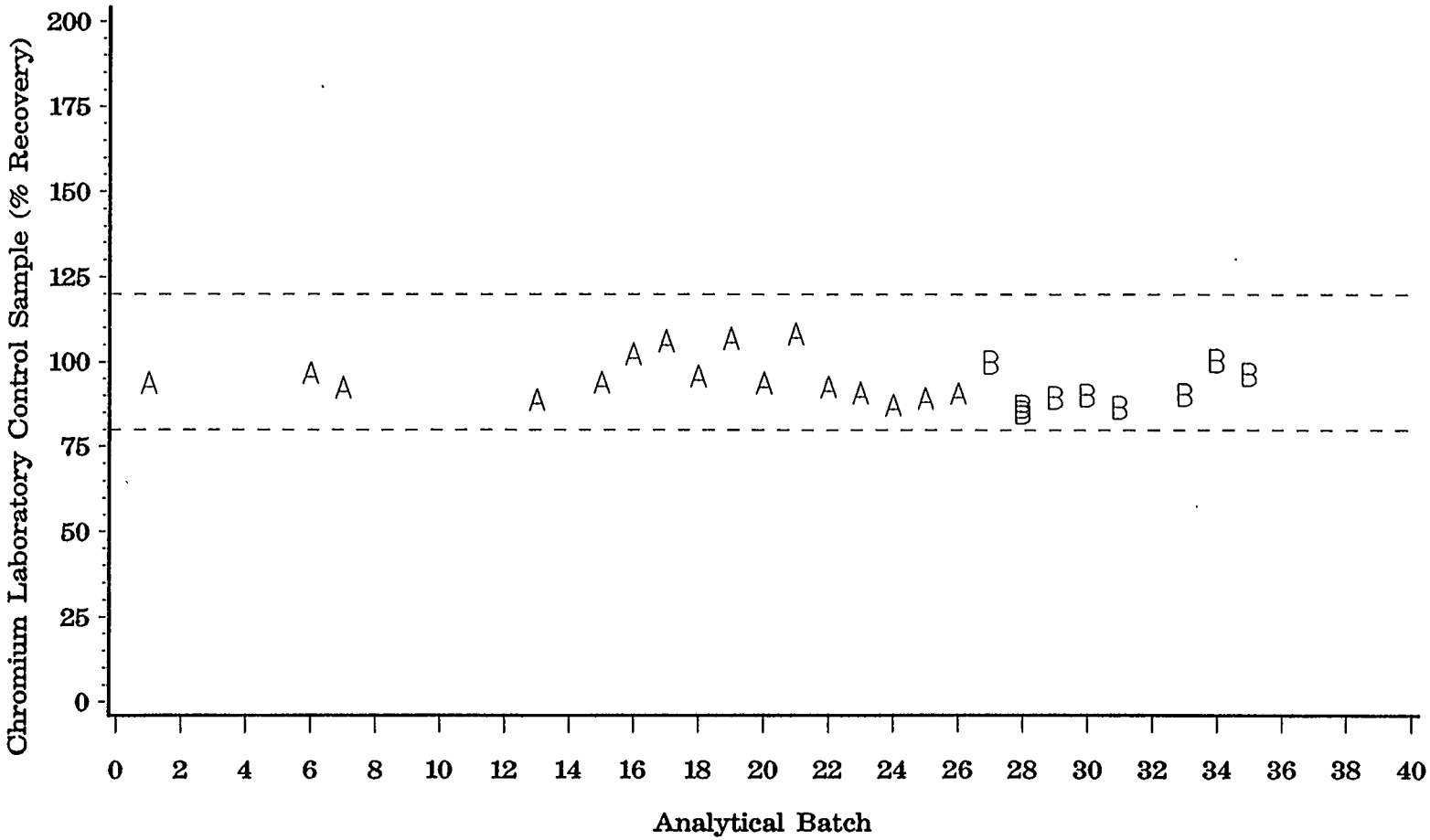


Fig. J.54. EPA CLP SOIL Laboratory Control Sample recoveries for Chromium sample analyses. Circled points indicate rejected data from the data validation process.

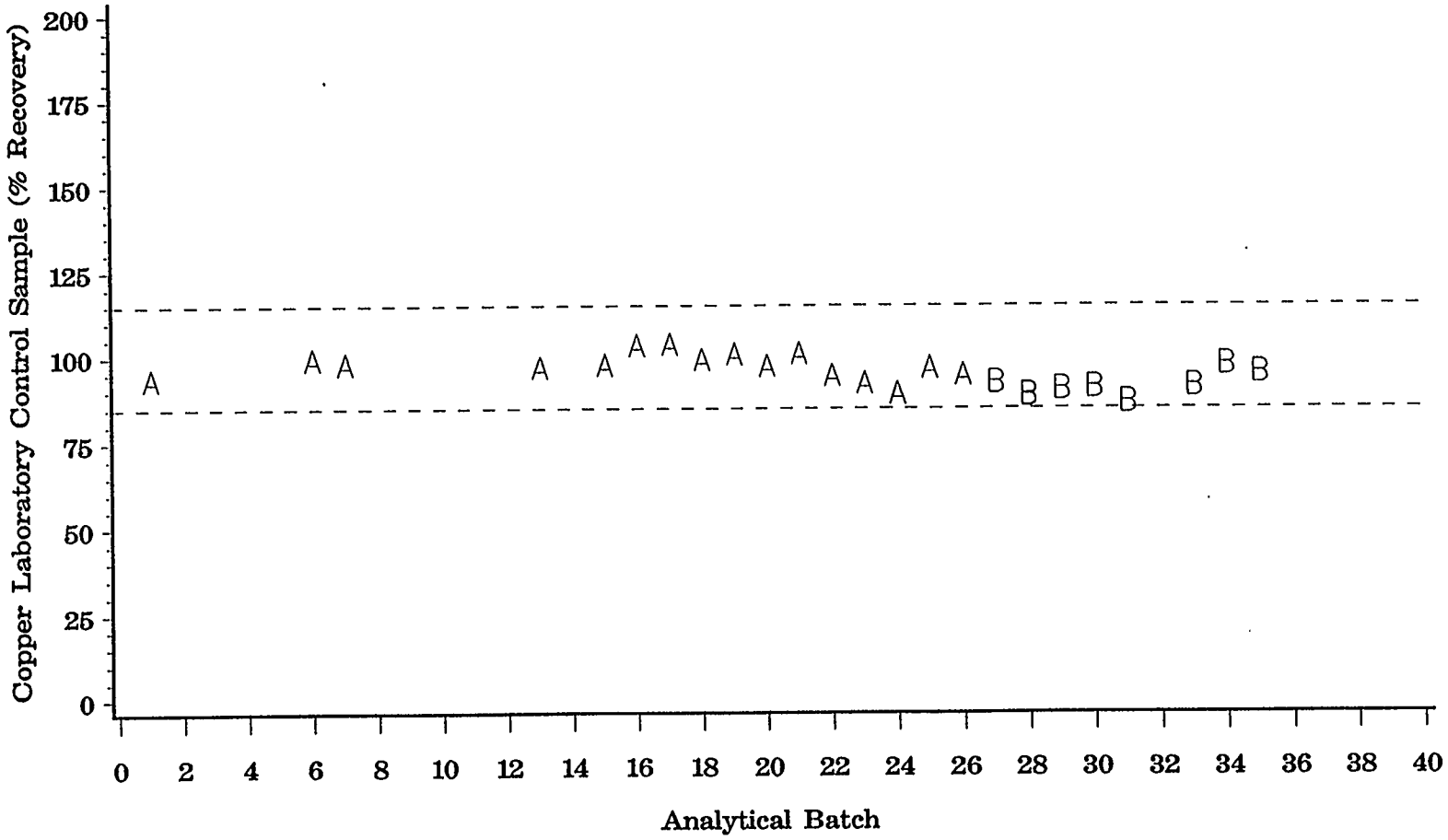


Fig. J.55. EPA CLP SOIL Laboratory Control Sample recoveries for Copper sample analyses. Circled points indicate rejected data from the data validation process.

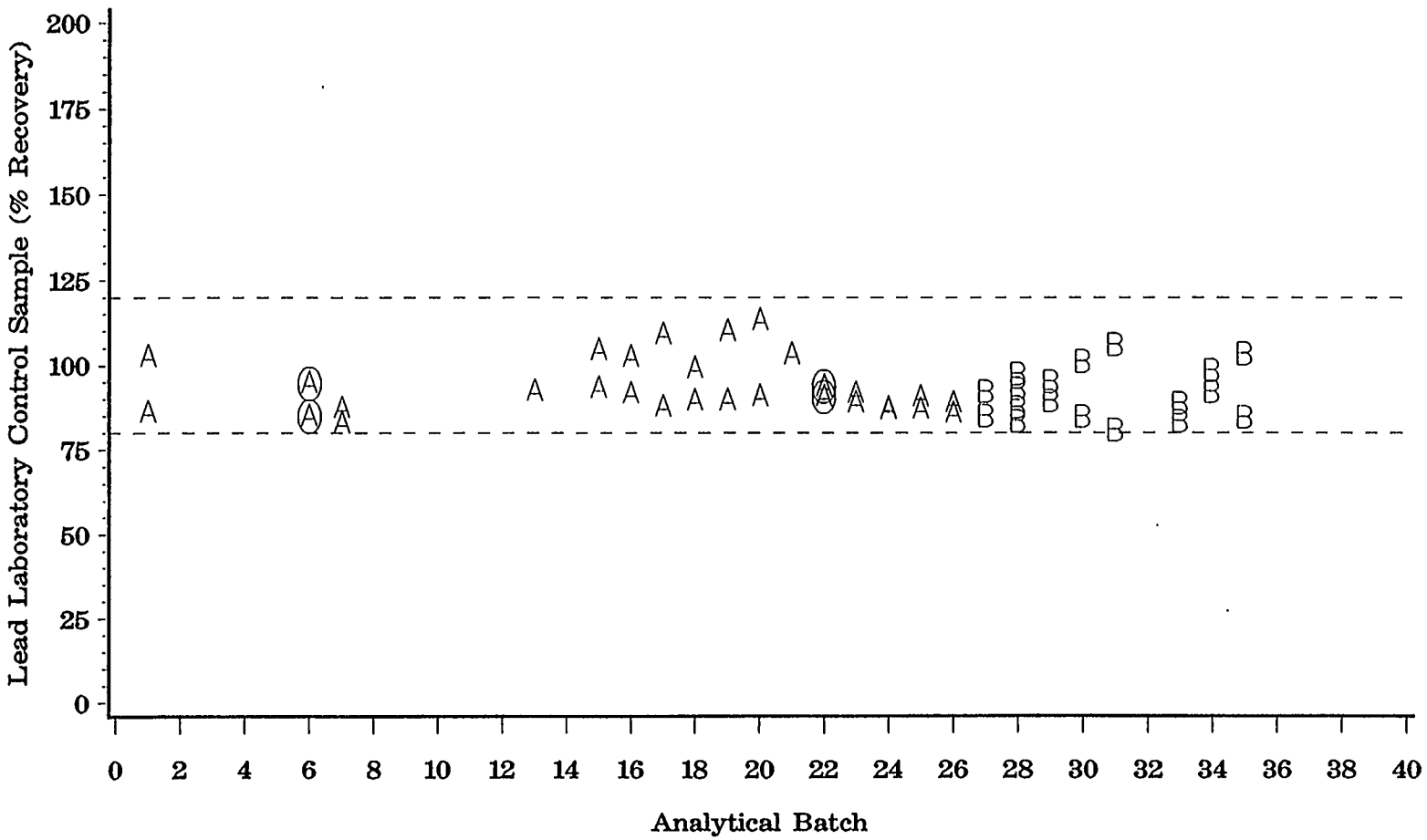


Fig. J.56. EPA CLP SOIL Laboratory Control Sample recoveries for Lead sample analyses. Circled points indicate rejected data from the data validation process.

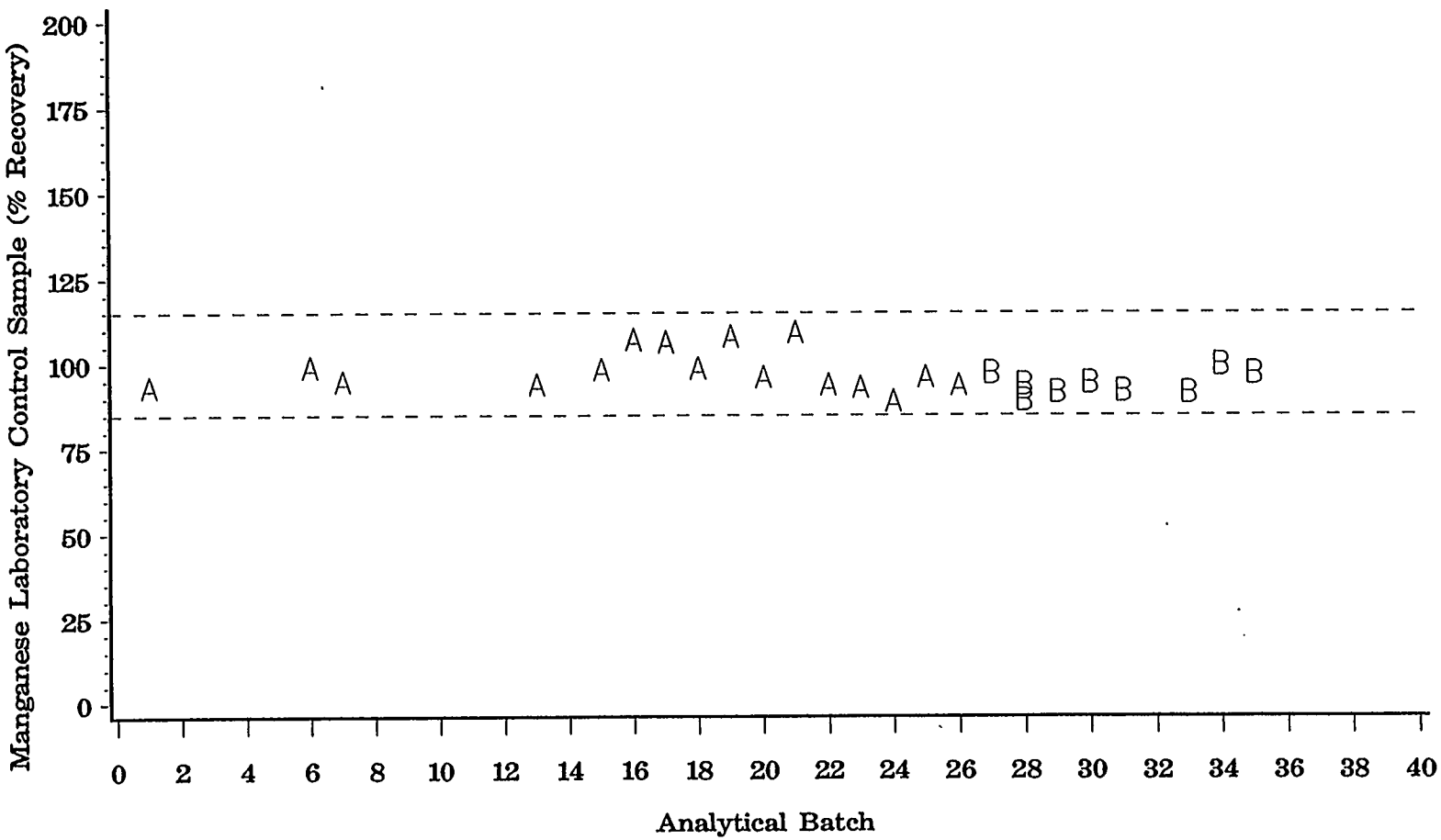


Fig. J.57. EPA CLP SOIL Laboratory Control Sample recoveries for Manganese sample analyses. Circled points indicate rejected data from the data validation process.

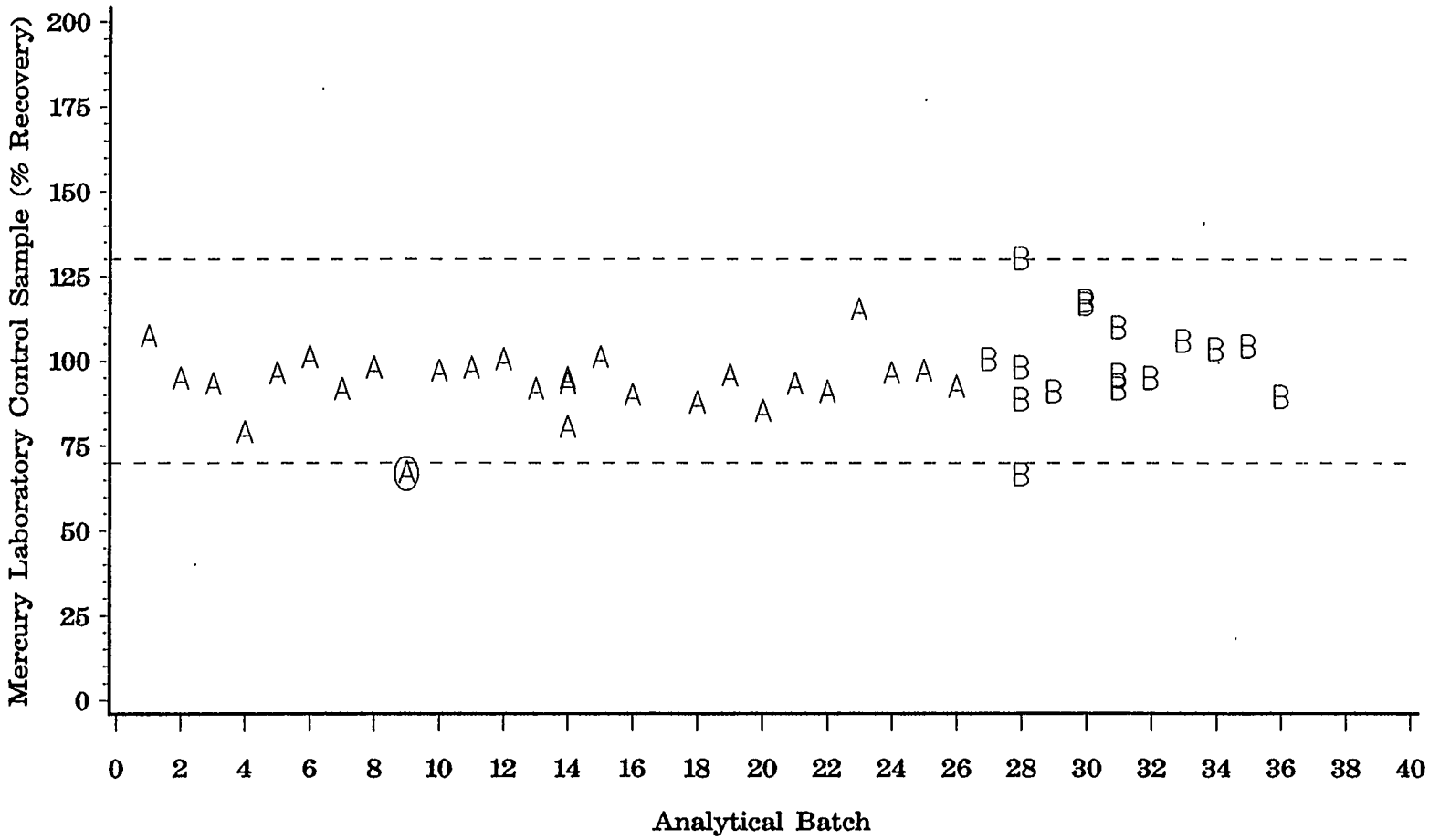


Fig. J.58. EPA CLP SOIL Laboratory Control Sample recoveries for Mercury sample analyses. Circled points indicate rejected data from the data validation process.

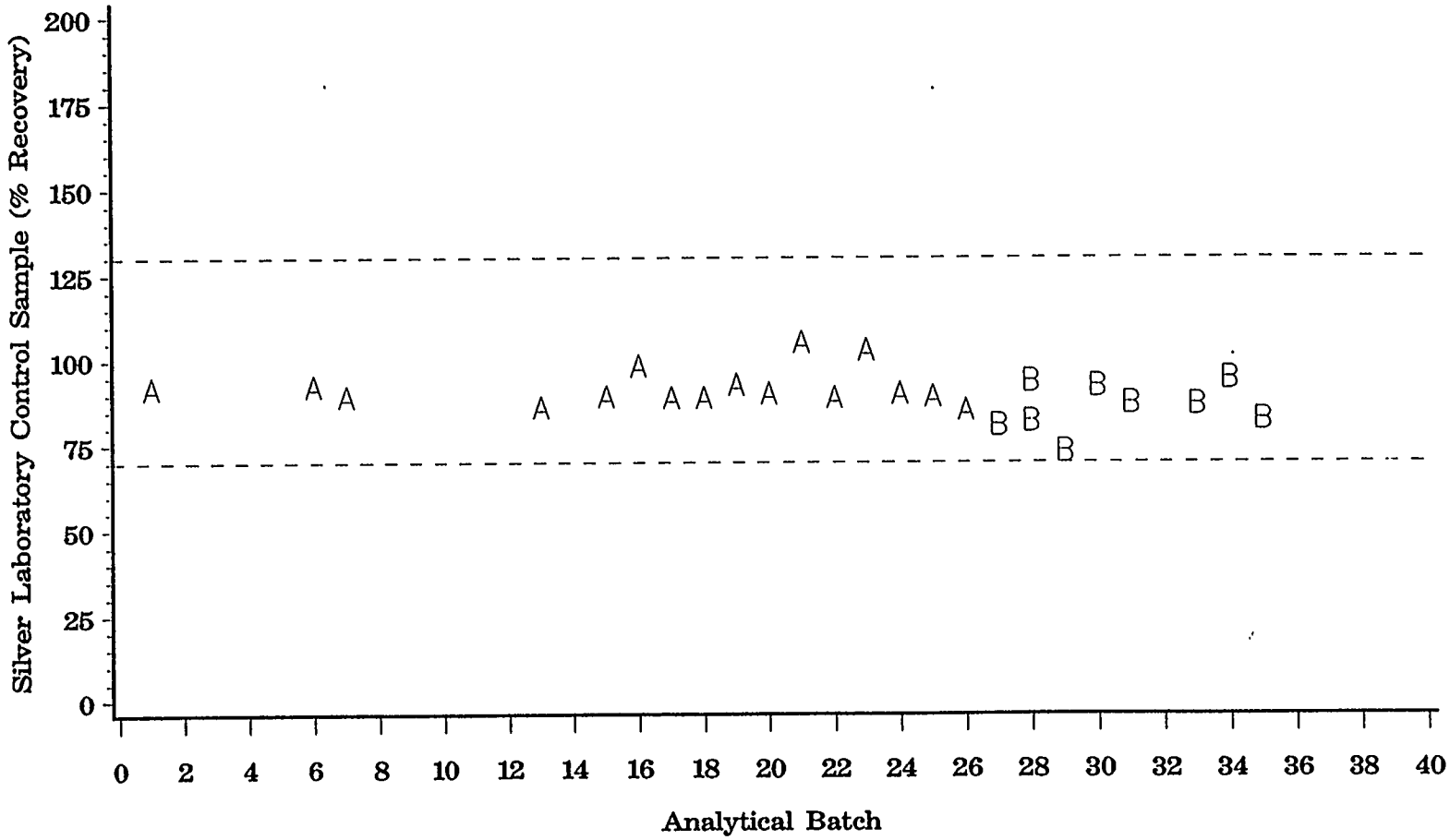


Fig. J.59. EPA CLP SOIL Laboratory Control Sample recoveries for Silver sample analyses. Circled points indicate rejected data from the data validation process.

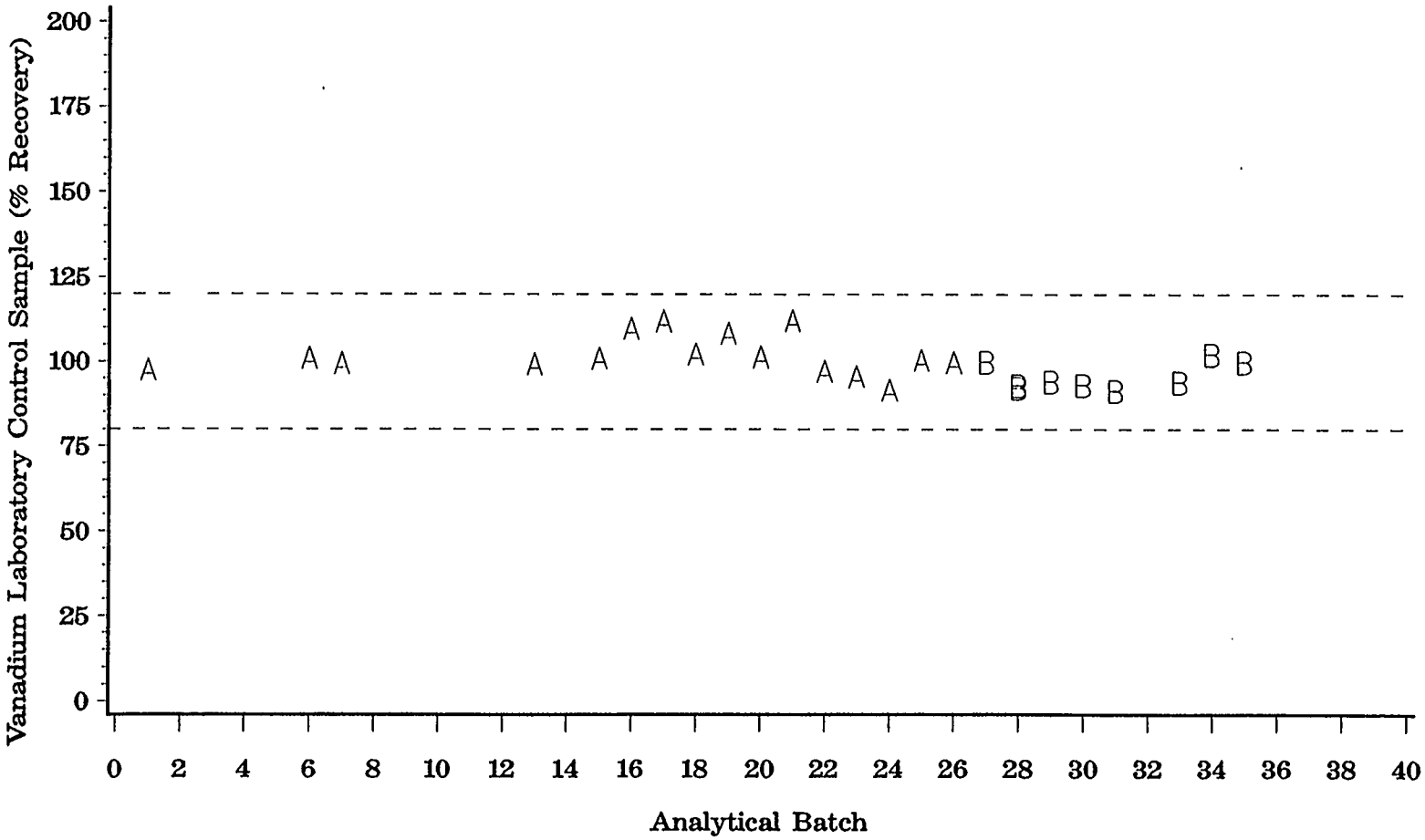


Fig. 5.60. EPA CLP SOIL Laboratory Control Sample recoveries for Vanadium sample analyses. Circled points indicate rejected data from the data validation process.

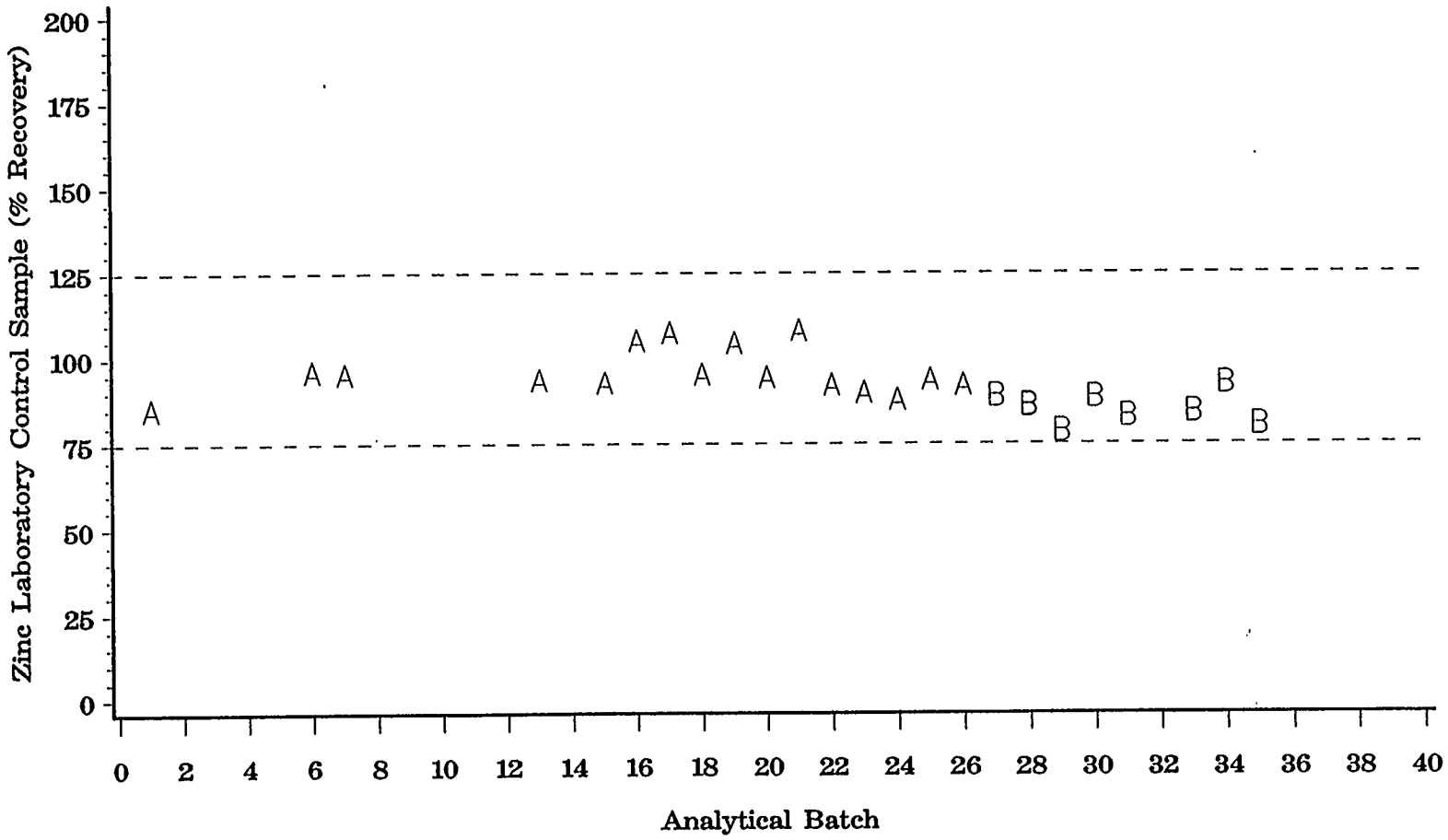


Fig. J.61, EPA CLP SOIL Laboratory Control Sample recoveries for Zinc sample analyses. Circled points indicate rejected data from the data validation process.

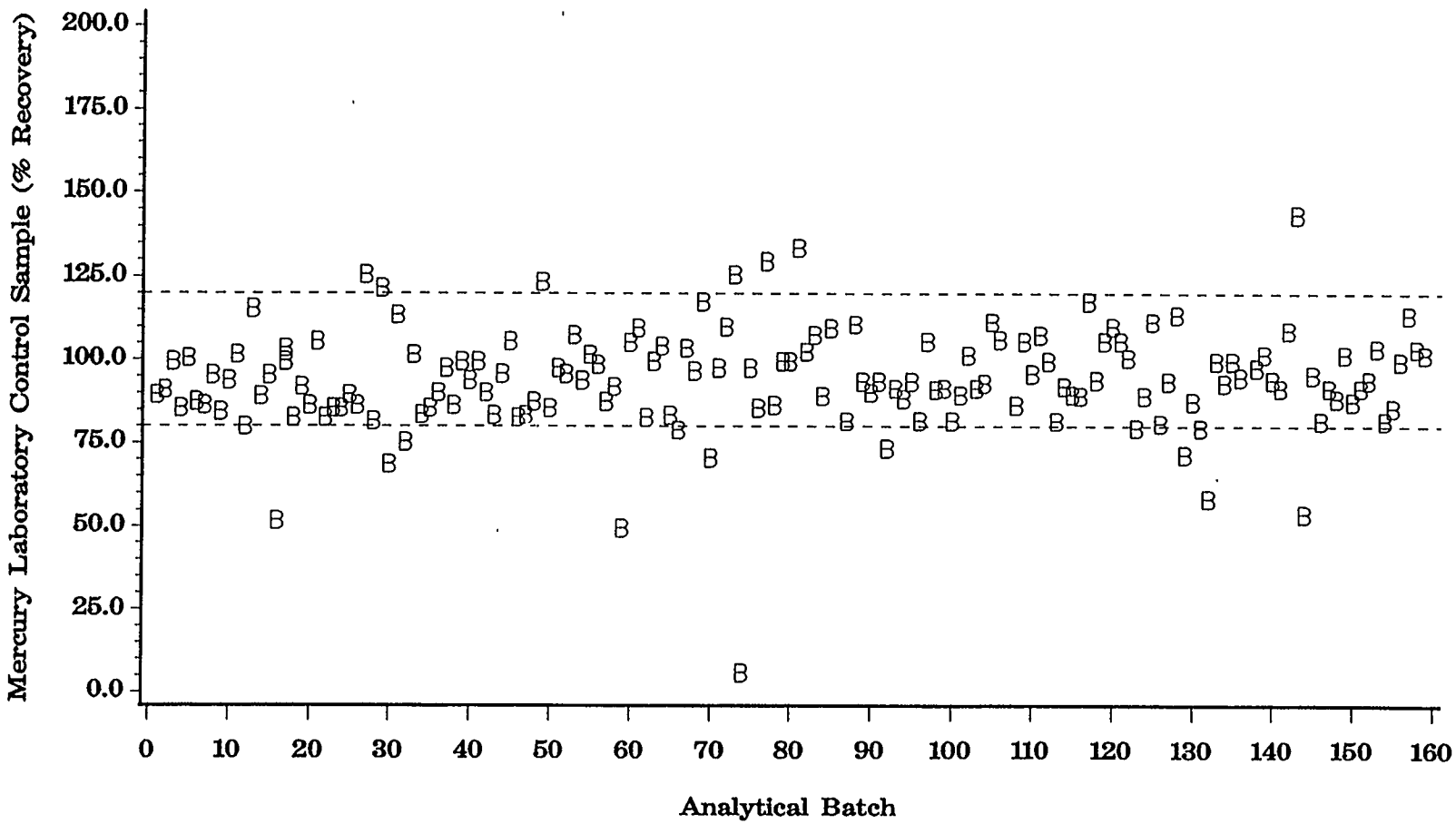


Fig. J.62. NAA SOIL Laboratory Control Sample recoveries for Mercury sample analyses.

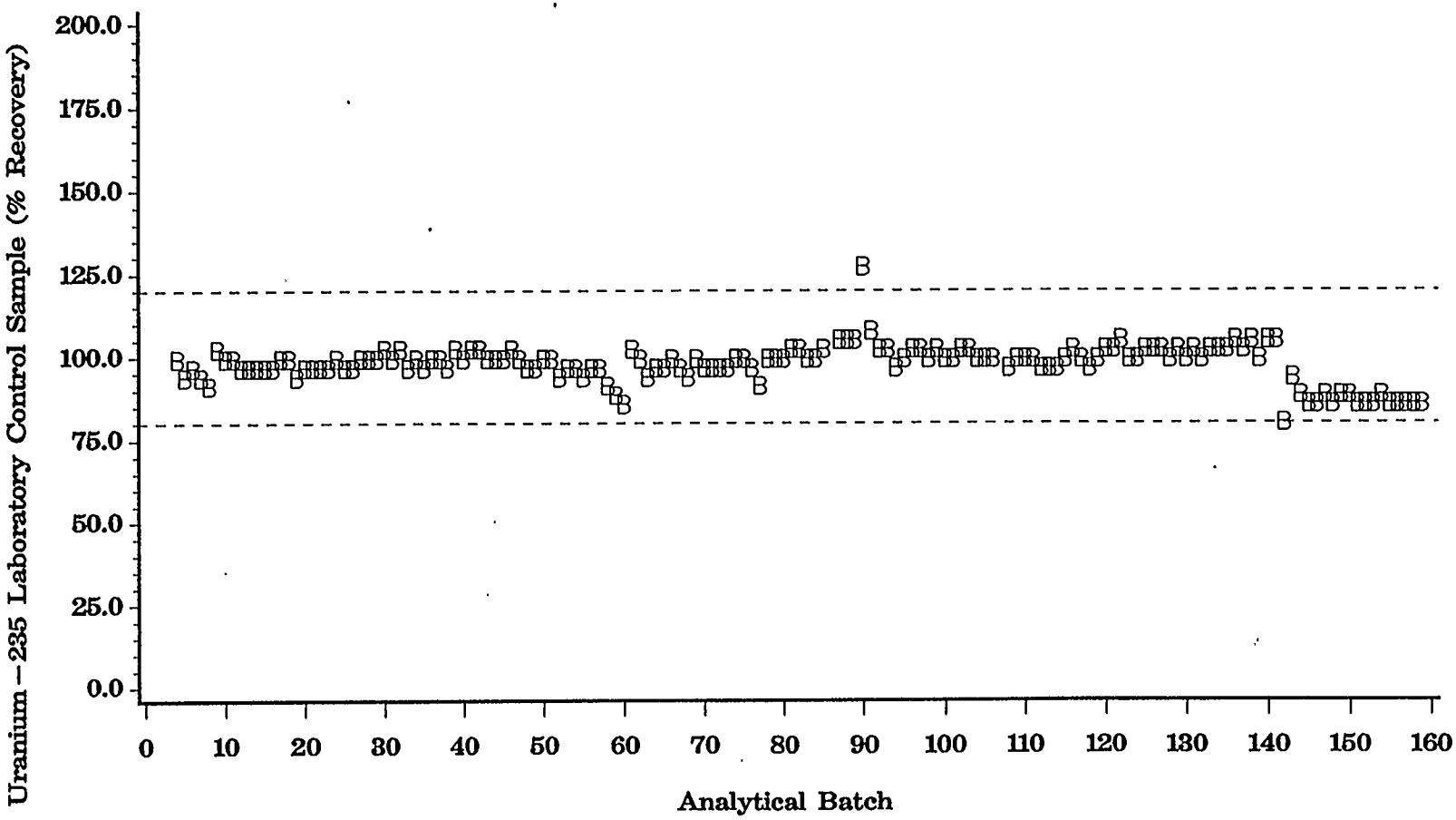


Fig. J.63. NAA SOIL Laboratory Control Sample recoveries for Uranium-235 sample analyses.

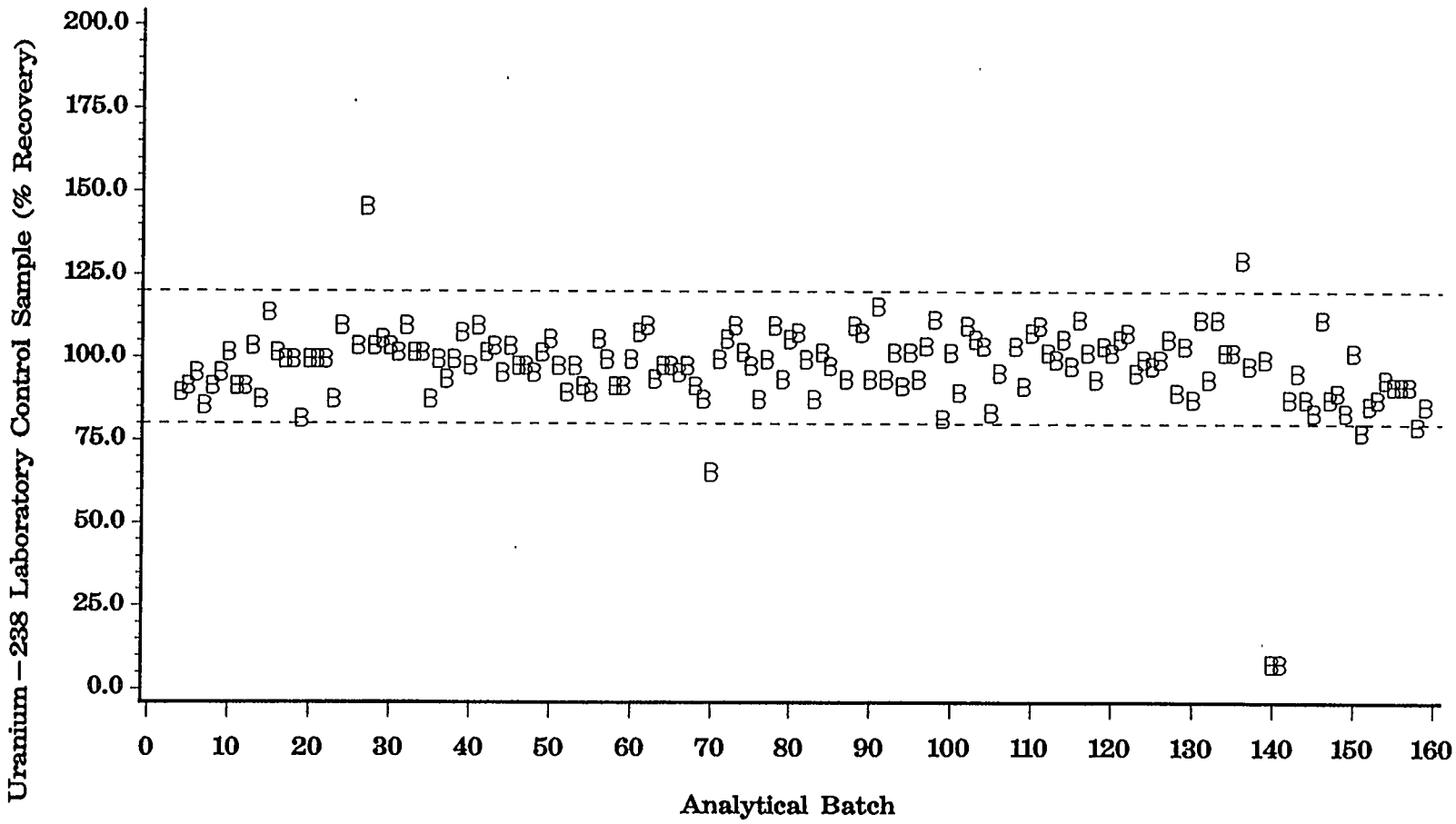


Fig. J.64. NAA SOIL Laboratory Control Sample recoveries for Uranium-238 sample analyses.

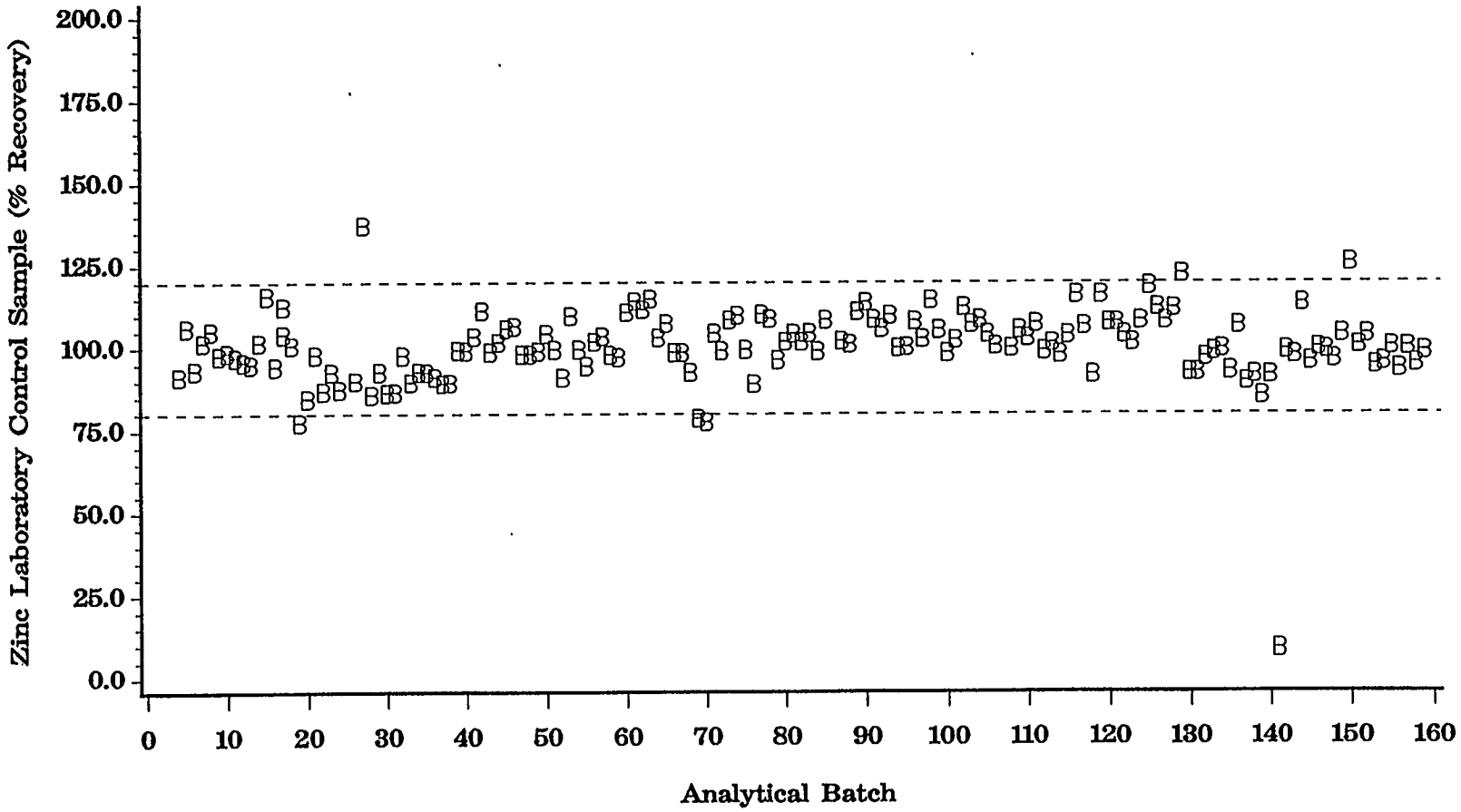


Fig. J.65. NAA SOIL Laboratory Control Sample recoveries for Zinc sample analyses.

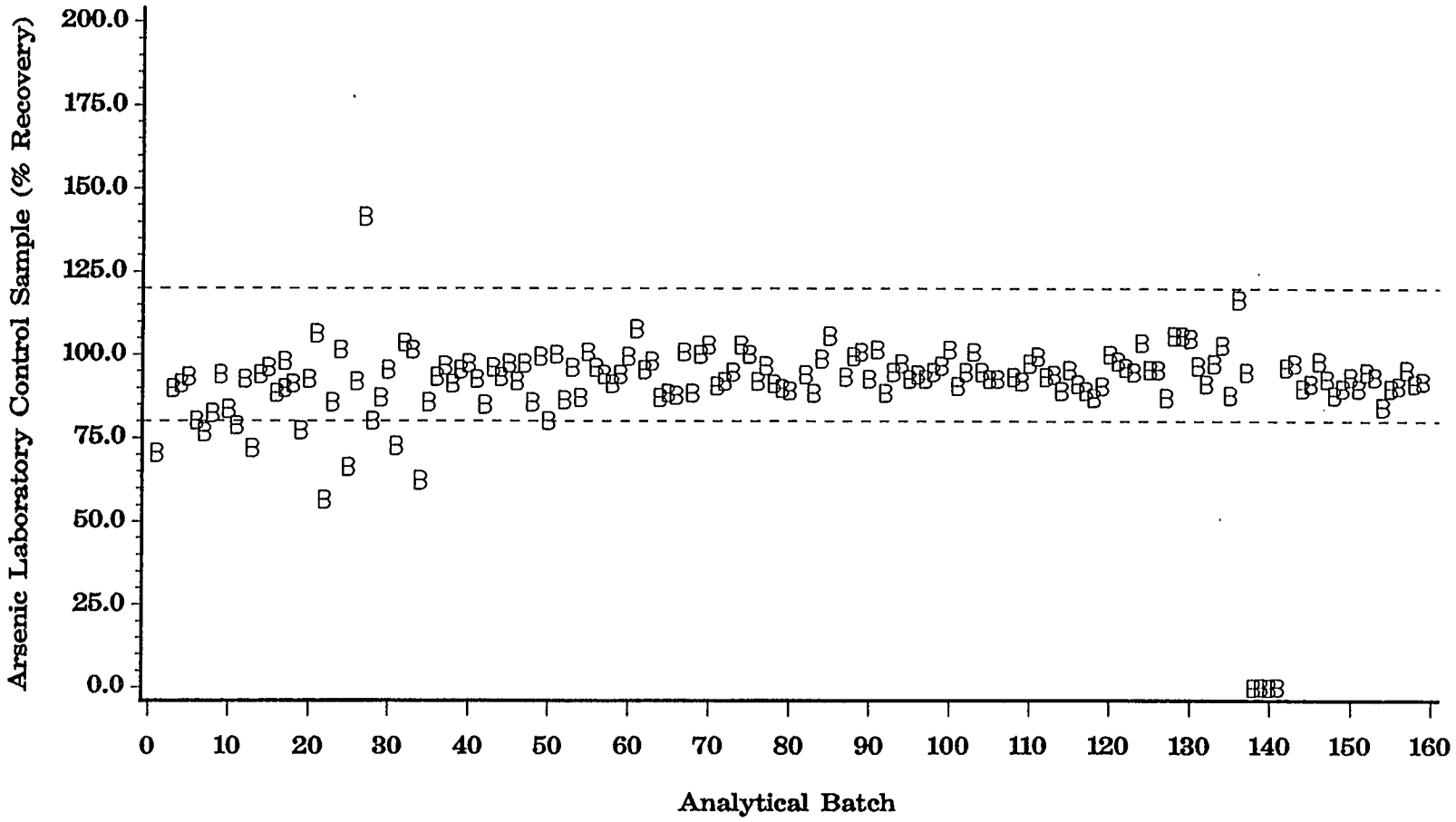


Fig. J.16. NAA SOIL Laboratory Control Sample recoveries for Arsenic sample analyses.

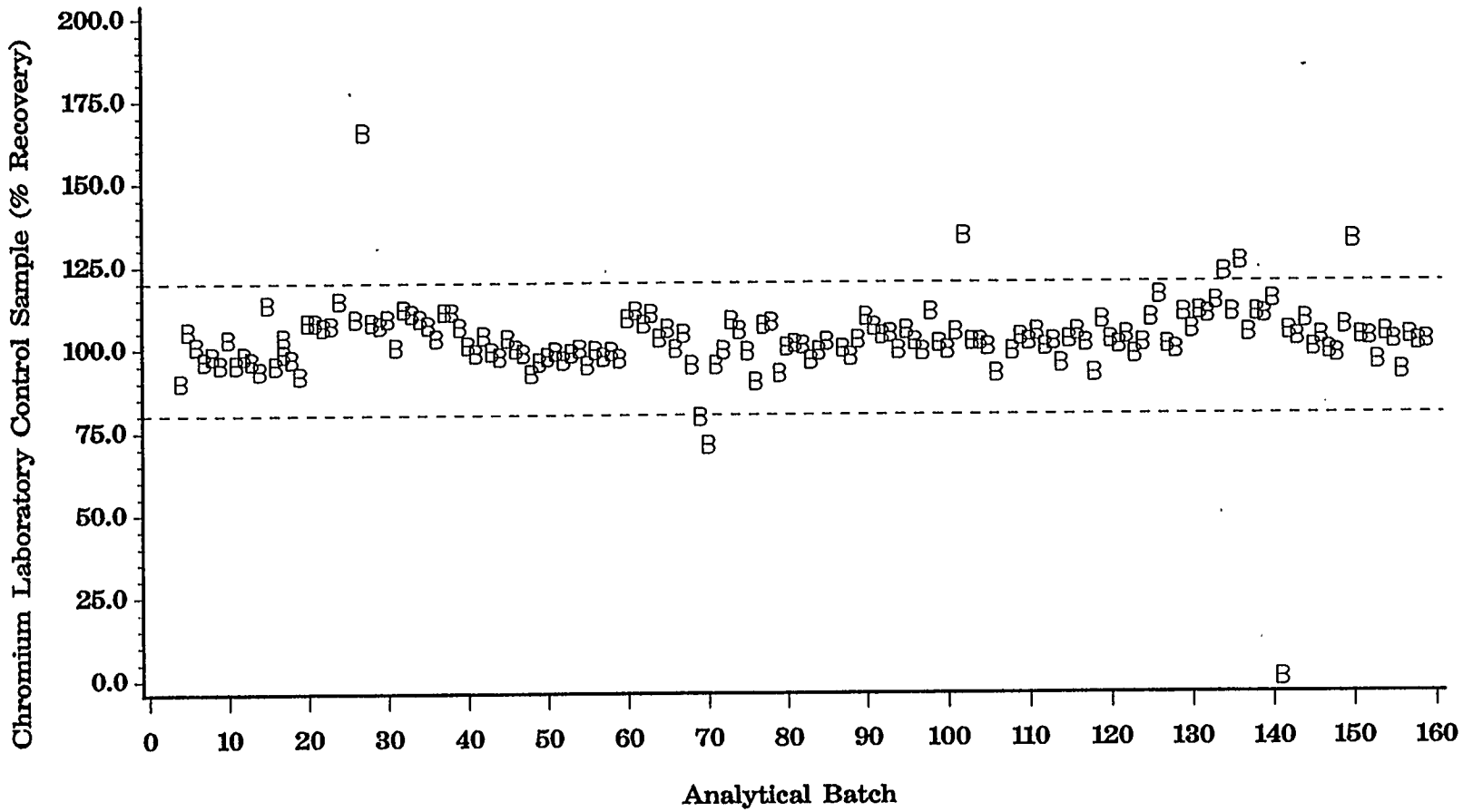


Fig. J.67. NAA SOIL Laboratory Control Sample recoveries for Chromium sample analyses.

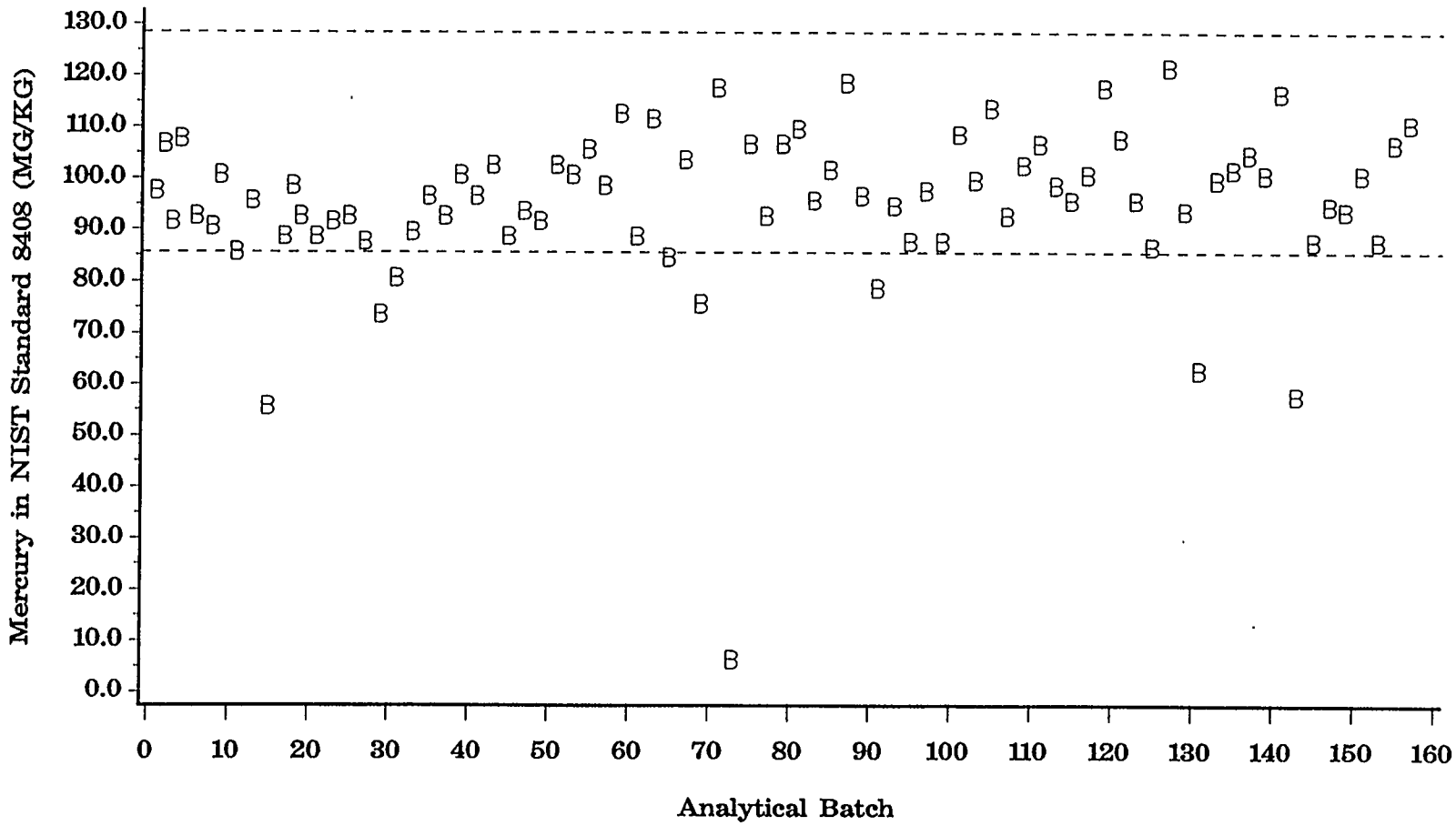


Fig. J.68. Mercury concentration in NIST standard 8408 analyzed by neutron activation analysis.

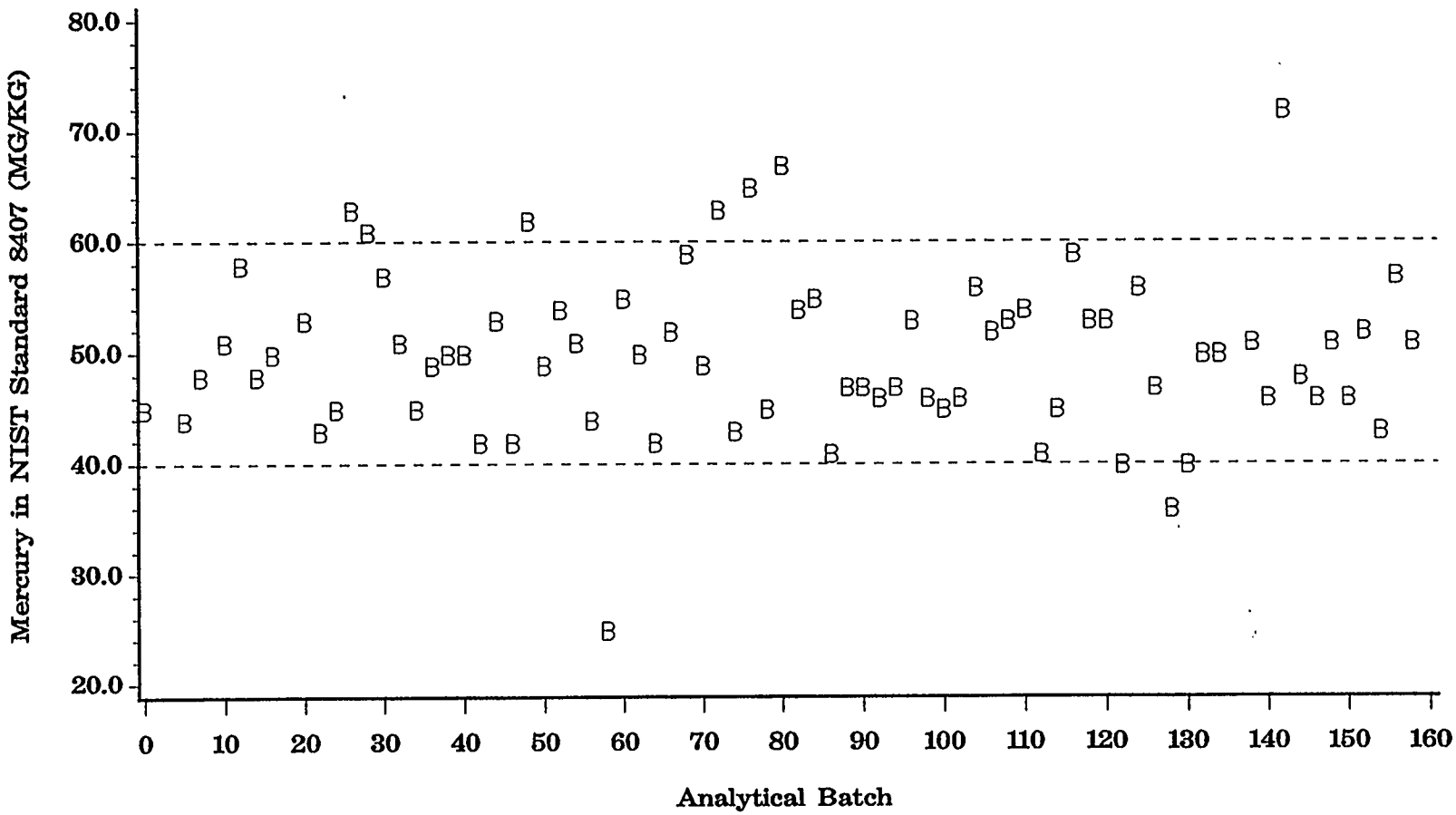


Fig. J.69. Mercury concentration in NIST standard 8407 analyzed by neutron activation analysis.

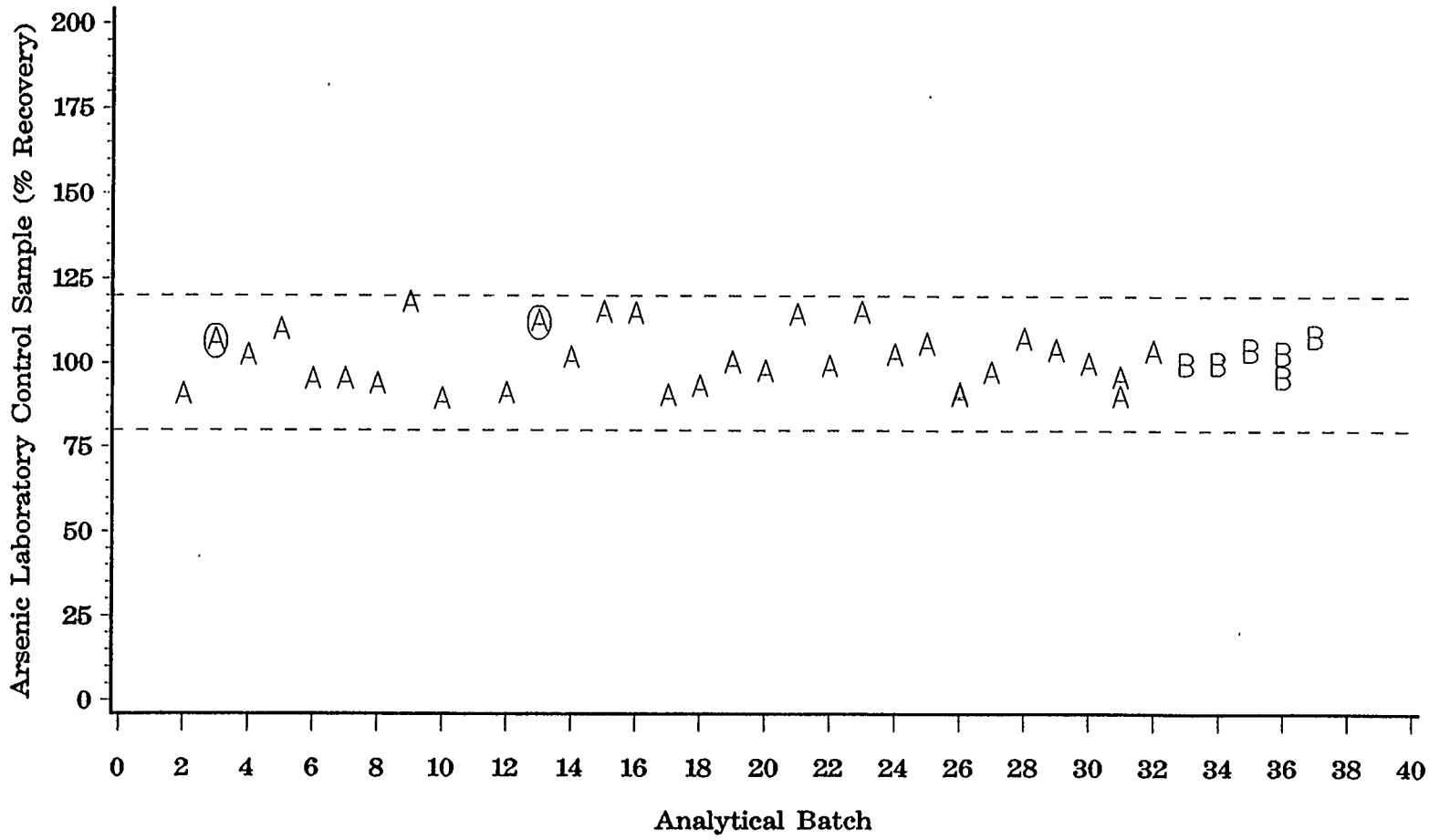


Fig. J.70. EPA CLP WATER Laboratory Control Sample recoveries for Arsenic sample analyses. Circled points indicate rejected data from the data validation process.

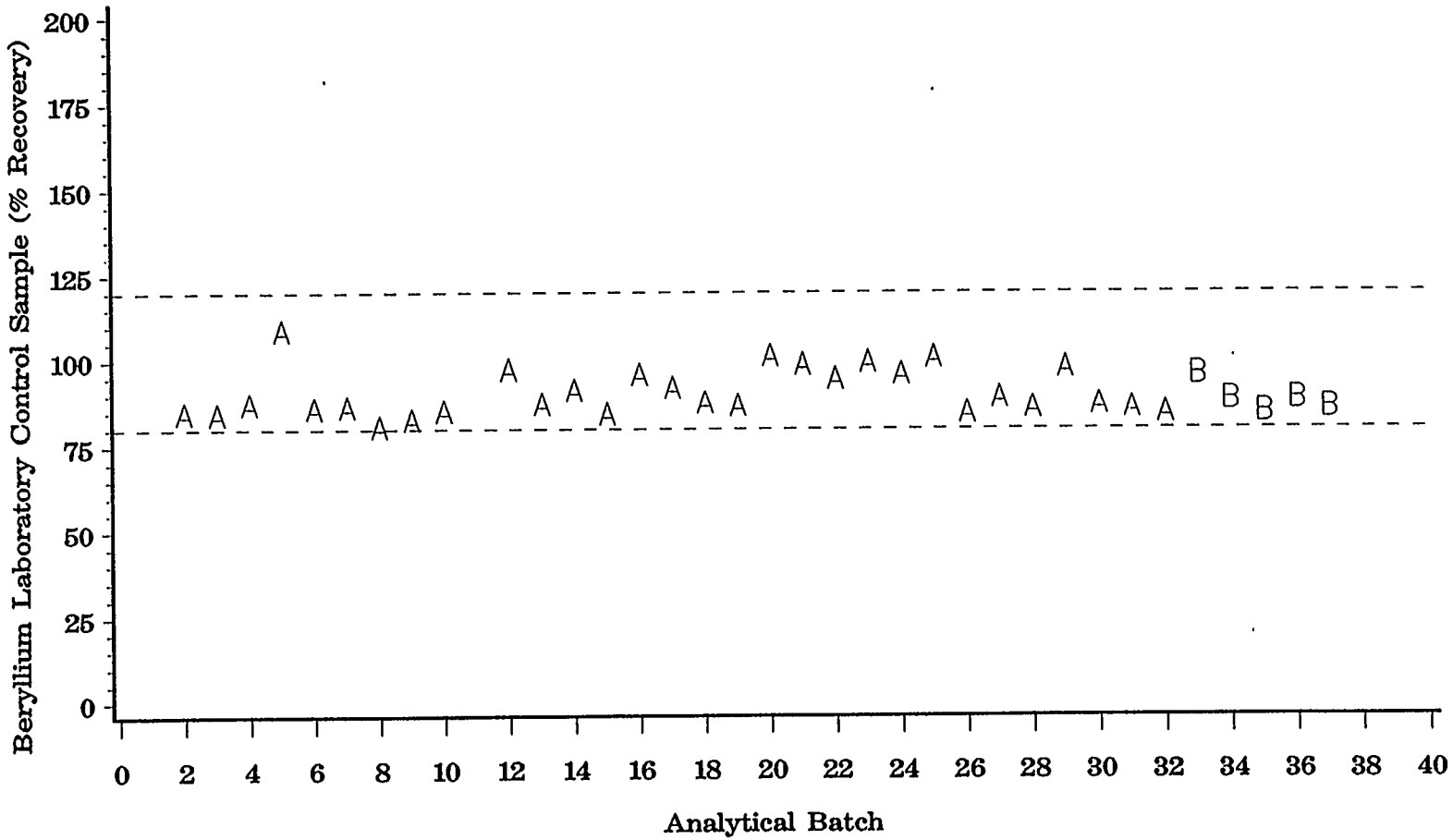


Fig. J.71. EPA CLP WATER Laboratory Control Sample recoveries for Beryllium sample analyses. Circled points indicate rejected data from the data validation process.

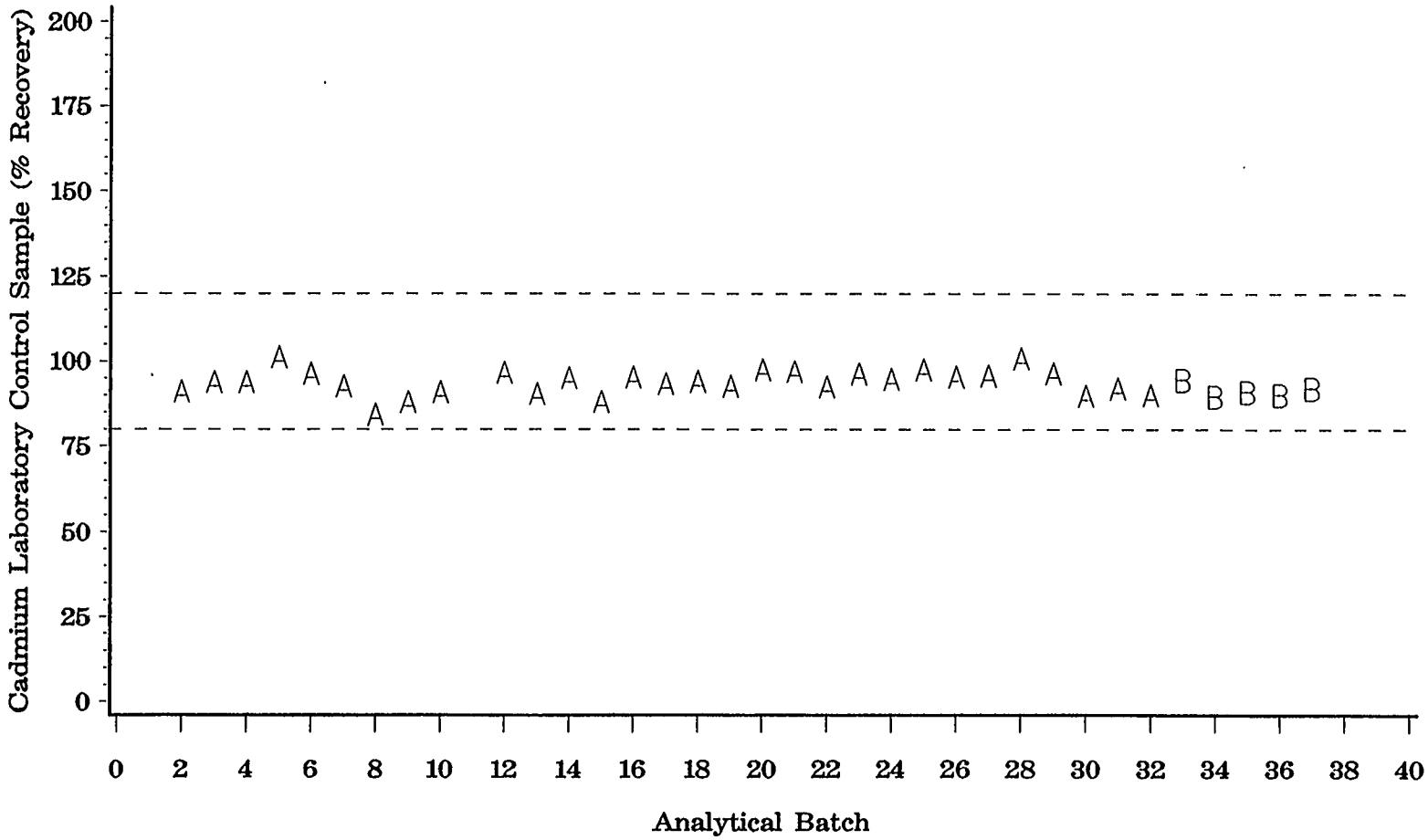


Fig. J.72. EPA CLP WATER Laboratory Control Sample recoveries for Cadmium sample analyses. Circled points indicate rejected data from the data validation process.

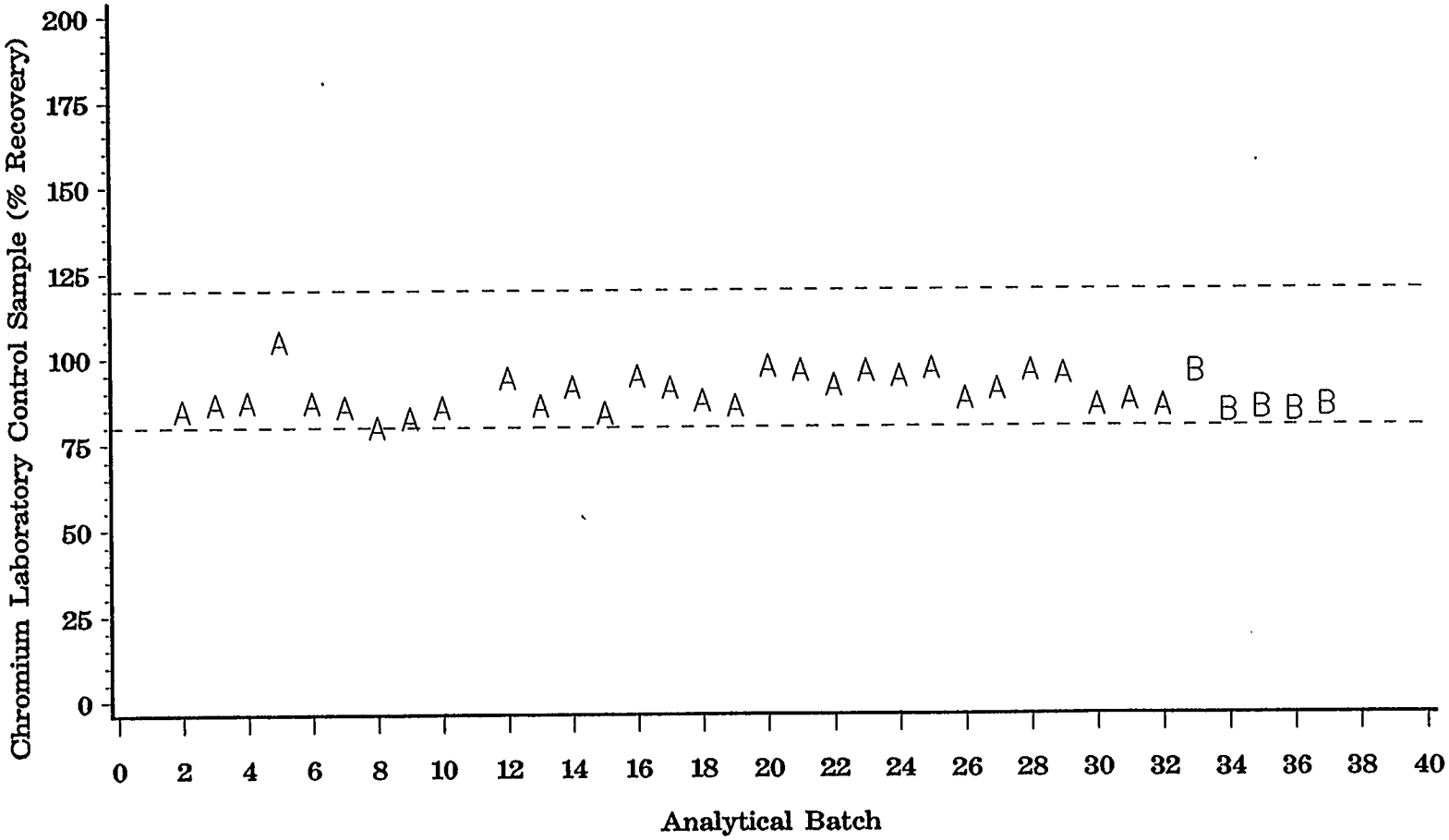


Fig. J.73. EPA CLP WATER Laboratory Control Sample recoveries for Chromium sample analyses. Circled points indicate rejected data from the data validation process.

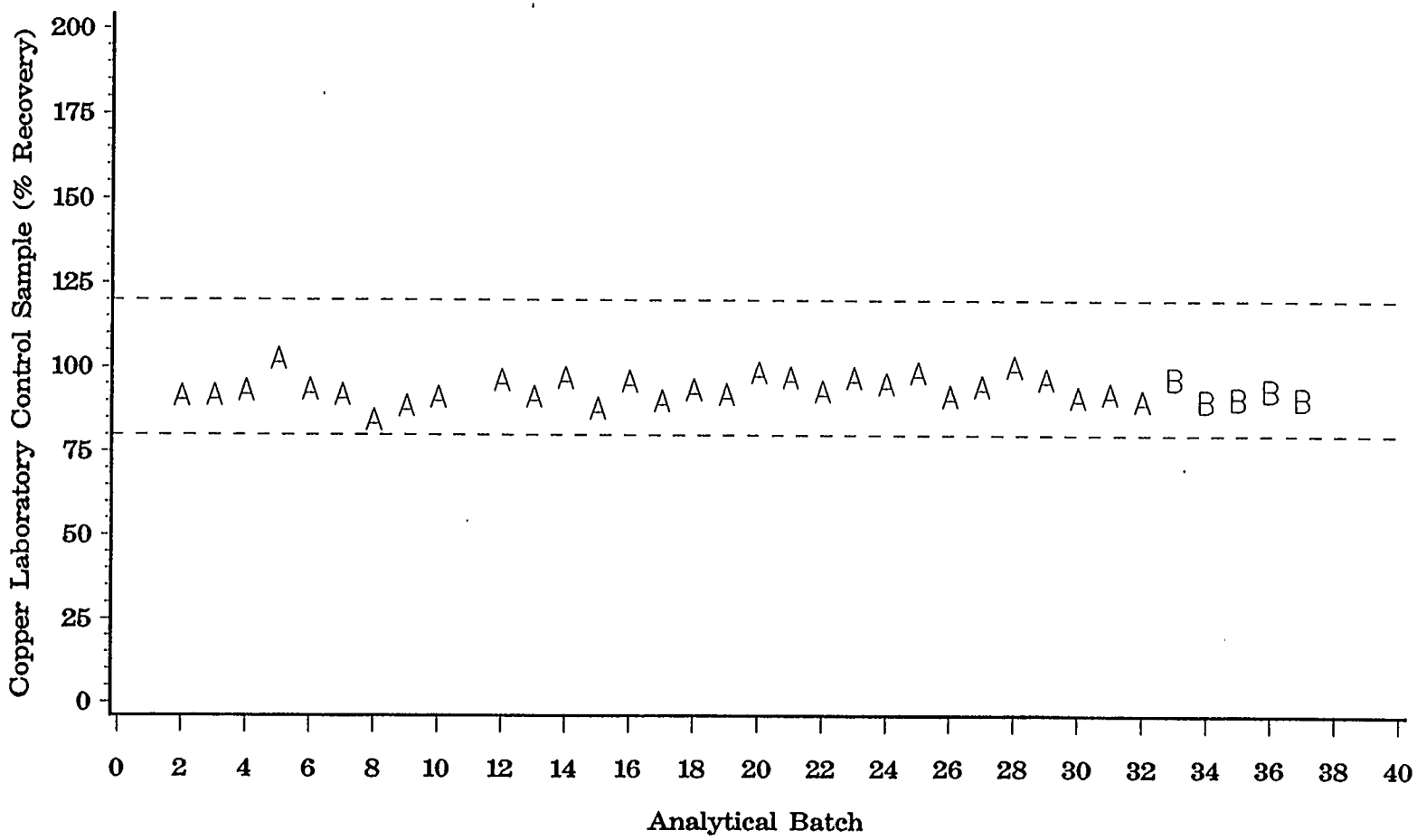


Fig. J.74. EPA CLP WATER Laboratory Control Sample recoveries for Copper sample analyses. Circled points indicate rejected data from the data validation process.

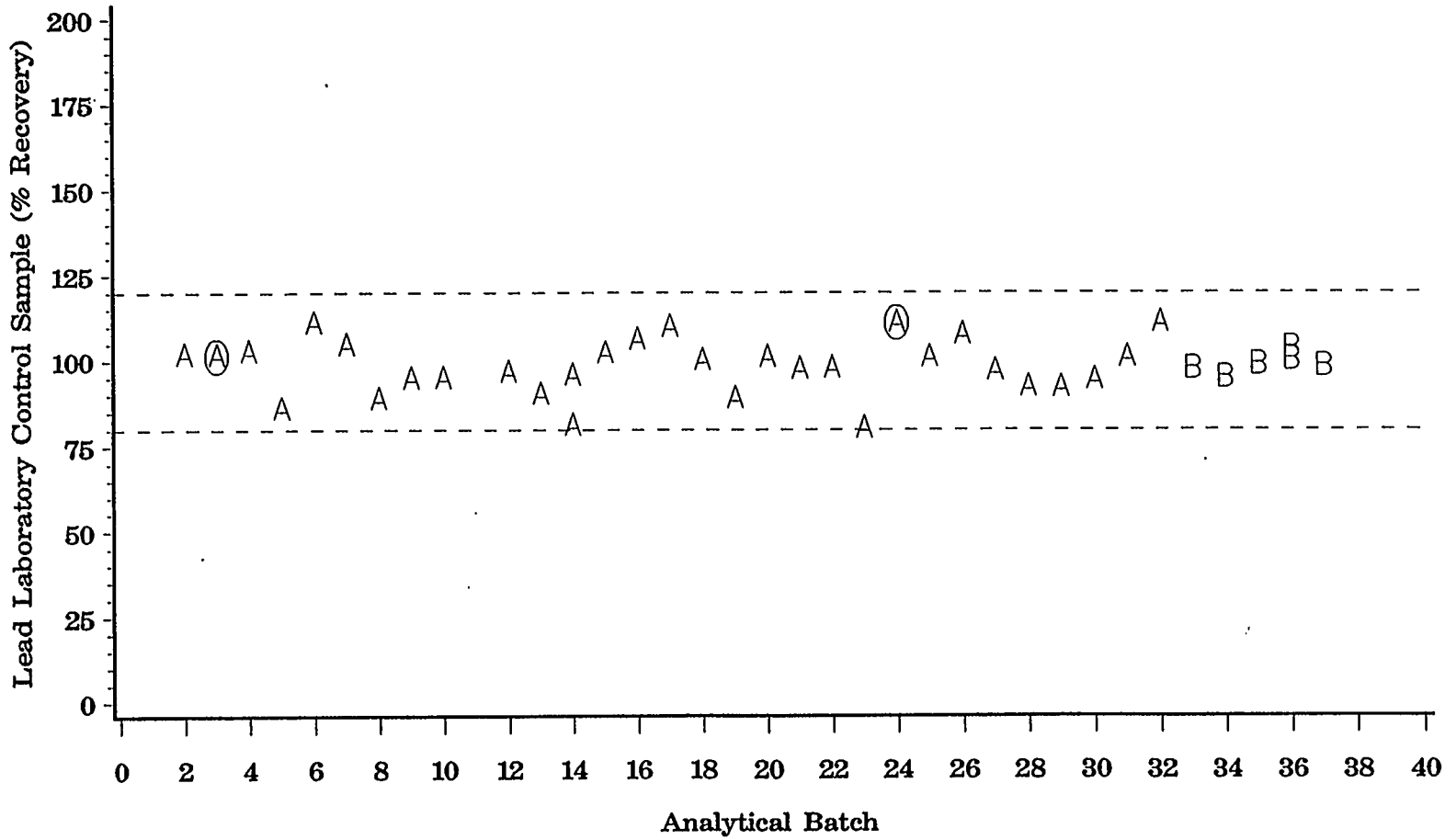


Fig.J.75. EPA CLP WATER Laboratory Control Sample recoveries for Lead sample analyses. Circled points indicate rejected data from the data validation process.

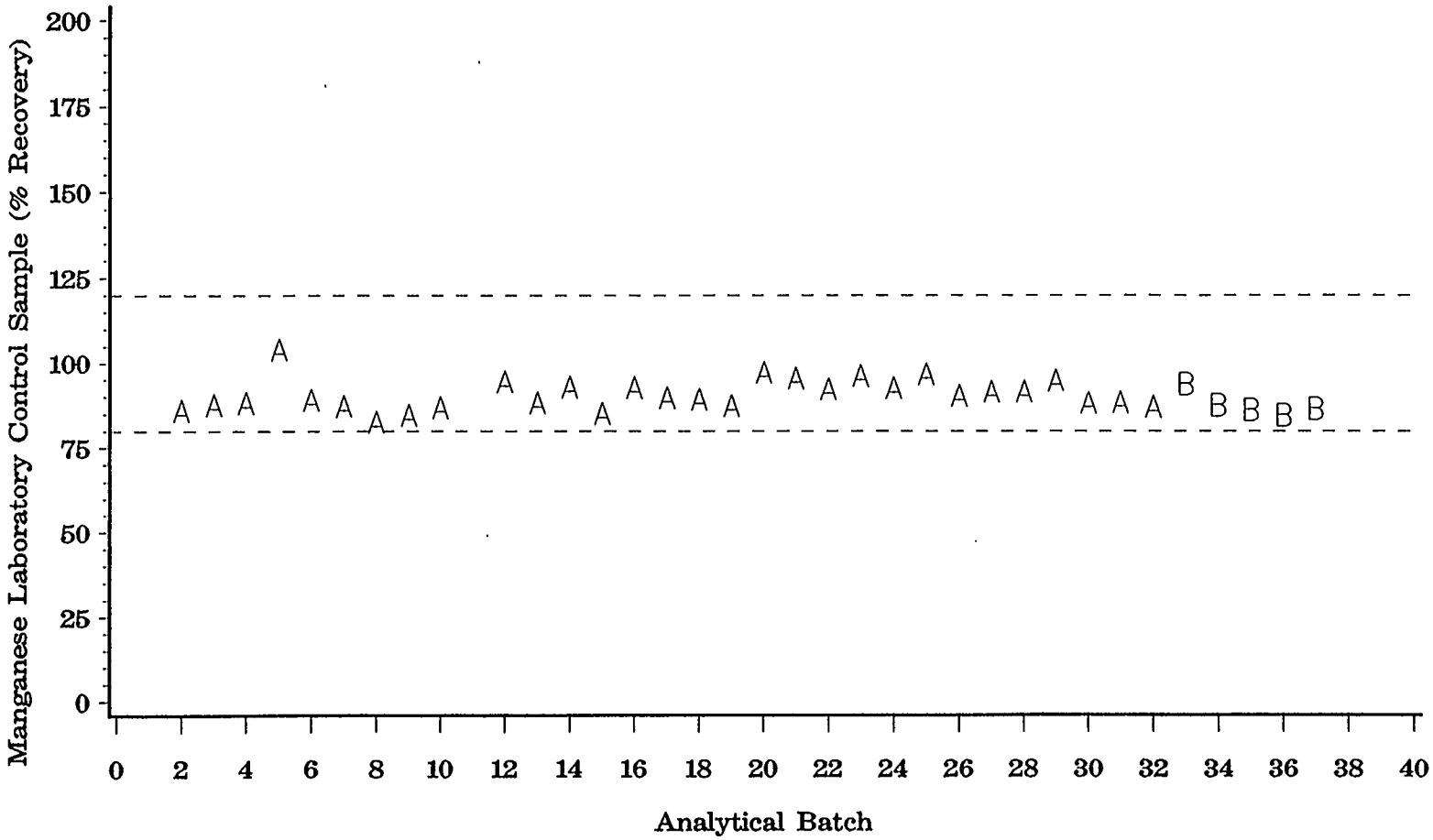


Fig. J.76. EPA CLP WATER Laboratory Control Sample recoveries for Manganese sample analyses. Circled points indicate rejected data from the data validation process.

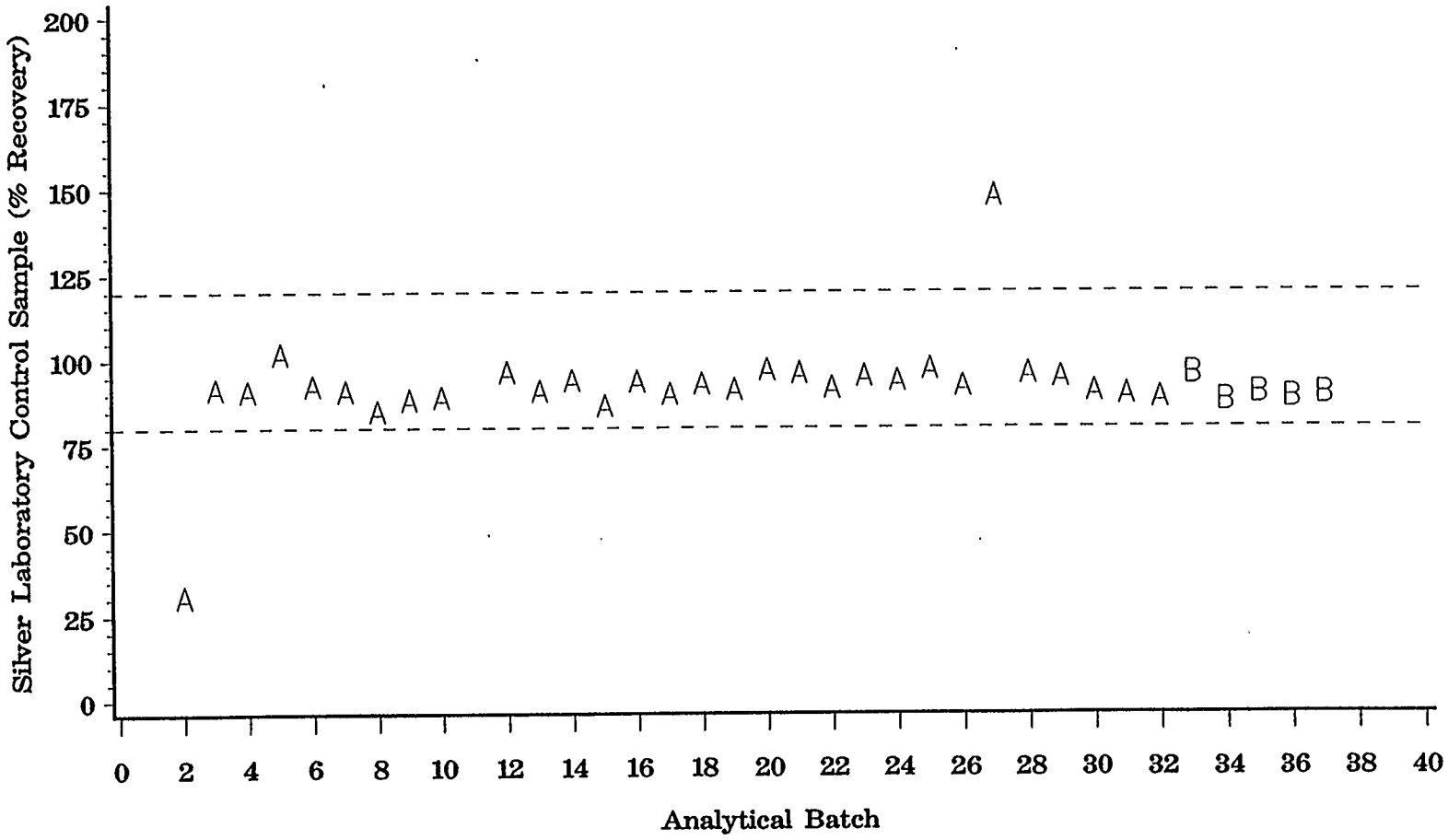


Fig. J.77 EPA CLP WATER Laboratory Control Sample recoveries for Silver sample analyses. Circled points indicate rejected data from the data validation process.

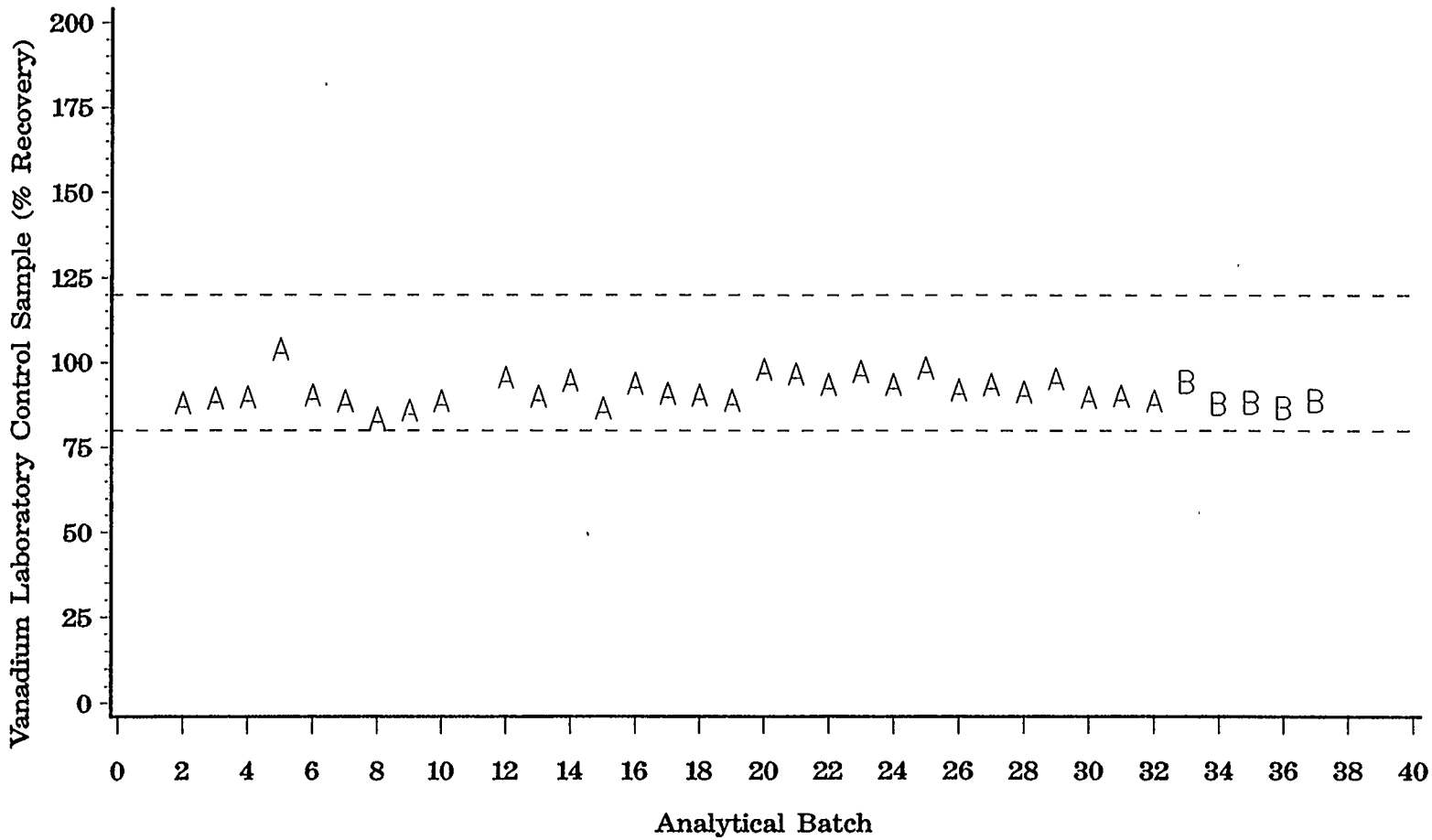


Fig.J.78. EPA CLP WATER Laboratory Control Sample recoveries for Vanadium sample analyses. Circled points indicate rejected data from the data validation process.

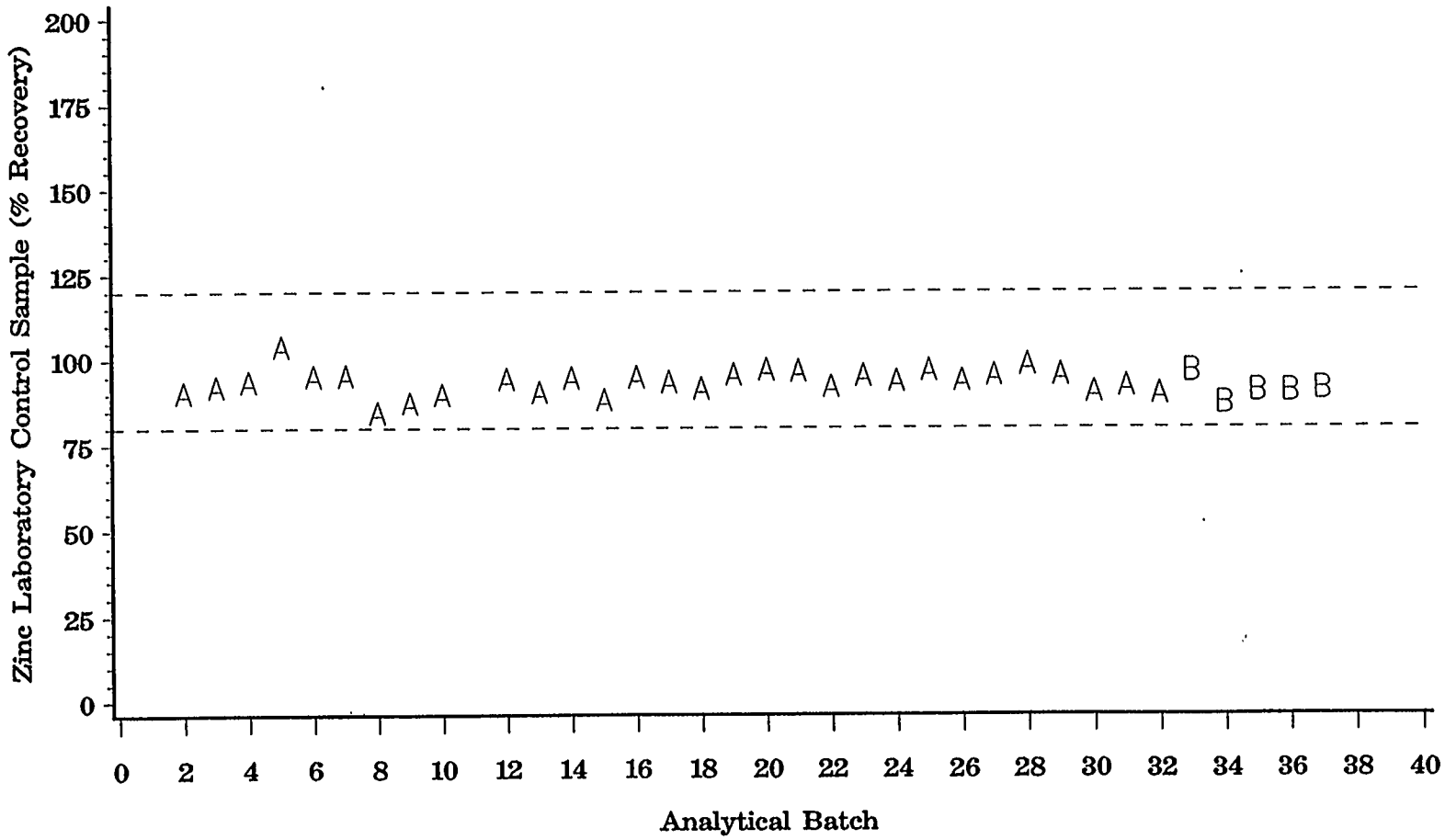


Fig. J.79. EPA CLP WATER Laboratory Control Sample recoveries for Zinc sample analyses. Circled points indicate rejected data from the data validation process.

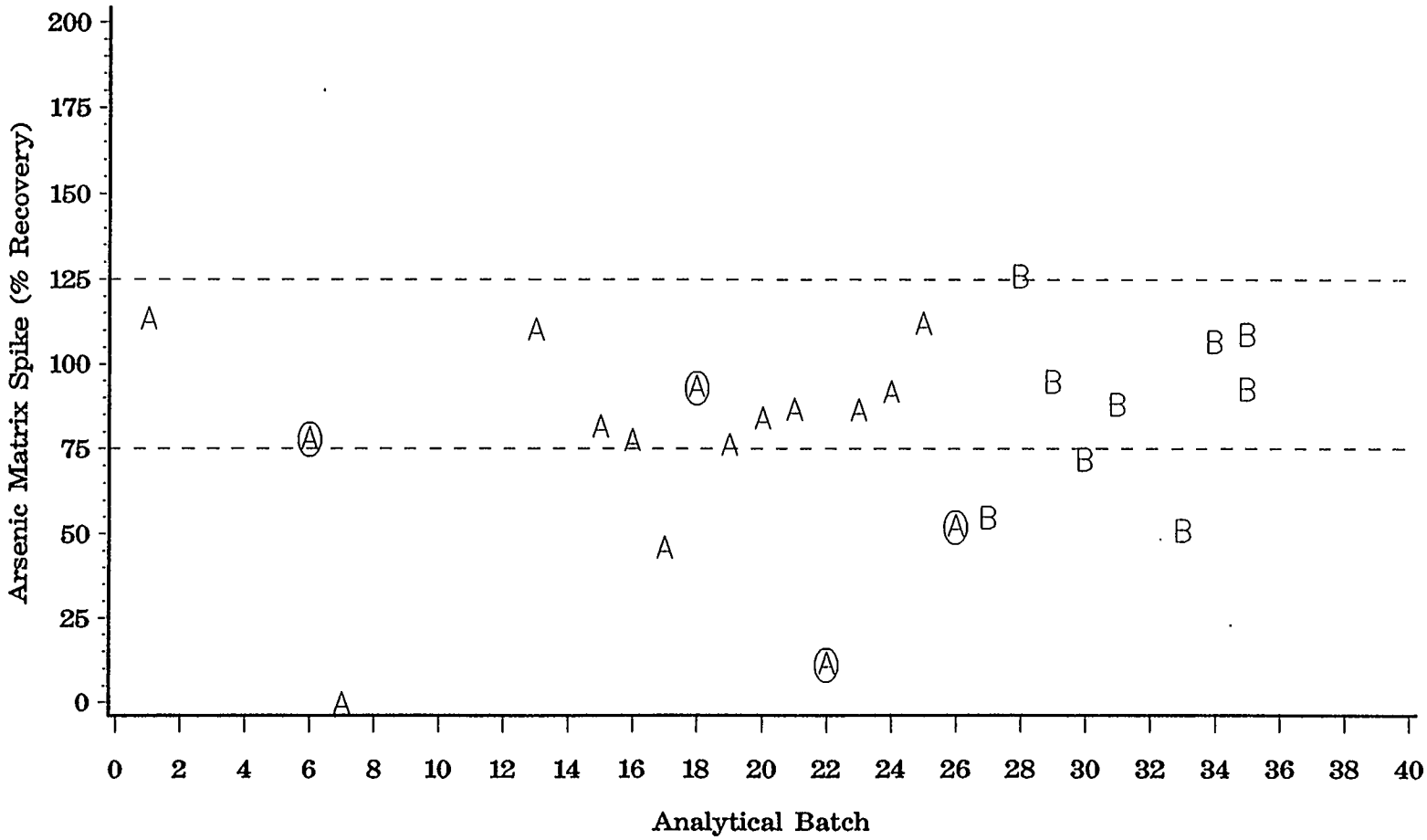


Fig. J.80. EPA CLP SOIL Matrix Spike recoveries for Arsenic sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

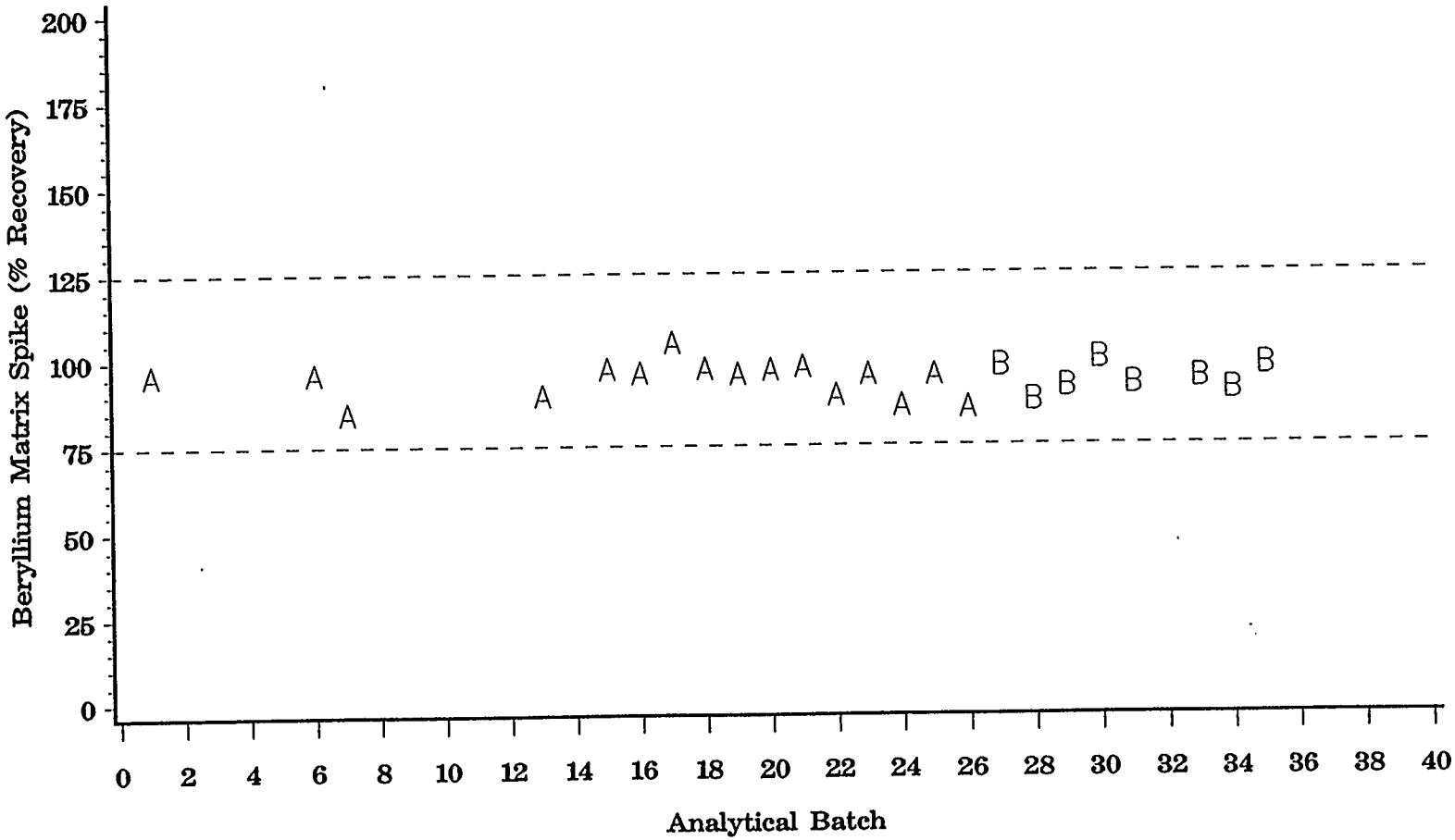


Fig. J.31. EPA CLP SOIL Matrix Spike recoveries for Beryllium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

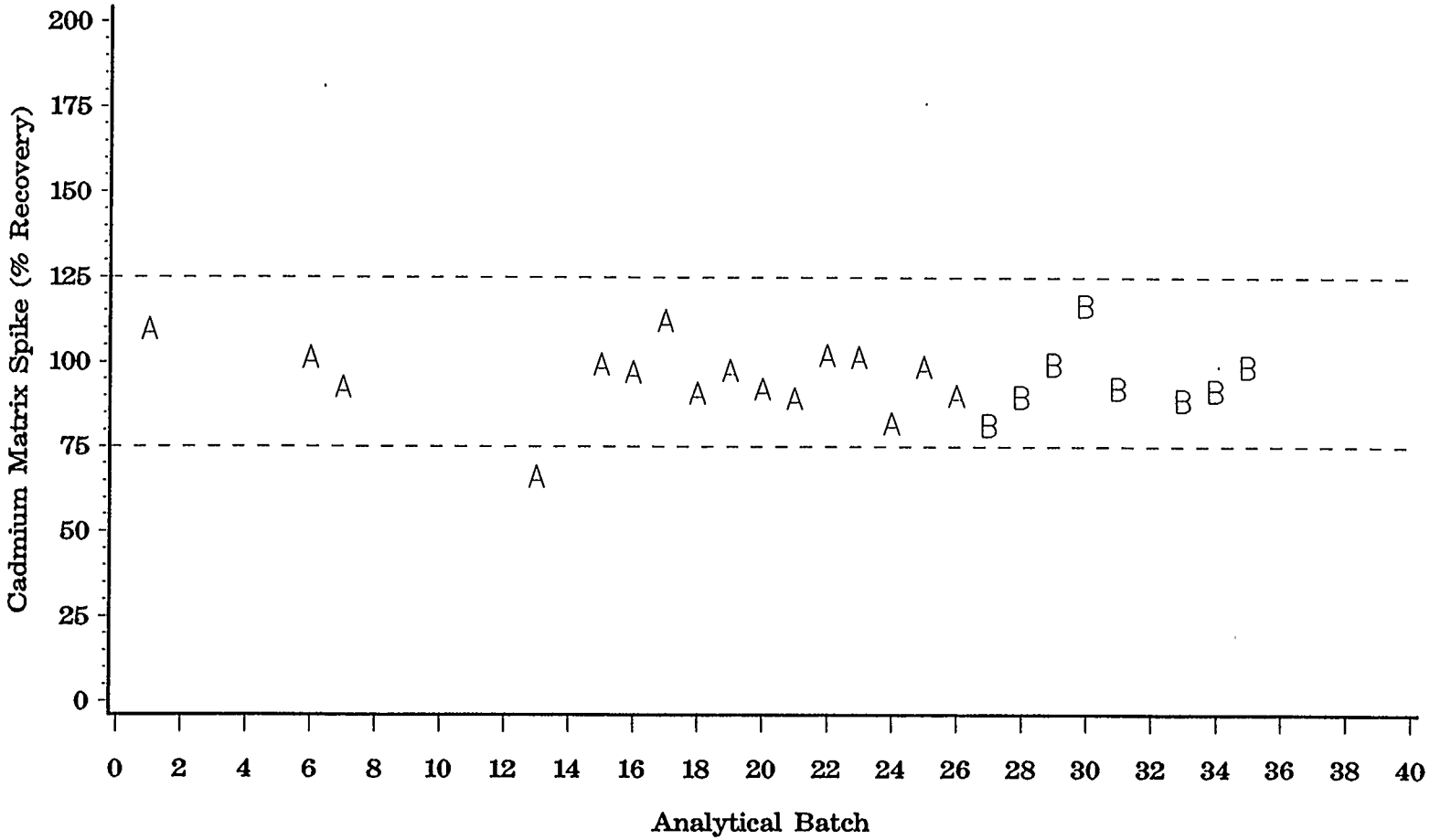


Fig. J.82. EPA CLP SOIL Matrix Spike recoveries for Cadmium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

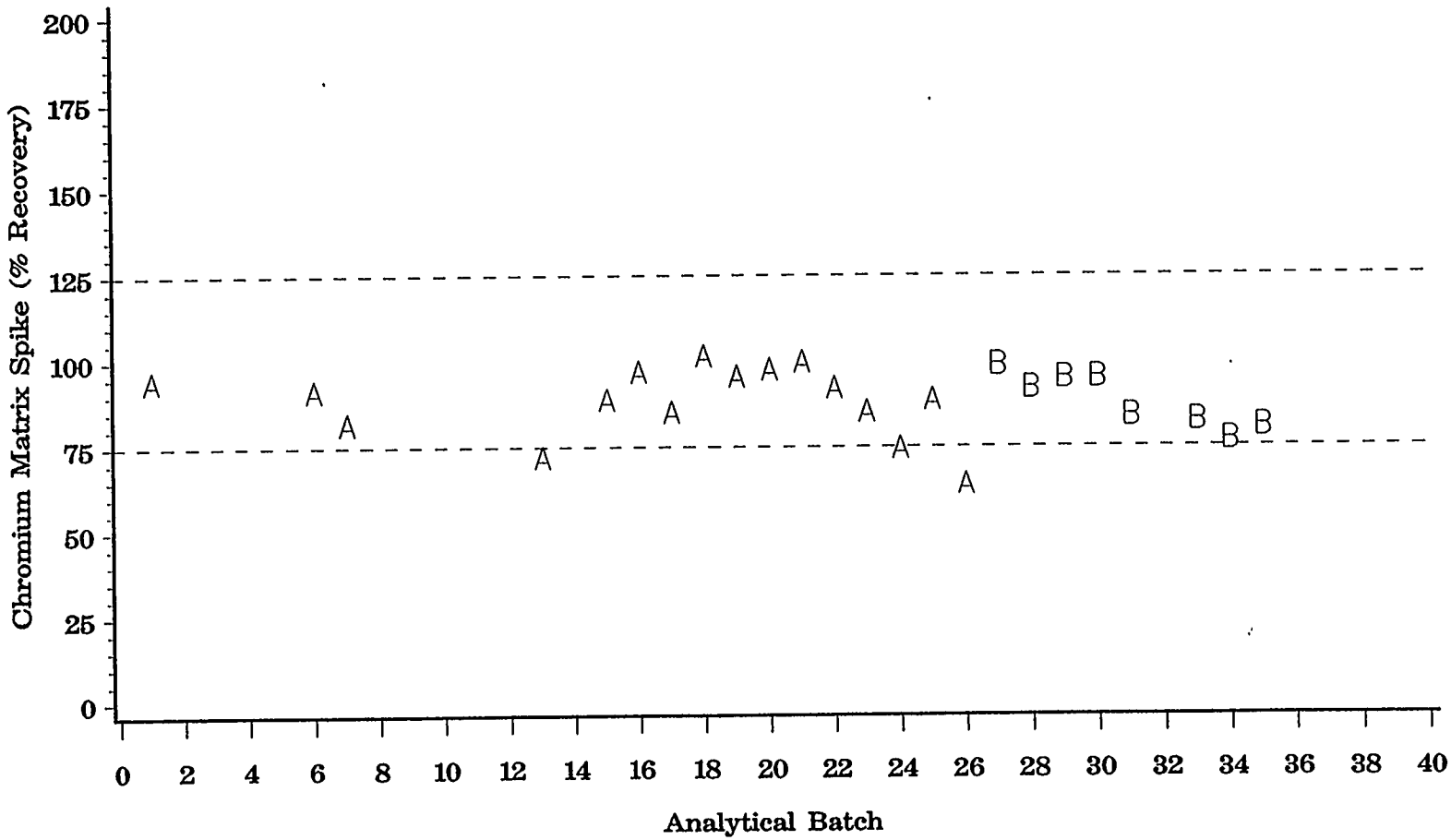


Fig. J.83. EPA CLP SOIL Matrix Spike recoveries for Chromium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

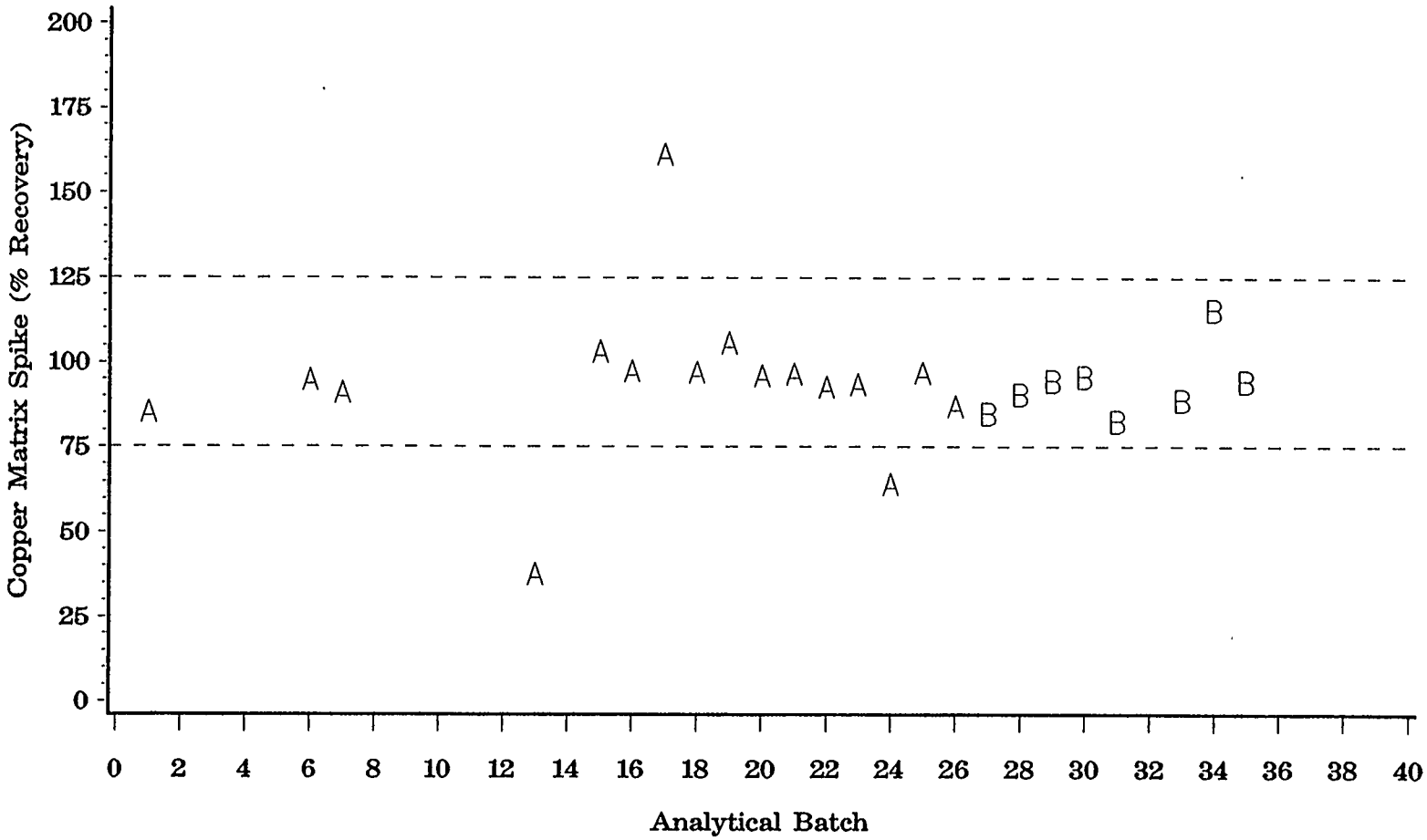


Fig. J.84. EPA CLP SOIL Matrix Spike recoveries for Copper sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

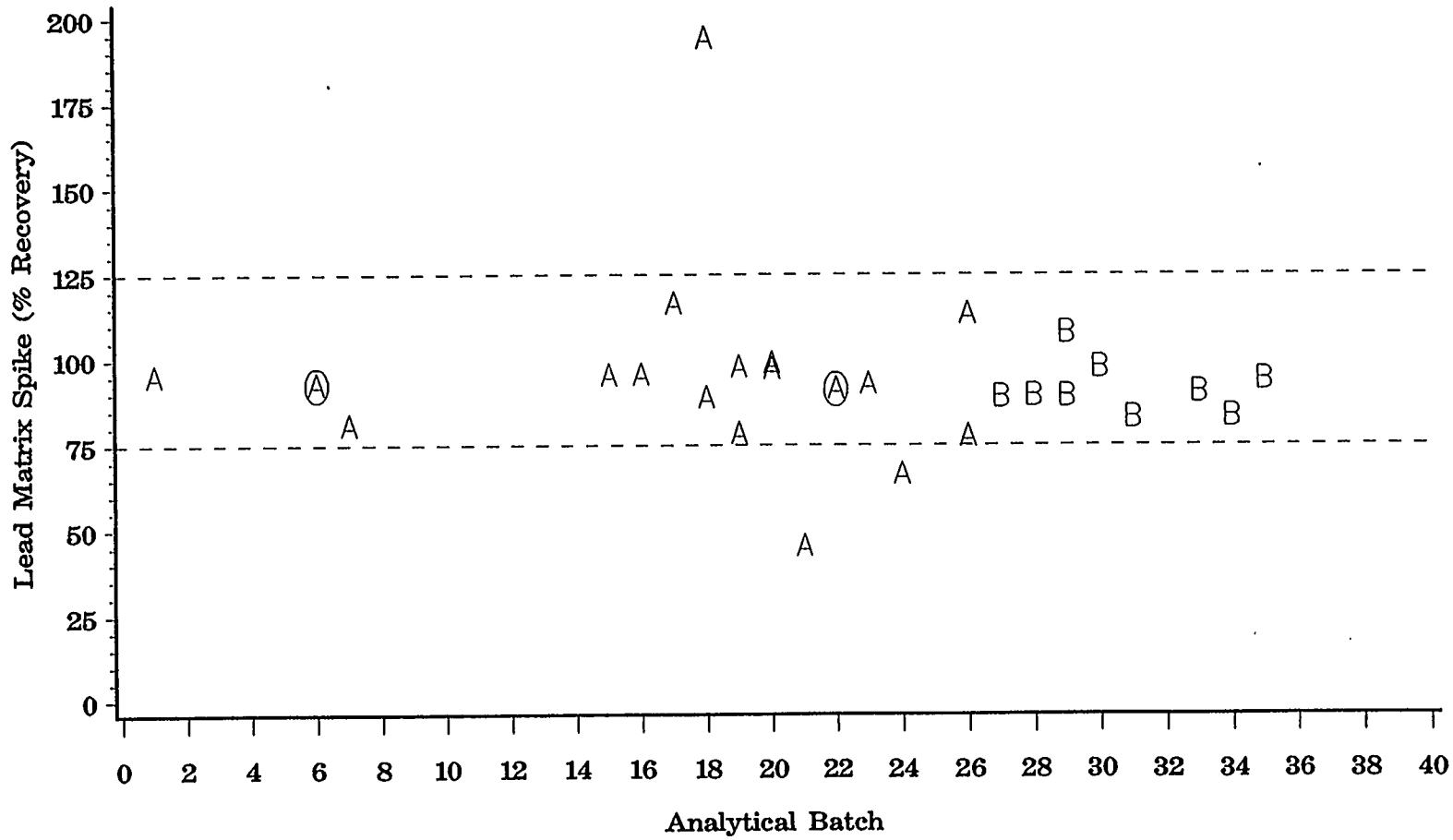


Fig. J.85. EPA CLP SOIL Matrix Spike recoveries for Lead sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

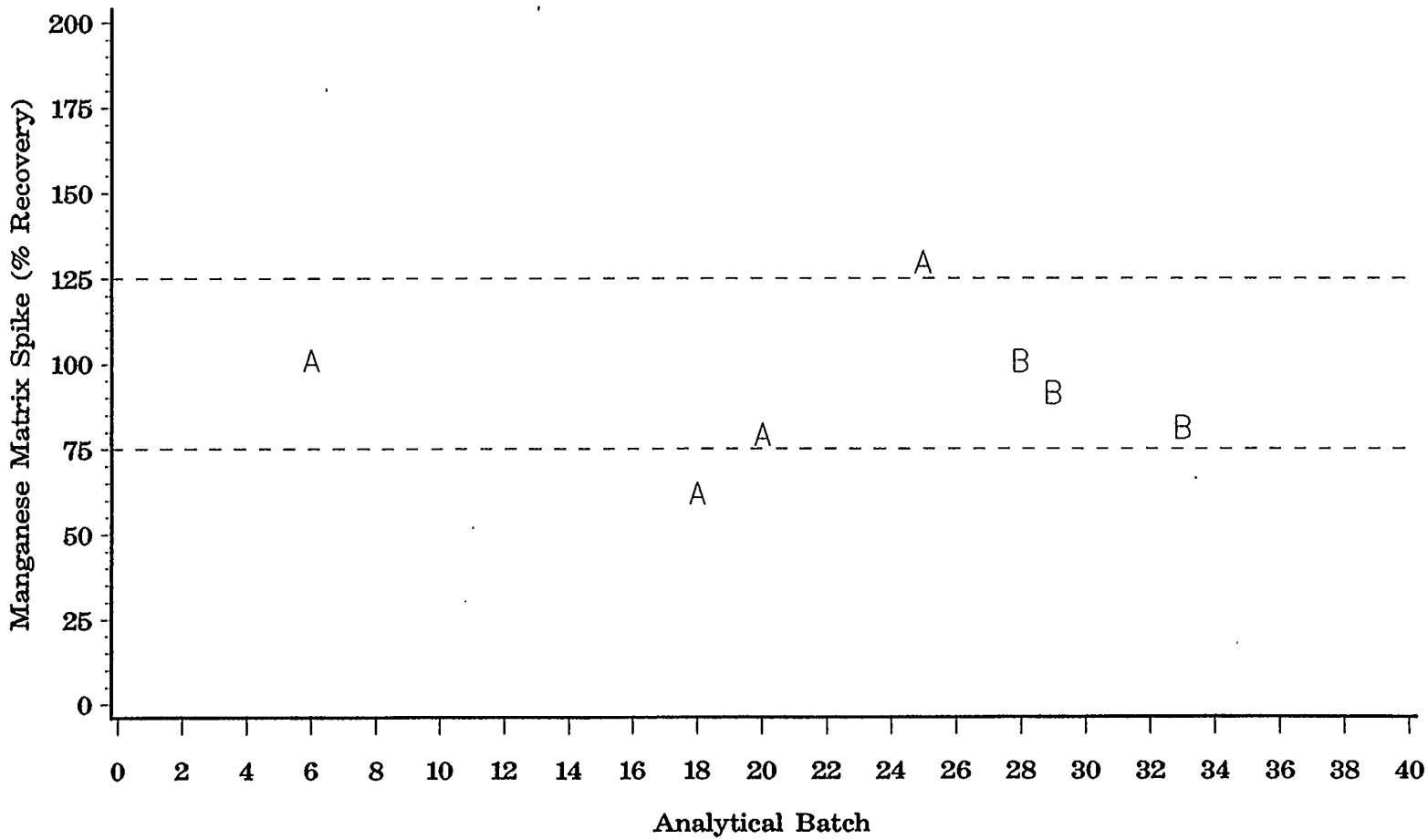


Fig. J.86. EPA CLP SOIL Matrix Spike recoveries for Manganese sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

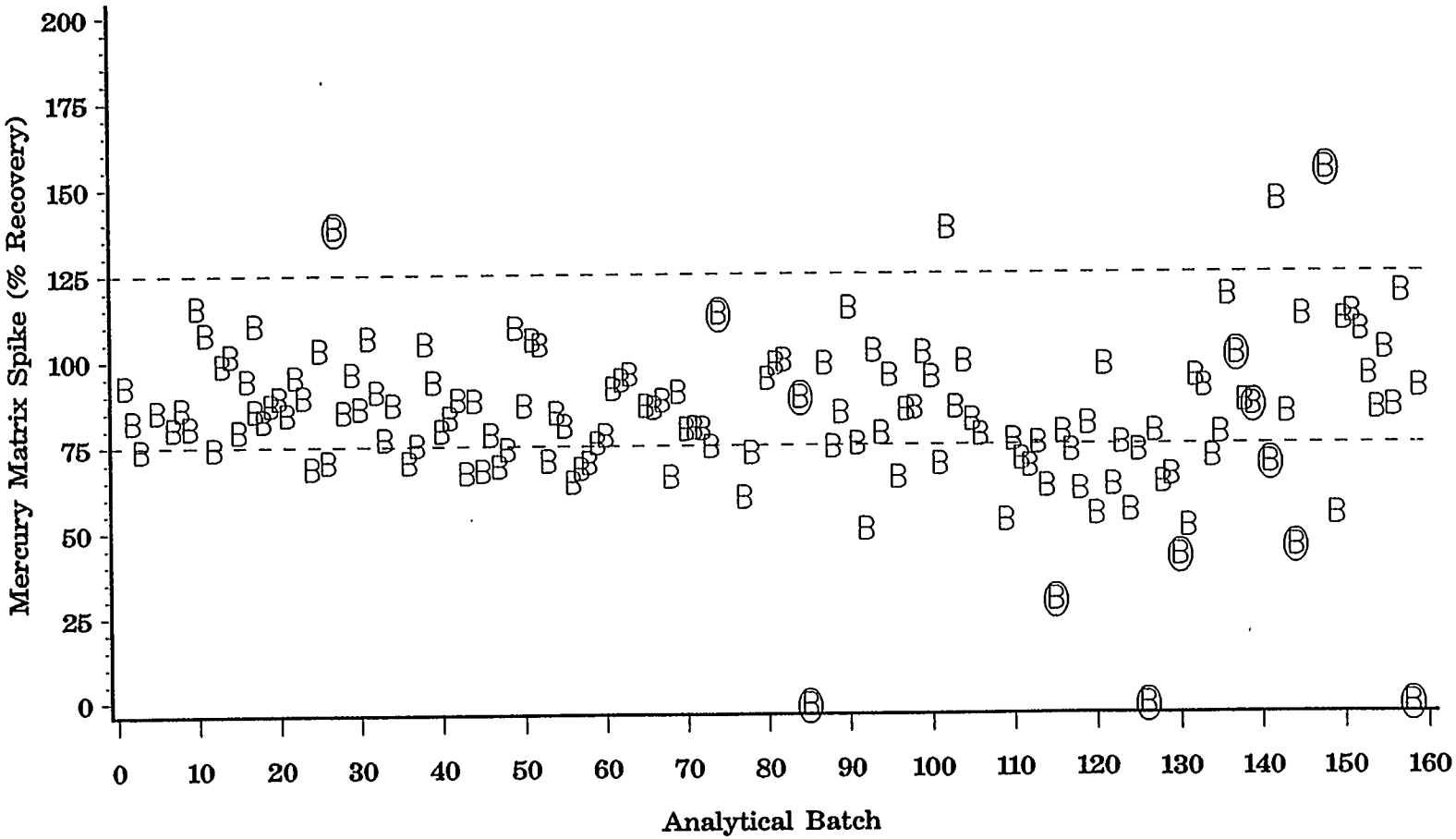


Fig. J.87. NAA SOIL Matrix Spike recoveries for Mercury sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the validation process.

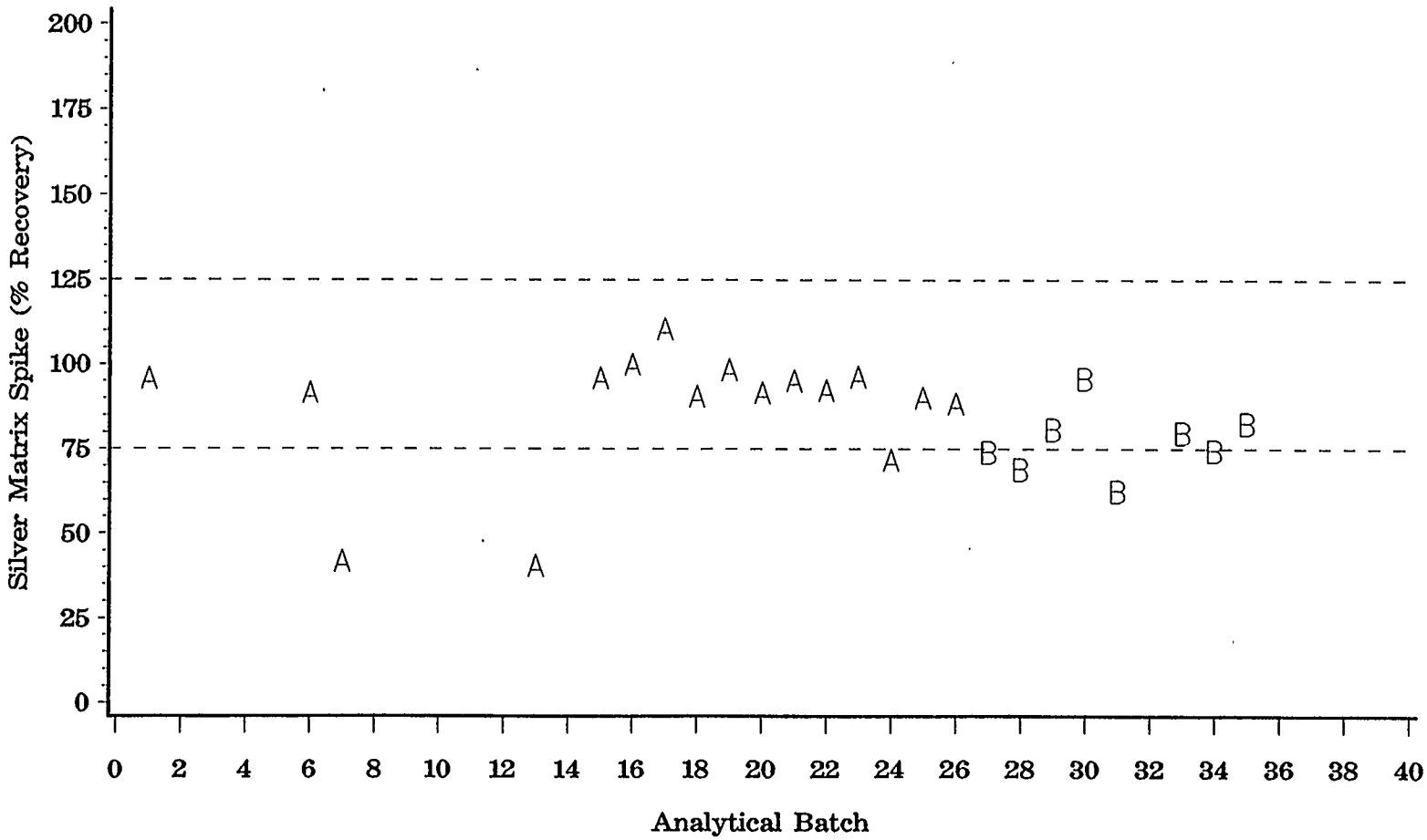


Fig.J.38. EPA CLP SOIL Matrix Spike recoveries for Silver sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

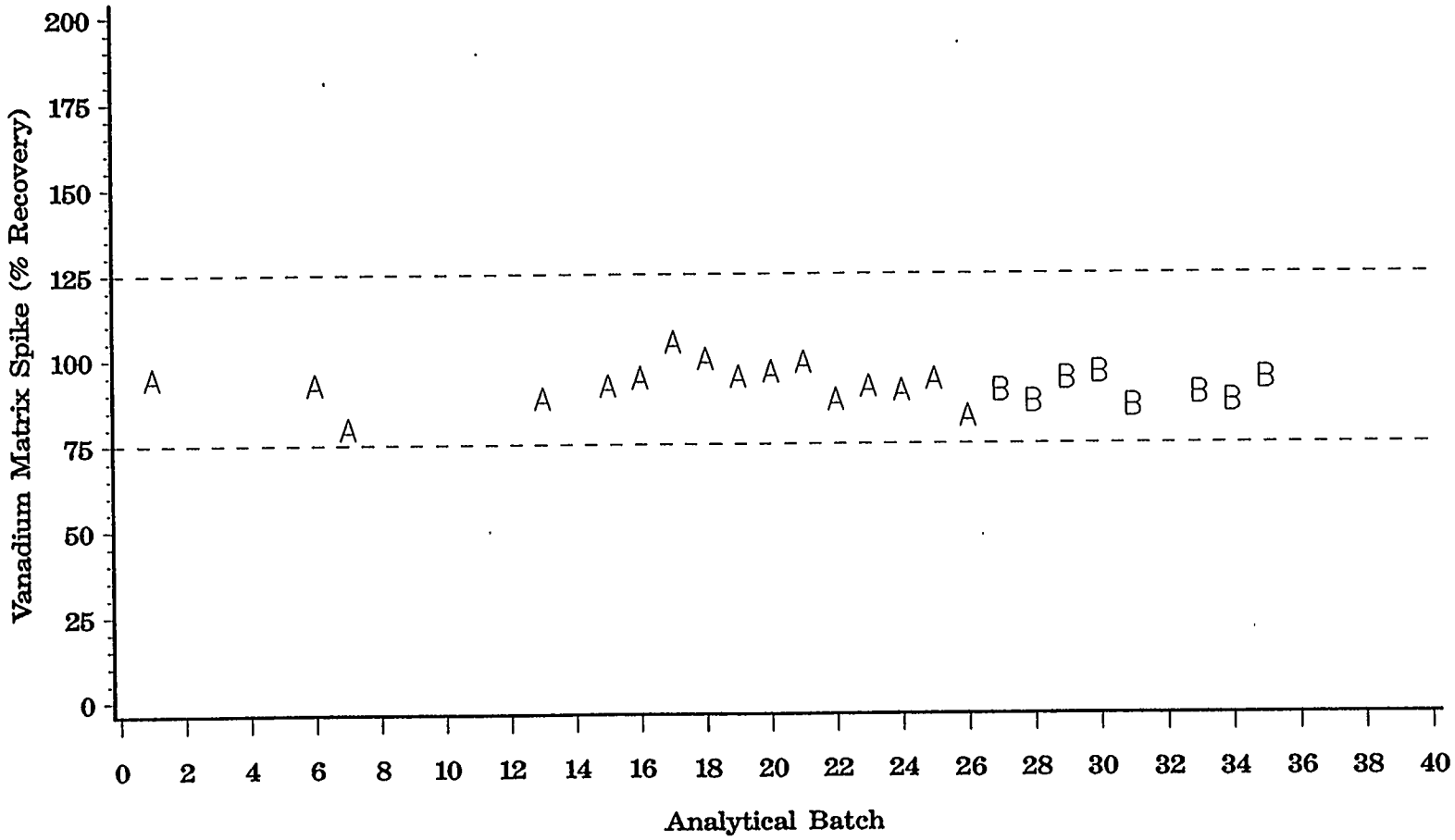


Fig. J.89. EPA CLP SOIL Matrix Spike recoveries for Vanadium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

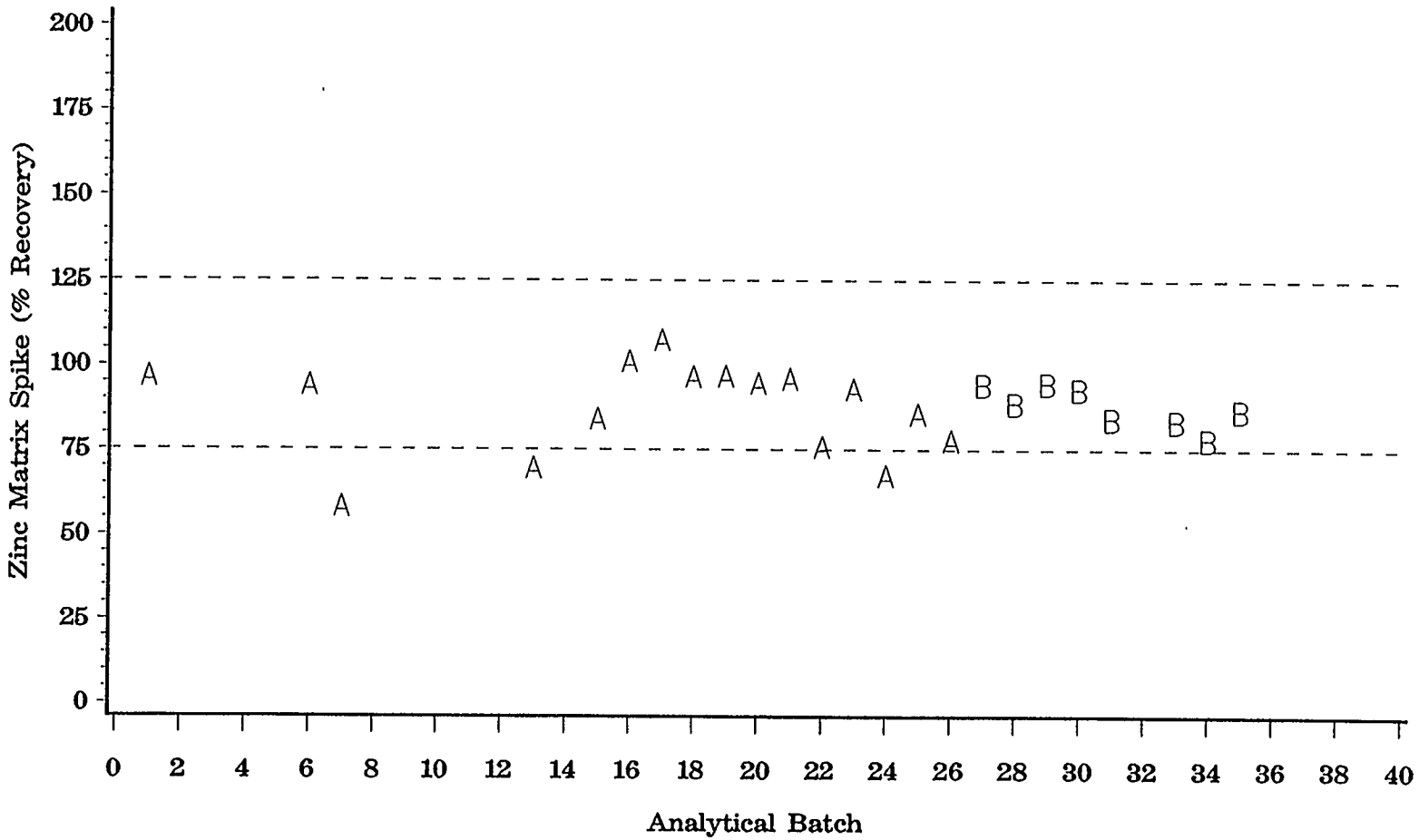


Fig. J.90. EPA CLP SOIL Matrix Spike recoveries for Zinc sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

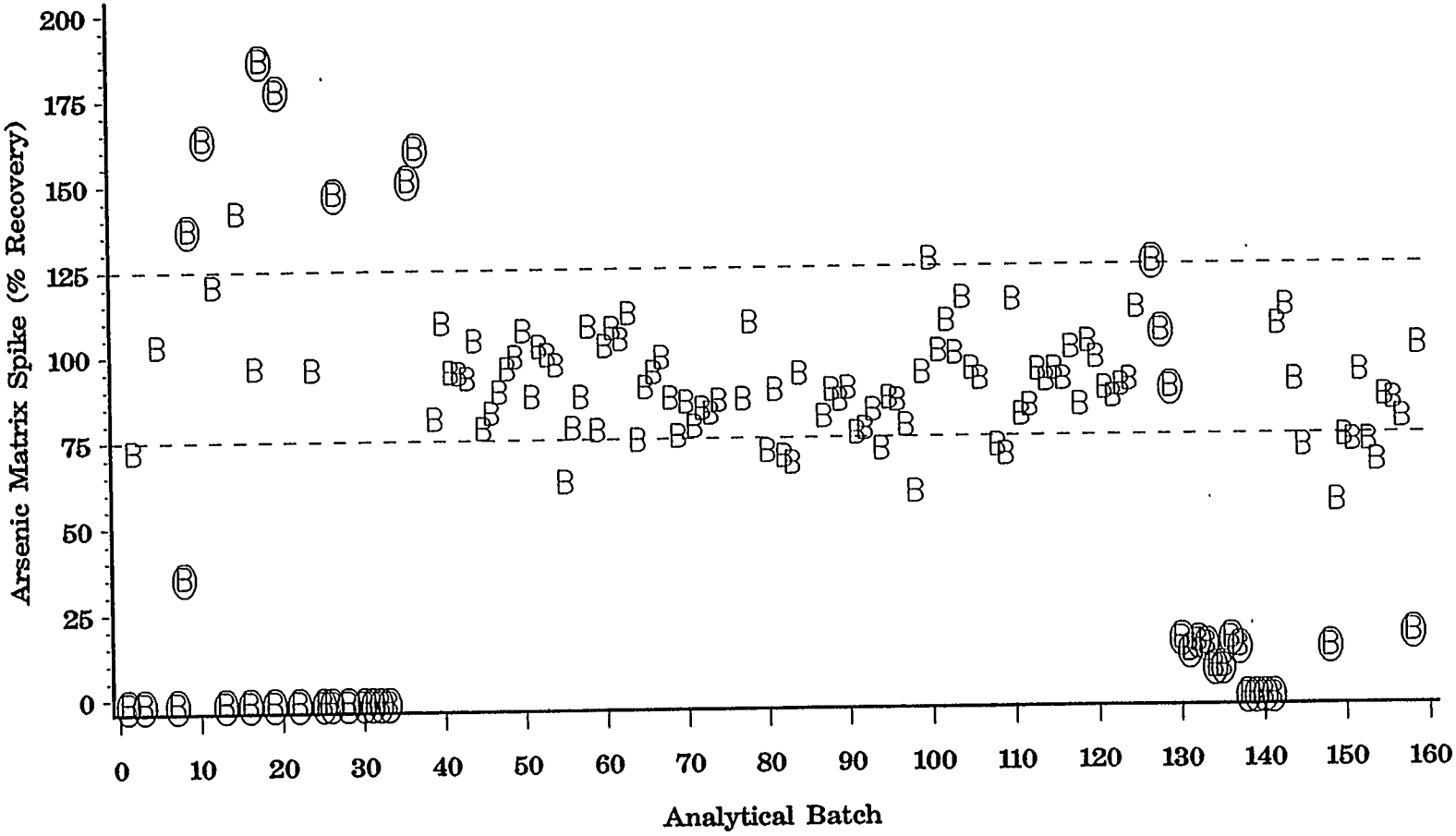


Fig. J.91. NAA SOIL Matrix Spike recoveries for Arsenic sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the validation process.

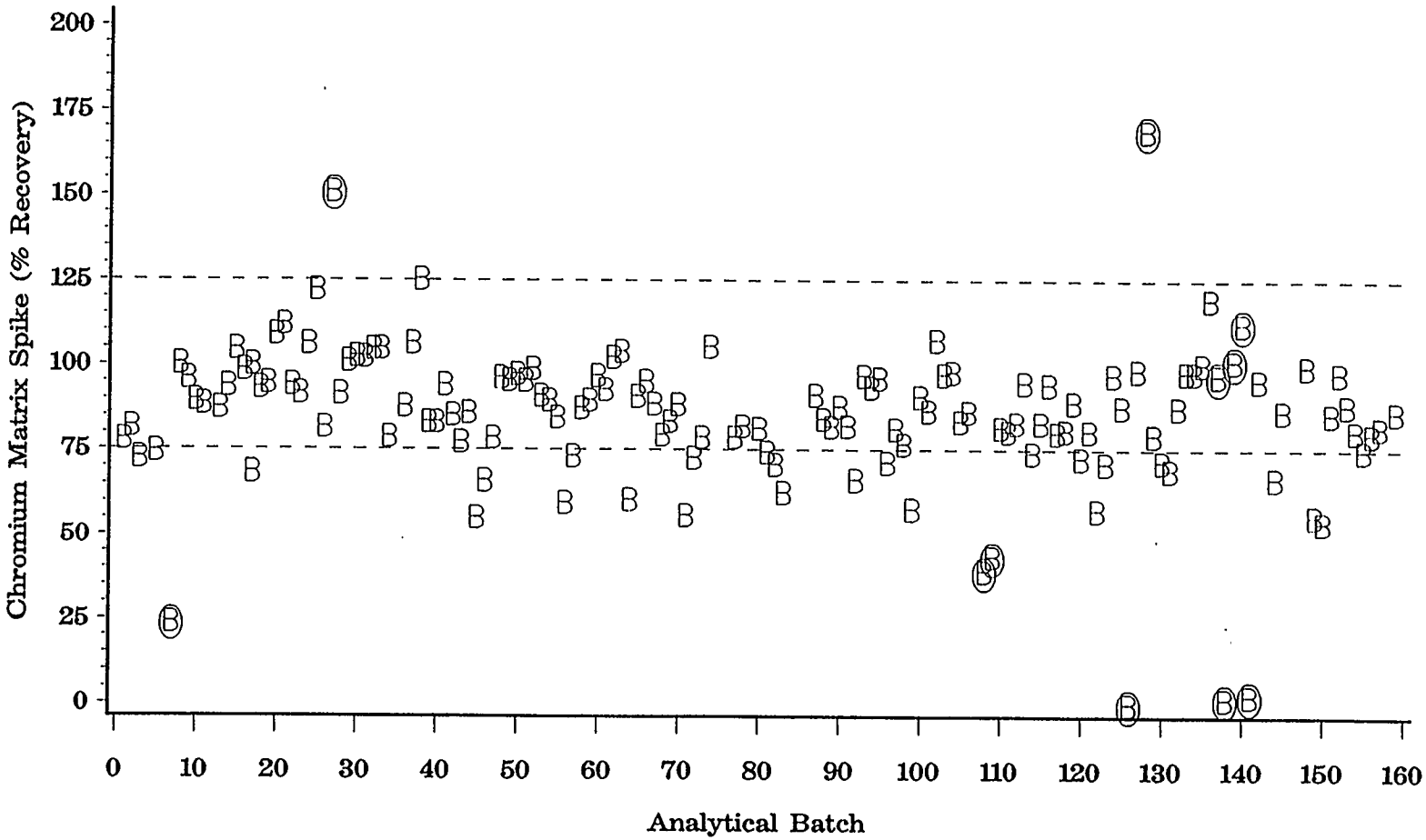


Fig. J.92. NAA SOIL Matrix Spike recoveries for Chromium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the validation process.

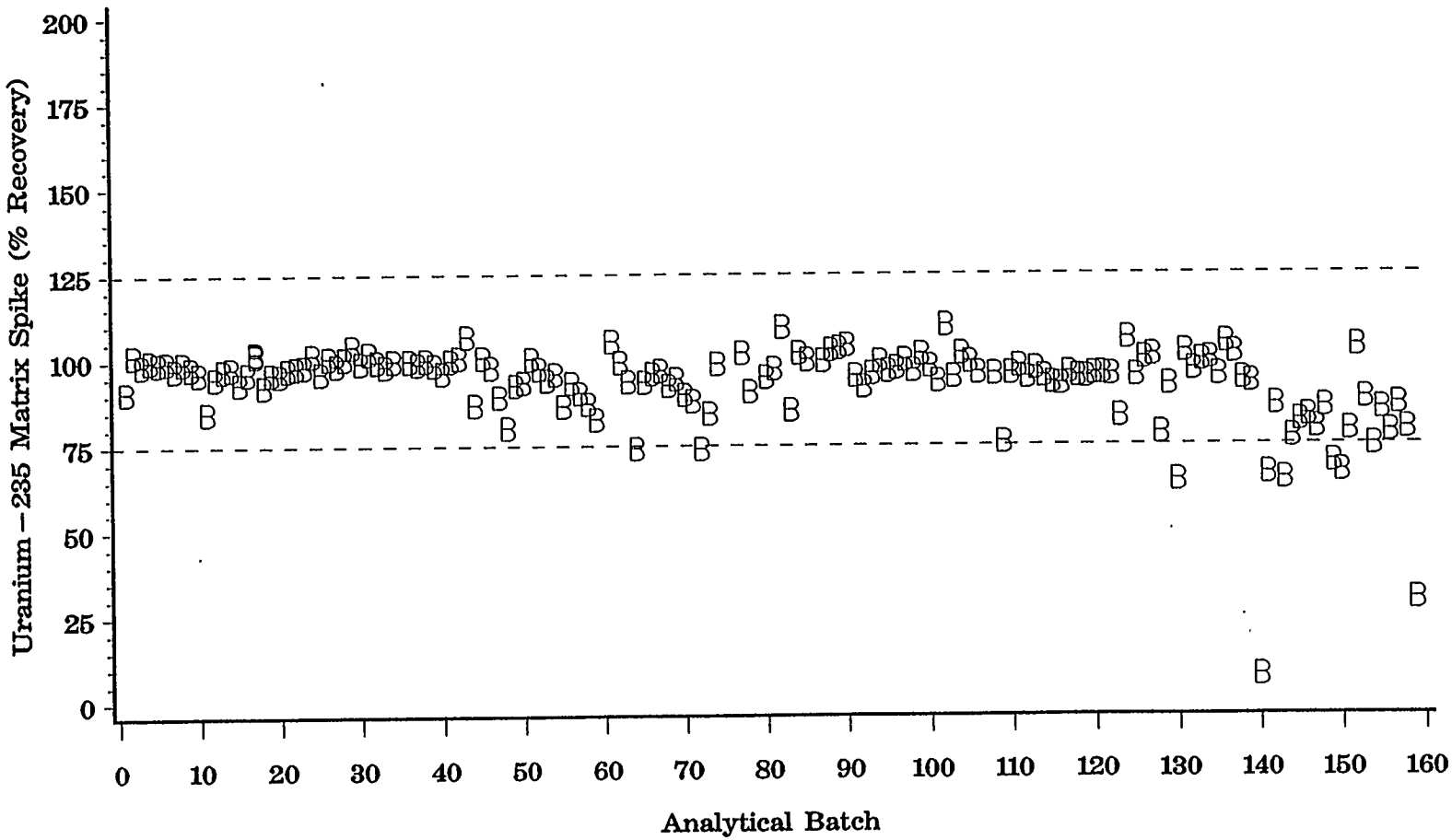


Fig. J.93. NAA SOIL Matrix Spike recoveries for Uranium-235 sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the validation process.

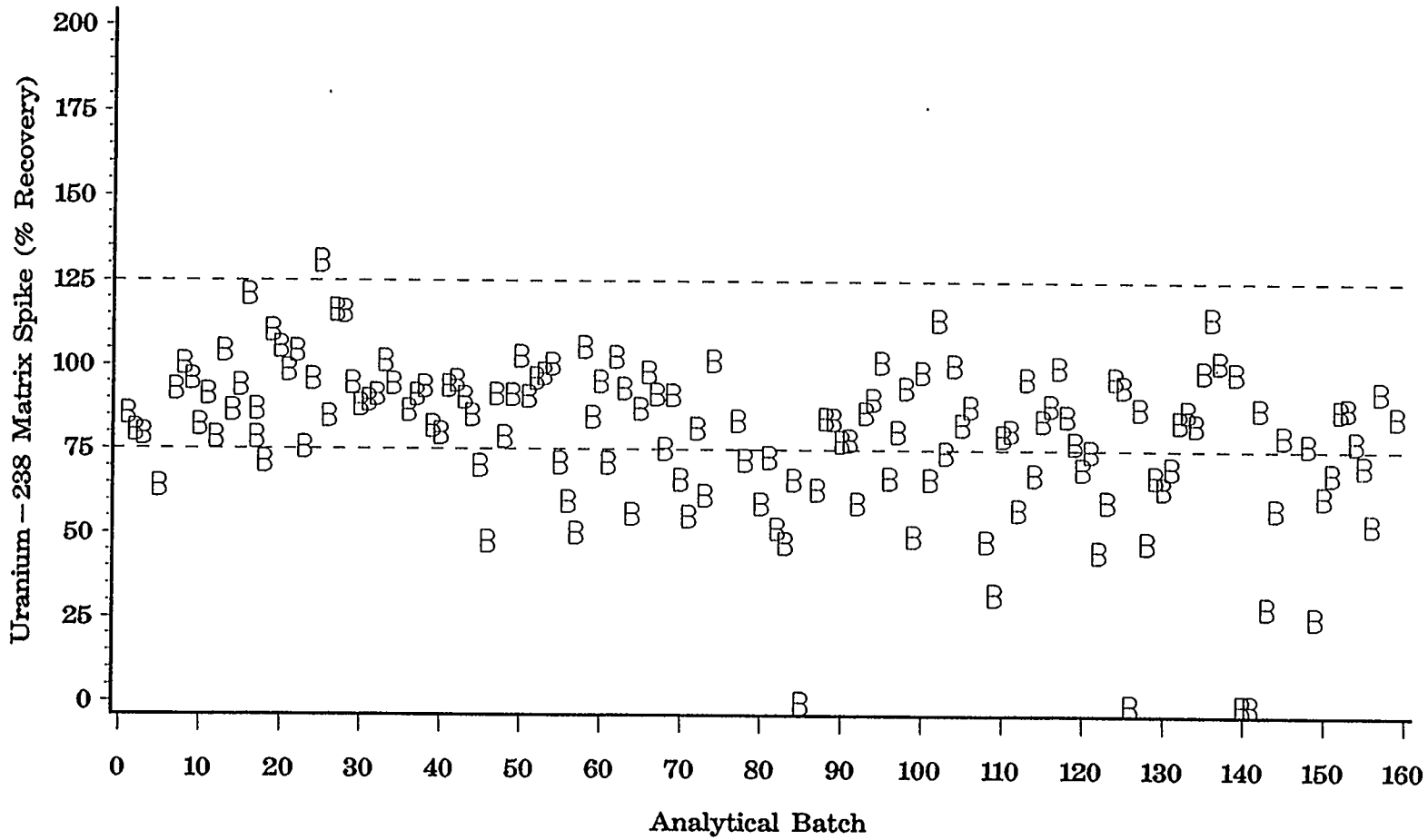


Fig. J.94. NAA SOIL Matrix Spike recoveries for Uranium – 238 sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the validation process.

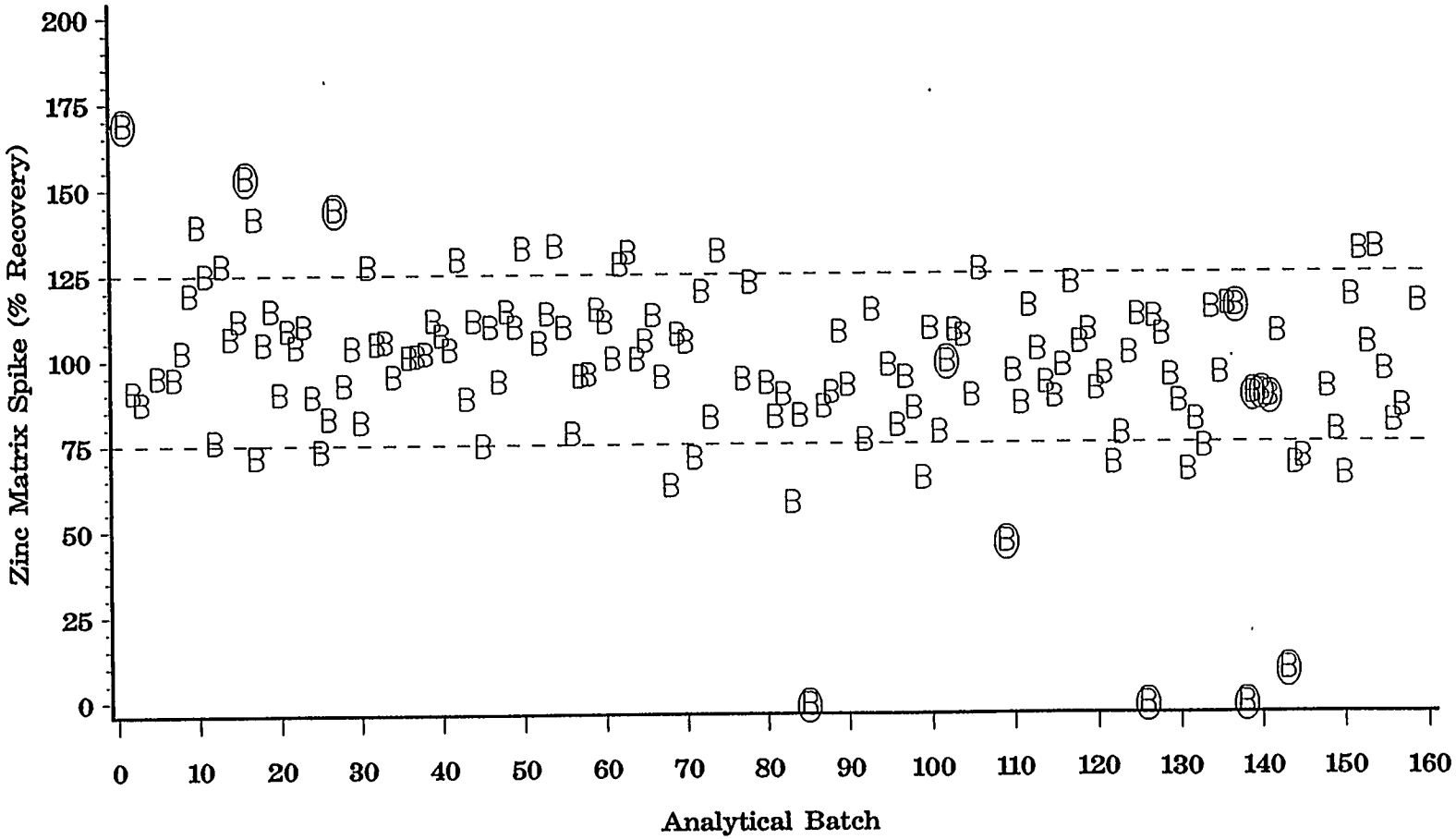


Fig. J.95. NAA SOIL Matrix Spike recoveries for Zinc sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the validation process.

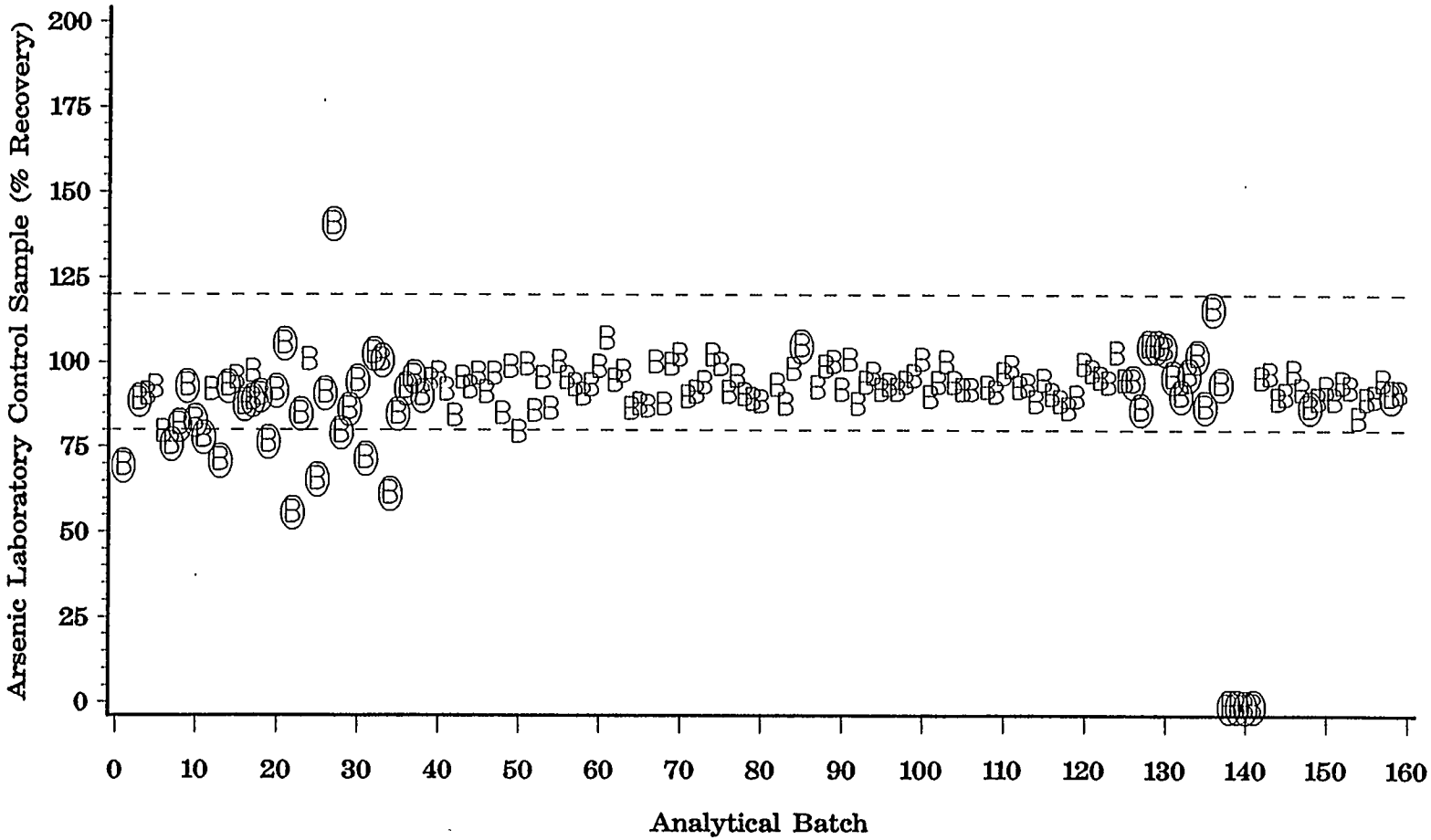


Fig. J.96. NAA SOIL Laboratory Control Sample recoveries for Arsenic sample analyses. Circled points indicate rejected data from the data validation process.

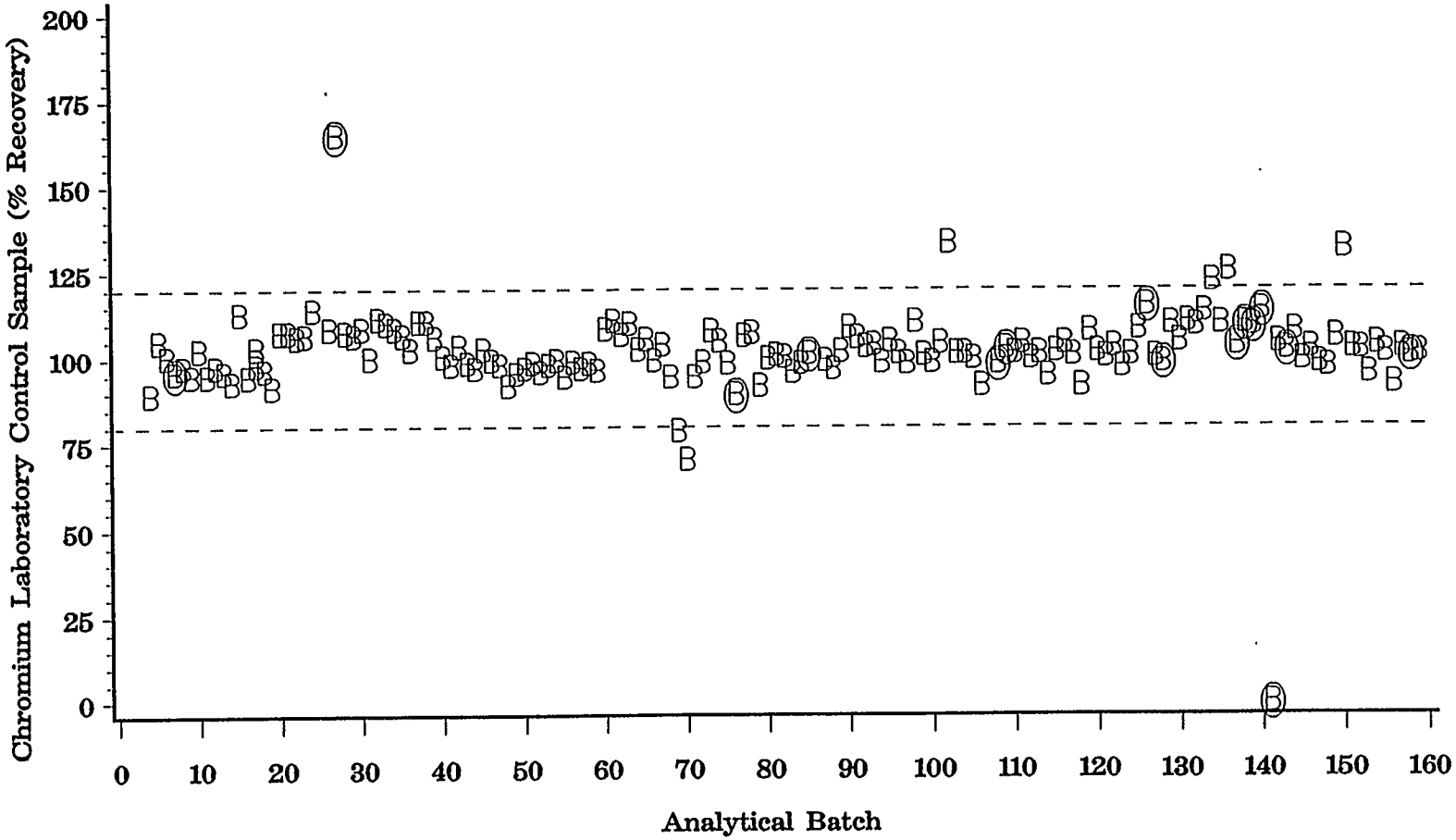


Fig. J.97. NAA SOIL Laboratory Control Sample recoveries for Chromium sample analyses. Circled points indicate rejected data from the data validation process.

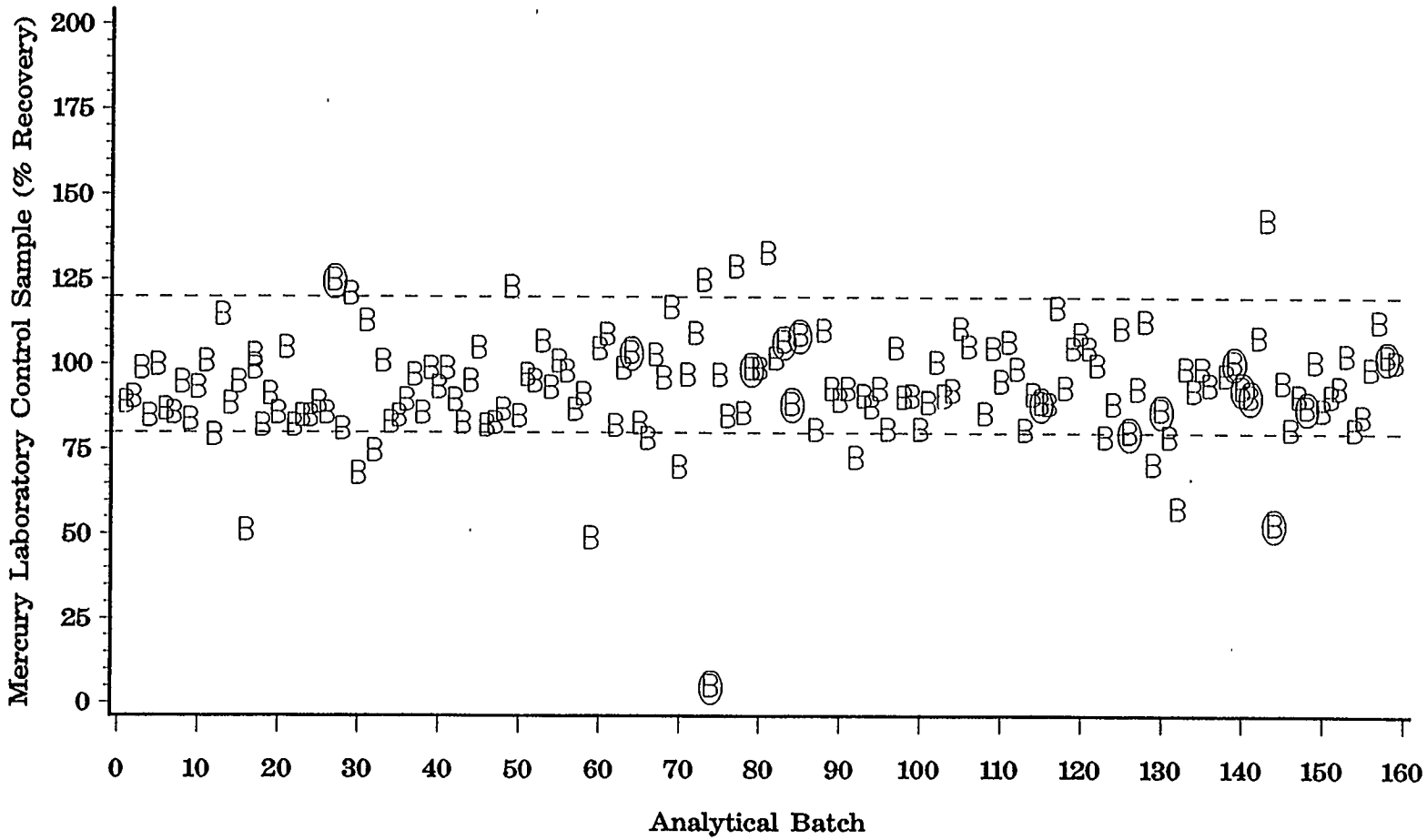


Fig. J.98. NAA SOIL Laboratory Control Sample recoveries for Mercury sample analyses. Circled points indicate rejected data from the data validation process.

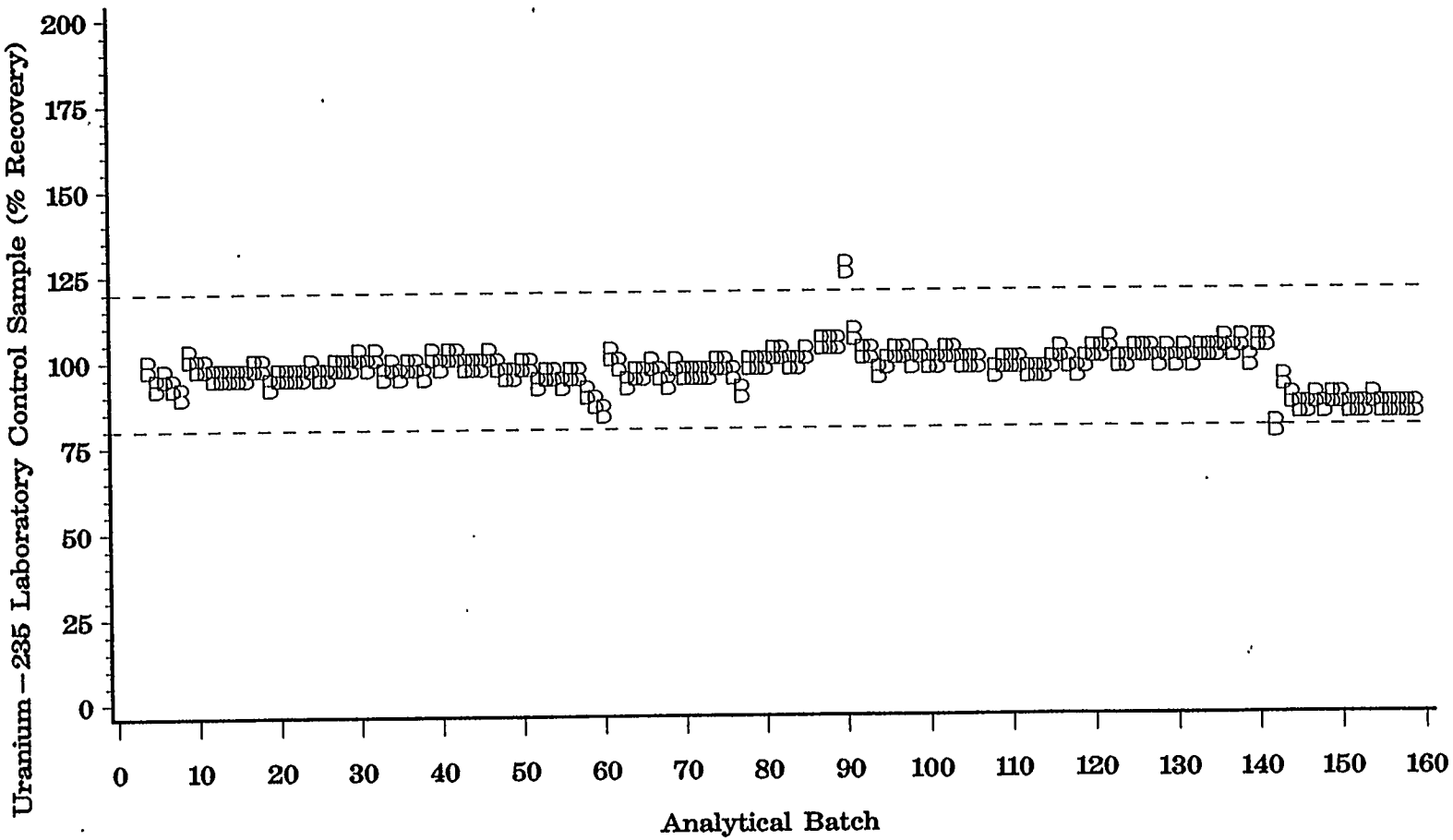


Fig. J.99. NAA SOIL Laboratory Control Sample recoveries for Uranium – 235 sample analyses. Circled points indicate rejected data from the data validation process.

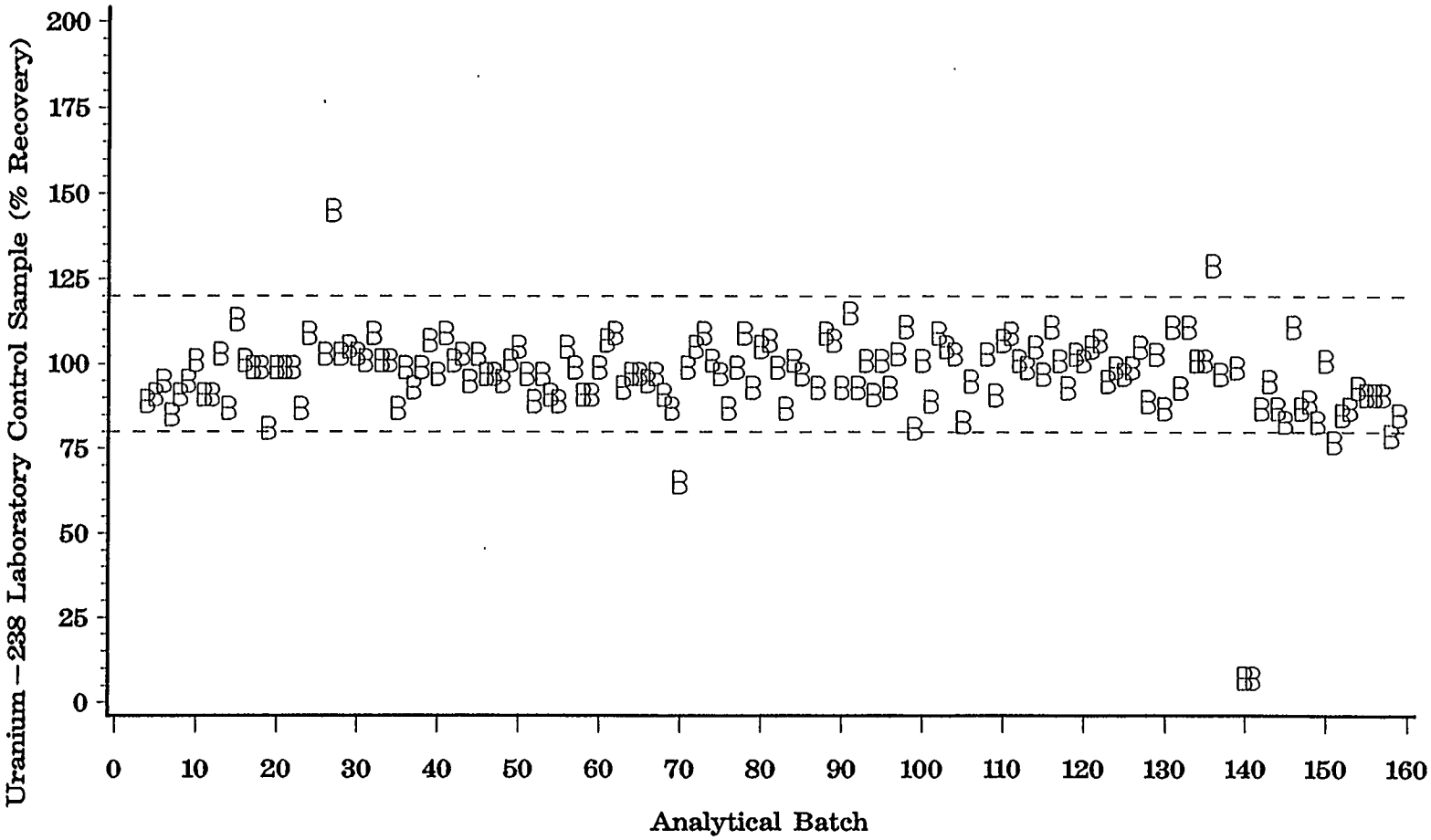


Fig. J.100. NAA SOIL Laboratory Control Sample recoveries for Uranium-238 sample analyses. Circled points indicate rejected data from the data validation process.

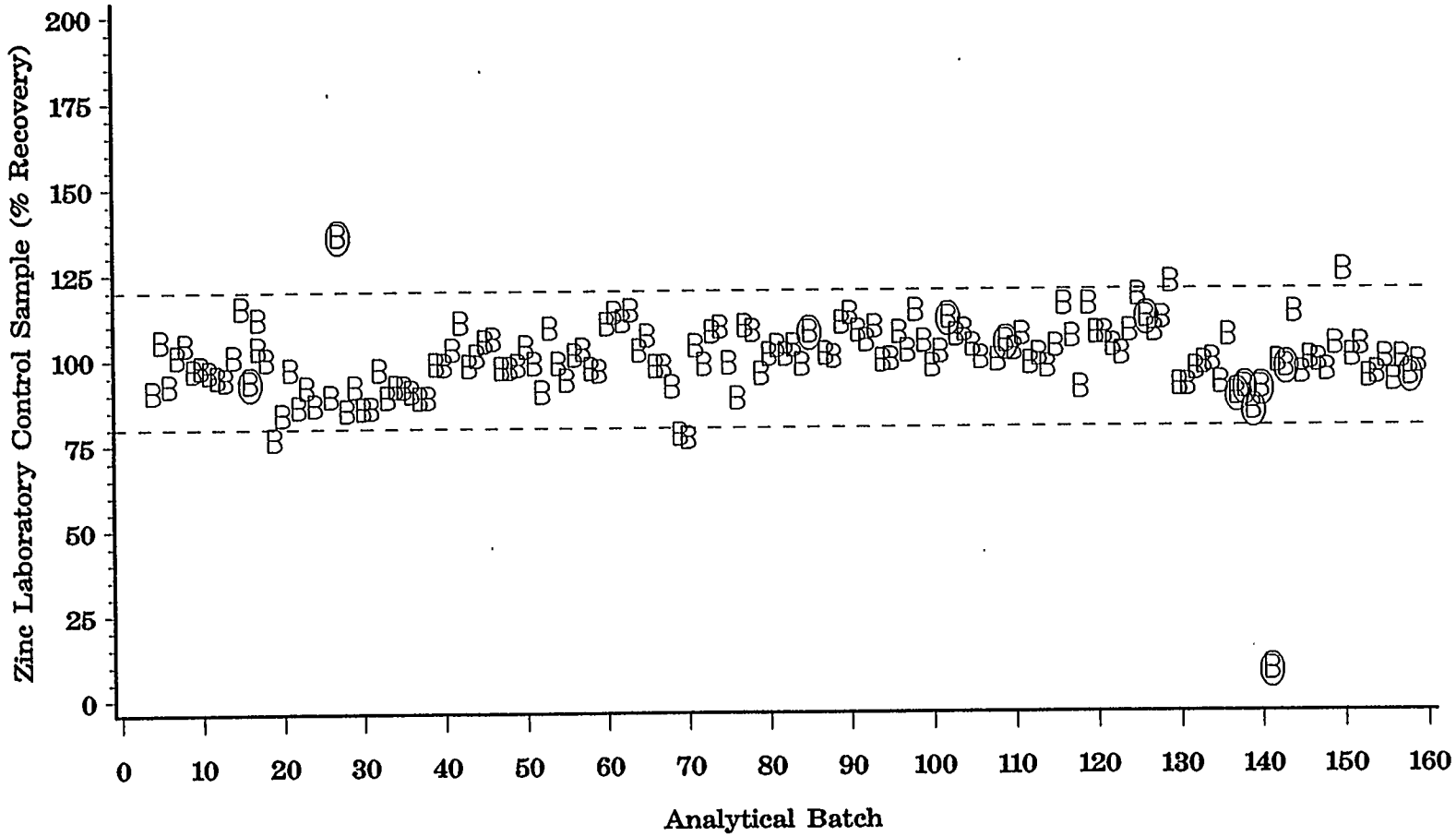


Fig.J.101. NAA SOIL Laboratory Control Sample recoveries for Zinc sample analyses. Circled points indicate rejected data from the data validation process.

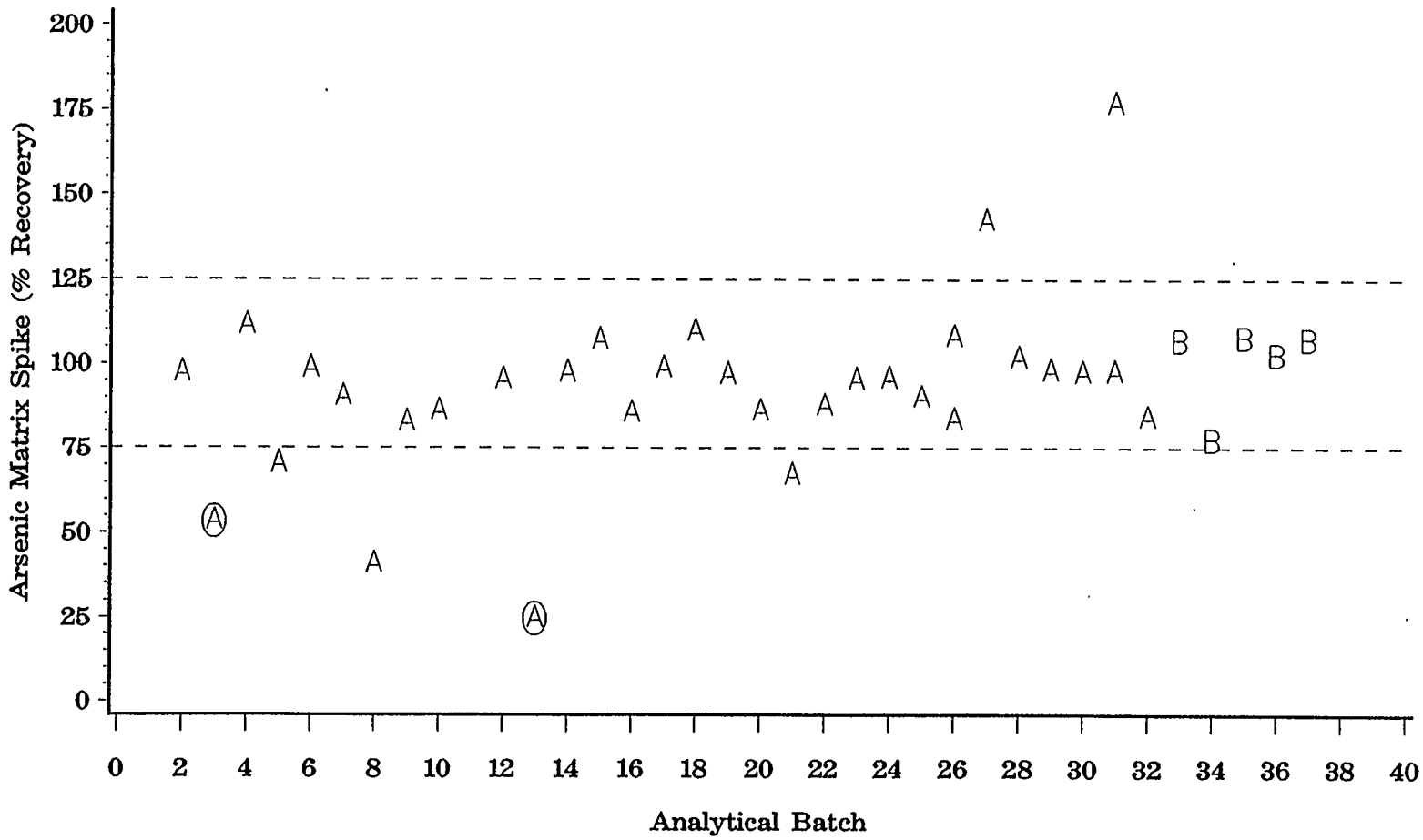


Fig. J.102. EPA CLP WATER Matrix Spike recoveries for Arsenic sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

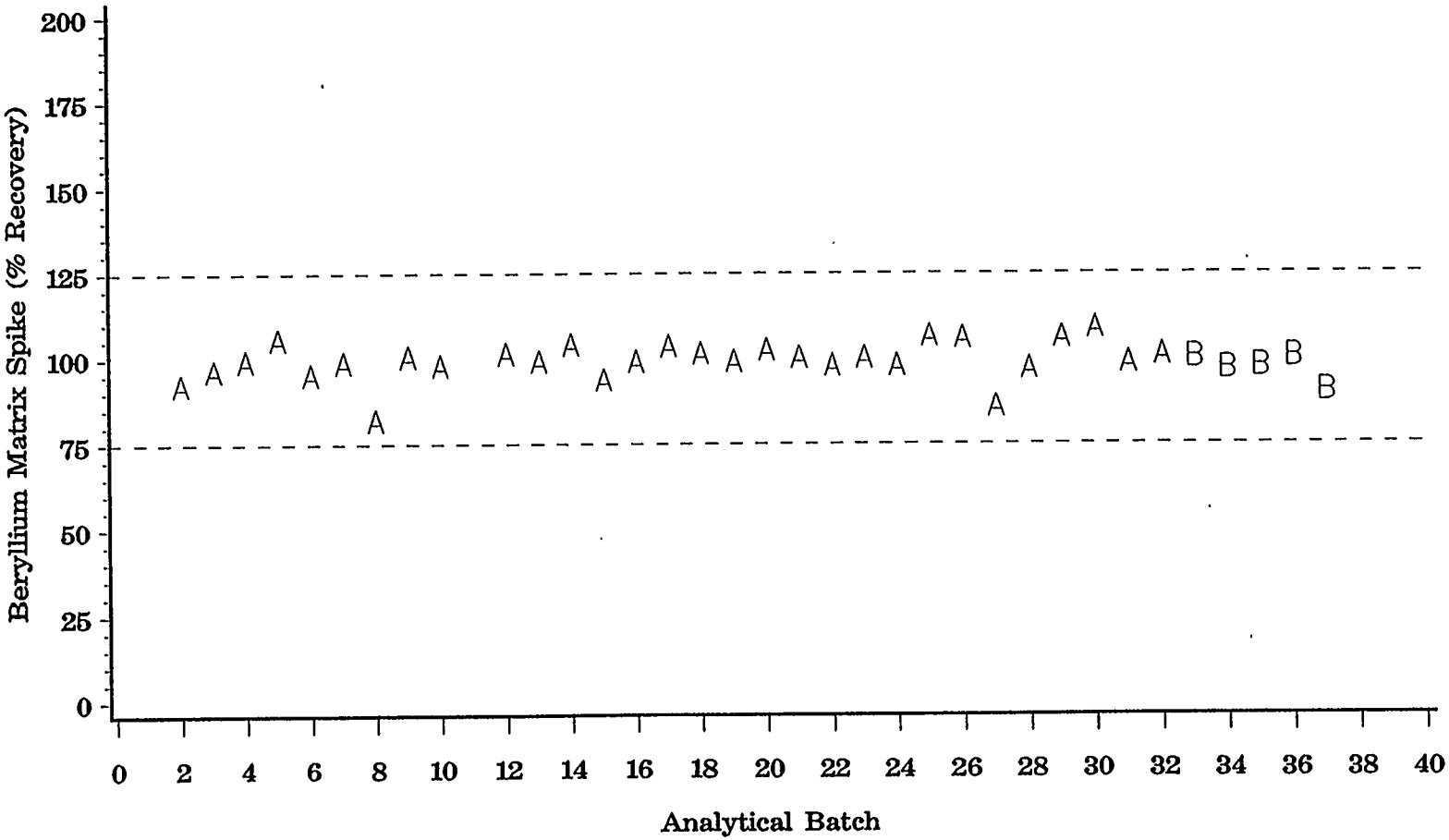


Fig. J.103. EPA CLP WATER Matrix Spike recoveries for Beryllium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

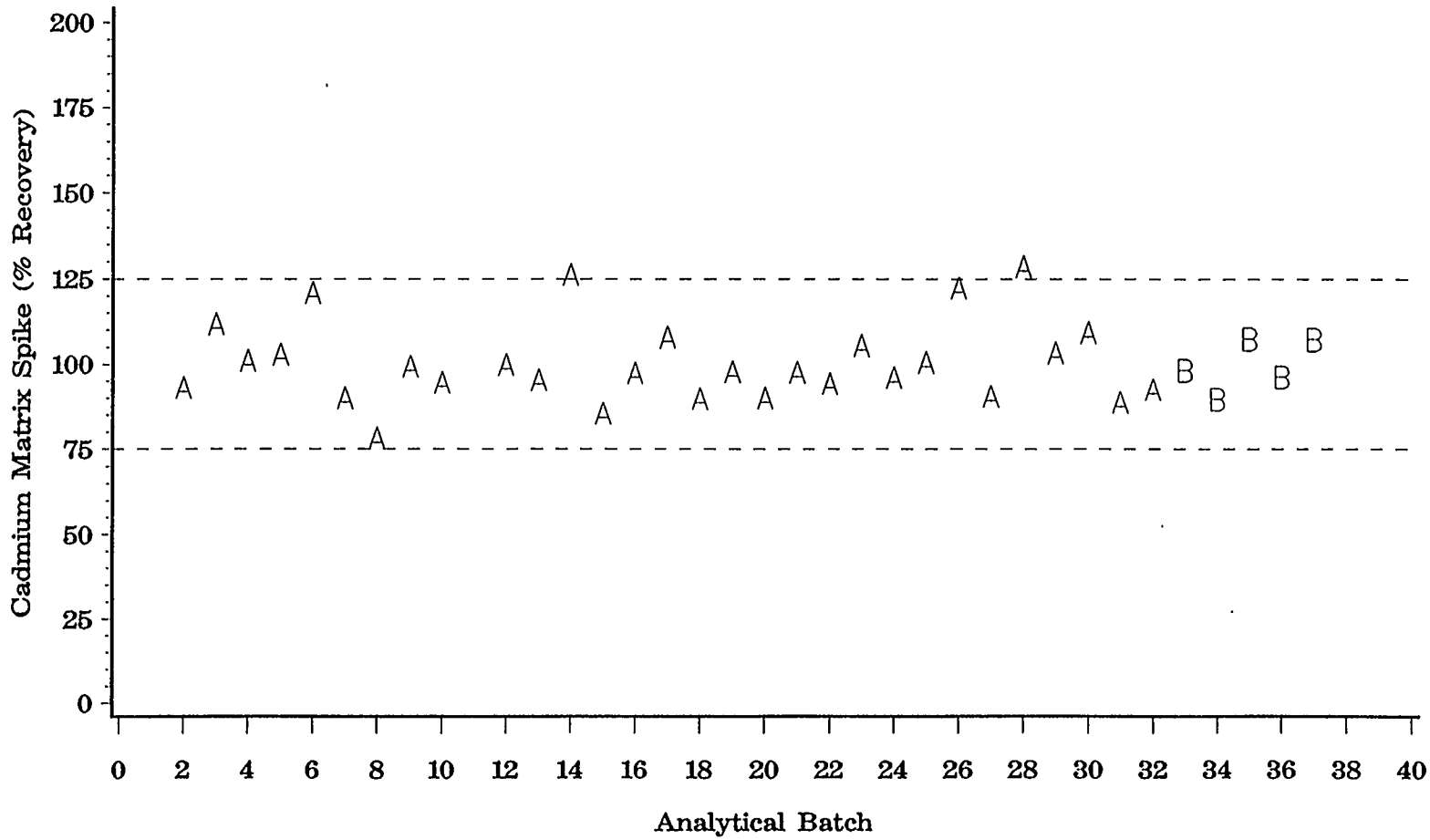


Fig. J.104. EPA CLP WATER Matrix Spike recoveries for Cadmium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

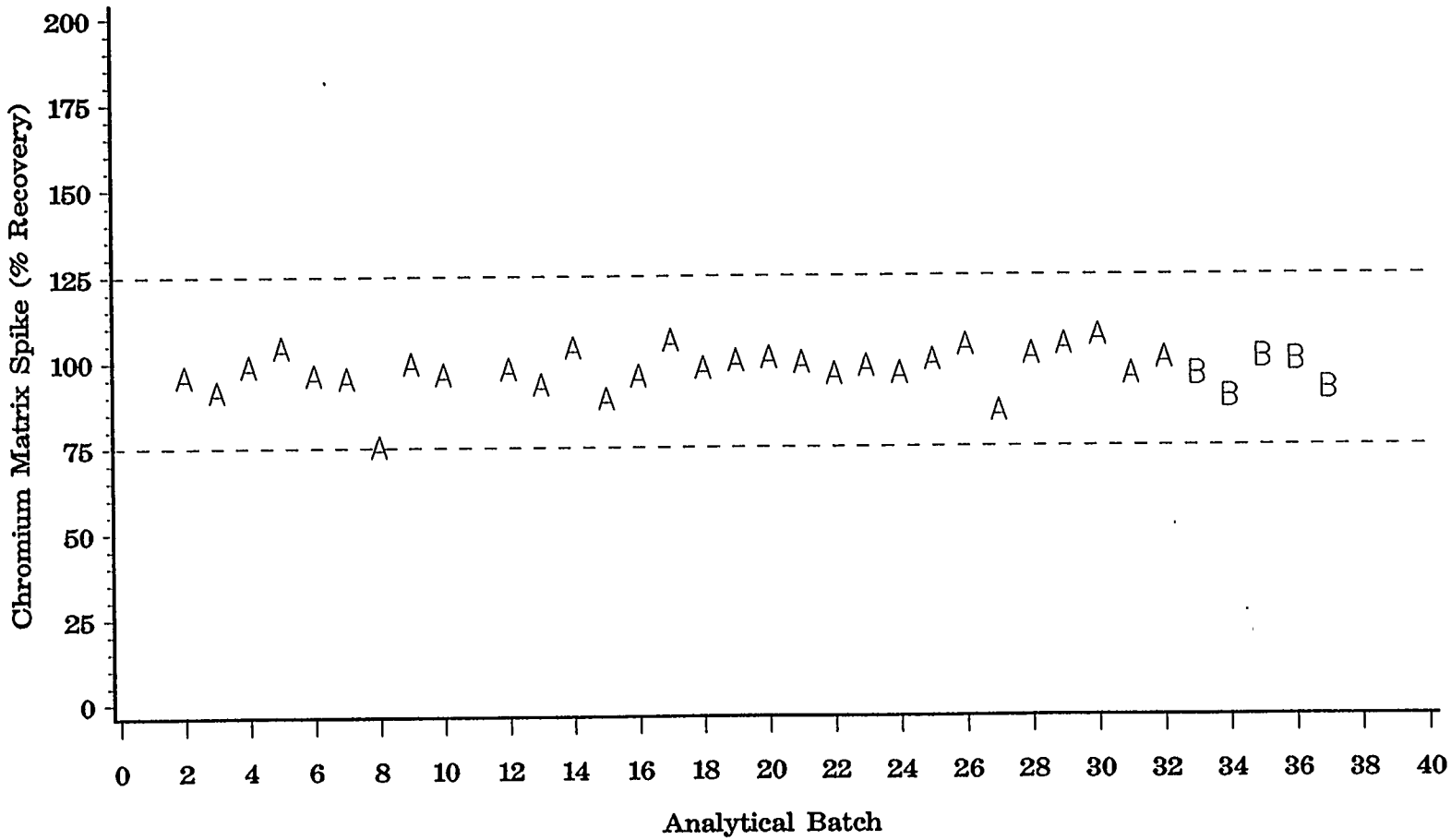


Fig. J.105. EPA CLP WATER Matrix Spike recoveries for Chromium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

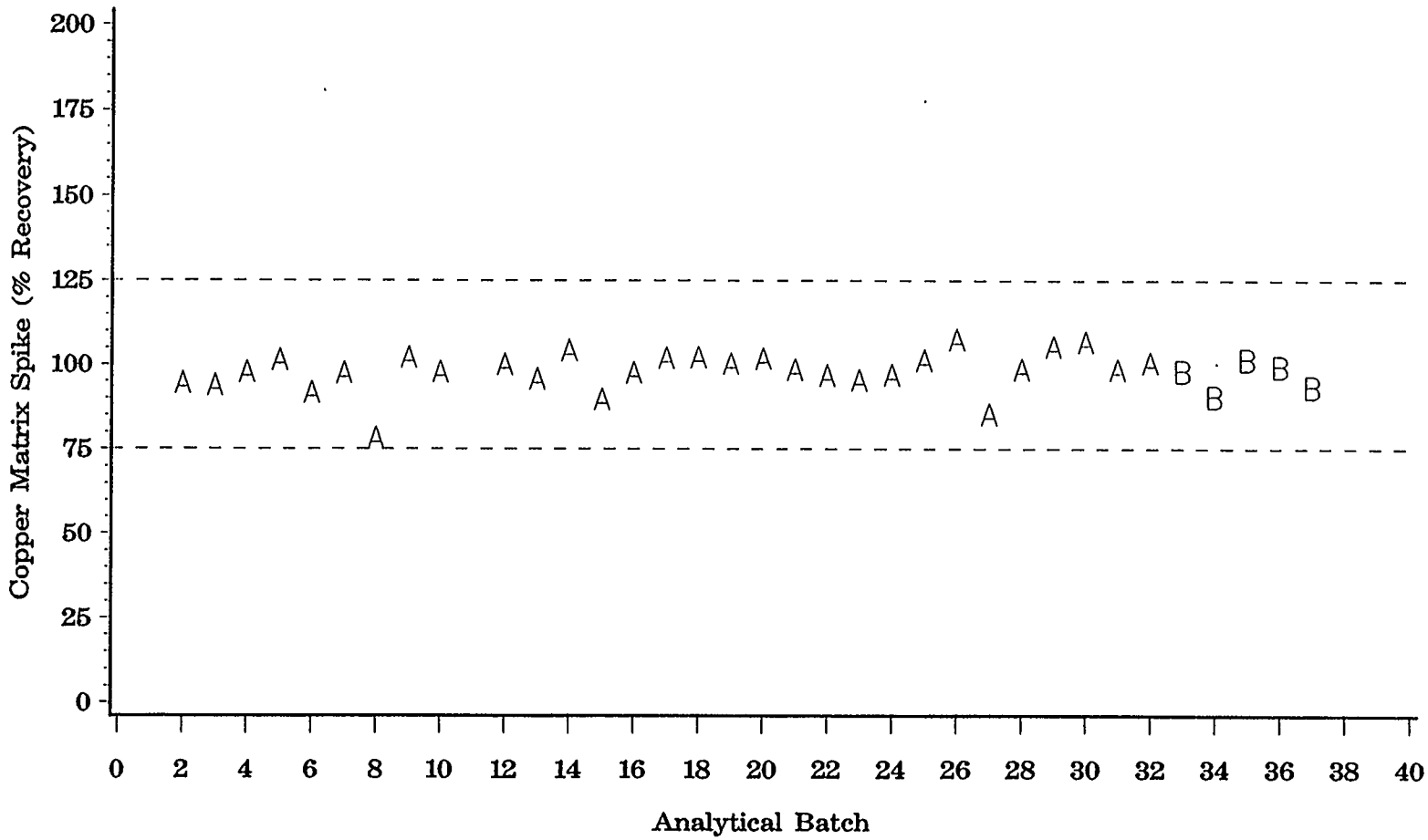


Fig. J.106. EPA CLP WATER Matrix Spike recoveries for Copper sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

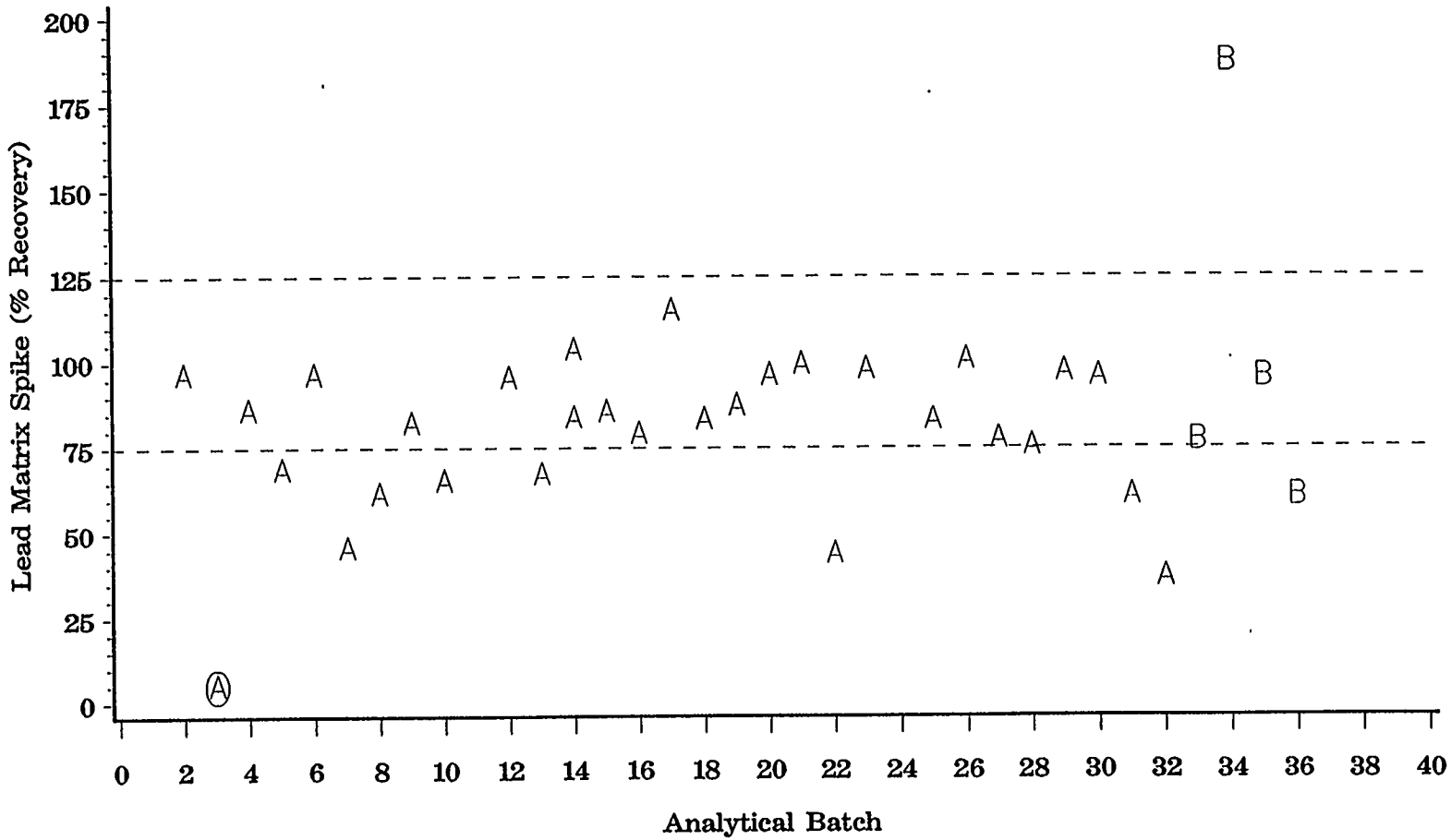


Fig. J.107. EPA CLP WATER Matrix Spike recoveries for Lead sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

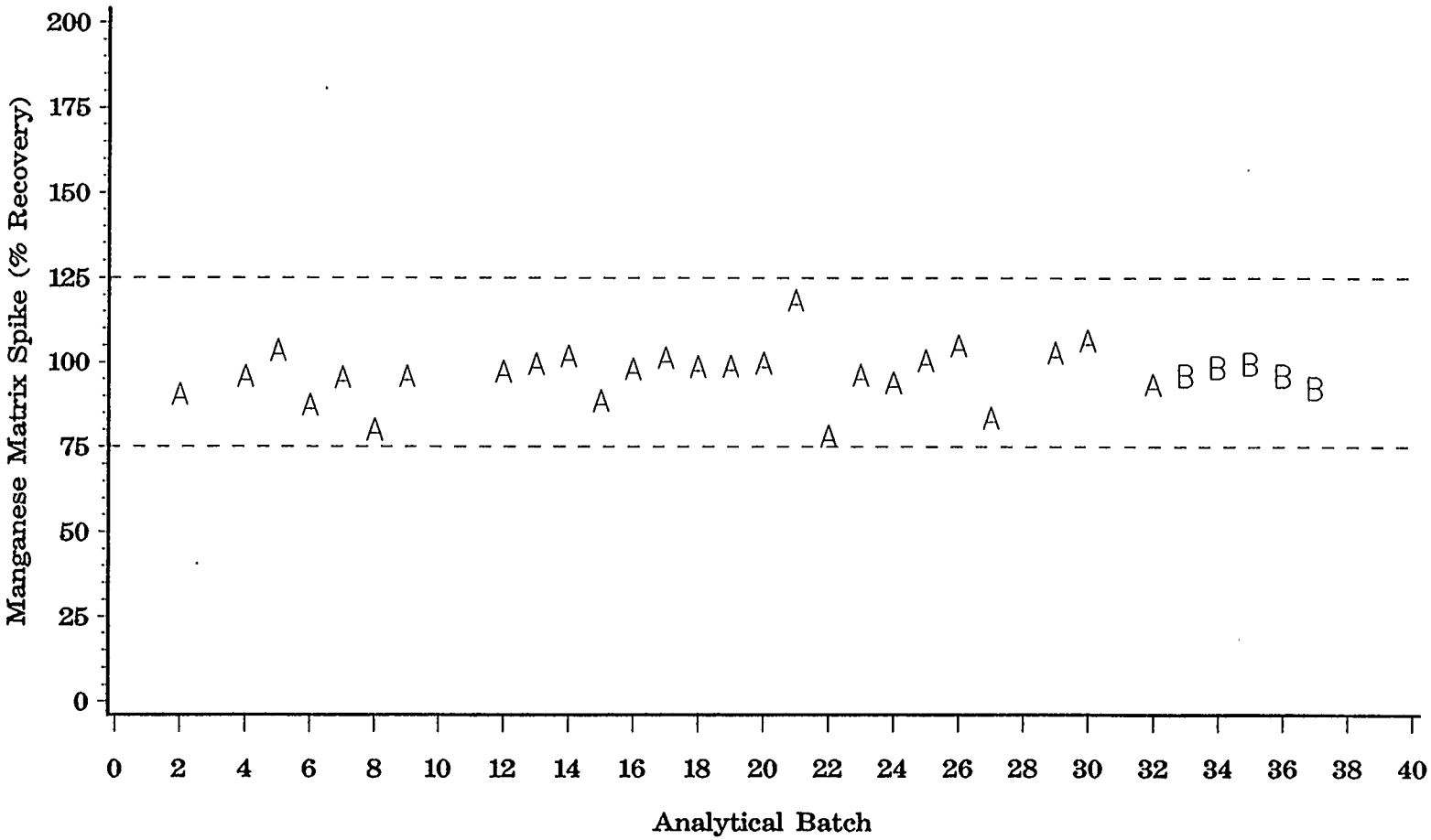


Fig. J.108. EPA CLP WATER Matrix Spike recoveries for Manganese sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

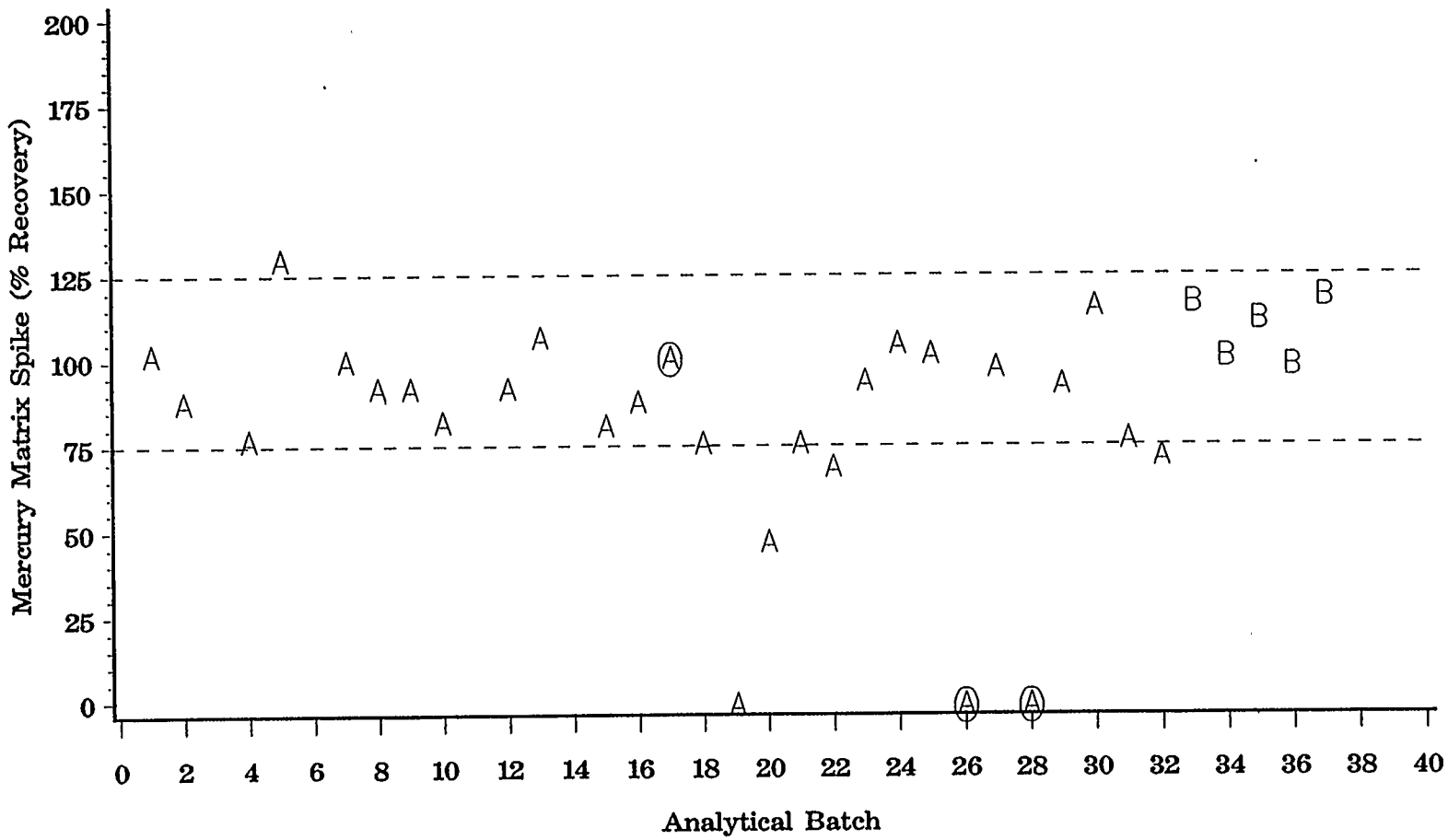


Fig. J.109. EPA CLP WATER Matrix Spike recoveries for Mercury sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

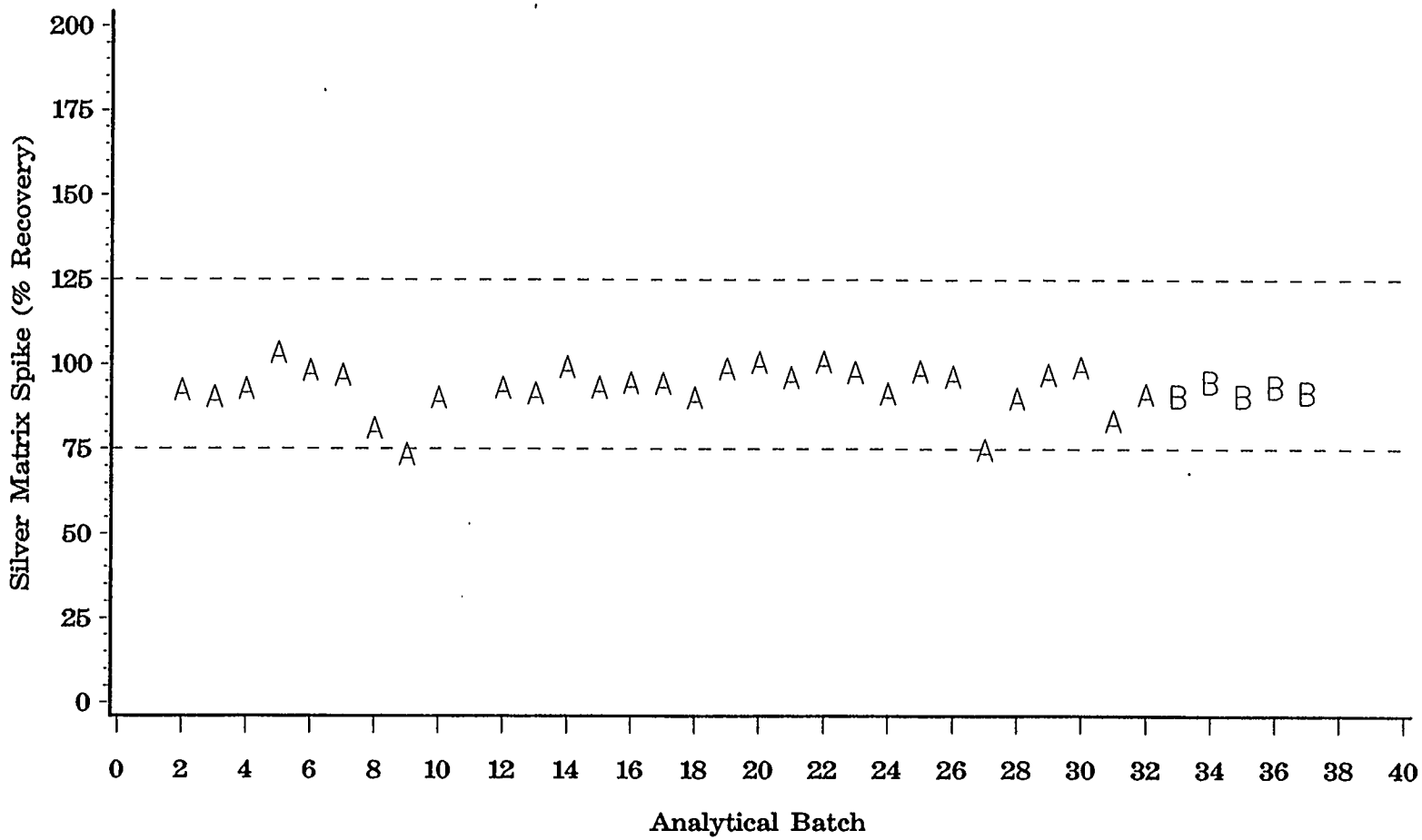


Fig. J.110. EPA CLP WATER Matrix Spike recoveries for Silver sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

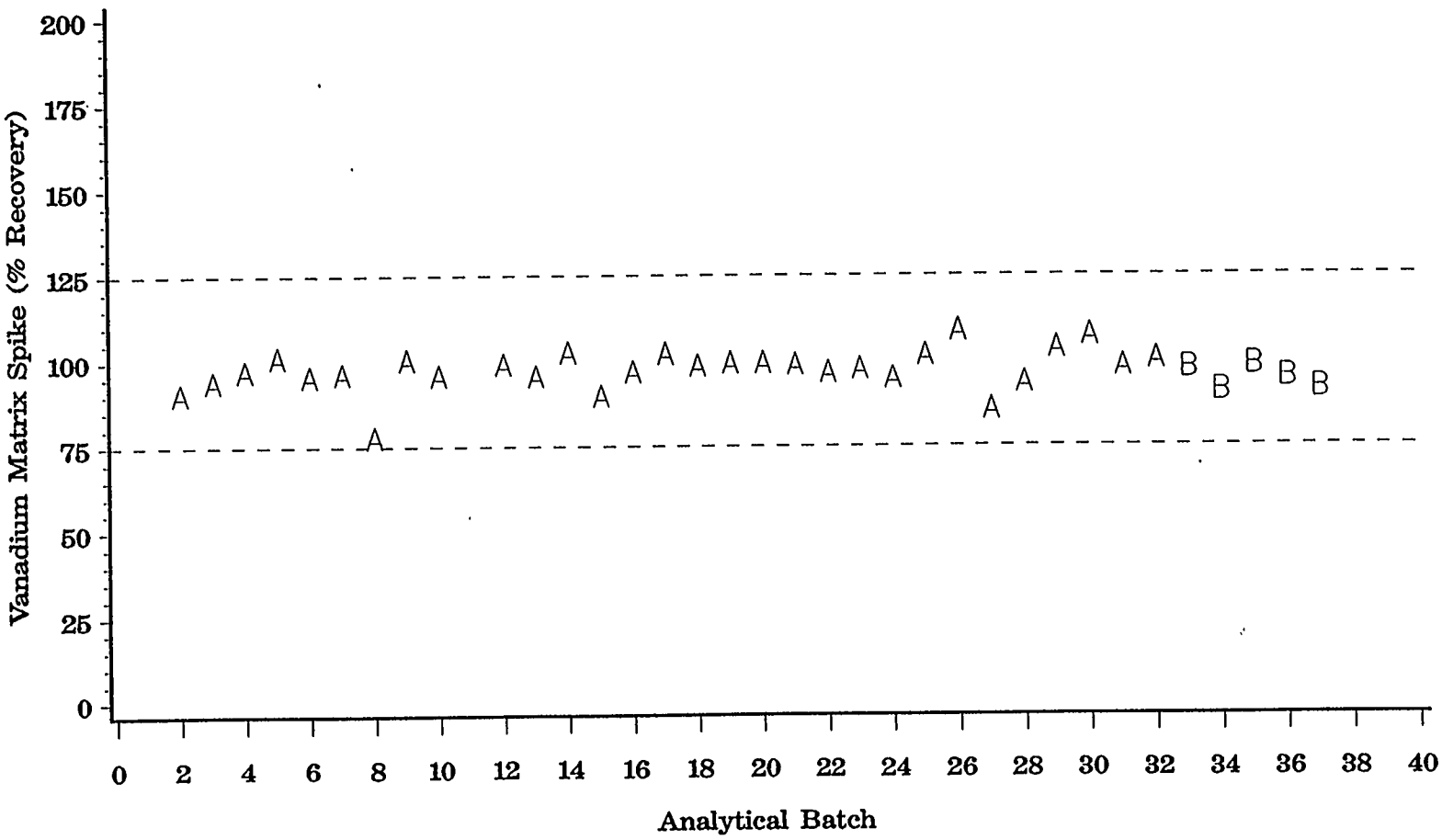


Fig. 3.111. EPA CLP WATER Matrix Spike recoveries for Vanadium sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

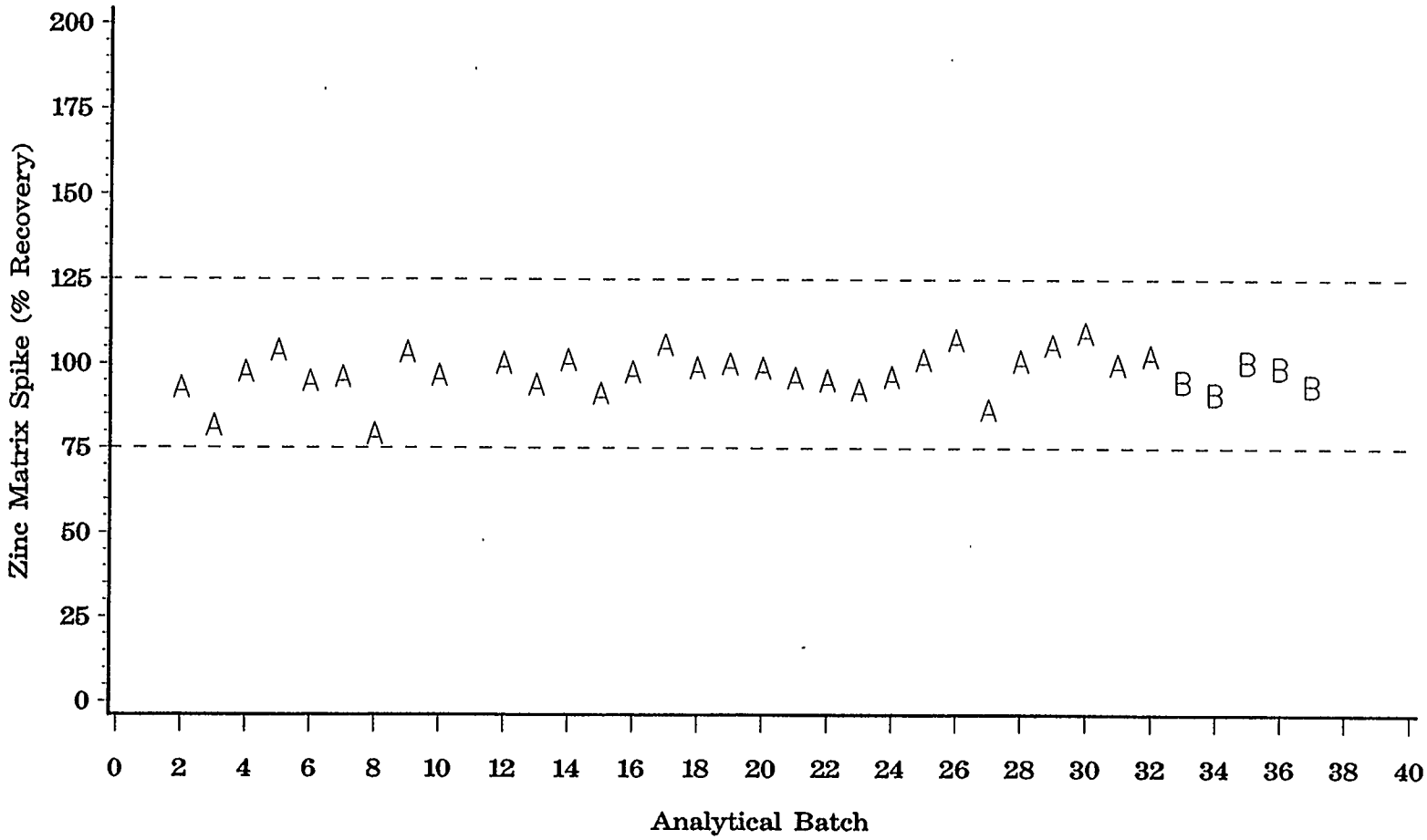


Fig. J.112. EPA CLP WATER Matrix Spike recoveries for Zinc sample analyses. Note data points for which CLP criteria provide exceptions for data qualification have been excluded from this presentation. Control limits represent CLP spike recovery guidance. Circled points indicate rejected data from the data validation process.

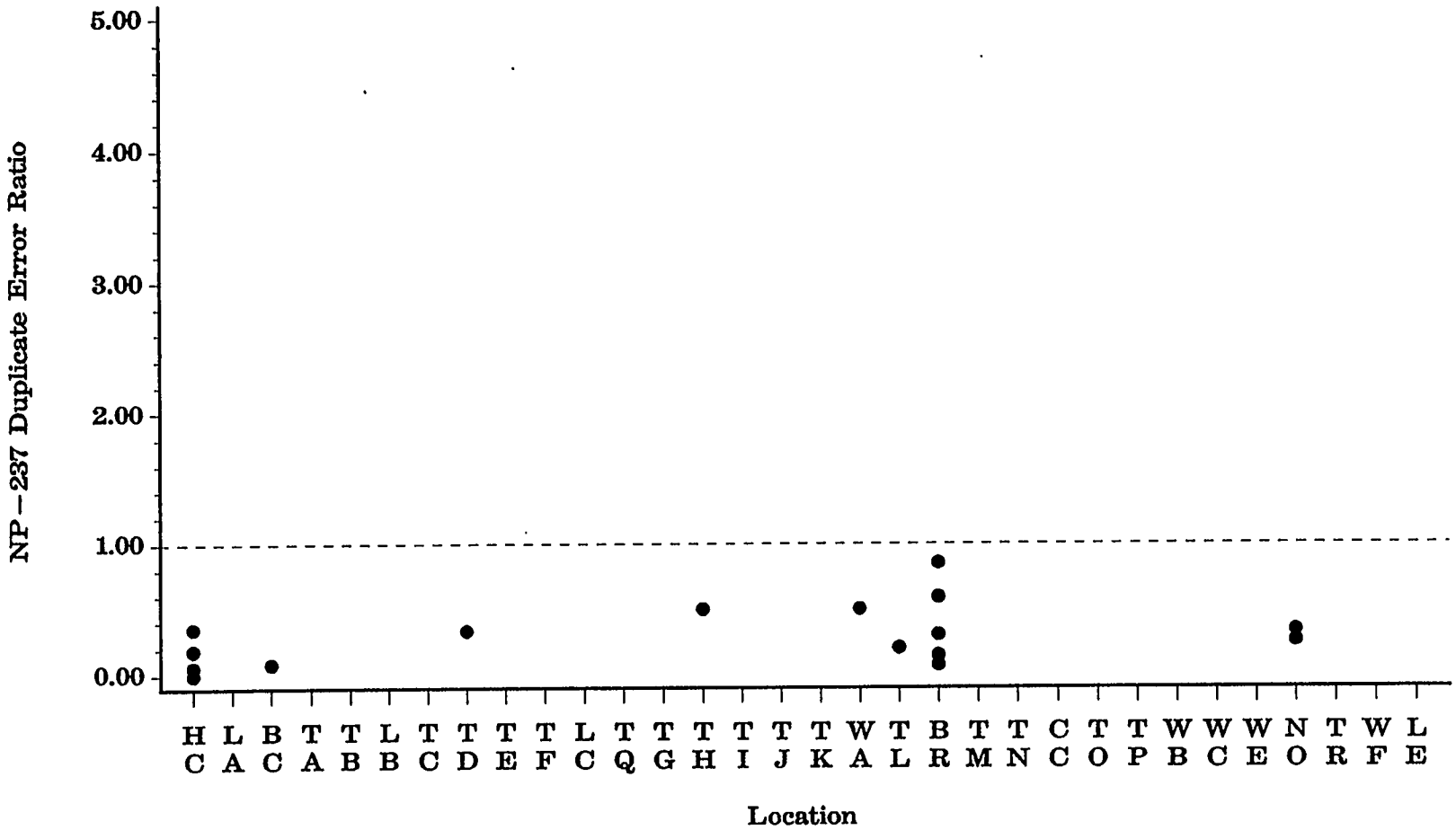


Fig. J.113. Phase 1A Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for NP-237 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

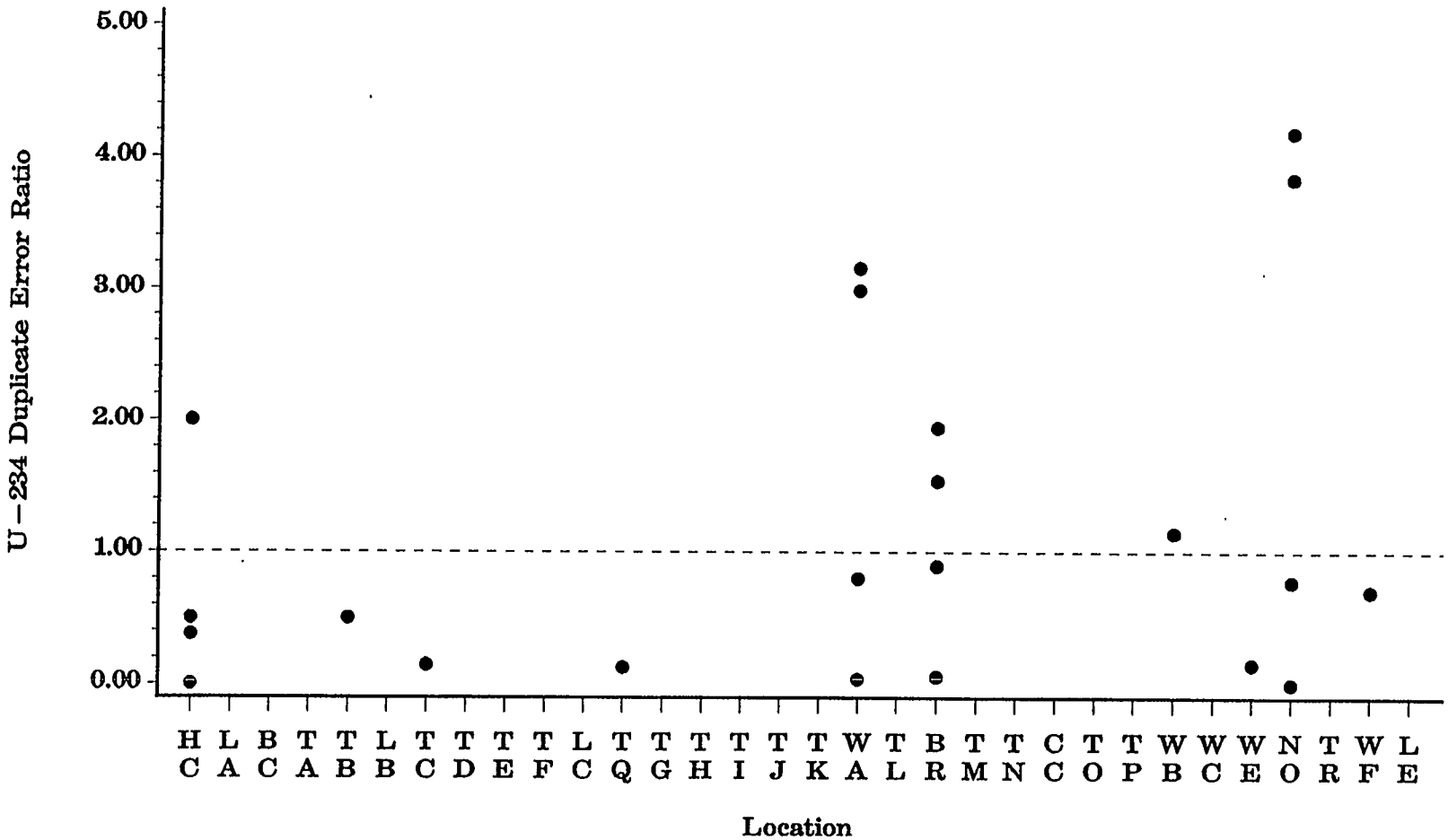


Fig. J.114. Phase 1A Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U−234 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

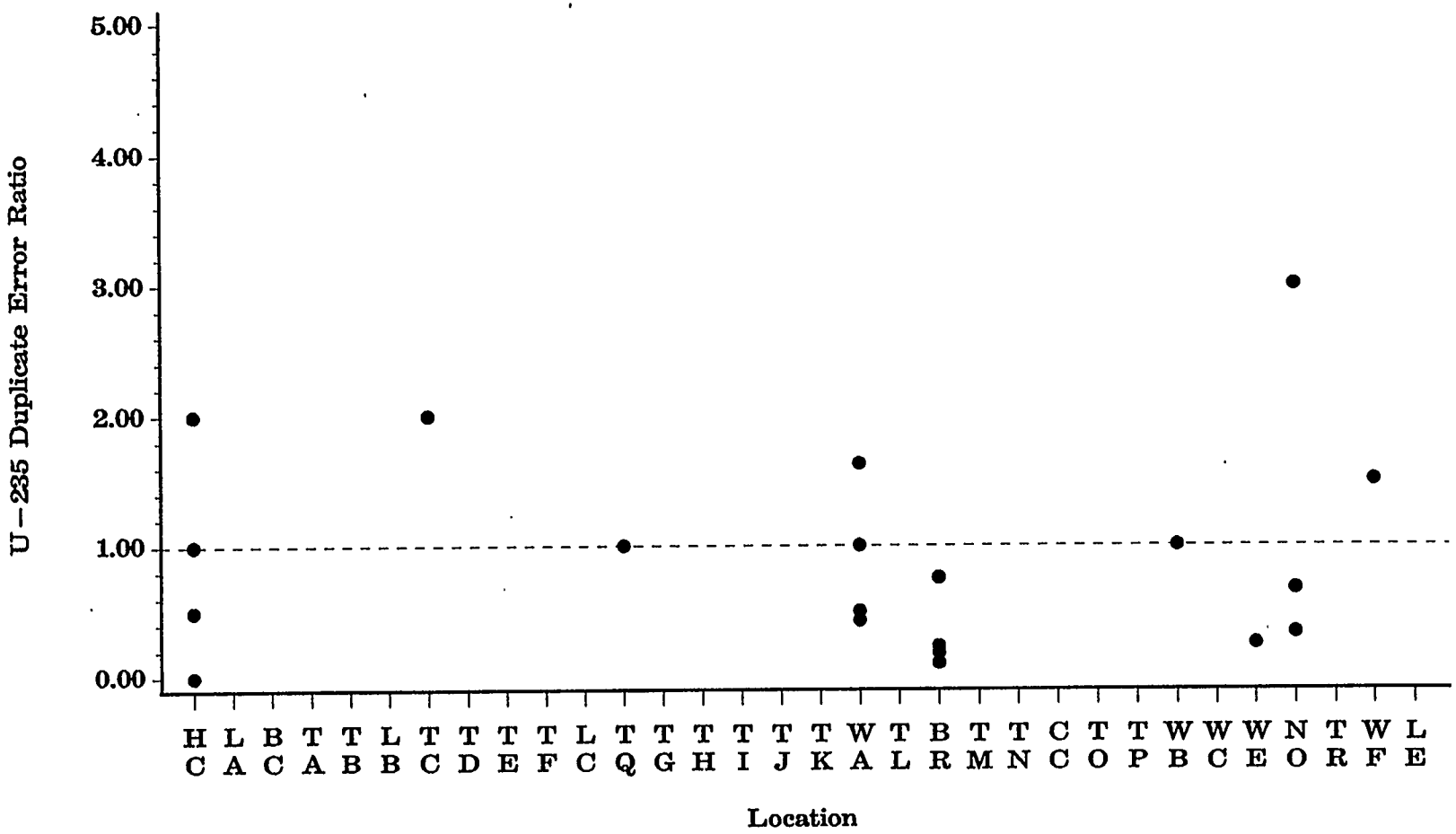


Fig. J.115. Phase 1A Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-235 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

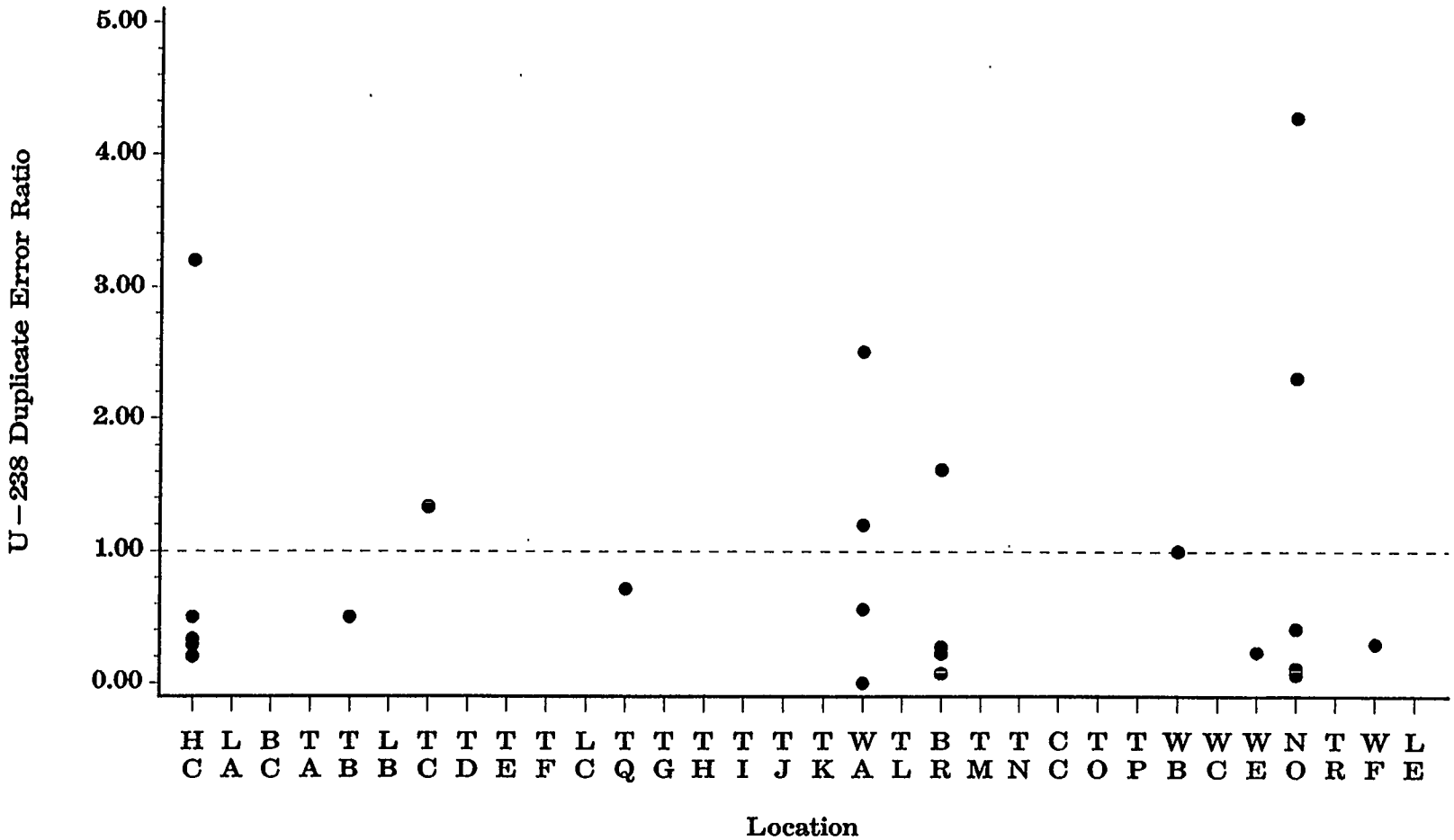


Fig. J.116. Phase 1A Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U−238 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

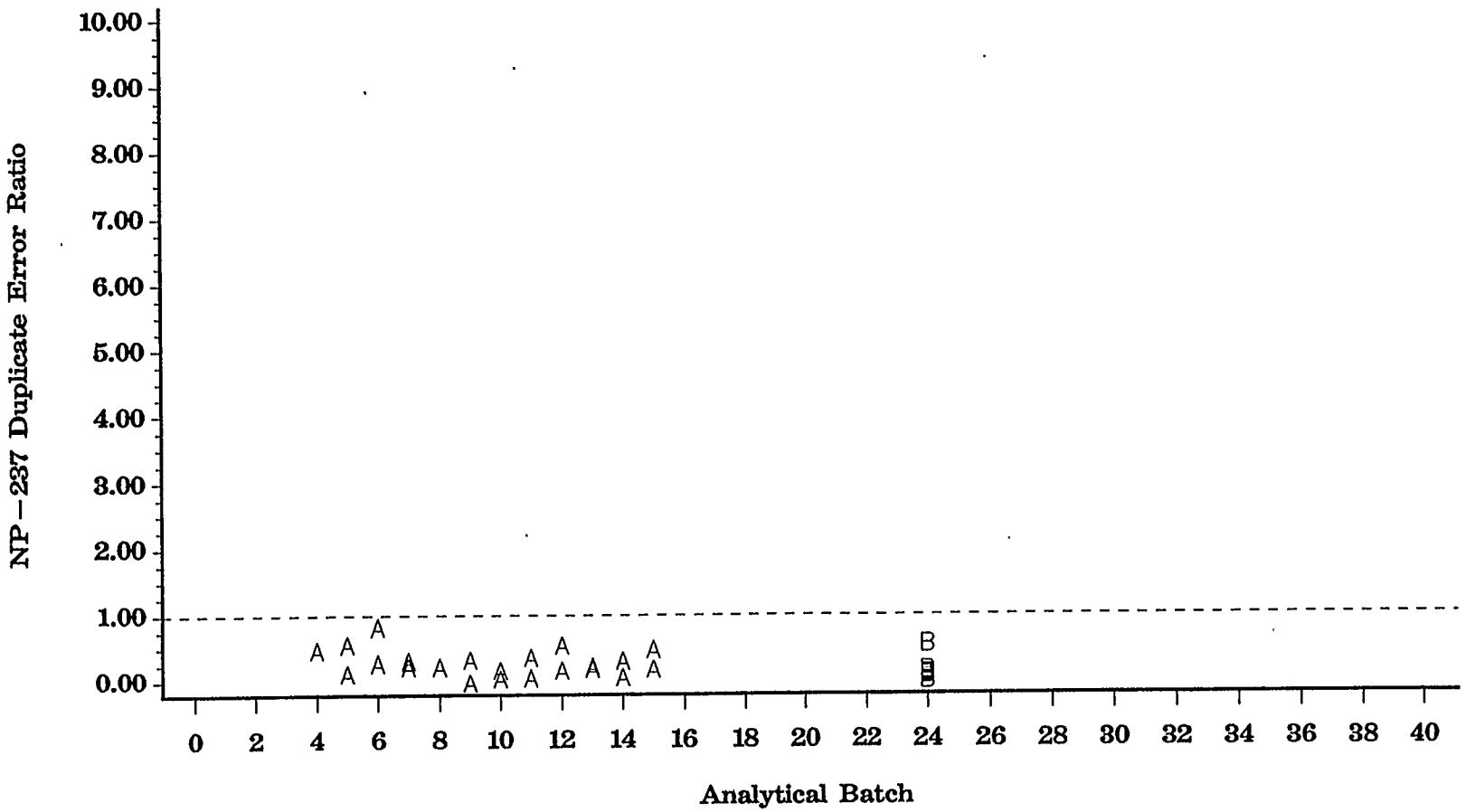


Fig. J.117. Phase 1A Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for NP-237 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

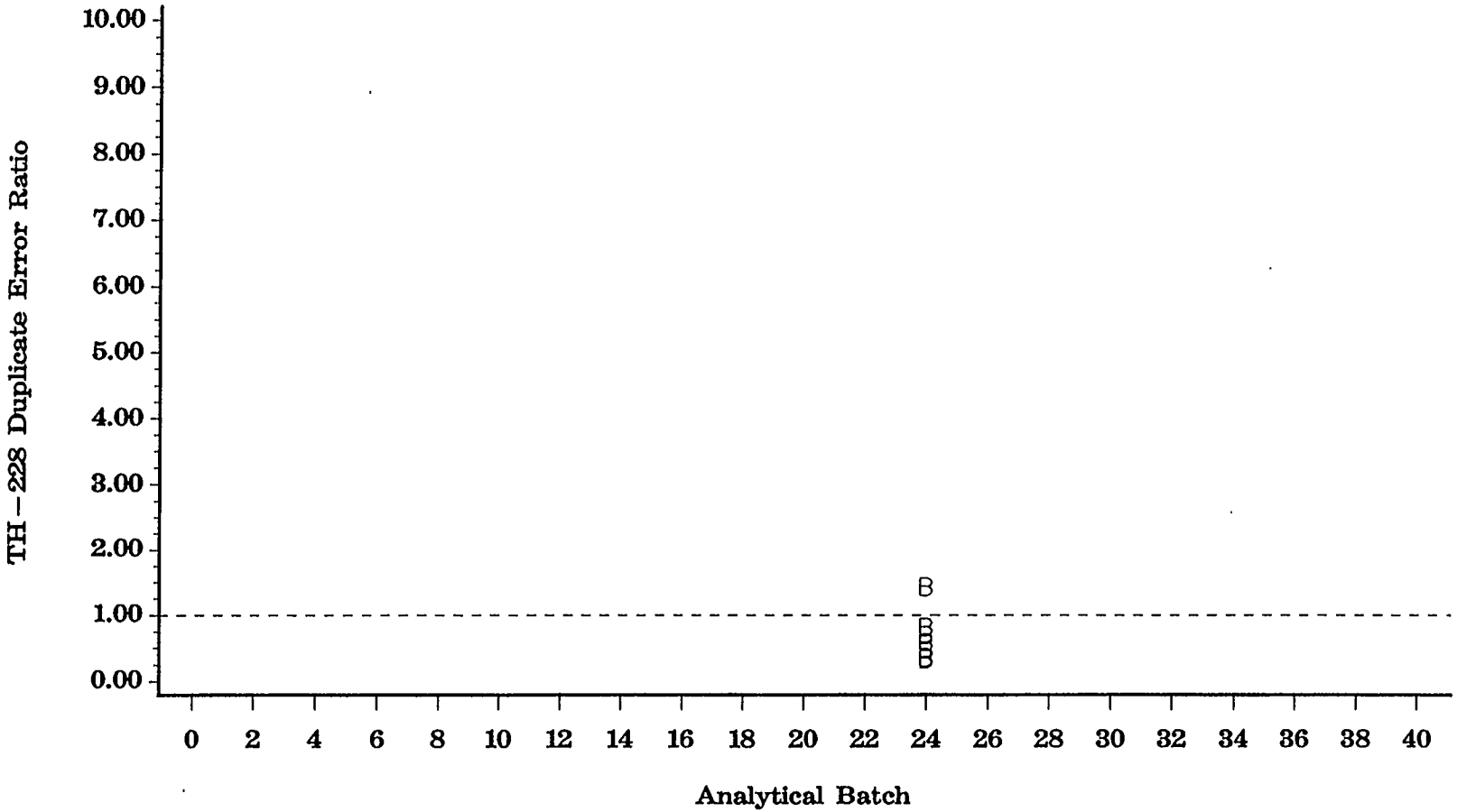


Fig. 3.118. Phase 1A Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for TH-228 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

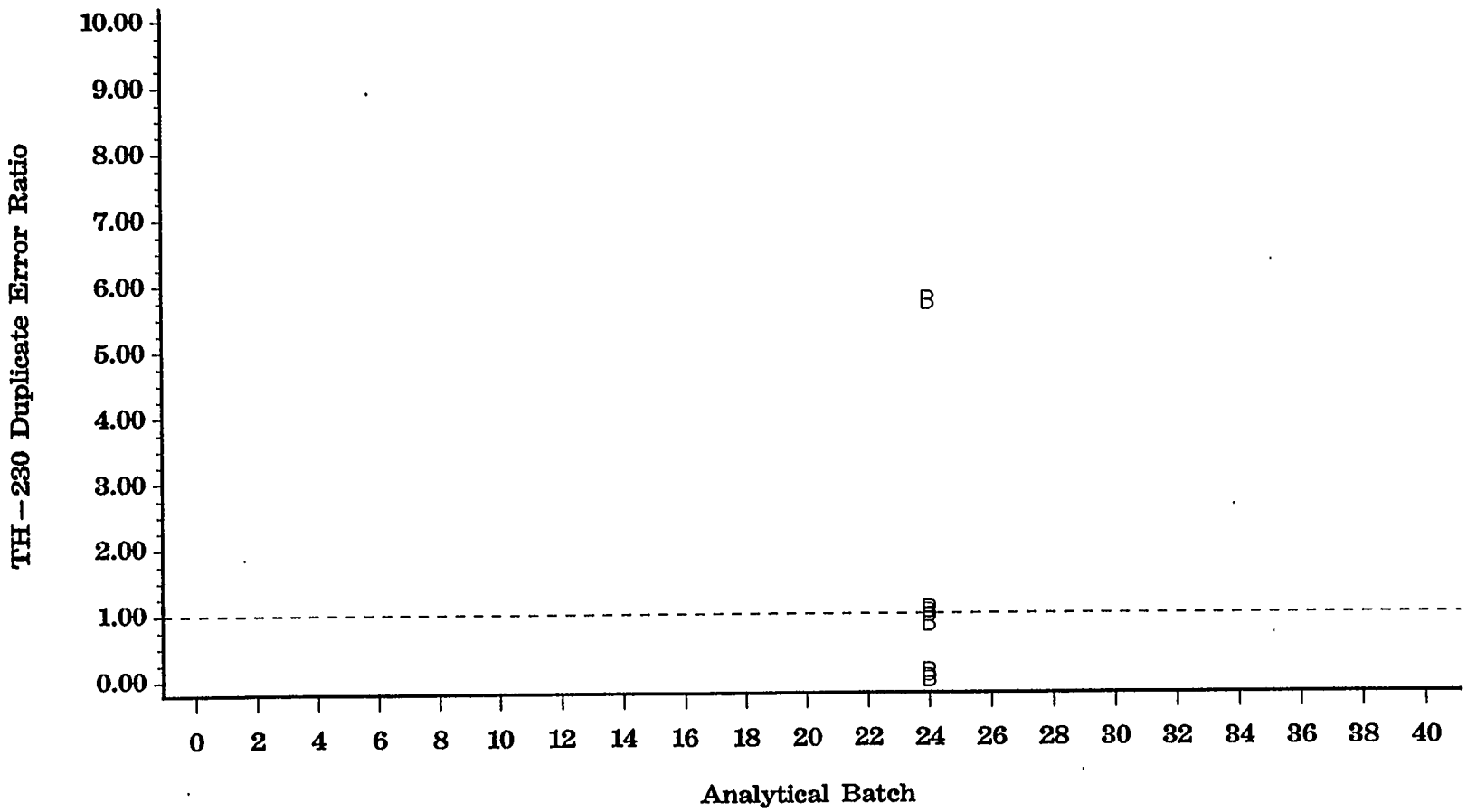


Fig. J.119. Phase 1B Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for TH-230 sample analyses. DER is calculated as follows |Sample Result - Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

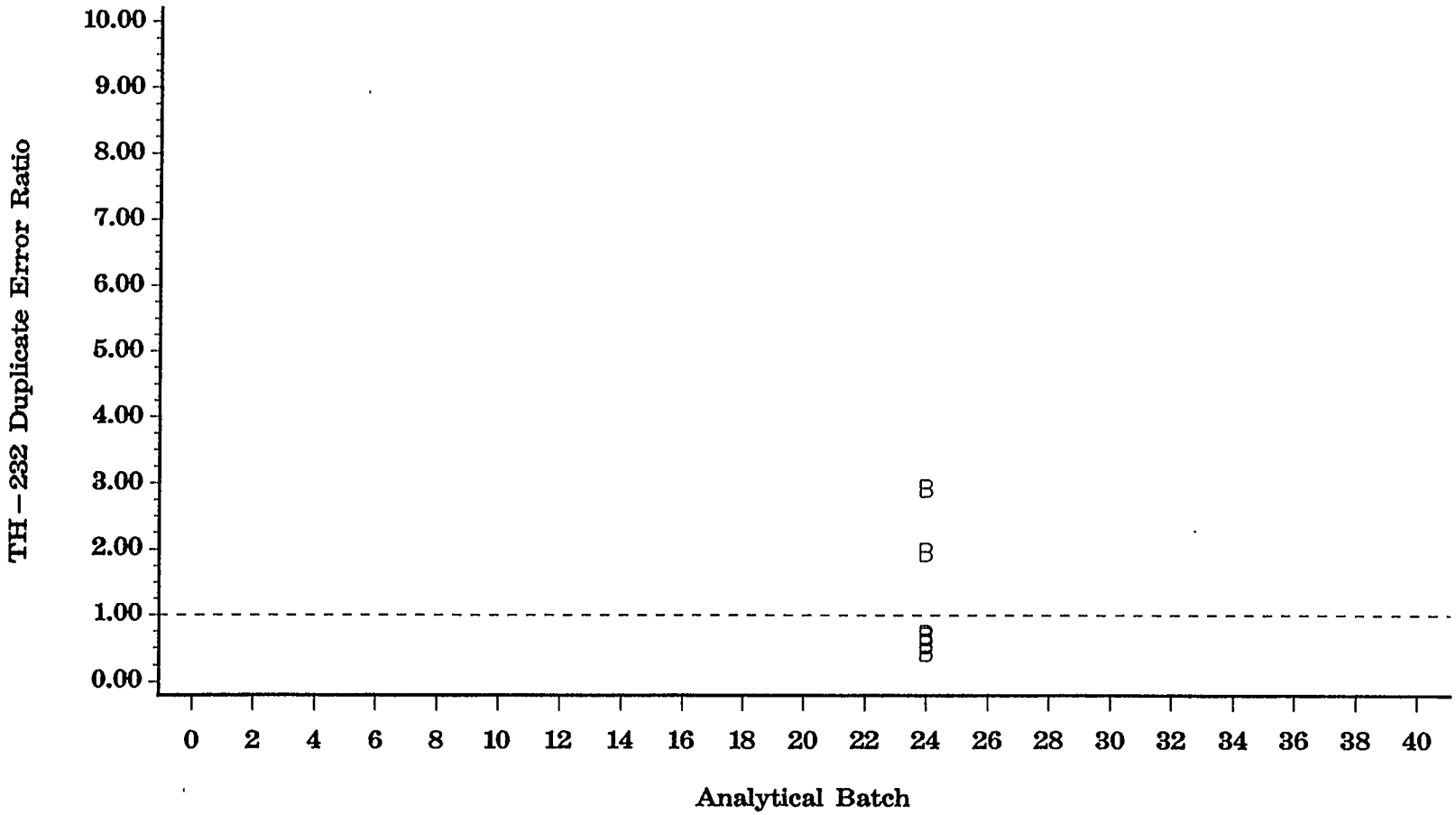


Fig. J.120., Phase 1B Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for TH-232 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

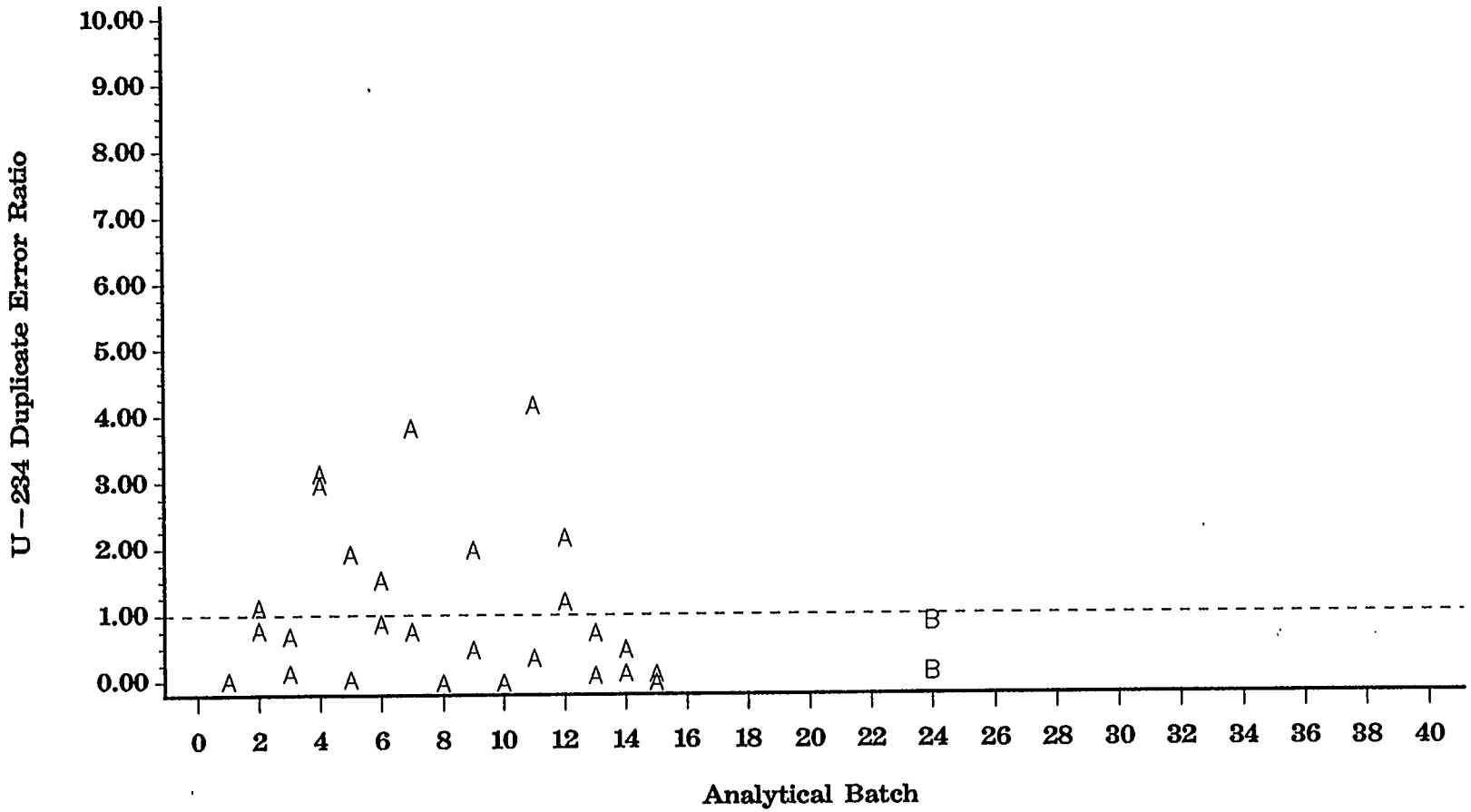


Fig. J.121. Phase 1A+1B Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-234 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

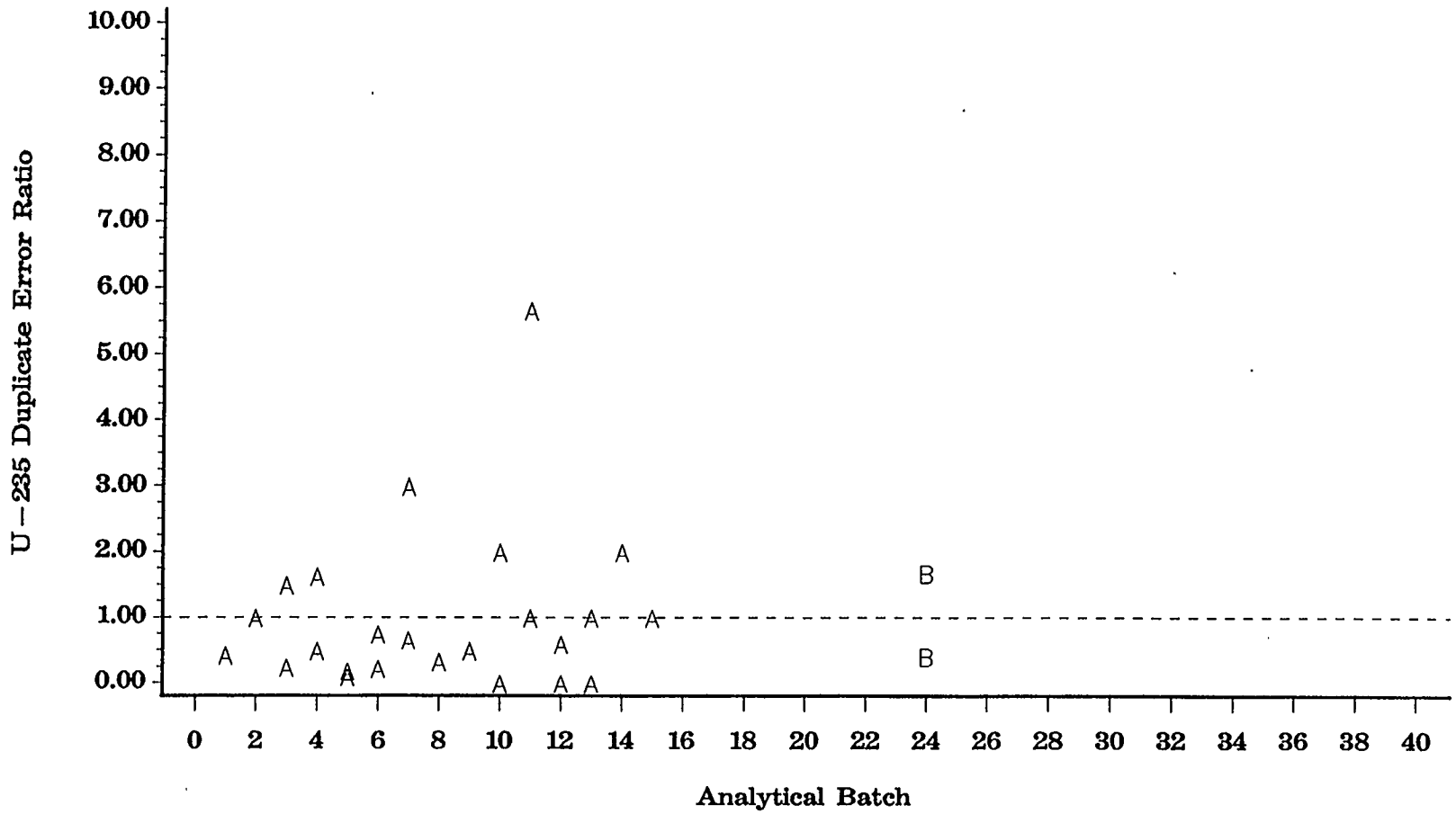


Fig. J.100. Phase 1A+1B Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U – 235 sample analyses. DER is calculated as follows |Sample Result – Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

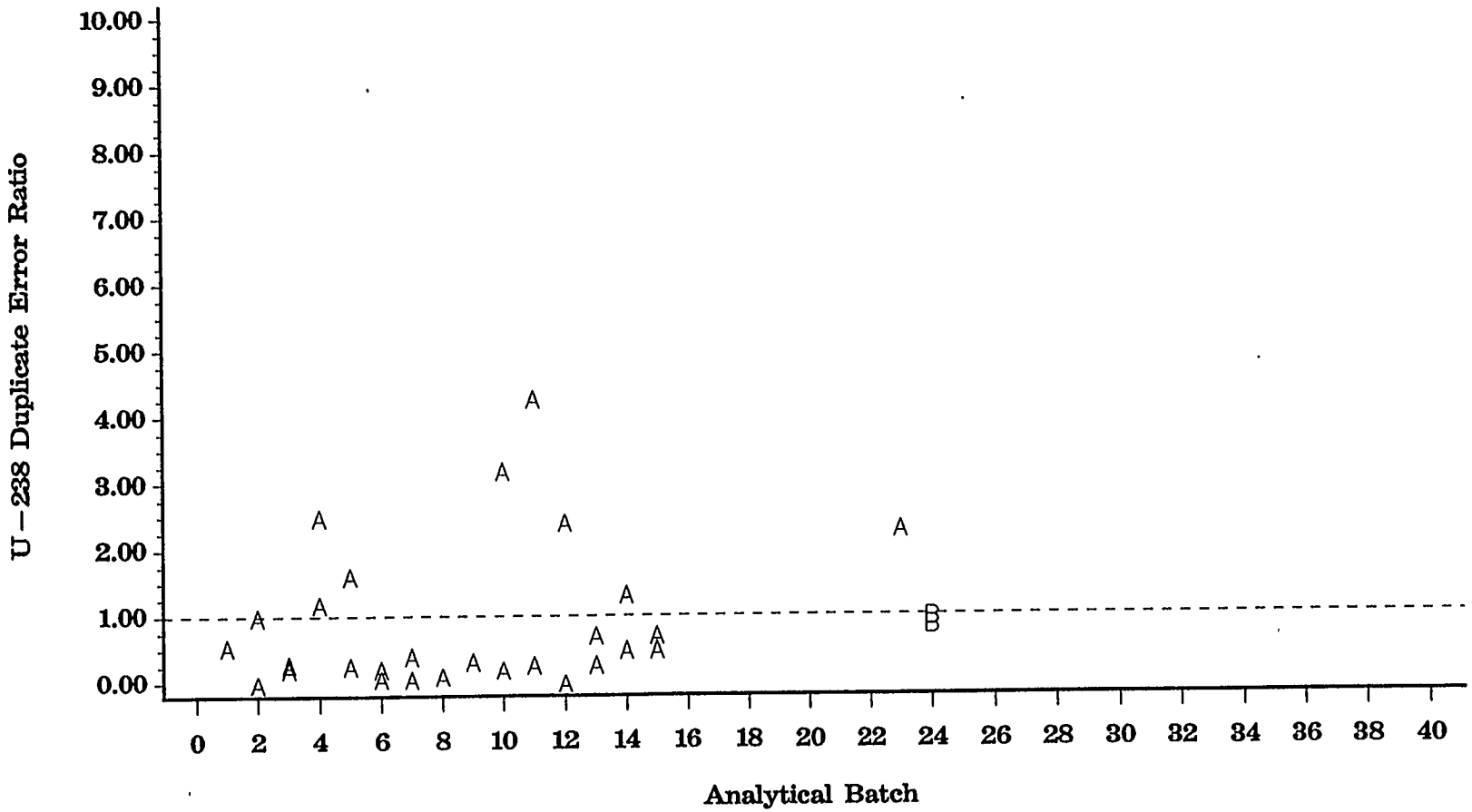


Fig. J.123. Phase 1A+1B Alpha Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-238 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

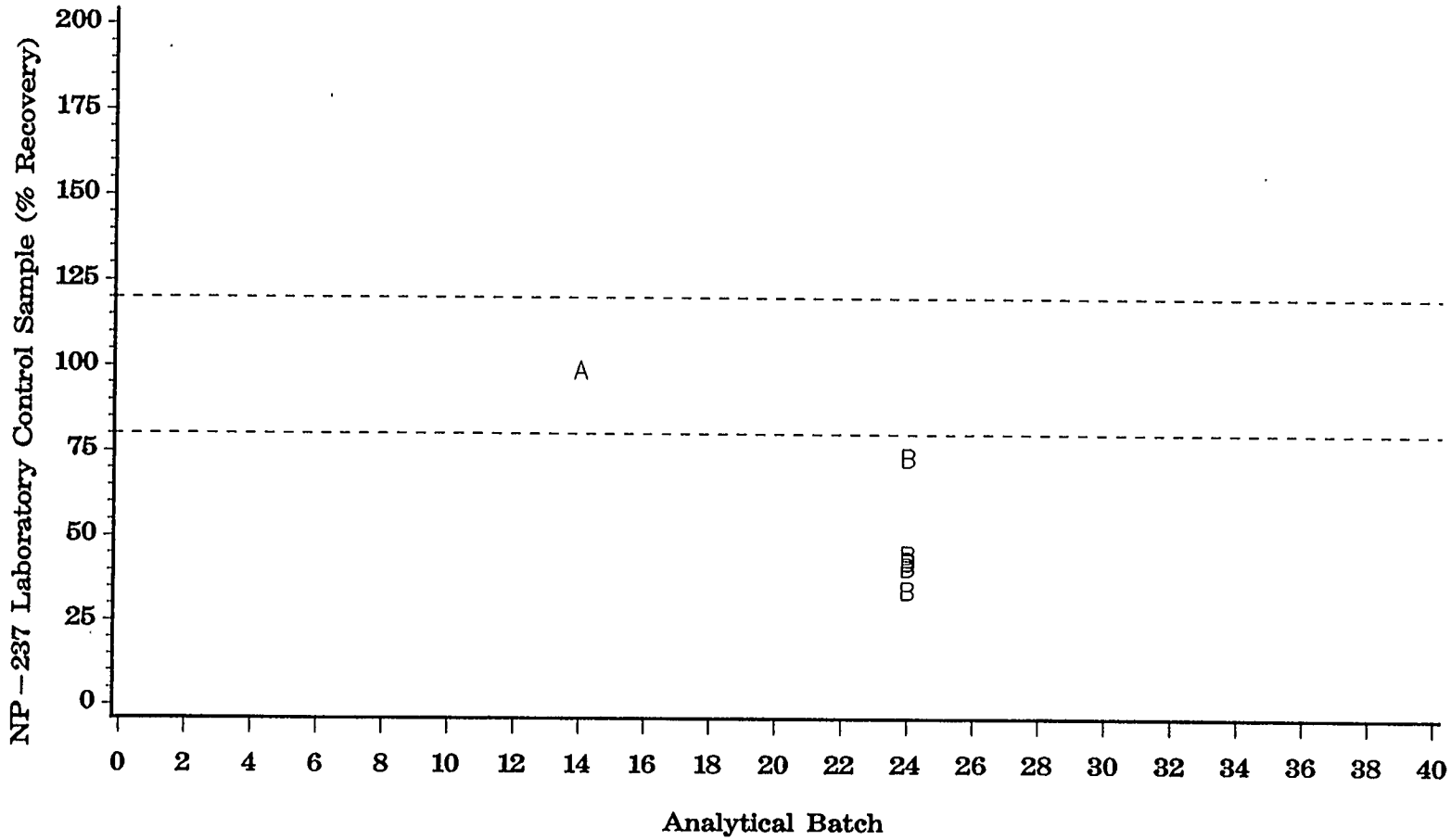


Fig. J.124. Phase 1A+1B Alpha Spec SOIL Laboratory Control Sample recoveries for NP-237 sample analyses.

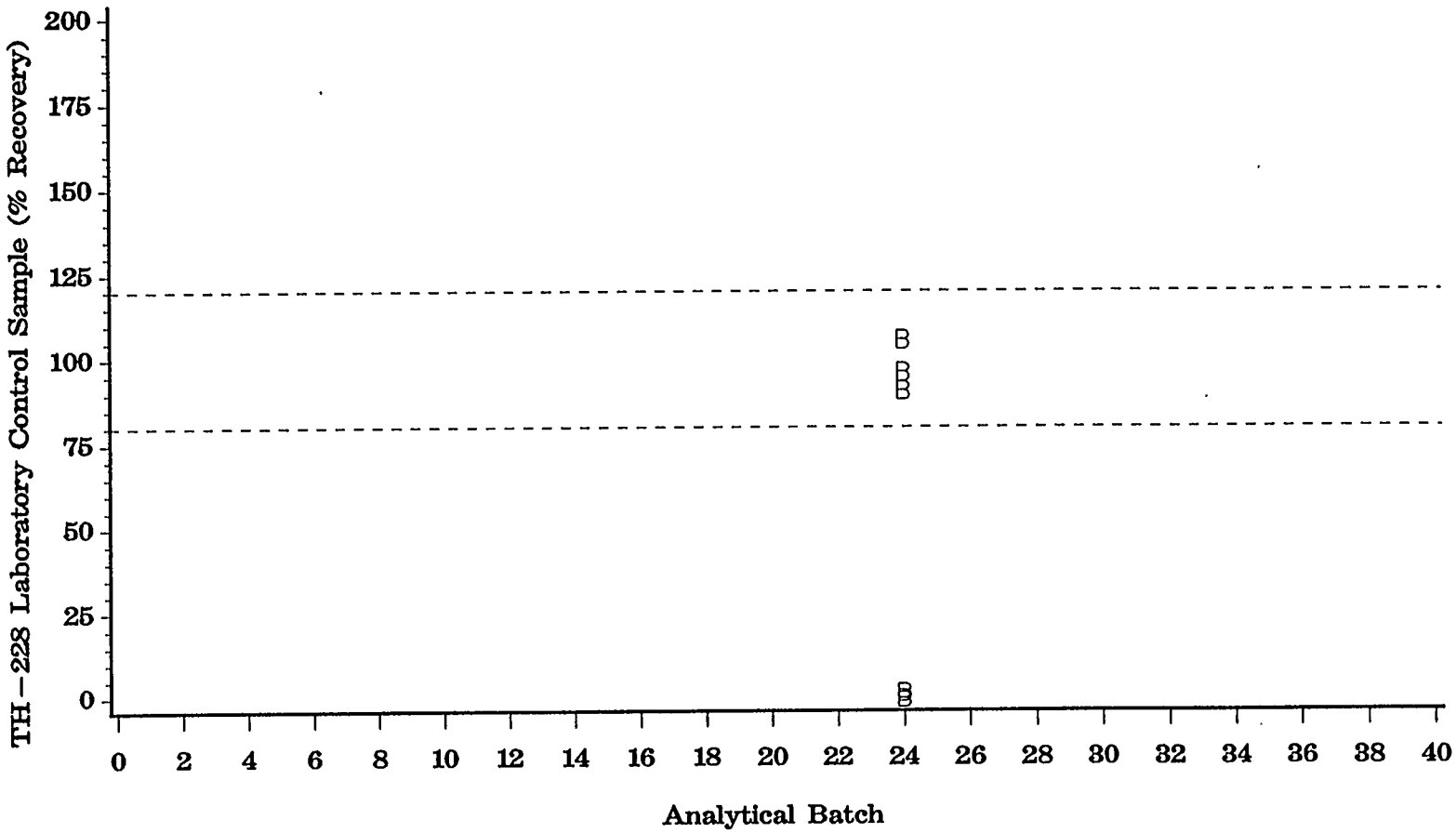


Fig. J.125. Phase 1B Alpha Spec SOIL Laboratory Control Sample recoveries for TH-228 sample analyses.

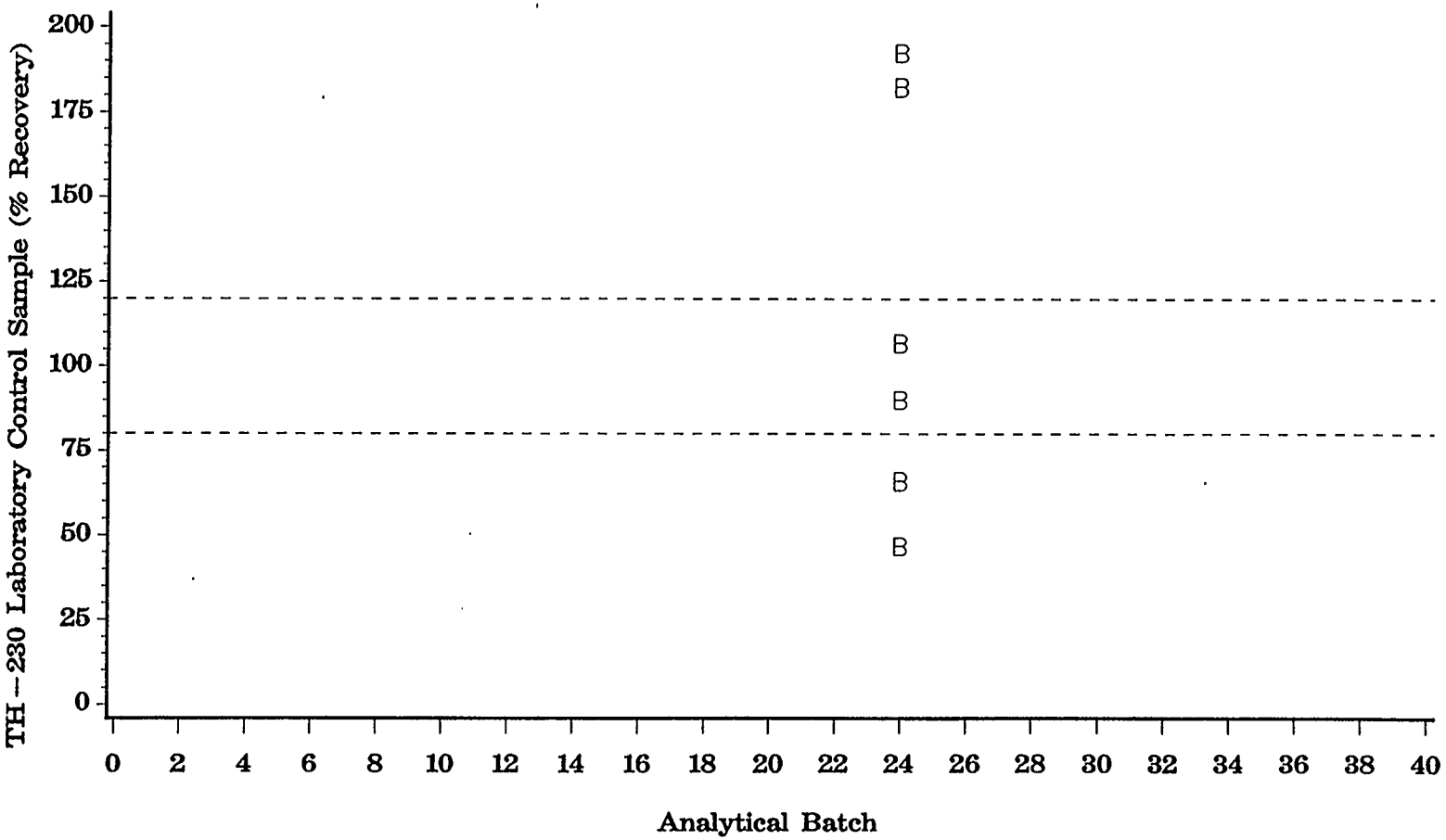


Fig. J.126. Phase 1B Alpha Spec SOIL Laboratory Control Sample recoveries for TH-230 sample analyses.

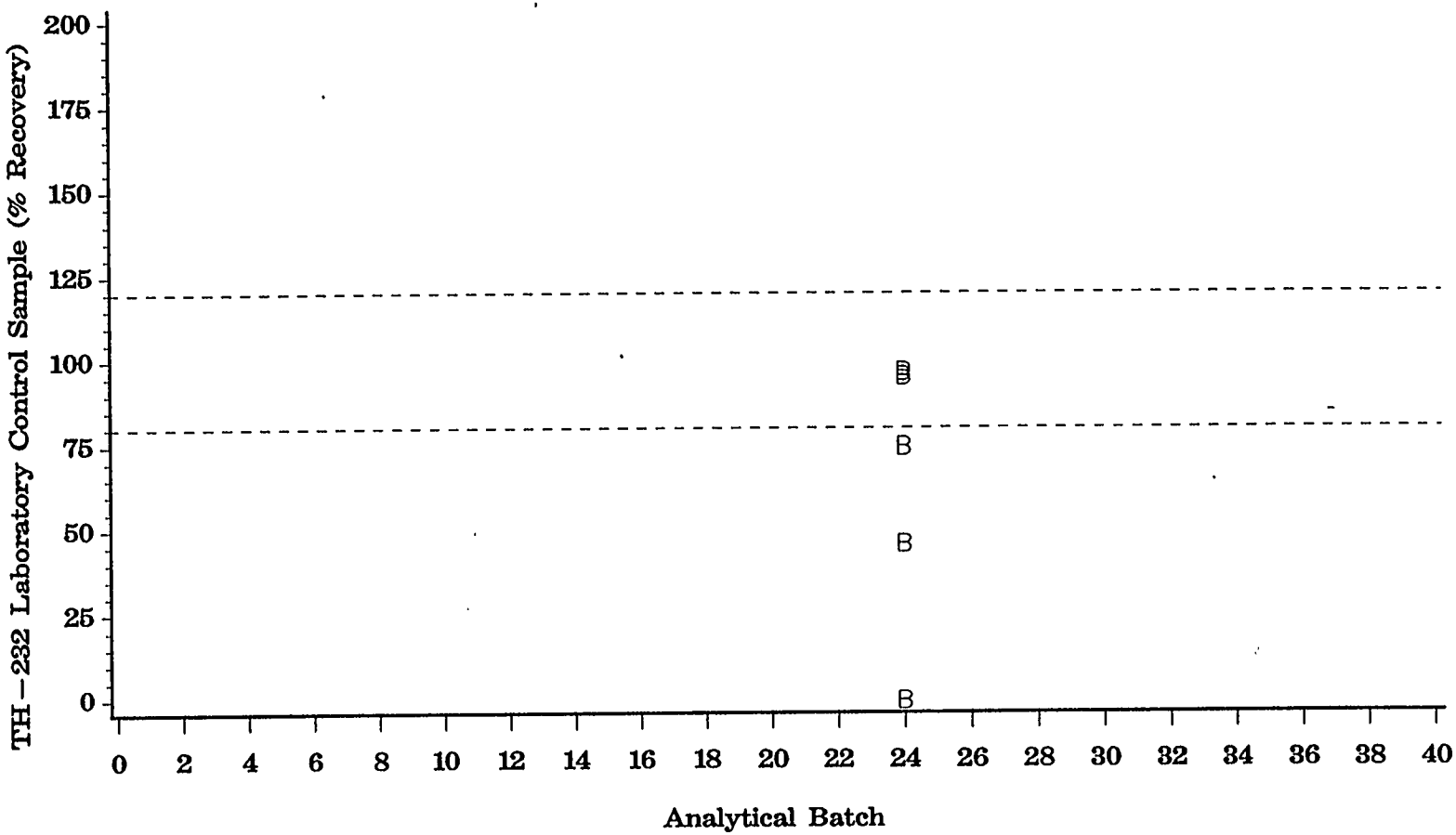


Fig.J.127. Phase 1B Alpha Spec SOIL Laboratory Control Sample recoveries for TH-232 sample analyses.

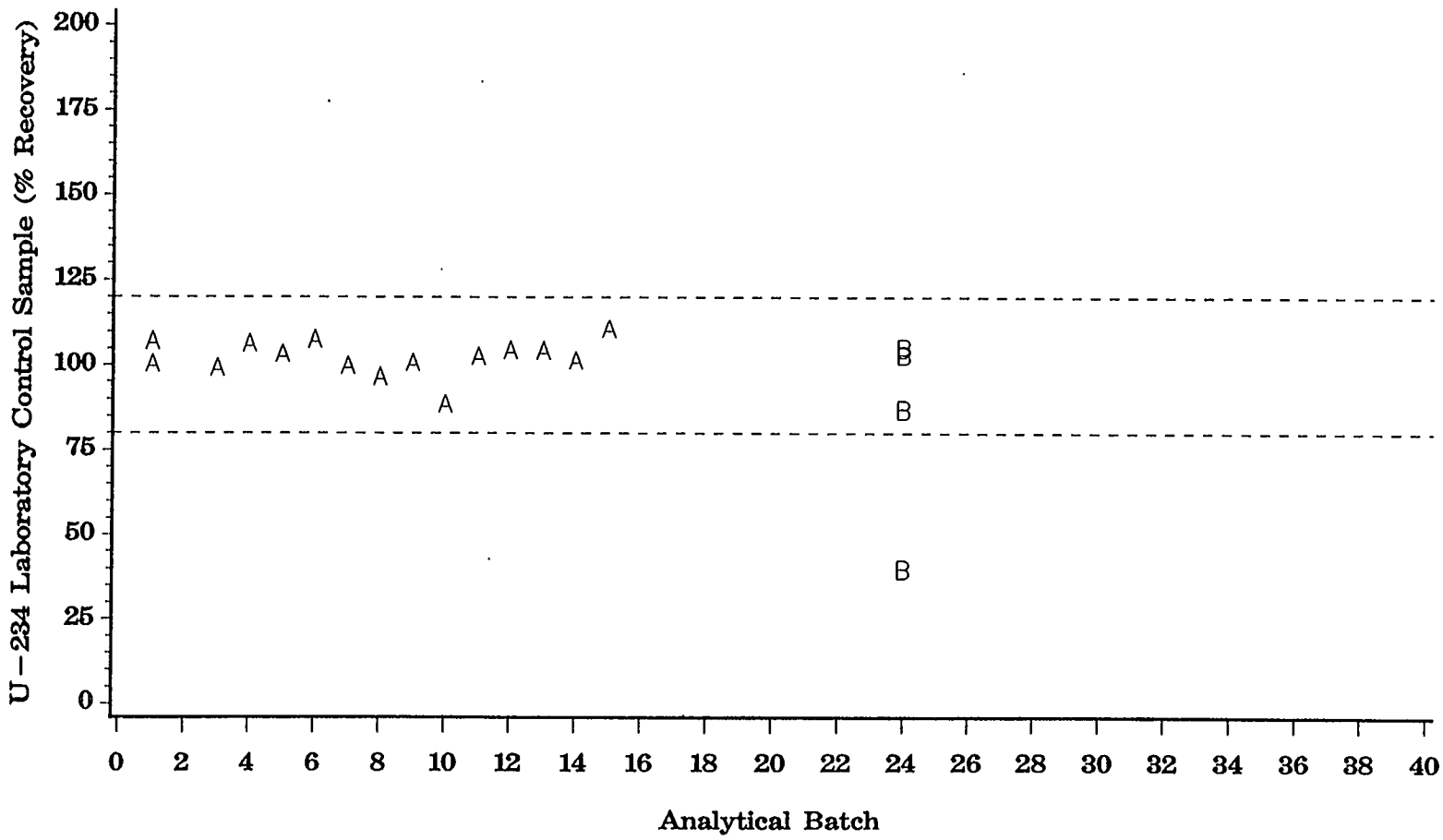


Fig. J.128. Phase 1A+1B Alpha Spec SOIL Laboratory Control Sample recoveries for U-234 sample analyses.

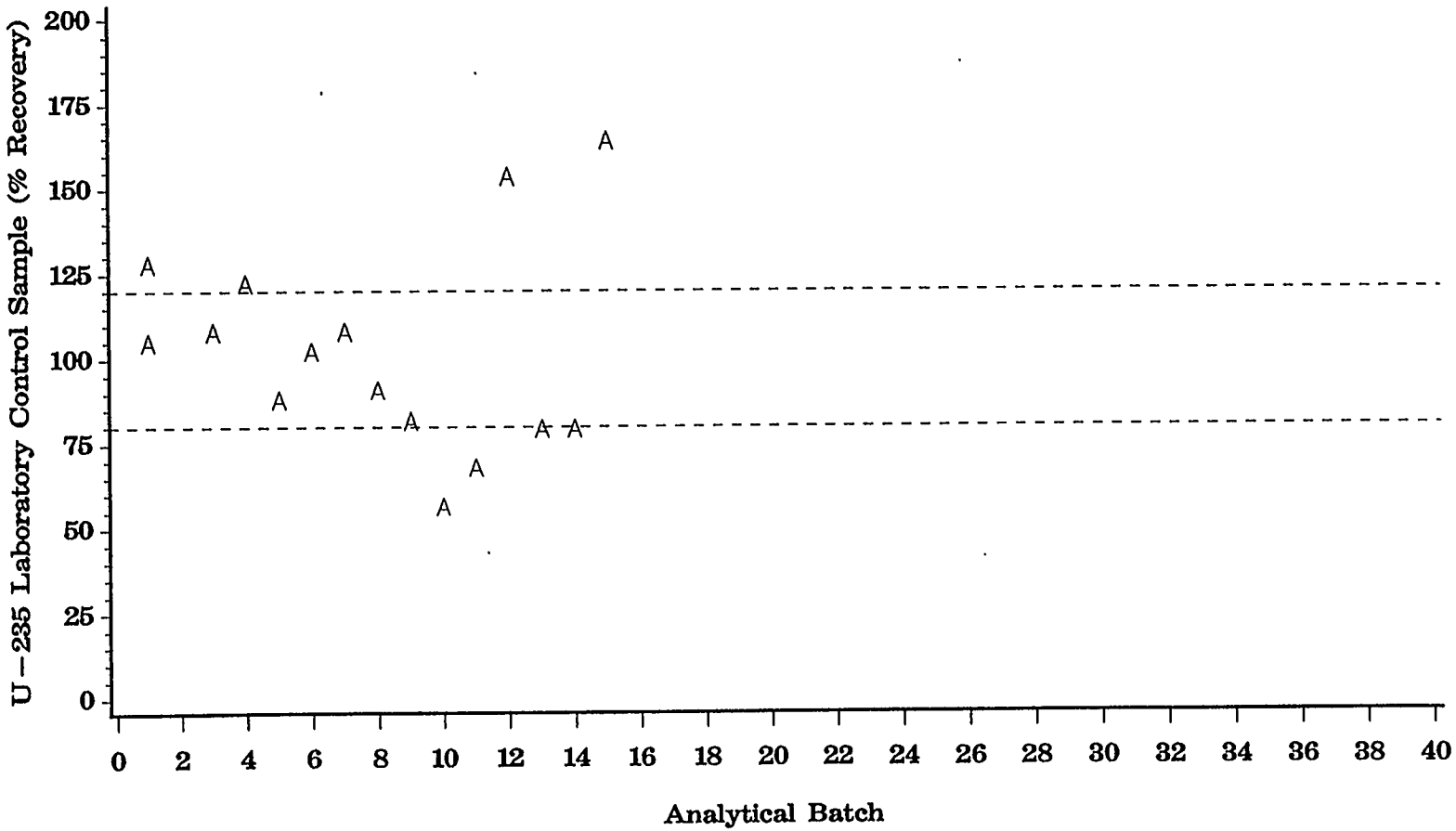


Fig. J.129. Phase 1A Alpha Spec SOIL Laboratory Control Sample recoveries for U-235 sample analyses.

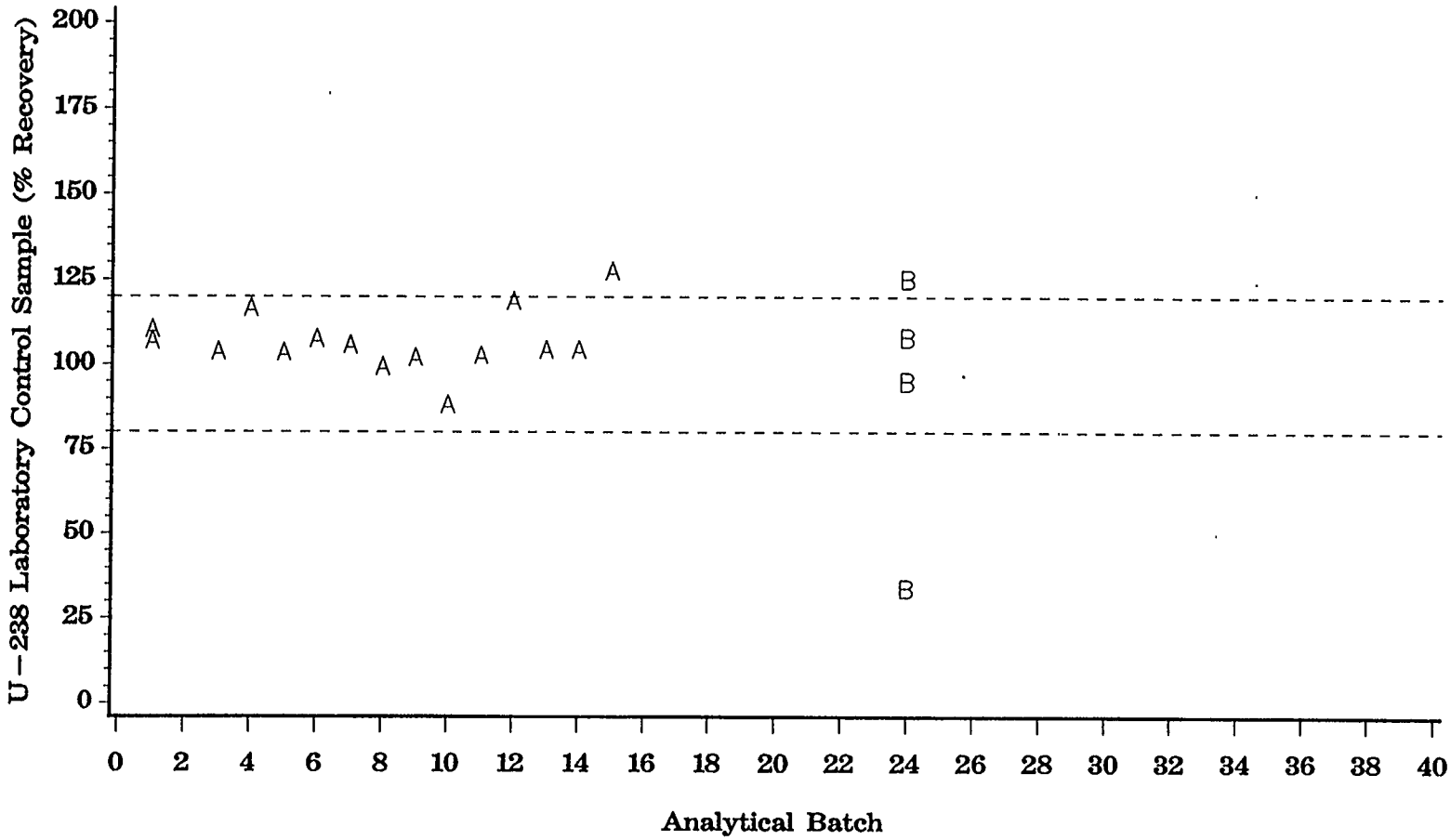


Fig. J.130. Phase 1A+1B Alpha Spec SOIL Laboratory Control Sample recoveries for U-238 sample analyses.

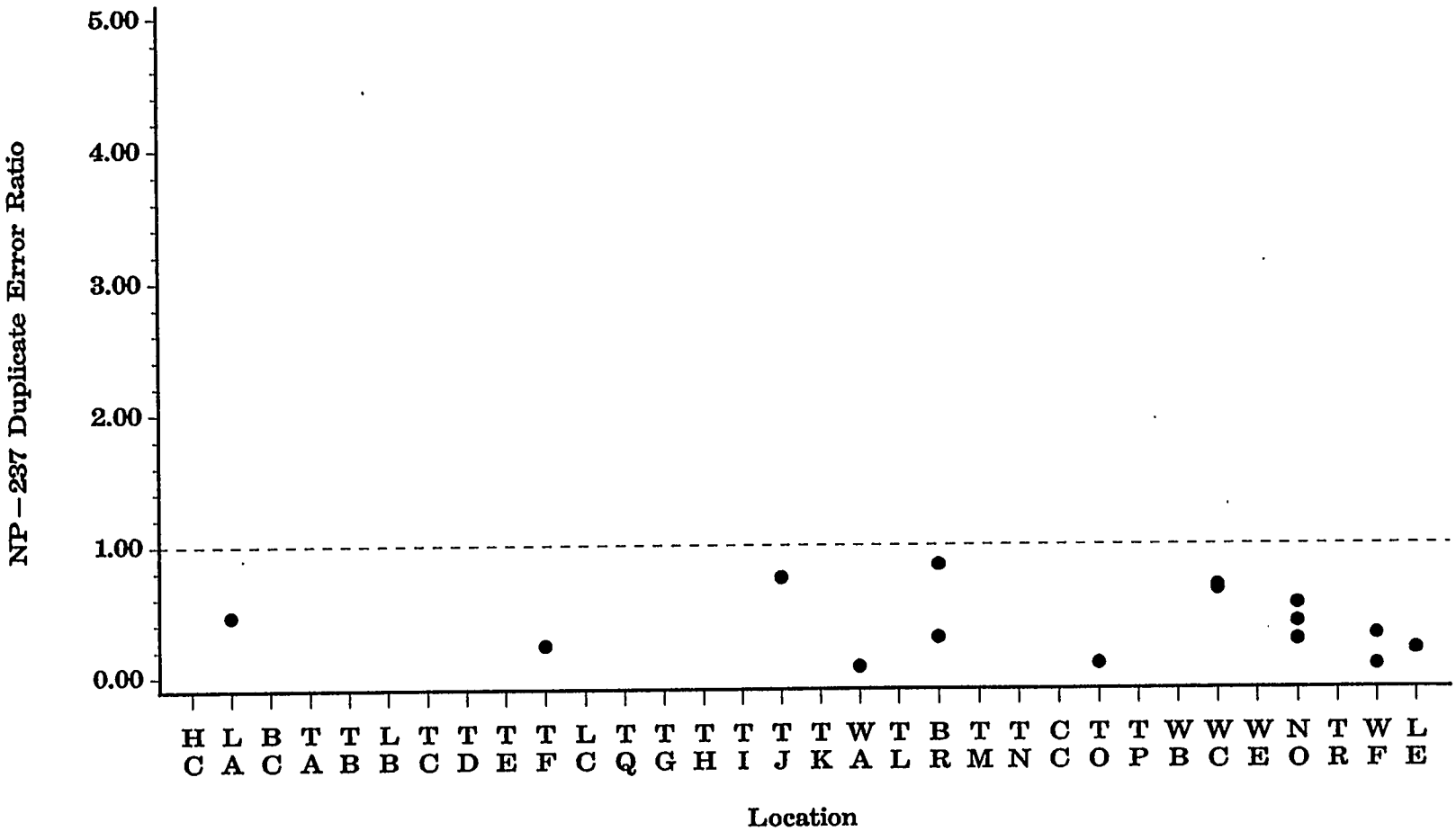


Fig. J.131. Phase 1A Alpha Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for NP-237 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

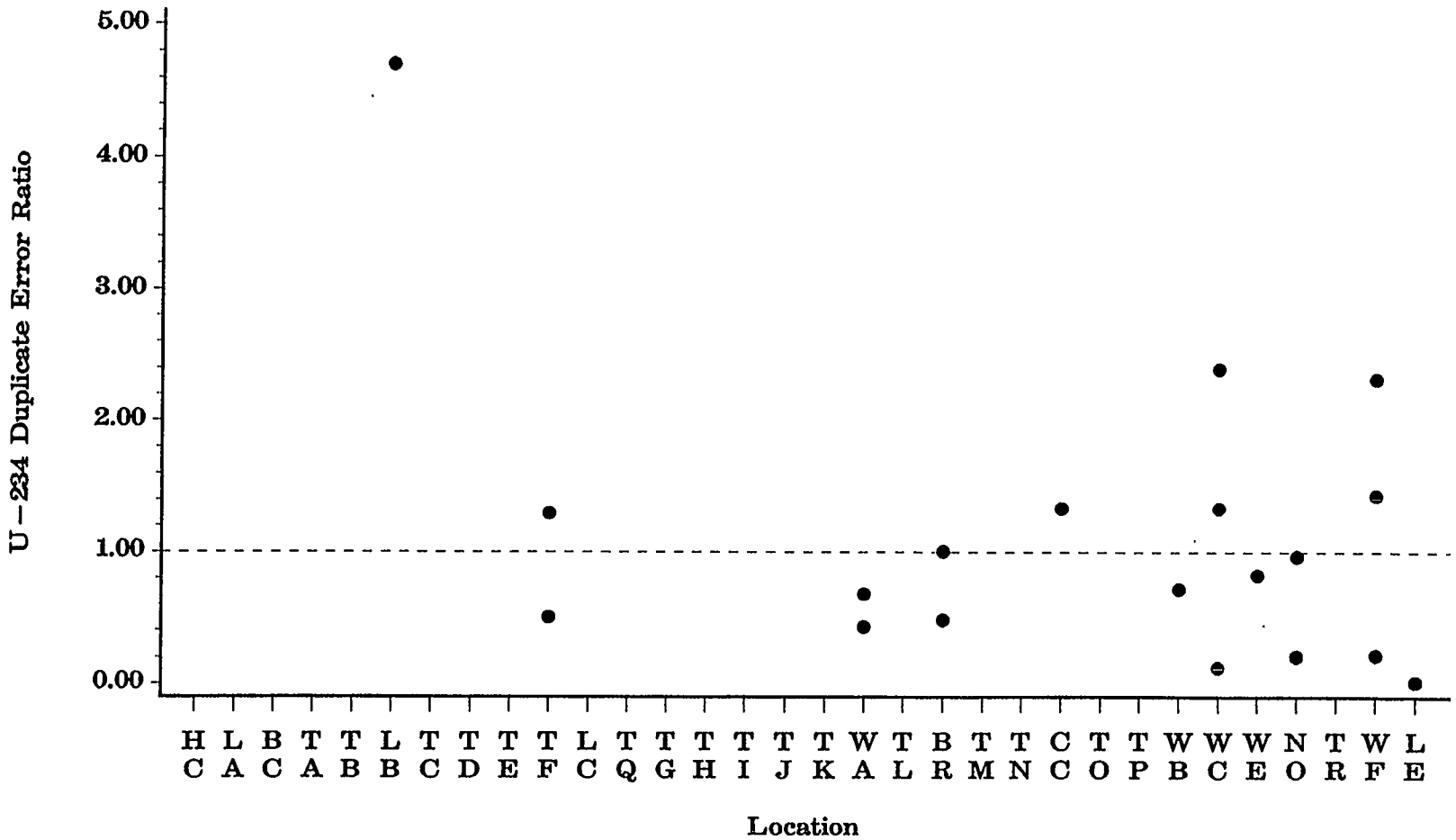


Fig.J.132. Phase 1A Alpha Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-234 sample analyses. DER is calculated as follows |Sample Result - Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

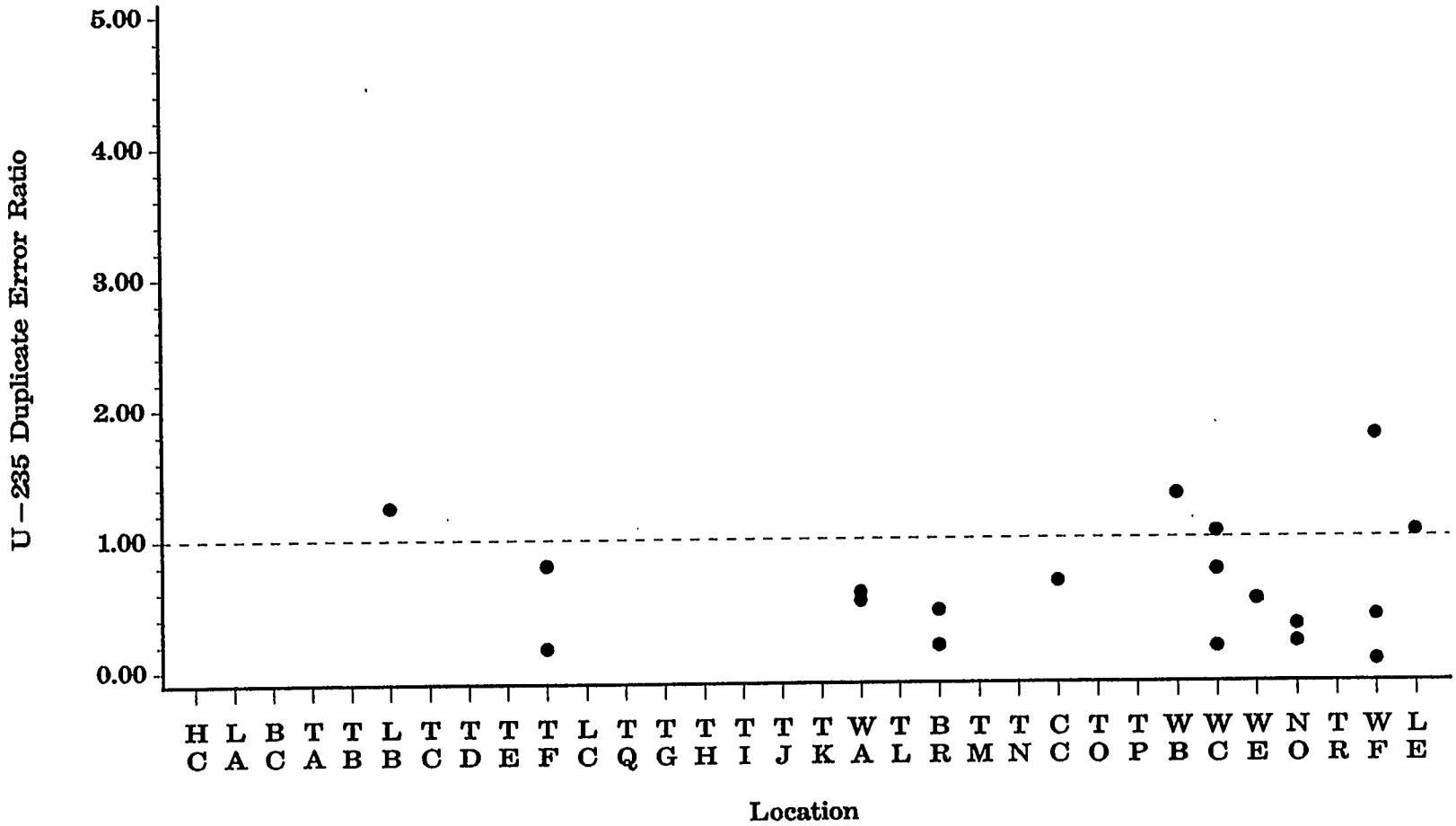


Fig. J.133. Phase 1A Alpha Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-235 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

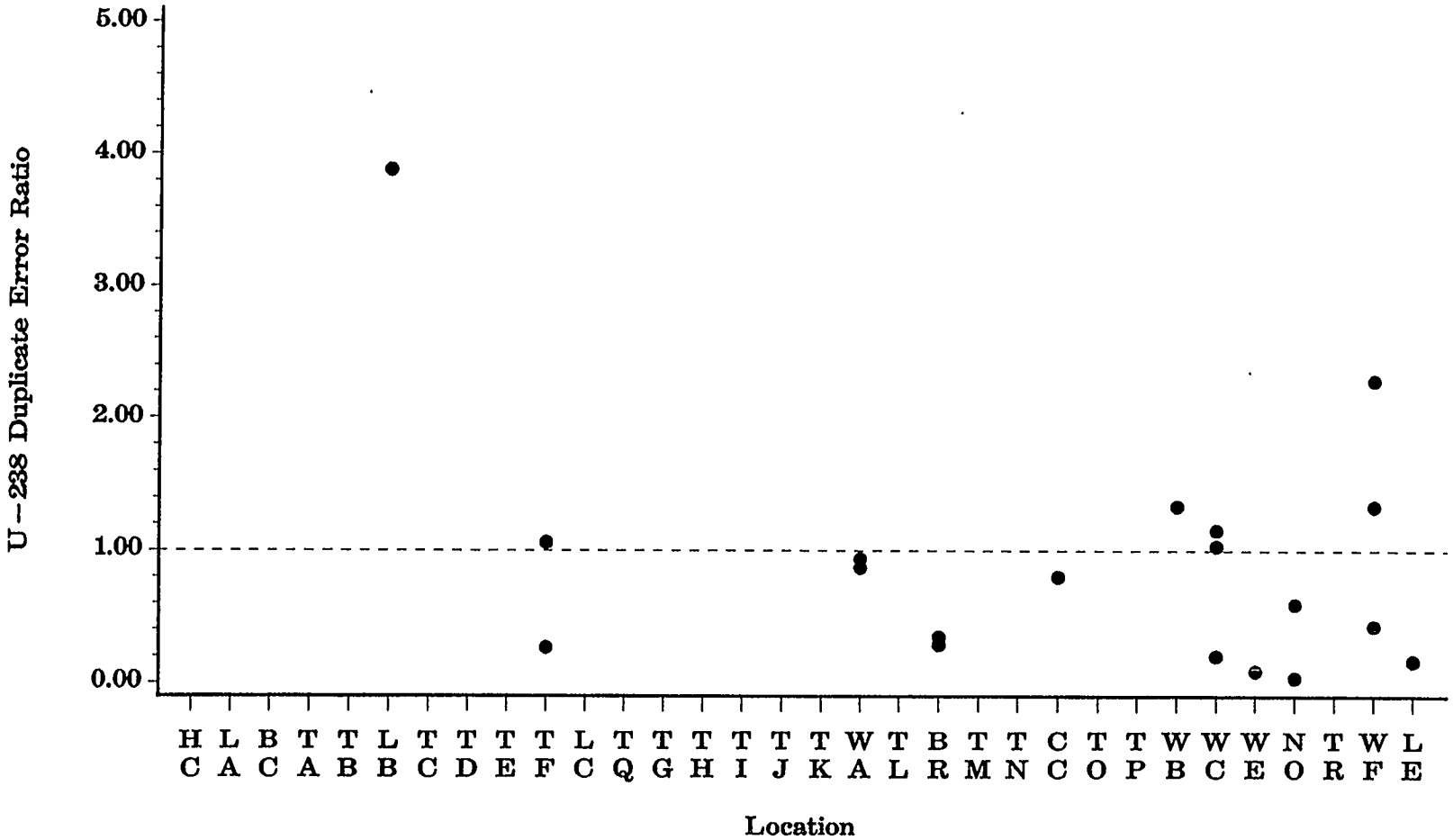


Fig. J.134 Phase 1A Alpha Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-238 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

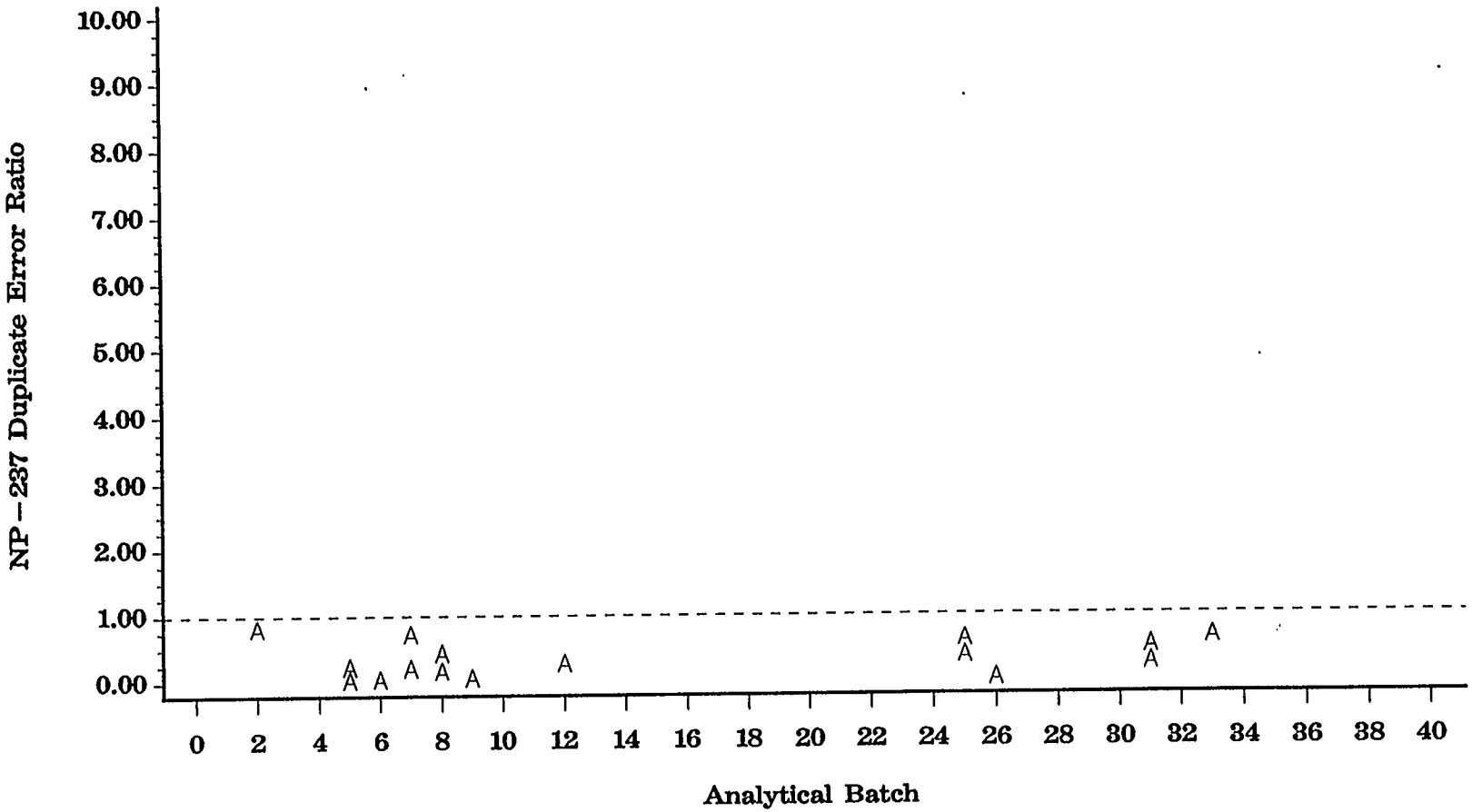


Fig. J.135. Phase 1A Alpha Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for NP-237 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

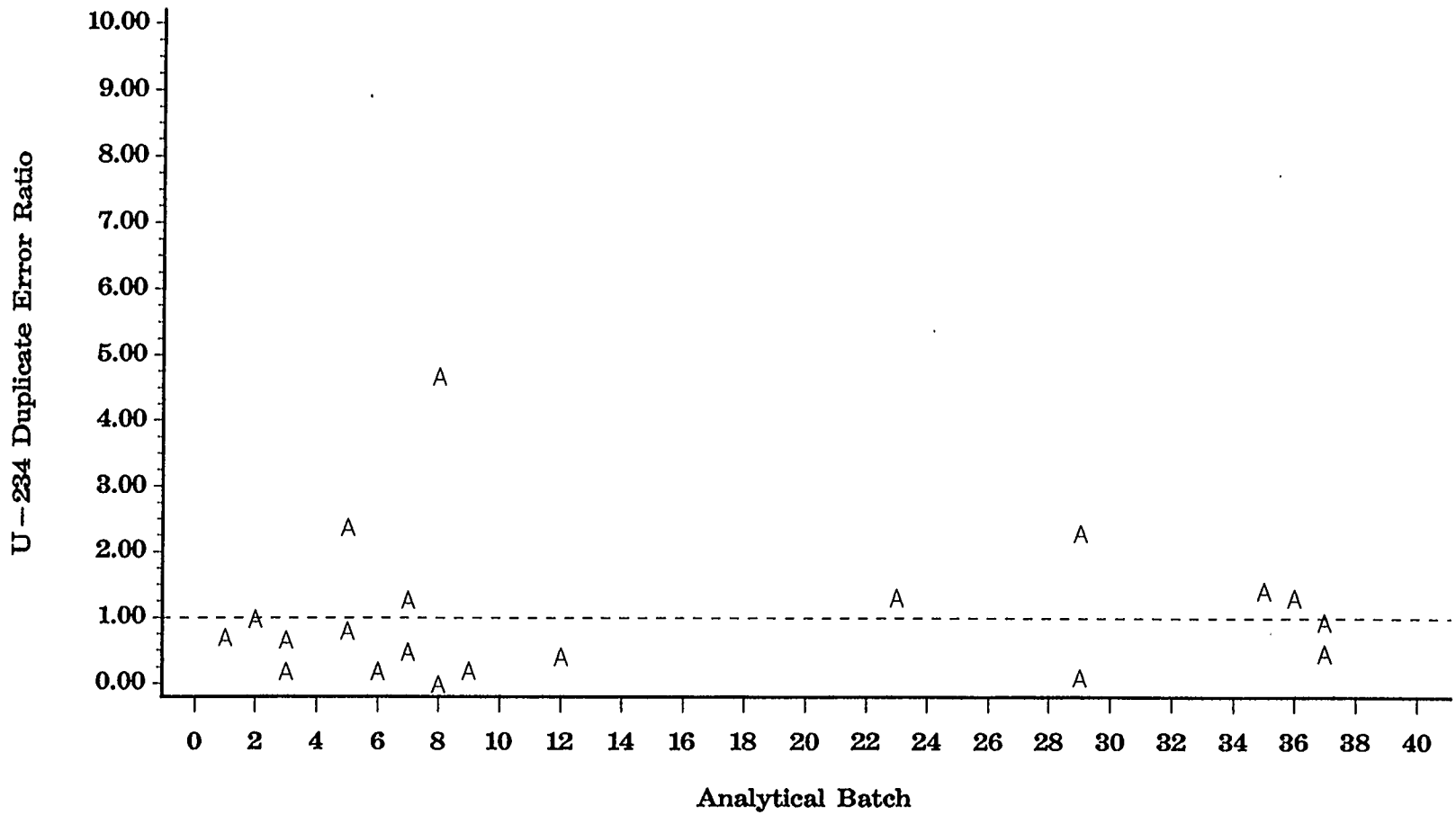


Fig. J.136: Phase 1A Alpha Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-234 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

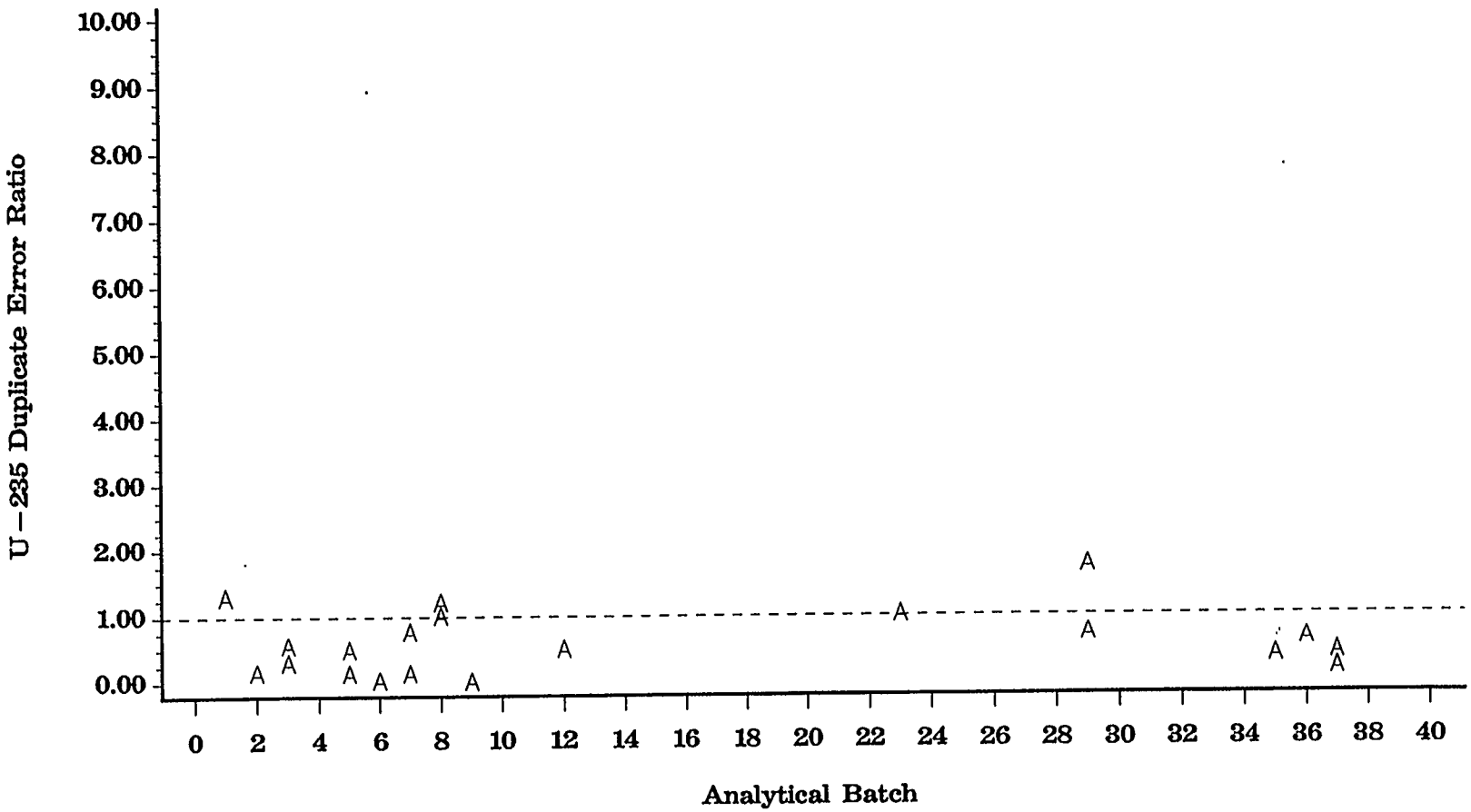


Fig. J.137. Phase 1A Alpha Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-235 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

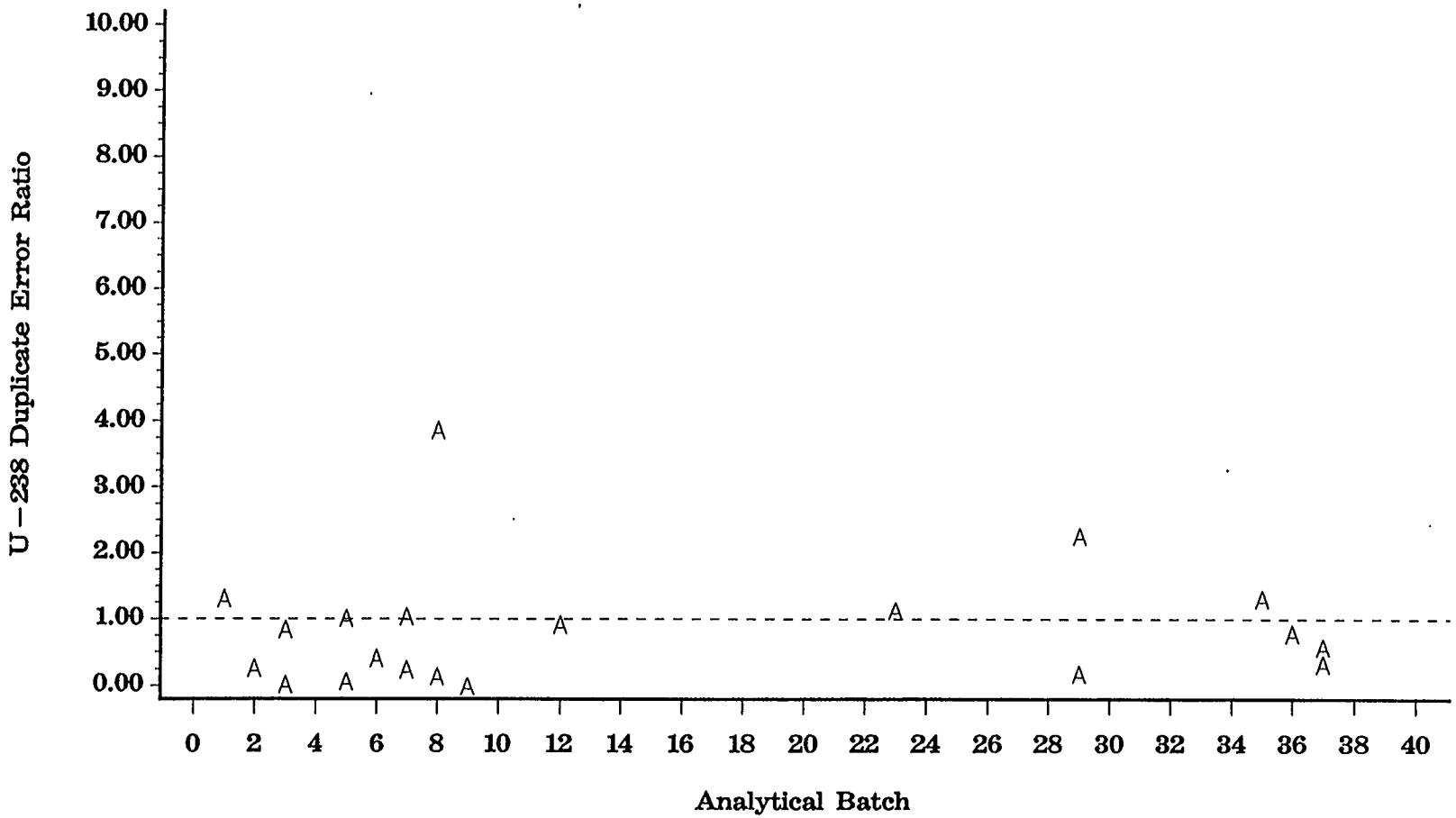


Fig. J.138. Phase 1A Alpha Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for U-238 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

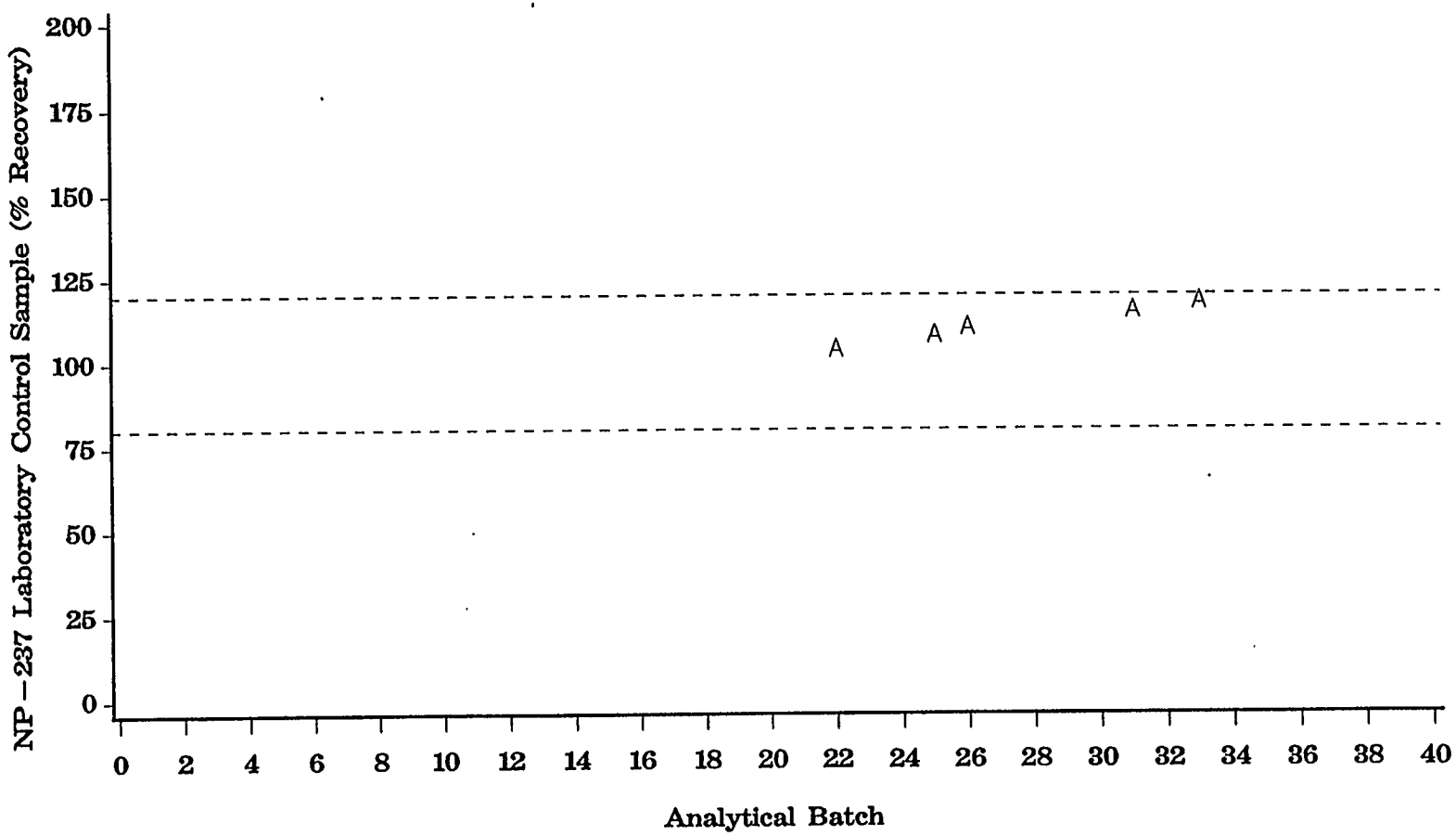


Fig. J.139. Phase 1B Alpha Spec WATER Laboratory Control Sample recoveries for NP-237 sample analyses.

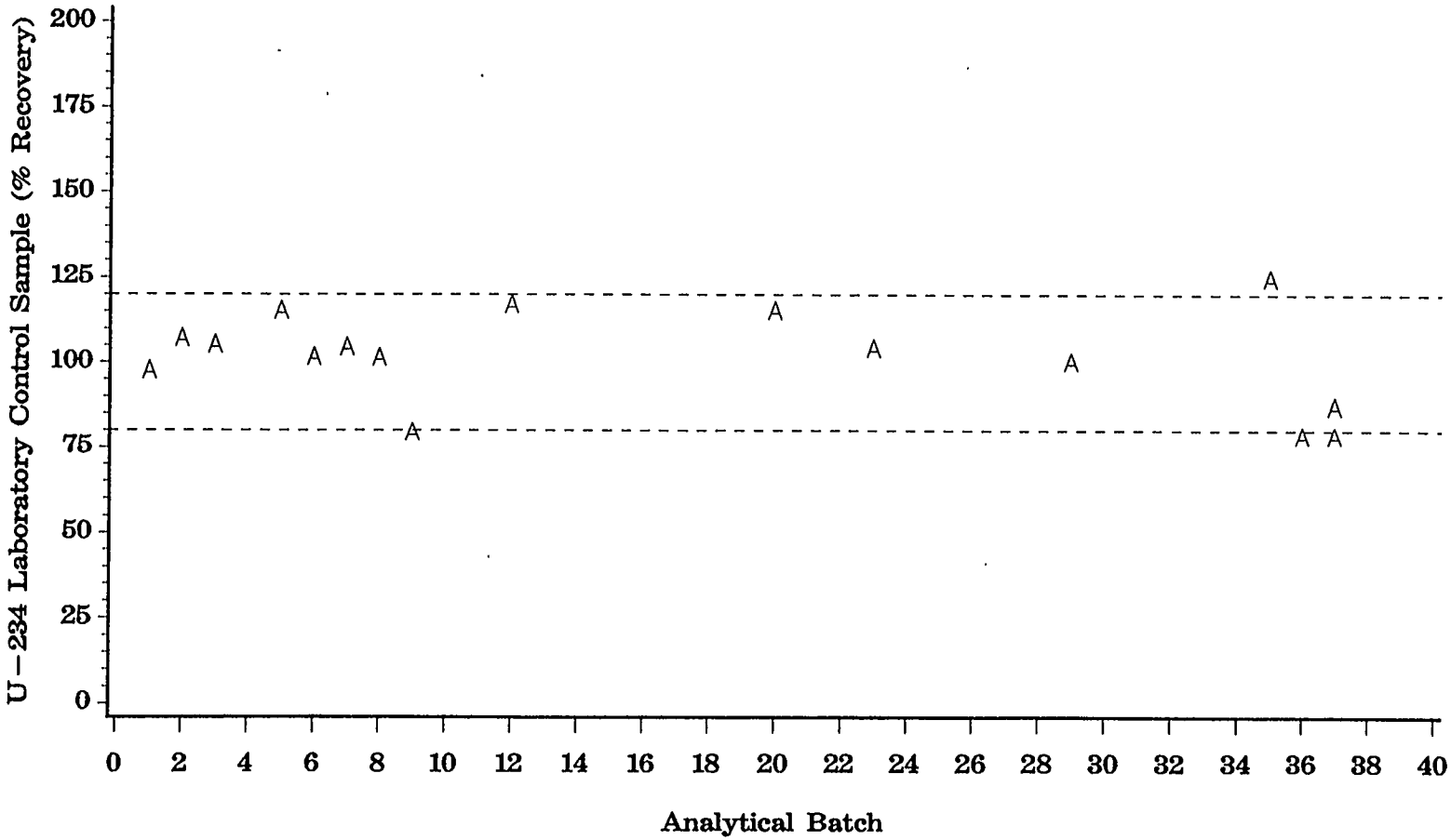


Fig. J.140. Phase 1A Alpha Spec WATER Laboratory Control Sample recoveries for U-234 sample analyses.

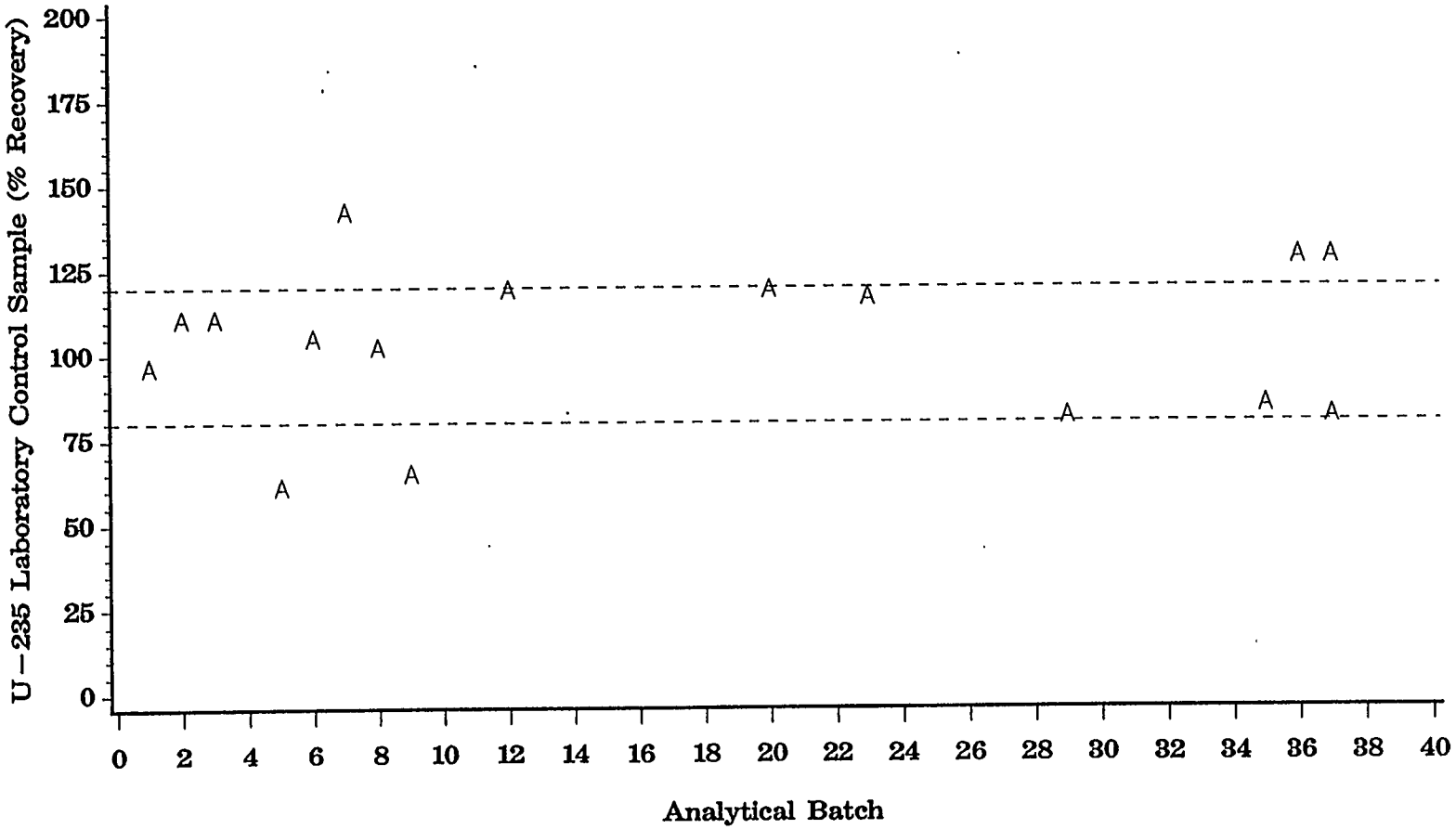


Fig. J.141. Phase 1A Alpha Spec WATER Laboratory Control Sample recoveries for U-235 sample analyses.

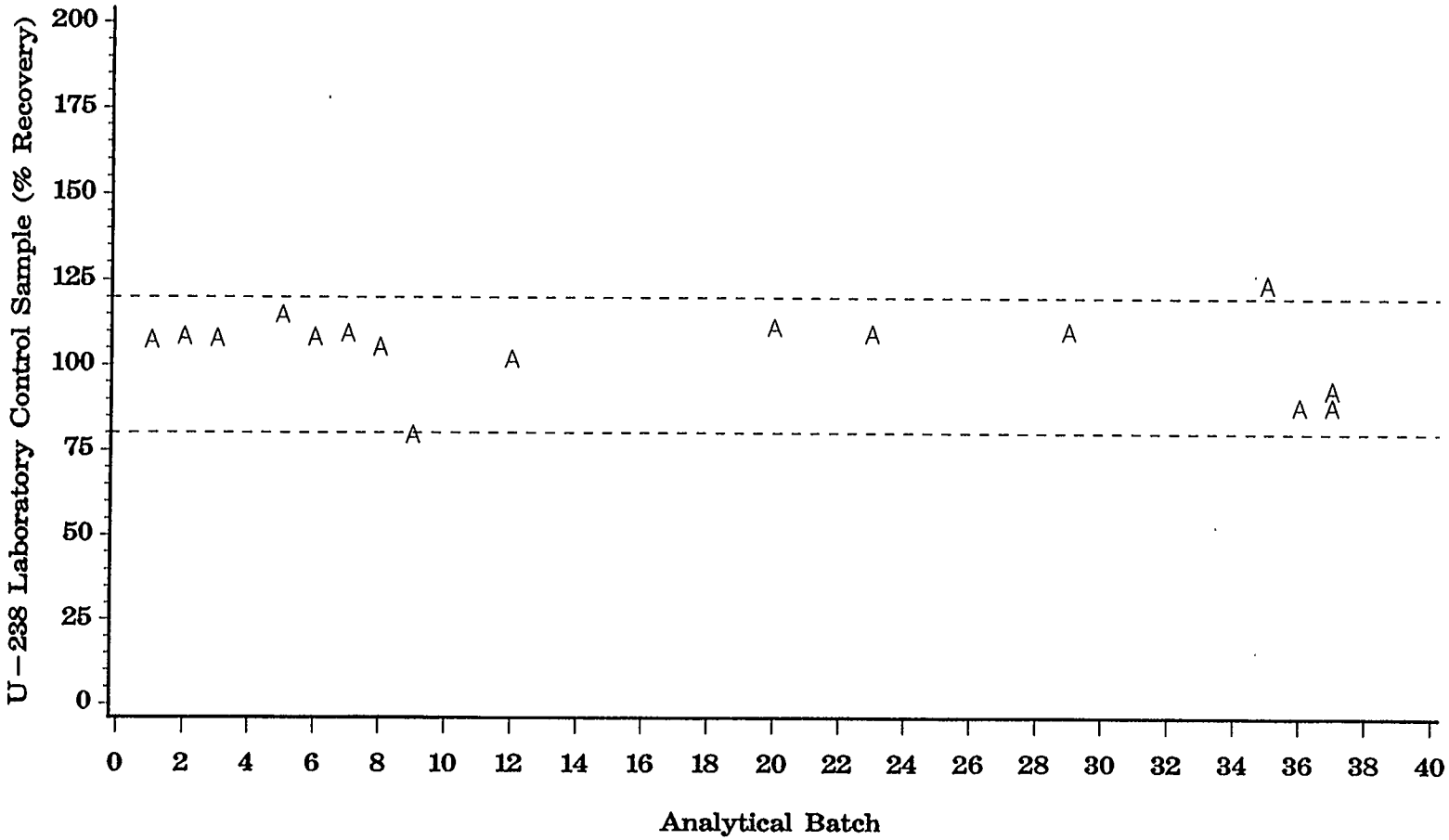


Fig. J.142. Phase 1A Alpha Spec WATER Laboratory Control Sample recoveries for U-238 sample analyses.

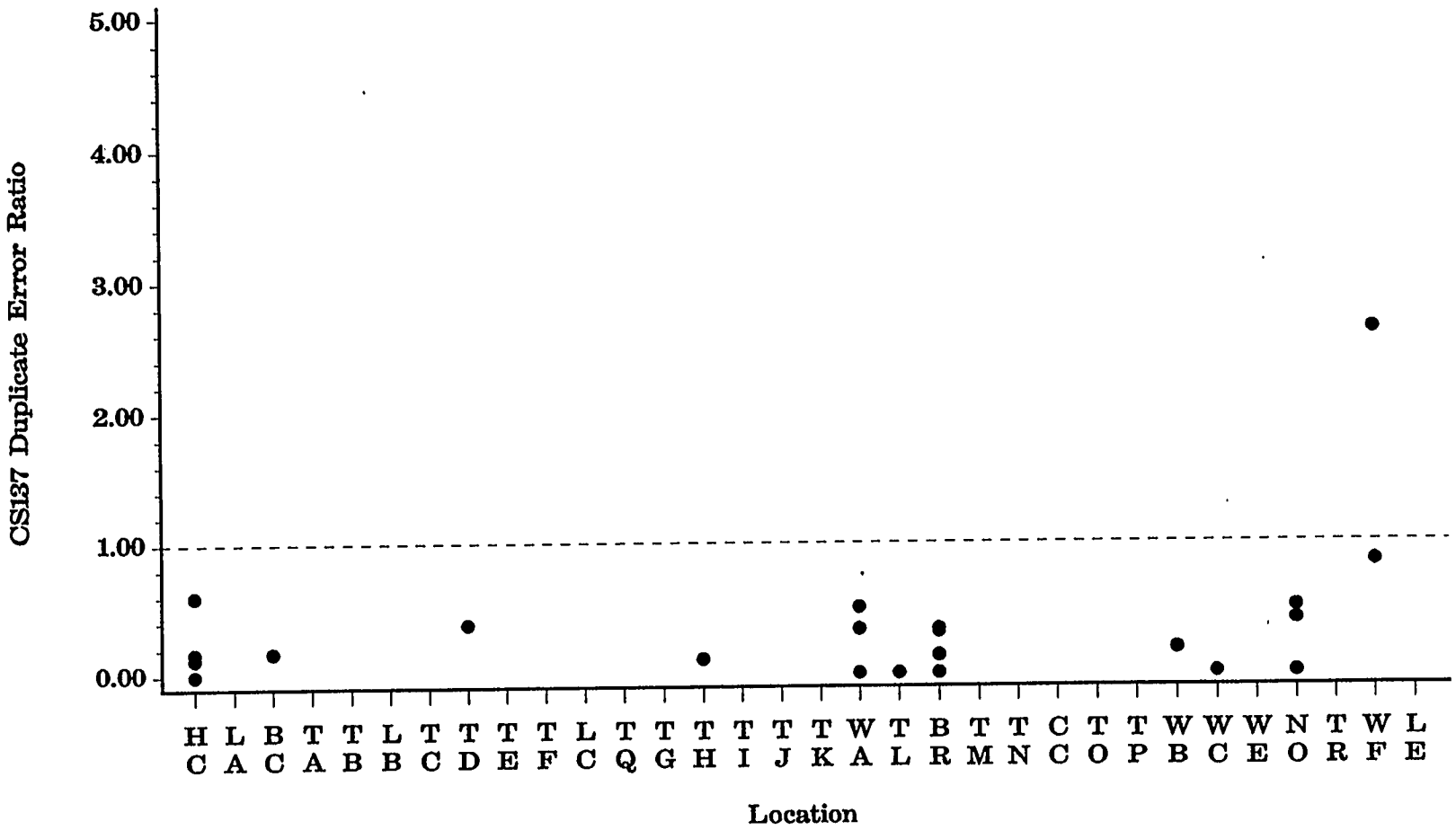


Fig. J.143. Phase 1A Gamma Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for CS137 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

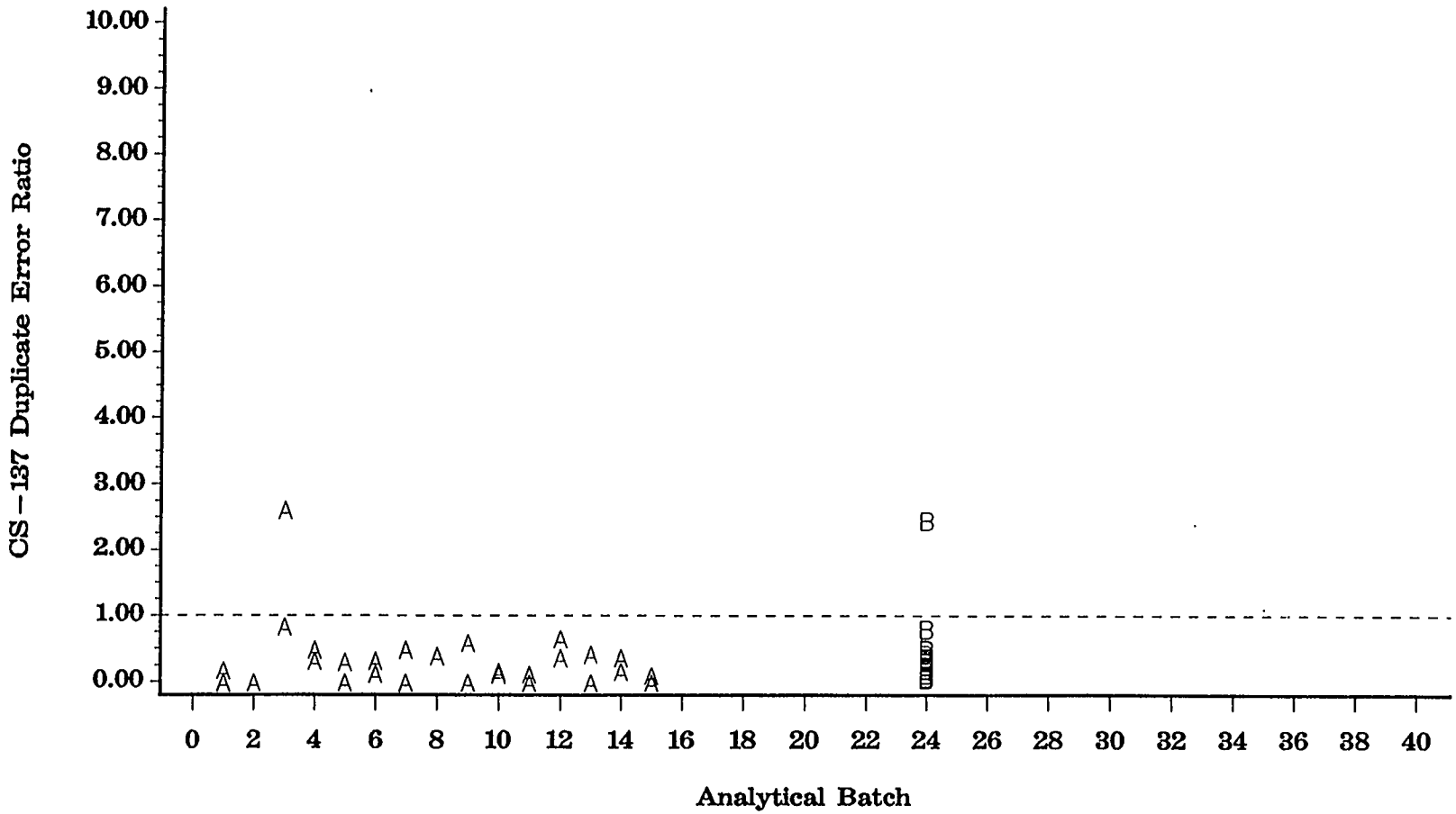


Fig. J.144. Phase 1A+1B Gamma Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for CS-137 sample analyses. DER is calculated as follows |Sample Result - Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

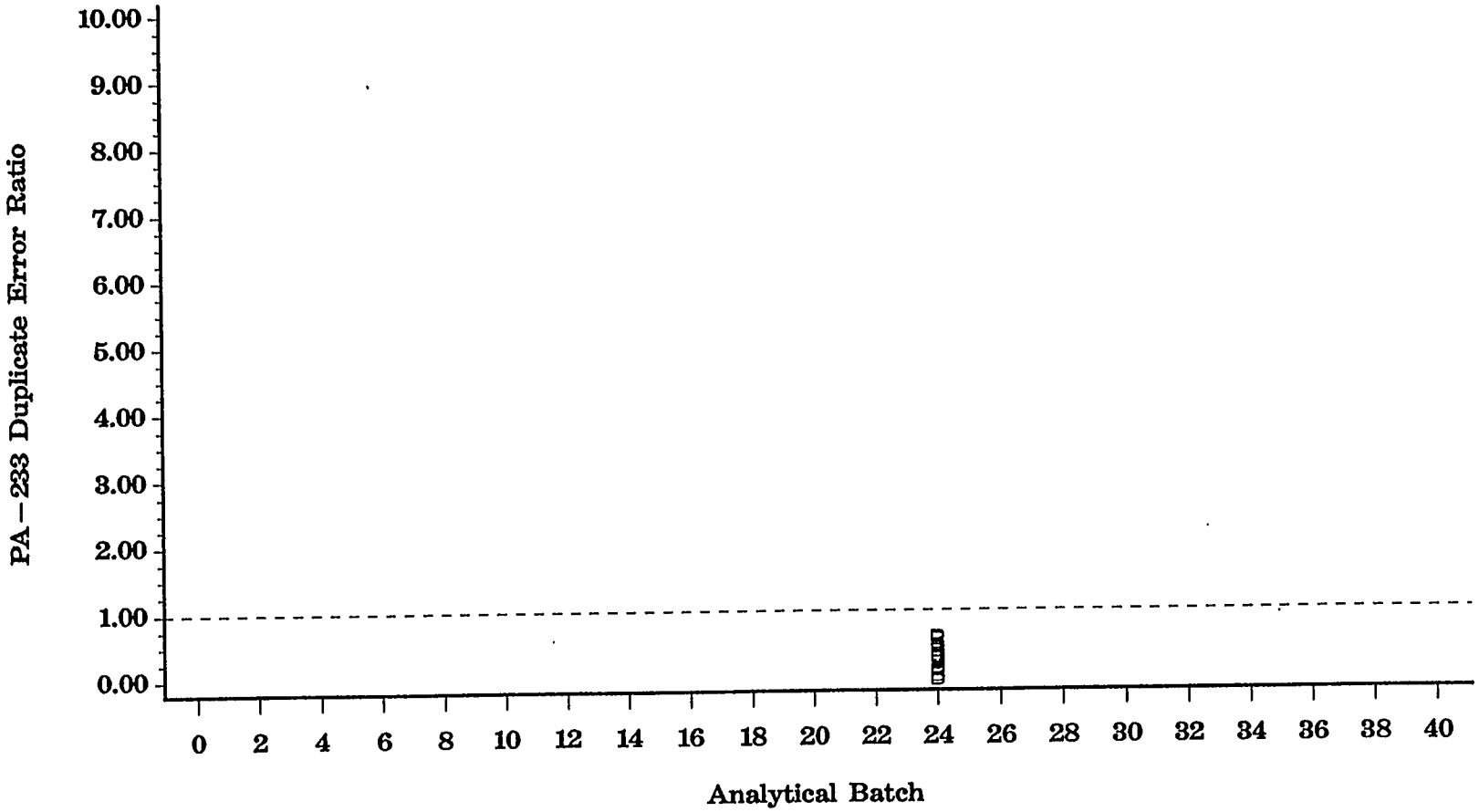


Fig. J.145. Phase 1B Gamma Spec SOIL Laboratory Duplicate Sample Duplicate Error Ratio (DER) for PA-233 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

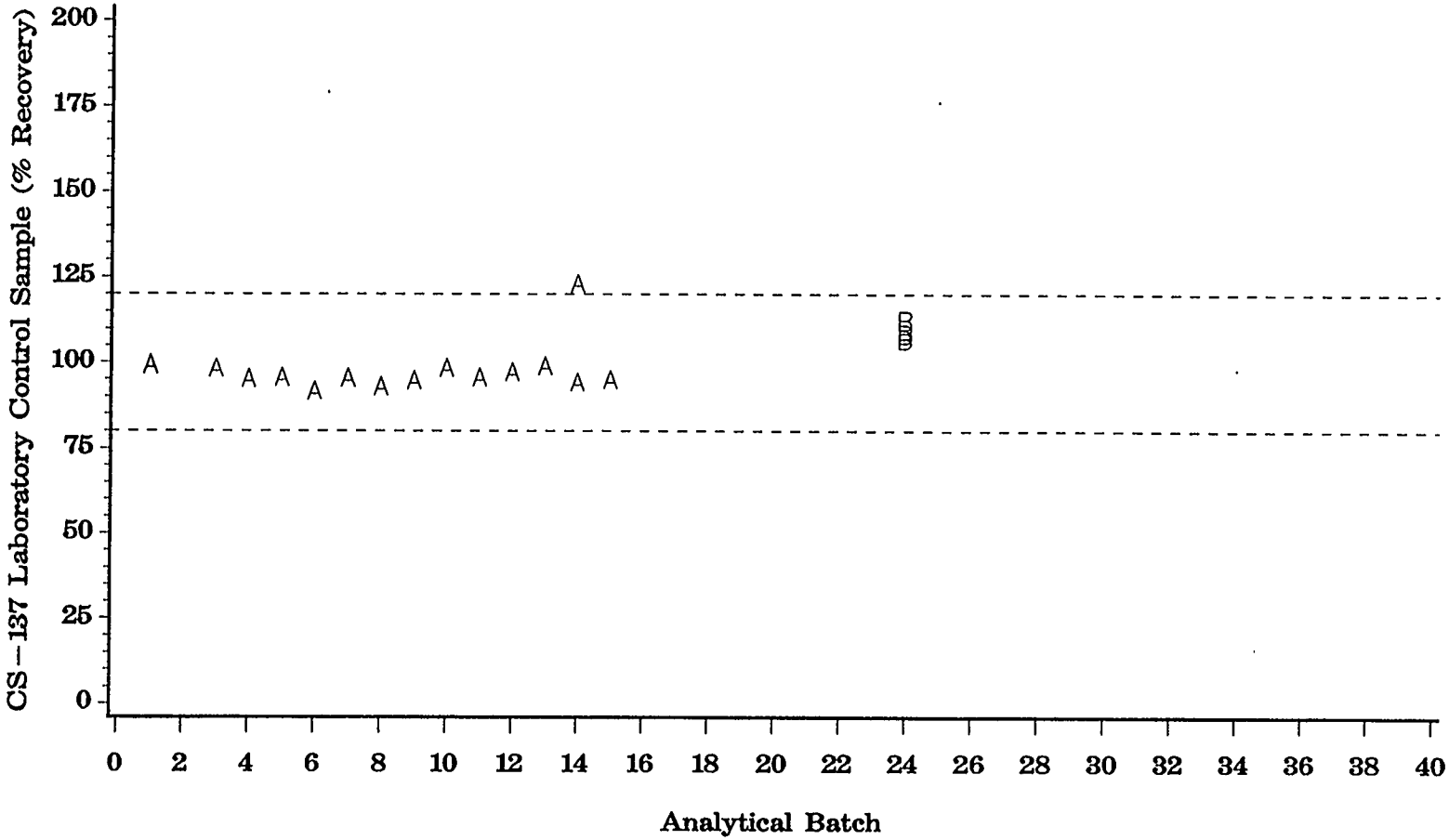


Fig. J.146. Phase 1A+1B Gamma Spec SOIL Laboratory Control Sample recoveries for CS-137 sample analyses.

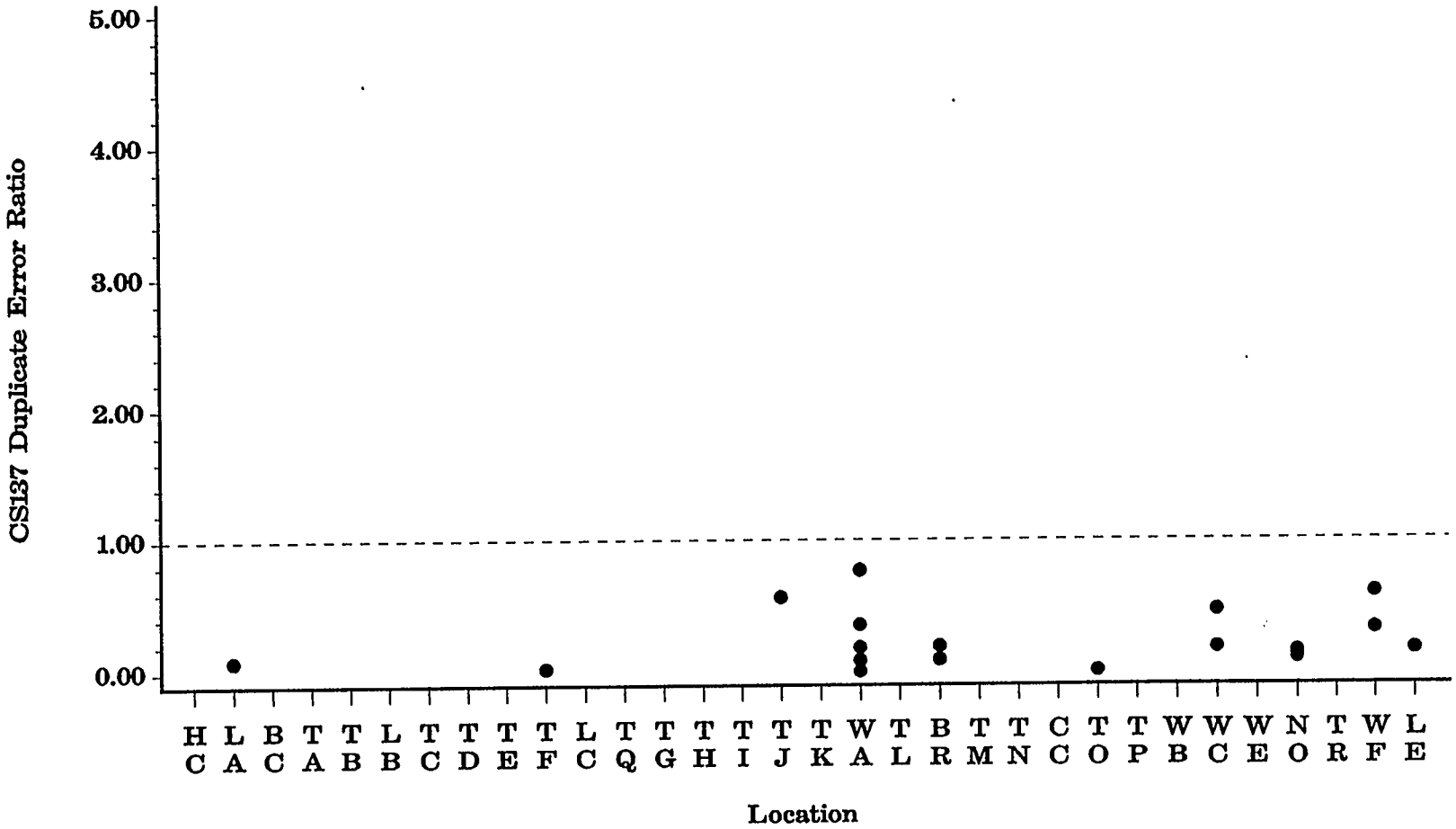


Fig. J.147 Phase 1A Gamma Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for CS137 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

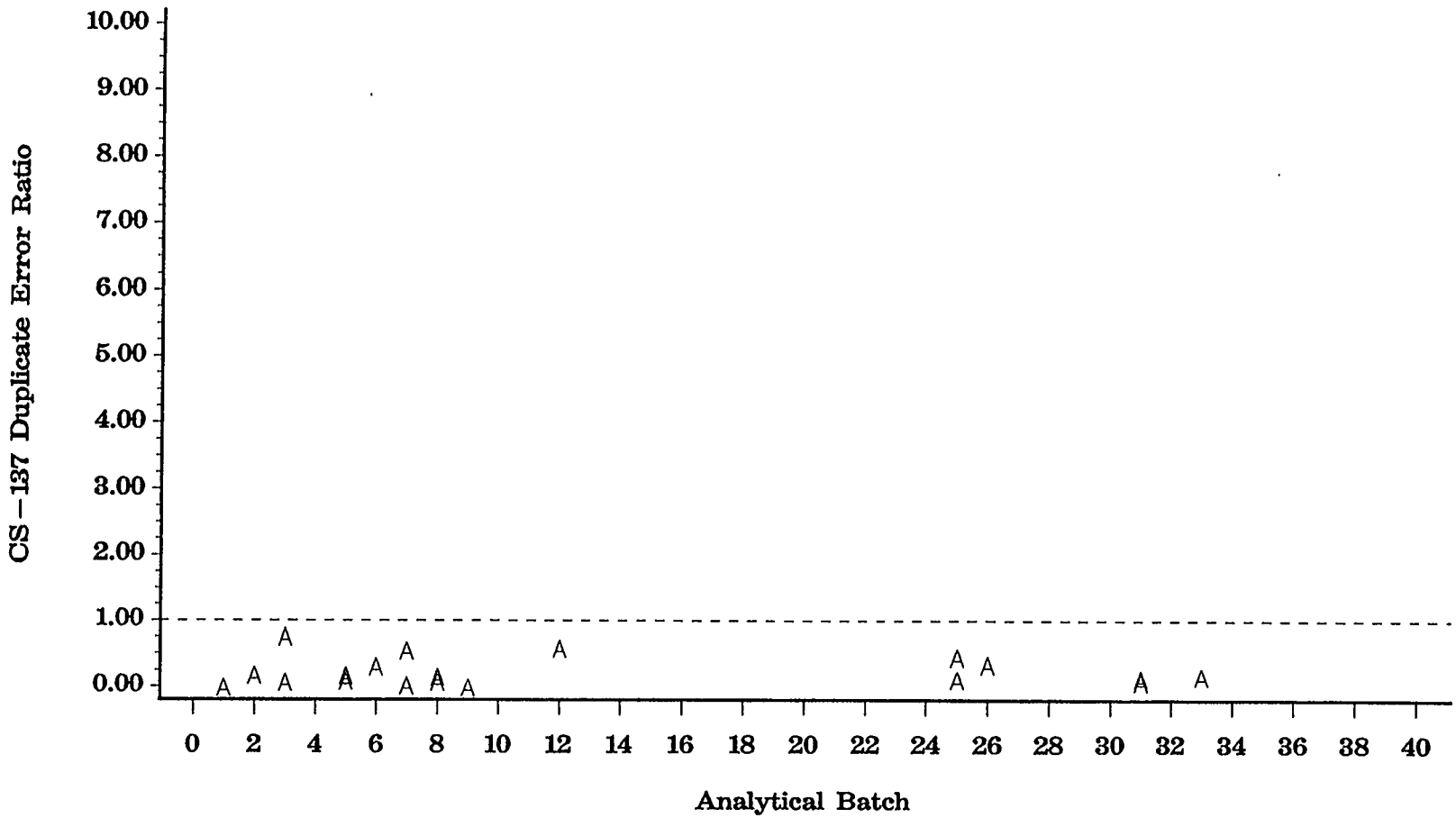


Fig. J.148. Phase 1A Gamma Spec WATER Laboratory Duplicate Sample Duplicate Error Ratio (DER) for CS-137 sample analyses. DER is calculated as follows |Sample Result − Duplicate Result| / Sample 2 Sigma Error + Duplicate 2 Sigma Error.

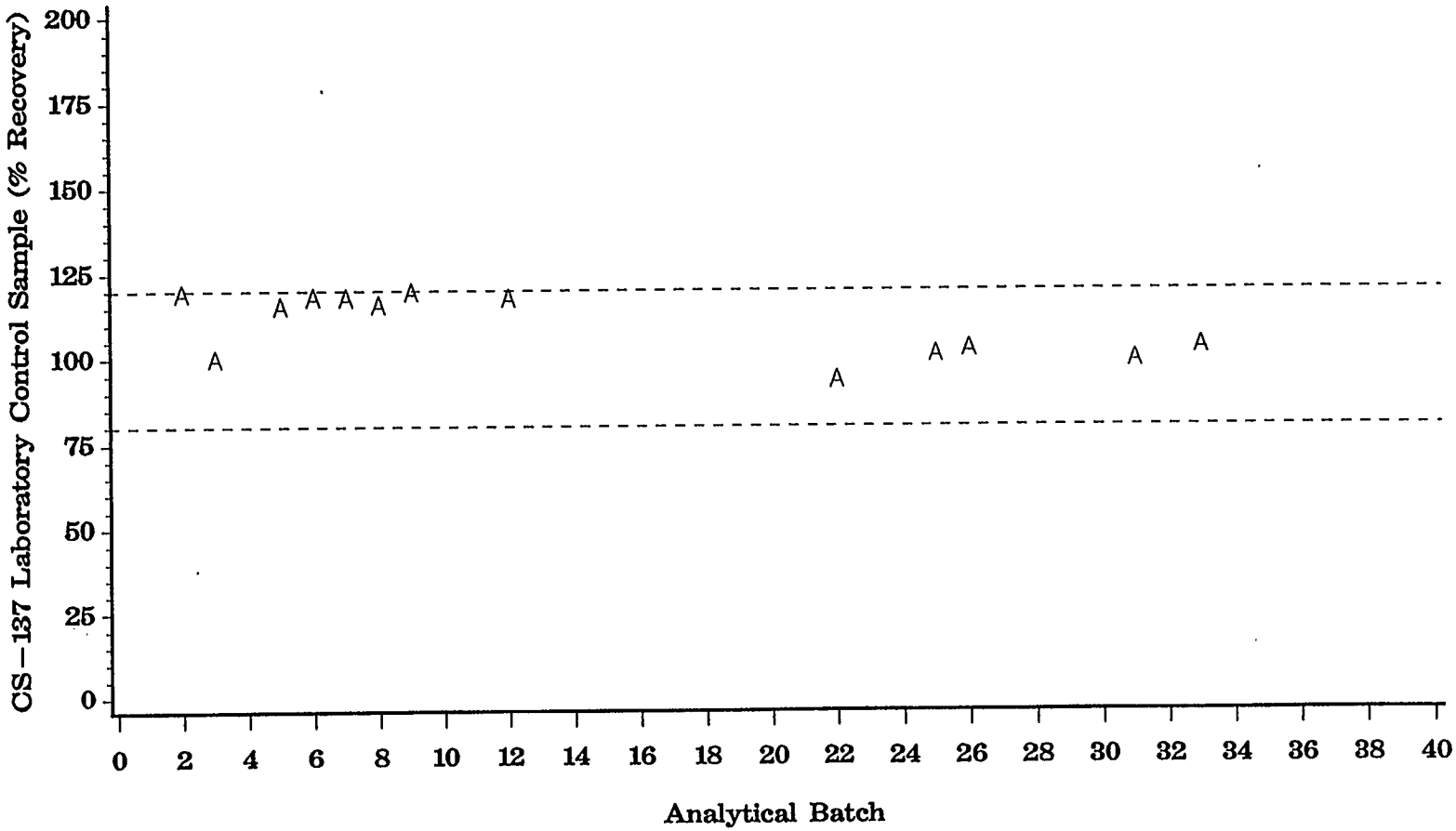


Fig. J.149. Phase 1A Gamma Spec WATER Laboratory Control Sample recoveries for CS-137 sample analyses.

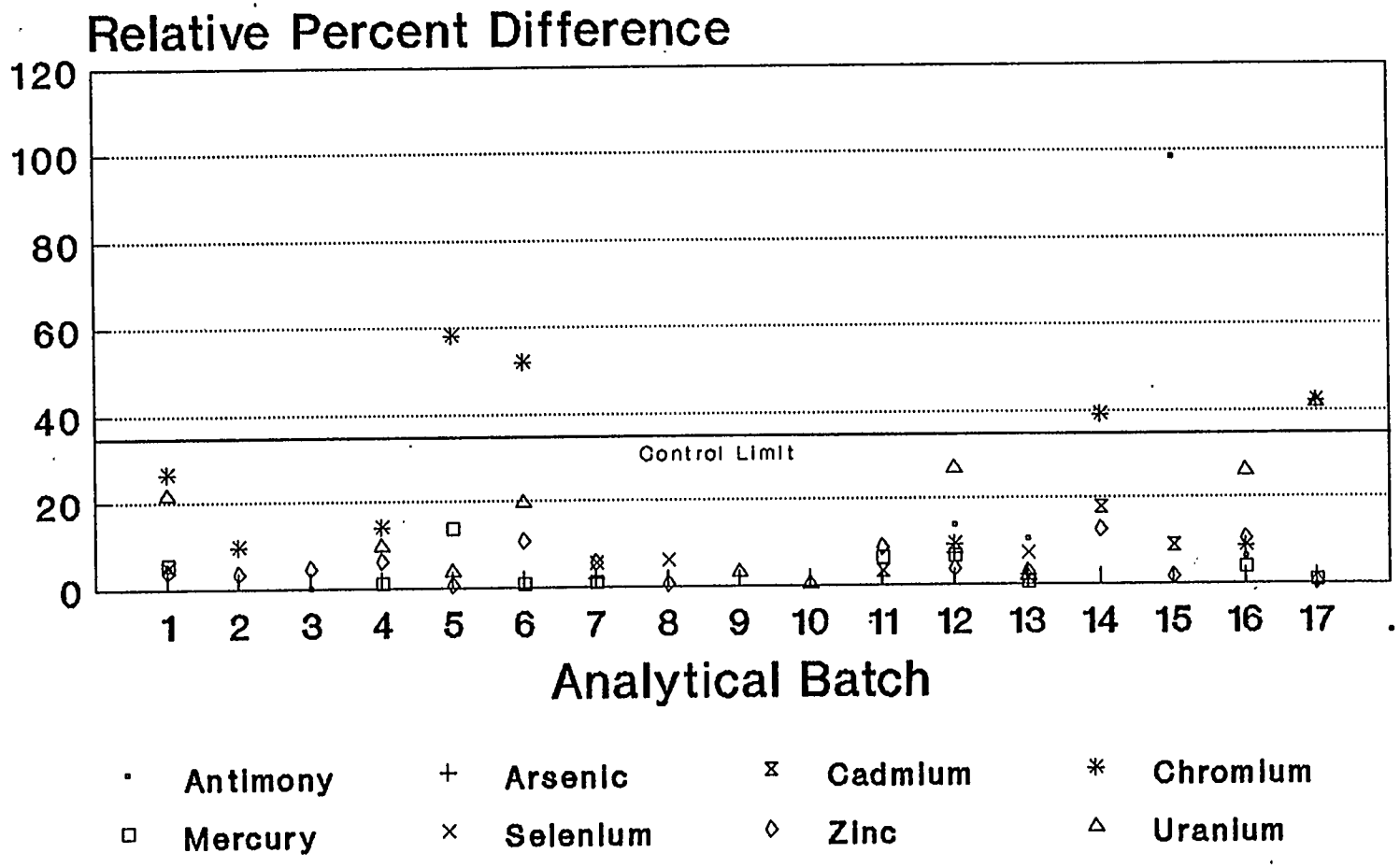


Fig. K.1. Reproducibility of NAA analyses of vegetation.

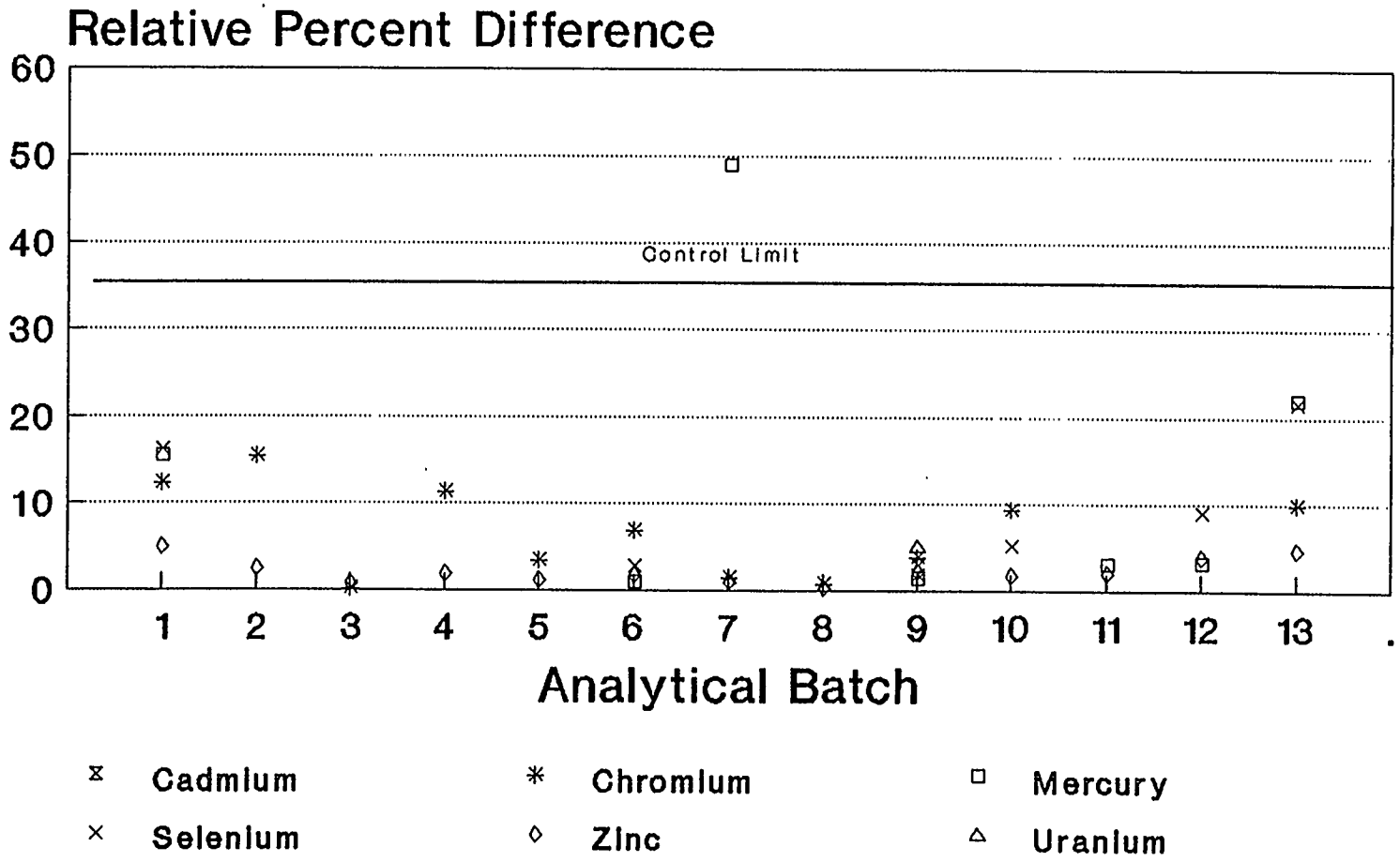
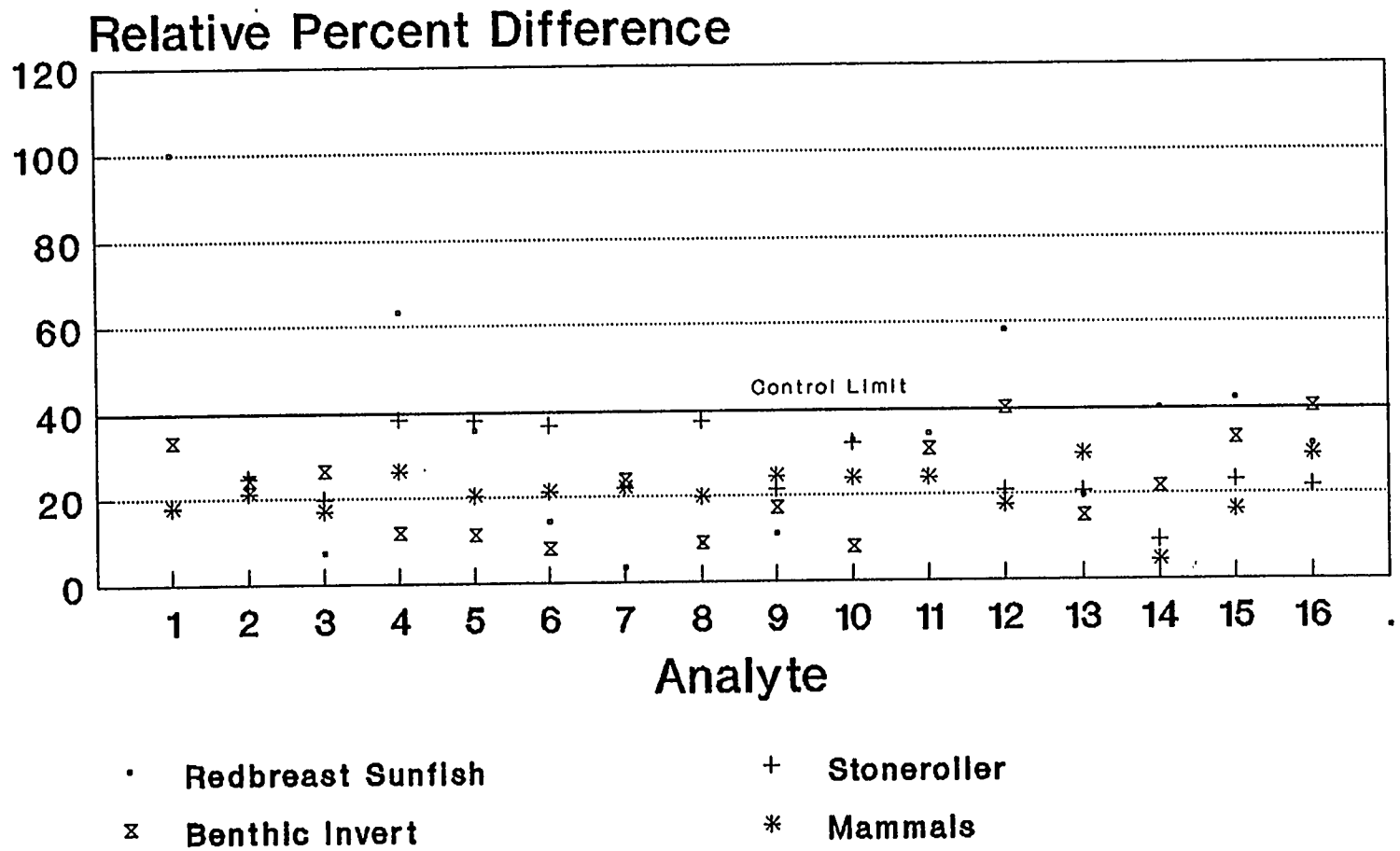


Fig. K.2. Reproducibility of NAA analyses of fauna.



Semivolatile organics

Fig. K.3. Reproducibility of organics analyses of fauna.

Table K.1. Recovery and RPD of PAH Analytes in Laboratory Control Samples of Animal Tissues

Analyte	Percent Recovery			RPD
	LCS[1]	LCS Dup.	Avg.	
Acenaphthene	6	3	6	100
	55	66	60.5	18
	56	40	48	33
	46	55	50.5	17.8
Acenaphthylene	18	14	16	25
	60	77	68.5	24.8
	47	37	42	23.8
	55	68	61.5	21
Anthracene	28	30	29	7
	46	56	51	19.6
	39	30	34.5	26.1
	49	58	53.5	16.8
Benzo[a]anthracene	65	34	49.5	63
	53	78	65.5	38.2
	55	49	52	11.5
	70	91	80.5	26.1
Benzo[a]pyrene	40	28	34	35.5
	45	66	55.5	37.8
	38	34	36	11
	49	90	54.5	20.2
Benzo[b]fluoranthene	46	40	43	14
	54	78	66	36.4
	54	50	52	7.7
	67	93	75	21

Table 5.1 (Continued)

Analyte	Percent Recovery			RPD
	LCS[1]	LCS Dup.	Avg.	
Benzo[g,h,i]perylene	31	32	31.5	3.2
	48	60	54	22
	52	41	46.5	23.7
	57	71	64	21.9
Benzo[k]fluoranthene	36	33	34.5	8.7
	50	73	61.5	37.4
	48	44	46	8.7
	60	73	66.5	19.6
Chrysene	38	34	36	11
	54	67	60.5	21.5
	57	48	52.5	17
	61	78	69.5	24.5
Dibenzo[a,h]anthracene	18	25	21.5	32.6
	42	58	50	32
	41	38	39.5	7.6
	51	65	58	24
Fluoranthene	38	27	32.5	34
	59	75	67	23.9
	57	42	49.5	30.3
	65	83	74	24
Fluorene	29	16	22.5	58
	52	64	58	20.7
	45	30	37.5	40
	52	62	57	17.5

Table 5.1 (Continued)

Analyte	Percent Recovery			RPD
	LCS[1]	LCS Dup.	Avg.	
Indeno[1,2,3-cd]pyrene	37	45	41	19.5
	70	86	78	20.5
	59	51	55	14.6
	70	94	82	29.3
Naphthalene	9	6	7.5	40
	62	68	65	9.2
	31	25	28	21.4
	45	47	46	4.3
Phenanthrene	26	17	21.5	42
	50	63	56.5	23
	50	36	43	32.6
	57	67	62	16
Pyrene	37	27	32	31.3
	49	61	55	21.8
	60	40	50	40
	56	75	65.5	29

[1] Laboratory Control Sample

Table K.2. Recovery and RPD of Pesticide Analytes in Laboratory Control Samples of Animal Tissues

Analyte	Percent Recovery			RPD
	LCS[1]	LCS Dup.	Avg.	
Aldrin	89	77	82	14.5
	80	84	82	4.9
	57	61	59	6.8
	87	69	78	23.1
Gamma-BHC	92	87	89.5	5.6
	94	99	96.5	5.2
	86	90	88	4.6
	93	76	84.5	20
4-4'-DDT	95	91	93	4.3
	96	97	96.5	1.03
	89	90	89.5	1.1
	104	96	100	8
Dieldrin	87	84	85.5	3.5
	85	86	85.5	1.2
	84	84	84	0
	84	75	79.5	11
Endrin	97	93	95	4.2
	94	91	92.5	3.2
	98	82	90	17.8
	96	90	93	6.5
Heptachlor	93	86	89.5	7.8
	86	93	89.5	7.8
	87	90	88.5	3.4
	91	73	82	22

[1] Laboratory Control Sample

Table K.3. Recovery and RPD of PAH Analytes in Laboratory Control Samples of Animal Tissues

Analyte	Percent Recovery			RPD
	LCS[1]	LCS Dup.	Avg.	
Acenaphthene	6	3	6	100
	55	66	60.5	18
	56	40	48	33
	46	55	50.5	17.8
Acenaphthylene	18	14	16	25
	60	77	68.5	24.8
	47	37	42	23.8
	55	68	61.5	21
Anthracene	28	30	29	7
	46	56	51	19.6
	39	30	34.5	26.1
	49	58	53.5	16.8
Benzo[a]anthracene	65	34	49.5	63
	53	78	65.5	38.2
	55	49	52	11.5
	70	91	80.5	26.1
Benzo[a]pyrene	40	28	34	35.5
	45	66	55.5	37.8
	38	34	36	11
	49	90	54.5	20.2
Benzo[b]fluoranthene	46	40	43	14
	54	78	66	36.4
	54	50	52	7.7
	67	93	75	21

Table K.3 (Continued)

Analyte	Percent Recovery			RPD
	LCS[1]	LCS Dup.	Avg.	
Benzo[g,h,i]perylene	31	32	31.5	3.2
	48	60	54	22
	52	41	46.5	23.7
	57	71	64	21.9
Benzo[k]fluoranthene	36	33	34.5	8.7
	50	73	61.5	37.4
	48	44	46	8.7
	60	73	66.5	19.6
Chrysene	38	34	36	11
	54	67	60.5	21.5
	57	48	52.5	17
	61	78	69.5	24.5
Dibenzo[a,h]anthracene	18	25	21.5	32.6
	42	58	50	32
	41	38	39.5	7.6
	51	65	58	24
Fluoranthene	38	27	32.5	34
	59	75	67	23.9
	57	42	49.5	30.3
	65	83	74	24
Fluorene	29	16	22.5	58
	52	64	58	20.7
	45	30	37.5	40
	52	62	57	17.5

Table K.3 (Continued)

Analyte	Percent Recovery			RPD
	LCS[1]	LCS Dup.	Avg.	
Indeno[1,2,3-cd]pyrene	37	45	41	19.5
	70	86	78	20.5
	59	51	55	14.6
	70	94	82	29.3
Naphthalene	9	6	7.5	40
	62	68	65	9.2
	31	25	28	21.4
	45	47	46	4.3
Phenanthrene	26	17	21.5	42
	50	63	56.5	23
	50	36	43	32.6
	57	67	62	16
Pyrene	37	27	32	31.3
	49	61	55	21.8
	60	40	50	40
	56	75	65.5	29

[1] Laboratory Control Sample

Table K.4. Recovery and RPD of Pesticide Analytes in Matrix Spike Samples of Animal Tissues

Analyte	Percent Recovery			RPD
	MS[1]	MS Dup.	Avg.	
Aldrin	63	71	67	-11.9
	68	88	78	25.6
	75	74	74.5	1.3
	83	78	80.5	6.2
	63	70	66.5	10.9
Gamma-BHC	48	58	53	18.9
	100	76	88	27.3
	93	102	97.5	9.2
	74	84	79	12.7
	62	69	65.5	10.7
4-4'-DDT	71	80	75.5	11.9
	87	46	66.5	61.7
	69	82	75.5	17.2
	88	88	88	0
	68	77	72.5	12.4
Dieldrin	45	102	73.5	77.6
	58	62	60	6.7
	68	76	72	11
	80	84	82	4.9
	76	70	73	8.2
Endrin	62	69	65.5	10.7
	55	44	49.5	22.2
	75	78	76.5	3.9
	93	96	94.5	3.2
	67	75	71	11.3
Heptachlor	51	59	55	14.6
	161	61	111	90.1
	84	82	83	2.4
	77	87	82	12.2
	65	73	69	11.6

[1] Matrix Spike Sample

Site	Vegetation type	Fraction of samples taken	
		Vegetation	Associated soil
3	Live grass	3/3	1/1
	Dead grass	2/2	1/1
	Browse	2/2	1/1
7	Live grass	2/2	1/1
	Dead grass	2/2	1/1
8	Live grass	3/3	1/1
	Dead grass	2/2	1/1
Reference	Live grass	3/3	1/1
	Dead grass	1/1	1/1
	Browse	1/1	1/1
3, near[1]	Beet root	0/3	3/3
	Kale leaf	3/3	3/3
	Tomato fruit	4/4	3/3
3, far	Beet root	4/4	4/4
	Kale leaf	3/3	3/3
	Tomato fruit	1/3	3/3
Reference	Beet root	0/3	3/3
	Kale leaf	3/3	3/3
	Tomato fruit	1/3	4/4

[1] Near = adjacent to EFPC; far = 100 m from stream bank

Table K.6. Fraction of planned samples that were taken for ecological risk assessment

Sample type	Site							Samples analyed		
	1	2	3	4	5	6	Refer-ence	NAA	Pest/ PCB	PAH
Fish										
Stoneroller	2/2	2/2	2/2	2/2	1/2	1/2	2/2	12	11	11
Redbreast	2/2	1/2	2/2	2/2	2/2	1/2	1/2	11	11	11
Redbreast sunfish fillets			1/1		1/0	0/1	0/1	2	2	1
Largemouth										
Benthic										
Infaunal	1/1	1/1	1/1	0/1	1/1	0/1	1/1	9	9	9
Crayfish	2/1	2/1	2/1	0/1	0/1	1/1	0/1	5	2	2
Terrestrial										
Earthworm	1/1	1/1	1/1	1/1	1/1	1/1	1/1	7	0	0
Insect,										
Insect,										
Terrestrial small mammals										
Shrew	0/1	0/1	0/1	1/1	1/1	0/1	0/1	10	10	10
Mouse	2/1	2/1	1/1	2/1	2/1	0/1	1/1	2	2	1
Vole	0/1	0/1	0/1	1/1	0/1	0/1	0/1	1	1	1
TOTAL BIO-LOGICAL[1]	10/ 14	9/ 14	11/ 15	10/ 14	9/ 14	7/ 15	9/ 15	74	55	53

[1] Total number taken does not include field duplicates and other samples not in planned number.

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Table L.1. Human health risk characterization summary: EFPC residential scenario: current land use, Bruner's Site adults long term exposure

Exposure Pathway	Risk Characterization: Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	4.95E−01	3.05E+00	2.42E−06	4.18E−05
Dermal Contact	1.79E−02	3.30E−01	5.36E−07	2.96E−05
SURFACE WATER				
Ingestion	2.69E−04	2.24E−03	2.26E−09	5.37E−08
Dermal Contact	1.30E−03	1.67E−02	2.03E−08	9.14E−07
SEDIMENT				
Dermal Contact	1.61E−04	1.57E−02	4.06E−09	1.02E−06
GROUNDWATER				
Ingestion (Residential)	3.52E+00	6.75E+00	1.57E−04	8.34E−04
Inhalation (VOCs)	1.05E−03	3.22E−03	2.96E−08	2.98E−07
FOOD CHAIN				
Produce (Residential)	5.30E+01	4.64E+02	2.36E−05	5.01E−04
Fish	7.94E−03	9.63E−02	1.75E−06	7.47E−05
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			5.98E−08	8.14E−07
SURFACE WATER				
Ingestion			7.36E−09	5.08E−07
GROUNDWATER				
Ingestion (Residential).			1.81E−05	1.86E−04
FOOD CHAIN				
Produce (Residential)			8.54E−08	1.83E−06
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.70E+01	4.75E+02		
Excess Lifetime Cancer Risk: Combined Exposure			1.86E−04	1.48E−03
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1.83E−05	1.90E−04

Table L.2. Human health risk characterization summary: EFPC residential scenario: current land use, Bruner's Site children long term exposure

Exposure Pathway	Risk Characterization: Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.73E+00	1.09E+01	2.83E−06	4.49E−05
Dermal Contact	2.33E−02	4.32E−01	2.33E−07	1.16E−05
SURFACE WATER				
Ingestion	7.72E−04	6.17E−03	2.33E−09	4.89E−08
Dermal Contact	1.70E−03	2.18E−02	8.84E−09	3.59E−07
SEDIMENT				
Dermal Contact	2.10E−04	2.05E−02	1.76E−09	3.99E−07
GROUNDWATER				
Ingestion (Residential)	3.66E+00	7.99E+00	5.46E−05	2.96E−04
Inhalation (VOCs)	6.12E−03	1.45E−02	5.75E−08	4.04E−07
FOOD CHAIN				
Produce (Residential)	1.18E+02	9.64E+02	1.76E−05	3.12E−04
Fish	1.39E−02	2.01E−01	1.02E−06	4.68E−0
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.49E−08	3.25E−07
SURFACE WATER				
Ingestion			2.45E−09	1.53E−07
GROUNDWATER				
Ingestion (Residential)			2.25E−06	2.46E−05
FOOD CHAIN				
Produce (Residential)			2.27E−08	4.22E−07
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.24E+02	9.83E+02		
Excess Lifetime Cancer Risk: Combined Exposure			7.63E−05	7.13E−04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2.30E−06	2.55E−

Table L.3. Risk characterization for soils (Bruner's Site): adults – ingestion exposure (current land use – residential)

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern/ Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	RfD WOE
INORGANICS (mg/kg)													
Aluminum	18670.00	22900.00	7.89E-03	1.01E-03	3.14E-02	1.34E-02							
Arsenic	8.20	11.30	3.47E-06	4.46E-07	1.55E-05	6.63E-06	1.16E-02	5.16E-02 skin; keratosis, hyperpigmentation		3	7.80E-07	1.16E-05	[A]
Barium	233.20	331.90	9.86E-05	1.27E-05	4.55E-04	1.95E-04	1.41E-03	6.50E-03 oral-cardiovasc. sys.; inc. blood pressure		3			
Beryllium	1.11	1.75	4.68E-07	6.02E-08	2.39E-06	1.02E-06	9.37E-05	4.78E-04 no observed effects		100	2.59E-07	4.41E-06	[B2]
Cadmium	13.72	25.17	5.80E-06	7.46E-07	3.45E-05	1.48E-05	1.16E-02	6.90E-02 kidney; proteinuria		10			
Chromium (III)	82.60	105.30	3.49E-05	4.49E-06	1.44E-04	6.18E-05	3.49E-05	1.44E-04 no observed effects		100			
Cobalt	15.55	17.00	6.57E-06	8.45E-07	2.33E-05	9.98E-06							[D]
Copper	181.50	268.40	7.67E-05	9.86E-06	3.68E-04	1.58E-04	2.07E-03	9.94E-03 Gastrointestinal system; irritation					[D]
Cyanide	3.49	9.01	1.48E-06	1.90E-07	1.23E-05	5.29E-06	7.38E-05	6.17E-04 thyroid, nerve; weight loss, myelin degen. CNS, blood		100			[B2]
Lead	115.00	143.00	4.86E-05	6.25E-06	1.96E-04	8.40E-05							[D]
Manganese	1270.00	1481.00	5.37E-04	6.90E-05	2.03E-03	8.69E-04	5.37E-03	2.03E-02 lung, CNS; respiratory, psychomotor distur		1			[D]
Mercury	324.90	628.70	1.37E-04	1.77E-05	8.61E-04	3.69E-04	4.58E-01	2.87E+00 oral -CNS; neurotoxicity		1000			[D]
Nickel	88.90	129.60	3.76E-05	4.83E-06	1.78E-04	7.61E-05	1.88E-03	8.88E-03 dec. body and organ weight		300			
Silver	13.86	21.72	5.86E-06	7.53E-07	2.98E-05	1.28E-05	1.17E-03	5.95E-03 skin; argyria		3			[D]
Vanadium	33.52	38.80	1.42E-05	1.82E-06	5.32E-05	2.28E-05	2.02E-03	7.59E-03 no observed effects		100			
Zinc	184.00	240.80	7.78E-05	1.00E-05	3.30E-04	1.41E-04	2.59E-04	1.10E-03 blood; anemia		3			[D]
ORGANICS (mg/kg)													
Arodor-1254	1.24	2.30	5.22E-07	6.71E-08	3.15E-06	1.35E-06					5.17E-07	1.04E-05	[B2]
Arodor-1260	1.39	2.51	5.85E-07	7.53E-08	3.43E-06	1.47E-06					5.80E-07	1.13E-05	[B2]
Acenaphthylene	0.24	0.35	9.99E-08	1.28E-08	4.77E-07	2.04E-07	3.33E-06	1.59E-05					[D]
Anthracene	0.17	0.30	7.20E-08	9.26E-09	4.15E-07	1.78E-07	2.40E-07	1.38E-06 no observed effects		3000			[D]
Benzo(a)anthracene	0.47	0.62	1.99E-07	2.55E-08	8.43E-07	3.61E-07	6.62E-06	2.81E-05			1.86E-08	2.64E-07	[B2]
Benzo(a)pyrene	0.46	0.57	1.96E-07	2.52E-08	7.81E-07	3.35E-07	6.53E-06	2.60E-05			1.84E-07	2.44E-06	[B2]
Benzo(b)fluoranthene	1.00	1.35	4.22E-07	5.43E-08	1.85E-06	7.93E-07	1.41E-05	6.17E-05			3.96E-08	5.79E-07	[B2]
Benzo(g,h,i)perylene	0.28	0.37	1.19E-07	1.53E-08	5.02E-07	2.15E-07	3.96E-06	1.67E-05					[D]
Benzo(k)fluoranthene	0.86	1.35	3.64E-07	4.68E-08	1.85E-06	7.92E-07	1.21E-05	6.16E-05			3.42E-08	5.78E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.21	0.33	8.93E-08	1.15E-08	4.53E-07	1.94E-07	4.47E-06	2.27E-05 liver; weight inc.		1000	1.61E-10	2.72E-09	[B2]
Di-n-butyl phthalate	0.21	0.33	8.85E-08	1.14E-08	4.54E-07	1.95E-07	8.85E-07	4.54E-06 liver, kidney damage		1000			[D]
Chrysene	0.53	0.69	2.23E-07	2.86E-08	9.45E-07	4.05E-07	7.42E-06	3.15E-05			2.09E-09	2.96E-08	[B2]
Fluoranthene	0.97	1.31	4.11E-07	5.29E-08	1.80E-06	7.71E-07	1.03E-05	4.50E-05 nephropathy, blood effects		3000			[D]
Indeno(1,2,3-cd)pyrene	0.25	0.36	1.06E-07	1.36E-08	4.97E-07	2.13E-07	3.52E-06	1.66E-05 skin disorders			9.91E-09	1.56E-07	[B2]
2-Methylnaphthalene	0.16	0.30	6.89E-08	8.86E-09	4.10E-07	1.76E-07	2.30E-06	1.37E-05 skin effects					
Naphthalene	0.21	0.33	8.82E-08	1.13E-08	4.54E-07	1.94E-07	2.21E-06	1.13E-05 eye, blood effects		1000			[D]
Phenanthrene	0.42	0.57	1.78E-07	2.28E-08	7.84E-07	3.36E-07	5.92E-06	2.61E-05 skin disorders					[D]
Pyrene	0.81	1.10	3.40E-07	4.37E-08	1.51E-06	6.47E-07	1.13E-05	5.03E-05 skin disorders		3000			[D]
RADIONUCLIDES (pCi/g)													
Americium 241	0.06	0.18		5.83E+00		1.91E+02					1.40E-09	4.58E-08	[A]
Cesium 137+D	1.35	1.79		1.31E+02		1.88E+03					3.67E-09	5.25E-08	[A]
Cobalt 60	0.02	0.04		2.11E+00		4.49E+01					3.16E-11	6.73E-10	[A]
Neptunium 237+D	0.02	0.06		1.78E+00		6.10E+01					3.92E-10	1.34E-08	[A]
Uranium 234	14.95	17.64		1.45E+03		1.85E+04					2.33E-08	2.96E-07	[A]
Uranium 235+D	0.71	0.96		6.85E+01		1.01E+03					1.10E-09	1.61E-08	[A]
Uranium 238+D	11.01	13.24		1.07E+03		1.39E+04					3.00E-08	3.89E-07	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	4.95E-01	3.05E+00		
Excess Lifetime Cancer Risk: Combined Exposure (d)			2.42E-06	4.18E-05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)			3.98E-08	8.14E-07

Table L.4. Risk characterization for soils (Bruner's Site): children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfDA UF	Excess Lifetime Cancer Risk (CDI xCSF) (MLE)	Excess Lifetime Cancer Risk (CDI xCSF) (RME)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	18670.00	22900.00	2.76E-02	1.18E-03	1.12E-01	1.44E-02							
Arsenic	8.20	11.30	1.21E-05	5.20E-07	5.54E-05	7.13E-06	4.04E-02	1.85E-01 skin; keratosis, hyperpigmentation		3	9.10E-07	1.25E-05	[A]
Barium	233.20	331.90	3.45E-04	1.48E-05	1.63E-03	2.09E-04	4.93E-03	2.33E-02 oral-cardiovasc. sys.; inc. blood pressure		3			
Beryllium	1.11	1.75	1.64E-06	7.03E-08	8.56E-06	1.10E-06	3.28E-04	1.71E-03 no observed effects		100	3.02E-07	4.73E-06	[B2]
Cadmium	13.72	25.17	2.03E-05	8.70E-07	1.23E-04	1.59E-05	4.06E-02	2.47E-01 kidney; proteinuria		10			
Chromium (III)	82.60	105.30	1.22E-04	5.24E-06	5.17E-04	6.64E-05	1.22E-04	5.17E-04 no observed effects		100			
Cobalt	15.55	17.00	2.30E-05	9.86E-07	8.34E-05	1.07E-05							
Copper	181.50	268.40	2.69E-04	1.15E-05	1.32E-03	1.69E-04	7.26E-03	3.56E-02 Gastrointestinal system; irritation					[D]
Cyanide	3.49	9.01	5.17E-06	2.21E-07	4.42E-05	5.68E-06	2.58E-04	2.21E-03 thyroid, nerve; weight loss, myelin degen.		100			[D]
Lead	115.00	143.00	1.70E-04	7.29E-06	7.01E-04	9.02E-05		CNS, blood					[B2]
Manganese	1270.00	1481.00	1.88E-03	8.05E-05	7.26E-03	9.34E-04	1.88E-02	7.26E-02 lung, CNS; respiratory, psychomotor distur		1			[D]
Mercury	324.90	628.70	4.81E-04	2.06E-05	3.08E-03	3.96E-04	1.60E+00	1.03E+01 oral -CNS; neurotoxicity		1000			[D]
Nickel	88.90	129.60	1.32E-04	5.64E-06	6.36E-04	8.17E-05	6.58E-03	3.18E-02 dec. body and organ weight		300			
Silver	13.86	21.72	2.05E-05	8.79E-07	1.07E-04	1.37E-05	4.10E-03	2.13E-02 skin; argyria		3			[D]
Vanadium	33.52	38.80	4.96E-05	2.13E-06	1.90E-04	2.45E-05	7.08E-03	2.72E-02 no observed effects		100			
Zinc	184.00	240.80	2.72E-04	1.17E-05	1.18E-03	1.52E-04	9.07E-04	3.94E-03 blood; anemia		3			[D]
ORGANICS (mg/kg)													
Arodor-1254	1.24	2.30	1.83E-06	7.83E-08	1.13E-05	1.45E-06					6.03E-07	1.12E-05	[B2]
Arodor-1260	1.39	2.51	2.05E-06	8.78E-08	1.23E-05	1.58E-06					6.76E-07	1.22E-05	[B2]
Acenaphthylene	0.24	0.35	3.50E-07	1.50E-08	1.71E-06	2.20E-07	1.17E-05	5.69E-05					[D]
Anthracene	0.17	0.30	2.52E-07	1.08E-08	1.49E-06	1.91E-07	8.40E-07	4.95E-06 no observed effects		3000			[D]
Benzo(a)anthracene	0.47	0.62	6.95E-07	2.98E-08	3.02E-06	3.88E-07	2.32E-05	1.01E-04			2.18E-08	2.83E-07	[B2]
Benzo(a)pyrene	0.46	0.57	6.85E-07	2.94E-08	2.80E-06	3.60E-07	2.28E-05	9.32E-05			2.14E-07	2.63E-06	[B2]
Benzo(b)fluoranthene	1.00	1.35	1.48E-06	6.33E-08	6.63E-06	8.52E-07	4.92E-05	2.21E-04			4.62E-08	6.22E-07	[B2]
Benzo(g,h,i)perylene	0.28	0.37	4.15E-07	1.78E-08	1.80E-06	2.31E-07	1.38E-05	5.99E-05					[D]
Benzo(k)fluoranthene	0.86	1.35	1.27E-06	5.46E-08	6.62E-06	8.51E-07	4.25E-05	2.21E-04			3.99E-08	6.21E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.21	0.33	3.13E-07	1.34E-08	1.62E-06	2.09E-07	1.56E-05	8.11E-05 liver; weight inc.		1000	1.88E-10	2.92E-09	[B2]
Di-n-butyl phthalate	0.21	0.33	3.10E-07	1.33E-08	1.63E-06	2.09E-07	3.10E-06	1.63E-05 liver, kidney damage		1000			[D]
Chrysene	0.53	0.69	7.79E-07	3.34E-08	3.38E-06	4.35E-07	2.60E-05	1.13E-04			2.44E-09	3.17E-08	[B2]
Fluoranthene	0.97	1.31	1.44E-06	6.17E-08	6.45E-06	8.29E-07	3.60E-05	1.61E-04 nephropathy, blood effects		3000			[D]
Indeno(1,2,3-cd)pyrene	0.25	0.36	3.70E-07	1.58E-08	1.78E-06	2.29E-07	1.23E-05	5.94E-05 skin disorders			1.16E-08	1.67E-07	[B2]
2-Methylnaphthalene	0.16	0.30	2.41E-07	1.03E-08	1.47E-06	1.89E-07	8.04E-06	4.89E-05 skin effects					
Naphthalene	0.21	0.33	3.09E-07	1.32E-08	1.62E-06	2.09E-07	7.72E-06	4.06E-05 eye, blood effects		1000			[D]
Phenanthrene	0.42	0.57	6.21E-07	2.66E-08	2.81E-06	3.61E-07	2.07E-05	9.36E-05 skin disorders					[D]
Pyrene	0.81	1.10	1.19E-06	5.10E-08	5.41E-06	6.95E-07	3.97E-05	1.80E-04 skin disorders		3000			[D]
RADIONUCLIDES (pCi/g)													
Americium 241	0.06	0.18		2.43E+00		7.61E+01					5.83E-10	1.83E-08	[A]
Cesium 137+D	1.35	1.79		5.46E+01		7.48E+02					1.53E-09	2.10E-08	[A]
Cobalt 60	0.02	0.04		8.78E-01		1.79E+01					1.32E-11	2.69E-10	[A]
Neptunium 237+D	0.02	0.06		7.42E-01		2.43E+01					1.63E-10	5.36E-09	[A]
Uranium 234	14.95	17.64		6.05E+02		7.39E+03					9.69E-09	1.18E-07	[A]
Uranium 235+D	0.71	0.96		2.86E+01		4.02E+02					4.57E-10	6.44E-09	[A]
Uranium 238+D	11.01	13.24		4.46E+02		5.55E+03					1.25E-08	1.55E-07	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.73E+00	1.09E+01
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.83E-06	4.49E-05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	2.49E-08	3.25E-07

Table L.5. Risk characterization for soils (Bruner's Site): adults – dermal exposure (current land use – residential)

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA Uf	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	18670.00	22900.00	2.84E-04	3.65E-05	3.39E-03	1.45E-03							
Arsenic	8.20	11.30	1.25E-07	1.60E-08	1.67E-06	7.17E-07	4.16E-04	5.58E-03	skin; keratosis, hyperpigmentation	3	2.81E-08	1.25E-06	[A]
Barium	233.20	331.90	3.55E-06	4.56E-07	4.91E-05	2.11E-05	5.07E-05	7.02E-04	oral-cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.11	1.75	1.69E-08	2.17E-09	2.58E-07	1.11E-07	3.37E-06	5.17E-05	no observed effects	100	9.32E-09	4.76E-07	[B2]
Cadmium	13.72	25.17	2.09E-07	2.68E-08	3.73E-06	1.60E-06	4.18E-04	7.45E-03	kidney; proteinuria	10			
Chromium (III)	82.60	105.30	1.26E-06	1.62E-07	1.56E-05	6.68E-06	1.26E-06	1.56E-05	no observed effects	100			
Cobalt	15.55	17.00	2.37E-07	3.04E-08	2.52E-06	1.08E-06							
Copper	181.50	268.40	2.76E-06	3.55E-07	3.97E-05	1.70E-05	7.46E-05	1.07E-03	Gastrointestinal system; irritation				[D]
Cyanide	3.49	9.01	5.32E-08	6.83E-09	1.33E-06	5.72E-07	2.66E-06	6.67E-05	thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	115.00	143.00	1.75E-06	2.25E-07	2.12E-05	9.08E-06			CNS, blood				[B2]
Manganese	1270.00	1481.00	1.93E-05	2.48E-06	2.19E-04	9.40E-05	1.93E-04	2.19E-03	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	324.90	628.70	4.94E-06	6.36E-07	9.31E-05	3.99E-05	1.65E-02	3.10E-01	oral -CNS; neurotoxicity	1000			[D]
Nickel	88.90	129.60	1.35E-06	1.74E-07	1.92E-05	8.22E-06	6.76E-05	9.60E-04	dec. body and organ weight	300			
Silver	13.86	21.72	2.11E-07	2.71E-08	3.22E-06	1.38E-06	4.22E-05	6.43E-04	skin; argyria	3			[D]
Vanadium	33.52	38.80	5.10E-07	6.56E-08	5.75E-06	2.46E-06	7.29E-05	8.21E-04	no observed effects	100			
Zinc	184.00	240.80	2.80E-06	3.60E-07	3.57E-05	1.53E-05	9.33E-06	1.19E-04	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Aroclor-1254	1.24	2.30	1.86E-07	2.42E-08	3.40E-06	1.46E-06					1.86E-07	1.12E-05	[B2]
Aroclor-1260	1.39	2.51	2.11E-07	2.71E-08	3.71E-06	1.59E-06					2.09E-07	1.23E-05	[B2]
Acenaphthylene	0.24	0.35	3.60E-08	4.62E-09	5.16E-07	2.21E-07	1.20E-06	1.72E-05					[D]
Anthracene	0.17	0.30	2.59E-08	3.33E-09	4.49E-07	1.92E-07	8.64E-08	1.50E-06	no observed effects	3000			[D]
Benzo(a)anthracene	0.47	0.62	7.15E-08	9.20E-09	9.11E-07	3.90E-07	2.38E-06	3.04E-05			6.71E-09	2.85E-07	[B2]
Benzo(a)pyrene	0.46	0.57	7.05E-08	9.06E-09	8.44E-07	3.62E-07	2.35E-06	2.81E-05			6.62E-08	2.64E-06	[B2]
Benzo(b)fluoranthene	1.00	1.35	1.52E-07	1.95E-08	2.00E-06	8.57E-07	5.06E-06	6.67E-05			1.43E-08	6.26E-07	[B2]
Benzo(g,h,i)perylene	0.28	0.37	4.27E-08	5.49E-09	5.42E-07	2.32E-07	1.42E-06	1.81E-05					[D]
Benzo(k)fluoranthene	0.86	1.35	1.31E-07	1.69E-08	2.00E-06	8.56E-07	4.37E-06	6.66E-05			1.23E-08	6.25E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.21	0.33	3.22E-08	4.13E-09	4.90E-07	2.10E-07	1.61E-06	2.45E-05	liver; weight inc.	1000	5.79E-11	2.94E-09	[B2]
Di-n-butyl phthalate	0.21	0.33	3.18E-08	4.09E-09	4.91E-07	2.10E-07	3.18E-07	4.91E-06	liver, kidney damage	1000			[D]
Chrysene	0.53	0.69	8.01E-08	1.03E-08	1.02E-06	4.38E-07	2.67E-06	3.40E-05			7.52E-10	3.19E-08	[B2]
Fluoranthene	0.97	1.31	1.48E-07	1.90E-08	1.95E-06	8.34E-07	3.70E-06	4.86E-05	nephropathy, blood effects	3000			[D]
Indeno(1,2,3-cd)pyrene	0.25	0.36	3.80E-08	4.89E-09	5.38E-07	2.30E-07	1.27E-06	1.79E-05	skin disorders		3.57E-09	1.68E-07	[B2]
2-Methylnaphthalene	0.16	0.30	2.48E-08	3.19E-09	4.43E-07	1.90E-07	8.27E-07	1.48E-05	skin effects				
Naphthalene	0.21	0.33	3.18E-08	4.08E-09	4.90E-07	2.10E-07	7.94E-07	1.23E-05	eye, blood effects	1000			[D]
Phenanthrene	0.42	0.57	6.39E-08	8.22E-09	8.47E-07	3.63E-07	2.13E-06	2.82E-05	skin disorders				[D]
Pyrene	0.81	1.10	1.22E-07	1.57E-08	1.63E-06	6.99E-07	4.08E-06	5.44E-05	skin disorders	3000			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.79E-02	3.30E-01					
Excess Lifetime Cancer Risk: Combined Exposure (d)											5.36E-07	2.96E-05	

Table L.6. Risk characterization for soils (Bruner's Site): adults – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	18670.00	22900.00	3.70E-04	1.59E-05	4.44E-03	5.70E-04							
Arsenic	8.20	11.30	1.63E-07	6.97E-09	2.19E-06	2.81E-07	5.42E-04	7.30E-03	skin; keratosis, hyperpigmentation	3	1.22E-08	4.92E-07	[A]
Barium	233.20	331.90	4.63E-06	1.98E-07	6.43E-05	8.26E-06	6.61E-05	9.18E-04	oral-cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.11	1.75	2.20E-08	9.42E-10	3.38E-07	4.35E-08	4.40E-06	6.76E-05	no observed effects	100	4.05E-09	1.87E-07	[B2]
Cadmium	13.72	25.17	2.72E-07	1.17E-08	4.87E-06	6.27E-07	5.44E-04	9.75E-03	kidney; proteinuria				
Chromium (III)	82.60	105.30	1.64E-06	7.02E-08	2.04E-05	2.62E-06	1.64E-06	2.04E-05	no observed effects	1000			
Cobalt	15.55	17.00	3.08E-07	1.32E-08	3.29E-06	4.23E-07							
Copper	181.50	268.40	3.60E-06	1.54E-07	5.20E-05	6.68E-06	9.73E-05	1.40E-03	Gastrointestinal system; irritation				[D]
Cyanide	3.49	9.01	6.93E-08	2.97E-09	1.74E-06	2.24E-07	3.46E-06	8.72E-05	thyroid, nerve; weight loss, myelin degen.	500			[D]
Lead	115.00	143.00	2.28E-06	9.78E-08	2.77E-05	3.56E-06			CNS, blood				[B2]
Manganese	1270.00	1481.00	2.52E-05	1.08E-06	2.87E-04	3.69E-05	2.52E-04	2.87E-03	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	324.90	628.70	6.44E-06	2.76E-07	1.22E-04	1.57E-05	2.15E-02	4.06E-01	oral -CNS; neurotoxicity	1000			[D]
Nickel	88.90	129.60	1.76E-06	7.56E-08	2.51E-05	3.23E-06	8.82E-05	1.26E-03	dec. body and organ weight	300			
Silver	13.86	21.72	2.75E-07	1.18E-08	4.21E-06	5.41E-07	5.50E-05	8.41E-04	skin; argyria	3			[D]
Vanadium	33.52	38.80	6.65E-07	2.85E-08	7.51E-06	9.66E-07	9.50E-05	1.07E-03	no observed effects	100			
Zinc	184.00	240.80	3.65E-06	1.56E-07	4.66E-05	6.00E-06	1.22E-05	1.55E-04	blood; anemia	10			[D]
ORGANICS (mg/kg)													
Aroclor-1254	1.24	2.30	2.45E-07	1.05E-08	4.45E-06	5.72E-07					8.08E-08	4.40E-06	[B2]
Aroclor-1260	1.39	2.51	2.75E-07	1.18E-08	4.86E-06	6.24E-07					9.07E-08	4.81E-06	[B2]
Acenaphthylene	0.24	0.35	4.69E-08	2.01E-09	6.74E-07	8.67E-08	1.56E-06	2.25E-05					[D]
Anthracene	0.17	0.30	3.38E-08	1.45E-09	5.87E-07	7.54E-08	1.13E-07	1.96E-06	no observed effects	300			[D]
Benzo(a)anthracene	0.47	0.62	9.32E-08	4.00E-09	1.19E-06	1.53E-07	3.11E-06	3.97E-05			2.92E-09	1.12E-07	[B2]
Benzo(a)pyrene	0.46	0.57	9.19E-08	3.94E-09	1.10E-06	1.42E-07	3.06E-06	3.68E-05			2.87E-08	1.04E-06	[B2]
Benzo(b)fluoranthene	1.00	1.35	1.98E-07	8.49E-09	2.62E-06	3.36E-07	6.60E-06	8.72E-05			6.19E-09	2.46E-07	[B2]
Benzo(g,h,i)perylene	0.28	0.37	5.57E-08	2.39E-09	7.09E-07	9.12E-08	1.86E-06	2.36E-05					[D]
Benzo(k)fluoranthene	0.86	1.35	1.71E-07	7.32E-09	2.61E-06	3.36E-07	5.70E-06	8.71E-05			5.35E-09	2.45E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.21	0.33	4.19E-08	1.80E-09	6.40E-07	8.23E-08	2.10E-06	3.20E-05	liver; weight inc.	1000	2.51E-11	1.15E-09	[B2]
Di-n-butyl phthalate	0.21	0.33	4.15E-08	1.78E-09	6.42E-07	8.25E-08	4.15E-07	6.42E-06	liver, kidney damage	100			[D]
Chrysene	0.53	0.69	1.04E-07	4.48E-09	1.34E-06	1.72E-07	3.48E-06	4.45E-05			3.27E-10	1.25E-08	[B2]
Fluoranthene	0.97	1.31	1.93E-07	8.27E-09	2.54E-06	3.27E-07	4.83E-06	6.36E-05	nephropathy, blood effects	300			[D]
Indeno(1,2,3-cd)pyrene	0.25	0.36	4.95E-08	2.12E-09	7.03E-07	9.04E-08	1.65E-06	2.34E-05	skin disorders		1.55E-09	6.60E-08	[B2]
2-Methylnaphthalene	0.16	0.30	3.23E-08	1.39E-09	5.79E-07	7.45E-08	1.08E-06	1.93E-05	skin effects	300			
Naphthalene	0.21	0.33	4.14E-08	1.77E-09	6.41E-07	8.25E-08	1.03E-06	1.60E-05	eye, blood effects	1000			[D]
Phenanthrene	0.42	0.57	8.33E-08	3.57E-09	1.11E-06	1.43E-07	2.78E-06	3.69E-05	skin disorders	300			[D]
Pyrene	0.81	1.10	1.60E-07	6.84E-09	2.13E-06	2.74E-07	5.32E-06	7.11E-05	skin disorders	300			[D]

Chemical Hazards:		
Hazard Index (HI):	2.33E-02	4.32E-01
Combined Exposure (d)		
Excess Lifetime Cancer Risk:		
Combined Exposure (d)	2.33E-07	1.16E-05

Table L.7. Risk characterization for surface water: adults – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	7.79E-05	1.00E-05	7.42E-04	3.18E-04							
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	7.50E-08	9.64E-09	7.00E-07	3.00E-07							
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	3.68E-05	3.36E-04	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	no observed effects	100			
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	[B2]
4,4'-DDD	4.22E-02	5.00E-02	5.78E-10	7.43E-11	4.07E-09	1.74E-09					1.78E-11	4.19E-10	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	liver; lesions	100	2.41E-11	5.86E-10	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07			liver; weight inc.	1000			[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	liver lesions	100	1.09E-09	2.79E-08	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	5.77E-08	7.42E-09	4.04E-07	1.73E-07	7.22E-08	5.05E-07	lung irritation	1000			[D]
Endosulfan	2.31E-02	2.50E-02	3.16E-10	4.06E-11	2.04E-09	8.72E-10	6.32E-06	4.07E-05	kidney lesions	3000			
Endosulfan Sulfate	3.48E-02	4.46E-02	4.77E-10	6.13E-11	3.63E-09	1.56E-09							
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	5.48E-08	7.05E-09	4.07E-07	1.74E-07	1.37E-06	1.02E-05	nephropathy, blood effects	3000			[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	liver, kidney effects		4.16E-11	1.06E-09	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	liver damage		3.46E-10	7.94E-09	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	liver, kidney, CNS effects	1000			
1,1,1-Trichloroethane	4.32E+00	4.85E+00	5.92E-08	7.61E-09	3.95E-07	1.69E-07	6.58E-07	4.39E-06	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	5.48E-08	7.05E-09	3.81E-07	1.63E-07			Liver, Kidney, CNS effects				
RADIONUCLIDES (pCi/L)													
Americium 241		5.12E+00				3.19E+02						7.66E-08	[A]
Cesium 137+D	3.52E+00	1.12E+01		1.11E+01		7.00E+02					3.11E-10	1.96E-08	[A]
Cobalt 60		5.62E+00				3.51E+02						5.26E-09	[A]
Neptunium 237+D	9.37E+00	2.86E+01		2.95E+01		1.79E+03					6.49E-09	3.93E-07	[A]
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02					1.85E-10	4.29E-09	[A]
Uranium 235+D	2.16E-01	2.95E-01		6.80E-01		1.84E+01					1.09E-11	2.94E-10	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02					3.64E-10	9.28E-09	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.69E-04	2.24E-03		
Excess Lifetime Cancer Risk: Combined Exposure (d)			2.26E-09	5.37E-08
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)			7.36E-09	5.08E-07

Table L.8. Risk characterization for surface water: children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	2.18E−04	9.35E−06	2.00E−03	2.57E−04							
Barium	7.92E+01	1.05E+02	3.04E−06	1.30E−07	2.30E−05	2.96E−06	4.34E−05	3.29E−04	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	2.99E−07	1.28E−08	2.89E−06	3.72E−07	2.99E−07	2.89E−06	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	2.10E−07	9.00E−09	1.88E−06	2.42E−07							
Copper	1.85E+01	2.19E+01	7.10E−07	3.04E−08	4.80E−06	6.17E−07	1.92E−05	1.30E−04	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E−05	4.42E−07	9.05E−05	1.16E−05	1.03E−04	9.05E−04	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	2.68E+00	3.93E+00	1.03E−07	4.40E−09	8.62E−07	1.11E−07	3.42E−04	2.87E−03	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	3.22E−07	1.38E−08	3.09E−06	3.97E−07	4.60E−05	4.41E−04	no observed effects	100			
Zinc	6.87E+01	9.09E+01	2.64E−06	1.13E−07	1.99E−05	2.56E−06	8.79E−06	6.64E−05	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	2.38E−07	1.02E−08	1.69E−06	2.17E−07	2.38E−06	1.69E−05	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E−02	2.50E−02	8.91E−10	3.82E−11	5.48E−09	7.05E−10	2.97E−05	1.83E−04	liver; lesions, toxicity	1000	6.49E−10	1.20E−08	[B2]
4,4'−DDD	4.22E−02	5.00E−02	1.62E−09	6.93E−11	1.10E−08	1.41E−09					1.66E−11	3.38E−10	[B2]
4,4'−DDT	4.02E−02	4.94E−02	1.54E−09	6.61E−11	1.08E−08	1.39E−09	3.08E−06	2.17E−05	liver; lesions	100	2.25E−11	4.73E−10	[B2]
Bis(2−ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E−07	1.56E−08	3.04E−06	3.90E−07	1.82E−05	1.52E−04	liver; weight inc.	1000	2.19E−10	5.46E−09	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E−07	6.69E−09	1.03E−06	1.32E−07	1.56E−05	1.03E−04	liver; lesions, fatty cyst formation	1000	4.08E−11	8.06E−10	[B2]
Dieldrin	3.87E−02	5.00E−02	1.49E−09	6.37E−11	1.10E−08	1.41E−09	2.97E−05	2.19E−04	liver lesions	100	1.02E−09	2.25E−08	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.62E−07	6.93E−09	1.09E−06	1.40E−07	2.02E−07	1.36E−06	lung irritation	1000			[D]
Endosulfan	2.31E−02	2.50E−02	8.85E−10	3.79E−11	5.48E−09	7.05E−10	1.77E−05	1.10E−04	kidney lesions	3000			
Endosulfan Sulfate	3.48E−02	4.46E−02	1.33E−09	5.72E−11	9.78E−09	1.26E−09							
Endrin	3.87E−02	5.00E−02	1.48E−09	6.36E−11	1.10E−08	1.41E−09	4.95E−06	3.65E−05	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	1.53E−07	6.58E−09	1.10E−06	1.41E−07	3.84E−06	2.74E−05	nephropathy, blood effects	3000			[D]
gamma−BHC	1.82E−02	2.34E−02	6.97E−10	2.99E−11	5.14E−09	6.60E−10	2.32E−06	1.71E−05	liver, kidney effects		3.89E−11	8.58E−10	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	8.28E−10	3.55E−11	5.48E−09	7.05E−10	6.37E−05	4.21E−04	liver damage		3.23E−10	6.41E−09	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E−07	6.87E−09	1.06E−06	1.36E−07	1.60E−05	1.06E−04	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	4.32E+00	4.85E+00	1.66E−07	7.10E−09	1.06E−06	1.37E−07	1.84E−06	1.18E−05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	1.53E−07	6.58E−09	1.03E−06	1.32E−07			Liver, Kidney, CNS effects				
RADIONUCLIDES (pCi/L)													
Americium 241		5.12E+00				9.58E+01						2.30E−08	[A]
Cesium 137+D	3.52E+00	1.12E+01		3.70E+00		2.10E+02					1.04E−10	5.88E−09	[A]
Cobalt 60		5.62E+00				1.05E+02						1.58E−09	[A]
Neptunium 237+D	9.37E+00	2.86E+01		9.83E+00		5.36E+02					2.16E−09	1.18E−07	[A]
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01					6.18E−11	1.29E−09	[A]
Uranium 235+D	2.16E−01	2.95E−01		2.27E−01		5.51E+00					3.63E−12	8.82E−11	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01					1.21E−10	2.78E−09	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	7.72E−04	6.17E−03		
Excess Lifetime Cancer Risk: Combined Exposure (d)			2.33E−09	4.89E−08
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)			2.45E−09	1.53E−07

Table L.9. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – residential)

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	6.03E−06	7.76E−07	1.01E−04	4.34E−05							
Barium	7.92E+01	1.05E+02	8.40E−08	1.08E−08	1.17E−06	5.00E−07	1.20E−06	1.67E−05	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	8.27E−09	1.06E−09	1.47E−07	6.29E−08	8.27E−09	1.47E−07	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	5.81E−09	7.47E−10	9.56E−08	4.10E−08							
Copper	1.85E+01	2.19E+01	1.96E−08	2.52E−09	2.43E−07	1.04E−07	5.30E−07	6.58E−06	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E−07	3.66E−08	4.59E−06	1.97E−06	2.85E−06	4.59E−05	lung, CNS; respiratory, psychomotor distu:	1			[D]
Mercury	2.68E+00	3.93E+00	2.84E−09	3.65E−10	4.37E−08	1.87E−08	9.46E−06	1.46E−04	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	8.91E−09	1.15E−09	1.57E−07	6.72E−08	1.27E−06	2.24E−05	no observed effects	100			
Zinc	6.87E+01	9.09E+01	7.29E−08	9.37E−09	1.01E−06	4.33E−07	2.43E−07	3.37E−06	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	4.12E−08	5.30E−09	5.35E−07	2.29E−07	4.12E−07	5.35E−06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E−02	2.50E−02	2.46E−10	3.17E−11	2.78E−09	1.19E−09	8.21E−06	9.26E−05	liver; lesions, toxicity	1000	5.39E−10	2.02E−08	[B2]
4,4'−DDD	4.22E−02	5.00E−02	7.83E−08	1.01E−08	9.73E−07	4.17E−07					2.42E−09	1.00E−07	[B2]
4,4'−DDT	4.02E−02	4.94E−02	1.15E−07	1.47E−08	1.48E−06	6.32E−07	2.29E−04	2.95E−03	liver; lesions	100	5.01E−09	2.15E−07	[B2]
Bis(2−ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E−06	2.67E−07	3.17E−05	1.36E−05	1.04E−04	1.59E−03	liver; weight inc.	1000	3.74E−09	1.90E−07	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E−07	3.09E−08	2.90E−06	1.24E−06	2.40E−05	2.90E−04	liver; lesions, fatty cyst formation	1000	1.88E−10	7.57E−09	[B2]
Dieldrin	3.87E−02	5.00E−02	4.11E−09	5.28E−10	5.56E−08	2.38E−08	8.22E−05	1.11E−03	liver lesions	100	8.45E−09	3.81E−07	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.34E−07	1.72E−08	1.65E−06	7.09E−07	1.68E−07	2.07E−06	lung irritation	1000			[D]
Endosulfan	2.31E−02	2.50E−02	4.84E−09	6.22E−10	5.49E−08	2.35E−08	9.67E−05	1.10E−03	kidney lesions	3000			
Endosulfan Sulfate	3.48E−02	4.46E−02	7.29E−09	9.37E−10	9.79E−08	4.20E−08							
Endrin	3.87E−02	5.00E−02	4.10E−09	5.28E−10	5.56E−08	2.38E−08	1.37E−05	1.85E−04	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	9.55E−06	1.23E−06	1.25E−04	5.36E−05	2.39E−04	3.13E−03	nephropathy, blood effects	3000			[D]
gamma−BHC	1.82E−02	2.34E−02	1.69E−09	2.17E−10	2.28E−08	9.77E−09	5.63E−06	7.60E−05	liver, kidney effects				[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	4.52E−09	5.82E−10	5.49E−08	2.35E−08	3.48E−04	4.22E−03	liver damage				[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E−06	1.71E−07	1.61E−05	6.92E−06	1.33E−04	1.61E−03	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	4.32E+00	4.85E+00	4.87E−07	6.26E−08	5.73E−06	2.46E−06	5.41E−06	6.37E−05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	4.24E−07	5.46E−08	5.20E−06	2.23E−06			Liver, Kidney, CNS effects	--			
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.30E−03	1.67E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											2.03E−08	9.14E−07	

Table L.10. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – residential)

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	6.03E−06	7.76E−07	1.01E−04	4.34E−05							
Barium	7.92E+01	1.05E+02	1.09E−07	4.69E−09	1.53E−06	1.96E−07	1.56E−06	2.18E−05	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	1.08E−08	4.62E−10	1.92E−07	2.47E−08	1.08E−08	1.92E−07	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	7.57E−09	3.24E−10	1.25E−07	1.61E−08							
Copper	1.85E+01	2.19E+01	2.56E−08	1.10E−09	3.18E−07	4.09E−08	6.91E−07	8.60E−06	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E−07	1.59E−08	6.00E−06	7.72E−07	3.72E−06	6.00E−05	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	2.68E+00	3.93E+00	3.70E−09	1.59E−10	5.72E−08	7.35E−09	1.23E−05	1.91E−04	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	1.16E−08	4.98E−10	2.05E−07	2.64E−08	1.66E−06	2.93E−05	no observed effects	100			
Zinc	6.87E+01	9.09E+01	9.50E−08	4.07E−09	1.32E−06	1.70E−07	3.17E−07	4.40E−06	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	5.37E−08	2.30E−09	7.00E−07	9.00E−08	5.37E−07	7.00E−06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E−02	2.50E−02	3.21E−10	1.38E−11	3.63E−09	4.67E−10	1.07E−05	1.21E−04	liver; lesions, toxicity	1000	2.34E−10	7.94E−09	[B2]
4,4'−DDD	4.22E−02	5.00E−02	1.02E−07	4.37E−09	1.27E−06	1.64E−07					1.05E−09	3.92E−08	[B2]
4,4'−DDT	4.02E−02	4.94E−02	1.49E−07	6.40E−09	1.93E−06	2.48E−07	2.99E−04	3.86E−03	liver; lesions	100	2.18E−09	8.44E−08	[B2]
Bis(2−ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E−06	1.16E−07	4.15E−05	5.34E−06	1.35E−04	2.08E−03	liver; weight inc.	1000	1.63E−09	7.47E−08	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E−07	1.34E−08	3.79E−06	4.87E−07	3.13E−05	3.79E−04	liver; lesions, fatty cyst formation	1000	8.19E−11	2.97E−09	[B2]
Dieldrin	3.87E−02	5.00E−02	5.36E−09	2.30E−10	7.27E−08	9.34E−09	1.07E−04	1.45E−03	liver lesions	100	3.67E−09	1.50E−07	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.75E−07	7.49E−09	2.16E−06	2.78E−07	2.18E−07	2.70E−06	lung irritation	1000			[D]
Endosulfan	2.31E−02	2.50E−02	6.30E−09	2.70E−10	7.18E−08	9.23E−09	1.26E−04	1.44E−03	kidney lesions	3000			
Endosulfan Sulfate	3.48E−02	4.46E−02	9.50E−09	4.07E−10	1.28E−07	1.65E−08							
Endrin	3.87E−02	5.00E−02	5.35E−09	2.29E−10	7.27E−08	9.34E−09	1.78E−05	2.42E−04	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	1.24E−05	5.33E−07	1.64E−04	2.10E−05	3.11E−04	4.09E−03	nephropathy, blood effects	3000			[D]
gamma−BHC	1.82E−02	2.34E−02	2.20E−09	9.43E−11	2.98E−08	3.83E−09	7.33E−06	9.93E−05	liver, kidney effects				[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	5.90E−09	2.53E−10	7.18E−08	9.23E−09	4.54E−04	5.52E−03	liver damage				[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E−06	7.43E−08	2.11E−05	2.71E−06	1.73E−04	2.11E−03	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	4.32E+00	4.85E+00	6.35E−07	2.72E−08	7.49E−06	9.63E−07	7.05E−06	8.32E−05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	5.53E−07	2.37E−08	6.81E−06	8.75E−07			Liver, Kidney, CNS effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.70E−03	2.18E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											8.84E−09	3.59E−07	

Table L.11. Risk characterization for sediments: adults – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	RfD WOE
INORGANICS (mg/kg)													
Aluminum	10300.00	14320.00	1.69E-06	2.18E-07	8.82E-05	3.78E-05							
Arsenic	7.93	10.93	1.30E-09	1.68E-10	6.73E-08	2.88E-08	4.35E-06	2.24E-04 skin; keratosis, hyperpigmentation		3	2.93E-10	5.05E-08	[A]
Barium	163.40	301.10	2.69E-08	3.45E-09	1.85E-06	7.95E-07	3.84E-07	2.65E-05 oral-cardiovasc. sys.; inc. blood pressure		3			
Beryllium	0.68	0.81	1.12E-10	1.44E-11	4.99E-09	2.14E-09	2.24E-08	9.97E-07 no observed effects		100	6.19E-11	9.19E-09	[B2]
Cadmium	7.36	16.39	1.21E-09	1.56E-10	1.01E-07	4.33E-08	2.42E-06	2.02E-04 kidney; proteinuria		10			
Chromium (III)	73.02	89.96	1.20E-08	1.54E-09	5.54E-07	2.37E-07	1.20E-08	5.54E-07 no observed effects		100			
Cobalt	18.07	22.09	2.97E-09	3.82E-10	1.36E-07	5.83E-08							
Copper	71.08	129.20	1.17E-08	1.50E-09	7.96E-07	3.41E-07	3.16E-07	2.15E-05 Gastrointestinal system; irritation					[D]
Lead	42.04	62.91	6.91E-09	8.89E-10	3.87E-07	1.66E-07		CNS, blood					[B2]
Manganese	1198.00	1615.00	1.97E-07	2.53E-08	9.94E-06	4.26E-06	1.97E-06	9.94E-05 lung, CNS; respiratory, psychomotor distu.		1			[D]
Mercury	271.90	729.50	4.47E-08	5.75E-09	4.49E-06	1.93E-06	1.49E-04	1.50E-02 oral -CNS; neurotoxicity		1000			[D]
Nickel	66.30	116.70	1.09E-08	1.40E-09	7.19E-07	3.08E-07	5.45E-07	3.59E-05 dec. body and organ weight		300			
Silver	3.37	8.63	5.53E-10	7.11E-11	5.31E-08	2.28E-08	1.11E-07	1.06E-05 skin; argyria		3			[D]
Vanadium	37.26	47.60	6.12E-09	7.87E-10	2.93E-07	1.26E-07	8.75E-07	4.19E-05 no observed effects		100			
Zinc	170.20	236.60	2.80E-08	3.60E-09	1.46E-06	6.24E-07	9.33E-08	4.86E-06 blood; anemia		3			[D]
ORGANICS (mg/kg)													
Acenaphthene	0.24	0.31	3.92E-10	5.04E-11	1.92E-08	8.22E-09	6.54E-09	3.20E-07 liver; hepatotoxicity		3000			
Acenaphthylene	0.21	0.24	3.52E-10	4.53E-11	1.45E-08	6.20E-09	1.17E-08	4.83E-07					[D]
Anthracene	0.27	0.46	4.38E-10	5.63E-11	2.85E-08	1.22E-08	1.46E-09	9.51E-08 no observed effects		3000			[D]
Aroclor-1248	0.41	0.91	6.74E-10	8.67E-11	5.59E-08	2.40E-08					6.67E-10	1.85E-07	[B2]
Aroclor-1260	0.62	1.25	1.02E-09	1.31E-10	7.72E-08	3.31E-08					1.01E-09	2.55E-07	[B2]
Benzo(a)anthracene	0.81	1.83	1.33E-09	1.71E-10	1.13E-07	4.83E-08	4.43E-08	3.75E-06			1.25E-10	3.52E-08	[B2]
Benzo(a)pyrene	0.74	1.64	1.21E-09	1.56E-10	1.01E-07	4.33E-08	4.04E-08	3.37E-06			1.14E-09	3.16E-07	[B2]
Benzo(b)fluoranthene	0.90	2.20	1.49E-09	1.91E-10	1.35E-07	5.81E-08	4.95E-08	4.52E-06			1.39E-10	4.24E-08	[B2]
Benzo(g,h,i)perylene	0.43	0.94	7.13E-10	9.17E-11	5.80E-08	2.49E-08	2.38E-08	1.93E-06					[D]
Benzo(k)fluoranthene	0.48	0.95	7.96E-10	1.02E-10	5.87E-08	2.52E-08	2.65E-08	1.96E-06			7.47E-11	1.84E-08	[B2]
Benzoic Acid	0.92	1.56	1.52E-09	1.95E-10	9.59E-08	4.11E-08	3.79E-10	2.40E-08 no observed effects		1			[D]
alpha-BHC	0.01	0.03	2.22E-11	2.86E-12	1.59E-09	6.82E-10					1.80E-11	4.30E-09	[B2]
gamma-BHC	0.02	0.03	2.49E-11	3.20E-12	1.66E-09	7.10E-10	8.28E-08	5.52E-06 liver, kidney effects			4.15E-12	9.23E-10	[C]
Butylbenzylphthalate	0.27	0.34	4.51E-10	5.80E-11	2.12E-08	9.08E-09							
Di-n-butyl phthalate	0.21	0.32	3.52E-10	4.53E-11	1.98E-08	8.49E-09	3.52E-09	1.98E-07 liver, kidney damage		1000			[D]
alpha-Chlordane	0.14	0.26	2.30E-10	2.96E-11	1.61E-08	6.88E-09							
Chrysene	0.77	1.74	1.27E-09	1.63E-10	1.07E-07	4.58E-08	4.23E-08	3.57E-06			1.19E-11	3.35E-09	[B2]
4,4'-DDD	0.03	0.05	4.48E-11	5.76E-12	3.18E-09	1.36E-09					1.38E-12	3.27E-10	[B2]
4,4'-DDE	0.03	0.06	5.37E-11	6.91E-12	3.47E-09	1.49E-09					2.35E-12	5.06E-10	[B2]
Dibenzo(a,h)anthracene	0.29	0.39	4.78E-10	6.14E-11	2.42E-08	1.04E-08	1.59E-08	8.06E-07 skin disorders			4.49E-10	7.57E-08	[B2]
Bis(2-ethylhexyl)phthalate	0.58	1.06	9.45E-10	1.22E-10	6.55E-08	2.81E-08	4.73E-08	3.28E-06 liver; weight inc.		1000	1.70E-12	3.93E-10	[B2]
Fluoranthene	1.84	3.84	3.03E-09	3.89E-10	2.36E-07	1.01E-07	7.57E-08	5.90E-06 nephropathy, blood effects		3000			[D]
Fluorene	0.23	0.28	3.75E-10	4.82E-11	1.71E-08	7.33E-09	9.37E-09	4.27E-07 skin disorders		3000			[D]
Indeno(1,2,3-cd)pyrene	0.44	1.02	7.31E-10	9.40E-11	6.25E-08	2.68E-08	2.44E-08	2.08E-06 skin disorders			6.86E-11	1.96E-08	[B2]
p,p'-Methoxychlor	0.14	0.26	2.23E-10	2.86E-11	1.59E-08	6.82E-09							
2-Methylnaphthalene	0.21	0.31	3.49E-10	4.49E-11	1.89E-08	8.09E-09	1.16E-08	6.29E-07 skin effects					
Naphthalene	0.21	0.30	3.38E-10	4.35E-11	1.87E-08	8.02E-09	8.45E-09	4.68E-07 eye, blood effects		1000			[D]
Di-n-octyl phthalate	0.28	0.35	4.56E-10	5.86E-11	2.13E-08	9.13E-09	2.28E-08	1.06E-06 skin disorders		1000			
Phenanthrene	0.65	1.13	1.06E-09	1.36E-10	6.95E-08	2.98E-08	3.53E-08	2.32E-06 skin disorders					[D]
Pyrene	1.49	3.95	2.44E-09	3.14E-10	2.43E-07	1.04E-07	8.15E-08	8.12E-06 skin disorders		3000			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.61E-04	1.57E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											4.06E-09	1.02E-06	

Table L.12. Risk characterization for sediments: children – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	10300.00	14320.00	2.21E-06	9.46E-08	1.15E-04	1.48E-05							
Arsenic	7.93	10.93	1.70E-09	7.28E-11	8.80E-08	1.13E-08	5.67E-06	2.93E-04 skin; keratosis, hyperpigmentation		3	1.27E-10	1.98E-08	[A]
Barium	163.40	301.10	3.50E-08	1.50E-09	2.42E-06	3.12E-07	5.00E-07	3.46E-05 oral-cardiovasc. sys.; inc. blood pressure		3			
Beryllium	0.68	0.81	1.46E-10	6.25E-12	6.52E-09	8.39E-10	2.92E-08	1.30E-06 no observed effects		100	2.69E-11	3.61E-09	[B2]
Cadmium	7.36	16.39	1.58E-09	6.76E-11	1.32E-07	1.70E-08	3.15E-06	2.64E-04 kidney; proteinuria		10			
Chromium (III)	73.02	89.96	1.56E-08	6.71E-10	7.24E-07	9.31E-08	1.56E-08	7.24E-07 no observed effects		100			
Cobalt	18.07	22.09	3.87E-09	1.66E-10	1.78E-07	2.29E-08							
Copper	71.08	129.20	1.52E-08	6.53E-10	1.04E-06	1.34E-07	4.12E-07	2.81E-05 Gastrointestinal system; irritation					[D]
Lead	42.04	62.91	9.01E-09	3.86E-10	5.07E-07	6.51E-08		CNS, blood					[B2]
Manganese	1198.00	1615.00	2.57E-07	1.10E-08	1.30E-05	1.67E-06	2.57E-06	1.30E-04 lung, CNS; respiratory, psychomotor distu		1			[D]
Mercury	271.90	729.50	5.83E-08	2.50E-09	5.87E-06	7.55E-07	1.94E-04	1.96E-02 oral -CNS; neurotoxicity		1000			[D]
Nickel	66.30	116.70	1.42E-08	6.09E-10	9.40E-07	1.21E-07	7.10E-07	4.70E-05 dec. body and organ weight		300			
Silver	3.37	8.63	7.21E-10	3.09E-11	6.95E-08	8.93E-09	1.44E-07	1.39E-05 skin; argyria		3			[D]
Vanadium	37.26	47.60	7.98E-09	3.42E-10	3.83E-07	4.93E-08	1.14E-06	5.48E-05 no observed effects		100			
Zinc	170.20	236.60	3.65E-08	1.56E-09	1.91E-06	2.45E-07	1.22E-07	6.35E-06 blood; anemia		3			[D]
ORGANICS (mg/kg)													
Acenaphthene	0.24	0.31	5.11E-10	2.19E-11	2.51E-08	3.23E-09	8.52E-09	4.16E-07 liver; hepatotoxicity		3000			
Acenaphthylene	0.21	0.24	4.59E-10	1.97E-11	1.89E-08	2.43E-09	1.53E-08	6.31E-07					[D]
Anthracene	0.27	0.46	5.71E-10	2.45E-11	3.73E-08	4.80E-09	1.90E-09	1.24E-07 no observed effects		3000			[D]
Aroclor-1248	0.41	0.91	8.78E-10	3.76E-11	7.32E-08	9.41E-09					2.90E-10	7.24E-08	[B2]
Aroclor-1260	0.62	1.25	1.33E-09	5.69E-11	1.01E-07	1.30E-08					4.38E-10	1.00E-07	[B2]
Benzo(a)anthracene	0.81	1.83	1.73E-09	7.42E-11	1.47E-07	1.89E-08	5.77E-08	4.91E-06			5.42E-11	1.38E-08	[B2]
Benzo(a)pyrene	0.74	1.64	1.58E-09	6.76E-11	1.32E-07	1.70E-08	5.26E-08	4.41E-06			4.94E-10	1.24E-07	[B2]
Benzo(b)fluoranthene	0.90	2.20	1.94E-09	8.30E-11	1.77E-07	2.28E-08	6.46E-08	5.91E-06			6.06E-11	1.66E-08	[B2]
Benzo(g,h,i)perylene	0.43	0.94	9.29E-10	3.98E-11	7.59E-08	9.76E-09	3.10E-08	2.53E-06					[D]
Benzo(k)fluoranthene	0.48	0.95	1.04E-09	4.44E-11	7.68E-08	9.88E-09	3.46E-08	2.56E-06			3.24E-11	7.21E-09	[B2]
Benzoic Acid	0.92	1.56	1.97E-09	8.46E-11	1.25E-07	1.61E-08	4.94E-10	3.14E-08 no observed effects		1			[D]
alpha-BHC	0.01	0.03	2.90E-11	1.24E-12	2.08E-09	2.68E-10					7.83E-12	1.69E-09	[B2]
gamma-BHC	0.02	0.03	3.24E-11	1.39E-12	2.17E-09	2.79E-10	1.08E-07	7.22E-06 liver, kidney effects			1.80E-12	3.62E-10	[C]
Butylbenzylphthalate	0.27	0.34	5.88E-10	2.52E-11	2.77E-08	3.56E-09							
Di-n-butyl phthalate	0.21	0.32	4.59E-10	1.97E-11	2.59E-08	3.33E-09	4.59E-09	2.59E-07 liver, kidney damage		1000			[D]
alpha-Chlordane	0.14	0.26	3.00E-10	1.29E-11	2.10E-08	2.70E-09							
Chrysene	0.77	1.74	1.66E-09	7.09E-11	1.40E-07	1.80E-08	5.52E-08	4.66E-06			5.18E-12	1.31E-09	[B2]
4,4'-DDD	0.03	0.05	5.83E-11	2.50E-12	4.16E-09	5.35E-10					6.00E-13	1.28E-10	[B2]
4,4'-DDE	0.03	0.06	7.00E-11	3.00E-12	4.54E-09	5.84E-10					1.02E-12	1.99E-10	[B2]
Dibenzo(a,h)anthracene	0.29	0.39	6.23E-10	2.67E-11	3.16E-08	4.07E-09	2.08E-08	1.05E-06 skin disorders			1.95E-10	2.97E-08	[B2]
Bis(2-ethylhexyl)phthalate	0.58	1.06	1.23E-09	5.28E-11	8.57E-08	1.10E-08	6.16E-08	4.28E-06 liver; weight inc.		1000	7.39E-13	1.54E-10	[B2]
Fluoranthene	1.84	3.84	3.94E-09	1.69E-10	3.09E-07	3.97E-08	9.86E-08	7.72E-06 nephropathy, blood effects		3000			[D]
Fluorene	0.23	0.28	4.88E-10	2.09E-11	2.24E-08	2.87E-09	1.22E-08	5.59E-07 skin disorders		3000			[D]
Indeno(1,2,3-cd)pyrene	0.44	1.02	9.53E-10	4.08E-11	8.17E-08	1.05E-08	3.18E-08	2.72E-06 skin disorders			2.98E-11	7.67E-09	[B2]
p,p'-Methoxychlor	0.14	0.26	2.90E-10	1.24E-11	2.08E-08	2.68E-09							
2-Methylnaphthalene	0.21	0.31	4.56E-10	1.95E-11	2.47E-08	3.17E-09	1.52E-08	8.23E-07 skin effects					
Naphthalene	0.21	0.30	4.41E-10	1.89E-11	2.45E-08	3.15E-09	1.10E-08	6.12E-07 eye, blood effects		1000			[D]
Di-n-octyl phthalate	0.28	0.35	5.94E-10	2.54E-11	2.78E-08	3.58E-09	2.97E-08	1.39E-06 skin disorders		1000			
Phenanthrene	0.65	1.13	1.38E-09	5.92E-11	9.08E-08	1.17E-08	4.61E-08	3.03E-06 skin disorders					[D]
Pyrene	1.49	3.95	3.19E-09	1.37E-10	3.18E-07	4.09E-08	1.06E-07	1.06E-05 skin disorders		3000			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.10E-04	2.05E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.76E-09	3.99E-07	

Table L.13. Risk characterization for groundwater: adults – ingestion exposure (current land use – residential)

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	RfDs WOE
INORGANICS (µg/L)													
Aluminum	2.00E+04	2.50E+04	3.83E-01	4.92E-02	6.84E-01	2.93E-01							
Antimony	1.53E+01	1.62E+01	2.93E-04	3.77E-05	4.45E-04	1.91E-04	7.32E-01	1.11E+00	whole body, blood; inc. mortality	1000			
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	skin; keratosis, hyperpigmentation	3	1.71E-05	1.15E-04	[A]
Barium	3.95E+02	4.85E+02	7.58E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.88E+00	2.56E+00	3.61E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	no observed effects	100	2.00E-05	1.29E-04	[B2]
Cadmium	3.51E+00	5.15E+00	6.74E-05	8.66E-06	1.41E-04	6.05E-05	1.35E-01	2.82E-01	kidney; proteinuria	10			
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.81E-04	6.33E-04	1.12E-03	no observed effects	100			
Cobalt	1.73E+01	2.18E+01	3.32E-04	4.27E-05	5.98E-04	2.56E-04							
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.80E-03	8.66E-03	2.40E-01	Gastrointestinal system; irritation				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04			CNS, blood				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	7.17E-01	1.21E+00	lung, CNS; respiratory, psychomotor distur	1			[D]
Mercury	1.39E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	oral – CNS; neurotoxicity	1000			[D]
Nickel	4.80E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	dec. body and organ weight	300			
Thallium	1.21E+00	1.26E+00	2.32E-05	2.99E-06	3.45E-05	1.48E-05	3.32E-01	4.93E-01	liver, blood; inc. sgot and serum LDH	3000			[D]
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	no observed effects	100			
Zinc	1.04E+01	1.29E+02	1.98E-04	2.55E-05	3.53E-03	1.51E-03	6.62E-04	1.18E-02	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Benzo(a)anthracene	5.02E+00	5.11E+00	9.63E-05	1.24E-05	1.40E-04	6.00E-05	3.21E-03	4.67E-03			9.04E-06	4.38E-05	[B2]
Benzo(a)pyrene	5.01E+00	5.11E+00	9.60E-05	1.23E-05	1.40E-04	6.00E-05	3.20E-03	4.66E-03			9.01E-05	4.38E-04	[B2]
Benzo(b)fluoranthene	5.02E+00	5.11E+00	9.63E-05	1.24E-05	1.40E-04	6.00E-05	3.21E-03	4.67E-03			9.04E-06	4.38E-05	[B2]
Benzo(k)fluoranthene	5.01E+00	5.11E+00	9.60E-05	1.23E-05	1.40E-04	6.00E-05	3.20E-03	4.66E-03			9.01E-06	4.38E-05	[B2]
Benzoic Acid	2.43E+01	2.50E+01	4.66E-04	5.99E-05	6.85E-04	2.94E-04	1.16E-04	1.71E-04	no observed effects	1			[D]
Bis(2-ethylhexyl)phthalate	4.84E+00	5.54E+00	9.29E-05	1.19E-05	1.52E-04	6.51E-05	4.64E-03	7.59E-03	liver; weight inc.	1000	1.67E-07	9.11E-07	[B2]
2-Butanone	8.55E+00	1.37E+01	1.64E-04	2.11E-05	3.75E-04	1.61E-04	3.28E-03	7.49E-03	oral–no observed effects	1000			[D]
Di-n-butyl phthalate	4.80E+00	4.96E+00	9.20E-05	1.18E-05	1.36E-04	5.83E-05	9.20E-04	1.36E-03	liver, kidney damage	1000			[D]
Carbon Disulfide	5.76E+00	8.36E+00	1.11E-04	1.42E-05	2.29E-04	9.81E-05	1.11E-03	2.29E-03	fetus; toxicity	100			
Chloroform	5.76E+00	8.34E+00	1.10E-04	1.42E-05	2.29E-04	9.79E-05	1.10E-02	2.29E-02	liver; lesions, fatty cyst formation	1000	8.66E-08	5.97E-07	[B2]
4,4'-DDT	5.15E-02	5.27E-02	9.87E-07	1.27E-07	1.44E-06	6.19E-07	1.97E-03	2.89E-03	liver; lesions	100	4.31E-08	2.10E-07	[B2]
Endrin	5.14E-02	5.27E-02	9.87E-07	1.27E-07	1.44E-06	6.19E-07	3.29E-03	4.81E-03	reprod., terato., CNS effects	100			[D]
Heptachlor Epoxide	2.57E-02	2.63E-02	4.93E-07	6.34E-08	7.21E-07	3.09E-07	3.79E-02	5.55E-02	liver damage		5.77E-07	2.81E-06	[B2]
alpha-Chlordane	1.37E-01	1.58E-01	2.63E-06	3.38E-07	4.33E-06	1.86E-06							
Chrysene	5.02E+00	5.11E+00	9.63E-05	1.24E-05	1.40E-04	6.00E-05	3.21E-03	4.67E-03			9.04E-07	4.38E-06	[B2]
Diethyl phthalate	4.56E+00	4.80E+00	8.74E-05	1.12E-05	1.31E-04	5.63E-05	1.09E-04	1.64E-04	lung irritation	1000			[D]
Fluoranthene	5.03E+00	5.11E+00	9.65E-05	1.24E-05	1.40E-04	6.00E-05	2.41E-03	3.50E-03	nephropathy, blood effects	3000			[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.69E-03	1.58E-03	2.23E-02	6.15E-02	liver, kidney damage, CNS effects	100	1.29E-06	1.19E-05	[B2]
Pyrene	5.05E+00	5.12E+00	9.68E-05	1.24E-05	1.40E-04	6.02E-05	3.23E-03	4.68E-03	skin disorders	3000			[D]
Tetrachloroethylene	5.78E+00	8.37E+00	1.11E-04	1.43E-05	2.29E-04	9.82E-05	1.11E-02	2.29E-02	liver, kidney, CNS effects	1000			
Xylenes	6.49E+00	1.02E+01	1.24E-04	1.60E-05	2.79E-04	1.20E-04	6.22E-05	1.40E-04	CNS hyperactivity, motor effects	100			[D]
RADIONUCLIDES (pCi/L)													
Americium 241	6.53E+00	1.33E+01		2.88E+04		2.78E+05					6.91E-06	6.68E-05	[A]
Cesium 137+D	9.54E-01	4.35E+00		4.21E+03		9.12E+04					1.18E-07	2.55E-06	[A]
Cobalt 60	1.26E+00	3.97E+00		5.55E+03		8.35E+04					8.32E-08	1.25E-06	[A]
Neptunium 237+D	7.59E+00	1.99E+01		3.35E+04		4.17E+05					7.37E-06	9.18E-05	[A]
Strontium 89	3.07E+00	4.15E+00		1.35E+04		8.72E+04					4.06E-08	2.62E-07	[A]
Strontium 90+D		6.06E-02				1.27E+03						4.58E-08	[A]
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04					1.44E-06	8.54E-06	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05					8.91E-07	6.11E-06	[A]
Uranium 235+D	5.50E-01	7.57E-01		2.43E+03		1.59E+04					3.88E-08	2.54E-07	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05					1.26E-06	8.86E-06	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	3.52E+00	6.75E+00		
Excess Lifetime Cancer Risk: Combined Exposure (d)			1.57E-04	8.34E-04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)			1.81E-05	1.86E-04

Table L.14. Risk characterization for groundwater: children – ingestion exposure (current land use – residential)

Chemical	MLB Concentration in GW (µg/L)	RMB Concentration in GW (µg/L)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	BPA WOE
INORGANICS (µg/L)													
Aluminum	2.00E+04	2.50E+04	3.98E-01	1.71E-02	8.10E-01	1.04E-01							
Antimony	1.53E+01	1.62E+01	3.05E-04	1.31E-05	5.27E-04	6.78E-05	7.61E-01	1.32E+00	whole body, blood; inc. mortality	1000			
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.38E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	no observed effects	100	6.92E-06	4.59E-05	[B2]
Cadmium	3.51E+00	5.15E+00	7.01E-05	3.00E-06	1.67E-04	2.15E-05	1.40E-01	3.34E-01	kidney; proteinuria	10			
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	no observed effects	100			
Cobalt	1.73E+01	2.18E+01	3.46E-04	1.48E-05	7.08E-04	9.10E-05							
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	Gastrointestinal system; irritation				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04			CNS, blood				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	7.46E-01	1.43E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	oral – CNS; neurotoxicity	1000			[D]
Nickel	4.80E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	dec. body and organ weight	300			
Thallium	1.21E+00	1.26E+00	2.42E-05	1.04E-06	4.09E-05	5.26E-06	3.45E-01	5.84E-01	liver, blood; inc. sgot and serum LDH	3000			[D]
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	no observed effects	100			
Zinc	1.04E+01	1.29E+02	2.06E-04	8.85E-06	4.18E-03	5.37E-04	6.88E-04	1.39E-02	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Benzo(a)anthracene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-06	1.56E-05	[B2]
Benzo(a)pyrene	5.01E+00	5.11E+00	9.99E-05	4.28E-06	1.66E-04	2.13E-05	3.33E-03	5.53E-03			3.12E-05	1.56E-04	[B2]
Benzo(b)fluoranthene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-06	1.56E-05	[B2]
Benzo(k)fluoranthene	5.01E+00	5.11E+00	9.99E-05	4.28E-06	1.66E-04	2.13E-05	3.33E-03	5.53E-03			3.12E-06	1.56E-05	[B2]
Benzoic Acid	2.43E+01	2.50E+01	4.84E-04	2.08E-05	8.11E-04	1.04E-04	1.21E-04	2.03E-04	no observed effects	1			[D]
Bis(2-ethylhexyl)phthalate	4.84E+00	5.54E+00	9.66E-05	4.14E-06	1.80E-04	2.31E-05	4.83E-03	8.99E-03	liver; weight inc.	1000	5.80E-08	3.24E-07	[B2]
2-Butanone	8.55E+00	1.37E+01	1.71E-04	7.31E-06	4.44E-04	5.70E-05	3.41E-03	8.87E-03	oral–no observed effects	1000			[D]
Di-n-butyl phthalate	4.80E+00	4.96E+00	9.57E-05	4.10E-06	1.61E-04	2.07E-05	9.57E-04	1.61E-03	liver, kidney damage	1000			[D]
Carbon Disulfide	5.76E+00	8.36E+00	1.15E-04	4.93E-06	2.71E-04	3.49E-05	1.15E-03	2.71E-03	fetus; toxicity	100			
Chloroform	5.76E+00	8.34E+00	1.15E-04	4.92E-06	2.71E-04	3.48E-05	1.15E-02	2.71E-02	liver; lesions, fatty cyst formation	1000	3.00E-08	2.12E-07	[B2]
4,4'-DDT	5.15E-02	5.27E-02	1.03E-06	4.40E-08	1.71E-06	2.20E-07	2.05E-03	3.42E-03	liver; lesions	100	1.50E-08	7.48E-08	[B2]
Endrin	5.14E-02	5.27E-02	1.03E-06	4.40E-08	1.71E-06	2.20E-07	3.42E-03	5.70E-03	reprod., terato., CNS effects	100			[D]
Heptachlor Epoxide	2.57E-02	2.63E-02	5.13E-07	2.20E-08	8.54E-07	1.10E-07	3.94E-02	6.57E-02	liver damage		2.00E-07	9.99E-07	[B2]
alpha-Chlordane	1.37E-01	1.58E-01	2.73E-06	1.17E-07	5.13E-06	6.60E-07							
Chrysene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-07	1.56E-06	[B2]
Diethyl phthalate	4.56E+00	4.80E+00	9.09E-05	3.90E-06	1.56E-04	2.00E-05	1.14E-04	1.95E-04	lung irritation	1000			[D]
Fluoranthene	5.03E+00	5.11E+00	1.00E-04	4.30E-06	1.66E-04	2.13E-05	2.51E-03	4.15E-03	nephropathy, blood effects	3000			[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	liver, kidney damage, CNS effects	100	4.47E-07	4.21E-06	[B2]
Pyrene	5.05E+00	5.12E+00	1.01E-04	4.31E-06	1.66E-04	2.14E-05	3.35E-03	5.54E-03	skin disorders	3000			[D]
Tetrachloroethylene	5.78E+00	8.37E+00	1.15E-04	4.94E-06	2.72E-04	3.49E-05	1.15E-02	2.72E-02	liver, kidney, CNS effects	1000			
Xylenes	6.49E+00	1.02E+01	1.29E-04	5.55E-06	3.31E-04	4.25E-05	6.47E-05	1.65E-04	CNS hyperactivity, motor effects	100			[D]
RADIONUCLIDES (pCi/L)													
Americium 241	6.53E+00	1.33E+01		3.56E+03		3.67E+04					8.55E-07	8.81E-06	[A]
Cesium 137+D	9.54E-01	4.35E+00		5.21E+02		1.20E+04					1.46E-08	3.37E-07	[A]
Cobalt 60	1.26E+00	3.97E+00		6.87E+02		1.10E+04					1.03E-08	1.65E-07	[A]
Neptunium 237+D	7.59E+00	1.99E+01		4.15E+03		5.51E+04					9.12E-07	1.21E-05	[A]
Strontium 89	3.07E+00	4.15E+00		1.68E+03		1.15E+04					5.03E-09	3.45E-08	[A]
Strontium 90+D		6.06E-02				1.68E+02						6.05E-09	[A]
Radium 228+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04					1.78E-07	1.13E-06	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04					1.10E-07	8.06E-07	[A]
Uranium 235+D	5.50E-01	7.57E-01		3.00E+02		2.10E+03					4.80E-09	3.36E-08	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04					1.56E-07	1.17E-06	[A]

Chemical Hazards:		
Hazard Index (HI): Combined Exposure (d)	3.66E+00	7.99E+00
Excess Lifetime Cancer Risk: Combined Exposure (d)	5.46E-05	2.96E-04
Radiological Hazards:		
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.25E-06	2.46E-05

Table L.15. Risk characterization for groundwater: adults – inhalation exposure (current land use – residential)

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA Uf	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	1.77E−04	2.28E−05	7.01E−04	3.00E−04			inc. liver, kidney weights, nephrotoxicity				
2−Butanone	8.55E+00	1.37E+01	4.22E−06	5.42E−07	1.40E−05	6.02E−06	1.48E−05	4.92E−05	oral−no observed effects	1000			
Carbon Disulfide	5.76E+00	8.36E+00	2.84E−06	3.65E−07	8.59E−06	3.68E−06	9.95E−04	3.01E−03	fetus; toxicity	1000			
Chloroform	5.76E+00	8.34E+00	2.84E−06	3.65E−07	8.57E−06	3.67E−06			liver; lesions, fatty cyst formation		2.96E−08	2.98E−07	[B2]
Methylene Chloride	6.97E+01	1.35E+02	3.44E−05	4.42E−06	1.38E−04	5.93E−05	4.01E−05	1.61E−04	liver, kidney damage, CNS effects	100			[B2]
Tetrachloroethylene	5.78E+00	8.37E+00	2.85E−06	3.67E−07	8.60E−06	3.68E−06			liver, kidney, CNS effects				
Xylenes	6.49E+00	1.02E+01	3.20E−06	4.11E−07	1.05E−05	4.49E−06			CNS hyperactivity, motor effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.05E−03	3.22E−03					
Excess Lifetime Cancer Risk: Combined Exposure (d)											2.96E−08	2.98E−07	

Table L.16. Risk characterization for groundwater: children – inhalation exposure (current land use – residential)

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfC) (MLE)	HQ Noncarc. Effects (CDI/RfC) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	1.03E−03	4.43E−05	3.17E−03	4.07E−04			inc. liver, kidney weights, nephrotoxicity				
2−Butanone	8.55E+00	1.37E+01	2.46E−05	1.05E−06	6.35E−05	8.17E−06	8.61E−05	2.22E−04	oral−no observed effects	1000			
Carbon Disulfide	5.76E+00	8.36E+00	1.66E−05	7.11E−07	3.88E−05	4.99E−06	5.80E−03	1.36E−02	fetus; toxicity	1000			
Chloroform	5.76E+00	8.34E+00	1.66E−05	7.10E−07	3.88E−05	4.98E−06			liver; lesions, fatty cyst formation		5.75E−08	4.04E−07	[B2]
Methylene Chloride	6.97E+01	1.35E+02	2.01E−04	8.60E−06	6.25E−04	8.04E−05	2.34E−04	7.30E−04	liver, kidney damage, CNS effects	100			[B2].
Tetrachloroethylene	5.76E+00	8.37E+00	1.66E−05	7.13E−07	3.89E−05	5.00E−06			liver, kidney, CNS effects				
Xylenes	6.49E+00	1.02E+01	1.87E−05	8.00E−07	4.74E−05	6.09E−06			CNS hyperactivity, motor effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.12E−03	1.45E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											5.75E−08	4.04E−07	

Table L.17. Risk characterization for produce (Bruner's Site): adults – ingestion exposure (current land use – residential)

Chemical	Plant Conc. from MLB Conc. in Soil (µg/day)	Plant Conc. from Groups from RMEs in Soil (µg/day)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE
INORGANICS (mg/kg PLANT TISSUE)													
Aluminum	7.47E+01	9.16E+01	1.14E-02	1.47E-03	6.40E-02	2.74E-02							
Arsenic	6.56E-01	9.04E-01	1.00E-04	1.29E-05	6.32E-04	2.71E-04	3.34E-01	2.11E+00	skin; keratosis, hyperpigmentation	3	2.25E-05	4.74E-04	[A]
Barium	2.33E+00	3.32E+00	3.56E-04	4.57E-05	2.32E-03	9.94E-04	5.08E-03	3.31E-02	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	4.43E-03	6.98E-03	6.76E-07	8.69E-08	4.88E-06	2.09E-06	1.35E-04	9.75E-04	no observed effects	100	3.74E-07	8.99E-06	[B2]
Cadmium	6.86E+00	1.26E+01	1.05E-03	1.35E-04	8.79E-03	3.77E-03	2.09E+00	1.76E+01	kidney; proteinuria	10			
Chromium (III)	8.26E-01	1.05E+00	1.26E-04	1.62E-05	7.36E-04	3.15E-04	1.26E-04	7.36E-04	no observed effects	100			
Cobalt	4.67E-01	5.10E-01	7.12E-05	9.15E-06	3.56E-04	1.53E-04							
Copper	9.08E+00	1.34E+01	1.38E-03	1.78E-04	9.38E-03	4.02E-03	3.74E-02	2.53E-01	Gastrointestinal system; irritation				[D]
Cyanide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00			thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	1.15E+00	1.43E+00	1.75E-04	2.26E-05	9.99E-04	4.28E-04			CNS, blood				[B2]
Manganese	5.08E+02	5.92E+02	7.75E-02	9.97E-03	4.14E-01	1.77E-01	7.75E-01	4.14E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	9.75E+01	1.89E+02	1.49E-02	1.91E-03	1.32E-01	5.65E-02	4.96E+01	4.39E+02	oral –CNS; neurotoxicity	1000			[D]
Nickel	4.45E+00	6.48E+00	6.78E-04	8.72E-05	4.53E-03	1.94E-03	3.39E-02	2.26E-01	dec. body and organ weight	300			
Silver	2.77E+00	4.34E+00	4.23E-04	5.44E-05	3.03E-03	1.30E-03	8.46E-02	6.07E-01	skin; argyria	3			[D]
Vanadium	6.70E-02	7.76E-02	1.02E-05	1.32E-06	5.42E-05	2.32E-05	1.46E-03	7.74E-03	no observed effects	100			
Zinc	7.36E+01	9.63E+01	1.12E-02	1.44E-03	6.73E-02	2.88E-02	3.74E-02	2.24E-01	blood; anemia	3			[D]
ORGANICS (mg/kg PLANT TISSUE)													
Arodor-1254	2.15E-03	4.00E-03	3.28E-07	4.22E-08	2.79E-06	1.20E-06					3.25E-07	9.21E-06	[B2]
Arodor-1260	1.36E-03	2.46E-03	2.07E-07	2.67E-08	1.72E-06	7.37E-07					2.05E-07	5.67E-06	[B2]
Acenaphthylene	1.02E-02	1.50E-02	1.55E-06	1.99E-07	1.05E-05	4.48E-06	5.17E-05	3.49E-04					[D]
Anthracene	3.92E-03	6.97E-03	5.98E-07	7.69E-08	4.87E-06	2.09E-06	1.99E-06	1.62E-05	no observed effects	3000			[D]
Benzo(a)anthracene	1.75E-03	2.29E-03	2.66E-07	3.43E-08	1.60E-06	6.84E-07	8.88E-06	5.32E-05			2.50E-08	5.00E-07	[B2]
Benzo(a)pyrene	8.73E-04	1.07E-03	1.33E-07	1.71E-08	7.51E-07	3.22E-07	4.44E-06	2.50E-05			1.25E-07	2.35E-06	[B2]
Benzo(b)fluoranthene	1.48E-03	2.00E-03	2.26E-07	2.90E-08	1.40E-06	6.00E-07	7.53E-06	4.67E-05			2.12E-08	4.38E-07	[B2]
Benzo(g,h,i)perylene	2.29E-04	2.98E-04	3.49E-08	4.49E-09	2.09E-07	8.94E-08	1.16E-06	6.95E-06					[D]
Benzo(k)fluoranthene	9.16E-04	1.43E-03	1.40E-07	1.80E-08	1.00E-06	4.29E-07	4.66E-06	3.34E-05			1.31E-08	3.14E-07	[B2]
Bis(2-ethylhexyl)phthalate	7.64E-03	1.20E-02	1.17E-06	1.50E-07	8.36E-06	3.58E-06	5.83E-05	4.18E-04	liver; weight inc.	1000	2.10E-09	5.01E-08	[B2]
Di-n-butyl phthalate	8.31E-03	1.32E-02	1.27E-06	1.63E-07	9.19E-06	3.94E-06	1.27E-05	9.19E-05	liver, kidney damage	1000			[D]
Chrysene	2.30E-03	3.01E-03	3.50E-07	4.50E-08	2.10E-06	9.00E-07	1.17E-05	7.00E-05			3.29E-09	6.57E-08	[B2]
Fluoranthene	9.06E-03	1.22E-02	1.38E-06	1.78E-07	8.54E-06	3.66E-06	3.46E-05	2.14E-04	nephropathy, blood effects	3000			[D]
Indeno(1,2,3-cd)pyrene	9.04E-05	1.31E-04	1.38E-08	1.77E-09	9.18E-08	3.93E-08	4.60E-07	3.06E-06	skin disorders		1.29E-09	2.87E-08	[B2]
2-Methylnaphthalene	9.27E-03	1.70E-02	1.41E-06	1.82E-07	1.19E-05	5.09E-06	4.71E-05	3.96E-04	skin effects				
Naphthalene	2.31E-02	3.66E-02	3.52E-06	4.53E-07	2.56E-05	1.10E-05	8.81E-05	6.40E-04	eye, blood effects	1000			[D]
Phenanthrene	9.28E-03	1.27E-02	1.42E-06	1.82E-07	8.84E-06	3.79E-06	4.72E-05	2.95E-04	skin disorders				[D]
Pyrene	7.90E-03	1.08E-02	1.21E-06	1.55E-07	7.56E-06	3.24E-06	4.02E-05	2.52E-04	skin disorders	3000			[D]
RADIONUCLIDES (pCi/kg PLANT TISSUE)													
Americium 241	6.00E-05	1.82E-04		2.11E+00		9.73E+01					5.05E-10	2.34E-08	[A]
Cesium 137+D	4.04E-02	5.36E-02		1.42E+03		2.87E+04					3.97E-08	8.03E-07	[A]
Cobalt 60	6.50E-04	1.28E-03		2.28E+01		6.87E+02					3.42E-10	1.03E-08	[A]
Neptunium 237+D	7.33E-04	2.32E-03		2.57E+01		1.24E+03					5.66E-09	2.74E-07	[A]
Uranium 234	2.99E-02	3.53E-02		1.05E+03		1.89E+04					1.68E-08	3.02E-07	[A]
Uranium 235+D	1.41E-03	1.92E-03		4.95E+01		1.03E+03					7.92E-10	1.65E-08	[A]
Uranium 238+D	2.20E-02	2.65E-02		7.73E+02		1.42E+04					2.16E-08	3.97E-07	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	5.30E+01	4.64E+02		
Excess Lifetime Cancer Risk: Combined Exposure (d)			2.36E-05	5.01E-04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)			8.54E-08	1.83E-06

Table L.18. Risk characterization for produce (Bruner's Site): children – ingestion exposure (current land use – residential)

Chemical	Plant Conc. from MLB Conc. in Soil (µg/kg)	Plant Conc. from Groups from RMBs in Soil (µg/kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE
INORGANICS (mg/kg PLANT TISSUE)													
Aluminum	7.47E+01	9.16E+01	2.55E-02	1.09E-03	1.33E-01	1.71E-02							
Arsenic	6.56E-01	9.04E-01	2.24E-04	9.59E-06	1.31E-03	1.68E-04	7.46E-01	4.37E+00	skin; keratosis, hyperpigmentation	3	1.68E-05	2.95E-04	[A]
Barium	2.33E+00	3.32E+00	7.95E-04	3.41E-05	4.81E-03	6.19E-04	1.14E-02	6.87E-02	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	4.43E-03	6.98E-03	1.51E-06	6.48E-08	1.01E-05	1.30E-06	3.02E-04	2.02E-03	no observed effects	100	2.79E-07	5.59E-06	[B2]
Cadmium	6.86E+00	1.26E+01	2.34E-03	1.00E-04	1.82E-02	2.35E-03	4.68E+00	3.65E+01	kidney; proteinuria	10			
Chromium (III)	8.26E-01	1.05E+00	2.82E-04	1.21E-05	1.53E-03	1.96E-04	2.82E-04	1.53E-03	no observed effects	100			
Cobalt	4.67E-01	5.10E-01	1.59E-04	6.82E-06	7.39E-04	9.50E-05							
Copper	9.08E+00	1.34E+01	3.10E-03	1.33E-04	1.95E-02	2.50E-03	8.37E-02	5.26E-01	Gastrointestinal system; irritation				[D]
Cyanide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00			thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	1.15E+00	1.43E+00	3.92E-04	1.68E-05	2.07E-03	2.66E-04			CNS, blood				[B2]
Manganese	5.08E+02	5.92E+02	1.73E-01	7.43E-03	8.59E-01	1.10E-01	1.73E+00	8.59E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	9.75E+01	1.89E+02	3.32E-02	1.42E-03	2.73E-01	3.51E-02	1.11E+02	9.11E+02	oral –CNS; neurotoxicity	1000			[D]
Nickel	4.45E+00	6.48E+00	1.52E-03	6.50E-05	9.39E-03	1.21E-03	7.58E-02	4.70E-01	dec. body and organ weight	300			
Silver	2.77E+00	4.34E+00	9.45E-04	4.05E-05	6.30E-03	8.10E-04	1.89E-01	1.26E+00	skin; argyria	3			[D]
Vanadium	6.70E-02	7.76E-02	2.29E-05	9.80E-07	1.12E-04	1.45E-05	3.27E-03	1.61E-02	no observed effects	100			
Zinc	7.36E+01	9.63E+01	2.51E-02	1.08E-03	1.40E-01	1.79E-02	8.37E-02	4.65E-01	blood; anemia	3			[D]
ORGANICS (mg/kg PLANT TISSUE)													
Arodor-1254	2.15E-03	4.00E-03	7.33E-07	3.14E-08	5.79E-06	7.45E-07					2.42E-07	5.73E-06	[B2]
Arodor-1260	1.36E-03	2.46E-03	4.64E-07	1.99E-08	3.57E-06	4.59E-07					1.53E-07	3.53E-06	[B2]
Acenaphthylene	1.02E-02	1.50E-02	3.47E-06	1.49E-07	2.17E-05	2.79E-06	1.16E-04	7.23E-04					[D]
Anthracene	3.92E-03	6.97E-03	1.34E-06	5.73E-08	1.01E-05	1.30E-06	4.45E-06	3.37E-05	no observed effects	3000			[D]
Benzo(a)anthracene	1.75E-03	2.29E-03	5.96E-07	2.55E-08	3.31E-06	4.26E-07	1.99E-05	1.10E-04			1.86E-08	3.11E-07	[B2]
Benzo(a)pyrene	8.73E-04	1.07E-03	2.98E-07	1.28E-08	1.56E-06	2.00E-07	9.93E-06	5.19E-05			9.32E-08	1.46E-06	[B2]
Benzo(b)fluoranthene	1.48E-03	2.00E-03	5.05E-07	2.16E-08	2.90E-06	3.73E-07	1.68E-05	9.68E-05			1.58E-08	2.73E-07	[B2]
Benzo(g,h,i)perylene	2.29E-04	2.98E-04	7.80E-08	3.34E-09	4.33E-07	5.56E-08	2.60E-06	1.44E-05					[D]
Benzo(k)fluoranthene	9.16E-04	1.43E-03	3.12E-07	1.34E-08	2.08E-06	2.67E-07	1.04E-05	6.93E-05			9.78E-09	1.95E-07	[B2]
Bis(2-ethylhexyl)phthalate	7.64E-03	1.20E-02	2.61E-06	1.12E-07	1.73E-05	2.23E-06	1.30E-04	8.67E-04	liver; weight inc.	1000	1.56E-09	3.12E-08	[B2]
Di-n-butyl phthalate	8.31E-03	1.32E-02	2.83E-06	1.21E-07	1.91E-05	2.45E-06	2.83E-05	1.91E-04	liver, kidney damage	1000			[D]
Chrysene	2.30E-03	3.01E-03	7.83E-07	3.36E-08	4.36E-06	5.60E-07	2.61E-05	1.45E-04			2.45E-09	4.09E-08	[B2]
Fluoranthene	9.06E-03	1.22E-02	3.09E-06	1.32E-07	1.77E-05	2.28E-06	7.72E-05	4.43E-04	nephropathy, blood effects	3000			[D]
Indeno(1,2,3-cd)pyrene	9.04E-05	1.31E-04	3.08E-08	1.32E-09	1.90E-07	2.45E-08	1.03E-06	6.35E-06	skin disorders		9.64E-10	1.79E-08	[B2]
2-Methylnaphthalene	9.27E-03	1.70E-02	3.16E-06	1.35E-07	2.47E-05	3.17E-06	1.05E-04	8.22E-04	skin effects				
Naphthalene	2.31E-02	3.66E-02	7.87E-06	3.37E-07	5.31E-05	6.83E-06	1.97E-04	1.33E-03	eye, blood effects	1000			[D]
Phenanthrene	9.28E-03	1.27E-02	3.17E-06	1.36E-07	1.83E-05	2.36E-06	1.06E-04	6.11E-04	skin disorders				[D]
Pyrene	7.90E-03	1.08E-02	2.69E-06	1.15E-07	1.57E-05	2.02E-06	8.98E-05	5.23E-04	skin disorders	3000			[D]
RADIONUCLIDES (pCi/kg PLANT TISSUE)													
Americium 241	6.00E-05	1.82E-04		5.60E-01		2.25E+01					1.34E-10	5.40E-09	[A]
Cesium 137+D	4.04E-02	5.36E-02		3.78E+02		6.63E+03					1.06E-08	1.86E-07	[A]
Cobalt 60	6.50E-04	1.28E-03		6.07E+00		1.59E+02					9.10E-11	2.38E-09	[A]
Neptunium 237+D	7.33E-04	2.32E-03		6.85E+00		2.88E+02					1.51E-09	6.33E-08	[A]
Uranium 234	2.99E-02	3.53E-02		2.79E+02		4.37E+03					4.47E-09	6.99E-08	[A]
Uranium 235+D	1.41E-03	1.92E-03		1.32E+01		2.38E+02					2.11E-10	3.80E-09	[A]
Uranium 238+D	2.20E-02	2.65E-02		2.06E+02		3.28E+03					5.76E-09	9.18E-08	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.18E+02	9.64E+02		
Excess Lifetime Cancer Risk: Combined Exposure (d)			1.76E-05	3.12E-04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)			2.27E-08	4.22E-07

Table L.19. Risk characterization for fish: adults – ingestion exposure (current land use – residential)

Chemical	MLB Concentration in Fish Tissue (mg/Kg)	RMB Concentration in Fish Tissue (mg/Kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE
INORGANICS													
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	oral – CNS; neurotoxicity	1000			[D]
ORGANICS													
Aroclor-1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06					6.37E-07	2.71E-05	[B2]
Aroclor-1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06					1.12E-06	4.76E-05	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.75E-06	7.47E-05	

Table L.20. Risk characterization for fish: children – ingestion exposure (current land use – residential)

Chemical	MLB Concentration in Fish Tissue (mg/Kg)	RMB Concentration in Fish Tissue (mg/Kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA Uf	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE
INORGANICS													
Mercury	0.76	0.78	4.16E-06	1.78E-07	6.04E-05	7.76E-06	1.39E-02	2.01E-01	oral – CNS; neurotoxicity	1000			[D]
ORGANICS													
Aroclor-1254	0.20	0.22	1.12E-06	4.81E-08	1.72E-05	2.21E-06					3.70E-07	1.70E-05	[B2]
Aroclor-1260	0.36	0.39	1.97E-06	8.44E-08	3.01E-05	3.88E-06					6.50E-07	2.98E-05	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.39E-02	2.01E-01					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.02E-06	4.68E-05	

Table L.21. Human health risk characterization summary: EFPC residential scenario: current land use, NOAA Site adult long term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.87E−01	2.12E+00	1.93E−06	3.11E−05
Dermal Contact	1.04E−02	2.31E−01	3.57E−07	2.17E−05
SURFACE WATER				
Ingestion	2.69E−04	2.24E−03	2.26E−09	5.37E−08
Dermal Contact	1.30E−03	1.67E−02	2.03E−08	9.14E−07
SEDIMENT				
Dermal Contact	1.61E−04	1.57E−02	4.06E−09	1.02E−06
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	3.00E+01	3.20E+02	2.34E−05	4.10E−04
Fish	7.94E−03	9.63E−02	1.75E−06	7.47E−05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			5.38E−08	1.01E−06
SURFACE WATER				
Ingestion			1.25E−09	5.08E−07
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			5.99E−08	1.58E−06
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.03E+01	3.22E+02		
Excess Lifetime Cancer Risk: Combined Exposure			2.75E−05	5.40E−04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1.15E−07	3.10E−06

Table L.22. Human health risk characterization summary: EFPC residential scenario: current land use, NOAA Site children long term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.00E+00	7.60E+00	2.25E−06	3.34E−05
Dermal Contact	1.35E−02	3.02E−01	1.55E−07	8.52E−06
SURFACE WATER				
Ingestion	7.72E−04	6.17E−03	2.33E−09	4.89E−08
Dermal Contact	1.70E−03	2.18E−02	8.84E−09	3.59E−07
SEDIMENT				
Dermal Contact	2.10E−04	2.05E−02	1.76E−09	3.99E−07
GROUNDWATER				
Ingestion (Agricultural/Residential)				
Inhalation (VOCs)				
FOOD CHAIN				
Produce (Residential)	6.70E+01	6.63E+02	1.74E−05	2.55E−04
Fish	1.39E−02	2.01E−01	1.02E−06	4.68E−05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.24E−08	4.04E−07
SURFACE WATER				
Ingestion			4.15E−10	1.53E−07
GROUNDWATER				
Ingestion (Agricultural/Residential)				
FOOD CHAIN				
Produce (Residential)			1.59E−08	3.65E−07
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	6.80E+01	6.71E+02		
Excess Lifetime Cancer Risk: Combined Exposure			2.09E−05	3.45E−04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			3.87E−08	9.22E−07

Table L.23. Risk characterization for soils (NOAA Site): adults – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in Soils ( )	RME Concentration in Soils ( )	Chronic Daily Intake (CDI) ( ): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	RFA UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	RFA WOE ( )
INORGANICS (mg/kg)													
Aluminum	13180.00	17680.00	5.57E-03	7.16E-04	2.42E-02	1.04E-02							
Arsenic	8.20	9.30	3.47E-06	4.46E-07	1.27E-05	5.46E-06	1.16E-02	4.25E-02	skin; keratosis, hyperpigmentation	3	7.80E-07	9.55E-06	[A]
Barium	233.20	190.70	9.86E-05	1.27E-05	2.61E-04	1.12E-04	1.41E-03	3.73E-03	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.11	1.08	4.68E-07	6.02E-08	1.48E-06	6.35E-07	9.37E-05	2.96E-04	no observed effects	100	2.59E-07	2.73E-06	[B2]
Cadmium	4.31	7.72	1.82E-06	2.34E-07	1.06E-05	4.53E-06	3.64E-03	2.12E-02	kidney; proteinuria	10			
Chromium (III)	43.15	71.70	1.82E-05	2.35E-06	9.82E-05	4.21E-05	1.82E-05	9.82E-05	no observed effects	100			
Cobalt	12.03	19.31	5.09E-06	6.54E-07	2.65E-05	1.13E-05							
Copper	84.27	135.00	3.56E-05	4.58E-06	1.85E-04	7.93E-05	9.63E-04	5.00E-03	Gastrointestinal system; irritation				[D]
Cyanide	0.64	0.95	2.71E-07	3.49E-08	1.30E-06	5.57E-07	1.36E-05	6.50E-05	thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	36.02	51.81	1.52E-05	1.96E-06	7.10E-05	3.04E-05			CNS, blood				[B2]
Manganese	511.30	850.90	2.16E-04	2.78E-05	1.17E-03	5.00E-04	2.16E-03	1.17E-02	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	187.30	443.20	7.92E-05	1.02E-05	6.07E-04	2.60E-04	2.64E-01	2.02E+00	oral –CNS; neurotoxicity	1000			[D]
Nickel	39.23	65.14	1.66E-05	2.13E-06	8.92E-05	3.82E-05	8.29E-04	4.46E-03	dec. body and organ weight	300			
Silver	4.13	7.38	1.75E-06	2.25E-07	1.01E-05	4.33E-06	3.49E-04	2.02E-03	skin; argyria	3			[D]
Vanadium	23.50	29.57	9.93E-06	1.28E-06	4.05E-05	1.74E-05	1.42E-03	5.79E-03	no observed effects	100			
Zinc	59.64	93.43	2.52E-05	3.24E-06	1.28E-04	5.49E-05	8.40E-05	4.27E-04	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Aroclor-1260	0.77	1.62	3.26E-07	4.19E-08	2.22E-06	9.53E-07					3.23E-07	7.34E-06	[B2]
Acenaphthene	0.46	0.96	1.95E-07	2.51E-08	1.32E-06	5.66E-07	3.26E-06	2.20E-05	liver; hepatotoxicity	3000			
Acenaphthylene	0.25	0.34	1.05E-07	1.35E-08	4.69E-07	2.01E-07	3.50E-06	1.56E-05					[D]
Anthracene	0.50	1.11	2.12E-07	2.72E-08	1.52E-06	6.51E-07	7.05E-07	5.06E-06	no observed effects	3000			[D]
Benzo(a)anthracene	0.91	1.93	3.83E-07	4.92E-08	2.64E-06	1.13E-06	1.28E-05	8.80E-05			3.59E-08	8.26E-07	[B2]
Benzo(a)pyrene	0.80	1.58	3.36E-07	4.32E-08	2.17E-06	9.28E-07	1.12E-05	7.22E-05			3.16E-07	6.78E-06	[B2]
Benzo(b)fluoranthene	1.22	2.36	5.17E-07	6.64E-08	3.24E-06	1.39E-06	1.72E-05	1.08E-04			4.85E-08	1.01E-06	[B2]
Benzo(g,h,i)perylene	0.54	1.05	2.29E-07	2.94E-08	1.44E-06	6.18E-07	7.62E-06	4.81E-05					[D]
Benzo(k)fluoranthene	0.74	1.12	3.12E-07	4.02E-08	1.54E-06	6.60E-07	1.04E-05	5.13E-05			2.93E-08	4.82E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.20	0.27	8.47E-08	1.09E-08	3.73E-07	1.60E-07	4.23E-06	1.87E-05	liver; weight inc.	1000	1.52E-10	2.24E-09	[B2]
Butyl benzyl phthalate	0.22	0.29	9.38E-08	1.21E-08	3.99E-07	1.71E-07	4.69E-07	2.00E-06	liver; weight changes	1000			[C]
Chrysene	0.86	1.78	3.62E-07	4.65E-08	2.43E-06	1.04E-06	1.21E-05	8.11E-05			3.40E-09	7.61E-08	[B2]
Dibenzofuran	0.29	0.47	1.22E-07	1.57E-08	6.43E-07	2.76E-07			thymus, liver, skin				[D]
Dibenzo(a,h)anthracene	0.28	0.44	1.18E-07	1.52E-08	6.05E-07	2.59E-07	3.95E-06	2.02E-05	skin disorders		1.11E-07	1.89E-06	[B2]
Fluoranthene	2.01	4.54	8.46E-07	1.09E-07	6.22E-06	2.67E-06	2.12E-05	1.56E-04	nephropathy, blood effects	3000			[D]
Fluorene	0.38	0.71	1.59E-07	2.05E-08	9.79E-07	4.20E-07	3.98E-06	2.45E-05	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	0.53	1.05	2.25E-07	2.89E-08	1.44E-06	6.15E-07	7.50E-06	4.79E-05	skin disorders		2.11E-08	4.49E-07	[B2]
2-Methylnaphthalene	0.27	0.38	1.15E-07	1.48E-08	5.15E-07	2.21E-07	3.84E-06	1.72E-05	skin effects				
Naphthalene	0.48	1.02	2.03E-07	2.61E-08	1.39E-06	5.96E-07	5.08E-06	3.48E-05	eye, blood effects	1000			[D]
Phenanthrene	1.64	4.13	6.92E-07	8.90E-08	5.66E-06	2.43E-06	2.31E-05	1.89E-04	skin disorders				[D]
Pyrene	1.61	3.61	6.80E-07	8.74E-08	4.94E-06	2.12E-06	2.27E-05	1.65E-04	skin disorders	3000			[D]
RADIONUCLIDES (pCi/g)													
Americium 241	-0.01	0.03		-1.13E+00		3.52E+01					-2.72E-10	8.45E-09	[A]
Cesium 137+D	0.75	1.32		7.32E+01		1.39E+03					2.05E-09	3.88E-08	[A]
Cobalt 60	0.01	0.01		6.48E-01		1.40E+01					9.72E-12	2.11E-10	[A]
Neptunium 237+D	-0.00	0.02		-2.43E-01		2.10E+01					-5.35E-11	4.62E-09	[A]
Uranium 234	12.97	22.08		1.26E+03		2.32E+04					2.02E-08	3.71E-07	[A]
Uranium 235+D	0.64	1.11		6.24E+01		1.16E+03					9.98E-10	1.86E-08	[A]
Uranium 238+D	11.34	19.42		1.10E+03		2.04E+04					3.09E-08	5.71E-07	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.87E-01	2.12E+00
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.93E-06	3.11E-05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	5.38E-08	1.01E-06

Table L.24. Risk characterization for soils (NOAA Site): children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in Soils ( )	RME Concentration in Soils ( )	Chronic Daily Intake (CDI) ( ): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE ( )
INORGANICS (mg/kg)													
Aluminum	13180.00	17680.00	1.95E-02	8.36E-04	8.67E-02	1.12E-02							
Arsenic	8.20	9.30	1.21E-05	5.20E-07	4.56E-05	5.87E-06	4.04E-02	1.52E-01	skin; keratosis, hyperpigmentation	3	9.10E-07	1.03E-05	[A]
Barium	233.20	190.70	3.45E-04	1.48E-05	9.35E-04	1.20E-04	4.93E-03	1.34E-02	oral-cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.11	1.08	1.64E-06	7.03E-08	5.31E-06	6.82E-07	3.28E-04	1.06E-03	no observed effects	100	3.02E-07	2.93E-06	[B2]
Cadmium	4.31	7.72	6.37E-06	2.73E-07	3.79E-05	4.87E-06	1.27E-02	7.57E-02	kidney; proteinuria	10			
Chromium (III)	43.15	71.70	6.38E-05	2.74E-06	3.52E-04	4.52E-05	6.38E-05	3.52E-04	no observed effects	100			
Cobalt	12.03	19.31	1.78E-05	7.63E-07	9.47E-05	1.22E-05							
Copper	84.27	135.00	1.25E-04	5.34E-06	6.62E-04	8.51E-05	3.37E-03	1.79E-02	Gastrointestinal system; irritation				[D]
Cyanide	0.64	0.95	9.49E-07	4.07E-08	4.65E-06	5.98E-07	4.75E-05	2.33E-04	thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	36.02	51.81	5.33E-05	2.28E-06	2.54E-04	3.27E-05			CNS, blood				[B2]
Manganese	511.30	850.90	7.56E-04	3.24E-05	4.17E-03	5.37E-04	7.56E-03	4.17E-02	lung, CNS; respiratory, psychomotor distur	1			[D]
Mercury	187.30	443.20	2.77E-04	1.19E-05	2.17E-03	2.80E-04	9.24E-01	7.25E+00	oral -CNS; neurotoxicity	1000			[D]
Nickel	39.23	65.14	5.80E-05	2.49E-06	3.20E-04	4.11E-05	2.90E-03	1.60E-02	dec. body and organ weight	300			
Silver	4.13	7.38	6.11E-06	2.62E-07	3.62E-05	4.65E-06	1.22E-03	7.24E-03	skin; argyria	3			[D]
Vanadium	23.50	29.57	3.48E-05	1.49E-06	1.45E-04	1.86E-05	4.97E-03	2.07E-02	no observed effects	100			
Zinc	59.64	93.43	8.82E-05	3.78E-06	4.58E-04	5.89E-05	2.94E-04	1.53E-03	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Aroclor-1260	0.77	1.62	1.14E-06	4.89E-08	7.96E-06	1.02E-06					3.77E-07	7.88E-06	[B2]
Acenaphthene	0.46	0.96	6.84E-07	2.93E-08	4.73E-06	6.09E-07	1.14E-05	7.89E-05	liver; hepatotoxicity	3000			
Acenaphthylene	0.25	0.34	3.67E-07	1.57E-08	1.68E-06	2.16E-07	1.22E-05	5.59E-05					[D]
Anthracene	0.50	1.11	7.40E-07	3.17E-08	5.44E-06	6.99E-07	2.47E-06	1.81E-05	no observed effects	3000			[D]
Benzo(a)anthracene	0.91	1.93	1.34E-06	5.74E-08	9.45E-06	1.22E-06	4.47E-05	3.15E-04			4.19E-08	8.87E-07	[B2]
Benzo(a)pyrene	0.80	1.58	1.18E-06	5.05E-08	7.76E-06	9.97E-07	3.92E-05	2.59E-04			3.68E-07	7.28E-06	[B2]
Benzo(b)fluoranthene	1.22	2.36	1.81E-06	7.75E-08	1.16E-05	1.49E-06	6.03E-05	3.86E-04			5.66E-08	1.09E-06	[B2]
Benzo(g,h,i)perylene	0.54	1.05	8.00E-07	3.43E-08	5.17E-06	6.64E-07	2.67E-05	1.72E-04					[D]
Benzo(k)fluoranthene	0.74	1.12	1.09E-06	4.69E-08	5.51E-06	7.09E-07	3.65E-05	1.84E-04			3.42E-08	5.17E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.20	0.27	2.96E-07	1.27E-08	1.34E-06	1.72E-07	1.48E-05	6.68E-05	liver; weight inc.	1000	1.78E-10	2.40E-09	[B2]
Butyl benzyl phthalate	0.22	0.29	3.28E-07	1.41E-08	1.43E-06	1.84E-07	1.64E-06	7.15E-06	liver; weight changes	1000			[C]
Chrysene	0.86	1.78	1.27E-06	5.43E-08	8.71E-06	1.12E-06	4.22E-05	2.90E-04			3.96E-09	8.18E-08	[B2]
Dibenzofuran	0.29	0.47	4.28E-07	1.83E-08	2.30E-06	2.96E-07			thymus, liver, skin				[D]
Dibenzo(a,h)anthracene	0.28	0.44	4.15E-07	1.78E-08	2.17E-06	2.78E-07	1.38E-05	7.22E-05	skin disorders		1.30E-07	2.03E-06	[B2]
Fluoranthene	2.01	4.54	2.97E-06	1.27E-07	2.23E-05	2.86E-06	7.42E-05	5.57E-04	nephropathy, blood effects	3000			[D]
Fluorene	0.38	0.71	5.58E-07	2.39E-08	3.51E-06	4.51E-07	1.39E-05	8.77E-05	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	0.53	1.05	7.88E-07	3.38E-08	5.14E-06	6.61E-07	2.63E-05	1.71E-04	skin disorders		2.46E-08	4.82E-07	[B2]
2-Methylnaphthalene	0.27	0.38	4.03E-07	1.73E-08	1.84E-06	2.37E-07	1.34E-05	6.15E-05	skin effects				
Naphthalene	0.48	1.02	7.11E-07	3.05E-08	4.98E-06	6.41E-07	1.78E-05	1.25E-04	eye, blood effects	1000			[D]
Phenanthrene	1.64	4.13	2.42E-06	1.04E-07	2.03E-05	2.61E-06	8.08E-05	6.75E-04	skin disorders				[D]
Pyrene	1.61	3.61	2.38E-06	1.02E-07	1.77E-05	2.28E-06	7.93E-05	5.90E-04	skin disorders	3000			[D]
RADIONUCLIDES (pCi/g)													
Americium 241	-0.01	0.03		-4.73E-01		1.40E+01					-1.13E-10	3.37E-09	[A]
Cesium 137+D	0.75	1.32		3.05E+01		5.53E+02					8.54E-10	1.55E-08	[A]
Cobalt 60	0.01	0.01		2.70E-01		5.61E+00					4.05E-12	8.41E-11	[A]
Neptunium 237+D	-0.00	0.02		-1.01E-01		8.38E+00					-2.23E-11	1.84E-09	[A]
Uranium 234	12.97	22.08		5.25E+02		9.25E+03					8.40E-09	1.48E-07	[A]
Uranium 235+D	0.64	1.11		2.60E+01		4.64E+02					4.16E-10	7.43E-09	[A]
Uranium 238+D	11.34	19.42		4.59E+02		8.14E+03					1.29E-08	2.28E-07	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.00E+00	7.60E+00
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.25E-06	3.34E-05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	2.24E-08	4.04E-07

Table L.25. Risk characterization for soils (NOAA Site): adults – dermal exposure (current land use – residential)

Chemical	MLB Concentration in Soils (.)	RMB Concentration in Soils (.)	Chronic Daily Intake (CDI) (.) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA UF (.)	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE (.)
INORGANICS (mg/kg)													
Aluminum	13180.00	17680.00	2.01E−04	2.58E−05	2.62E−03	1.12E−03							
Arsenic	8.20	9.30	1.25E−07	1.60E−08	1.38E−06	5.90E−07	4.16E−04	4.59E−03	skin; keratosis, hyperpigmentation	3	2.81E−08	1.03E−06	[A]
Barium	233.20	190.70	3.55E−06	4.56E−07	2.82E−05	1.21E−05	5.07E−05	4.03E−04	oral−cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.11	1.08	1.69E−08	2.17E−09	1.60E−07	6.87E−08	3.37E−06	3.20E−05	no observed effects	100	9.32E−09	2.95E−07	[B2]
Cadmium	4.31	7.72	6.55E−08	8.43E−09	1.14E−06	4.90E−07	1.31E−04	2.29E−03	kidney; proteinuria	10			
Chromium (III)	43.15	71.70	6.57E−07	8.44E−08	1.06E−05	4.55E−06	6.57E−07	1.06E−05	no observed effects	100			
Cobalt	12.03	19.31	1.83E−07	2.35E−08	2.86E−06	1.23E−06							
Copper	84.27	135.00	1.28E−06	1.65E−07	2.00E−05	8.57E−06	3.47E−05	5.40E−04	Gastrointestinal system; irritation				[D]
Cyanide	0.64	0.95	9.76E−09	1.26E−09	1.40E−07	6.02E−08	4.88E−07	7.02E−06	thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	36.02	51.81	5.48E−07	7.05E−08	7.67E−06	3.29E−06			CNS, blood				[B2]
Manganese	511.30	850.90	7.78E−06	1.00E−06	1.26E−04	5.40E−05	7.78E−05	1.26E−03	lung, CNS; respiratory, psychomotor distu:	1			[D]
Mercury	187.30	443.20	2.85E−06	3.66E−07	6.56E−05	2.81E−05	9.50E−03	2.19E−01	oral −CNS; neurotoxicity	1000			[D]
Nickel	39.23	65.14	5.97E−07	7.68E−08	9.65E−06	4.13E−06	2.98E−05	4.82E−04	dec. body and organ weight	300			
Silver	4.13	7.38	6.29E−08	8.09E−09	1.09E−06	4.68E−07	1.26E−05	2.18E−04	skin; argyria	3			[D]
Vanadium	23.50	29.57	3.58E−07	4.60E−08	4.38E−06	1.88E−06	5.11E−05	6.26E−04	no observed effects	100			
Zinc	59.64	93.43	9.08E−07	1.17E−07	1.38E−05	5.93E−06	3.03E−06	4.61E−05	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Aroclor−1260	0.77	1.62	1.17E−07	1.51E−08	2.40E−06	1.03E−06					1.16E−07	7.93E−06	[B2]
Acenaphthene	0.46	0.96	7.03E−08	9.04E−09	1.43E−06	6.12E−07	1.17E−06	2.38E−05	liver; hepatotoxicity	3000			
Acenaphthylene	0.25	0.34	3.78E−08	4.86E−09	5.07E−07	2.17E−07	1.26E−06	1.69E−05					[D]
Anthracene	0.50	1.11	7.62E−08	9.79E−09	1.64E−06	7.04E−07	2.54E−07	5.47E−06	no observed effects	3000			[D]
Benzo(a)anthracene	0.91	1.93	1.38E−07	1.77E−08	2.85E−06	1.22E−06	4.59E−06	9.51E−05			1.29E−08	8.93E−07	[B2]
Benzo(a)pyrene	0.80	1.58	1.21E−07	1.56E−08	2.34E−06	1.00E−06	4.04E−06	7.80E−05			1.14E−07	7.32E−06	[B2]
Benzo(b)fluoranthene	1.22	2.36	1.86E−07	2.39E−08	3.50E−06	1.50E−06	6.20E−06	1.17E−04			1.75E−08	1.09E−06	[B2]
Benzo(g,h,i)perylene	0.54	1.05	8.23E−08	1.06E−08	1.56E−06	6.68E−07	2.74E−06	5.20E−05					[D]
Benzo(k)fluoranthene	0.74	1.12	1.12E−07	1.45E−08	1.66E−06	7.13E−07	3.75E−06	5.55E−05			1.06E−08	5.21E−07	[B2]
Bis(2−ethylhexyl)phthalate	0.20	0.27	3.05E−08	3.92E−09	4.03E−07	1.73E−07	1.52E−06	2.02E−05	liver; weight inc.	1000	5.49E−11	2.42E−09	[B2]
Butyl benzyl phthalate	0.22	0.29	3.38E−08	4.34E−09	4.32E−07	1.85E−07	1.69E−07	2.16E−06	liver; weight changes	1000			[C]
Chrysene	0.86	1.78	1.30E−07	1.67E−08	2.63E−06	1.13E−06	4.34E−06	8.77E−05			1.22E−09	8.23E−08	[B2]
Dibenzofuran	0.29	0.47	4.40E−08	5.66E−09	6.96E−07	2.98E−07			thymus, liver, skin				[D]
Dibenzo(a,h)anthracene	0.28	0.44	4.26E−08	5.48E−09	6.54E−07	2.80E−07	1.42E−06	2.18E−05	skin disorders		4.00E−08	2.04E−06	[B2]
Fluoranthene	2.01	4.54	3.05E−07	3.93E−08	6.73E−06	2.88E−06	7.64E−06	1.68E−04	nephropathy, blood effects	3000			[D]
Fluorene	0.38	0.71	5.74E−08	7.38E−09	1.06E−06	4.54E−07	1.43E−06	2.65E−05	skin disorders	3000			[D]
Indeno(1,2,3−cd)pyrene	0.53	1.05	8.10E−08	1.04E−08	1.55E−06	6.65E−07	2.70E−06	5.17E−05	skin disorders		7.61E−09	4.86E−07	[B2]
2−Methylnaphthalene	0.27	0.38	4.15E−08	5.33E−09	5.57E−07	2.39E−07	1.38E−06	1.86E−05	skin effects				
Naphthalene	0.48	1.02	7.32E−08	9.41E−09	1.50E−06	6.45E−07	1.83E−06	3.76E−05	eye, blood effects	1000			[D]
Phenanthrene	1.64	4.13	2.49E−07	3.20E−08	6.12E−06	2.62E−06	8.31E−06	2.04E−04	skin disorders				[D]
Pyrene	1.61	3.61	2.45E−07	3.15E−08	5.34E−06	2.29E−06	8.16E−06	1.78E−04	skin disorders	3000			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.04E−02	2.31E−01					
Excess Lifetime Cancer Risk: Combined Exposure (d)											3.57E−07	2.17E−05	

Table L.26. Risk characterization for soils (NOAA Site): children – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Soils (-)	RME Concentration in Soils (-)	Chronic Daily Intake (CDI) (-) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF (-)	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE (-)
INORGANICS (mg/kg)													
Aluminum	13180.00	17680.00	2.61E−04	1.12E−05	3.42E−03	4.40E−04							
Arsenic	8.20	9.30	1.63E−07	6.97E−09	1.80E−06	2.32E−07	5.42E−04	6.00E−03	skin; keratosis, hyperpigmentation	3	1.22E−08	4.05E−07	[A]
Barium	233.20	190.70	4.63E−06	1.98E−07	3.69E−05	4.75E−06	6.61E−05	5.28E−04	oral−cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.11	1.08	2.20E−08	9.42E−10	2.10E−07	2.69E−08	4.40E−06	4.19E−05	no observed effects	100	4.05E−09	1.16E−07	[B2]
Cadmium	4.31	7.72	8.54E−08	3.66E−09	1.50E−06	1.92E−07	1.71E−04	2.99E−03	kidney; proteinuria				
Chromium (III)	43.15	71.70	8.56E−07	3.67E−08	1.39E−05	1.79E−06	8.56E−07	1.39E−05	no observed effects	1000			
Cobalt	12.03	19.31	2.39E−07	1.02E−08	3.74E−06	4.81E−07							
Copper	84.27	135.00	1.67E−06	7.16E−08	2.61E−05	3.36E−06	4.52E−05	7.07E−04	Gastrointestinal system; irritation				[D]
Cyanide	0.64	0.95	1.27E−08	5.45E−10	1.84E−07	2.36E−08	6.36E−07	9.18E−06	thyroid, nerve; weight loss, myelin degen.	500			[D]
Lead	36.02	51.81	7.14E−07	3.06E−08	1.00E−05	1.29E−06			CNS, blood				[B2]
Manganese	511.30	850.90	1.01E−05	4.35E−07	1.65E−04	2.12E−05	1.01E−04	1.65E−03	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	187.30	443.20	3.71E−06	1.59E−07	8.58E−05	1.10E−05	1.24E−02	2.86E−01	oral −CNS; neurotoxicity	1000			[D]
Nickel	39.23	65.14	7.78E−07	3.33E−08	1.26E−05	1.62E−06	3.89E−05	6.31E−04	dec. body and organ weight	300			
Silver	4.13	7.38	8.20E−08	3.51E−09	1.43E−06	1.84E−07	1.64E−05	2.86E−04	skin; argyria	3			[D]
Vanadium	23.50	29.57	4.66E−07	2.00E−08	5.73E−06	7.36E−07	6.66E−05	8.18E−04	no observed effects	100			
Zinc	59.64	93.43	1.18E−06	5.07E−08	1.81E−05	2.33E−06	3.94E−06	6.03E−05	blood; anemia	10			[D]
ORGANICS (mg/kg)													
Aroclor−1260	0.77	1.62	1.53E−07	6.56E−09	3.14E−06	4.04E−07					5.05E−08	3.11E−06	[B2]
Acenaphthene	0.46	0.96	9.17E−08	3.93E−09	1.87E−06	2.40E−07	1.53E−06	3.11E−05	liver; hepatotoxicity	300			
Acenaphthylene	0.25	0.34	4.92E−08	2.11E−09	6.63E−07	8.52E−08	1.64E−06	2.21E−05					[D]
Anthracene	0.50	1.11	9.93E−08	4.25E−09	2.15E−06	2.76E−07	3.31E−07	7.16E−06	no observed effects	300			[D]
Benzo(a)anthracene	0.91	1.93	1.80E−07	7.70E−09	3.73E−06	4.80E−07	5.99E−06	1.24E−04			5.62E−09	3.50E−07	[B2]
Benzo(a)pyrene	0.80	1.58	1.58E−07	6.76E−09	3.06E−06	3.94E−07	5.26E−06	1.02E−04			4.94E−08	2.87E−06	[B2]
Benzo(b)fluoranthene	1.22	2.36	2.42E−07	1.04E−08	4.58E−06	5.88E−07	8.08E−06	1.53E−04			7.58E−09	4.30E−07	[B2]
Benzo(g,h,i)perylene	0.54	1.05	1.07E−07	4.60E−09	2.04E−06	2.62E−07	3.58E−06	6.80E−05					[D]
Benzo(k)fluoranthene	0.74	1.12	1.47E−07	6.28E−09	2.18E−06	2.80E−07	4.89E−06	7.26E−05			4.59E−09	2.04E−07	[B2]
Bis(2−ethylhexyl)phthalate	0.20	0.27	3.97E−08	1.70E−09	5.27E−07	6.78E−08	1.99E−06	2.64E−05	liver; weight inc.	1000	2.38E−11	9.49E−10	[B2]
Butyl benzyl phthalate	0.22	0.29	4.40E−08	1.89E−09	5.64E−07	7.26E−08	2.20E−07	2.82E−06	liver; weight changes	100			[C]
Chrysene	0.86	1.78	1.70E−07	7.27E−09	3.44E−06	4.42E−07	5.66E−06	1.15E−04			5.31E−10	3.23E−08	[B2]
Dibenzofuran	0.29	0.47	5.74E−08	2.46E−09	9.10E−07	1.17E−07			thymus, liver, skin				[D]
Dibenzo(a,h)anthracene	0.28	0.44	5.56E−08	2.38E−09	8.55E−07	1.10E−07	1.85E−06	2.85E−05	skin disorders		1.74E−08	8.02E−07	[B2]
Fluoranthene	2.01	4.54	3.98E−07	1.71E−08	8.80E−06	1.13E−06	9.95E−06	2.20E−04	nephropathy, blood effects	300			[D]
Fluorene	0.38	0.71	7.48E−08	3.20E−09	1.38E−06	1.78E−07	1.87E−06	3.46E−05	skin disorders	300			[D]
Indeno(1,2,3−cd)pyrene	0.53	1.05	1.06E−07	4.53E−09	2.03E−06	2.61E−07	3.52E−06	6.77E−05	skin disorders		3.30E−09	1.91E−07	[B2]
2−Methylnaphthalene	0.27	0.38	5.40E−08	2.32E−09	7.28E−07	9.36E−08	1.80E−06	2.43E−05	skin effects	300			
Naphthalene	0.48	1.02	9.54E−08	4.09E−09	1.97E−06	2.53E−07	2.38E−06	4.92E−05	eye, blood effects	1000			[D]
Phenanthrene	1.64	4.13	3.25E−07	1.39E−08	8.00E−06	1.03E−06	1.08E−05	2.67E−04	skin disorders	300			[D]
Pyrene	1.61	3.61	3.19E−07	1.37E−08	6.99E−06	8.98E−07	1.06E−05	2.33E−04	skin disorders	300			[D]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.35E−02	3.02E−01
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.55E−07	8.52E−06

Table L.27. Risk characterization for surface water: adults – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in SW (-)	RME Concentration in SW (-)	Chronic Daily Intake (CDI) (-) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF (-)	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE (-)
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	7.79E-05	1.00E-05	7.42E-04	3.18E-04							
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	7.50E-08	9.64E-09	7.00E-07	3.00E-07							
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	3.68E-05	3.36E-04	lung, CNS; respiratory, psychomotor distu:	1			[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	no observed effects	100			
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	[B2]
4,4'-DDD	4.22E-02	5.00E-02	5.78E-10	7.43E-11	4.07E-09	1.74E-09					1.78E-11	4.19E-10	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	liver; lesions	100	2.41E-11	5.86E-10	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07			liver; weight inc.	1000			[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	liver lesions	100	1.09E-09	2.79E-08	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	5.77E-08	7.42E-09	4.04E-07	1.73E-07	7.22E-08	5.05E-07	lung irritation	1000			[D]
Endosulfan	2.31E-02	2.50E-02	3.16E-10	4.06E-11	2.04E-09	8.72E-10	6.32E-06	4.07E-05	kidney lesions	3000			
Endosulfan Sulfate	3.48E-02	4.46E-02	4.77E-10	6.13E-11	3.63E-09	1.56E-09							
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	5.48E-08	7.05E-09	4.07E-07	1.74E-07	1.37E-06	1.02E-05	nephropathy, blood effects	3000			[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	liver, kidney effects		4.16E-11	1.06E-09	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	liver damage		3.46E-10	7.94E-09	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	liver, kidney, CNS effects	1000			
1,1,1-Trichloroethane	4.32E+00	4.85E+00	5.92E-08	7.61E-09	3.95E-07	1.69E-07	6.58E-07	4.39E-06	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	5.48E-08	7.05E-09	3.81E-07	1.63E-07			Liver, Kidney, CNS effects				
RADIONUCLIDES (pCi/L)													
Americium 241	-8.08E+00	5.12E+00		-2.55E+01		3.19E+02					-6.11E-09	7.66E-08	[A]
Cesium 137+D	3.52E+00	1.12E+01		1.11E+01		7.00E+02					3.11E-10	1.96E-08	[A]
Cobalt 60	-1.33E-01	5.62E+00		-4.20E-01		3.51E+02					-6.30E-12	5.26E-09	[A]
Neptunium 237+D	9.37E+00	2.86E+01		2.95E+01		1.79E+03					6.49E-09	3.93E-07	[A]
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02					1.85E-10	4.29E-09	[A]
Uranium 235+D	2.16E-01	2.95E-01		6.80E-01		1.84E+01					1.09E-11	2.94E-10	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02					3.64E-10	9.28E-09	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.69E-04	2.24E-03					
Excess Lifetime Cancer Risk: Combined Exposure (d)											2.26E-09	5.37E-08	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											1.25E-09	5.08E-07	

Table L.28. Risk characterization for surface water: children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in SW ()	RME Concentration in SW ()	Chronic Daily Intake (CDI) () CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF ()	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE ()
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	2.18E−04	9.35E−06	2.00E−03	2.57E−04							
Barium	7.92E+01	1.05E+02	3.04E−06	1.30E−07	2.30E−05	2.96E−06	4.34E−05	3.29E−04	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	2.99E−07	1.28E−08	2.89E−06	3.72E−07	2.99E−07	2.89E−06	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	2.10E−07	9.00E−09	1.88E−06	2.42E−07							
Copper	1.85E+01	2.19E+01	7.10E−07	3.04E−08	4.80E−06	6.17E−07	1.92E−05	1.30E−04	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E−05	4.42E−07	9.05E−05	1.16E−05	1.03E−04	9.05E−04	lung, CNS; respiratory, psychomotor distu:	1			[D]
Mercury	2.68E+00	3.93E+00	1.03E−07	4.40E−09	8.62E−07	1.11E−07	3.42E−04	2.87E−03	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	3.22E−07	1.38E−08	3.09E−06	3.97E−07	4.60E−05	4.41E−04	no observed effects	100			
Zinc	6.87E+01	9.09E+01	2.64E−06	1.13E−07	1.99E−05	2.56E−06	8.79E−06	6.64E−05	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	2.38E−07	1.02E−08	1.69E−06	2.17E−07	2.38E−06	1.69E−05	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E−02	2.50E−02	8.91E−10	3.82E−11	5.48E−09	7.05E−10	2.97E−05	1.83E−04	liver; lesions, toxicity	1000	6.49E−10	1.20E−08	[B2]
4,4'−DDD	4.22E−02	5.00E−02	1.62E−09	6.93E−11	1.10E−08	1.41E−09					1.66E−11	3.38E−10	[B2]
4,4'−DDT	4.02E−02	4.94E−02	1.54E−09	6.61E−11	1.08E−08	1.39E−09	3.08E−06	2.17E−05	liver; lesions	100	2.25E−11	4.73E−10	[B2]
Bis(2−ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E−07	1.56E−08	3.04E−06	3.90E−07	1.82E−05	1.52E−04	liver; weight inc.	1000	2.19E−10	5.46E−09	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E−07	6.69E−09	1.03E−06	1.32E−07	1.56E−05	1.03E−04	liver; lesions, fatty cyst formation	1000	4.08E−11	8.06E−10	[B2]
Dieldrin	3.87E−02	5.00E−02	1.49E−09	6.37E−11	1.10E−08	1.41E−09	2.97E−05	2.19E−04	liver lesions	100	1.02E−09	2.25E−08	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.62E−07	6.93E−09	1.09E−06	1.40E−07	2.02E−07	1.36E−06	lung irritation	1000			[D]
Endosulfan	2.31E−02	2.50E−02	8.85E−10	3.79E−11	5.48E−09	7.05E−10	1.77E−05	1.10E−04	kidney lesions	3000			
Endosulfan Sulfate	3.48E−02	4.46E−02	1.33E−09	5.72E−11	9.78E−09	1.26E−09							
Endrin	3.87E−02	5.00E−02	1.48E−09	6.36E−11	1.10E−08	1.41E−09	4.95E−06	3.65E−05	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	1.53E−07	6.58E−09	1.10E−06	1.41E−07	3.84E−06	2.74E−05	nephropathy, blood effects	3000			[D]
gamma−BHC	1.82E−02	2.34E−02	6.97E−10	2.99E−11	5.14E−09	6.60E−10	2.32E−06	1.71E−05	liver, kidney effects		3.89E−11	8.58E−10	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	8.28E−10	3.55E−11	5.48E−09	7.05E−10	6.37E−05	4.21E−04	liver damage		3.23E−10	6.41E−09	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E−07	6.87E−09	1.06E−06	1.36E−07	1.60E−05	1.06E−04	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	4.32E+00	4.85E+00	1.66E−07	7.10E−09	1.06E−06	1.37E−07	1.84E−06	1.18E−05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	1.53E−07	6.58E−09	1.03E−06	1.32E−07			Liver, Kidney, CNS effects				
RADIONUCLIDES (pCi/L)													
Americium 241	−8.08E+00	5.12E+00		−8.49E+00		9.58E+01					−2.04E−09	2.30E−08	[A]
Cesium 137+D	3.52E+00	1.12E+01		3.70E+00		2.10E+02					1.04E−10	5.88E−09	[A]
Cobalt 60	−1.33E−01	5.62E+00		−1.40E−01		1.05E+02					−2.10E−12	1.58E−09	[A]
Neptunium 237+D	9.37E+00	2.86E+01		9.83E+00		5.36E+02					2.16E−09	1.18E−07	[A]
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01					6.18E−11	1.29E−09	[A]
Uranium 235+D	2.16E−01	2.95E−01		2.27E−01		5.51E+00					3.63E−12	8.82E−11	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01					1.21E−10	2.78E−09	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)		7.72E−04	6.17E−03	
Excess Lifetime Cancer Risk: Combined Exposure (d)				2.33E−09	4.89E−08
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)				4.15E−10	1.53E−07

Table L.29. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – residential)

Chemical	MLE Concentration in SW (.)	RME Concentration in SW (.)	Chronic Daily Intake (CDI) (.) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF (.)	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE (.)
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	6.03E−06	7.76E−07	1.01E−04	4.34E−05							
Barium	7.92E+01	1.05E+02	8.40E−08	1.08E−08	1.17E−06	5.00E−07	1.20E−06	1.67E−05	oral−cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	8.27E−09	1.06E−09	1.47E−07	6.29E−08	8.27E−09	1.47E−07	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	5.81E−09	7.47E−10	9.56E−08	4.10E−08							
Copper	1.85E+01	2.19E+01	1.96E−08	2.52E−09	2.43E−07	1.04E−07	5.30E−07	6.58E−06	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E−07	3.66E−08	4.59E−06	1.97E−06	2.85E−06	4.59E−05	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	2.68E+00	3.93E+00	2.84E−09	3.65E−10	4.37E−08	1.87E−08	9.46E−06	1.46E−04	oral −CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	8.91E−09	1.15E−09	1.57E−07	6.72E−08	1.27E−06	2.24E−05	no observed effects	100			
Zinc	6.87E+01	9.09E+01	7.29E−08	9.37E−09	1.01E−06	4.33E−07	2.43E−07	3.37E−06	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	4.12E−08	5.30E−09	5.35E−07	2.29E−07	4.12E−07	5.35E−06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E−02	2.50E−02	2.46E−10	3.17E−11	2.78E−09	1.19E−09	8.21E−06	9.26E−05	liver; lesions, toxicity	1000	5.39E−10	2.02E−08	[B2]
4,4'−DDD	4.22E−02	5.00E−02	7.83E−08	1.01E−08	9.73E−07	4.17E−07					2.42E−09	1.00E−07	[B2]
4,4'−DDT	4.02E−02	4.94E−02	1.15E−07	1.47E−08	1.48E−06	6.32E−07	2.29E−04	2.95E−03	liver; lesions	100	5.01E−09	2.15E−07	[B2]
Bis(2−ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E−06	2.67E−07	3.17E−05	1.36E−05	1.04E−04	1.59E−03	liver; weight inc.	1000	3.74E−09	1.90E−07	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E−07	3.09E−08	2.90E−06	1.24E−06	2.40E−05	2.90E−04	liver; lesions, fatty cyst formation	1000	1.88E−10	7.57E−09	[B2]
Dieldrin	3.87E−02	5.00E−02	4.11E−09	5.28E−10	5.56E−08	2.38E−08	8.22E−05	1.11E−03	liver lesions	100	8.45E−09	3.81E−07	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.34E−07	1.72E−08	1.65E−06	7.09E−07	1.68E−07	2.07E−06	lung irritation	1000			[D]
Endosulfan	2.31E−02	2.50E−02	4.84E−09	6.22E−10	5.49E−08	2.35E−08	9.67E−05	1.10E−03	kidney lesions	3000			
Endosulfan Sulfate	3.48E−02	4.46E−02	7.29E−09	9.37E−10	9.79E−08	4.20E−08							
Endrin	3.87E−02	5.00E−02	4.10E−09	5.28E−10	5.56E−08	2.38E−08	1.37E−05	1.85E−04	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	9.55E−06	1.23E−06	1.25E−04	5.36E−05	2.39E−04	3.13E−03	nephropathy, blood effects	3000			[D]
gamma−BHC	1.82E−02	2.34E−02	1.69E−09	2.17E−10	2.28E−08	9.77E−09	5.63E−06	7.60E−05	liver, kidney effects				[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	4.52E−09	5.82E−10	5.49E−08	2.35E−08	3.48E−04	4.22E−03	liver damage				[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E−06	1.71E−07	1.61E−05	6.92E−06	1.33E−04	1.61E−03	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	4.32E+00	4.85E+00	4.87E−07	6.26E−08	5.73E−06	2.46E−06	5.41E−06	6.37E−05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	4.24E−07	5.46E−08	5.20E−06	2.23E−06			Liver, Kidney, CNS effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.30E−03	1.67E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											2.03E−08	9.14E−07	

Table L.30. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – residential)

Chemical	MLE Concentration in SW ( )	RME Concentration in SW ( )	Chronic Daily Intake (CDI) ( ): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE ( )
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	6.03E−06	7.76E−07	1.01E−04	4.34E−05							
Barium	7.92E+01	1.05E+02	1.09E−07	4.69E−09	1.53E−06	1.96E−07	1.56E−06	2.18E−05	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	1.08E−08	4.62E−10	1.92E−07	2.47E−08	1.08E−08	1.92E−07	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	7.57E−09	3.24E−10	1.25E−07	1.61E−08							
Copper	1.85E+01	2.19E+01	2.56E−08	1.10E−09	3.18E−07	4.09E−08	6.91E−07	8.60E−06	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E−07	1.59E−08	6.00E−06	7.72E−07	3.72E−06	6.00E−05	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	2.68E+00	3.93E+00	3.70E−09	1.59E−10	5.72E−08	7.35E−09	1.23E−05	1.91E−04	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	1.16E−08	4.98E−10	2.05E−07	2.64E−08	1.66E−06	2.93E−05	no observed effects	100			
Zinc	6.87E+01	9.09E+01	9.50E−08	4.07E−09	1.32E−06	1.70E−07	3.17E−07	4.40E−06	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	5.37E−08	2.30E−09	7.00E−07	9.00E−08	5.37E−07	7.00E−06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E−02	2.50E−02	3.21E−10	1.38E−11	3.63E−09	4.67E−10	1.07E−05	1.21E−04	liver; lesions, toxicity	1000	2.34E−10	7.94E−09	[B2]
4,4'−DDD	4.22E−02	5.00E−02	1.02E−07	4.37E−09	1.27E−06	1.64E−07					1.05E−09	3.92E−08	[B2]
4,4'−DDT	4.02E−02	4.94E−02	1.49E−07	6.40E−09	1.93E−06	2.48E−07	2.99E−04	3.86E−03	liver; lesions	100	2.18E−09	8.44E−08	[B2]
Bis(2−ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E−06	1.16E−07	4.15E−05	5.34E−06	1.35E−04	2.08E−03	liver; weight inc.	1000	1.63E−09	7.47E−08	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E−07	1.34E−08	3.79E−06	4.87E−07	3.13E−05	3.79E−04	liver; lesions, fatty cyst formation	1000	8.19E−11	2.97E−09	[B2]
Dieldrin	3.87E−02	5.00E−02	5.36E−09	2.30E−10	7.27E−08	9.34E−09	1.07E−04	1.45E−03	liver lesions	100	3.67E−09	1.50E−07	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.75E−07	7.49E−09	2.16E−06	2.78E−07	2.18E−07	2.70E−06	lung irritation	1000			[D]
Endosulfan	2.31E−02	2.50E−02	6.30E−09	2.70E−10	7.18E−08	9.23E−09	1.26E−04	1.44E−03	kidney lesions	3000			
Endosulfan Sulfate	3.48E−02	4.46E−02	9.50E−09	4.07E−10	1.28E−07	1.65E−08							
Endrin	3.87E−02	5.00E−02	5.35E−09	2.29E−10	7.27E−08	9.34E−09	1.78E−05	2.42E−04	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	1.24E−05	5.33E−07	1.64E−04	2.10E−05	3.11E−04	4.09E−03	nephropathy, blood effects	3000			[D]
gamma−BHC	1.82E−02	2.34E−02	2.20E−09	9.43E−11	2.98E−08	3.83E−09	7.33E−06	9.93E−05	liver, kidney effects				[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	5.90E−09	2.53E−10	7.18E−08	9.23E−09	4.54E−04	5.52E−03	liver damage				[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E−06	7.43E−08	2.11E−05	2.71E−06	1.73E−04	2.11E−03	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	4.32E+00	4.85E+00	6.35E−07	2.72E−08	7.49E−06	9.63E−07	7.05E−06	8.32E−05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	5.53E−07	2.37E−08	6.81E−06	8.75E−07			Liver, Kidney, CNS effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.70E−03	2.18E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											8.84E−09	3.59E−07	

Table L.31. Risk characterization for sediments: adults – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Sediment (-)	RME Concentration in Sediment (-)	Chronic Daily Intake (CDI) (-) CDI Noncarc. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF (-)	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE (-)
INORGANICS (mg/kg)													
Aluminum	10300.00	14320.00	1.69E-06	2.18E-07	8.82E-05	3.78E-05							
Arsenic	7.93	10.93	1.30E-09	1.68E-10	6.73E-08	2.88E-08	4.35E-06	2.24E-04	skin; keratosis, hyperpigmentation	3	2.93E-10	5.05E-08	[A]
Barium	163.40	301.10	2.69E-08	3.45E-09	1.85E-06	7.95E-07	3.84E-07	2.65E-05	oral-cardiovasc. sys.; inc. blood pressure	3			
Beryllium	0.68	0.81	1.12E-10	1.44E-11	4.99E-09	2.14E-09	2.24E-08	9.97E-07	no observed effects	100	6.19E-11	9.19E-09	[B2]
Cadmium	7.36	16.39	1.21E-09	1.56E-10	1.01E-07	4.33E-08	2.42E-06	2.02E-04	kidney; proteinuria	10			
Chromium (III)	73.02	89.96	1.20E-08	1.54E-09	5.54E-07	2.37E-07	1.20E-08	5.54E-07	no observed effects	100			
Cobalt	18.07	22.09	2.97E-09	3.82E-10	1.36E-07	5.83E-08							
Copper	71.08	129.20	1.17E-08	1.50E-09	7.96E-07	3.41E-07	3.16E-07	2.15E-05	Gastrointestinal system; irritation				[D]
Lead	42.04	62.91	6.91E-09	8.89E-10	3.87E-07	1.66E-07			CNS, blood				[B2]
Manganese	1198.00	1615.00	1.97E-07	2.53E-08	9.94E-06	4.26E-06	1.97E-06	9.94E-05	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	271.90	729.50	4.47E-08	5.75E-09	4.49E-06	1.93E-06	1.49E-04	1.50E-02	oral -CNS; neurotoxicity	1000			[D]
Nickel	66.30	116.70	1.09E-08	1.40E-09	7.19E-07	3.08E-07	5.45E-07	3.59E-05	dec. body and organ weight	300			
Silver	3.37	8.63	5.53E-10	7.11E-11	5.31E-08	2.28E-08	1.11E-07	1.06E-05	skin; argyria	3			[D]
Vanadium	37.26	47.60	6.12E-09	7.87E-10	2.93E-07	1.26E-07	8.75E-07	4.19E-05	no observed effects	100			
Zinc	170.20	236.60	2.80E-08	3.60E-09	1.46E-06	6.24E-07	9.33E-08	4.86E-06	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Acenaphthene	0.24	0.31	3.92E-10	5.04E-11	1.92E-08	8.22E-09	6.54E-09	3.20E-07	liver; hepatotoxicity	3000			
Acenaphthylene	0.21	0.24	3.52E-10	4.53E-11	1.45E-08	6.20E-09	1.17E-08	4.83E-07					[D]
Anthracene	0.27	0.46	4.38E-10	5.63E-11	2.85E-08	1.22E-08	1.46E-09	9.51E-08	no observed effects	3000			[D]
Aroclor-1248	0.41	0.91	6.74E-10	8.67E-11	5.59E-08	2.40E-08					6.67E-10	1.85E-07	[B2]
Aroclor-1260	0.62	1.25	1.02E-09	1.31E-10	7.72E-08	3.31E-08					1.01E-09	2.55E-07	[B2]
Benzo(a)anthracene	0.81	1.83	1.33E-09	1.71E-10	1.13E-07	4.83E-08	4.43E-08	3.75E-06			1.25E-10	3.52E-08	[B2]
Benzo(a)pyrene	0.74	1.64	1.21E-09	1.56E-10	1.01E-07	4.33E-08	4.04E-08	3.37E-06			1.14E-09	3.16E-07	[B2]
Benzo(b)fluoranthene	0.90	2.20	1.49E-09	1.91E-10	1.35E-07	5.81E-08	4.95E-08	4.52E-06			1.39E-10	4.24E-08	[B2]
Benzo(g,h,i)perylene	0.43	0.94	7.13E-10	9.17E-11	5.80E-08	2.49E-08	2.38E-08	1.93E-06					[D]
Benzo(k)fluoranthene	0.48	0.95	7.96E-10	1.02E-10	5.87E-08	2.52E-08	2.65E-08	1.96E-06			7.47E-11	1.84E-08	[B2]
Benzoic Acid	0.92	1.56	1.52E-09	1.95E-10	9.59E-08	4.11E-08	3.79E-10	2.40E-08	no observed effects	1			[D]
alpha-BHC	0.01	0.03	2.22E-11	2.86E-12	1.59E-09	6.82E-10					1.80E-11	4.30E-09	[B2]
gamma-BHC	0.02	0.03	2.49E-11	3.20E-12	1.66E-09	7.10E-10	8.28E-08	5.52E-06	liver, kidney effects		4.15E-12	9.23E-10	[C]
Butylbenzylphthalate	0.27	0.34	4.51E-10	5.80E-11	2.12E-08	9.08E-09							
Di-n-butyl phthalate	0.21	0.32	3.52E-10	4.53E-11	1.98E-08	8.49E-09	3.52E-09	1.98E-07	liver, kidney damage	1000			[D]
alpha-Chlordane	0.14	0.26	2.30E-10	2.96E-11	1.61E-08	6.88E-09							
Chrysene	0.77	1.74	1.27E-09	1.63E-10	1.07E-07	4.58E-08	4.23E-08	3.57E-06			1.19E-11	3.35E-09	[B2]
4,4'-DDD	0.03	0.05	4.48E-11	5.76E-12	3.18E-09	1.36E-09					1.38E-12	3.27E-10	[B2]
4,4'-DDE	0.03	0.06	5.37E-11	6.91E-12	3.47E-09	1.49E-09					2.35E-12	5.06E-10	[B2]
Dibenzo(a,h)anthracene	0.29	0.39	4.78E-10	6.14E-11	2.42E-08	1.04E-08	1.59E-08	8.06E-07	skin disorders		4.49E-10	7.57E-08	[B2]
Bis(2-ethylhexyl)phthalate	0.58	1.06	9.45E-10	1.22E-10	6.55E-08	2.81E-08	4.73E-08	3.28E-06	liver; weight inc.	1000	1.70E-12	3.93E-10	[B2]
Fluoranthene	1.84	3.84	3.03E-09	3.89E-10	2.36E-07	1.01E-07	7.57E-08	5.90E-06	nephropathy, blood effects	3000			[D]
Fluorene	0.23	0.28	3.75E-10	4.82E-11	1.71E-08	7.33E-09	9.37E-09	4.27E-07	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	0.44	1.02	7.31E-10	9.40E-11	6.25E-08	2.68E-08	2.44E-08	2.08E-06	skin disorders		6.86E-11	1.96E-08	[B2]
p,p'-Methoxychlor	0.14	0.26	2.23E-10	2.86E-11	1.59E-08	6.82E-09							
2-Methylnaphthalene	0.21	0.31	3.49E-10	4.49E-11	1.89E-08	8.09E-09	1.16E-08	6.29E-07	skin effects				
Naphthalene	0.21	0.30	3.38E-10	4.35E-11	1.87E-08	8.02E-09	8.45E-09	4.68E-07	eye, blood effects	1000			[D]
Di-n-octyl phthalate	0.28	0.35	4.56E-10	5.86E-11	2.13E-08	9.13E-09	2.28E-08	1.06E-06	skin disorders	1000			
Phenanthrene	0.65	1.13	1.06E-09	1.36E-10	6.95E-08	2.98E-08	3.53E-08	2.32E-06	skin disorders				[D]
Pyrene	1.49	3.95	2.44E-09	3.14E-10	2.43E-07	1.04E-07	8.15E-08	8.12E-06	skin disorders	3000			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.61E-04	1.57E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											4.06E-09	1.02E-06	

Table L.32. Risk characterization for sediments: children – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Sediment ()	RME Concentration in Sediment ()	Chronic Daily Intake (CDI) () CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfD UF ()	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE ()
INORGANICS (mg/kg)													
Aluminum	10300.00	14320.00	2.21E-06	9.46E-08	1.15E-04	1.48E-05							
Arsenic	7.93	10.93	1.70E-09	7.28E-11	8.80E-08	1.13E-08	5.67E-06	2.93E-04 skin; keratosis, hyperpigmentation		3	1.27E-10	1.98E-08	[A]
Barium	163.40	301.10	3.50E-08	1.50E-09	2.42E-06	3.12E-07	5.00E-07	3.46E-05 oral-cardiovasc. sys.; inc. blood pressure		3			
Beryllium	0.68	0.81	1.46E-10	6.25E-12	6.52E-09	8.39E-10	2.92E-08	1.30E-06 no observed effects		100	2.69E-11	3.61E-09	[B2]
Cadmium	7.36	16.39	1.58E-09	6.76E-11	1.32E-07	1.70E-08	3.15E-06	2.64E-04 kidney; proteinuria		10			
Chromium (III)	73.02	89.96	1.56E-08	6.71E-10	7.24E-07	9.31E-08	1.56E-08	7.24E-07 no observed effects		100			
Cobalt	18.07	22.09	3.87E-09	1.66E-10	1.78E-07	2.29E-08							
Copper	71.08	129.20	1.52E-08	6.53E-10	1.04E-06	1.34E-07	4.12E-07	2.81E-05 Gastrointestinal system; irritation					[D]
Lead	42.04	62.91	9.01E-09	3.86E-10	5.07E-07	6.51E-08		CNS, blood					[B2]
Manganese	1198.00	1615.00	2.57E-07	1.10E-08	1.30E-05	1.67E-06	2.57E-06	1.30E-04 lung, CNS; respiratory, psychomotor distu		1			[D]
Mercury	271.90	729.50	5.83E-08	2.50E-09	5.87E-06	7.55E-07	1.94E-04	1.96E-02 oral -CNS; neurotoxicity		1000			[D]
Nickel	66.30	116.70	1.42E-08	6.09E-10	9.40E-07	1.21E-07	7.10E-07	4.70E-05 dec. body and organ weight		300			
Silver	3.37	8.63	7.21E-10	3.09E-11	6.95E-08	8.93E-09	1.44E-07	1.39E-05 skin; argyria		3			[D]
Vanadium	37.26	47.60	7.98E-09	3.42E-10	3.83E-07	4.93E-08	1.14E-06	5.48E-05 no observed effects		100			
Zinc	170.20	236.60	3.65E-08	1.56E-09	1.91E-06	2.45E-07	1.22E-07	6.35E-06 blood; anemia		3			[D]
ORGANICS (mg/kg)													
Acenaphthene	0.24	0.31	5.11E-10	2.19E-11	2.51E-08	3.23E-09	8.52E-09	4.18E-07 liver; hepatotoxicity		3000			
Acenaphthylene	0.21	0.24	4.59E-10	1.97E-11	1.89E-08	2.43E-09	1.53E-08	6.31E-07					[D]
Anthracene	0.27	0.46	5.71E-10	2.45E-11	3.73E-08	4.80E-09	1.90E-09	1.24E-07 no observed effects		3000			[D]
Aroclor-1248	0.41	0.91	8.78E-10	3.76E-11	7.32E-08	9.41E-09					2.90E-10	7.24E-08	[B2]
Aroclor-1260	0.62	1.25	1.33E-09	5.69E-11	1.01E-07	1.30E-08					4.38E-10	1.00E-07	[B2]
Benzo(a)anthracene	0.81	1.83	1.73E-09	7.42E-11	1.47E-07	1.89E-08	5.77E-08	4.91E-06			5.42E-11	1.38E-08	[B2]
Benzo(a)pyrene	0.74	1.64	1.58E-09	6.76E-11	1.32E-07	1.70E-08	5.26E-08	4.41E-06			4.94E-10	1.24E-07	[B2]
Benzo(b)fluoranthene	0.90	2.20	1.94E-09	8.30E-11	1.77E-07	2.28E-08	6.46E-08	5.91E-06			6.06E-11	1.66E-08	[B2]
Benzo(g,h,i)perylene	0.43	0.94	9.29E-10	3.98E-11	7.59E-08	9.76E-09	3.10E-08	2.53E-06					[D]
Benzo(k)fluoranthene	0.48	0.95	1.04E-09	4.44E-11	7.68E-08	9.88E-09	3.46E-08	2.56E-06			3.24E-11	7.21E-09	[B2]
Benzoic Acid	0.92	1.56	1.97E-09	8.46E-11	1.25E-07	1.61E-08	4.94E-10	3.14E-08 no observed effects		1			[D]
alpha-BHC	0.01	0.03	2.90E-11	1.24E-12	2.08E-09	2.68E-10					7.83E-12	1.69E-09	[B2]
gamma-BHC	0.02	0.03	3.24E-11	1.39E-12	2.17E-09	2.79E-10	1.08E-07	7.22E-06 liver, kidney effects			1.80E-12	3.62E-10	[C]
Butylbenzylphthalate	0.27	0.34	5.88E-10	2.52E-11	2.77E-08	3.56E-09							
Di-n-butyl phthalate	0.21	0.32	4.59E-10	1.97E-11	2.59E-08	3.33E-09	4.59E-09	2.59E-07 liver, kidney damage		1000			[D]
alpha-Chlordane	0.14	0.26	3.00E-10	1.29E-11	2.10E-08	2.70E-09							
Chrysene	0.77	1.74	1.66E-09	7.09E-11	1.40E-07	1.80E-08	5.52E-08	4.66E-06			5.18E-12	1.31E-09	[B2]
4,4'-DDD	0.03	0.05	5.83E-11	2.50E-12	4.16E-09	5.35E-10					6.00E-13	1.28E-10	[B2]
4,4'-DDE	0.03	0.06	7.00E-11	3.00E-12	4.54E-09	5.84E-10					1.02E-12	1.99E-10	[B2]
Dibenzo(a,h)anthracene	0.29	0.39	6.23E-10	2.67E-11	3.16E-08	4.07E-09	2.08E-08	1.05E-06 skin disorders			1.95E-10	2.97E-08	[B2]
Bis(2-ethylhexyl)phthalate	0.58	1.06	1.23E-09	5.28E-11	8.57E-08	1.10E-08	6.16E-08	4.28E-06 liver; weight inc.		1000	7.39E-13	1.54E-10	[B2]
Fluoranthene	1.84	3.84	3.94E-09	1.69E-10	3.09E-07	3.97E-08	9.86E-08	7.72E-06 nephropathy, blood effects		3000			[D]
Fluorene	0.23	0.28	4.88E-10	2.09E-11	2.24E-08	2.87E-09	1.22E-08	5.59E-07 skin disorders		3000			[D]
Indeno(1,2,3-cd)pyrene	0.44	1.02	9.53E-10	4.08E-11	8.17E-08	1.05E-08	3.18E-08	2.72E-06 skin disorders			2.98E-11	7.67E-09	[B2]
p,p'-Methoxychlor	0.14	0.26	2.90E-10	1.24E-11	2.08E-08	2.68E-09							
2-Methylnaphthalene	0.21	0.31	4.56E-10	1.95E-11	2.47E-08	3.17E-09	1.52E-08	8.23E-07 skin effects					
Naphthalene	0.21	0.30	4.41E-10	1.89E-11	2.45E-08	3.15E-09	1.10E-08	6.12E-07 eye, blood effects		1000			[D]
Di-n-octyl phthalate	0.28	0.35	5.94E-10	2.54E-11	2.78E-08	3.58E-09	2.97E-08	1.39E-06 skin disorders		1000			
Phenanthrene	0.65	1.13	1.38E-09	5.92E-11	9.08E-08	1.17E-08	4.61E-08	3.03E-06 skin disorders					[D]
Pyrene	1.49	3.95	3.19E-09	1.37E-10	3.18E-07	4.09E-08	1.06E-07	1.06E-05 skin disorders		3000			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.10E-04	2.05E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.76E-09	3.99E-07	

Table L.33. Risk characterization for groundwater: adults — ingestion exposure (current land use — residential)

Chemical	Chronic Daily Intake (CDI) ( )						Risk Estimates					
	MLE Concentration in GW ( )	RME Concentration in GW ( )	CDI Noncarc. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carcinogenic Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfD UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	RfD WOE ( )
INORGANICS (µg/L)													
Aluminum	2.00E+04	2.50E+04	3.83E−01	4.92E−02	6.84E−01	2.93E−01				1000			
Antimony	1.53E+01	1.62E+01	2.93E−04	3.77E−05	4.45E−04	1.91E−04	7.32E−01	1.11E+00	whole body, blood; inc. mortality	3	1.71E−05	1.15E−04	[A]
Arsenic	3.97E+00	5.58E+00	7.61E−05	9.78E−06	1.53E−04	6.55E−05	2.54E−01	5.09E−01	skin; keratosis, hyperpigmentation	3			
Barium	3.95E+02	4.85E+02	7.58E−03	9.74E−04	1.33E−02	5.70E−03	1.08E−01	1.90E−01	oral−cardiovasc. sys.; inc. blood pressure	100	2.00E−05	1.29E−04	[B2]
Beryllium	1.88E+00	2.56E+00	3.61E−05	4.64E−06	7.01E−05	3.00E−05	7.22E−03	1.40E−02	no observed effects	10			
Cadmium	3.51E+00	5.15E+00	6.74E−05	8.66E−06	1.41E−04	6.05E−05	1.35E−01	2.82E−01	kidney; proteinuria	100			
Chromium (III)	3.30E+01	4.10E+01	6.33E−04	8.14E−05	1.12E−03	4.81E−04	6.33E−04	1.12E−03	no observed effects				
Cobalt	1.73E+01	2.18E+01	3.32E−04	4.27E−05	5.98E−04	2.56E−04							[D]
Copper	1.67E+01	3.24E+02	3.20E−04	4.12E−05	8.87E−03	3.80E−03	8.66E−03	2.40E−01	Gastrointestinal system; irritation				[B2]
Lead	2.68E+01	3.53E+01	5.13E−04	6.60E−05	9.68E−04	4.15E−04			CNS, blood				[D]
Manganese (water)	3.74E+03	4.42E+03	7.17E−02	9.22E−03	1.21E−01	5.19E−02	7.17E−01	1.21E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	1.39E+01	2.19E+01	2.66E−04	3.42E−05	5.99E−04	2.57E−04	8.86E−01	2.00E+00	oral −CNS; neurotoxicity	1000			
Nickel	4.80E+01	6.43E+01	9.21E−04	1.18E−04	1.76E−03	7.55E−04	4.61E−02	8.81E−02	dec. body and organ weight	300			
Thallium	1.21E+00	1.26E+00	2.32E−05	2.99E−06	3.45E−05	1.48E−05	3.32E−01	4.93E−01	liver, blood; inc. sgot and serum LDH	3000			[D]
Vanadium	3.91E+01	4.90E+01	7.49E−04	9.64E−05	1.34E−03	5.76E−04	1.07E−01	1.92E−01	no observed effects	100			
Zinc	1.04E+01	1.29E+02	1.98E−04	2.55E−05	3.53E−03	1.51E−03	6.62E−04	1.18E−02	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	6.89E−03	8.86E−04	1.87E−02	8.01E−03	6.89E−02	1.87E−01	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Benzo(a)anthracene	5.02E+00	5.11E+00	9.63E−05	1.24E−05	1.40E−04	6.00E−05	3.21E−03	4.67E−03			9.04E−06	4.38E−05	[B2]
Benzo(a)pyrene	5.01E+00	5.11E+00	9.60E−05	1.23E−05	1.40E−04	6.00E−05	3.20E−03	4.66E−03			9.01E−05	4.38E−04	[B2]
Benzo(b)fluoranthene	5.02E+00	5.11E+00	9.63E−05	1.24E−05	1.40E−04	6.00E−05	3.21E−03	4.67E−03			9.04E−06	4.38E−05	[B2]
Benzo(k)fluoranthene	5.01E+00	5.11E+00	9.60E−05	1.23E−05	1.40E−04	6.00E−05	3.20E−03	4.66E−03			9.01E−06	4.38E−05	[B2]
Benzoic Acid	2.43E+01	2.50E+01	4.66E−04	5.99E−05	6.85E−04	2.94E−04	1.16E−04	1.71E−04	no observed effects	1			[D]
Bis(2−ethylhexyl)phthalate	4.84E+00	5.54E+00	9.29E−05	1.19E−05	1.52E−04	6.51E−05	4.64E−03	7.59E−03	liver; weight inc.	1000	1.67E−07	9.11E−07	[B2]
2−Butanone	8.55E+00	1.37E+01	1.64E−04	2.11E−05	3.75E−04	1.61E−04	3.28E−03	7.49E−03	oral−no observed effects	1000			[D]
Di−n−butyl phthalate	4.80E+00	4.96E+00	9.20E−05	1.18E−05	1.36E−04	5.83E−05	9.20E−04	1.36E−03	liver, kidney damage	1000			[D]
Carbon Disulfide	5.76E+00	8.36E+00	1.11E−04	1.42E−05	2.29E−04	9.81E−05	1.11E−03	2.29E−03	fetus; toxicity	100			
Chloroform	5.76E+00	8.34E+00	1.10E−04	1.42E−05	2.29E−04	9.79E−05	1.10E−02	2.29E−02	liver; lesions, fatty cyst formation	1000	8.66E−08	5.97E−07	[B2]
4,4'−DDT	5.15E−02	5.27E−02	9.87E−07	1.27E−07	1.44E−06	6.19E−07	1.97E−03	2.89E−03	liver; lesions	100	4.31E−08	2.10E−07	[B2]
Endrin	5.14E−02	5.27E−02	9.87E−07	1.27E−07	1.44E−06	6.19E−07	3.29E−03	4.81E−03	reprod., terato., CNS effects	100			[D]
Heptachlor Epoxide	2.57E−02	2.63E−02	4.93E−07	6.34E−08	7.21E−07	3.09E−07	3.79E−02	5.55E−02	liver damage		5.77E−07	2.81E−06	[B2]
alpha−Chlordane	1.37E−01	1.58E−01	2.63E−06	3.38E−07	4.33E−06	1.86E−06							
Chrysene	5.02E+00	5.11E+00	9.63E−05	1.24E−05	1.40E−04	6.00E−05	3.21E−03	4.67E−03			9.04E−07	4.38E−06	[B2]
Diethyl phthalate	4.56E+00	4.80E+00	8.74E−05	1.12E−05	1.31E−04	5.63E−05	1.09E−04	1.64E−04	lung irritation	1000			[D]
Fluoranthene	5.03E+00	5.11E+00	9.65E−05	1.24E−05	1.40E−04	6.00E−05	2.41E−03	3.50E−03	nephropathy, blood effects	3000			[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E−03	1.72E−04	3.69E−03	1.58E−03	2.23E−02	6.15E−02	liver, kidney damage, CNS effects	100	1.29E−06	1.19E−05	[B2]
Pyrene	5.05E+00	5.12E+00	9.68E−05	1.24E−05	1.40E−04	6.02E−05	3.23E−03	4.68E−03	skin disorders	3000			[D]
Tetrachloroethylene	5.78E+00	8.37E+00	1.11E−04	1.43E−05	2.29E−04	9.82E−05	1.11E−02	2.29E−02	liver, kidney, CNS effects	1000			
Xylenes	6.49E+00	1.02E+01	1.24E−04	1.60E−05	2.79E−04	1.20E−04	6.22E−05	1.40E−04	CNS hyperactivity, motor effects	100			[D]
RADIONUCLIDES (pCi/L)													
Americium 241	6.53E+00	1.33E+01		2.88E+04		2.78E+05					6.91E−06	6.68E−05	[A]
Cesium 137+D	9.54E−01	4.35E+00		4.21E+03		9.12E+04					1.18E−07	2.55E−06	[A]
Cobalt 60	1.26E+00	3.97E+00		5.55E+03		8.35E+04					8.32E−08	1.25E−06	[A]
Neptunium 237+D	7.59E+00	1.99E+01		3.35E+04		4.17E+05					7.37E−06	9.18E−05	[A]
Strontium 89	3.07E+00	4.15E+00		1.35E+04		8.72E+04					4.06E−08	2.62E−07	[A]
Strontium 90+D	−1.51E−01	6.06E−02		−6.65E+02		1.27E+03					−2.40E−08	4.58E−08	[A]
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04					1.44E−06	8.54E−06	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05					8.91E−07	6.11E−06	[A]
Uranium 235+D	5.50E−01	7.57E−01		2.43E+03		1.59E+04					3.88E−08	2.54E−07	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05					1.26E−06	8.86E−06	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	3.52E+00	6.75E+00
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.57E−04	8.34E−04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	1.81E−05	1.86E−04

Table L.34. Risk characterization for groundwater: children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in GW ( ) (µg/L)	RMB Concentration in GW ( ) (µg/L)	Chronic Daily Intake (CDI) ( ) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	BPA UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	BPA WOE ( )
INORGANICS (µg/L)													
Aluminum	2.00E+04	2.50E+04	3.98E-01	1.71E-02	8.10E-01	1.04E-01							
Antimony	1.53E+01	1.62E+01	3.05E-04	1.31E-05	5.27E-04	6.78E-05	7.61E-01	1.32E+00	whole body, blood; inc. mortality	1000			
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.38E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	no observed effects	100	6.92E-06	4.59E-05	[B2]
Cadmium	3.51E+00	5.15E+00	7.01E-05	3.00E-06	1.67E-04	2.15E-05	1.40E-01	3.34E-01	kidney; proteinuria	10			
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	no observed effects	100			
Cobalt	1.73E+01	2.18E+01	3.46E-04	1.48E-05	7.08E-04	9.10E-05							
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	Gastrointestinal system; irritation				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04			CNS, blood				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	7.46E-01	1.43E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	oral – CNS; neurotoxicity	1000			[D]
Nickel	4.80E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	dec. body and organ weight	300			
Thallium	1.21E+00	1.26E+00	2.42E-05	1.04E-06	4.09E-05	5.26E-06	3.45E-01	5.84E-01	liver, blood; inc. sgot and serum LDH	3000			[D]
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	no observed effects	100			
Zinc	1.04E+01	1.29E+02	2.06E-04	8.85E-06	4.18E-03	5.37E-04	6.88E-04	1.39E-02	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Benzo(a)anthracene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-06	1.56E-05	[B2]
Benzo(a)pyrene	5.01E+00	5.11E+00	9.99E-05	4.28E-06	1.66E-04	2.13E-05	3.33E-03	5.53E-03			3.12E-05	1.56E-04	[B2]
Benzo(b)fluoranthene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-06	1.56E-05	[B2]
Benzo(k)fluoranthene	5.01E+00	5.11E+00	9.99E-05	4.28E-06	1.66E-04	2.13E-05	3.33E-03	5.53E-03			3.12E-06	1.56E-05	[B2]
Benzoic Acid	2.43E+01	2.50E+01	4.84E-04	2.08E-05	8.11E-04	1.04E-04	1.21E-04	2.03E-04	no observed effects	1			[D]
Bis(2-ethylhexyl)phthalate	4.84E+00	5.54E+00	9.66E-05	4.14E-06	1.80E-04	2.31E-05	4.83E-03	8.99E-03	liver; weight inc.	1000	5.80E-08	3.24E-07	[B2]
2-Butanone	8.55E+00	1.37E+01	1.71E-04	7.31E-06	4.44E-04	5.70E-05	3.41E-03	8.87E-03	oral–no observed effects	1000			[D]
Di-n-butyl phthalate	4.80E+00	4.96E+00	9.57E-05	4.10E-06	1.61E-04	2.07E-05	9.57E-04	1.61E-03	liver, kidney damage	1000			[D]
Carbon Disulfide	5.76E+00	8.36E+00	1.15E-04	4.93E-06	2.71E-04	3.49E-05	1.15E-03	2.71E-03	fetus; toxicity	100			
Chloroform	5.76E+00	8.34E+00	1.15E-04	4.92E-06	2.71E-04	3.48E-05	1.15E-02	2.71E-02	liver; lesions, fatty cyst formation	1000	3.00E-08	2.12E-07	[B2]
4,4'-DDT	5.15E-02	5.27E-02	1.03E-06	4.40E-08	1.71E-06	2.20E-07	2.05E-03	3.42E-03	liver; lesions	100	1.50E-08	7.48E-08	[B2]
Endrin	5.14E-02	5.27E-02	1.03E-06	4.40E-08	1.71E-06	2.20E-07	3.42E-03	5.70E-03	reprod., terato., CNS effects	100			[D]
Heptachlor Epoxide	2.57E-02	2.63E-02	5.13E-07	2.20E-08	8.54E-07	1.10E-07	3.94E-02	6.57E-02	liver damage		2.00E-07	9.99E-07	[B2]
alpha-Chlordane	1.37E-01	1.58E-01	2.73E-06	1.17E-07	5.13E-06	6.60E-07							
Chrysene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-07	1.56E-06	[B2]
Diethyl phthalate	4.56E+00	4.80E+00	9.09E-05	3.90E-06	1.56E-04	2.00E-05	1.14E-04	1.95E-04	lung irritation	1000			[D]
Fluoranthene	5.03E+00	5.11E+00	1.00E-04	4.30E-06	1.66E-04	2.13E-05	2.51E-03	4.15E-03	nephropathy, blood effects	3000			[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	liver, kidney damage, CNS effects	100	4.47E-07	4.21E-06	[B2]
Pyrene	5.05E+00	5.12E+00	1.01E-04	4.31E-06	1.66E-04	2.14E-05	3.35E-03	5.54E-03	skin disorders	3000			[D]
Tetrachloroethylene	5.78E+00	8.37E+00	1.15E-04	4.94E-06	2.72E-04	3.49E-05	1.15E-02	2.72E-02	liver, kidney, CNS effects	1000			
Xylenes	6.49E+00	1.02E+01	1.29E-04	5.55E-06	3.31E-04	4.25E-05	6.47E-05	1.65E-04	CNS hyperactivity, motor effects	100			[D]
RADIONUCLIDES (pCi/L)													
Americium 241	6.53E+00	1.33E+01		3.56E+03		3.67E+04					8.55E-07	8.81E-06	[A]
Cesium 137+D	9.54E-01	4.35E+00		5.21E+02		1.20E+04					1.46E-08	3.37E-07	[A]
Cobalt 60	1.26E+00	3.97E+00		6.87E+02		1.10E+04					1.03E-08	1.65E-07	[A]
Neptunium 237+D	7.59E+00	1.99E+01		4.15E+03		5.51E+04					9.12E-07	1.21E-05	[A]
Strontium 89	3.07E+00	4.15E+00		1.68E+03		1.15E+04					5.03E-09	3.45E-08	[A]
Strontium 90+D	-1.51E-01	6.06E-02		-8.24E+01		1.68E+02					-2.97E-09	6.05E-09	[A]
Radium 228+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04					1.78E-07	1.13E-06	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04					1.10E-07	8.06E-07	[A]
Uranium 235+D	5.50E-01	7.57E-01		3.00E+02		2.10E+03					4.80E-09	3.36E-08	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04					1.56E-07	1.17E-06	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.66E+00	7.99E+00					
Excess Lifetime Cancer Risk: Combined Exposure (d)											5.46E-05	2.96E-04	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											2.24E-06	2.46E-05	

Table L.35. Risk characterization for groundwater: adults – inhalation exposure (current land use – residential)

Chemical	MLE Concentration in GW () ()	RME Concentration in GW () ()	Chronic Daily Intake (CDI) () CDI Noncarc. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF ()	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE ()
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	1.77E−04	2.28E−05	7.01E−04	3.00E−04			inc. liver, kidney weights, nephrotoxicity				
2−Butanone	8.55E+00	1.37E+01	4.22E−06	5.42E−07	1.40E−05	6.02E−06	1.48E−05	4.92E−05	oral−no observed effects	1000			
Carbon Disulfide	5.76E+00	8.36E+00	2.84E−06	3.65E−07	8.59E−06	3.68E−06	9.95E−04	3.01E−03	fetus; toxicity	1000			
Chloroform	5.76E+00	8.34E+00	2.84E−06	3.65E−07	8.57E−06	3.67E−06			liver; lesions, fatty cyst formation		2.96E−08	2.98E−07	[B2]
Methylene Chloride	6.97E+01	1.35E+02	3.44E−05	4.42E−06	1.38E−04	5.93E−05	4.01E−05	1.61E−04	liver, kidney damage, CNS effects	100			[B2]
Tetrachloroethylene	5.78E+00	8.37E+00	2.85E−06	3.67E−07	8.60E−06	3.68E−06			liver, kidney, CNS effects				
Xylenes	6.49E+00	1.02E+01	3.20E−06	4.11E−07	1.05E−05	4.49E−06			CNS hyperactivity, motor effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.05E−03	3.22E−03					
Excess Lifetime Cancer Risk: Combined Exposure (d)											2.96E−08	2.98E−07	

Table L.36. Risk characterization for groundwater: children – inhalation exposure (current land use – residential)

Chemical	MLE Concentration in GW ( ) ( )	RME Concentration in GW ( ) ( )	Chronic Daily Intake (CDI) ( ) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfC) (MLE)	HQ Noncarc. Effects (CDI/RfC) (RME)	Noncarcinogenic Effect of Concern	EPA UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE ( )
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	1.03E−03	4.43E−05	3.17E−03	4.07E−04			inc. liver, kidney weights, nephrotoxicity				
2−Butanone	8.55E+00	1.37E+01	2.46E−05	1.05E−06	6.35E−05	8.17E−06	8.61E−05	2.22E−04	oral−no observed effects	1000			
Carbon Disulfide	5.76E+00	8.36E+00	1.66E−05	7.11E−07	3.88E−05	4.99E−06	5.80E−03	1.36E−02	fetus; toxicity	1000			
Chloroform	5.76E+00	8.34E+00	1.66E−05	7.10E−07	3.88E−05	4.98E−06			liver; lesions, fatty cyst formation		5.75E−08	4.04E−07	[B2]
Methylene Chloride	6.97E+01	1.35E+02	2.01E−04	8.60E−06	6.25E−04	8.04E−05	2.34E−04	7.30E−04	liver, kidney damage, CNS effects	100			[B2]
Tetrachloroethylene	5.78E+00	8.37E+00	1.66E−05	7.13E−07	3.89E−05	5.00E−06			liver, kidney, CNS effects				
Xylenes	6.49E+00	1.02E+01	1.87E−05	8.00E−07	4.74E−05	6.09E−06			CNS hyperactivity, motor effects				
Chemical Hazards:													
Hazard Index (HI): Combined Exposure (d)							6.12E−03	1.45E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											5.75E−08	4.04E−07	

Table L.37. Risk characterization for produce (NOAA Site): adults – ingestion exposure (current land use – residential)

Chemical	Plant Conc. from MLB Conc. in Soil (µg/day)	Plant Conc. from Groups from RMEs in Soil (µg/day)	Chronic Daily Intake (CDI) ( ): CDI Noncarc. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE ( )
INORGANICS (mg/kg PLANT TISSUE)													
Aluminum	5.27E+01	7.07E+01	8.04E-03	1.03E-03	4.94E-02	2.12E-02							
Arsenic	6.56E-01	7.44E-01	1.00E-04	1.29E-05	5.20E-04	2.23E-04	3.34E-01	1.73E+00	skin; keratosis, hyperpigmentation	3	2.25E-05	3.90E-04	[A]
Barium	2.33E+00	1.91E+00	3.56E-04	4.57E-05	1.33E-03	5.71E-04	5.08E-03	1.90E-02	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	4.43E-03	4.33E-03	6.76E-07	8.69E-08	3.02E-06	1.30E-06	1.35E-04	6.05E-04	no observed effects	100	3.74E-07	5.57E-06	[B2]
Cadmium	2.15E+00	3.86E+00	3.29E-04	4.22E-05	2.70E-03	1.16E-03	6.57E-01	5.39E+00	kidney; proteinuria	10			
Chromium (III)	4.32E-01	7.17E-01	6.58E-05	8.47E-06	5.01E-04	2.15E-04	6.58E-05	5.01E-04	no observed effects	100			
Cobalt	3.61E-01	5.79E-01	5.51E-05	7.08E-06	4.05E-04	1.73E-04							
Copper	4.21E+00	6.75E+00	6.43E-04	8.27E-05	4.72E-03	2.02E-03	1.74E-02	1.27E-01	Gastrointestinal system; irritation				[D]
Cyanide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00			thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	3.60E-01	5.18E-01	5.50E-05	7.07E-06	3.62E-04	1.55E-04			CNS, blood				[B2]
Manganese	2.05E+02	3.40E+02	3.12E-02	4.01E-03	2.38E-01	1.02E-01	3.12E-01	2.38E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	5.62E+01	1.33E+02	8.57E-03	1.10E-03	9.29E-02	3.98E-02	2.86E+01	3.10E+02	oral –CNS; neurotoxicity	1000			[D]
Nickel	1.96E+00	3.26E+00	2.99E-04	3.85E-05	2.28E-03	9.75E-04	1.50E-02	1.14E-01	dec. body and organ weight	300			
Silver	8.27E-01	1.46E+00	1.26E-04	1.62E-05	1.03E-03	4.42E-04	2.52E-02	2.06E-01	skin; argyria	3			[D]
Vanadium	4.70E-02	5.91E-02	7.17E-06	9.22E-07	4.13E-05	1.77E-05	1.02E-03	5.90E-03	no observed effects	100			
Zinc	2.39E+01	3.74E+01	3.64E-03	4.68E-04	2.61E-02	1.12E-02	1.21E-02	8.70E-02	blood; anemia	3			[D]
ORGANICS (mg/kg PLANT TISSUE)													
Aroclor-1260	7.58E-04	1.59E-03	1.16E-07	1.49E-08	1.11E-06	4.77E-07					1.14E-07	3.67E-06	[B2]
Acenaphthene	2.43E-02	5.07E-02	3.70E-06	4.76E-07	3.54E-05	1.52E-05	6.17E-05	5.90E-04	liver; hepatotoxicity	3000			
Acenaphthylene	1.07E-02	1.47E-02	1.63E-06	2.09E-07	1.03E-05	4.40E-06	5.43E-05	3.43E-04					[D]
Anthracene	1.15E-02	2.55E-02	1.76E-06	2.26E-07	1.78E-05	7.64E-06	5.86E-06	5.94E-05	no observed effects	3000			[D]
Benzo(a)anthracene	3.37E-03	7.16E-03	5.13E-07	6.60E-08	5.00E-06	2.14E-06	1.71E-05	1.67E-04			4.82E-08	1.56E-06	[B2]
Benzo(a)pyrene	1.50E-03	2.98E-03	2.29E-07	2.94E-08	2.08E-06	8.92E-07	7.63E-06	6.94E-05			2.15E-07	6.51E-06	[B2]
Benzo(b)fluoranthene	1.81E-03	3.50E-03	2.77E-07	3.56E-08	2.45E-06	1.05E-06	9.22E-06	8.16E-05			2.60E-08	7.66E-07	[B2]
Benzo(g,h,i)perylene	4.41E-04	8.58E-04	6.72E-08	8.64E-09	5.99E-07	2.57E-07	2.24E-06	2.00E-05					[D]
Benzo(k)fluoranthene	7.86E-04	1.20E-03	1.20E-07	1.54E-08	8.35E-07	3.58E-07	4.00E-06	2.78E-05			1.13E-08	2.61E-07	[B2]
Bis(2-ethylhexyl)phthalate	7.24E-03	9.85E-03	1.11E-06	1.42E-07	6.88E-06	2.95E-06	5.53E-05	3.44E-04	liver; weight inc.	1000	1.99E-09	4.13E-08	[B2]
Butyl benzyl phthalate	9.80E-03	1.29E-02	1.50E-06	1.92E-07	8.99E-06	3.85E-06	7.48E-06	4.50E-05	liver; weight changes	1000			[C]
Chrysene	3.73E-03	7.74E-03	5.69E-07	7.32E-08	5.41E-06	2.32E-06	1.90E-05	1.80E-04			5.34E-09	1.69E-07	[B2]
Dibenzofuran	1.16E-02	1.89E-02	1.78E-06	2.28E-07	1.32E-05	5.66E-06			thymus, liver, skin				[D]
Dibenzo(a,h)anthracene	4.75E-04	7.48E-04	7.24E-08	9.31E-09	5.22E-07	2.24E-07	2.41E-06	1.74E-05	skin disorders		6.80E-08	1.63E-06	[B2]
Fluoranthene	1.87E-02	4.23E-02	2.85E-06	3.66E-07	2.95E-05	1.27E-05	7.12E-05	7.38E-04	nephropathy, blood effects	3000			[D]
Fluorene	1.07E-02	2.03E-02	1.64E-06	2.11E-07	1.42E-05	6.09E-06	4.09E-05	3.55E-04	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	1.93E-04	3.79E-04	2.94E-08	3.78E-09	2.65E-07	1.14E-07	9.80E-07	8.83E-06	skin disorders		2.76E-09	8.29E-08	[B2]
2-Methylnaphthalene	1.55E-02	2.14E-02	2.36E-06	3.04E-07	1.49E-05	6.40E-06	7.88E-05	4.98E-04	skin effects				
Naphthalene	5.32E-02	1.12E-01	8.12E-06	1.04E-06	7.85E-05	3.37E-05	2.03E-04	1.96E-03	eye, blood effects	1000			[D]
Phenanthrene	3.62E-02	9.13E-02	5.52E-06	7.10E-07	6.38E-05	2.73E-05	1.84E-04	2.13E-03	skin disorders				[D]
Pyrene	1.58E-02	3.54E-02	2.41E-06	3.10E-07	2.47E-05	1.06E-05	8.03E-05	8.25E-04	skin disorders	3000			[D]
RADIONUCLIDES (pCi/kg PLANT TISSUE)													
Americium 241		3.35E-05				1.79E+01						4.31E-09	[A]
Cesium 137+D	2.26E-02	3.96E-02		7.93E+02		2.12E+04					2.22E-08	5.94E-07	[A]
Cobalt 60	2.00E-04	4.01E-04		7.02E+00		2.15E+02					1.05E-10	3.22E-09	[A]
Uranium 234	2.59E-02	4.42E-02		9.10E+02		2.36E+04					1.46E-08	3.78E-07	[A]
Uranium 235+D	1.28E-03	2.22E-03		4.51E+01		1.19E+03					7.21E-10	1.90E-08	[A]
Uranium 238+D	2.27E-02	3.88E-02		7.96E+02		2.08E+04					2.23E-08	5.82E-07	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	3.00E+01	3.20E+02		
Excess Lifetime Cancer Risk: Combined Exposure (d)			2.34E-05	4.10E-04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)			5.99E-08	1.58E-06

Table L.38. Risk characterization for produce (NOAA Site): children – ingestion exposure (current land use – residential)

Chemical	Chronic Daily Intake (CDI) ( )						Risk Estimates					
	Plant Conc. from MLE Conc. in Soil (µg/day)	Plant Conc. from Groups from RMEs in Soil (µg/day)	CDI Noncarc. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carcinogenic Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE ( )
INORGANICS (mg/kg PLANT TISSUE)													
Aluminum	5.27E+01	7.07E+01	1.80E−02	7.71E−04	1.03E−01	1.32E−02							
Arsenic	6.56E−01	7.44E−01	2.24E−04	9.59E−06	1.08E−03	1.39E−04	7.46E−01	3.59E+00	skin; keratosis, hyperpigmentation	3	1.68E−05	2.43E−04	[A]
Barium	2.33E+00	1.91E+00	7.95E−04	3.41E−05	2.76E−03	3.55E−04	1.14E−02	3.95E−02	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	4.43E−03	4.33E−03	1.51E−06	6.48E−08	6.27E−06	8.07E−07	3.02E−04	1.25E−03	no observed effects	100	2.79E−07	3.47E−06	[B2]
Cadmium	2.15E+00	3.86E+00	7.34E−04	3.15E−05	5.60E−03	7.19E−04	1.47E+00	1.12E+01	kidney; proteinuria	10			
Chromium (III)	4.32E−01	7.17E−01	1.47E−04	6.31E−06	1.04E−03	1.34E−04	1.47E−04	1.04E−03	no observed effects	100			
Cobalt	3.61E−01	5.79E−01	1.23E−04	5.28E−06	8.40E−04	1.08E−04							
Copper	4.21E+00	6.75E+00	1.44E−03	6.16E−05	9.78E−03	1.26E−03	3.88E−02	2.64E−01	Gastrointestinal system; irritation				[D]
Cyanide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00			thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	3.60E−01	5.18E−01	1.23E−04	5.27E−06	7.51E−04	9.66E−05			CNS, blood				[B2]
Manganese	2.05E+02	3.40E+02	6.98E−02	2.99E−03	4.93E−01	6.34E−02	6.98E−01	4.93E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	5.62E+01	1.33E+02	1.92E−02	8.21E−04	1.93E−01	2.48E−02	6.39E+01	6.42E+02	oral –CNS; neurotoxicity	1000			[D]
Nickel	1.96E+00	3.26E+00	6.69E−04	2.87E−05	4.72E−03	6.07E−04	3.35E−02	2.36E−01	dec. body and organ weight	300			
Silver	8.27E−01	1.48E+00	2.82E−04	1.21E−05	2.14E−03	2.75E−04	5.64E−02	4.28E−01	skin; argyria	3			[D]
Vanadium	4.70E−02	5.91E−02	1.60E−05	6.87E−07	8.57E−05	1.10E−05	2.29E−03	1.22E−02	no observed effects	100			
Zinc	2.39E+01	3.74E+01	8.14E−03	3.49E−04	5.42E−02	6.96E−03	2.71E−02	1.81E−01	blood; anemia	3			[D]
ORGANICS (mg/kg PLANT TISSUE)													
Aroclor−1260	7.58E−04	1.59E−03	2.58E−07	1.11E−08	2.31E−06	2.97E−07					8.53E−08	2.29E−06	[B2]
Acenaphthene	2.43E−02	5.07E−02	8.28E−06	3.55E−07	7.34E−05	9.44E−06	1.38E−04	1.22E−03	liver; hepatotoxicity	3000			
Acenaphthylene	1.07E−02	1.47E−02	3.64E−06	1.56E−07	2.13E−05	2.74E−06	1.21E−04	7.11E−04					[D]
Anthracene	1.15E−02	2.55E−02	3.93E−06	1.68E−07	3.70E−05	4.75E−06	1.31E−05	1.23E−04	no observed effects	3000			[D]
Benzo(a)anthracene	3.37E−03	7.16E−03	1.15E−06	4.92E−08	1.04E−05	1.33E−06	3.83E−05	3.46E−04			3.59E−08	9.74E−07	[B2]
Benzo(a)pyrene	1.50E−03	2.98E−03	5.11E−07	2.19E−08	4.32E−06	5.55E−07	1.70E−05	1.44E−04			1.60E−07	4.05E−06	[B2]
Benzo(b)fluoranthene	1.81E−03	3.50E−03	6.18E−07	2.65E−08	5.08E−06	6.53E−07	2.06E−05	1.69E−04			1.93E−08	4.77E−07	[B2]
Benzo(g,h,i)perylene	4.41E−04	8.58E−04	1.50E−07	6.44E−09	1.24E−06	1.60E−07	5.01E−06	4.15E−05					[D]
Benzo(k)fluoranthene	7.86E−04	1.20E−03	2.68E−07	1.15E−08	1.73E−06	2.23E−07	8.94E−06	5.77E−05			8.39E−09	1.63E−07	[B2]
Bis(2−ethylhexyl)phthalate	7.24E−03	9.85E−03	2.47E−06	1.06E−07	1.43E−05	1.84E−06	1.24E−04	7.14E−04	liver; weight inc.	1000	1.48E−09	2.57E−08	[B2]
Butyl benzyl phthalate	9.80E−03	1.29E−02	3.34E−06	1.43E−07	1.87E−05	2.40E−06	1.67E−05	9.33E−05	liver; weight changes	1000			[C]
Chrysene	3.73E−03	7.74E−03	1.27E−06	5.45E−08	1.12E−05	1.44E−06	4.24E−05	3.74E−04			3.98E−09	1.05E−07	[B2]
Dibenzofuran	1.16E−02	1.89E−02	3.97E−06	1.70E−07	2.74E−05	3.52E−06			thymus, liver, skin				[D]
Dibenzo(a,h)anthracene	4.75E−04	7.48E−04	1.62E−07	6.94E−09	1.08E−06	1.39E−07	5.40E−06	3.61E−05	skin disorders		5.07E−08	1.02E−06	[B2]
Fluoranthene	1.87E−02	4.23E−02	6.37E−06	2.73E−07	6.13E−05	7.88E−06	1.59E−04	1.53E−03	nephropathy, blood effects	3000			[D]
Fluorene	1.07E−02	2.03E−02	3.66E−06	1.57E−07	2.95E−05	3.79E−06	9.15E−05	7.37E−04	skin disorders	3000			[D]
Indeno(1,2,3−cd)pyrene	1.93E−04	3.79E−04	6.57E−08	2.82E−09	5.50E−07	7.07E−08	2.19E−06	1.83E−05	skin disorders		2.06E−09	5.16E−08	[B2]
2−Methylnaphthalene	1.55E−02	2.14E−02	5.29E−06	2.27E−07	3.10E−05	3.98E−06	1.76E−04	1.03E−03	skin effects				
Naphthalene	5.32E−02	1.12E−01	1.81E−05	7.77E−07	1.63E−04	2.09E−05	4.54E−04	4.07E−03	eye, blood effects	1000			[D]
Phenanthrene	3.62E−02	9.13E−02	1.23E−05	5.29E−07	1.32E−04	1.70E−05	4.12E−04	4.41E−03	skin disorders				[D]
Pyrene	1.58E−02	3.54E−02	5.39E−06	2.31E−07	5.13E−05	6.60E−06	1.80E−04	1.71E−03	skin disorders	3000			[D]
RADIONUCLIDES (pCi/kg PLANT TISSUE)													
Americium 241		3.35E−05				4.15E+00						9.96E−10	[A]
Cesium 137+D	2.26E−02	3.96E−02		2.11E+02		4.90E+03					5.91E−09	1.37E−07	[A]
Cobalt 60	2.00E−04	4.01E−04		1.87E+00		4.97E+01					2.80E−11	7.45E−10	[A]
Uranium 234	2.59E−02	4.42E−02		2.42E+02		5.47E+03					3.88E−09	8.75E−08	[A]
Uranium 235+D	1.28E−03	2.22E−03		1.20E+01		2.74E+02					1.92E−10	4.39E−09	[A]
Uranium 238+D	2.27E−02	3.88E−02		2.12E+02		4.81E+03					5.93E−09	1.35E−07	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.70E+01	6.63E+02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.74E−05	2.55E−04	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											1.59E−08	3.65E−07	

Table L.39. Risk characterization for fish: adults – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in Fish Tissue (mg/Kg)	RME Concentration in Fish Tissue (mg/Kg)	Chronic Daily Intake (CDI) (-) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF (-)	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE (-)
INORGANICS													
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	oral –CNS; neurotoxicity	1000			[D]
ORGANICS													
Aroclor-1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06					6.37E-07	2.71E-05	[B2]
Aroclor-1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06					1.12E-06	4.76E-05	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.75E-06	7.47E-05	

Table L.40. Risk characterization for fish: children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in Fish Tissue (mg/Kg)	RME Concentration in Fish Tissue (mg/Kg)	Chronic Daily Intake (CDI) () CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF ()	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE ()
INORGANICS													
Mercury	0.76	0.78	4.16E-06	1.78E-07	6.04E-05	7.76E-06	1.39E-02	2.01E-01	oral -CNS; neurotoxicity	1000			[D]
ORGANICS													
Aroclor-1254	0.20	0.22	1.12E-06	4.81E-08	1.72E-05	2.21E-06					3.70E-07	1.70E-05	[B2]
Aroclor-1260	0.36	0.39	1.97E-06	8.44E-08	3.01E-05	3.88E-06					6.50E-07	2.98E-05	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.39E-02	2.01E-01					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.02E-06	4.68E-05	

Table L.41. Human health risk characterization summary: EFPC residential scenario: current land use, Sturm Site adults long term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.21E−01	5.24E−01	1.01E−06	1.64E−05
Dermal Contact	4.38E−03	5.72E−02	1.91E−07	1.04E−05
SURFACE WATER				
Ingestion	2.69E−04	2.24E−03	2.26E−09	5.37E−08
Dermal Contact	1.30E−03	1.67E−02	2.03E−08	9.14E−07
SEDIMENT				
Dermal Contact	1.61E−04	1.57E−02	4.06E−09	1.02E−06
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	1.24E+01	7.64E+01	1.56E−05	3.16E−04
Fish	7.94E−03	9.63E−02	1.75E−06	7.47E−05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.93E−08	5.15E−07
SURFACE WATER				
Ingestion			1.25E−09	5.08E−07
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			4.02E−08	9.08E−07
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.26E+01	7.71E+01		
Excess Lifetime Cancer Risk: Combined Exposure			1.86E−05	4.20E−04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			7.07E−08	1.93E−06

Table L.42. Human health risk characterization summary: EFPC residential scenario: current land use, Sturm Site children long term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	4.23E−01	1.88E+00	1.18E−06	1.76E−05
Dermal Contact	5.71E−03	7.49E−02	8.31E−08	4.07E−06
SURFACE WATER				
Ingestion	7.72E−04	6.17E−03	2.33E−09	4.89E−08
Dermal Contact	1.70E−03	2.18E−02	8.84E−09	3.59E−07
SEDIMENT				
Dermal Contact	2.10E−04	2.05E−02	1.76E−09	3.99E−07
GROUNDWATER				
Ingestion (Agricultural/Residential)				
Inhalation (VOCs)				
FOOD CHAIN				
Produce (Residential)	2.78E+01	1.58E+02	1.16E−05	1.97E−04
Fish	1.39E−02	2.01E−01	1.02E−06	4.68E−05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.22E−08	2.06E−07
SURFACE WATER				
Ingestion			4.15E−10	1.53E−07
GROUNDWATER				
Ingestion (Agricultural/Residential)				
FOOD CHAIN				
Produce (Residential)			1.07E−08	2.10E−07
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.82E+01	1.61E+02		
Excess Lifetime Cancer Risk: Combined Exposure			1.39E−05	2.66E−04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2.33E−08	5.68E−07

Table L.43. Risk characterization for soils (Sturm Site): adults – ingestion exposure (current land use – residential)

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UR	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	BPA WOE
INORGANICS (mg/kg)													
Aluminum	14530.00	15620.00	6.14E-03	7.90E-04	2.14E-02	9.17E-03							
Arsenic	5.57	7.37	2.35E-06	3.03E-07	1.01E-05	4.32E-06	7.84E-03	3.36E-02	skin; keratosis, hyperpigmentation	3	5.29E-07	7.57E-06	[A]
Barium	104.30	119.50	4.41E-05	5.67E-06	1.64E-04	7.02E-05	6.30E-04	2.34E-03	oral–cardiovasc. sys.; inc. blood pressure	3			
Cadmium	4.27	7.01	1.80E-06	2.32E-07	9.61E-06	4.12E-06	3.61E-03	1.92E-02	kidney; proteinuria	10			
Chromium (III)	37.43	49.45	1.58E-05	2.03E-06	6.77E-05	2.90E-05	1.58E-05	6.77E-05	no observed effects	100			
Cobalt	13.15	16.10	5.56E-06	7.15E-07	2.21E-05	9.45E-06							
Copper	87.90	147.40	3.72E-05	4.78E-06	2.02E-04	8.65E-05	1.00E-03	5.46E-03	Gastrointestinal system; irritation				[D]
Cyanide	10.69	31.61	4.52E-06	5.81E-07	4.33E-05	1.86E-05	2.26E-04	2.17E-03	thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	58.83	72.20	2.49E-05	3.20E-06	9.89E-05	4.24E-05			CNS, blood				[B2]
Manganese	1054.00	1248.00	4.46E-04	5.73E-05	1.71E-03	7.33E-04	4.46E-03	1.71E-02	lung, CNS; respiratory, psychomotor distur	1			[D]
Mercury	70.93	94.53	3.00E-05	3.85E-06	1.29E-04	5.55E-05	9.99E-02	4.32E-01	oral –CNS; neurotoxicity	1000			[D]
Nickel	35.98	50.54	1.52E-05	1.96E-06	6.92E-05	2.97E-05	7.60E-04	3.46E-03	dec. body and organ weight	300			
Silver	3.87	6.48	1.63E-06	2.10E-07	8.87E-06	3.80E-06	3.27E-04	1.77E-03	skin; argyria	3			[D]
Vanadium	27.73	31.00	1.17E-05	1.51E-06	4.25E-05	1.82E-05	1.67E-03	6.07E-03	no observed effects	100			
Zinc	106.90	145.90	4.52E-05	5.81E-06	2.00E-04	8.57E-05	1.51E-04	6.66E-04	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Arodor-1260	0.22	0.37	9.30E-08	1.20E-08	5.07E-07	2.17E-07					9.21E-08	1.67E-06	[B2]
Acenaphthylene	0.18	0.22	7.55E-08	9.71E-09	2.95E-07	1.26E-07	2.52E-06	9.82E-06					[D]
Anthracene	0.18	0.22	7.61E-08	9.78E-09	2.95E-07	1.26E-07	2.54E-07	9.82E-07	no observed effects	3000			[D]
Benzoic Acid	0.56	1.05	2.37E-07	3.05E-08	1.44E-06	6.16E-07	5.93E-08	3.60E-07	no observed effects	1			[D]
Benzo(a)anthracene	0.46	0.82	1.93E-07	2.49E-08	1.12E-06	4.81E-07	6.45E-06	3.74E-05			1.82E-08	3.51E-07	[B2]
Benzo(a)pyrene	0.50	0.94	2.10E-07	2.70E-08	1.29E-06	5.52E-07	7.01E-06	4.29E-05			1.97E-07	4.03E-06	[B2]
Benzo(b)fluoranthene	0.98	1.80	4.14E-07	5.33E-08	2.47E-06	1.06E-06	1.38E-05	8.22E-05			3.89E-08	7.71E-07	[B2]
Benzo(g,h,i)perylene	0.41	0.73	1.73E-07	2.23E-08	1.00E-06	4.29E-07	5.78E-06	3.33E-05					[D]
Benzo(k)fluoranthene	0.98	1.80	4.14E-07	5.33E-08	2.47E-06	1.06E-06	1.38E-05	8.22E-05			3.89E-08	7.71E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.17	0.22	7.19E-08	9.24E-09	2.95E-07	1.26E-07	3.59E-06	1.47E-05	liver; weight inc.	1000	1.29E-10	1.77E-09	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	8.14E-08	1.05E-08	2.90E-07	1.24E-07	2.71E-06	9.68E-06	skin disorders		7.64E-08	9.09E-07	[B2]
Di-n-butyl phthalate	0.08	0.17	3.55E-08	4.56E-09	2.38E-07	1.02E-07	3.55E-07	2.38E-06	liver, kidney damage	1000			[D]
Chrysene	0.59	1.10	2.50E-07	3.22E-08	1.51E-06	6.46E-07	8.35E-06	5.02E-05			2.35E-09	4.71E-08	[B2]
Fluoranthene	1.07	2.10	4.51E-07	5.80E-08	2.88E-06	1.23E-06	1.13E-05	7.19E-05	nephropathy, blood effects	3000			[D]
Fluorene	0.17	0.22	7.16E-08	9.21E-09	2.95E-07	1.26E-07	1.79E-06	7.36E-06	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	0.36	0.64	1.51E-07	1.95E-08	8.77E-07	3.76E-07	5.05E-06	2.92E-05	skin disorders		1.42E-08	2.74E-07	[B2]
2-Methylnaphthalene	0.13	0.22	5.39E-08	6.93E-09	2.95E-07	1.26E-07	1.80E-06	9.82E-06	skin effects				
Phenanthrene	0.42	0.80	1.78E-07	2.28E-08	1.10E-06	4.70E-07	5.92E-06	3.65E-05	skin disorders				[D]
Pyrene	0.83	1.50	3.49E-07	4.48E-08	2.05E-06	8.81E-07	1.16E-05	6.85E-05	skin disorders	3000			[D]
RADIONUCLIDES (pCi/g)													
Americium 241	0.05	0.17		4.54E+00		1.75E+02					1.09E-09	4.20E-08	[A]
Cesium 137+D	0.72	0.99		6.97E+01		1.04E+03					1.95E-09	2.90E-08	[A]
Cobalt 60	0.00	0.01		2.81E-17		1.55E+01					4.22E-28	2.32E-10	[A]
Neptunium 237+D	0.02	0.06		2.11E+00		6.30E+01					4.63E-10	1.39E-08	[A]
Uranium 234	7.54	11.94		7.33E+02		1.25E+04					1.17E-08	2.01E-07	[A]
Uranium 235+D	0.29	0.39		2.84E+01		4.10E+02					4.54E-10	6.57E-09	[A]
Uranium 238+D	5.02	7.59		4.88E+02		7.97E+03					1.37E-08	2.23E-07	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.21E-01	5.24E-01					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.01E-06	1.64E-05	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											2.93E-08	5.15E-07	

Table L.44. Risk characterization for soils (Sturm Site): children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	14530.00	15620.00	2.15E−02	9.21E−04	7.66E−02	9.85E−03							
Arsenic	5.57	7.37	8.24E−06	3.53E−07	3.61E−05	4.65E−06	2.75E−02	1.20E−01	skin; keratosis, hyperpigmentation	3	6.18E−07	8.13E−06	[A]
Barium	104.30	119.50	1.54E−04	6.61E−06	5.86E−04	7.54E−05	2.20E−03	8.37E−03	oral−cardiovasc. sys.; inc. blood pressure	3			
Cadmium	4.27	7.01	6.31E−06	2.71E−07	3.44E−05	4.42E−06	1.26E−02	6.88E−02	kidney; proteinuria	10			
Chromium (III)	37.43	49.45	5.54E−05	2.37E−06	2.43E−04	3.12E−05	5.54E−05	2.43E−04	no observed effects	100			
Cobalt	13.15	16.10	1.95E−05	8.34E−07	7.90E−05	1.02E−05							
Copper	87.90	147.40	1.30E−04	5.57E−06	7.23E−04	9.30E−05	3.51E−03	1.95E−02	Gastrointestinal system; irritation				[D]
Cyanide	10.69	31.61	1.58E−05	6.78E−07	1.55E−04	1.99E−05	7.91E−04	7.75E−03	thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	58.83	72.20	8.70E−05	3.73E−06	3.54E−04	4.55E−05			CNS, blood				[B2]
Manganese	1054.00	1248.00	1.56E−03	6.68E−05	6.12E−03	7.87E−04	1.56E−02	6.12E−02	lung, CNS; respiratory, psychomotor distur	1			[D]
Mercury	70.93	94.53	1.05E−04	4.50E−06	4.64E−04	5.96E−05	3.50E−01	1.55E+00	oral −CNS; neurotoxicity	1000			[D]
Nickel	35.98	50.54	5.32E−05	2.28E−06	2.48E−04	3.19E−05	2.66E−03	1.24E−02	dec. body and organ weight	300			
Silver	3.87	6.48	5.72E−06	2.45E−07	3.18E−05	4.08E−06	1.14E−03	6.35E−03	skin; argyria	3			[D]
Vanadium	27.73	31.00	4.10E−05	1.76E−06	1.52E−04	1.96E−05	5.86E−03	2.17E−02	no observed effects	100			
Zinc	106.90	145.90	1.58E−04	6.78E−06	7.16E−04	9.20E−05	5.27E−04	2.39E−03	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Arodor−1260	0.22	0.37	3.25E−07	1.39E−08	1.81E−06	2.33E−07					1.07E−07	1.80E−06	[B2]
Acenaphthylene	0.18	0.22	2.64E−07	1.13E−08	1.05E−06	1.36E−07	8.81E−06	3.52E−05					[D]
Anthracene	0.18	0.22	2.66E−07	1.14E−08	1.05E−06	1.36E−07	8.88E−07	3.52E−06	no observed effects	3000			[D]
Benzoic Acid	0.56	1.05	8.30E−07	3.56E−08	5.15E−06	6.62E−07	2.08E−07	1.29E−06	no observed effects	1			[D]
Benzo(a)anthracene	0.46	0.82	6.77E−07	2.90E−08	4.02E−06	5.17E−07	2.26E−05	1.34E−04			2.12E−08	3.78E−07	[B2]
Benzo(a)pyrene	0.50	0.94	7.36E−07	3.15E−08	4.61E−06	5.93E−07	2.45E−05	1.54E−04			2.30E−07	4.33E−06	[B2]
Benzo(b)fluoranthene	0.98	1.80	1.45E−06	6.21E−08	8.83E−06	1.14E−06	4.83E−05	2.94E−04			4.54E−08	8.29E−07	[B2]
Benzo(g,h,i)perylene	0.41	0.73	6.07E−07	2.60E−08	3.58E−06	4.60E−07	2.02E−05	1.19E−04					[D]
Benzo(k)fluoranthene	0.98	1.80	1.45E−06	6.21E−08	8.83E−06	1.14E−06	4.83E−05	2.94E−04			4.54E−08	8.29E−07	[B2]
Bis(2−ethylhexyl)phthalate	0.17	0.22	2.52E−07	1.08E−08	1.05E−06	1.36E−07	1.26E−05	5.27E−05	liver; weight inc.	1000	1.51E−10	1.90E−09	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	2.85E−07	1.22E−08	1.04E−06	1.34E−07	9.49E−06	3.47E−05	skin disorders		8.91E−08	9.76E−07	[B2]
Di−n−butyl phthalate	0.08	0.17	1.24E−07	5.32E−09	8.52E−07	1.09E−07	1.24E−06	8.52E−06	liver, kidney damage	1000			[D]
Chrysene	0.59	1.10	8.77E−07	3.76E−08	5.40E−06	6.94E−07	2.92E−05	1.80E−04			2.74E−09	5.06E−08	[B2]
Fluoranthene	1.07	2.10	1.58E−06	6.77E−08	1.03E−05	1.32E−06	3.95E−05	2.58E−04	nephropathy, blood effects	3000			[D]
Fluorene	0.17	0.22	2.51E−07	1.07E−08	1.05E−06	1.36E−07	6.27E−06	2.64E−05	skin disorders	3000			[D]
Indeno(1,2,3−cd)pyrene	0.36	0.64	5.30E−07	2.27E−08	3.14E−06	4.04E−07	1.77E−05	1.05E−04	skin disorders		1.66E−08	2.95E−07	[B2]
2−Methylnaphthalene	0.13	0.22	1.89E−07	8.08E−09	1.05E−06	1.36E−07	6.29E−06	3.52E−05	skin effects				
Phenanthrene	0.42	0.80	6.21E−07	2.66E−08	3.92E−06	5.05E−07	2.07E−05	1.31E−04	skin disorders				[D]
Pyrene	0.83	1.50	1.22E−06	5.23E−08	7.36E−06	9.46E−07	4.07E−05	2.45E−04	skin disorders	3000			[D]
RADIONUCLIDES (pCi/g)													
Americium 241	0.05	0.17		1.89E+00		6.98E+01					4.54E−10	1.67E−08	[A]
Cesium 137+D	0.72	0.99		2.90E+01		4.14E+02					8.13E−10	1.16E−08	[A]
Cobalt 60	0.00	0.01		1.17E−17		6.17E+00					1.76E−28	9.25E−11	[A]
Neptunium 237+D	0.02	0.06		8.78E−01		2.51E+01					1.93E−10	5.53E−09	[A]
Uranium 234	7.54	11.94		3.05E+02		5.00E+03					4.88E−09	8.00E−08	[A]
Uranium 235+D	0.29	0.39		1.18E+01		1.64E+02					1.89E−10	2.62E−09	[A]
Uranium 238+D	5.02	7.59		2.03E+02		3.18E+03					5.69E−09	8.90E−08	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.23E−01	1.88E+00					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.18E−06	1.76E−05	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											1.22E−08	2.06E−07	

Table L.45. Risk characterization for soils (Sturm Site): adults – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	14530.00	15620.00	2.21E-04	2.84E-05	2.31E-03	9.91E-04							
Arsenic	5.57	7.37	8.47E-08	1.09E-08	1.09E-06	4.67E-07	2.82E-04	3.64E-03	skin; keratosis, hyperpigmentation	3	1.91E-08	8.18E-07	[A]
Barium	104.30	119.50	1.59E-06	2.04E-07	1.77E-05	7.58E-06	2.27E-05	2.53E-04	oral-cardiovasc. sys.; inc. blood pressure	3			
Cadmium	4.27	7.01	6.49E-08	8.35E-09	1.04E-06	4.45E-07	1.30E-04	2.08E-03	kidney; proteinuria	10			
Chromium (III)	37.43	49.45	5.70E-07	7.32E-08	7.32E-06	3.14E-06	5.70E-07	7.32E-06	no observed effects	100			
Cobalt	13.15	16.10	2.00E-07	2.57E-08	2.38E-06	1.02E-06							
Copper	87.90	147.40	1.34E-06	1.72E-07	2.16E-05	9.35E-06	3.62E-05	5.90E-04	Gastrointestinal system; irritation				[D]
Cyanide	10.69	31.61	1.63E-07	2.09E-08	4.68E-06	2.01E-06	8.13E-06	2.34E-04	thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	58.83	72.20	8.95E-07	1.15E-07	1.07E-05	4.58E-06			CNS, blood				[B2]
Manganese	1054.00	1248.00	1.60E-05	2.06E-06	1.85E-04	7.92E-05	1.60E-04	1.85E-03	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	70.93	94.53	1.08E-06	1.39E-07	1.40E-05	6.00E-06	3.60E-03	4.67E-02	oral -CNS; neurotoxicity	1000			[D]
Nickel	35.98	50.54	5.48E-07	7.04E-08	7.46E-06	3.21E-06	2.74E-05	3.74E-04	dec. body and organ weight	300			
Silver	3.87	6.48	5.88E-08	7.57E-09	9.59E-07	4.11E-07	1.18E-05	1.92E-04	skin; argyria	3			[D]
Vanadium	27.73	31.00	4.22E-07	5.43E-08	4.59E-06	1.97E-06	6.03E-05	6.56E-04	no observed effects	100			
Zinc	106.90	145.90	1.63E-06	2.09E-07	2.16E-05	9.26E-06	5.42E-06	7.20E-05	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Aroclor-1260	0.22	0.37	3.35E-08	4.30E-09	5.46E-07	2.35E-07					3.31E-08	1.81E-06	[B2]
Acenaphthylene	0.18	0.22	2.72E-08	3.50E-09	3.16E-07	1.36E-07	9.06E-07	1.06E-05					[D]
Anthracene	0.18	0.22	2.74E-08	3.52E-09	3.16E-07	1.36E-07	9.13E-08	1.06E-06	no observed effects	3000			[D]
Benzoic Acid	0.56	1.05	8.54E-08	1.10E-08	1.55E-06	6.66E-07	2.14E-08	3.89E-07	no observed effects	1			[D]
Benzo(a)anthracene	0.46	0.82	6.96E-08	8.95E-09	1.21E-06	5.20E-07	2.32E-06	4.05E-05			6.53E-09	3.80E-07	[B2]
Benzo(a)pyrene	0.50	0.94	7.57E-08	9.73E-09	1.39E-06	5.97E-07	2.52E-06	4.64E-05			7.11E-08	4.35E-06	[B2]
Benzo(b)fluoranthene	0.98	1.80	1.49E-07	1.92E-08	2.67E-06	1.14E-06	4.97E-06	8.88E-05			1.40E-08	8.34E-07	[B2]
Benzo(g,h,i)perylene	0.41	0.73	6.24E-08	8.02E-09	1.08E-06	4.63E-07	2.08E-06	3.60E-05					[D]
Benzo(k)fluoranthene	0.98	1.80	1.49E-07	1.92E-08	2.67E-06	1.14E-06	4.97E-06	8.88E-05			1.40E-08	8.34E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.17	0.22	2.59E-08	3.33E-09	3.18E-07	1.36E-07	1.29E-06	1.59E-05	liver; weight inc.	1000	4.66E-11	1.91E-09	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	2.93E-08	3.77E-09	3.14E-07	1.35E-07	9.76E-07	1.05E-05	skin disorders	.	2.75E-08	9.82E-07	[B2]
Di-n-butyl phthalate	0.08	0.17	1.28E-08	1.64E-09	2.57E-07	1.10E-07	1.28E-07	2.57E-06	liver, kidney damage	1000			[D]
Chrysene	0.59	1.10	9.02E-08	1.16E-08	1.63E-06	6.98E-07	3.01E-06	5.43E-05			8.46E-10	5.10E-08	[B2]
Fluoranthene	1.07	2.10	1.62E-07	2.09E-08	3.11E-06	1.33E-06	4.06E-06	7.77E-05	nephropathy, blood effects	3000			[D]
Fluorene	0.17	0.22	2.58E-08	3.32E-09	3.18E-07	1.36E-07	6.45E-07	7.96E-06	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	0.36	0.64	5.45E-08	7.01E-09	9.48E-07	4.06E-07	1.82E-06	3.16E-05	skin disorders		5.12E-09	2.97E-07	[B2]
2-Methylnaphthalene	0.13	0.22	1.94E-08	2.49E-09	3.18E-07	1.36E-07	6.47E-07	1.06E-05	skin effects				
Phenanthrene	0.42	0.80	6.39E-08	8.22E-09	1.18E-06	5.08E-07	2.13E-06	3.95E-05	skin disorders				[D]
Pyrene	0.83	1.50	1.26E-07	1.61E-08	2.22E-06	9.52E-07	4.18E-06	7.40E-05	skin disorders	3000			[D]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)			4.38E-03	5.72E-02
Excess Lifetime Cancer Risk: Combined Exposure (d)			1.91E-07	1.04E-05

Table L.46. Risk characterization for soils (Sturm Site): children – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	14530.00	15620.00	2.88E-04	1.24E-05	3.03E-03	3.89E-04							
Arsenic	5.57	7.37	1.10E-07	4.73E-09	1.43E-06	1.83E-07	3.68E-04	4.76E-03	skin; keratosis, hyperpigmentation	3	8.28E-09	3.21E-07	[A]
Barium	104.30	119.50	2.07E-06	8.87E-08	2.31E-05	2.98E-06	2.96E-05	3.31E-04	oral-cardiovasc. sys.; inc. blood pressure	3			
Cadmium	4.27	7.01	8.46E-08	3.63E-09	1.36E-06	1.75E-07	1.69E-04	2.72E-03	kidney; proteinuria				
Chromium (III)	37.43	49.45	7.42E-07	3.18E-08	9.58E-06	1.23E-06	7.42E-07	9.58E-06	no observed effects	1000			
Cobalt	13.15	16.10	2.61E-07	1.12E-08	3.12E-06	4.01E-07							
Copper	87.90	147.40	1.74E-06	7.47E-08	2.85E-05	3.67E-06	4.71E-05	7.72E-04	Gastrointestinal system; irritation				[D]
Cyanide	10.69	31.61	2.12E-07	9.09E-09	6.12E-06	7.87E-07	1.06E-05	3.06E-04	thyroid, nerve; weight loss, myelin degen.	500			[D]
Lead	58.83	72.20	1.17E-06	5.00E-08	1.40E-05	1.80E-06			CNS, blood				[B2]
Manganese	1054.00	1248.00	2.09E-05	8.96E-07	2.42E-04	3.11E-05	2.09E-04	2.42E-03	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	70.93	94.53	1.41E-06	6.03E-08	1.83E-05	2.35E-06	4.69E-03	6.10E-02	oral -CNS; neurotoxicity	1000			[D]
Nickel	35.98	50.54	7.14E-07	3.06E-08	9.79E-06	1.26E-06	3.57E-05	4.89E-04	dec. body and organ weight	300			
Silver	3.87	6.48	7.67E-08	3.29E-09	1.25E-06	1.61E-07	1.53E-05	2.51E-04	skin; argyria	3			[D]
Vanadium	27.73	31.00	5.50E-07	2.36E-08	6.00E-06	7.72E-07	7.86E-05	8.58E-04	no observed effects	100			
Zinc	106.90	145.90	2.12E-06	9.09E-08	2.83E-05	3.63E-06	7.07E-06	9.42E-05	blood; anemia	10			[D]
ORGANICS (mg/kg)													
Aroclor-1260	0.22	0.37	4.36E-08	1.87E-09	7.17E-07	9.21E-08					1.44E-08	7.09E-07	[B2]
Acenaphthylene	0.18	0.22	3.54E-08	1.52E-09	4.16E-07	5.35E-08	1.18E-06	1.39E-05					[D]
Anthracene	0.18	0.22	3.57E-08	1.53E-09	4.16E-07	5.35E-08	1.19E-07	1.39E-06	no observed effects	300			[D]
Benzoic Acid	0.56	1.05	1.11E-07	4.77E-09	2.03E-06	2.61E-07	2.78E-08	5.08E-07	no observed effects	1			[D]
Benzo(a)anthracene	0.46	0.82	9.07E-08	3.89E-09	1.59E-06	2.04E-07	3.02E-06	5.29E-05			2.84E-09	1.49E-07	[B2]
Benzo(a)pyrene	0.50	0.94	9.87E-08	4.23E-09	1.82E-06	2.34E-07	3.29E-06	6.07E-05			3.09E-08	1.71E-06	[B2]
Benzo(b)fluoranthene	0.98	1.80	1.94E-07	8.33E-09	3.49E-06	4.48E-07	6.48E-06	1.16E-04			6.08E-09	3.27E-07	[B2]
Benzo(g,h,i)perylene	0.41	0.73	8.13E-08	3.49E-09	1.41E-06	1.82E-07	2.71E-06	4.71E-05					[D]
Benzo(k)fluoranthene	0.98	1.80	1.94E-07	8.33E-09	3.49E-06	4.48E-07	6.48E-06	1.16E-04			6.08E-09	3.27E-07	[B2]
Bis(2-ethylhexyl)phthalate	0.17	0.22	3.37E-08	1.45E-09	4.16E-07	5.35E-08	1.69E-06	2.08E-05	liver; weight inc.	1000	2.02E-11	7.50E-10	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	3.82E-08	1.64E-09	4.11E-07	5.28E-08	1.27E-06	1.37E-05	skin disorders		1.19E-08	3.85E-07	[B2]
Di-n-butyl phthalate	0.08	0.17	1.66E-08	7.13E-10	3.36E-07	4.32E-08	1.66E-07	3.36E-06	liver, kidney damage	100			[D]
Chrysene	0.59	1.10	1.18E-07	5.04E-09	2.13E-06	2.74E-07	3.92E-06	7.10E-05			3.68E-10	2.00E-08	[B2]
Fluoranthene	1.07	2.10	2.12E-07	9.07E-09	4.07E-06	5.23E-07	5.29E-06	1.02E-04	nephropathy, blood effects	300			[D]
Fluorene	0.17	0.22	3.36E-08	1.44E-09	4.16E-07	5.35E-08	8.40E-07	1.04E-05	skin disorders	300			[D]
Indeno(1,2,3-cd)pyrene	0.36	0.64	7.10E-08	3.04E-09	1.24E-06	1.59E-07	2.37E-06	4.13E-05	skin disorders		2.22E-09	1.16E-07	[B2]
2-Methylnaphthalene	0.13	0.22	2.53E-08	1.08E-09	4.16E-07	5.35E-08	8.43E-07	1.39E-05	skin effects	300			
Phenanthrene	0.42	0.80	8.33E-08	3.57E-09	1.55E-06	1.99E-07	2.78E-06	5.16E-05	skin disorders	300			[D]
Pyrene	0.83	1.50	1.64E-07	7.01E-09	2.91E-06	3.74E-07	5.45E-06	9.68E-05	skin disorders	300			[D]

Chemical Hazards:		
Hazard Index (HI): Combined Exposure (d)	5.71E-03	7.49E-02
Excess Lifetime Cancer Risk: Combined Exposure (d)	8.31E-08	4.07E-06

Table L.47. Risk characterization for surface water: adults – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Nonbarcinogenic Effect of Concern	EPA Uf	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	7.79E−05	1.00E−05	7.42E−04	3.18E−04							
Barium	7.92E+01	1.05E+02	1.08E−06	1.39E−07	8.55E−06	3.66E−06	1.55E−05	1.22E−04	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	1.07E−07	1.37E−08	1.07E−06	4.61E−07	1.07E−07	1.07E−06	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	7.50E−08	9.64E−09	7.00E−07	3.00E−07							
Copper	1.85E+01	2.19E+01	2.53E−07	3.26E−08	1.78E−06	7.64E−07	6.85E−06	4.82E−05	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E−06	4.73E−07	3.36E−05	1.44E−05	3.68E−05	3.36E−04	lung, CNS; respiratory, psychomotor distu:	1			[D]
Mercury	2.68E+00	3.93E+00	3.66E−08	4.71E−09	3.20E−07	1.37E−07	1.22E−04	1.07E−03	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	1.15E−07	1.48E−08	1.15E−06	4.92E−07	1.64E−05	1.64E−04	no observed effects	100			
Zinc	6.87E+01	9.09E+01	9.41E−07	1.21E−07	7.40E−06	3.17E−06	3.14E−06	2.47E−05	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	8.51E−08	1.09E−08	6.27E−07	2.69E−07	8.51E−07	6.27E−06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E−02	2.50E−02	3.18E−10	4.09E−11	2.04E−09	8.72E−10	1.06E−05	6.78E−05	liver; lesions, toxicity	1000	6.96E−10	1.48E−08	[B2]
4,4'−DDD	4.22E−02	5.00E−02	5.78E−10	7.43E−11	4.07E−09	1.74E−09					1.78E−11	4.19E−10	[B2]
4,4'−DDT	4.02E−02	4.94E−02	5.51E−10	7.08E−11	4.02E−09	1.72E−09	1.10E−06	8.04E−06	liver; lesions	100	2.41E−11	5.86E−10	[B2]
Bis(2−ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E−07	1.67E−08	1.13E−06	4.83E−07			liver; weight inc.	1000			[B2]
Chloroform	4.07E+00	4.69E+00	5.58E−08	7.17E−09	3.81E−07	1.63E−07	5.58E−06	3.81E−05	liver; lesions, fatty cyst formation	1000	4.37E−11	9.97E−10	[B2]
Dieldrin	3.87E−02	5.00E−02	5.31E−10	6.82E−11	4.07E−09	1.74E−09	1.06E−05	8.14E−05	liver lesions	100	1.09E−09	2.79E−08	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	5.77E−08	7.42E−09	4.04E−07	1.73E−07	7.22E−08	5.05E−07	lung irritation	1000			[D]
Endosulfan	2.31E−02	2.50E−02	3.16E−10	4.06E−11	2.04E−09	8.72E−10	6.32E−06	4.07E−05	kidney lesions	3000			
Endosulfan Sulfate	3.48E−02	4.46E−02	4.77E−10	6.13E−11	3.63E−09	1.56E−09							
Endrin	3.87E−02	5.00E−02	5.30E−10	6.81E−11	4.07E−09	1.74E−09	1.77E−06	1.36E−05	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	5.48E−08	7.05E−09	4.07E−07	1.74E−07	1.37E−06	1.02E−05	nephropathy, blood effects	3000			[D]
gamma−BHC	1.82E−02	2.34E−02	2.49E−10	3.20E−11	1.91E−09	8.17E−10	8.30E−07	6.36E−06	liver, kidney effects		4.16E−11	1.06E−09	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	2.96E−10	3.80E−11	2.04E−09	8.72E−10	2.28E−05	1.57E−04	liver damage		3.46E−10	7.94E−09	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E−08	7.36E−09	3.94E−07	1.69E−07	5.72E−06	3.94E−05	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	4.32E+00	4.85E+00	5.92E−08	7.61E−09	3.95E−07	1.69E−07	6.58E−07	4.39E−06	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	5.48E−08	7.05E−09	3.81E−07	1.63E−07			Liver, Kidney, CNS effects				
RADIONUCLIDES (pCi/L)													
Americium 241	−8.08E+00	5.12E+00		−2.55E+01		3.19E+02					−6.11E−09	7.66E−08	[A]
Cesium 137+D	3.52E+00	1.12E+01		1.11E+01		7.00E+02					3.11E−10	1.96E−08	[A]
Cobalt 60	−1.33E−01	5.62E+00		−4.20E−01		3.51E+02					−6.30E−12	5.26E−09	[A]
Neptunium 237+D	9.37E+00	2.86E+01		2.95E+01		1.79E+03					6.49E−09	3.93E−07	[A]
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02					1.85E−10	4.29E−09	[A]
Uranium 235+D	2.16E−01	2.95E−01		6.80E−01		1.84E+01					1.09E−11	2.94E−10	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02					3.64E−10	9.28E−09	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)			2.69E−04	2.24E−03
Excess Lifetime Cancer Risk: Combined Exposure (d)			2.26E−09	5.37E−08
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)			1.25E−09	5.08E−07

Table L.48. Risk characterization for surface water: children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	BPA WOE
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	2.18E−04	9.35E−06	2.00E−03	2.57E−04							
Barium	7.92E+01	1.05E+02	3.04E−06	1.30E−07	2.30E−05	2.96E−06	4.34E−05	3.29E−04	oral–cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	2.99E−07	1.28E−08	2.89E−06	3.72E−07	2.99E−07	2.89E−06	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	2.10E−07	9.00E−09	1.88E−06	2.42E−07							
Copper	1.85E+01	2.19E+01	7.10E−07	3.04E−08	4.80E−06	6.17E−07	1.92E−05	1.30E−04	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E−05	4.42E−07	9.05E−05	1.16E−05	1.03E−04	9.05E−04	lung, CNS; respiratory, psychomotor distu.	1			[D]
Mercury	2.68E+00	3.93E+00	1.03E−07	4.40E−09	8.62E−07	1.11E−07	3.42E−04	2.87E−03	oral –CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	3.22E−07	1.38E−08	3.09E−06	3.97E−07	4.60E−05	4.41E−04	no observed effects	100			
Zinc	6.87E+01	9.09E+01	2.64E−06	1.13E−07	1.99E−05	2.56E−06	8.79E−06	6.64E−05	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	2.38E−07	1.02E−08	1.69E−06	2.17E−07	2.38E−06	1.69E−05	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E−02	2.50E−02	8.91E−10	3.82E−11	5.48E−09	7.05E−10	2.97E−05	1.83E−04	liver; lesions, toxicity	1000	6.49E−10	1.20E−08	[B2]
4,4'−DDD	4.22E−02	5.00E−02	1.62E−09	6.93E−11	1.10E−08	1.41E−09					1.66E−11	3.38E−10	[B2]
4,4'−DDT	4.02E−02	4.94E−02	1.54E−09	6.61E−11	1.08E−08	1.39E−09	3.08E−06	2.17E−05	liver; lesions	100	2.25E−11	4.73E−10	[B2]
Bis(2−ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E−07	1.56E−08	3.04E−06	3.90E−07	1.82E−05	1.52E−04	liver; weight inc.	1000	2.19E−10	5.46E−09	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E−07	6.69E−09	1.03E−06	1.32E−07	1.56E−05	1.03E−04	liver; lesions, fatty cyst formation	1000	4.08E−11	8.06E−10	[B2]
Dieldrin	3.87E−02	5.00E−02	1.49E−09	6.37E−11	1.10E−08	1.41E−09	2.97E−05	2.19E−04	liver lesions	100	1.02E−09	2.25E−08	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.62E−07	6.93E−09	1.09E−06	1.40E−07	2.02E−07	1.36E−06	lung irritation	1000			[D]
Endosulfan	2.31E−02	2.50E−02	8.85E−10	3.79E−11	5.48E−09	7.05E−10	1.77E−05	1.10E−04	kidney lesions	3000			
Endosulfan Sulfate	3.48E−02	4.46E−02	1.33E−09	5.72E−11	9.78E−09	1.26E−09							
Endrin	3.87E−02	5.00E−02	1.48E−09	6.36E−11	1.10E−08	1.41E−09	4.95E−06	3.65E−05	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	1.53E−07	6.58E−09	1.10E−06	1.41E−07	3.84E−06	2.74E−05	nephropathy, blood effects	3000			[D]
gamma−BHC	1.82E−02	2.34E−02	6.97E−10	2.99E−11	5.14E−09	6.60E−10	2.32E−06	1.71E−05	liver, kidney effects		3.89E−11	8.58E−10	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	8.28E−10	3.55E−11	5.48E−09	7.05E−10	6.37E−05	4.21E−04	liver damage		3.23E−10	6.41E−09	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E−07	6.87E−09	1.06E−06	1.36E−07	1.60E−05	1.06E−04	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	4.32E+00	4.85E+00	1.66E−07	7.10E−09	1.06E−06	1.37E−07	1.84E−06	1.18E−05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	1.53E−07	6.58E−09	1.03E−06	1.32E−07			Liver, Kidney, CNS effects				
RADIONUCLIDES (pCi/L)													
Americium 241	−8.08E+00	5.12E+00		−8.49E+00		9.58E+01					−2.04E−09	2.30E−08	[A]
Cesium 137+D	3.52E+00	1.12E+01		3.70E+00		2.10E+02					1.04E−10	5.88E−09	[A]
Cobalt 60	−1.33E−01	5.62E+00		−1.40E−01		1.05E+02					−2.10E−12	1.58E−09	[A]
Neptunium 237+D	9.37E+00	2.86E+01		9.83E+00		5.36E+02					2.16E−09	1.18E−07	[A]
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01					6.18E−11	1.29E−09	[A]
Uranium 235+D	2.16E−01	2.95E−01		2.27E−01		5.51E+00					3.63E−12	8.82E−11	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01					1.21E−10	2.78E−09	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)		7.72E−04	6.17E−03	
Excess Lifetime Cancer Risk: Combined Exposure (d)				2.33E−09 / 4.89E−08
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)				4.15E−10 / 1.53E−07

Table L.49. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – residential)

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA Uf	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	6.03E-06	7.76E-07	1.01E-04	4.34E-05							
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	oral-cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	5.81E-09	7.47E-10	9.56E-08	4.10E-08							
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	2.85E-06	4.59E-05	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	oral -CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	no observed effects	100			
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.21E-06	9.26E-05	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	[B2]
4,4'-DDD	4.22E-02	5.00E-02	7.83E-08	1.01E-08	9.73E-07	4.17E-07					2.42E-09	1.00E-07	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	liver; lesions	100	5.01E-09	2.15E-07	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	liver; weight inc.	1000	3.74E-09	1.90E-07	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	[B2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	liver lesions	100	8.45E-09	3.81E-07	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.34E-07	1.72E-08	1.65E-06	7.09E-07	1.68E-07	2.07E-06	lung irritation	1000			[D]
Endosulfan	2.31E-02	2.50E-02	4.84E-09	6.22E-10	5.49E-08	2.35E-08	9.67E-05	1.10E-03	kidney lesions	3000			
Endosulfan Sulfate	3.48E-02	4.46E-02	7.29E-09	9.37E-10	9.79E-08	4.20E-08							
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	9.55E-06	1.23E-06	1.25E-04	5.36E-05	2.39E-04	3.13E-03	nephropathy, blood effects	3000			[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	liver, kidney effects				[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	liver damage				[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	liver, kidney, CNS effects	1000			
1,1,1-Trichloroethane	4.32E+00	4.85E+00	4.87E-07	6.26E-08	5.73E-06	2.46E-06	5.41E-06	6.37E-05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	4.24E-07	5.46E-08	5.20E-06	2.23E-06			Liver, Kidney, CNS effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.30E-03	1.67E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											2.03E-08	9.14E-07	

Table L.50. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – residential)

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	BPA WOE
INORGANICS (µg/L)													
Aluminum	5.69E+03	9.12E+03	6.03E-06	7.76E-07	1.01E-04	4.34E-05							
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	oral-cardiovasc. sys.; inc. blood pressure	3			
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	no observed effects	100			
Cobalt	5.48E+00	8.60E+00	7.57E-09	3.24E-10	1.25E-07	1.61E-08							
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	Gastrointestinal system; irritation				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	3.72E-06	6.00E-05	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	oral -CNS; neurotoxicity	1000			[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	no observed effects	100			
Zinc	6.87E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Aldrin	2.32E-02	2.50E-02	3.21E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	[B2]
4,4'-DDD	4.22E-02	5.00E-02	1.02E-07	4.37E-09	1.27E-06	1.64E-07					1.05E-09	3.92E-08	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	liver; lesions	100	2.18E-09	8.44E-08	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	liver; weight inc.	1000	1.63E-09	7.47E-08	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	liver; lesions, fatty cyst formation	1000	8.19E-11	2.97E-09	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	liver lesions	100	3.67E-09	1.50E-07	[B2]
Diethyl phthalate	4.21E+00	4.96E+00	1.75E-07	7.49E-09	2.16E-06	2.78E-07	2.18E-07	2.70E-06	lung irritation	1000			[D]
Endosulfan	2.31E-02	2.50E-02	6.30E-09	2.70E-10	7.18E-08	9.23E-09	1.26E-04	1.44E-03	kidney lesions	3000			
Endosulfan Sulfate	3.48E-02	4.46E-02	9.50E-09	4.07E-10	1.28E-07	1.65E-08							
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	reprod., terato., CNS effects	100			[D]
Fluoranthene	4.00E+00	5.00E+00	1.24E-05	5.33E-07	1.64E-04	2.10E-05	3.11E-04	4.09E-03	nephropathy, blood effects	3000			[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	liver, kidney effects				[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	liver damage				[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	liver, kidney, CNS effects	1000			
1,1,1-Trichloroethane	4.32E+00	4.85E+00	6.35E-07	2.72E-08	7.49E-06	9.63E-07	7.05E-06	8.32E-05	CNS depressant, lung, kidney toxicity	1000			[D]
Trichloroethylene	4.00E+00	4.68E+00	5.53E-07	2.37E-08	6.81E-06	8.75E-07			Liver, Kidney, CNS effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.70E-03	2.18E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											8.84E-09	3.59E-07	

Table L.51. Risk characterization for sediments: adults – dermal exposure (current land use – residential)

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	RfD UF	Excess Lifetime Cancer Risk (CDI×CSF) (MLB)	Excess Lifetime Cancer Risk (CDI×CSF) (RMB)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	10300.00	14320.00	1.69E−06	2.18E−07	8.82E−05	3.78E−05							
Arsenic	7.93	10.93	1.30E−09	1.68E−10	6.73E−08	2.88E−08	4.35E−06	2.24E−04	skin; keratosis, hyperpigmentation	3	2.93E−10	5.05E−08	[A]
Barium	163.40	301.10	2.69E−08	3.45E−09	1.85E−06	7.95E−07	3.84E−07	2.65E−05	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	0.68	0.81	1.12E−10	1.44E−11	4.99E−09	2.14E−09	2.24E−08	9.97E−07	no observed effects	100	6.19E−11	9.19E−09	[B2]
Cadmium	7.36	16.39	1.21E−09	1.56E−10	1.01E−07	4.33E−08	2.42E−06	2.02E−04	kidney; proteinuria	10			
Chromium (III)	73.02	89.96	1.20E−08	1.54E−09	5.54E−07	2.37E−07	1.20E−08	5.54E−07	no observed effects	100			
Cobalt	18.07	22.09	2.97E−09	3.82E−10	1.36E−07	5.83E−08							
Copper	71.08	129.20	1.17E−08	1.50E−09	7.96E−07	3.41E−07	3.16E−07	2.15E−05	Gastrointestinal system; irritation				[D]
Lead	42.04	62.91	6.91E−09	8.89E−10	3.87E−07	1.66E−07			CNS, blood				[B2]
Manganese	1198.00	1615.00	1.97E−07	2.53E−08	9.94E−06	4.26E−06	1.97E−06	9.94E−05	lung, CNS; respiratory, psychomotor distu:	1			[D]
Mercury	271.90	729.50	4.47E−08	5.75E−09	4.49E−06	1.93E−06	1.49E−04	1.50E−02	oral –CNS; neurotoxicity	1000			[D]
Nickel	66.30	116.70	1.09E−08	1.40E−09	7.19E−07	3.08E−07	5.45E−07	3.59E−05	dec. body and organ weight	300			
Silver	3.37	8.63	5.53E−10	7.11E−11	5.31E−08	2.28E−08	1.11E−07	1.06E−05	skin; argyria	3			[D]
Vanadium	37.26	47.60	6.12E−09	7.87E−10	2.93E−07	1.26E−07	8.75E−07	4.19E−05	no observed effects	100			
Zinc	170.20	236.60	2.80E−08	3.60E−09	1.46E−06	6.24E−07	9.33E−08	4.86E−06	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Acenaphthene	0.24	0.31	3.92E−10	5.04E−11	1.92E−08	8.22E−09	6.54E−09	3.20E−07	liver; hepatotoxicity	3000			
Acenaphthylene	0.21	0.24	3.52E−10	4.53E−11	1.45E−08	6.20E−09	1.17E−08	4.83E−07					[D]
Anthracene	0.27	0.46	4.38E−10	5.63E−11	2.85E−08	1.22E−08	1.46E−09	9.51E−08	no observed effects	3000			[D]
Aroclor−1248	0.41	0.91	6.74E−10	8.67E−11	5.59E−08	2.40E−08					6.67E−10	1.85E−07	[B2]
Aroclor−1260	0.62	1.25	1.02E−09	1.31E−10	7.72E−08	3.31E−08					1.01E−09	2.55E−07	[B2]
Benzo(a)anthracene	0.81	1.83	1.33E−09	1.71E−10	1.13E−07	4.83E−08	4.43E−08	3.75E−06			1.25E−10	3.52E−08	[B2]
Benzo(a)pyrene	0.74	1.64	1.21E−09	1.56E−10	1.01E−07	4.33E−08	4.04E−08	3.37E−06			1.14E−09	3.16E−07	[B2]
Benzo(b)fluoranthene	0.90	2.20	1.49E−09	1.91E−10	1.35E−07	5.81E−08	4.95E−08	4.52E−06			1.39E−10	4.24E−08	[B2]
Benzo(g,h,i)perylene	0.43	0.94	7.13E−10	9.17E−11	5.80E−08	2.49E−08	2.38E−08	1.93E−06					[D]
Benzo(k)fluoranthene	0.48	0.95	7.96E−10	1.02E−10	5.87E−08	2.52E−08	2.65E−08	1.96E−06			7.47E−11	1.84E−08	[B2]
Benzoic Acid	0.92	1.56	1.52E−09	1.95E−10	9.59E−08	4.11E−08	3.79E−10	2.40E−08	no observed effects	1			[D]
alpha−BHC	0.01	0.03	2.22E−11	2.86E−12	1.59E−09	6.82E−10					1.80E−11	4.30E−09	[B2]
gamma−BHC	0.02	0.03	2.49E−11	3.20E−12	1.66E−09	7.10E−10	8.28E−08	5.52E−06	liver, kidney effects		4.15E−12	9.23E−10	[C]
Butylbenzylphthalate	0.27	0.34	4.51E−10	5.80E−11	2.12E−08	9.08E−09							
Di−n−butyl phthalate	0.21	0.32	3.52E−10	4.53E−11	1.98E−08	8.49E−09	3.52E−09	1.98E−07	liver, kidney damage	1000			[D]
alpha−Chlordane	0.14	0.26	2.30E−10	2.96E−11	1.61E−08	6.88E−09							
Chrysene	0.77	1.74	1.27E−09	1.63E−10	1.07E−07	4.58E−08	4.23E−08	3.57E−06			1.19E−11	3.35E−09	[B2]
4,4'−DDD	0.03	0.05	4.48E−11	5.76E−12	3.18E−09	1.36E−09					1.38E−12	3.27E−10	[B2]
4,4'−DDE	0.03	0.06	5.37E−11	6.91E−12	3.47E−09	1.49E−09					2.35E−12	5.06E−10	[B2]
Dibenzo(a,h)anthracene	0.29	0.39	4.78E−10	6.14E−11	2.42E−08	1.04E−08	1.59E−08	8.06E−07	skin disorders		4.49E−10	7.57E−08	[B2]
Bis(2−ethylhexyl)phthalate	0.58	1.06	9.45E−10	1.22E−10	6.55E−08	2.81E−08	4.73E−08	3.28E−06	liver; weight inc.	1000	1.70E−12	3.93E−10	[B2]
Fluoranthene	1.84	3.84	3.03E−09	3.89E−10	2.36E−07	1.01E−07	7.57E−08	5.90E−06	nephropathy, blood effects	3000			[D]
Fluorene	0.23	0.28	3.75E−10	4.82E−11	1.71E−08	7.33E−09	9.37E−09	4.27E−07	skin disorders	3000			[D]
Indeno(1,2,3−cd)pyrene	0.44	1.02	7.31E−10	9.40E−11	6.25E−08	2.68E−08	2.44E−08	2.08E−06	skin disorders		6.86E−11	1.96E−08	[B2]
p,p'−Methoxychlor	0.14	0.26	2.23E−10	2.86E−11	1.59E−08	6.82E−09							
2−Methylnaphthalene	0.21	0.31	3.49E−10	4.49E−11	1.89E−08	8.09E−09	1.16E−08	6.29E−07	skin effects				
Naphthalene	0.21	0.30	3.38E−10	4.35E−11	1.87E−08	8.02E−09	8.45E−09	4.68E−07	eye, blood effects	1000			[D]
Di−n−octyl phthalate	0.28	0.35	4.56E−10	5.86E−11	2.13E−08	9.13E−09	2.28E−08	1.06E−06	skin disorders	1000			
Phenanthrene	0.65	1.13	1.06E−09	1.36E−10	6.95E−08	2.98E−08	3.53E−08	2.32E−06	skin disorders				[D]
Pyrene	1.49	3.95	2.44E−09	3.14E−10	2.43E−07	1.04E−07	8.15E−08	8.12E−06	skin disorders	3000			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.61E−04	1.57E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											4.06E−09	1.02E−06	

Table L.52. Risk characterization for sediments: children – dermal exposure (current land use – residential)

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfD Uf	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (mg/kg)													
Aluminum	10300.00	14320.00	2.21E-06	9.46E-08	1.15E-04	1.48E-05							
Arsenic	7.93	10.93	1.70E-09	7.28E-11	8.80E-08	1.13E-08	5.67E-06	2.93E-04	skin; keratosis, hyperpigmentation	3	1.27E-10	1.98E-08	[A]
Barium	163.40	301.10	3.50E-08	1.50E-09	2.42E-06	3.12E-07	5.00E-07	3.46E-05	oral-cardiovasc. sys.; inc. blood pressure	3			
Beryllium	0.68	0.81	1.46E-10	6.25E-12	6.52E-09	8.39E-10	2.92E-08	1.30E-06	no observed effects	100	2.69E-11	3.61E-09	[B2]
Cadmium	7.36	16.39	1.58E-09	6.76E-11	1.32E-07	1.70E-08	3.15E-06	2.64E-04	kidney; proteinuria	10			
Chromium (III)	73.02	89.96	1.56E-08	6.71E-10	7.24E-07	9.31E-08	1.56E-08	7.24E-07	no observed effects	100			
Cobalt	18.07	22.09	3.87E-09	1.66E-10	1.78E-07	2.29E-08							
Copper	71.08	129.20	1.52E-08	6.53E-10	1.04E-06	1.34E-07	4.12E-07	2.81E-05	Gastrointestinal system; irritation				[D]
Lead	42.04	62.91	9.01E-09	3.86E-10	5.07E-07	6.51E-08			CNS, blood				[B2]
Manganese	1198.00	1615.00	2.57E-07	1.10E-08	1.30E-05	1.67E-06	2.57E-06	1.30E-04	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	271.90	729.50	5.83E-08	2.50E-09	5.87E-06	7.55E-07	1.94E-04	1.96E-02	oral -CNS; neurotoxicity	1000			[D]
Nickel	66.30	116.70	1.42E-08	6.09E-10	9.40E-07	1.21E-07	7.10E-07	4.70E-05	dec. body and organ weight	300			
Silver	3.37	8.63	7.21E-10	3.09E-11	6.95E-08	8.93E-09	1.44E-07	1.39E-05	skin; argyria	3			[D]
Vanadium	37.26	47.60	7.98E-09	3.42E-10	3.83E-07	4.93E-08	1.14E-06	5.48E-05	no observed effects	100			
Zinc	170.20	236.60	3.65E-08	1.56E-09	1.91E-06	2.45E-07	1.22E-07	6.35E-06	blood; anemia	3			[D]
ORGANICS (mg/kg)													
Acenaphthene	0.24	0.31	5.11E-10	2.19E-11	2.51E-08	3.23E-09	8.52E-09	4.18E-07	liver; hepatotoxicity	3000			
Acenaphthylene	0.21	0.24	4.59E-10	1.97E-11	1.89E-08	2.43E-09	1.53E-08	6.31E-07					[D]
Anthracene	0.27	0.46	5.71E-10	2.45E-11	3.73E-08	4.80E-09	1.90E-09	1.24E-07	no observed effects	3000			[D]
Aroclor-1248	0.41	0.91	8.78E-10	3.76E-11	7.32E-08	9.41E-09					2.90E-10	7.24E-08	[B2]
Aroclor-1260	0.62	1.25	1.33E-09	5.69E-11	1.01E-07	1.30E-08					4.38E-10	1.00E-07	[B2]
Benzo(a)anthracene	0.81	1.83	1.73E-09	7.42E-11	1.47E-07	1.89E-08	5.77E-08	4.91E-06			5.42E-11	1.38E-08	[B2]
Benzo(a)pyrene	0.74	1.64	1.56E-09	6.76E-11	1.32E-07	1.70E-08	5.26E-08	4.41E-06			4.94E-10	1.24E-07	[B2]
Benzo(b)fluoranthene	0.90	2.20	1.94E-09	8.30E-11	1.77E-07	2.28E-08	6.46E-08	5.91E-06			6.06E-11	1.66E-08	[B2]
Benzo(g,h,i)perylene	0.43	0.94	9.29E-10	3.98E-11	7.59E-08	9.76E-09	3.10E-08	2.53E-06					[D]
Benzo(k)fluoranthene	0.48	0.95	1.04E-09	4.44E-11	7.68E-08	9.88E-09	3.46E-08	2.56E-06			3.24E-11	7.21E-09	[B2]
Benzoic Acid	0.92	1.56	1.97E-09	8.46E-11	1.25E-07	1.61E-08	4.94E-10	3.14E-08	no observed effects	1			[D]
alpha-BHC	0.01	0.03	2.90E-11	1.24E-12	2.08E-09	2.68E-10					7.83E-12	1.69E-09	[B2]
gamma-BHC	0.02	0.03	3.24E-11	1.39E-12	2.17E-09	2.79E-10	1.08E-07	7,22E-06	liver, kidney effects		1.80E-12	3.62E-10	[C]
Butylbenzylphthalate	0.27	0.34	5.88E-10	2.52E-11	2.77E-08	3.56E-09							
Di-n-butyl phthalate	0.21	0.32	4.59E-10	1.97E-11	2.59E-08	3.33E-09	4.59E-09	2.59E-07	liver, kidney damage	1000			[D]
alpha-Chlordane	0.14	0.26	3.00E-10	1.29E-11	2.10E-08	2.70E-09							
Chrysene	0.77	1.74	1.66E-09	7.09E-11	1.40E-07	1.80E-08	5.52E-08	4.66E-06			5.18E-12	1.31E-09	[B2]
4,4'-DDD	0.03	0.05	5.83E-11	2.50E-12	4.16E-09	5.35E-10					6.00E-13	1.28E-10	[B2]
4,4'-DDE	0.03	0.06	7.00E-11	3.00E-12	4.54E-09	5.84E-10					1.02E-12	1.99E-10	[B2]
Dibenzo(a,h)anthracene	0.29	0.39	6.23E-10	2.67E-11	3.16E-08	4.07E-09	2.08E-08	1.05E-06	skin disorders		1.95E-10	2.97E-08	[B2]
Bis(2-ethylhexyl)phthalate	0.58	1.06	1.23E-09	5.28E-11	8.57E-08	1.10E-08	6.16E-08	4.28E-06	liver; weight inc.	1000	7.39E-13	1.54E-10	[B2]
Fluoranthene	1.84	3.84	3.94E-09	1.69E-10	3.09E-07	3.97E-08	9.86E-08	7.72E-06	nephropathy, blood effects	3000			[D]
Fluorene	0.23	0.28	4.88E-10	2.09E-11	2.24E-08	2.87E-09	1.22E-08	5.59E-07	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	0.44	1.02	9.53E-10	4.08E-11	8.17E-08	1.05E-08	3.18E-08	2.72E-06	skin disorders		2.98E-11	7.67E-09	[B2]
p,p'-Methoxychlor	0.14	0.26	2.90E-10	1.24E-11	2.08E-08	2.68E-09							
2-Methylnaphthalene	0.21	0.31	4.56E-10	1.95E-11	2.47E-08	3.17E-09	1.52E-08	8.23E-07	skin effects				
Naphthalene	0.21	0.30	4.41E-10	1.89E-11	2.45E-08	3.15E-09	1.10E-08	6.12E-07	eye, blood effects	1000			[D]
Di-n-octyl phthalate	0.28	0.35	5.94E-10	2.54E-11	2.78E-08	3.58E-09	2.97E-08	1.39E-06	skin disorders	1000			
Phenanthrene	0.65	1.13	1.38E-09	5.92E-11	9.08E-08	1.17E-08	4.61E-08	3.03E-06	skin disorders				[D]
Pyrene	1.49	3.95	3.19E-09	1.37E-10	3.18E-07	4.09E-08	1.06E-07	1.06E-05	skin disorders	3000			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.10E-04	2.05E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.76E-09	3.99E-07	

Table L.53. Risk characterization for groundwater: adults – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (µg/L)													
Aluminum	2.00E+04	2.50E+04	3.83E-01	4.92E-02	6.84E-01	2.93E-01							
Antimony	1.53E+01	1.62E+01	2.93E-04	3.77E-05	4.45E-04	1.91E-04	7.32E-01	1.11E+00	whole body, blood; inc. mortality	1000			
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	skin; keratosis, hyperpigmentation	3	1.71E-05	1.15E-04	[A]
Barium	3.95E+02	4.85E+02	7.58E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.88E+00	2.56E+00	3.61E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	no observed effects	100	2.00E-05	1.29E-04	[B2]
Cadmium	3.51E+00	5.15E+00	6.74E-05	8.66E-06	1.41E-04	6.05E-05	1.35E-01	2.82E-01	kidney; proteinuria	10			
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.81E-04	6.33E-04	1.12E-03	no observed effects	100			
Cobalt	1.73E+01	2.18E+01	3.32E-04	4.27E-05	5.98E-04	2.56E-04							
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.80E-03	8.66E-03	2.40E-01	Gastrointestinal system; irritation				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04			CNS, blood				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	7.17E-01	1.21E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	1.39E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	oral –CNS; neurotoxicity	1000			[D]
Nickel	4.80E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	dec. body and organ weight	300			
Thallium	1.21E+00	1.26E+00	2.32E-05	2.99E-06	3.45E-05	1.48E-05	3.32E-01	4.93E-01	liver, blood; inc. sgot and serum LDH	3000			[D]
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	no observed effects	100			
Zinc	1.04E+01	1.29E+02	1.98E-04	2.55E-05	3.53E-03	1.51E-03	6.62E-04	1.18E-02	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Benzo(a)anthracene	5.02E+00	5.11E+00	9.63E-05	1.24E-05	1.40E-04	6.00E-05	3.21E-03	4.67E-03			9.04E-06	4.38E-05	[B2]
Benzo(a)pyrene	5.01E+00	5.11E+00	9.60E-05	1.23E-05	1.40E-04	6.00E-05	3.20E-03	4.66E-03			9.01E-05	4.38E-04	[B2]
Benzo(b)fluoranthene	5.02E+00	5.11E+00	9.63E-05	1.24E-05	1.40E-04	6.00E-05	3.21E-03	4.67E-03			9.04E-06	4.38E-05	[B2]
Benzo(k)fluoranthene	5.01E+00	5.11E+00	9.60E-05	1.23E-05	1.40E-04	6.00E-05	3.20E-03	4.66E-03			9.01E-06	4.38E-05	[B2]
Benzoic Acid	2.43E+01	2.50E+01	4.66E-04	5.99E-05	6.85E-04	2.94E-04	1.16E-04	1.71E-04	no observed effects	1			[D]
Bis(2-ethylhexyl)phthalate	4.84E+00	5.54E+00	9.29E-05	1.19E-05	1.52E-04	6.51E-05	4.64E-03	7.59E-03	liver; weight inc.	1000	1.67E-07	9.11E-07	[B2]
2-Butanone	8.55E+00	1.37E+01	1.64E-04	2.11E-05	3.75E-04	1.61E-04	3.28E-03	7.49E-03	oral–no observed effects	1000			[D]
Di-n-butyl phthalate	4.80E+00	4.96E+00	9.20E-05	1.18E-05	1.36E-04	5.83E-05	9.20E-04	1.36E-03	liver, kidney damage	1000			[D]
Carbon Disulfide	5.76E+00	8.36E+00	1.11E-04	1.42E-05	2.29E-04	9.81E-05	1.11E-03	2.29E-03	fetus; toxicity	100			
Chloroform	5.76E+00	8.34E+00	1.10E-04	1.42E-05	2.29E-04	9.79E-05	1.10E-02	2.29E-02	liver; lesions, fatty cyst formation	1000	8.66E-08	5.97E-07	[B2]
4,4'-DDT	5.15E-02	5.27E-02	9.87E-07	1.27E-07	1.44E-06	6.19E-07	1.97E-03	2.89E-03	liver; lesions	100	4.31E-08	2.10E-07	[B2]
Endrin	5.14E-02	5.27E-02	9.87E-07	1.27E-07	1.44E-06	6.19E-07	3.29E-03	4.81E-03	reprod., terato., CNS effects	100			[D]
Heptachlor Epoxide	2.57E-02	2.63E-02	4.93E-07	6.34E-08	7.21E-07	3.09E-07	3.79E-02	5.55E-02	liver damage		5.77E-07	2.81E-06	[B2]
alpha-Chlordane	1.37E-01	1.58E-01	2.63E-06	3.38E-07	4.33E-06	1.86E-06							
Chrysene	5.02E+00	5.11E+00	9.63E-05	1.24E-05	1.40E-04	6.00E-05	3.21E-03	4.67E-03			9.04E-07	4.38E-06	[B2]
Diethyl phthalate	4.56E+00	4.80E+00	8.74E-05	1.12E-05	1.31E-04	5.63E-05	1.09E-04	1.64E-04	lung irritation	1000			[D]
Fluoranthene	5.03E+00	5.11E+00	9.65E-05	1.24E-05	1.40E-04	6.00E-05	2.41E-03	3.50E-03	nephropathy, blood effects	3000			[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.69E-03	1.58E-03	2.23E-02	6.15E-02	liver, kidney damage, CNS effects	100	1.29E-06	1.19E-05	[B2]
Pyrene	5.05E+00	5.12E+00	9.68E-05	1.24E-05	1.40E-04	6.02E-05	3.23E-03	4.68E-03	skin disorders	3000			[D]
Tetrachloroethylene	5.78E+00	8.37E+00	1.11E-04	1.43E-05	2.29E-04	9.82E-05	1.11E-02	2.29E-02	liver, kidney, CNS effects	1000			
Xylenes	6.49E+00	1.02E+01	1.24E-04	1.60E-05	2.79E-04	1.20E-04	6.22E-05	1.40E-04	CNS hyperactivity, motor effects	100			[D]
RADIONUCLIDES (pCi/L)													
Americium 241	6.53E+00	1.33E+01		2.88E+04		2.78E+05					6.91E-06	6.68E-05	[A]
Cesium 137+D	9.54E-01	4.35E+00		4.21E+03		9.12E+04					1.18E-07	2.55E-06	[A]
Cobalt 60	1.26E+00	3.97E+00		5.55E+03		8.35E+04					8.32E-08	1.25E-06	[A]
Neptunium 237+D	7.59E+00	1.99E+01		3.35E+04		4.17E+05					7.37E-06	9.18E-05	[A]
Strontium 89	3.07E+00	4.15E+00		1.35E+04		8.72E+04					4.06E-08	2.62E-07	[A]
Strontium 90+D	-1.51E-01	6.06E-02		-6.65E+02		1.27E+03					-2.40E-08	4.58E-08	[A]
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04					1.44E-06	8.54E-06	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05					8.91E-07	6.11E-06	[A]
Uranium 235+D	5.50E-01	7.57E-01		2.43E+03		1.59E+04					3.88E-08	2.54E-07	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05					1.26E-06	8.86E-06	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.52E+00	6.75E+00					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.57E-04	8.34E-04	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											1.81E-05	1.86E-04	

Table L.54. Risk characterization for groundwater: children – ingestion exposure (current land use – residential)

Chemical	MLB Concentration in GW (mg/L)	RMB Concentration in GW (mg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE
INORGANICS (µg/L)													
Aluminum	2.00E+04	2.50E+04	3.98E-01	1.71E-02	8.10E-01	1.04E-01							
Antimony	1.53E+01	1.62E+01	3.05E-04	1.31E-05	5.27E-04	6.78E-05	7.61E-01	1.32E+00	whole body, blood; inc. mortality	1000			
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.38E+04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	oral–cardiovasc. sys.; inc. blood pressure	3			
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	no observed effects	100	6.92E-06	4.59E-05	[B2]
Cadmium	3.51E+00	5.15E+00	7.01E-05	3.00E-06	1.67E-04	2.15E-05	1.40E-01	3.34E-01	kidney; proteinuria	10			
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	no observed effects	100			
Cobalt	1.73E+01	2.18E+01	3.46E-04	1.48E-05	7.08E-04	9.10E-05							
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	Gastrointestinal system; irritation				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04			CNS, blood				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	7.46E-01	1.43E+00	lung, CNS; respiratory, psychomotor distu	1			[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	oral – CNS; neurotoxicity	1000			[D]
Nickel	4.80E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	dec. body and organ weight	300			
Thallium	1.21E+00	1.26E+00	2.42E-05	1.04E-06	4.09E-05	5.26E-06	3.45E-01	5.84E-01	liver, blood; inc. sgot and serum LDH	3000			[D]
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	no observed effects	100			
Zinc	1.04E+01	1.29E+02	2.06E-04	8.85E-06	4.18E-03	5.37E-04	6.88E-04	1.39E-02	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Benzo(a)anthracene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-06	1.56E-05	[B2]
Benzo(a)pyrene	5.01E+00	5.11E+00	9.99E-05	4.28E-06	1.66E-04	2.13E-05	3.33E-03	5.53E-03			3.12E-05	1.56E-04	[B2]
Benzo(b)fluoranthene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-06	1.56E-05	[B2]
Benzo(k)fluoranthene	5.01E+00	5.11E+00	9.99E-05	4.28E-06	1.66E-04	2.13E-05	3.33E-03	5.53E-03			3.12E-06	1.56E-05	[B2]
Benzoic Acid	2.43E+01	2.50E+01	4.84E-04	2.08E-05	8.11E-04	1.04E-04	1.21E-04	2.03E-04	no observed effects	1			[D]
Bis(2-ethylhexyl)phthalate	4.84E+00	5.54E+00	9.66E-05	4.14E-06	1.80E-04	2.31E-05	4.83E-03	8.99E-03	liver; weight inc.	1000	5.80E-08	3.24E-07	[B2]
2-Butanone	8.55E+00	1.37E+01	1.71E-04	7.31E-06	4.44E-04	5.70E-05	3.41E-03	8.87E-03	oral–no observed effects	1000			[D]
Di-n-butyl phthalate	4.80E+00	4.96E+00	9.57E-05	4.10E-06	1.61E-04	2.07E-05	9.57E-04	1.61E-03	liver, kidney damage –	1000			[D]
Carbon Disulfide	5.76E+00	8.36E+00	1.15E-04	4.93E-06	2.71E-04	3.49E-05	1.15E-03	2.71E-03	fetus; toxicity	100			
Chloroform	5.76E+00	8.34E+00	1.15E-04	4.92E-06	2.71E-04	3.48E-05	1.15E-02	2.71E-02	liver; lesions, fatty cyst formation	1000	3.00E-08	2.12E-07	[B2]
4,4'-DDT	5.15E-02	5.27E-02	1.03E-06	4.40E-08	1.71E-06	2.20E-07	2.05E-03	3.42E-03	liver; lesions	100	1.50E-08	7.48E-08	[B2]
Endrin	5.14E-02	5.27E-02	1.03E-06	4.40E-08	1.71E-06	2.20E-07	3.42E-03	5.70E-03	reprod., terato., CNS effects	100			[D]
Heptachlor Epoxide	2.57E-02	2.63E-02	5.13E-07	2.20E-08	8.54E-07	1.10E-07	3.94E-02	6.57E-02	liver damage		2.00E-07	9.99E-07	[B2]
alpha-Chlordane	1.37E-01	1.58E-01	2.73E-06	1.17E-07	5.13E-06	6.60E-07							
Chrysene	5.02E+00	5.11E+00	1.00E-04	4.29E-06	1.66E-04	2.13E-05	3.34E-03	5.53E-03			3.13E-07	1.56E-06	[B2]
Diethyl phthalate	4.56E+00	4.60E+00	9.09E-05	3.90E-06	1.56E-04	2.00E-05	1.14E-04	1.95E-04	lung irritation	1000			[D]
Fluoranthene	5.03E+00	5.11E+00	1.00E-04	4.30E-06	1.66E-04	2.13E-05	2.51E-03	4.15E-03	nephropathy, blood effects	3000			[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	liver, kidney damage, CNS effects	100	4.47E-07	4.21E-06	[B2]
Pyrene	5.05E+00	5.12E+00	1.01E-04	4.31E-06	1.66E-04	2.14E-05	3.35E-03	5.54E-03	skin disorders	3000			[D]
Tetrachloroethylene	5.78E+00	8.37E+00	1.15E-04	4.94E-06	2.72E-04	3.49E-05	1.15E-02	2.72E-02	liver, kidney, CNS effects	1000			
Xylenes	6.49E+00	1.02E+01	1.29E-04	5.55E-06	3.31E-04	4.25E-05	6.47E-05	1.65E-04	CNS hyperactivity, motor effects	100			[D]
RADIONUCLIDES (pCi/L)													
Americium 241	6.53E+00	1.33E+01		3.56E+03		3.67E+04					8.55E-07	8.81E-06	[A]
Cesium 137+D	9.54E-01	4.35E+00		5.21E+02		1.20E+04					1.46E-08	3.37E-07	[A]
Cobalt 60	1.26E+00	3.97E+00		6.87E+02		1.10E+04					1.03E-08	1.65E-07	[A]
Neptunium 237+D	7.59E+00	1.99E+01		4.15E+03		5.51E+04					9.12E-07	1.21E-05	[A]
Strontium 89	3.07E+00	4.15E+00		1.68E+03		1.15E+04					5.03E-09	3.45E-08	[A]
Strontium 90+D	-1.51E-01	6.06E-02		-8.24E+01		1.68E+02					-2.97E-09	6.05E-09	[A]
Radium 226+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04					1.78E-07	1.13E-06	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04					1.10E-07	8.06E-07	[A]
Uranium 235+D	5.50E-01	7.57E-01		3.00E+02		2.10E+03					4.80E-09	3.36E-08	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04					1.56E-07	1.17E-06	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.66E+00	7.99E+00					
Excess Lifetime Cancer Risk: Combined Exposure (d)											5.46E-05	2.96E-04	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											2.24E-06	2.46E-05	

Table L.55. Risk characterization for groundwater: adults – inhalation exposure (current land use – residential)

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	1.77E−04	2.28E−05	7.01E−04	3.00E−04			inc. liver, kidney weights, nephrotoxicity				
2−Butanone	8.55E+00	1.37E+01	4.22E−06	5.42E−07	1.40E−05	6.02E−06	1.48E−05	4.92E−05	oral−no observed effects	1000			
Carbon Disulfide	5.76E+00	8.36E+00	2.84E−06	3.65E−07	8.59E−06	3.68E−06	9.95E−04	3.01E−03	fetus; toxicity	1000			
Chloroform	5.76E+00	8.34E+00	2.84E−06	3.65E−07	8.57E−06	3.67E−06			liver; lesions, fatty cyst formation		2.96E−08	2.98E−07	[B2]
Methylene Chloride	6.97E+01	1.35E+02	3.44E−05	4.42E−06	1.38E−04	5.93E−05	4.01E−05	1.61E−04	liver, kidney damage, CNS effects	100			[B2]
Tetrachloroethylene	5.78E+00	8.37E+00	2.85E−06	3.67E−07	8.60E−06	3.68E−06			liver, kidney, CNS effects				
Xylenes	6.49E+00	1.02E+01	3.20E−06	4.11E−07	1.05E−05	4.49E−06			CNS hyperactivity, motor effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.05E−03	3.22E−03					
Excess Lifetime Cancer Risk: Combined Exposure (d)											2.96E−08	2.98E−07	

Table L.56. Risk characterization for groundwater: children – inhalation exposure (current land use – residential)

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfC) (MLE)	HQ Noncarc. Effects (CDI/RfC) (RME)	Noncarcinogenic Effect of Concern	EPA Uf	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
ORGANICS (µg/L)													
Acetone	3.59E+02	6.82E+02	1.03E−03	4.43E−05	3.17E−03	4.07E−04			inc. liver, kidney weights, nephrotoxicity				
2−Butanone	8.55E+00	1.37E+01	2.46E−05	1.05E−06	6.35E−05	8.17E−06	8.61E−05	2.22E−04	oral−no observed effects	1000			
Carbon Disulfide	5.76E+00	8.36E+00	1.66E−05	7.11E−07	3.88E−05	4.99E−06	5.80E−03	1.36E−02	fetus; toxicity	1000			
Chloroform	5.76E+00	8.34E+00	1.66E−05	7.10E−07	3.88E−05	4.98E−06			liver; lesions, fatty cyst formation		5.75E−08	4.04E−07	[B2]
Methylene Chloride	6.97E+01	1.35E+02	2.01E−04	8.60E−06	6.25E−04	8.04E−05	2.34E−04	7.30E−04	liver, kidney damage, CNS effects	100			[B2]
Tetrachloroethylene	5.78E+00	8.37E+00	1.66E−05	7.13E−07	3.89E−05	5.00E−06			liver, kidney, CNS effects				
Xylenes	6.49E+00	1.02E+01	1.87E−05	8.00E−07	4.74E−05	6.09E−06			CNS hyperactivity, motor effects				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.12E−03	1.45E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											5.75E−08	4.04E−07	

Table L.58. Risk characterization for produce (Sturm Site): children – ingestion exposure (current land use – residential)

Chemical	Plant Conc. from MLE Conc. in Soil (µg/day)	Plant Conc. from Groups from RMEs in Soil (µg/day)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	RfDA WOE
INORGANICS (mg/kg PLANT TISSUE)													
Aluminum	5.81E+01	6.25E+01	1.98E-02	8.50E-04	9.06E-02	1.16E-02							
Arsenic	4.45E-01	5.89E-01	1.52E-04	6.51E-06	8.54E-04	1.10E-04	5.06E-01	2.85E+00	skin; keratosis, hyperpigmentation	3	1.14E-05	1.92E-04	[A]
Barium	1.04E+00	1.20E+00	3.56E-04	1.52E-05	1.73E-03	2.23E-04	5.08E-03	2.47E-02	oral–cardiovasc. sys.; inc. blood pressure	3			
Cadmium	2.13E+00	3.51E+00	7.28E-04	3.12E-05	5.08E-03	6.54E-04	1.46E+00	1.02E+01	kidney; proteinuria	10			
Chromium (III)	3.74E-01	4.95E-01	1.28E-04	5.47E-06	7.17E-04	9.22E-05	1.28E-04	7.17E-04	no observed effects	100			
Cobalt	3.95E-01	4.83E-01	1.35E-04	5.77E-06	7.00E-04	9.00E-05							
Copper	4.40E+00	7.37E+00	1.50E-03	6.42E-05	1.07E-02	1.37E-03	4.05E-02	2.89E-01	Gastrointestinal system; irritation				[D]
Cyanide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00			thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	5.88E-01	7.22E-01	2.01E-04	8.60E-06	1.05E-03	1.35E-04			CNS, blood				[B2]
Manganese	4.22E+02	4.99E+02	1.44E-01	6.16E-03	7.24E-01	9.30E-02	1.44E+00	7.24E+00	lung, CNS; respiratory, psychomotor distur	1			[D]
Mercury	2.13E+01	2.84E+01	7.26E-03	3.11E-04	4.11E-02	5.28E-03	2.42E+01	1.37E+02	oral – CNS; neurotoxicity	1000			[D]
Nickel	1.80E+00	2.53E+00	6.14E-04	2.63E-05	3.66E-03	4.71E-04	3.07E-02	1.83E-01	dec. body and organ weight	300			
Silver	7.73E-01	1.30E+00	2.64E-04	1.13E-05	1.88E-03	2.41E-04	5.28E-02	3.75E-01	skin; argyria	3			[D]
Vanadium	5.55E-02	6.20E-02	1.89E-05	8.11E-07	8.99E-05	1.16E-05	2.70E-03	1.28E-02	no observed effects	100			
Zinc	4.28E+01	5.84E+01	1.46E-02	6.25E-04	8.46E-02	1.09E-02	4.86E-02	2.82E-01	blood; anemia	3			[D]
ORGANICS (mg/kg PLANT TISSUE)													
Aroclor-1260	2.16E-04	3.63E-04	7.37E-08	3.16E-09	5.26E-07	6.77E-08					2.43E-08	5.21E-07	[B2]
Acenaphthylene	7.68E-03	9.25E-03	2.62E-06	1.12E-07	1.34E-05	1.72E-06	8.74E-05	4.47E-04					[D]
Anthracene	4.14E-03	4.95E-03	1.41E-06	6.05E-08	7.17E-06	9.22E-07	4.71E-06	2.39E-05	no observed effects	3000			[D]
Benzoic Acid	4.51E-01	8.44E-01	1.54E-04	6.59E-06	1.22E-03	1.57E-04	3.85E-05	3.06E-04	no observed effects	1			[D]
Benzo(a)anthracene	1.70E-03	3.05E-03	5.80E-07	2.48E-08	4.42E-06	5.68E-07	1.93E-05	1.47E-04			1.81E-08	4.14E-07	[B2]
Benzo(a)pyrene	9.38E-04	1.77E-03	3.20E-07	1.37E-08	2.57E-06	3.30E-07	1.07E-05	8.56E-05			1.00E-07	2.41E-06	[B2]
Benzo(b)fluoranthene	1.45E-03	2.67E-03	4.96E-07	2.12E-08	3.87E-06	4.97E-07	1.65E-05	1.29E-04			1.55E-08	3.63E-07	[B2]
Benzo(g,h,i)perylene	3.34E-04	5.95E-04	1.14E-07	4.88E-09	8.62E-07	1.11E-07	3.80E-06	2.87E-05					[D]
Benzo(k)fluoranthene	1.04E-03	1.91E-03	3.55E-07	1.52E-08	2.77E-06	3.57E-07	1.18E-05	9.25E-05			1.11E-08	2.60E-07	[B2]
Bis(2-ethylhexyl)phthalate	6.15E-03	7.78E-03	2.10E-06	8.99E-08	1.13E-05	1.45E-06	1.05E-04	5.64E-04	liver; weight inc.	1000	1.26E-09	2.03E-08	[B2]
Dibenzo(a,h)anthracene	3.26E-04	3.59E-04	1.11E-07	4.77E-09	5.21E-07	6.69E-08	3.71E-06	1.74E-05	skin disorders		3.48E-08	4.89E-07	[B2]
Di-n-butyl phthalate	3.33E-03	6.89E-03	1.14E-06	4.87E-08	9.99E-06	1.28E-06	1.14E-05	9.99E-05	liver, kidney damage	1000			[D]
Chrysene	2.58E-03	4.79E-03	8.81E-07	3.77E-08	6.95E-06	8.93E-07	2.94E-05	2.32E-04			2.76E-09	6.52E-08	[B2]
Fluoranthene	9.93E-03	1.95E-02	3.39E-06	1.45E-07	2.83E-05	3.64E-06	8.47E-05	7.08E-04	nephropathy, blood effects	3000			[D]
Fluorene	4.82E-03	6.12E-03	1.65E-06	7.05E-08	8.87E-06	1.14E-06	4.11E-05	2.22E-04	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	1.30E-04	2.32E-04	4.42E-08	1.89E-09	3.36E-07	4.31E-08	1.47E-06	1.12E-05	skin disorders		1.38E-09	3.15E-08	[B2]
2-Methylnaphthalene	7.25E-03	1.22E-02	2.47E-06	1.06E-07	1.77E-05	2.28E-06	8.24E-05	5.91E-04	skin effects				
Phenanthrene	9.28E-03	1.77E-02	3.17E-06	1.36E-07	2.56E-05	3.30E-06	1.06E-04	8.54E-04	skin disorders				[D]
Pyrene	8.10E-03	1.47E-02	2.76E-06	1.18E-07	2.13E-05	2.74E-06	9.21E-05	7.11E-04	skin disorders	3000			[D]
RADIONUCLIDES (pCi/kg PLANT TISSUE)													
Americium 241	4.67E-05	1.67E-04		4.36E-01		2.06E+01					1.05E-10	4.95E-09	[A]
Cesium 137+D	2.15E-02	2.96E-02		2.01E+02		3.67E+03					5.62E-09	1.03E-07	[A]
Cobalt 60	8.67E-21	4.42E-04		8.10E-17		5.47E+01					1.21E-27	8.20E-10	[A]
Uranium 234	1.51E-02	2.39E-02		1.41E+02		2.96E+03					2.25E-09	4.73E-08	[A]
Uranium 235+D	5.84E-04	7.82E-04		5.45E+00		9.68E+01					8.72E-11	1.55E-09	[A]
Uranium 238+D	1.00E-02	1.52E-02		9.37E+01		1.88E+03					2.62E-09	5.26E-08	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.78E+01	1.58E+02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.16E-05	1.97E-04	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											1.07E-08	2.10E-07	

Table L.57. Risk characterization for produce (Sturm Site): adults – ingestion exposure (current land use – residential)

Chemical	Chronic Daily Intake (CDI): Plant Conc. from MLE Conc. in Soil (µg/day)	Plant Conc. from Groups from RME in Soil (µg/day)	CDI Noncarc. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	RfD UP	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (mg/kg PLANT TISSUE)													
Aluminum	5.81E+01	6.25E+01	8.87E-03	1.14E-03	4.37E-02	1.87E-02							
Arsenic	4.45E-01	5.89E-01	6.80E-05	8.74E-06	4.12E-04	1.76E-04	2.27E-01	1.37E+00	skin; keratosis, hyperpigmentation	3	1.53E-05	3.09E-04	[A]
Barium	1.04E+00	1.20E+00	1.59E-04	2.05E-05	8.35E-04	3.58E-04	2.27E-03	1.19E-02	oral-cardiovasc. sys.; inc. blood pressure	3			
Cadmium	2.13E+00	3.51E+00	3.26E-04	4.19E-05	2.45E-03	1.05E-03	6.51E-01	4.90E+00	kidney; proteinuria	10			
Chromium (III)	3.74E-01	4.95E-01	5.71E-05	7.34E-06	3.45E-04	1.48E-04	5.71E-05	3.45E-04	no observed effects	100			
Cobalt	3.95E-01	4.83E-01	6.02E-05	7.74E-06	3.37E-04	1.45E-04							
Copper	4.40E+00	7.37E+00	6.71E-04	8.62E-05	5.15E-03	2.21E-03	1.81E-02	1.39E-01	Gastrointestinal system; irritation				[D]
Cyanide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00			thyroid, nerve; weight loss, myelin degen.	100			[D]
Lead	5.88E-01	7.22E-01	8.98E-05	1.15E-05	5.04E-04	2.16E-04			CNS, blood				[B2]
Manganese	4.22E+02	4.99E+02	6.43E-02	8.27E-03	3.49E-01	1.49E-01	6.43E-01	3.49E+00	lung, CNS; respiratory, psychomotor distur	1			[D]
Mercury	2.13E+01	2.84E+01	3.25E-03	4.17E-04	1.98E-02	8.49E-03	1.08E+01	6.60E+01	oral -CNS; neurotoxicity	1000			[D]
Nickel	1.60E+00	2.53E+00	2.74E-04	3.53E-05	1.77E-03	7.57E-04	1.37E-02	8.83E-02	dec. body and organ weight	300			
Silver	7.73E-01	1.30E+00	1.18E-04	1.52E-05	9.05E-04	3.88E-04	2.36E-02	1.81E-01	skin; argyria	3			[D]
Vanadium	5.55E-02	6.20E-02	8.46E-06	1.09E-06	4.33E-05	1.86E-05	1.21E-03	6.19E-03	no observed effects	100			
Zinc	4.28E+01	5.84E+01	6.52E-03	8.39E-04	4.08E-02	1.75E-02	2.17E-02	1.36E-01	blood; anemia	3			[D]
ORGANICS (mg/kg PLANT TISSUE)													
Aroclor-1260	2.16E-04	3.63E-04	3.30E-08	4.24E-09	2.54E-07	1.09E-07					3.26E-08	8.37E-07	[B2]
Acenaphthylene	7.68E-03	9.25E-03	1.17E-06	1.51E-07	6.46E-06	2.77E-06	3.91E-05	2.15E-04					[D]
Anthracene	4.14E-03	4.95E-03	6.32E-07	8.12E-08	3.46E-06	1.48E-06	2.11E-06	1.15E-05	no observed effects	3000			[D]
Benzoic Acid	4.51E-01	8.44E-01	6.88E-05	8.85E-06	5.90E-04	2.53E-04	1.72E-05	1.47E-04	no observed effects	1			[D]
Benzo(a)anthracene	1.70E-03	3.05E-03	2.59E-07	3.33E-08	2.13E-06	9.12E-07	8.64E-06	7.09E-05			2.43E-08	6.66E-07	[B2]
Benzo(a)pyrene	9.38E-04	1.77E-03	1.43E-07	1.84E-08	1.24E-06	5.30E-07	4.77E-06	4.13E-05			1.34E-07	3.87E-06	[B2]
Benzo(b)fluoranthene	1.45E-03	2.67E-03	2.22E-07	2.85E-08	1.86E-06	7.99E-07	7.39E-06	6.22E-05			2.08E-08	5.83E-07	[B2]
Benzo(g,h,i)perylene	3.34E-04	5.95E-04	5.10E-08	6.55E-09	4.16E-07	1.78E-07	1.70E-06	1.39E-05					[D]
Benzo(k)fluoranthene	1.04E-03	1.91E-03	1.59E-07	2.04E-08	1.34E-06	5.73E-07	5.30E-06	4.46E-05			1.49E-08	4.18E-07	[B2]
Bis(2-ethylhexyl)phthalate	6.15E-03	7.78E-03	9.38E-07	1.21E-07	5.43E-06	2.33E-06	4.69E-05	2.72E-04	liver; weight inc.	1000	1.69E-09	3.26E-08	[B2]
Dibenzo(a,h)anthracene	3.26E-04	3.59E-04	4.98E-08	6.40E-09	2.51E-07	1.08E-07	1.66E-06	8.36E-06	skin disorders		4.67E-08	7.85E-07	[B2]
Di-n-butyl phthalate	3.33E-03	6.89E-03	5.08E-07	6.53E-08	4.82E-06	2.06E-06	5.08E-06	4.82E-05	liver, kidney damage	1000			[D]
Chrysene	2.58E-03	4.79E-03	3.94E-07	5.07E-08	3.35E-06	1.44E-06	1.31E-05	1.12E-04			3.70E-09	1.05E-07	[B2]
Fluoranthene	9.93E-03	1.95E-02	1.52E-06	1.95E-07	1.37E-05	5.85E-06	3.79E-05	3.41E-04	nephropathy, blood effects	3000			[D]
Fluorene	4.82E-03	6.12E-03	7.36E-07	9.47E-08	4.28E-06	1.83E-06	1.84E-05	1.07E-04	skin disorders	3000			[D]
Indeno(1,2,3-cd)pyrene	1.30E-04	2.32E-04	1.98E-08	2.54E-09	1.62E-07	6.93E-08	6.59E-07	5.39E-06	skin disorders		1.86E-09	5.06E-08	[B2]
2-Methylnaphthalene	7.25E-03	1.22E-02	1.11E-06	1.42E-07	8.54E-06	3.66E-06	3.69E-05	2.85E-04	skin effects				
Phenanthrene	9.28E-03	1.77E-02	1.42E-06	1.82E-07	1.24E-05	5.29E-06	4.72E-05	4.12E-04	skin disorders				[D]
Pyrene	8.10E-03	1.47E-02	1.24E-06	1.59E-07	1.03E-05	4.41E-06	4.12E-05	3.43E-04	skin disorders	3000			[D]
RADIONUCLIDES (pCi/kg PLANT TISSUE)													
Americium 241	4.67E-05	1.67E-04		1.64E+00		8.92E+01					3.93E-10	2.14E-08	[A]
Cesium 137+D	2.15E-02	2.96E-02		7.54E+02		1.59E+04					2.11E-08	4.44E-07	[A]
Cobalt 60	8.67E-21	4.42E-04		3.04E-16		2.36E+02					4.56E-27	3.55E-09	[A]
Uranium 234	1.51E-02	2.39E-02		5.29E+02		1.28E+04					8.46E-09	2.05E-07	[A]
Uranium 235+D	5.84E-04	7.82E-04		2.05E+01		4.19E+02					3.28E-10	6.70E-09	[A]
Uranium 238+D	1.00E-02	1.52E-02		3.52E+02		8.13E+03					9.86E-09	2.28E-07	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.24E+01	7.64E+01					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.56E-05	3.16E-04	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)											4.02E-08	9.08E-07	

Table L.59. Risk characterization for fish: adults – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in Fish Tissue (mg/Kg)	RME Concentration in Fish Tissue (mg/Kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA Uf	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS													
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	oral -CNS; neurotoxicity	1000			[D]
ORGANICS													
Aroclor-1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06					6.37E-07	2.71E-05	[B2]
Aroclor-1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06					1.12E-06	4.76E-05	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.75E-06	7.47E-05	

Table L.60. Risk characterization for fish: children – ingestion exposure (current land use – residential)

Chemical	MLE Concentration in Fish Tissue (mg/Kg)	RME Concentration in Fish Tissue (mg/Kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA Uncertainty Factor	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS													
Mercury	0.76	0.78	4.16E-06	1.78E-07	6.04E-05	7.76E-06	1.39E-02	2.01E-01	oral -CNS; neurotoxicity	1000			[D]
ORGANICS													
Aroclor-1254	0.20	0.22	1.12E-06	4.81E-08	1.72E-05	2.21E-06					3.70E-07	1.70E-05	[B2]
Aroclor-1260	0.36	0.39	1.97E-06	8.44E-08	3.01E-05	3.88E-06					6.50E-07	2.98E-05	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.39E-02	2.01E-01					
Excess Lifetime Cancer Risk: Combined Exposure (d)											1.02E-06	4.68E-05	

Table L.61. Human health risk characterization summary EFPC: residential scenario: current land use subchronic evaluation (Bruner's Site) – adults

Exposure Pathway	Hazard Index (HI):
CHEMICALS	
SOIL PATHWAYS	
Ingestion	2.98E+00
Dermal Contact	3.23E−01
SURFACE WATER	
Ingestion	2.16E−03
Dermal Contact	1.14E−02
SEDIMENT	
Dermal Contact	1.55E−02
GROUNDWATER	
Ingestion	5.80E+00
Inhalation (VOCs)	3.18E−03
FOOD CHAIN	
Produce	1.04E+03
Beef	
Dairy	
Fish	9.63E−02
AIR PATHWAY	
Particulates: Harvesting	2.77E−01
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.05E+03

Table L.62. Human health risk characterization summary EFPC: residential scenario: current land use subchronic evaluation (Bruner's Site) – children

Exposure Pathway	Hazard Index (HI):
CHEMICALS	
SOIL PATHWAYS	
Ingestion	1.79E+01
Dermal Contact	7.08E−01
SURFACE WATER	
Ingestion	1.00E−02
Dermal Contact	2.51E−02
SEDIMENT	
Dermal Contact	3.39E−02
GROUNDWATER	
Ingestion (Agricultural/Residential)	6.87E+00
Inhalation (VOCs)	2.42E−02
FOOD CHAIN	
Produce (Residential)	3.63E+03
Beef	
Dairy	
Fish	3.38E−01
AIR PATHWAY	
Particulates: Harvesting	
Chemical Hazards:	
Hazard Index (HI):	3.66E+03
Combined Exposure	

Table L.63. Risk characterization for soils: adults – ingestion exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in Soils	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (mg/kg)					
Aluminum	22900.00	3.14E−02			
Arsenic	11.30	1.55E−05	5.16E−02	skin; keratosis, hyperpigmentation	3
Barium	331.90	4.55E−04	6.50E−03	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	1.75	2.39E−06	4.78E−04	no observed effects	100
Cadmium	25.17	3.45E−05		kidney; proteinuria	10
Chromium (III)	105.30	1.44E−04	1.44E−04	no observed effects	100
Cobalt	17.00	2.33E−05			
Copper	268.40	3.68E−04	9.94E−03	Gastrointestinal system; irritation	
Cyanide	9.01	1.23E−05	6.17E−04	thyroid, nerve; weight loss, myelin degen.	100
Lead	143.00	1.96E−04		CNS, blood	
Manganese	1481.00	2.03E−03	2.03E−02	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	628.70	8.61E−04	2.87E+00	oral −CNS; neurotoxicity	1000
Nickel	129.60	1.78E−04	8.88E−03	dec. body and organ weight	300
Silver	21.72	2.98E−05	5.95E−03	skin; argyria	3
Vanadium	38.80	5.32E−05	7.59E−03	no observed effects	100
Zinc	240.80	3.30E−04	1.65E−03	blood; anemia	3
ORGANICS (mg/kg)					
Aroclor−1254	2.30	3.15E−06			
Aroclor−1260	2.51	3.43E−06			
Acenaphthylene	0.35	4.77E−07	1.59E−06		
Anthracene	0.30	4.15E−07	1.38E−07	no observed effects	3000
Benzo(a)anthracene	0.62	8.43E−07	2.81E−06		
Benzo(a)pyrene	0.57	7.81E−07	2.60E−06		
Benzo(b)fluoranthene	1.35	1.85E−06	6.17E−06		
Benzo(g,h,i)perylene	0.37	5.02E−07	1.67E−06		
Benzo(k)fluoranthene	1.35	1.85E−06	6.16E−06		
Bis(2−ethylhexyl)phthalate	0.33	4.53E−07	2.27E−05	liver; weight inc.	1000
Di−n−butyl phthalate	0.33	4.54E−07	4.54E−07	liver, kidney damage	1000
Chrysene	0.69	9.45E−07	3.15E−06		
Fluoranthene	1.31	1.80E−06	4.50E−06	nephropathy, blood effects	3000
Indeno(1,2,3−cd)pyrene	0.36	4.97E−07	1.66E−06	skin disorders	
2−Methylnaphthalene	0.30	4.10E−07	1.37E−06	skin effects	
Naphthalene	0.33	4.54E−07	1.13E−05	eye, blood effects	1000
Phenanthrene	0.57	7.84E−07	2.61E−06	skin disorders	
Pyrene	1.10	1.51E−06	5.03E−06	skin disorders	3000

Chemical Hazards:
Hazard Index (HI): 2.98E+00
Combined Exposure (d)

Table L.64. Risk characterization for soils: children – ingestion exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in Soils	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (mg/kg)					
Aluminum	22900.00	1.88E−01			
Arsenic	11.30	9.30E−05	3.10E−01	skin; keratosis, hyperpigmentation	3
Barium	331.90	2.73E−03	3.90E−02	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	1.75	1.44E−05	2.87E−03	no observed effects	100
Cadmium	25.17	2.07E−04		kidney; proteinuria	10
Chromium (III)	105.30	8.66E−04	8.66E−04	no observed effects	100
Cobalt	17.00	1.40E−04			
Copper	268.40	2.21E−03	5.97E−02	Gastrointestinal system; irritation	
Cyanide	9.01	7.41E−05	3.71E−03	thyroid, nerve; weight loss, myelin degen.	100
Lead	143.00	1.18E−03		CNS, blood	
Manganese	1481.00	1.22E−02	1.22E−01	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	628.70	5.17E−03	1.72E+01	oral −CNS; neurotoxicity	1000
Nickel	129.60	1.07E−03	5.33E−02	dec. body and organ weight	300
Silver	21.72	1.79E−04	3.57E−02	skin; argyria	3
Vanadium	38.80	3.19E−04	4.56E−02	no observed effects	100
Zinc	240.80	1.98E−03	9.91E−03	blood; anemia	3
ORGANICS (mg/kg)					
Aroclor−1254	2.30	1.89E−05			
Aroclor−1260	2.51	2.06E−05			
Acenaphthylene	0.35	2.86E−06	9.55E−06		
Anthracene	0.30	2.49E−06	8.31E−07	no observed effects	3000
Benzo(a)anthracene	0.62	5.06E−06	1.69E−05		
Benzo(a)pyrene	0.57	4.69E−06	1.56E−05		
Benzo(b)fluoranthene	1.35	1.11E−05	3.71E−05		
Benzo(g,h,i)perylene	0.37	3.01E−06	1.00E−05		
Benzo(k)fluoranthene	1.35	1.11E−05	3.70E−05		
Bis(2−ethylhexyl)phthalate	0.33	2.72E−06	1.36E−04	liver; weight inc.	1000
Di−n−butyl phthalate	0.33	2.73E−06	2.73E−06	liver, kidney damage	1000
Chrysene	0.69	5.67E−06	1.89E−05		
Fluoranthene	1.31	1.08E−05	2.70E−05	nephropathy, blood effects	3000
Indeno(1,2,3−cd)pyrene	0.36	2.99E−06	9.96E−06	skin disorders	
2−Methylnaphthalene	0.30	2.46E−06	8.20E−06	skin effects	
Naphthalene	0.33	2.73E−06	6.81E−05	eye, blood effects	1000
Phenanthrene	0.57	4.71E−06	1.57E−05	skin disorders	
Pyrene	1.10	9.07E−06	3.02E−05	skin disorders	3000
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)			1.79E+01		

Table L.65. Risk characterization for soils: adults – dermal exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in Soils	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (mg/kg)					
Aluminum	22900.00	3.39E−03			
Arsenic	11.30	1.67E−06	5.58E−03	skin; keratosis, hyperpigmentation	3
Barium	331.90	4.91E−05	7.02E−04	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	1.75	2.58E−07	5.17E−05	no observed effects	100
Cadmium	25.17	3.73E−06		kidney; proteinuria	10
Chromium (III)	105.30	1.56E−05	1.56E−05	no observed effects	100
Cobalt	17.00	2.52E−06			
Copper	268.40	3.97E−05	1.07E−03	Gastrointestinal system; irritation	
Cyanide	9.01	1.33E−06	6.67E−05	thyroid, nerve; weight loss, myelin degen.	100
Lead	143.00	2.12E−05		CNS, blood	
Manganese	1481.00	2.19E−04	2.19E−03	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	628.70	9.31E−05	3.10E−01	oral −CNS; neurotoxicity	1000
Nickel	129.60	1.92E−05	9.60E−04	dec. body and organ weight	300
Silver	21.72	3.22E−06	6.43E−04	skin; argyria	3
Vanadium	38.80	5.75E−06	8.21E−04	no observed effects	100
Zinc	240.80	3.57E−05	1.78E−04	blood; anemia	3
ORGANICS (mg/kg)					
Aroclor−1254	2.30	3.40E−06			
Aroclor−1260	2.51	3.71E−06			
Acenaphthylene	0.35	5.16E−07	1.72E−06		
Anthracene	0.30	4.49E−07	1.50E−07	no observed effects	3000
Benzo(a)anthracene	0.62	9.11E−07	3.04E−06		
Benzo(a)pyrene	0.57	8.44E−07	2.81E−06		
Benzo(b)fluoranthene	1.35	2.00E−06	6.67E−06		
Benzo(g,h,i)perylene	0.37	5.42E−07	1.81E−06		
Benzo(k)fluoranthene	1.35	2.00E−06	6.66E−06		
Bis(2−ethylhexyl)phthalate	0.33	4.90E−07	2.45E−05	liver; weight inc.	1000
Di−n−butyl phthalate	0.33	4.91E−07	4.91E−07	liver, kidney damage	1000
Chrysene	0.69	1.02E−06	3.40E−06		
Fluoranthene	1.31	1.95E−06	4.86E−06	nephropathy, blood effects	3000
Indeno(1,2,3−cd)pyrene	0.36	5.38E−07	1.79E−06	skin disorders	
2−Methylnaphthalene	0.30	4.43E−07	1.48E−06	skin effects	
Naphthalene	0.33	4.90E−07	1.23E−05	eye, blood effects	1000
Phenanthrene	0.57	8.47E−07	2.82E−06	skin disorders	
Pyrene	1.10	1.63E−06	5.44E−06	skin disorders	3000

Chemical Hazards:
Hazard Index (HI): 3.23E−01
Combined Exposure (d)

Excess Lifetime Cancer Risk:
Combined Exposure (d)

Table L.66. Risk characterization for soils: children – dermal exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in Soils	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (mg/kg)					
Aluminum	22900.00	7.44E−03			
Arsenic	11.30	3.67E−06	1.22E−02	skin; keratosis, hyperpigmentation	3
Barium	331.90	1.08E−04	1.54E−03	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	1.75	5.67E−07	1.13E−04	no observed effects	100
Cadmium	25.17	8.18E−06		kidney; proteinuria	
Chromium (III)	105.30	3.42E−05	3.42E−05	no observed effects	1000
Cobalt	17.00	5.52E−06			
Copper	268.40	8.72E−05	2.36E−03	Gastrointestinal system; irritation	
Cyanide	9.01	2.93E−06	1.46E−04	thyroid, nerve; weight loss, myelin degen.	500
Lead	143.00	4.65E−05		CNS, blood	
Manganese	1481.00	4.81E−04	4.81E−03	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	628.70	2.04E−04	6.81E−01	oral −CNS; neurotoxicity	1000
Nickel	129.60	4.21E−05	2.11E−03	dec. body and organ weight	300
Silver	21.72	7.06E−06	1.41E−03	skin; argyria	3
Vanadium	38.80	1.26E−05	1.80E−03	no observed effects	100
Zinc	240.80	7.82E−05	3.91E−04	blood; anemia	10
ORGANICS (mg/kg)					
Aroclor−1254	2.30	7.46E−06			
Aroclor−1260	2.51	8.14E−06			
Acenaphthylene	0.35	1.13E−06	3.77E−06		
Anthracene	0.30	9.84E−07	3.28E−07	no observed effects	300
Benzo(a)anthracene	0.62	2.00E−06	6.66E−06		
Benzo(a)pyrene	0.57	1.85E−06	6.17E−06		
Benzo(b)fluoranthene	1.35	4.39E−06	1.46E−05		
Benzo(g,h,i)perylene	0.37	1.19E−06	3.97E−06		
Benzo(k)fluoranthene	1.35	4.38E−06	1.46E−05		
Bis(2−ethylhexyl)phthalate	0.33	1.07E−06	5.37E−05	liver; weight inc.	1000
Di−n−butyl phthalate	0.33	1.08E−06	1.08E−06	liver, kidney damage	100
Chrysene	0.69	2.24E−06	7.47E−06		
Fluoranthene	1.31	4.27E−06	1.07E−05	nephropathy, blood effects	300
Indeno(1,2,3−cd)pyrene	0.36	1.18E−06	3.93E−06	skin disorders	
2−Methylnaphthalene	0.30	9.72E−07	3.24E−06	skin effects	300
Naphthalene	0.33	1.08E−06	2.69E−05	eye, blood effects	1000
Phenanthrene	0.57	1.86E−06	6.20E−06	skin disorders	300
Pyrene	1.10	3.58E−06	1.19E−05	skin disorders	300

Chemical Hazards:
Hazard Index (HI): 7.08E−01
Combined Exposure (d)

Excess Lifetime Cancer Risk:
Combined Exposure (d)

Table L.67. Risk characterization for surface water: adults – ingestion exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in SW	Risk Estimates: Subchronic Daily Intake Noncarc. Effects (SCDI)	HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (μg/L)					
Aluminum	9.12E+03	7.42E−04			
Barium	1.05E+02	8.55E−06	1.22E−04	oral−cardiovasc. sys.; inc. blood pressure	3
Chromium (III)	1.32E+01	1.07E−06	1.07E−06	no observed effects	100
Cobalt	8.60E+00	7.00E−07			
Copper	2.19E+01	1.78E−06	4.82E−05	Gastrointestinal system; irritation	
Manganese (water)	4.13E+02	3.36E−05	3.36E−04	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	3.93E+00	3.20E−07	1.07E−03	oral −CNS; neurotoxicity	1000
Vanadium	1.41E+01	1.15E−06	1.64E−04	no observed effects	100
Zinc	9.09E+01	7.40E−06	3.70E−05	blood; anemia	3
ORGANICS (μg/L)					
Acetone	7.70E+00	6.27E−07	6.27E−07	inc. liver, kidney weights, nephrotoxicity	1000
Aldrin	2.50E−02	2.04E−09	6.78E−05	liver; lesions, toxicity	1000
4,4'−DDD	5.00E−02	4.07E−09			
4,4'−DDT	4.94E−02	4.02E−09	8.04E−06	liver; lesions	100
Bis(2−ethylhexyl)phthalate	1.39E+01	1.13E−06		liver; weight inc.	1000
Chloroform	4.69E+00	3.81E−07	3.81E−05	liver; lesions, fatty cyst formation	1000
Dieldrin	5.00E−02	4.07E−09	8.14E−05	liver lesions	100
Diethyl phthalate	4.96E+00	4.04E−07	5.05E−08	lung irritation	1000
Endosulfan	2.50E−02	2.04E−09	1.02E−05	kidney lesions	3000
Endosulfan Sulfate	4.46E−02	3.63E−09			
Endrin	5.00E−02	4.07E−09	1.36E−05	reprod., terato., CNS effects	100
Fluoranthene	5.00E+00	4.07E−07	1.02E−06	nephropathy, blood effects	3000
gamma−BHC	2.34E−02	1.91E−09	6.36E−07	liver, kidney effects	
Heptachlor Epoxide	2.50E−02	2.04E−09	1.57E−04	liver damage	
Tetrachloroethylene	4.84E+00	3.94E−07	3.94E−06	liver, kidney, CNS effects	1000
1,1,1−Trichloroethane	4.85E+00	3.95E−07	4.39E−07	CNS depressant, lung, kidney toxicity	1000
Trichloroethylene	4.68E+00	3.81E−07		Liver, Kidney, CNS effects	

Chemical Hazards:
Hazard Index (HI): 2.16E−03
Combined Exposure (d)

Table L.68. Risk characterization for surface water: children – ingestion exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in SW	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (μg/L)					
Aluminum	9.12E+03	3.35E−03			
Barium	1.05E+02	3.86E−05	5.51E−04	oral−cardiovasc. sys.; inc. blood pressure	3
Chromium (III)	1.32E+01	4.85E−06	4.85E−06	no observed effects	100
Cobalt	8.60E+00	3.16E−06			
Copper	2.19E+01	8.05E−06	2.18E−04	Gastrointestinal system; irritation	
Manganese (water)	4.13E+02	1.52E−04	1.52E−03	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	3.93E+00	1.45E−06	4.82E−03	oral −CNS; neurotoxicity	1000
Vanadium	1.41E+01	5.18E−06	7.41E−04	no observed effects	100
Zinc	9.09E+01	3.34E−05	1.67E−04	blood; anemia	3
ORGANICS (μg/L)					
Acetone	7.70E+00	2.83E−06	2.83E−06	inc. liver, kidney weights, nephrotoxicity	1000
Aldrin	2.50E−02	9.19E−09	3.06E−04	liver; lesions, toxicity	1000
4,4'−DDD	5.00E−02	1.84E−08			
4,4'−DDT	4.94E−02	1.82E−08	3.63E−05	liver; lesions	100
Bis(2−ethylhexyl)phthalate	1.39E+01	5.09E−06	2.55E−04	liver; weight inc.	1000
Chloroform	4.69E+00	1.72E−06	1.72E−04	liver; lesions, fatty cyst formation	1000
Dieldrin	5.00E−02	1.84E−08	3.68E−04	liver lesions	100
Diethyl phthalate	4.96E+00	1.82E−06	2.28E−07	lung irritation	1000
Endosulfan	2.50E−02	9.19E−09	4.60E−05	kidney lesions	3000
Endosulfan Sulfate	4.46E−02	1.64E−08			
Endrin	5.00E−02	1.84E−08	6.13E−05	reprod., terato., CNS effects	100
Fluoranthene	5.00E+00	1.84E−06	4.60E−06	nephropathy, blood effects	3000
gamma−BHC	2.34E−02	8.61E−09	2.87E−06	liver, kidney effects	
Heptachlor Epoxide	2.50E−02	9.19E−09	7.07E−04	liver damage	
Tetrachloroethylene	4.84E+00	1.78E−06	1.78E−05	liver, kidney, CNS effects	1000
1,1,1−Trichloroethane	4.85E+00	1.78E−06	1.98E−06	CNS depressant, lung, kidney toxicity	1000
Trichloroethylene	4.68E+00	1.72E−06		Liver, Kidney, CNS effects	
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)			1.00E−02		

Table L.69. Risk characterization for surface water: adults – dermal exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in SW	Subchronic Daily Intake Noncarc. Effects (SCDI)	HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (μg/L)					
Aluminum	9.12E+03	1.01E−04			
Barium	1.05E+02	1.17E−06	1.67E−05	oral−cardiovasc. sys.; inc. blood pressure	3
Chromium (III)	1.32E+01	1.47E−07	1.47E−07	no observed effects	100
Cobalt	8.60E+00	9.56E−08			
Copper	2.19E+01	2.43E−07	6.58E−06	Gastrointestinal system; irritation	
Manganese (water)	4.13E+02	4.59E−06	4.59E−05	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	3.93E+00	4.37E−08	1.46E−04	oral −CNS; neurotoxicity	1000
Vanadium	1.41E+01	1.57E−07	2.24E−05	no observed effects	100
Zinc	9.09E+01	1.01E−06	5.05E−06	blood; anemia	3
ORGANICS (μg/L)					
Acetone	7.70E+00	5.35E−07	5.35E−07	inc. liver, kidney weights, nephrotoxicity	1000
Aldrin	2.50E−02	2.78E−09	9.26E−05	liver; lesions, toxicity	1000
4,4'−DDD	5.00E−02	9.73E−07			
4,4'−DDT	4.94E−02	1.48E−06	2.95E−03	liver; lesions	100
Bis(2−ethylhexyl)phthalate	1.39E+01	3.17E−05	1.59E−03	liver; weight inc.	1000
Chloroform	4.69E+00	2.90E−06	2.90E−04	liver; lesions, fatty cyst formation	1000
Dieldrin	5.00E−02	5.56E−08	1.11E−03	liver lesions	100
Diethyl phthalate	4.96E+00	1.65E−06	2.07E−07	lung irritation	1000
Endosulfan	2.50E−02	5.49E−08	2.74E−04	kidney lesions	3000
Endosulfan Sulfate	4.46E−02	9.79E−08			
Endrin	5.00E−02	5.56E−08	1.85E−04	reprod., terato., CNS effects	100
Fluoranthene	5.00E+00	1.25E−04	3.13E−04	nephropathy, blood effects	3000
gamma−BHC	2.34E−02	2.28E−08	7.60E−06	liver, kidney effects	
Heptachlor Epoxide	2.50E−02	5.49E−08	4.22E−03	liver damage	
Tetrachloroethylene	4.84E+00	1.61E−05	1.61E−04	liver, kidney, CNS effects	1000
1,1,1−Trichloroethane	4.85E+00	5.73E−06	6.37E−06	CNS depressant, lung, kidney toxicity	1000
Trichloroethylene	4.68E+00	5.20E−06		Liver, Kidney, CNS effects	

Chemical Hazards:
Hazard Index (HI): 1.14E−02
Combined Exposure (d)

Table L.70. Risk characterization for surface water: children – dermal exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in SW	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (μg/L)					
Aluminum	9.12E+03	1.01E−04			
Barium	1.05E+02	2.56E−06	3.66E−05	oral−cardiovasc. sys.; inc. blood pressure	3
Chromium (III)	1.32E+01	3.22E−07	3.22E−07	no observed effects	100
Cobalt	8.60E+00	2.10E−07			
Copper	2.19E+01	5.34E−07	1.44E−05	Gastrointestinal system; irritation	
Manganese (water)	4.13E+02	1.01E−05	1.01E−04	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	3.93E+00	9.59E−08	3.20E−04	oral −CNS; neurotoxicity	1000
Vanadium	1.41E+01	3.44E−07	4.91E−05	no observed effects	100
Zinc	9.09E+01	2.22E−06	1.11E−05	blood; anemia	3
ORGANICS (μg/L)					
Acetone	7.70E+00	1.17E−06	1.17E−06	inc. liver, kidney weights, nephrotoxicity	1000
Aldrin	2.50E−02	6.10E−09	2.03E−04	liver; lesions, toxicity	1000
4,4'−DDD	5.00E−02	2.13E−06			
4,4'−DDT	4.94E−02	3.24E−06	6.47E−03	liver; lesions	100
Bis(2−ethylhexyl)phthalate	1.39E+01	6.97E−05	3.48E−03	liver; weight inc.	1000
Chloroform	4.69E+00	6.36E−06	6.36E−04	liver; lesions, fatty cyst formation	1000
Dieldrin	5.00E−02	1.22E−07	2.44E−03	liver lesions	100
Diethyl phthalate	4.96E+00	3.63E−06	4.54E−07	lung irritation	1000
Endosulfan	2.50E−02	1.20E−07	6.02E−04	kidney lesions	3000
Endosulfan Sulfate	4.46E−02	2.15E−07			
Endrin	5.00E−02	1.22E−07	4.06E−04	reprod., terato., CNS effects	100
Fluoranthene	5.00E+00	2.74E−04	6.86E−04	nephropathy, blood effects	3000
gamma−BHC	2.34E−02	5.00E−08	1.67E−05	liver, kidney effects	
Heptachlor Epoxide	2.50E−02	1.20E−07	9.26E−03	liver damage	
Tetrachloroethylene	4.84E+00	3.54E−05	3.54E−04	liver, kidney, CNS effects	1000
1,1,1−Trichloroethane	4.85E+00	1.26E−05	1.40E−05	CNS depressant, lung, kidney toxicity	1000
Trichloroethylene	4.68E+00	1.14E−05		Liver, Kidney, CNS effects	
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)			2.51E−02		

Table L.71. Risk characterization for sediment: adults – dermal exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in Sediment	Risk Estimates: Subchronic Daily Intake Noncarc. Effects (SCDI)	HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (mg/kg)					
Aluminum	14320.00	8.82E−05			
Arsenic	10.93	6.73E−08	2.24E−04	skin; keratosis, hyperpigmentation	3
Barium	301.10	1.85E−06	2.65E−05	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	0.81	4.99E−09	9.97E−07	no observed effects	100
Cadmium	16.39	1.01E−07		kidney; proteinuria	10
Chromium (III)	89.96	5.54E−07	5.54E−07	no observed effects	100
Cobalt	22.09	1.36E−07			
Copper	129.20	7.96E−07	2.15E−05	Gastrointestinal system; irritation	
Lead	62.91	3.87E−07		CNS, blood	
Manganese	1615.00	9.94E−06	9.94E−05	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	729.50	4.49E−06	1.50E−02	oral −CNS; neurotoxicity	1000
Nickel	116.70	7.19E−07	3.59E−05	dec. body and organ weight	300
Silver	8.63	5.31E−08	1.06E−05	skin; argyria	3
Vanadium	47.60	2.93E−07	4.19E−05	no observed effects	100
Zinc	236.60	1.46E−06	7.28E−06	blood; anemia	3
ORGANICS (mg/kg)					
Acenaphthene	0.31	1.92E−08	3.20E−08	liver; hepatotoxicity	3000
Acenaphthylene	0.24	1.45E−08	4.83E−08		
Anthracene	0.46	2.85E−08	9.51E−09	no observed effects	3000
Aroclor−1248	0.91	5.59E−08			
Aroclor−1260	1.25	7.72E−08			
Benzo(a)anthracene	1.83	1.13E−07	3.75E−07		
Benzo(a)pyrene	1.64	1.01E−07	3.37E−07		
Benzo(b)fluoranthene	2.20	1.35E−07	4.52E−07		
Benzo(g,h,i)perylene	0.94	5.80E−08	1.93E−07		
Benzo(k)fluoranthene	0.95	5.87E−08	1.96E−07		
Benzoic Acid	1.56	9.59E−08	2.40E−08	no observed effects	1
alpha−BHC	0.03	1.59E−09			
gamma−BHC	0.03	1.66E−09	5.52E−07	liver, kidney effects	
Butylbenzylphthalate	0.34	2.12E−08			
Di−n−butyl phthalate	0.32	1.98E−08	1.98E−08	liver, kidney damage	1000
alpha−Chlordane	0.26	1.61E−08			
Chrysene	1.74	1.07E−07	3.57E−07		
4,4'−DDD	0.05	3.18E−09			
4,4'−DDE	0.06	3.47E−09			
Dibenzo(a,h)anthracene	0.39	2.42E−08	8.06E−08	skin disorders	
Bis(2−ethylhexyl)phthalate	1.06	6.55E−08	3.28E−06	liver; weight inc.	1000
Fluoranthene	3.84	2.36E−07	5.90E−07	nephropathy, blood effects	3000
Fluorene	0.28	1.71E−08	4.27E−08	skin disorders	3000
Indeno(1,2,3−cd)pyrene	1.02	6.25E−08	2.08E−07	skin disorders	
p,p'−Methoxychlor	0.26	1.59E−08			
2−Methylnaphthalene	0.31	1.89E−08	6.29E−08	skin effects	
Naphthalene	0.30	1.87E−08	4.68E−07	eye, blood effects	1000
Di−n−octyl phthalate	0.35	2.13E−08	1.06E−06	skin disorders	1000
Phenanthrene	1.13	6.95E−08	2.32E−07	skin disorders	
Pyrene	3.95	2.43E−07	8.12E−07	skin disorders	3000

Chemical Hazards:
Hazard Index (HI): 1.55E−02
Combined Exposure (d)

Table L.72. Risk characterization for sediment: children – dermal exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in Sediment	Risk Estimates: Subchronic Daily Intake Noncarc. Effects (SCDI)	HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (mg/kg)					
Aluminum	14320.00	1.93E−04			
Arsenic	10.93	1.48E−07	4.92E−04	skin; keratosis, hyperpigmentation	3
Barium	301.10	4.07E−06	5.81E−05	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	0.81	1.09E−08	2.19E−06	no observed effects	100
Cadmium	16.39	2.21E−07		kidney; proteinuria	10
Chromium (III)	89.96	1.22E−06	1.22E−06	no observed effects	100
Cobalt	22.09	2.98E−07			
Copper	129.20	1.75E−06	4.72E−05	Gastrointestinal system; irritation	
Lead	62.91	8.50E−07		CNS, blood	
Manganese	1615.00	2.18E−05	2.18E−04	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	729.50	9.85E−06	3.28E−02	oral −CNS; neurotoxicity	1000
Nickel	116.70	1.58E−06	7.88E−05	dec. body and organ weight	300
Silver	8.63	1.17E−07	2.33E−05	skin; argyria	3
Vanadium	47.60	6.43E−07	9.19E−05	no observed effects	100
Zinc	236.60	3.20E−06	1.60E−05	blood; anemia	3
ORGANICS (mg/kg)					
Acenaphthene	0.31	4.21E−08	7.01E−08	liver; hepatotoxicity	3000
Acenaphthylene	0.24	3.18E−08	1.06E−07		
Anthracene	0.46	6.26E−08	2.09E−08	no observed effects	3000
Aroclor−1248	0.91	1.23E−07			
Aroclor−1260	1.25	1.69E−07			
Benzo(a)anthracene	1.83	2.47E−07	8.24E−07		
Benzo(a)pyrene	1.64	2.22E−07	7.39E−07		
Benzo(b)fluoranthene	2.20	2.97E−07	9.91E−07		
Benzo(g,h,i)perylene	0.94	1.27E−07	4.24E−07		
Benzo(k)fluoranthene	0.95	1.29E−07	4.29E−07		
Benzoic Acid	1.56	2.10E−07	5.26E−08	no observed effects	1
alpha−BHC	0.03	3.49E−09			
gamma−BHC	0.03	3.64E−09	1.21E−06	liver, kidney effects	
Butylbenzylphthalate	0.34	4.65E−08			
Di−n−butyl phthalate	0.32	4.35E−08	4.35E−08	liver, kidney damage	1000
alpha−Chlordane	0.26	3.52E−08			
Chrysene	1.74	2.35E−07	7.82E−07		
4,4'−DDD	0.05	6.98E−09			
4,4'−DDE	0.06	7.62E−09			
Dibenzo(a,h)anthracene	0.39	5.31E−08	1.77E−07	skin disorders	
Bis(2−ethylhexyl)phthalate	1.06	1.44E−07	7.19E−06	liver; weight inc.	1000
Fluoranthene	3.84	5.18E−07	1.30E−06	nephropathy, blood effects	3000
Fluorene	0.28	3.75E−08	9.37E−08	skin disorders	3000
Indeno(1,2,3−cd)pyrene	1.02	1.37E−07	4.57E−07	skin disorders	
p,p'−Methoxychlor	0.26	3.49E−08			
2−Methylnaphthalene	0.31	4.14E−08	1.38E−07	skin effects	
Naphthalene	0.30	4.10E−08	1.03E−06	eye, blood effects	1000
Di−n−octyl phthalate	0.35	4.67E−08	2.34E−06	skin disorders	1000
Phenanthrene	1.13	1.52E−07	5.08E−07	skin disorders	
Pyrene	3.95	5.34E−07	1.78E−06	skin disorders	3000

Chemical Hazards:
Hazard Index (HI): 3.39E−02
Combined Exposure (d)

Table L.73. Risk characterization for groundwater: adults – ingestion exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in GW	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (μg/L)					
Aluminum	2.50E+04	6.84E−01			
Antimony	1.62E+01	4.45E−04	1.11E+00	whole body, blood; inc. mortality	1000
Arsenic	5.58E+00	1.53E−04	5.09E−01	skin; keratosis, hyperpigmentation	3
Barium	4.85E+02	1.33E−02	1.90E−01	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	2.56E+00	7.01E−05	1.40E−02	no observed effects	100
Cadmium	5.15E+00	1.41E−04		kidney; proteinuria	10
Chromium (III)	4.10E+01	1.12E−03	1.12E−03	no observed effects	100
Cobalt	2.18E+01	5.98E−04			
Copper	3.24E+02	8.87E−03	2.40E−01	Gastrointestinal system; irritation	
Lead	3.53E+01	9.68E−04		CNS, blood	
Manganese (water)	4.42E+03	1.21E−01	1.21E+00	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	2.19E+01	5.99E−04	2.00E+00	oral −CNS; neurotoxicity	1000
Nickel	6.43E+01	1.76E−03	8.81E−02	dec. body and organ weight	300
Thallium	1.26E+00	3.45E−05	4.93E−02	liver, blood; inc. sgot and serum LDH	3000
Vanadium	4.90E+01	1.34E−03	1.92E−01	no observed effects	100
Zinc	1.29E+02	3.53E−03	1.76E−02	blood; anemia	3
ORGANICS (μg/L)					
Acetone	6.82E+02	1.87E−02	1.87E−02	inc. liver, kidney weights, nephrotoxicity	1000
Benzo(a)anthracene	5.11E+00	1.40E−04	4.67E−04		
Benzo(a)pyrene	5.11E+00	1.40E−04	4.66E−04		
Benzo(b)fluoranthene	5.11E+00	1.40E−04	4.67E−04		
Benzo(k)fluoranthene	5.11E+00	1.40E−04	4.66E−04		
Benzoic Acid	2.50E+01	6.85E−04	1.71E−04	no observed effects	1
Bis(2−ethylhexyl)phthalate	5.54E+00	1.52E−04	7.59E−03	liver; weight inc.	1000
2−Butanone	1.37E+01	3.75E−04	7.49E−04	oral−no observed effects	1000
Di−n−butyl phthalate	4.96E+00	1.36E−04	1.36E−04	liver, kidney damage	1000
Carbon Disulfide	8.36E+00	2.29E−04	2.29E−03	fetus; toxicity	100
Chloroform	8.34E+00	2.29E−04	2.29E−02	liver; lesions, fatty cyst formation	1000
4,4'−DDT	5.27E−02	1.44E−06	2.89E−03	liver; lesions	100
Endrin	5.27E−02	1.44E−06	4.81E−03	reprod., terato., CNS effects	100
Heptachlor Epoxide	2.63E−02	7.21E−07	5.55E−02	liver damage	
alpha−Chlordane	1.58E−01	4.33E−06			
Chrysene	5.11E+00	1.40E−04	4.67E−04		
Diethyl phthalate	4.80E+00	1.31E−04	1.64E−05	lung irritation	1000
Fluoranthene	5.11E+00	1.40E−04	3.50E−04	nephropathy, blood effects	3000
Methylene Chloride	1.35E+02	3.69E−03	6.15E−02	liver, kidney damage, CNS effects	100
Pyrene	5.12E+00	1.40E−04	4.68E−04	skin disorders	3000
Tetrachloroethylene	8.37E+00	2.29E−04	2.29E−03	liver, kidney, CNS effects	1000
Xylenes	1.02E+01	2.79E−04	6.98E−05	CNS hyperactivity, motor effects	100

Chemical Hazards:
Hazard Index (HI): 5.80E+00
Combined Exposure (d)

Table L.74. Risk characterization for groundwater: children – ingestion exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in GW	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (μg/L)					
Aluminum	2.50E+04	8.10E−01			
Antimony	1.62E+01	5.27E−04	1.32E+00	whole body, blood; inc. mortality	1000
Arsenic	5.58E+00	1.81E−04	6.03E−01	skin; keratosis, hyperpigmentation	3
Barium	4.85E+02	1.57E−02	2.25E−01	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	2.56E+00	8.31E−05	1.66E−02	no observed effects	100
Cadmium	5.15E+00	1.67E−04		kidney; proteinuria	10
Chromium (III)	4.10E+01	1.33E−03	1.33E−03	no observed effects	100
Cobalt	2.18E+01	7.08E−04			
Copper	3.24E+02	1.05E−02	2.84E−01	Gastrointestinal system; irritation	
Lead	3.53E+01	1.15E−03		CNS, blood	
Manganese (water)	4.42E+03	1.43E−01	1.43E+00	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	2.19E+01	7.09E−04	2.36E+00	oral −CNS; neurotoxicity	1000
Nickel	6.43E+01	2.09E−03	1.04E−01	dec. body and organ weight	300
Thallium	1.26E+00	4.09E−05	5.84E−02	liver, blood; inc. sgot and serum LDH	3000
Vanadium	4.90E+01	1.59E−03	2.27E−01	no observed effects	100
Zinc	1.29E+02	4.18E−03	2.09E−02	blood; anemia	3
ORGANICS (μg/L)					
Acetone	6.82E+02	2.21E−02	2.21E−02	inc. liver, kidney weights, nephrotoxicity	1000
Benzo(a)anthracene	5.11E+00	1.66E−04	5.53E−04		
Benzo(a)pyrene	5.11E+00	1.66E−04	5.53E−04		
Benzo(b)fluoranthene	5.11E+00	1.66E−04	5.53E−04		
Benzo(k)fluoranthene	5.11E+00	1.66E−04	5.53E−04		
Benzoic Acid	2.50E+01	8.11E−04	2.03E−04	no observed effects	1
Bis(2−ethylhexyl)phthalate	5.54E+00	1.80E−04	8.99E−03	liver; weight inc.	1000
2−Butanone	1.37E+01	4.44E−04	8.87E−04	oral−no observed effects	1000
Di−n−butyl phthalate	4.96E+00	1.61E−04	1.61E−04	liver, kidney damage	1000
Carbon Disulfide	8.36E+00	2.71E−04	2.71E−03	fetus; toxicity	100
Chloroform	8.34E+00	2.71E−04	2.71E−02	liver; lesions, fatty cyst formation	1000
4,4'−DDT	5.27E−02	1.71E−06	3.42E−03	liver; lesions	100
Endrin	5.27E−02	1.71E−06	5.70E−03	reprod., terato., CNS effects	100
Heptachlor Epoxide	2.63E−02	8.54E−07	6.57E−02	liver damage	
alpha−Chlordane	1.58E−01	5.13E−06			
Chrysene	5.11E+00	1.66E−04	5.53E−04		
Diethyl phthalate	4.80E+00	1.56E−04	1.95E−05	lung irritation	1000
Fluoranthene	5.11E+00	1.66E−04	4.15E−04	nephropathy, blood effects	3000
Methylene Chloride	1.35E+02	4.37E−03	7.28E−02	liver, kidney damage, CNS effects	100
Pyrene	5.12E+00	1.66E−04	5.54E−04	skin disorders	3000
Tetrachloroethylene	8.37E+00	2.72E−04	2.72E−03	liver, kidney, CNS effects	1000
Xylenes	1.02E+01	3.31E−04	8.27E−05	CNS hyperactivity, motor effects	100

Chemical Hazards:
Hazard Index (HI): 6.87E+00
Combined Exposure (d)

Table L.75. Risk characterization for groundwater: adults – inhalation exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in GW	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
ORGANICS (μg/L)					
Acetone	6.82E+02	7.01E−04		inc. liver, kidney weights, nephrotoxicity	
2−Butanone	1.37E+01	1.40E−05	1.64E−05	oral−no observed effects	1000
Carbon Disulfide	8.36E+00	8.59E−06	3.01E−03	fetus; toxicity	1000
Chloroform	8.34E+00	8.57E−06		liver; lesions, fatty cyst formation	
Methylene Chloride	1.35E+02	1.38E−04	1.61E−04	liver, kidney damage, CNS effects	100
Tetrachloroethylene	8.37E+00	8.60E−06		liver, kidney, CNS effects	
Xylenes	1.02E+01	1.05E−05		CNS hyperactivity, motor effects	
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)			3.18E−03		

Table L.76. Risk characterization for groundwater: children – inhalation exposure (current land use – residential); Bruners (subchronic evaluation)

Chemical	Concentration in GW	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
ORGANICS (µg/L)					
Acetone	6.82E+02	5.32E−03		inc. liver, kidney weights, nephrotoxicity	
2−Butanone	1.37E+01	1.07E−04	1.24E−04	oral−no observed effects	1000
Carbon Disulfide	8.36E+00	6.52E−05	2.28E−02	fetus; toxicity	1000
Chloroform	8.34E+00	6.50E−05		liver; lesions, fatty cyst formation	
Methylene Chloride	1.35E+02	1.05E−03	1.22E−03	liver, kidney damage, CNS effects	100
Tetrachloroethylene	8.37E+00	6.52E−05		liver, kidney, CNS effects	
Xylenes	1.02E+01	7.94E−05		CNS hyperactivity, motor effects	
Chemical Hazards:					
Hazard Index (HI):			2.42E−02		
Combined Exposure (d)					

Table L.77. Risk characterization for produce: adults – ingestion exposure (current land use – agricultural); Bruners (subchronic evaluation)

Chemical	Concentration in Produce	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (mg/kg PLANT TISSUE)					
Aluminum	9.16E+01	1.49E−01			
Arsenic	9.04E−01	1.47E−03	4.91E+00	skin; keratosis, hyperpigmentation	3
Barium	3.32E+00	5.41E−03	7.73E−02	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	6.98E−03	1.14E−05	2.28E−03	no observed effects	100
Cadmium	1.26E+01	2.05E−02		kidney; proteinuria	10
Chromium (III)	1.05E+00	1.72E−03	1.72E−03	no observed effects	100
Cobalt	5.10E−01	8.31E−04			
Copper	1.34E+01	2.19E−02	5.91E−01	Gastrointestinal system; irritation	
Cyanide	0.00E+00	0.00E+00		thyroid, nerve; weight loss, myelin degen.	100
Lead	1.43E+00	2.33E−03		CNS, blood	
Manganese	5.92E+02	9.66E−01	9.66E+00	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	1.89E+02	3.07E−01	1.02E+03	oral −CNS; neurotoxicity	1000
Nickel	6.48E+00	1.06E−02	5.28E−01	dec. body and organ weight	300
Silver	4.34E+00	7.08E−03	1.42E+00	skin; argyria	3
Vanadium	7.76E−02	1.26E−04	1.81E−02	no observed effects	100
Zinc	9.63E+01	1.57E−01	7.85E−01	blood; anemia	3
ORGANICS (mg/kg PLANT TISSUE)					
Aroclor−1254	4.00E−03	6.51E−06			
Aroclor−1260	2.46E−03	4.01E−06			
Acenaphthylene	1.50E−02	2.44E−05	8.14E−05		
Anthracene	6.97E−03	1.14E−05	3.79E−06	no observed effects	3000
Benzo(a)anthracene	2.29E−03	3.73E−06	1.24E−05		
Benzo(a)pyrene	1.07E−03	1.75E−06	5.84E−06		
Benzo(b)fluoranthene	2.00E−03	3.27E−06	1.09E−05		
Benzo(g,h,i)perylene	2.98E−04	4.87E−07	1.62E−06		
Benzo(k)fluoranthene	1.43E−03	2.34E−06	7.79E−06		
Bis(2−ethylhexyl)phthalate	1.20E−02	1.95E−05	9.75E−04	liver; weight inc.	1000
Di−n−butyl phthalate	1.32E−02	2.14E−05	2.14E−05	liver, kidney damage	1000
Chrysene	3.01E−03	4.90E−06	1.63E−05		
Fluoranthene	1.22E−02	1.99E−05	4.98E−05	nephropathy, blood effects	3000
Indeno(1,2,3−cd)pyrene	1.31E−04	2.14E−07	7.14E−07	skin disorders	
2−Methylnaphthalene	1.70E−02	2.77E−05	9.24E−05	skin effects	
Naphthalene	3.66E−02	5.97E−05	1.49E−03	eye, blood effects	1000
Phenanthrene	1.27E−02	2.06E−05	6.87E−05	skin disorders	
Pyrene	1.08E−02	1.76E−05	5.88E−05	skin disorders	3000
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)			1.04E+03		

Table L.78. Risk characterization for produce: children – ingestion exposure (current land use – agricultural); Bruners (subchronic evaluation)

Chemical	Concentration in Produce	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF
INORGANICS (mg/kg PLANT TISSUE)					
Aluminum	9.16E+01	5.20E−01			
Arsenic	9.04E−01	5.13E−03	1.71E+01	skin; keratosis, hyperpigmentation	3
Barium	3.32E+00	1.88E−02	2.69E−01	oral−cardiovasc. sys.; inc. blood pressure	3
Beryllium	6.98E−03	3.96E−05	7.92E−03	no observed effects	100
Cadmium	1.26E+01	7.14E−02		kidney; proteinuria	10
Chromium (III)	1.05E+00	5.97E−03	5.97E−03	no observed effects	100
Cobalt	5.10E−01	2.89E−03			
Copper	1.34E+01	7.61E−02	2.06E+00	Gastrointestinal system; irritation	
Cyanide	0.00E+00	0.00E+00		thyroid, nerve; weight loss, myelin degen.	100
Lead	1.43E+00	8.11E−03		CNS, blood	
Manganese	5.92E+02	3.36E+00	3.36E+01	lung, CNS; respiratory, psychomotor disturb.	1
Mercury	1.89E+02	1.07E+00	3.57E+03	oral −CNS; neurotoxicity	1000
Nickel	6.48E+00	3.68E−02	1.84E+00	dec. body and organ weight	300
Silver	4.34E+00	2.46E−02	4.93E+00	skin; argyria	3
Vanadium	7.76E−02	4.40E−04	6.29E−02	no observed effects	100
Zinc	9.63E+01	5.46E−01	2.73E+00	blood; anemia	3
ORGANICS (mg/kg PLANT TISSUE)					
Aroclor−1254	4.00E−03	2.27E−05			
Aroclor−1260	2.46E−03	1.40E−05			
Acenaphthylene	1.50E−02	8.49E−05	2.83E−04		
Anthracene	6.97E−03	3.95E−05	1.32E−05	no observed effects	3000
Benzo(a)anthracene	2.29E−03	1.30E−05	4.32E−05		
Benzo(a)pyrene	1.07E−03	6.10E−06	2.03E−05		
Benzo(b)fluoranthene	2.00E−03	1.14E−05	3.79E−05		
Benzo(g,h,i)perylene	2.98E−04	1.69E−06	5.64E−06		
Benzo(k)fluoranthene	1.43E−03	8.14E−06	2.71E−05		
Bis(2−ethylhexyl)phthalate	1.20E−02	6.79E−05	3.39E−03	liver; weight inc.	1000
Di−n−butyl phthalate	1.32E−02	7.46E−05	7.46E−05	liver, kidney damage	1000
Chrysene	3.01E−03	1.70E−05	5.68E−05		
Fluoranthene	1.22E−02	6.94E−05	1.73E−04	nephropathy, blood effects	3000
Indeno(1,2,3−cd)pyrene	1.31E−04	7.45E−07	2.48E−06	skin disorders	
2−Methylnaphthalene	1.70E−02	9.65E−05	3.22E−04	skin effects	
Naphthalene	3.66E−02	2.08E−04	5.20E−03	eye, blood effects	1000
Phenanthrene	1.27E−02	7.18E−05	2.39E−04	skin disorders	
Pyrene	1.08E−02	6.14E−05	2.05E−04	skin disorders	3000

Chemical Hazards:
Hazard Index (HI): 3.63E+03
Combined Exposure (d)

Table L.79. Risk characterization for fish: adults – ingestion exposure (current land use – agricultural); Bruners (subchronic evaluation)

Chemical	Concentration in Fish	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	Risk Estimates: EPA UF
INORGANICS					
Mercury	0.78	2.89E−05	9.63E−02	oral – CNS; neurotoxicity	1000
ORGANICS					
Aroclor−1254	0.22	8.21E−06			
Aroclor−1260	0.39	1.44E−05			
Chemical Hazards:					
Hazard Index (HI):			9.63E−02		
Combined Exposure (d)					

Table L.80. Risk characterization for fish: children – ingestion exposure (current land use – agricultural); Bruners (subchronic evaluation)

Chemical	Concentration in Fish	Subchronic Daily Intake Noncarc. Effects (SCDI)	Risk Estimates: HQ Noncarc. Effects (SCDI/RfD) (RME)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	Risk Estimates: EPA UF
INORGANICS					
Mercury	0.78	1.01E−04	3.38E−01	oral −CNS; neurotoxicity	1000
ORGANICS					
Aroclor−1254	0.22	2.88E−05			
Aroclor−1260	0.39	5.06E−05			
Chemical Hazards:					
Hazard Index (HI):			3.38E−01		
Combined Exposure (d)					

Table L.81. Risk characterization for surface water: adults – hypothetical drinking water ingestion exposure

Chemical	MLB Concentration in SW[a]	RMB Concentration in SW[a]	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	Noncarcinogenic Effect of Concern	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE
INORGANICS (μg/L)													
Barium	4.62E+01	5.66E+01	8.87E−04	1.14E−04	1.55E−03	6.64E−04	1.27E−02	2.21E−02	oral−cardiovasc. sys.; inc. blood pressure	3			
Manganese (water)	3.39E+01	5.18E+01	6.50E−04	8.35E−05	1.42E−03	6.08E−04	6.50E−03	1.42E−02	lung, CNS; respiratory, psychomotor distu	1			[D]
Zinc	2.40E+01	4.36E+01	4.59E−04	5.91E−05	1.19E−03	5.12E−04	1.53E−03	3.98E−03	blood; anemia	3			[D]
ORGANICS (μg/L)													
Acetone	5.00E+00	5.00E+00	9.59E−05	1.23E−05	1.37E−04	5.87E−05	9.59E−04	1.37E−03	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Diethyl phthalate	4.25E+00	5.00E+00	8.15E−05	1.05E−05	1.37E−04	5.87E−05	1.02E−04	1.71E−04	lung irritation	1000			[D]
Tetrachloroethylene	2.13E+00	2.50E+00	4.08E−05	5.24E−06	6.85E−05	2.94E−05	4.08E−03	6.85E−03	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	2.63E+00	2.92E+00	5.03E−05	6.47E−06	8.00E−05	3.43E−05	5.59E−04	8.89E−04	CNS depressant, lung, kidney toxicity	1000			[D]
RADIONUCLIDES (pCi/L)													
Americium 241		1.68E+01				3.52E+05						8.46E−05	
Cesium 137+D	7.73E+00	2.87E+01		3.41E+04		6.02E+05					9.55E−07	1.69E−05	
Cobalt 60	8.02E−01	1.53E+01		3.54E+03		3.21E+05					5.31E−08	4.81E−06	
Uranium 234	4.54E+00	6.25E+00		2.00E+04		1.31E+05					3.20E−07	2.10E−06	
Uranium 235+D	2.87E−01	6.30E−01		1.26E+03		1.32E+04					2.02E−08	2.12E−07	
Uranium 238+D	6.41E+00	1.05E+01		2.83E+04		2.21E+05					7.91E−07	6.19E−06	
Chemical Hazards:													
Hazard Index (HI): Combined Exposure (d)							2.64E−02	4.96E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											0.00E+00	0.00E+00	
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure (d)											2.14E−06	1.15E−04	

[a] There is a great deal of uncertainty surrounding the estimates of surface water activity of americium and cobalt. Mean activity levels of these nuclides were negative values and the standard error of the mean exceeds the maximum activity levels. Consequently, these estimates of activity are not considered a reliable basis for risk assessment.

Table L.82. Risk characterization for surface water: children – hypothetical drinking water ingestion exposure

Chemical	MLE Concentration in SW[a]	RME Concentration in SW[a]	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	Noncarcinogenic Effect of Concern	EPA Uncertainty Factor	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	EPA WOE
INORGANICS (µg/L)													
Barium	4.62E+01	5.66E+01	9.22E−04	3.95E−05	1.84E−03	2.36E−04	1.32E−02	2.62E−02	oral−cardiovasc. sys.; inc. blood pressure	3			
Manganese (water)	3.39E+01	5.18E+01	6.76E−04	2.90E−05	1.68E−03	2.16E−04	6.76E−03	1.68E−02	lung, CNS; respiratory, psychomotor distu	1			[D]
Zinc	2.40E+01	4.36E+01	4.78E−04	2.05E−05	1.41E−03	1.82E−04	1.59E−03	4.71E−03	blood; anemia	3			[D]
ORGANICS (µg/L)													
Acetone	5.00E+00	5.00E+00	9.97E−05	4.27E−06	1.62E−04	2.09E−05	9.97E−04	1.62E−03	inc. liver, kidney weights, nephrotoxicity	1000			[D]
Diethyl phthalate	4.25E+00	5.00E+00	8.48E−05	3.63E−06	1.62E−04	2.09E−05	1.06E−04	2.03E−04	lung irritation	1000			[D]
Tetrachloroethylene	2.13E+00	2.50E+00	4.24E−05	1.82E−06	8.11E−05	1.04E−05	4.24E−03	8.11E−03	liver, kidney, CNS effects	1000			
1,1,1−Trichloroethane	2.63E+00	2.92E+00	5.24E−05	2.24E−06	9.47E−05	1.22E−05	5.82E−04	1.05E−03	CNS depressant, lung, kidney toxicity	1000			[D]
RADIONUCLIDES (pCi/L)													
Americium 241		1.68E+01				8.77E+04						2.10E−05	
Cesium 137+D	7.73E+00	2.87E+01		8.54E+03		1.50E+05					2.39E−07	4.20E−06	
Cobalt 60	8.02E−01	1.53E+01		8.86E+02		7.98E+04					1.33E−08	1.20E−06	
Uranium 234	4.54E+00	6.25E+00		5.02E+03		3.27E+04					8.03E−08	5.22E−07	
Uranium 235+D	2.87E−01	6.30E−01		3.17E+02		3.29E+03					5.07E−09	5.27E−08	
Uranium 238+D	6.41E+00	1.05E+01		7.08E+03		5.50E+04					1.98E−07	1.54E−06	
Chemical Hazards:													
Hazard Index (HI): Combined Exposure (d)							2.74E−02	5.87E−02					
Excess Lifetime Cancer Risk: Combined Exposure (d)											0.00E+00	0.00E+00	
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure (d)											5.36E−07	2.85E−05	

[a] There is a great deal of uncertainty surrounding the estimates of surface water activity of americium and cobalt. Mean activity levels of these nuclides were negative values and the standard error of the mean exceeds the maximum activity levels. Consequently, these estimates of activity are not considered a reliable basis for risk assessment.

Table L.83. EFPC Phase 1A chemical and radionuclide results: baseflow

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
1,1,1−Trichloroethane	UG/L	1	4	5.000E+00	2.500E+00	2.625E+00	3.000E+00	2.919E+00	2.919E+00	1.250E−01
Acetone	UG/L	1	4	1.000E+01	5.000E+00	5.000E+00	5.000E+00	5.000E+00	5.000E+00	0.000E+00
Americium 241	PCI/L	5	5	4.911E+01	−2.758E+01	−4.250E+00	2.758E+01	1.678E+01	1.678E+01	9.864E+00
Barium	UG/L	5	5	1.000E+00	3.420E+01	4.624E+01	6.000E+01	5.658E+01	5.658E+01	4.851E+00
Cesium 137+D	PCI/L	5	5	1.916E+01	−2.366E+01	7.730E+00	3.312E+01	2.869E+01	2.869E+01	9.832E+00
Cobalt 60	PCI/L	5	5	1.315E+01	−1.502E+01	8.020E−01	1.802E+01	1.527E+01	1.527E+01	6.786E+00
Diethyl phthalate	UG/L	1	4	1.000E+01	2.000E+00	4.250E+00	5.000E+00	6.015E+00	5.000E+00	7.500E−01
Manganese	UG/L	5	5	1.000E+00	1.980E+01	3.388E+01	6.660E+01	5.177E+01	5.177E+01	8.390E+00
Neptunium 237+D	PCI/L	5	5	3.940E+01	−2.593E+01	5.274E+00	3.631E+01	2.715E+01	2.715E+01	1.026E+01
Tetrachloroethylene	UG/L	1	4	5.000E+00	1.000E+00	2.125E+00	2.500E+00	3.008E+00	2.500E+00	3.750E−01
Uranium 234	PCI/L	3	3	2.178E−01	2.770E+00	4.540E+00	6.250E+00	7.475E+00	6.250E+00	1.005E+00
Uranium 235+D	PCI/L	3	3	4.922E−02	6.000E−02	2.867E−01	6.300E−01	7.964E−01	6.300E−01	1.746E−01
Uranium 238+D	PCI/L	3	3	2.546E−01	3.100E+00	6.407E+00	1.053E+01	1.278E+01	1.053E+01	2.183E+00
Zinc	UG/L	3	5	3.000E+00	6.600E+00	2.395E+01	5.970E+01	4.357E+01	4.357E+01	9.203E+00

Table L.84. EFPC Phase 1A chemical and radionuclide results: groundwater

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2−Butanone	UG/L	1	80	1.000E+01	2.000E+00	8.550E+00	2.500E+02	1.367E+01	1.367E+01	3.074E+00
2−Methylphenol	UG/L	1	70	1.000E+01	2.000E+00	5.014E+00	8.500E+00	5.125E+00	5.125E+00	6.670E−02
4−Nitrophenol	UG/L	1	68	5.000E+01	2.000E+00	1.766E+01	2.800E+01	1.898E+01	1.898E+01	7.881E−01
4,4'−DDT	UG/L	1	79	1.000E−01	4.900E−03	5.145E−02	6.500E−02	5.269E−02	5.269E−02	7.447E−04
Acetone	UG/L	23	78	1.000E+01	2.000E+00	3.592E+02	1.400E+04	6.819E+02	6.819E+02	1.938E+02
alpha−Chlordane	UG/L	4	79	5.000E−01	4.800E−03	1.370E−01	3.100E−01	1.581E−01	1.581E−01	1.270E−02
Aluminum	UG/L	69	83	3.500E+01	2.960E+01	1.996E+04	1.200E+05	2.496E+04	2.496E+04	3.003E+03
Americium 241	PCI/L	83	83	1.209E+01	−9.652E+01	6.526E+00	1.103E+02	1.325E+01	1.325E+01	4.039E+00
Antimony	UG/L	3	83	2.800E+01	1.100E+01	1.527E+01	4.080E+01	1.624E+01	1.624E+01	5.823E−01
Arsenic	UG/L	23	79	3.000E+00	1.000E+00	3.966E+00	7.640E+01	5.575E+00	5.575E+00	9.665E−01
Barium	UG/L	82	83	1.000E+00	5.000E−01	3.952E+02	3.150E+03	4.582E+02	4.852E+02	5.408E+01
Benzoic Acid	UG/L	1	31	5.000E+01	3.000E+00	2.429E+01	2.500E+01	2.549E+01	2.500E+01	7.097E−01
Benzo(a)anthracene	UG/L	1	76	1.000E+01	3.000E+00	5.020E+00	8.500E+00	5.109E+00	5.109E+00	5.334E−02
Benzo(a)pyrene	UG/L	1	76	1.000E+01	2.000E+00	5.007E+00	8.500E+00	5.108E+00	5.108E+00	6.105E−02
Benzo(b)fluoranthene	UG/L	1	76	1.000E+01	3.000E+00	5.020E+00	8.500E+00	5.109E+00	5.109E+00	5.334E−02
Benzo(k)fluoranthene	UG/L	1	76	1.000E+01	2.000E+00	5.007E+00	8.500E+00	5.108E+00	5.108E+00	6.105E−02
Beryllium	UG/L	16	83	1.000E+00	5.000E−01	1.883E+00	2.810E+01	2.559E+00	2.559E+00	4.064E−01
Bis(2−ethylhexyl)phthalate	UG/L	16	77	1.000E+01	1.000E+00	4.844E+00	3.100E+01	5.543E+00	5.543E+00	4.199E−01
Butylbenzylphthalate	UG/L	1	76	1.000E+01	1.000E+00	4.993E+00	8.500E+00	5.111E+00	5.111E+00	7.040E−02
Cadmium	UG/L	7	83	4.000E+00	1.500E+00	3.514E+00	7.510E+01	5.152E+00	5.152E+00	9.840E−01
Carbon Disulfide	UG/L	6	80	5.000E+00	1.000E+00	5.763E+00	1.250E+02	8.359E+00	8.359E+00	1.560E+00
Cesium 137+D	PCI/L	82	82	4.759E+00	−4.022E+01	9.544E−01	5.205E+01	4.345E+00	4.345E+00	2.038E+00
Chloroform	UG/L	2	80	5.000E+00	2.000E+00	5.756E+00	1.250E+02	8.342E+00	8.342E+00	1.554E+00
Chromium (III)	UG/L	60	83	5.000E+00	2.000E+00	3.302E+01	2.680E+02	4.100E+01	4.100E+01	4.798E+00
Chrysene	UG/L	1	76	1.000E+01	3.000E+00	5.020E+00	8.500E+00	5.109E+00	5.109E+00	5.334E−02
Cobalt	UG/L	46	83	6.000E+00	2.500E+00	1.733E+01	1.440E+02	2.181E+01	2.181E+01	2.696E+00
Cobalt 60	PCI/L	82	82	3.472E+00	−5.406E+01	1.258E+00	4.505E+01	3.974E+00	3.974E+00	1.632E+00
Copper	UG/L	62	83	4.000E+00	1.500E+00	1.671E+01	6.320E+03	3.236E+02	3.236E+02	9.408E+01
Diethyl phthalate	UG/L	9	76	1.000E+01	5.000E−01	4.559E+00	7.000E+00	4.795E+00	4.795E+00	1.417E−01
Di−n−butyl phthalate	UG/L	3	76	1.000E+01	5.000E−01	4.796E+00	5.000E+00	4.964E+00	4.964E+00	1.010E−01
Dissolved Aluminum	UG/L	9	83	3.500E+01	1.650E+01	6.306E+01	2.510E+04	1.193E+03	1.193E+03	3.381E+02
Dissolved Antimony	UG/L	4	83	2.800E+01	1.100E+01	1.468E+01	3.820E+01	1.541E+01	1.541E+01	4.421E−01
Dissolved Arsenic	UG/L	16	83	3.000E+00	1.000E+00	2.947E+00	2.160E+01	3.568E+00	3.568E+00	3.732E−01
Dissolved Barium	UG/L	83	83	1.000E+00	1.510E+01	1.623E+02	1.110E+03	1.917E+02	1.917E+02	1.713E+01
Dissolved Beryllium	UG/L	2	83	1.000E+00	5.000E−01	6.578E−01	6.900E+00	7.978E−01	7.978E−01	8.414E−02
Dissolved Cadmium	UG/L	2	83	4.000E+00	1.500E+00	2.075E+00	6.300E+00	2.196E+00	2.196E+00	7.317E−01
Dissolved Chromium (III)	UG/L	5	83	5.000E+00	2.000E+00	3.287E+00	3.550E+01	4.013E+00	4.013E+00	4.364E−01
Dissolved Cobalt	UG/L	11	83	6.000E+00	2.500E+00	4.712E+00	1.100E+02	6.872E+00	6.872E+00	1.298E+00
Dissolved Copper	UG/L	13	83	4.000E+00	1.500E+00	3.976E+00	1.080E+02	6.118E+00	6.118E+00	1.287E+00
Dissolved Lead	UG/L	7	83	3.000E+00	5.000E−01	1.442E+00	9.200E+00	1.691E+00	1.691E+00	1.498E−01
Dissolved Manganese	UG/L	80	83	1.000E+00	5.000E−01	2.948E+03	2.760E+04	3.655E+03	3.655E+03	4.247E+02
Dissolved Mercury	UG/L	4	58	2.000E−01	1.000E−01	5.771E−01	2.610E+01	1.327E+00	1.327E+00	4.483E−01
Dissolved Nickel	UG/L	16	83	1.200E+01	3.500E+00	1.064E+01	1.600E+02	1.391E+01	1.391E+01	1.971E+00
Dissolved Vanadium	UG/L	6	83	5.000E+00	2.000E+00	5.113E+00	1.910E+02	8.909E+00	8.909E+00	2.281E+00
Dissolved Zinc	UG/L	41	83	3.000E+00	1.000E+00	1.085E+01	2.100E+02	1.550E+01	1.550E+01	2.799E+00
Endosulfan II	UG/L	1	79	1.000E−01	3.500E−03	5.125E−02	6.500E−02	5.248E−02	5.248E−02	7.389E−04
Endrin	UG/L	1	79	1.000E−01	3.400E−03	5.144E−02	6.500E−02	5.270E−02	5.270E−02	7.600E−04
Fluoranthene	UG/L	1	76	1.000E+01	4.000E+00	5.033E+00	8.500E+00	5.113E+00	5.113E+00	4.806E−02
gamma−BHC	UG/L	1	79	5.000E−02	2.800E−03	2.570E−02	3.350E−02	2.632E−02	2.632E−02	3.734E−04
Heptachlor Epoxide	UG/L	1	79	5.000E−02	3.500E−03	2.571E−02	3.350E−02	2.632E−02	2.632E−02	3.665E−04
Lead	UG/L	59	81	3.000E+00	1.000E+00	2.675E+01	2.990E+02	3.534E+01	3.534E+01	5.158E+00
Manganese (water)	UG/L	81	83	1.000E+00	5.000E−01	3.738E+03	2.100E+04	4.417E+03	4.417E+03	4.083E+02
Mercury	UG/L	57	83	2.000E−01	1.000E−01	1.386E+01	2.800E+02	2.185E+01	2.185E+01	4.803E+00
Methylene Chloride	UG/L	16	80	5.000E+00	5.000E−01	6.974E+01	2.500E+03	1.346E+02	1.346E+02	3.894E+01
Neptunium 237+D	PCI/L	79	79	1.073E+01	−9.854E+01	7.592E+00	2.386E+02	1.987E+01	1.987E+01	7.374E+00
Nickel	UG/L	56	83	1.200E+01	3.500E+00	4.804E+01	6.570E+02	6.428E+01	6.428E+01	9.759E+00
Pentachlorophenol	UG/L	1	68	5.000E+01	2.000E+00	1.766E+01	2.800E+01	1.898E+01	1.898E+01	7.881E−01
Pyrene	UG/L	1	76	1.000E+01	5.000E+00	5.046E+00	8.500E+00	5.123E+00	5.123E+00	4.605E−02
p,p'−Methoxychlor	UG/L	1	79	5.000E−01	1.100E−02	2.575E−01	3.350E−01	2.641E−01	2.641E−01	3.962E−03
Strontium 89	PCI/L	77	77	6.107E−01	−1.090E+00	3.069E+00	4.109E+01	4.152E+00	4.152E+00	6.507E−01
Strontium 90+D	PCI/L	58	58	2.021E−01	−3.160E+00	−1.509E−01	1.510E+00	6.061E−02	6.061E−02	1.265E−01
Tetrachloroethylene	UG/L	1	80	5.000E+00	1.000E+00	5.781E+00	1.250E+02	8.367E+00	8.367E+00	1.553E+00
Thallium	UG/L	1	83	3.000E+00	1.000E+00	1.212E+00	2.100E+00	1.260E+00	1.260E+00	2.901E−01
Radium 228+D	PCI/L	77	77	1.304E−01	−6.000E−01	3.265E+00	2.629E+01	4.069E+00	4.069E+00	4.827E−01
Xylenes	UG/L	1	80	5.000E+00	2.500E+00	6.487E+00	1.800E+02	1.019E+01	1.019E+01	2.227E+00
Uranium 234	PCI/L	55	55	1.254E−01	8.000E−02	1.263E+01	1.091E+02	1.817E+01	1.817E+01	3.309E+00
Uranium 235+D	PCI/L	65	65	2.439E−02	0.000E+00	5.500E−01	5.260E+00	7.573E−01	7.573E−01	1.242E−01
Uranium 238+D	PCI/L	60	60	1.075E−01	8.000E−02	1.023E+01	1.151E+02	1.506E+01	1.506E+01	2.895E+00
Vanadium	UG/L	56	83	5.000E+00	1.500E+00	3.908E+01	2.250E+02	4.902E+01	4.902E+01	5.977E+00
Zinc	UG/L	54	83	3.000E+00	1.000E+00	1.035E+01	7.430E+02	1.288E+02	1.288E+02	1.523E+01

Table L.85. EFPC Phase 1A chemical and radionuclide results: sediment

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2-Methylnaphthalene	MG/KG	1	7	3.300E-01	2.300E-02	2.126E-01	4.500E-01	3.066E-01	3.066E-01	4.837E-02
4,4'-DDD	MG/KG	1	8	1.600E-02	2.300E-03	2.723E-02	1.100E-01	5.164E-02	5.164E-02	1.288E-02
4,4'-DDE	MG/KG	1	8	1.600E-02	1.000E-02	3.269E-02	1.100E-01	5.642E-02	5.642E-02	1.253E-02
Acenaphthene	MG/KG	1	7	3.300E-01	1.300E-01	2.386E-01	4.500E-01	3.115E-01	3.115E-01	3.752E-02
Acenaphthylene	MG/KG	2	7	3.300E-01	1.600E-01	2.143E-01	2.500E-01	2.351E-01	2.351E-01	1.071E-02
alpha-BHC	MG/KG	1	8	8.000E-03	2.400E-04	1.353E-02	5.500E-02	2.584E-02	2.584E-02	6.497E-03
alpha-Chlordane	MG/KG	1	8	8.000E-02	4.100E-02	1.401E-01	5.500E-01	2.609E-01	2.609E-01	6.372E-02
Aluminum	MG/KG	9	9	1.000E+01	3.900E+03	1.030E+04	2.410E+04	1.432E+04	1.432E+04	2.164E+03
Americium 241	PCI/G	8	8	8.930E-02	-1.800E-01	-8.750E-02	4.000E-02	-3.639E-02	-3.639E-02	2.698E-02
Anthracene	MG/KG	4	7	3.300E-01	6.500E-02	2.666E-01	8.500E-01	4.633E-01	4.633E-01	1.012E-01
Aroclor-1248	MG/KG	1	8	8.000E-02	5.000E-02	4.100E-01	2.200E+00	9.086E-01	9.086E-01	2.632E-01
Aroclor-1260	MG/KG	1	8	1.600E-01	1.000E-01	6.194E-01	2.800E+00	1.254E+00	1.254E+00	3.352E-01
Arsenic	MG/KG	9	9	4.000E+00	2.900E+00	7.933E+00	1.760E+01	1.093E+01	1.093E+01	1.611E+00
Barium	MG/KG	9	9	5.000E-01	4.220E+01	1.634E+02	7.400E+02	3.011E+02	3.011E+02	7.407E+01
Benzoic Acid	MG/KG	1	6	1.600E+00	5.000E-02	9.217E-01	2.200E+00	1.558E+00	1.558E+00	3.156E-01
Benzo(a)anthracene	MG/KG	6	7	3.300E-01	4.900E-02	8.084E-01	3.900E+00	1.829E+00	1.829E+00	5.254E-01
Benzo(a)pyrene	MG/KG	5	7	3.300E-01	1.100E-01	7.364E-01	3.500E+00	1.642E+00	1.642E+00	4.659E-01
Benzo(b)fluoranthene	MG/KG	5	6	3.300E-01	4.400E-02	9.040E-01	4.100E+00	2.200E+00	2.200E+00	6.432E-01
Benzo(g,h,i)perylene	MG/KG	4	7	3.300E-01	9.100E-02	4.337E-01	2.000E+00	9.422E-01	9.422E-01	2.617E-01
Benzo(k)fluoranthene	MG/KG	4	6	3.300E-01	9.900E-02	4.840E-01	1.600E+00	9.538E-01	9.538E-01	2.332E-01
Beryllium	MG/KG	2	9	2.000E-01	4.700E-01	6.806E-01	1.100E+00	8.100E-01	8.100E-01	6.963E-02
Bis(2-ethylhexyl)phthalate	MG/KG	5	7	3.300E-01	7.500E-02	5.750E-01	1.800E+00	1.064E+00	1.064E+00	2.517E-01
Butylbenzylphthalate	MG/KG	1	7	3.300E-01	2.050E-01	2.743E-01	4.500E-01	3.439E-01	3.439E-01	3.583E-02
Cadmium	MG/KG	8	9	1.000E+00	5.500E-01	7.360E+00	4.610E+01	1.639E+01	1.639E+01	4.858E+00
Cesium 137+D	PCI/G	8	8	2.395E-02	3.200E-01	9.150E-01	1.270E+00	1.146E+00	1.146E+00	1.219E-01
Chromium (III)	MG/KG	9	9	1.000E+00	3.620E+01	7.302E+01	1.190E+02	8.996E+01	8.996E+01	9.106E+00
Chrysene	MG/KG	6	7	3.300E-01	4.800E-02	7.726E-01	3.700E+00	1.737E+00	1.737E+00	4.966E-01
Cobalt	MG/KG	9	9	1.000E+00	9.400E+00	1.807E+01	2.870E+01	2.209E+01	2.209E+01	2.164E+00
Cobalt 60	PCI/G	8	8	1.038E-02	-2.000E-02	2.875E-02	1.600E-01	6.869E-02	6.869E-02	2.108E-02
Copper	MG/KG	9	9	1.000E+00	7.600E+00	7.108E+01	3.130E+02	1.292E+02	1.292E+02	3.125E+01
Dibenzo(a,h)anthracene	MG/KG	1	7	3.300E-01	2.050E-01	2.907E-01	5.800E-01	3.929E-01	3.929E-01	5.259E-02
Di-n-butyl phthalate	MG/KG	2	6	3.300E-01	7.100E-02	2.143E-01	4.500E-01	3.218E-01	3.218E-01	5.333E-02
Di-n-octyl phthalate	MG/KG	1	7	3.300E-01	2.050E-01	2.771E-01	4.500E-01	3.458E-01	3.458E-01	3.535E-02
Fluoranthene	MG/KG	5	7	3.300E-01	8.700E-02	1.841E+00	7.100E+00	3.836E+00	3.836E+00	1.027E+00
Fluorene	MG/KG	1	7	3.300E-01	1.400E-01	2.279E-01	3.650E-01	2.776E-01	2.776E-01	2.561E-02
gamma-BHC	MG/KG	1	8	8.000E-03	5.000E-03	1.512E-02	5.500E-02	2.691E-02	2.691E-02	6.220E-03
Indeno(1,2,3-cd)pyrene	MG/KG	5	7	3.300E-01	5.800E-02	4.447E-01	2.200E+00	1.015E+00	1.015E+00	2.935E-01
Lead	MG/KG	9	9	5.000E-01	1.280E+01	4.204E+01	1.130E+02	6.291E+01	6.291E+01	1.122E+01
Manganese	MG/KG	9	9	5.000E-01	4.640E+02	1.198E+03	2.620E+03	1.615E+03	1.615E+03	2.242E+02
Mercury	MG/KG	9	9	1.000E-01	1.000E+01	2.719E+02	2.240E+03	7.295E+02	7.295E+02	2.461E+02
Naphthalene	MG/KG	1	7	3.300E-01	2.300E-02	2.056E-01	4.500E-01	3.038E-01	3.038E-01	5.057E-02
Neptunium 237+D	PCI/G	8	8	2.236E-02	-7.000E-02	2.625E-02	7.000E-02	5.724E-02	5.724E-02	1.636E-02
Nickel	MG/KG	9	9	1.000E+01	1.350E+01	6.630E+01	2.750E+02	1.167E+02	1.167E+02	2.711E+01
Phenanthrene	MG/KG	4	7	3.300E-01	2.050E-01	6.450E-01	1.700E+00	1.128E+00	1.128E+00	2.485E-01
Pyrene	MG/KG	5	6	3.300E-01	7.300E-02	1.487E+00	7.600E+00	3.954E+00	3.954E+00	1.224E+00
p,p'-Methoxychlor	MG/KG	1	8	8.000E-02	4.200E-03	1.355E-01	5.500E-01	2.585E-01	2.585E-01	6.490E-02
Silver	MG/KG	1	9	1.000E+00	4.500E-01	3.365E+00	2.600E+01	8.627E+00	8.627E+00	2.829E+00
Uranium 234	PCI/G	8	8	9.982E-02	3.560E+00	5.326E+00	9.110E+00	6.641E+00	6.641E+00	6.939E-01
Uranium 235+D	PCI/G	8	8	2.016E-02	1.000E-01	2.250E-01	3.700E-01	2.866E-01	2.866E-01	3.251E-02
Uranium 238+D	PCI/G	8	8	8.803E-02	2.560E+00	3.926E+00	6.440E+00	4.917E+00	4.917E+00	5.231E-01
Vanadium	MG/KG	9	9	1.000E+00	1.990E+01	3.726E+01	6.710E+01	4.760E+01	4.760E+01	5.560E+00
Zinc	MG/KG	9	9	1.000E+00	5.460E+01	1.702E+02	3.470E+02	2.366E+02	2.366E+02	3.574E+01

Table L.86. EFPC Phase 1A chemical and radionuclide results: soil – Bruner's Site

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2-Methylnaphthalene	MG/KG	4	6	3.300E-01	4.300E-02	1.630E-01	4.750E-01	2.991E-01	2.991E-01	6.753E-02
Acenaphthylene	MG/KG	1	6	3.300E-01	5.300E-02	2.363E-01	4.750E-01	3.482E-01	3.482E-01	5.552E-02
Aluminum	MG/KG	6	6	1.000E+01	1.440E+04	1.867E+04	2.790E+04	2.290E+04	2.290E+04	2.102E+03
Americium 241	PCI/G	6	6	1.911E-01	-5.000E-02	6.000E-02	3.000E-01	1.817E-01	1.817E-01	6.039E-02
Anthracene	MG/KG	4	6	3.300E-01	5.300E-02	1.703E-01	4.750E-01	3.030E-01	3.030E-01	6.585E-02
Aroclor-1254	MG/KG	3	6	1.600E-01	1.000E-01	1.235E+00	3.000E+00	2.297E+00	2.297E+00	5.270E-01
Aroclor-1260	MG/KG	4	6	1.600E-01	1.050E-01	1.385E+00	3.800E+00	2.507E+00	2.507E+00	5.569E-01
Arsenic	MG/KG	6	6	4.000E+00	4.200E+00	8.200E+00	1.510E+01	1.130E+01	1.130E+01	1.538E+00
Barium	MG/KG	6	6	5.000E-01	9.900E+01	2.332E+02	4.540E+02	3.319E+02	3.319E+02	4.900E+01
Benzo(a)anthracene	MG/KG	6	6	3.300E-01	3.000E-01	4.700E-01	7.800E-01	6.153E-01	6.153E-01	7.211E-02
Benzo(a)pyrene	MG/KG	6	6	3.300E-01	3.400E-01	4.633E-01	7.100E-01	5.702E-01	5.702E-01	5.302E-02
Benzo(b)fluoranthene	MG/KG	6	6	3.300E-01	5.500E-01	9.983E-01	1.700E+00	1.351E+00	1.351E+00	1.750E-01
Benzo(g,h,i)perylene	MG/KG	1	6	3.300E-01	2.050E-01	2.808E-01	4.750E-01	3.663E-01	3.663E-01	4.241E-02
Benzo(k)fluoranthene	MG/KG	6	6	3.300E-01	1.700E-01	8.617E-01	1.700E+00	1.349E+00	1.349E+00	2.420E-01
Beryllium	MG/KG	2	6	2.000E-01	5.000E-01	1.108E+00	2.200E+00	1.745E+00	1.745E+00	3.158E-01
Bis(2-ethylhexyl)phthalate	MG/KG	4	6	3.300E-01	7.900E-02	2.113E-01	4.750E-01	3.307E-01	3.307E-01	5.923E-02
Cadmium	MG/KG	6	6	1.000E+00	1.800E+00	1.372E+01	4.130E+01	2.517E+01	2.517E+01	5.686E+00
Cesium 137+D	PCI/G	6	6	3.786E-02	4.500E-01	1.348E+00	1.890E+00	1.786E+00	1.786E+00	2.170E-01
Chromium (III)	MG/KG	6	6	1.000E+00	3.700E+01	8.260E+01	1.120E+02	1.053E+02	1.053E+02	1.128E+01
Chrysene	MG/KG	6	6	3.300E-01	3.600E-01	5.267E-01	8.600E-01	6.895E-01	6.895E-01	8.082E-02
Cobalt	MG/KG	6	6	1.000E+00	1.350E+01	1.555E+01	1.840E+01	1.700E+01	1.700E+01	7.196E-01
Cobalt 60	PCI/G	6	6	1.518E-02	-1.000E-02	2.167E-02	5.000E-02	4.275E-02	4.275E-02	1.046E-02
Copper	MG/KG	6	6	1.000E+00	4.490E+01	1.815E+02	3.610E+02	2.684E+02	2.684E+02	4.314E+01
Cyanide	MG/KG	3	6	6.000E-01	3.150E-01	3.493E+00	1.710E+01	9.006E+00	9.006E+00	2.736E+00
Di-n-butyl phthalate	MG/KG	2	6	3.300E-01	5.100E-02	2.093E-01	4.750E-01	3.314E-01	3.314E-01	6.057E-02
Fluoranthene	MG/KG	6	6	3.300E-01	6.200E-01	9.733E-01	1.700E+00	1.314E+00	1.314E+00	1.690E-01
Indeno(1,2,3-cd)pyrene	MG/KG	2	6	3.300E-01	4.900E-02	2.498E-01	4.750E-01	3.631E-01	3.631E-01	5.620E-02
Lead	MG/KG	6	6	5.000E-01	6.100E+01	1.150E+02	1.550E+02	1.430E+02	1.430E+02	1.392E+01
Manganese	MG/KG	6	6	5.000E-01	1.050E+03	1.270E+03	1.740E+03	1.481E+03	1.481E+03	1.046E+02
Mercury	MG/KG	5	6	1.000E-01	6.000E-02	3.249E+02	1.010E+03	6.287E+02	6.287E+02	1.507E+02
Naphthalene	MG/KG	2	6	3.300E-01	5.300E-02	2.087E-01	4.750E-01	3.312E-01	3.312E-01	6.080E-02
Neptunium 237+D	PCI/G	6	6	4.140E-02	-6.000E-02	1.833E-02	7.000E-02	5.810E-02	5.810E-02	1.973E-02
Nickel	MG/KG	6	6	1.000E+01	2.410E+01	8.890E+01	1.740E+02	1.296E+02	1.296E+02	2.020E+01
Phenanthrene	MG/KG	6	6	3.300E-01	2.200E-01	4.200E-01	6.900E-01	5.723E-01	5.723E-01	7.559E-02
Pyrene	MG/KG	6	6	3.300E-01	4.900E-01	8.050E-01	1.400E+00	1.102E+00	1.102E+00	1.476E-01
Silver	MG/KG	5	6	1.000E+00	8.500E-01	1.386E+01	2.970E+01	2.172E+01	2.172E+01	3.902E+00
Uranium 234	PCI/G	2	2	2.221E-01	1.226E+01	1.495E+01	1.764E+01	3.193E+01	1.764E+01	2.690E+00
Uranium 235+D	PCI/G	2	2	4.924E-02	4.500E-01	7.050E-01	9.600E-01	2.315E+00	9.600E-01	2.550E-01
Uranium 238+D	PCI/G	2	2	1.904E-01	8.780E+00	1.101E+01	1.324E+01	2.509E+01	1.324E+01	2.230E+00
Vanadium	MG/KG	6	6	1.000E+00	2.790E+01	3.352E+01	4.490E+01	3.880E+01	3.880E+01	2.623E+00
Zinc	MG/KG	6	6	1.000E+00	7.290E+01	1.840E+02	2.620E+02	2.408E+02	2.408E+02	2.819E+01

Table L.87. EFPC Phase 1A chemical and radionuclide results: soil – NOAA Site

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2–Methylnaphthalene	MG/KG	2	6	3.300E–01	1.600E–01	2.725E–01	5.000E–01	3.759E–01	3.759E–01	5.133E–02
Acenaphthene	MG/KG	2	6	3.300E–01	9.900E–02	4.623E–01	1.700E+00	9.649E–01	9.649E–01	2.494E–01
Acenaphthylene	MG/KG	1	6	3.300E–01	6.900E–02	2.482E–01	3.950E–01	3.421E–01	3.421E–01	4.663E–02
Aluminum	MG/KG	6	6	1.000E+01	6.640E+03	1.318E+04	1.970E+04	1.768E+04	1.768E+04	2.230E+03
Americium 241	PCI/G	6	6	1.222E–01	–9.000E–02	–1.167E–02	6.000E–02	3.352E–02	3.352E–02	2.242E–02
Anthracene	MG/KG	3	6	3.300E–01	6.300E–02	5.005E–01	2.000E+00	1.109E+00	1.109E+00	3.020E–01
Aroclor–1260	MG/KG	4	6	1.600E–01	1.000E–01	7.717E–01	2.800E+00	1.623E+00	1.623E+00	4.225E–01
Arsenic	MG/KG	5	5	4.000E+00	1.100E+00	5.980E+00	9.300E+00	9.632E+00	9.300E+00	1.713E+00
Barium	MG/KG	6	6	5.000E–01	3.600E+01	1.248E+02	2.400E+02	1.907E+02	1.907E+02	3.271E+01
Benzo(a)anthracene	MG/KG	4	6	3.300E–01	2.050E–01	9.058E–01	3.400E+00	1.927E+00	1.927E+00	5.067E–01
Benzo(a)pyrene	MG/KG	4	6	3.300E–01	2.050E–01	7.958E–01	2.700E+00	1.581E+00	1.581E+00	3.897E–01
Benzo(b)fluoranthene	MG/KG	4	6	3.300E–01	2.050E–01	1.222E+00	3.900E+00	2.363E+00	2.363E+00	5.661E–01
Benzo(g,h,i)perylene	MG/KG	4	6	3.300E–01	2.050E–01	5.408E–01	1.800E+00	1.053E+00	1.053E+00	2.544E–01
Benzo(k)fluoranthene	MG/KG	4	6	3.300E–01	2.050E–01	7.392E–01	1.300E+00	1.124E+00	1.124E+00	1.908E–01
Beryllium	MG/KG	3	6	2.000E–01	1.250E–01	6.558E–01	1.300E+00	1.082E+00	1.082E+00	2.113E–01
Bis(2–ethylhexyl)phthalate	MG/KG	2	6	3.300E–01	6.700E–02	2.003E–01	3.350E–01	2.723E–01	2.723E–01	3.571E–02
Butyl benzyl phthalate	MG/KG	1	6	3.300E–01	8.200E–02	2.220E–01	3.350E–01	2.914E–01	2.914E–01	3.446E–02
Cadmium	MG/KG	4	6	1.000E+00	3.650E–01	4.307E+00	1.170E+01	7.721E+00	7.721E+00	1.694E+00
Cesium 137+D	PCI/G	6	6	2.640E–02	1.300E–01	7.533E–01	1.710E+00	1.320E+00	1.320E+00	2.814E–01
Chromium (III)	MG/KG	6	6	1.000E+00	9.400E+00	4.315E+01	9.870E+01	7.170E+01	7.170E+01	1.417E+01
Chrysene	MG/KG	4	6	3.300E–01	2.050E–01	8.558E–01	3.100E+00	1.776E+00	1.776E+00	4.566E–01
Cobalt	MG/KG	6	6	1.000E+00	1.800E+00	1.203E+01	2.570E+01	1.931E+01	1.931E+01	3.612E+00
Cobalt 60	PCI/G	6	6	1.118E–02	0.000E+00	6.667E–03	2.000E–02	1.338E–02	1.338E–02	3.333E–03
Copper	MG/KG	6	6	1.000E+00	4.100E+00	8.427E+01	1.350E+02	1.354E+02	1.350E+02	2.539E+01
Cyanide	MG/KG	3	6	6.000E–01	3.000E–01	6.417E–01	1.300E+00	9.485E–01	9.485E–01	1.523E–01
Dibenzofuran	MG/KG	2	6	3.300E–01	6.000E–02	2.892E–01	7.000E–01	4.697E–01	4.697E–01	8.960E–02
Dibenzo(a,h)anthracene	MG/KG	2	6	3.300E–01	6.600E–02	2.802E–01	6.400E–01	4.414E–01	4.414E–01	7.999E–02
Fluoranthene	MG/KG	4	6	3.300E–01	2.050E–01	2.007E+00	8.200E+00	4.542E+00	4.542E+00	1.258E+00
Fluorene	MG/KG	2	6	3.300E–01	8.700E–02	3.770E–01	1.200E+00	7.149E–01	7.149E–01	1.677E–01
Indeno(1,2,3–cd)pyrene	MG/KG	4	6	3.300E–01	2.050E–01	5.325E–01	1.800E+00	1.048E+00	1.048E+00	2.560E–01
Lead	MG/KG	6	6	5.000E–01	1.180E+01	3.602E+01	6.200E+01	5.181E+01	5.181E+01	7.838E+00
Manganese	MG/KG	6	6	5.000E–01	2.560E+01	5.113E+02	9.470E+02	8.509E+02	8.509E+02	1.686E+02
Mercury	MG/KG	6	6	1.000E–01	6.300E–01	1.873E+02	8.030E+02	4.432E+02	4.432E+02	1.270E+02
Naphthalene	MG/KG	2	6	3.300E–01	1.100E–01	4.808E–01	1.800E+00	1.016E+00	1.016E+00	2.654E–01
Neptunium 237+D	PCI/G	4	4	3.717E–02	–3.000E–02	–2.500E–03	2.000E–02	2.176E–02	2.000E–02	1.031E–02
Nickel	MG/KG	6	6	1.000E+01	3.700E+00	3.923E+01	7.620E+01	6.514E+01	6.514E+01	1.286E+01
Phenanthrene	MG/KG	4	6	3.300E–01	2.050E–01	1.638E+00	7.800E+00	4.131E+00	4.131E+00	1.237E+00
Pyrene	MG/KG	4	6	3.300E–01	2.050E–01	1.609E+00	6.500E+00	3.608E+00	3.608E+00	9.920E–01
Silver	MG/KG	4	6	1.000E+00	8.500E–01	4.133E+00	1.120E+01	7.376E+00	7.376E+00	1.609E+00
Uranium 234	PCI/G	5	5	1.397E–01	3.100E–01	1.297E+01	2.684E+01	2.208E+01	2.208E+01	4.273E+00
Uranium 235+D	PCI/G	5	5	3.187E–02	1.000E–02	6.420E–01	1.250E+00	1.108E+00	1.108E+00	2.184E–01
Uranium 238+D	PCI/G	5	5	1.317E–01	2.100E–01	1.134E+01	2.261E+01	1.942E+01	1.942E+01	3.790E+00
Vanadium	MG/KG	6	6	1.000E+00	1.350E+01	2.350E+01	3.080E+01	2.957E+01	2.957E+01	3.014E+00
Zinc	MG/KG	3	6	1.000E+00	1.410E+01	5.964E+01	1.170E+02	9.343E+01	9.343E+01	1.677E+01

Table L.88. EFPC Phase 1A chemical and radionuclide results: soil – Sturm Site

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2-Methylnaphthalene	MG/KG	2	4	3.300E-01	4.500E-02	1.275E-01	2.150E-01	2.333E-01	2.150E-01	4.498E-02
Acenaphthylene	MG/KG	1	4	3.300E-01	9.000E-02	1.787E-01	2.150E-01	2.492E-01	2.150E-01	2.996E-02
Aluminum	MG/KG	6	6	1.000E+01	1.300E+04	1.453E+04	1.620E+04	1.562E+04	1.562E+04	5.383E+02
Americium 241	PCI/G	6	6	1.076E-01	-1.000E-01	4.667E-02	3.200E-01	1.665E-01	1.665E-01	5.948E-02
Anthracene	MG/KG	2	4	3.300E-01	1.100E-01	1.800E-01	2.150E-01	2.358E-01	2.150E-01	2.372E-02
Aroclor-1260	MG/KG	2	4	1.600E-01	9.500E-02	2.200E-01	3.700E-01	3.856E-01	3.700E-01	7.039E-02
Arsenic	MG/KG	6	6	4.000E+00	3.400E+00	5.567E+00	9.700E+00	7.366E+00	7.366E+00	8.928E-01
Barium	MG/KG	6	6	5.000E-01	7.470E+01	1.043E+02	1.300E+02	1.195E+02	1.195E+02	7.525E+00
Benzoic Acid	MG/KG	2	4	1.600E+00	4.500E-02	5.613E-01	1.050E+00	1.226E+00	1.050E+00	2.824E-01
Benzo(a)anthracene	MG/KG	4	4	3.300E-01	1.200E-01	4.575E-01	8.200E-01	8.855E-01	8.200E-01	1.819E-01
Benzo(a)pyrene	MG/KG	4	4	3.300E-01	1.400E-01	4.975E-01	9.400E-01	9.621E-01	9.400E-01	1.974E-01
Benzo(b)fluoranthene	MG/KG	4	4	3.300E-01	2.900E-01	9.800E-01	1.800E+00	1.902E+00	1.800E+00	3.917E-01
Benzo(g,h,i)perylene	MG/KG	4	4	3.300E-01	1.000E-01	4.100E-01	7.300E-01	7.994E-01	7.300E-01	1.655E-01
Benzo(k)fluoranthene	MG/KG	4	4	3.300E-01	2.900E-01	9.800E-01	1.800E+00	1.902E+00	1.800E+00	3.917E-01
Bis(2-ethylhexyl)phthalate	MG/KG	2	4	3.300E-01	1.200E-01	1.700E-01	2.150E-01	2.206E-01	2.150E-01	2.151E-02
Cadmium	MG/KG	5	6	1.000E+00	4.000E-01	4.267E+00	8.400E+00	7.014E+00	7.014E+00	1.363E+00
Cesium 137+D	PCI/G	6	6	2.279E-02	2.400E-01	7.167E-01	1.200E+00	9.878E-01	9.878E-01	1.346E-01
Chromium (III)	MG/KG	6	6	1.000E+00	1.770E+01	3.743E+01	6.200E+01	4.945E+01	4.945E+01	5.965E+00
Chrysene	MG/KG	4	4	3.300E-01	1.600E-01	5.925E-01	1.100E+00	1.172E+00	1.100E+00	2.464E-01
Cobalt	MG/KG	5	6	1.000E+00	4.300E+00	1.315E+01	1.610E+01	1.682E+01	1.610E+01	1.824E+00
Cobalt 60	PCI/G	6	6	1.027E-02	-3.000E-02	2.891E-19	2.000E-02	1.472E-02	1.472E-02	7.303E-03
Copper	MG/KG	6	6	1.000E+00	1.720E+01	8.790E+01	2.200E+02	1.474E+02	1.474E+02	2.951E+01
Cyanide	MG/KG	1	6	6.000E-01	3.000E-01	1.069E+01	6.260E+01	3.161E+01	3.161E+01	1.038E+01
Dibenzo(a,h)anthracene	MG/KG	2	4	3.300E-01	1.800E-01	1.925E-01	2.150E-01	2.120E-01	2.120E-01	8.292E-03
Di-n-butyl phthalate	MG/KG	1	4	3.300E-01	2.800E-02	8.388E-02	1.950E-01	1.736E-01	1.736E-01	3.811E-02
Fluoranthene	MG/KG	4	4	3.300E-01	2.600E-01	1.067E+00	2.100E+00	2.158E+00	2.100E+00	4.633E-01
Fluorene	MG/KG	1	4	3.300E-01	5.300E-02	1.695E-01	2.150E-01	2.616E-01	2.150E-01	3.912E-02
Indeno(1,2,3-cd)pyrene	MG/KG	4	4	3.300E-01	8.300E-02	3.582E-01	6.400E-01	7.023E-01	6.400E-01	1.462E-01
Lead	MG/KG	6	6	5.000E-01	2.620E+01	5.883E+01	7.220E+01	7.358E+01	7.220E+01	7.316E+00
Manganese	MG/KG	6	6	5.000E-01	6.020E+02	1.054E+03	1.300E+03	1.248E+03	1.248E+03	9.649E+01
Mercury	MG/KG	6	6	1.000E-01	3.160E+01	7.093E+01	1.180E+02	9.453E+01	9.453E+01	1.171E+01
Neptunium 237+D	PCI/G	6	6	2.421E-02	-7.000E-02	2.167E-02	6.000E-02	6.244E-02	6.000E-02	2.023E-02
Nickel	MG/KG	6	6	1.000E+01	1.340E+01	3.598E+01	6.210E+01	5.054E+01	5.054E+01	7.225E+00
Phenanthrene	MG/KG	4	4	3.300E-01	1.100E-01	4.200E-01	8.000E-01	8.349E-01	8.000E-01	1.763E-01
Pyrene	MG/KG	4	4	3.300E-01	2.300E-01	8.250E-01	1.500E+00	1.612E+00	1.500E+00	3.346E-01
Silver	MG/KG	4	6	1.000E+00	8.000E-01	3.867E+00	9.100E+00	6.476E+00	6.476E+00	1.295E+00
Uranium 234	PCI/G	5	5	9.708E-02	2.840E+00	7.538E+00	1.461E+01	1.194E+01	1.194E+01	2.066E+00
Uranium 235+D	PCI/G	5	5	2.020E-02	1.700E-01	2.920E-01	4.400E-01	3.909E-01	3.909E-01	4.641E-02
Uranium 238+D	PCI/G	5	5	8.104E-02	1.920E+00	5.016E+00	8.240E+00	7.591E+00	7.591E+00	1.208E+00
Vanadium	MG/KG	6	6	1.000E+00	2.110E+01	2.773E+01	3.120E+01	3.100E+01	3.100E+01	1.621E+00
Zinc	MG/KG	6	6	1.000E+00	4.850E+01	1.069E+02	1.620E+02	1.459E+02	1.459E+02	1.936E+01

Table L.89. East Fork Poplar Creek Phase 1A and 1B results for soil: parameters sampled, but not detected in East Fork Poplar Creek

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximim Result	Measurement Units	Number of Measurements
Soil	Pesticides and PCBs	Aroclor-1016	34.0	83.19	510	UG/KG	120
		Aroclor-1221	69.0	104.75	510	UG/KG	120
		Aroclor-1232	34.0	83.19	510	UG/KG	120
		Aroclor-1242	34.0	83.19	510	UG/KG	120
		Aroclor-1248	34.0	83.19	510	UG/KG	120
		Toxaphene	180.0	239.30	1000	UG/KG	100
		alpha-BHC	1.8	6.79	51	UG/KG	100
		beta-BHC	1.8	6.79	51	UG/KG	100
Soil	Semivolatile Organics	1,2,4-Trichlorobenzene	340.0	469.59	1400	UG/KG	97
		1,2-Dichlorobenzene	340.0	469.59	1400	UG/KG	97
		1,3-Dichlorobenzene	340.0	469.59	1400	UG/KG	97
		1,4-Dichlorobenzene	340.0	469.59	1400	UG/KG	97
		2,2'-oxybis(1-Chloropropane)	340.0	469.59	1400	UG/KG	97
		2,4,5-Trichlorophenol	820.0	1680.10	6700	UG/KG	97
		2,4,6-Trichlorophenol	340.0	469.59	1400	UG/KG	97
		2,4-Dichlorophenol	340.0	469.59	1400	UG/KG	97
		2,4-Dimethylphenol	340.0	469.59	1400	UG/KG	97
		2,4-Dinitrophenol	820.0	1824.74	6700	UG/KG	78
		2,4-Dinitrotoluene	340.0	469.59	1400	UG/KG	97
		2,6-Dinitrotoluene	340.0	469.59	1400	UG/KG	97
		2-Chloronaphthalene	340.0	469.59	1400	UG/KG	97
		2-Chlorophenol	340.0	469.59	1400	UG/KG	97
		2-Methylphenol	340.0	469.59	1400	UG/KG	97
		2-Nitroaniline	820.0	1680.10	6700	UG/KG	97
		2-Nitrophenol	340.0	469.59	1400	UG/KG	97
		3,3'-Dichlorobenzidine	340.0	693.20	2800	UG/KG	97
		3-Nitroaniline	820.0	1680.10	6700	UG/KG	97
		4,6-Dinitro-2-methylphenol	820.0	1680.10	6700	UG/KG	97
		4-Bromophenyl-phenylether	340.0	469.59	1400	UG/KG	97
		4-Chloroaniline	340.0	469.59	1400	UG/KG	97
		4-Chlorophenyl-phenylether	340.0	469.59	1400	UG/KG	97
		4-Methylphenol	340.0	469.59	1400	UG/KG	97
		4-Nitroaniline	820.0	1680.10	6700	UG/KG	97
		Benzyl Alcohol	370.0	526.34	1400	UG/KG	41
		Dimethylphthalate	340.0	469.59	1400	UG/KG	97
		Hexachlorobenzene	340.0	469.59	1400	UG/KG	97
		Hexachlorobutadiene	340.0	469.59	1400	UG/KG	97
		Hexachlorocyclopentadiene	340.0	469.59	1400	UG/KG	97
		Hexachloroethane	340.0	469.59	1400	UG/KG	97
		Isophorone	340.0	469.59	1400	UG/KG	97
		N-Nitroso-di-n-propylamine	340.0	469.59	1400	UG/KG	97
		N-Nitrosodiphenylamine	340.0	469.59	1400	UG/KG	97
		Nitrobenzene	340.0	469.59	1400	UG/KG	97
		Phenol	340.0	469.59	1400	UG/KG	97
		bis(2-Chloroethoxy)methane	340.0	469.59	1400	UG/KG	97
		bis(2-Chloroethyl)ether	340.0	469.59	1400	UG/KG	97

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximum Result	Measurement Units	Number of Measurements
Soil	Volatile Organics	1,1,1-Trichloroethane	6.0	9.00	20	UG/KG	12
		1,1,2,2-Tetrachloroethane	6.0	9.00	20	UG/KG	12
		1,1,2-Trichloroethane	6.0	9.00	20	UG/KG	12
		1,1-Dichloroethane	6.0	9.00	20	UG/KG	12
		1,1-Dichloroethene	6.0	9.00	20	UG/KG	12
		1,2-Dichloroethane	6.0	9.00	20	UG/KG	12
		1,2-Dichloroethene	6.0	9.00	20	UG/KG	12
		1,2-Dichloropropane	6.0	9.00	20	UG/KG	12
		2-Butanone	12.0	18.17	40	UG/KG	12
		2-Hexanone	12.0	18.17	40	UG/KG	12
		4-Methyl-2-pentanone	12.0	18.17	40	UG/KG	12
		Benzene	6.0	9.00	20	UG/KG	12
		Bromodichloromethane	6.0	9.00	20	UG/KG	12
		Bromoform	6.0	9.00	20	UG/KG	12
		Bromomethane	12.0	18.17	40	UG/KG	12
		Carbon Disulfide	6.0	9.00	20	UG/KG	12
		Carbon Tetrachloride	6.0	9.00	20	UG/KG	12
		Chlorobenzene	6.0	9.00	20	UG/KG	12
		Chloroethane	12.0	18.17	40	UG/KG	12
		Chloroform	6.0	9.00	20	UG/KG	12
		Chloromethane	12.0	18.17	40	UG/KG	12
		Dibromochloromethane	6.0	9.00	20	UG/KG	12
		Ethylbenzene	6.0	9.00	20	UG/KG	12
		Methylene Chloride	10.0	37.33	110	UG/KG	12
		Styrene	6.0	9.00	20	UG/KG	12
		Tetrachloroethene	6.0	9.00	20	UG/KG	12
		Toluene	6.0	9.00	20	UG/KG	12
		Trichloroethene	6.0	9.00	20	UG/KG	12
		Vinyl Acetate	12.0	18.17	40	UG/KG	12
		Vinyl Chloride	12.0	18.17	40	UG/KG	12
		Xylene, Total	6.0	9.00	20	UG/KG	12
		cis-1,3-Dichloropropene	6.0	9.00	20	UG/KG	12
		trans-1,3-Dichloropropene	6.0	9.00	20	UG/KG	12

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximim Result	Measurement Units	Number of Measurements
Sediment	Volatile Organics	1,1-Dichloroethene	0.350	0.35	0.35	MG/L	5
		1,2-Dichlorobenzene	10.000	10.00	10.00	UG/L	4
		1,2-Dichloroethane	0.250	0.25	0.25	MG/L	5
		1,4-Dichlorobenzene	10.000	10.00	10.00	UG/L	4
		2,4,5-T	25.000	25.00	25.00	UG/KG	2
		2,4,5-TP	25.000	25.00	25.00	UG/KG	2
		2,4-D	100.000	100.00	100.00	UG/KG	2
		2,4-Dinitrotoluene	10.000	10.00	10.00	UG/L	4
		2-Butanone	100.000	100.00	100.00	MG/L	5
		Arsenic	2.500	2.50	2.50	MG/L	5
		Barium	50.000	50.00	50.00	MG/L	5
		Benzene	0.250	0.25	0.25	MG/L	5
		Cadmium	0.500	0.50	0.50	MG/L	5
		Carbon Tetrachloride	0.250	0.25	0.25	MG/L	5
		Chlordane	0.015	0.02	0.02	MG/L	5
		Chlorobenzene	50.000	50.00	50.00	MG/L	5
		Chloroform	3.000	3.00	3.00	MG/L	5
		Chromium	2.500	2.50	2.50	MG/L	5
		Endrin	0.010	0.01	0.01	MG/L	5
		Heptachlor	0.004	0.00	0.00	MG/L	5
		Heptachlor Epoxide	0.004	0.00	0.00	MG/L	5
		Hexachlorobenzene	10.000	10.00	10.00	UG/L	4
		Hexachlorobutadiene	10.000	10.00	10.00	UG/L	4
		Hexachloroethane	10.000	10.00	10.00	UG/L	4
		Lead	2.500	2.50	2.50	MG/L	5
		Mercury	0.100	0.10	0.10	MG/L	5
		Nitrobenzene	10.000	10.00	10.00	UG/L	4
		Pyridine	10.000	10.00	10.00	UG/KG	1
		Pyridine	10.000	10.00	10.00	UG/L	4
		Selenium	0.500	0.50	0.50	MG/L	5
		Silver	0.500	0.50	0.50	MG/L	5
		Tetrachloroethene	0.350	0.35	0.35	MG/L	5
		Toxaphene	0.250	0.25	0.25	MG/L	5
		Trichloroethene	0.250	0.25	0.25	MG/L	5
		Vinyl Chloride	0.100	0.10	0.10	MG/L	5
		bis(2-Chloroethyl)ether	20.000	20.00	20.00	UG/L	4
		gamma-BHC (Lindane)	0.200	0.20	0.20	MG/L	5
		p,p'-Methoxychlor	5.000	5.00	5.00	MG/L	5
Sediment	Inorganic Compounds	Antimony	6.800	9.94	16.40	MG/KG	51
		Silver	0.900	1.85	3.00	MG/KG	57
		Thallium	0.670	0.81	1.10	MG/KG	57
Sediment	Pesticides and PCBs	Aroclor-1016	39.000	102.86	1100.00	UG/KG	56
		Aroclor-1221	79.000	124.61	1100.00	UG/KG	56
		Aroclor-1232	39.000	102.86	1100.00	UG/KG	56
		Aroclor-1242	39.000	102.86	1100.00	UG/KG	56
		Aroclor-1248	39.000	102.86	1100.00	UG/KG	56
		Endrin Ketone	3.900	18.50	220.00	UG/KG	56
		Toxaphene	200.000	272.32	2200.00	UG/KG	56
		p,p'-Methoxychlor	2.000	92.27	1100.00	UG/KG	56

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximim Result	Measurement Units	Number of Measurements
Sediment	Radionuclides	Americium-241	-0.210	-0.03	0.20	PCI/G	30
Sediment	Semivolatile Organics	1,2,4-Trichlorobenzene	390.000	452.55	900.00	UG/KG	55
		1,2-Dichlorobenzene	10.000	444.64	900.00	UG/KG	56
		1,3-Dichlorobenzene	390.000	452.55	900.00	UG/KG	55
		1,4-Dichlorobenzene	10.000	444.64	900.00	UG/KG	56
		2,2'-oxybis(1-Chloropropane)	390.000	452.55	900.00	UG/KG	55
		2,4,5-Trichlorophenol	940.000	1673.82	4400.00	UG/KG	55
		2,4,6-Trichlorophenol	390.000	452.55	900.00	UG/KG	55
		2,4-Dichlorophenol	390.000	452.55	900.00	UG/KG	55
		2,4-Dimethylphenol	390.000	452.55	900.00	UG/KG	55
		2,4-Dinitrophenol	990.000	1855.58	4400.00	UG/KG	43
		2,4-Dinitrotoluene	10.000	444.64	900.00	UG/KG	56
		2,6-Dinitrotoluene	390.000	452.55	900.00	UG/KG	55
		2-Chloronaphthalene	390.000	452.55	900.00	UG/KG	55
		2-Chlorophenol	390.000	452.55	900.00	UG/KG	55
		2-Methylnaphthalene	46.000	445.56	900.00	UG/KG	55
		2-Methylphenol	390.000	452.55	900.00	UG/KG	55
		2-Nitroaniline	940.000	1673.82	4400.00	UG/KG	55
		2-Nitrophenol	390.000	452.55	900.00	UG/KG	55
		3,3'-Dichlorobenzidine	390.000	691.09	1800.00	UG/KG	55
		3-Nitroaniline	940.000	1673.82	4400.00	UG/KG	55
		4,6-Dinitro-2-methylphenol	940.000	1673.82	4400.00	UG/KG	55
		4-Bromophenyl-phenylether	390.000	452.55	900.00	UG/KG	55
		4-Chloro-3-methylphenol	390.000	452.55	900.00	UG/KG	55
		4-Chloroaniline	390.000	452.55	900.00	UG/KG	55
		4-Chlorophenyl-phenylether	390.000	452.55	900.00	UG/KG	55
		4-Methylphenol	390.000	452.55	900.00	UG/KG	55
		4-Nitroaniline	940.000	1673.82	4400.00	UG/KG	55
		4-Nitrophenol	940.000	1673.82	4400.00	UG/KG	55
		Benzyl Alcohol	400.000	469.64	900.00	UG/KG	28
		Hexachlorobenzene	10.000	444.64	900.00	UG/KG	56
		Hexachlorobutadiene	10.000	444.64	900.00	UG/KG	56
		Hexachlorocyclopentadiene	390.000	452.55	900.00	UG/KG	55
		Hexachloroethane	10.000	444.64	900.00	UG/KG	56
		Isophorone	390.000	452.55	900.00	UG/KG	55
		N-Nitroso-di-n-propylamine	390.000	452.55	900.00	UG/KG	55
		N-Nitrosodiphenylamine	390.000	452.55	900.00	UG/KG	55
		Nitrobenzene	10.000	444.64	900.00	UG/KG	56
		Pentachlorophenol	940.000	1673.82	4400.00	UG/KG	55
		Phenol	390.000	452.55	900.00	UG/KG	55
		bis(2-Chloroethoxy)methane	390.000	452.55	900.00	UG/KG	55
		bis(2-Chloroethyl)ether	20.000	444.82	900.00	UG/KG	56

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result
Disturbed Water	Inorganic Compounds	Antimony	44.00
		Beryllium	2.00
		Cadmium	5.00
		Lead	3.30
		Nickel	30.00
		Selenium	4.00
		Silver	10.00
		Thallium	3.00

Media	Contaminant Type	Average Result	Maximim Result	Measurement Units	Number of Measurements
Disturbed Water	Inorganic Compounds	44.00	44.00	UG/L	5
		2.00	2.00	UG/L	5
		5.00	5.00	UG/L	5
		7.48	11.30	UG/L	5
		30.00	30.00	UG/L	5
		4.00	4.00	UG/L	5
		10.00	10.00	UG/L	5
		3.00	3.00	UG/L	5

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result
Disturbed Water	Pesticides and PCBs	4,4'-DDD	0.10
		4,4'-DDE	0.10
		4,4'-DDT	0.10
		Aldrin	0.05
		Aroclor-1016	1.00
		Aroclor-1221	2.00
		Aroclor-1232	1.00
		Aroclor-1242	1.00
		Aroclor-1248	1.00
		Aroclor-1254	1.00
		Aroclor-1260	1.00
		Endosulfan I	0.05
		Endosulfan II	0.10
		Endosulfan sulfate	0.10
		Endrin aldehyde	0.10
		Endrin ketone	0.10
		Heptachlor	0.05
		Heptachlor epoxide	0.05
		Toxaphene	5.00
		alpha-BHC	0.05
		alpha-Chlordane	0.05
		beta-BHC	0.05
		delta-BHC	0.05
		gamma-BHC	0.05
		gamma-Chlordane	0.05

Media	Contaminant Type	Average Result	Maximim Result	Measurement Units	Number of Measurements
Disturbed Water	Pesticides and PCBs	0.10	0.10	UG/L	5
		0.10	0.10	UG/L	5
		0.10	0.10	UG/L	5
		0.05	0.05	UG/L	5
		1.00	1.00	UG/L	5
		2.00	2.00	UG/L	5
		1.00	1.00	UG/L	5
		1.00	1.00	UG/L	5
		1.00	1.00	UG/L	5
		1.00	1.00	UG/L	5
		1.00	1.00	UG/L	5
		0.05	0.05	UG/L	5
		0.10	0.10	UG/L	5
		0.10	0.10	UG/L	5
		0.10	0.10	UG/L	5
		0.10	0.10	UG/L	5
		0.05	0.05	UG/L	5
		0.05	0.05	UG/L	5
		5.00	5.00	UG/L	5
		0.05	0.05	UG/L	5
		0.05	0.05	UG/L	5
		0.05	0.05	UG/L	5
		0.05	0.05	UG/L	5
		0.05	0.05	UG/L	5
		0.05	0.05	UG/L	5

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result
Disturbed Water	Pesticides and PCBs	p,p'-Methoxychlor	0.50

Media	Contaminant Type	Average Result	Maximim Result	Measurement Units	Number of Measurements
Disturbed Water	Pesticides and PCBs	0.50	0.50	UG/L	5

Disturbed Water	Semivolatile Organics	1,2,4-Trichlorobenzene	10.00
		1,2-Dichlorobenzene	10.00
		1,3-Dichlorobenzene	10.00
		1,4-Dichlorobenzene	10.00
		2,2'-Oxybis(1-Chloropropane)	10.00
		2,4,5-Trichlorophenol	25.00
		2,4,6-Trichlorophenol	10.00
		2,4-Dichlorophenol	10.00
		2,4-Dimethylphenol	10.00
		2,4-Dinitrophenol	25.00
		2,4-Dinitrotoluene	10.00
		2,6-Dinitrotoluene	10.00
		2-Chloronaphthalene	10.00
		2-Chlorophenol	10.00
		2-Methylnaphthalene	10.00
		2-Methylphenol	10.00
		2-Nitroaniline	25.00
		2-Nitrophenol	10.00
		3,3'-Dichlorobenzidine	10.00
		3-Nitroaniline	25.00
		4,6-Dinitro-2-Methylphenol	25.00

Disturbed Water	Semivolatile Organics	10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		26.20	31.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		26.20	31.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		26.20	31.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		26.20	31.00	UG/L	5
		26.20	31.00	UG/L	5

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result
Disturbed Water	Semivolatile Organics	4-Bromophenyl-phenylether	10.00
		4-Chloro-3-Methylphenol	10.00
		4-Chloroaniline	10.00
		4-Chlorophenyl-phenylether	10.00
		4-Methylphenol	10.00
		4-Nitroaniline	25.00
		4-Nitrophenol	25.00
		Acenaphthene	10.00
		Acenaphthylene	10.00
		Anthracene	10.00
		Benzo(a)Anthracene	10.00
		Benzo(a)Pyrene	10.00
		Benzo(b)Fluoranthene	10.00
		Benzo(g,h,i)Perylene	10.00
		Benzo(k)Fluoranthene	10.00
		Butylbenzylphthalate	10.00
		Carbazole	10.00
		Chrysene	10.00
		Di-n-Butylphthalate	10.00
		Di-n-Octyl Phthalate	10.00
		Dibenzo(a,h)Anthracene	10.00
		Dibenzofuran	10.00
		Diethylphthalate	10.00
		Dimethyl Phthalate	10.00
		Fluorene	10.00

Media	Contaminant Type	Average Result	Maximim Result	Measurement Units	Number of Measurements
Disturbed Water	Semivolatile Organics	10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		26.20	31.00	UG/L	5
		26.20	31.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result
Disturbed Water	Semivolatile Organics	Hexachlorobenzene	10.00
		Hexachlorobutadiene	10.00
		Hexachlorocyclopentadiene	10.00
		Hexachloroethane	10.00
		Indeno(1,2,3-cd)Pyrene	10.00
		Isophorone	10.00
		N-Nitroso-Di-n-Propylamine	10.00
		N-Nitrosodiphenylamine	10.00
		Naphthalene	10.00
		Nitrobenzene	10.00
		Pentachlorophenol	25.00
		Phenanthrene	10.00
		Phenol	10.00
		Pyrene	10.00
		bis(2-Chloroethoxy)Methane	10.00
		bis(2-Chloroethyl)Ether	10.00

Media	Contaminant Type	Average Result	Maximim Result	Measurement Units	Number of Measurements
Disturbed Water	Semivolatile Organics	10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		26.20	31.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5
		10.40	12.00	UG/L	5

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximum Result	Measurement Units	Number of Measurements
Baseflow	Inorganic Compounds	Antimony	28.00	31.8261	36.00	UG/L	23
		Arsenic	3.00	3.9565	5.00	UG/L	23
		Beryllium	1.00	1.0000	1.00	UG/L	23
		Cadmium	4.00	4.4783	5.00	UG/L	23
		Chromium	4.00	4.5217	5.00	UG/L	23
		Cobalt	5.00	6.0435	7.00	UG/L	23
		Lead	2.00	2.9450	8.30	UG/L	20
		Nickel	8.00	9.5652	11.00	UG/L	23
		Selenium	3.00	3.0000	3.00	UG/L	23
		Silver	4.00	4.9565	6.00	UG/L	23
		Thallium	2.00	2.5217	3.00	UG/L	23
		Vanadium	4.00	4.9565	6.00	UG/L	23
Baseflow	Pesticides and PCBs	4,4'-DDE	0.10	0.1000	0.10	UG/L	14
		Aroclor-1016	0.50	0.8929	1.00	UG/L	14
		Aroclor-1221	0.50	1.6786	2.00	UG/L	14
		Aroclor-1232	0.50	0.8929	1.00	UG/L	14
		Aroclor-1242	0.50	0.8929	1.00	UG/L	14
		Aroclor-1248	0.50	0.8929	1.00	UG/L	14
		Aroclor-1254	1.00	1.0000	1.00	UG/L	14
		Aroclor-1260	1.00	1.0000	1.00	UG/L	14
		Endrin aldehyde	0.10	0.1000	0.10	UG/L	11
		Endrin ketone	0.10	0.1000	0.10	UG/L	14
		Heptachlor	0.05	0.0500	0.05	UG/L	14
		Toxaphene	1.00	4.1429	5.00	UG/L	14
		alpha-BHC	0.05	0.0500	0.05	UG/L	14
		alpha-Chlordane	0.05	0.1464	0.50	UG/L	14
		beta-BHC	0.05	0.0500	0.05	UG/L	14
		delta-BHC	0.05	0.0500	0.05	UG/L	14
		gamma-Chlordane	0.05	0.1464	0.50	UG/L	14
		p,p'-Methoxychlor	0.50	0.5000	0.50	UG/L	14
Baseflow	Radionuclides	Americium-241	-58.60	-5.2704	58.60	PCI/L	23

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximum Result	Measurement Units	Number of Measurements
Baseflow	Semivolatile Organics	1,2,4-Trichlorobenzene	10.00	10.0455	11.00	UG/L	22
		1,2-Dichlorobenzene	10.00	10.0455	11.00	UG/L	22
		1,3-Dichlorobenzene	10.00	10.0455	11.00	UG/L	22
		1,4-Dichlorobenzene	10.00	10.0455	11.00	UG/L	22
		2,2'-oxybis(1-Chloropropane)	10.00	10.0455	11.00	UG/L	22
		2,4,5-Trichlorophenol	25.00	37.7727	56.00	UG/L	22
		2,4,6-Trichlorophenol	10.00	10.0455	11.00	UG/L	22
		2,4-Dichlorophenol	10.00	10.0455	11.00	UG/L	22
		2,4-Dimethylphenol	10.00	10.0455	11.00	UG/L	22
		2,4-Dinitrophenol	25.00	37.7727	56.00	UG/L	22
		2,4-Dinitrotoluene	10.00	10.0455	11.00	UG/L	22
		2,6-Dinitrotoluene	10.00	10.0455	11.00	UG/L	22
		2-Chloronaphthalene	10.00	10.0455	11.00	UG/L	22
		2-Chlorophenol	10.00	10.0455	11.00	UG/L	22
		2-Methylnaphthalene	10.00	10.0455	11.00	UG/L	22
		2-Methylphenol	10.00	10.0455	11.00	UG/L	22
		2-Nitroaniline	25.00	37.7727	56.00	UG/L	22
		2-Nitrophenol	10.00	10.0455	11.00	UG/L	22
		3,3'-Dichlorobenzidine	10.00	15.0909	22.00	UG/L	22
		3-Nitroaniline	25.00	37.7727	56.00	UG/L	22
		4,6-Dinitro-2-methylphenol	25.00	37.7727	56.00	UG/L	22
		4-Bromophenyl-phenylether	10.00	10.0455	11.00	UG/L	22
		4-Chloro-3-methylphenol	10.00	10.0455	11.00	UG/L	22
		4-Chloroaniline	10.00	10.0455	11.00	UG/L	22
		4-Chlorophenyl-phenylether	10.00	10.0455	11.00	UG/L	22
		4-Methylphenol	10.00	10.0455	11.00	UG/L	22
		4-Nitroaniline	25.00	37.7727	56.00	UG/L	22
		4-Nitrophenol	25.00	37.7727	56.00	UG/L	22
		Acenaphthene	10.00	10.0455	11.00	UG/L	22
		Acenaphthylene	10.00	10.0455	11.00	UG/L	22
		Anthracene	10.00	10.0455	11.00	UG/L	22
		Benzo(a)anthracene	10.00	10.0455	11.00	UG/L	22
		Benzo(a)pyrene	10.00	10.0455	11.00	UG/L	22
		Benzo(b)fluoranthene	10.00	10.0455	11.00	UG/L	22
		Benzo(g,h,i)perylene	10.00	10.0455	11.00	UG/L	22
		Benzo(k)fluoranthene	10.00	10.0455	11.00	UG/L	22
		Benzoic acid	50.00	50.5455	56.00	UG/L	11
		Benzyl alcohol	10.00	10.0909	11.00	UG/L	11
		Butylbenzylphthalate	10.00	10.0455	11.00	UG/L	22
		Carbazole	10.00	10.0000	10.00	UG/L	11
		Chrysene	10.00	10.0455	11.00	UG/L	22
		Di-n-butylphthalate	10.00	10.0455	11.00	UG/L	22
		Di-n-octylphthalate	10.00	10.0455	11.00	UG/L	22
		Dibenz(a,h)anthracene	10.00	10.0455	11.00	UG/L	22
		Dibenzofuran	10.00	10.0455	11.00	UG/L	22
		Dimethylphthalate	10.00	10.0455	11.00	UG/L	22
		Fluoranthene	10.00	10.0455	11.00	UG/L	22
		Fluorene	10.00	10.0455	11.00	UG/L	22
		Hexachlorobenzene	10.00	10.0455	11.00	UG/L	22
		Hexachlorobutadiene	10.00	10.0455	11.00	UG/L	22
		Hexachlorocyclopentadiene	10.00	10.0455	11.00	UG/L	22
		Hexachloroethane	10.00	10.0455	11.00	UG/L	22
		Indeno(1,2,3-cd)pyrene	10.00	10.0455	11.00	UG/L	22
		Isophorone	10.00	10.0455	11.00	UG/L	22
		N-Nitroso-di-n-propylamine	10.00	10.0455	11.00	UG/L	22

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximim Result	Measurement Units	Number of Measurements
Baseflow	Semivolatile Organics	N-Nitrosodiphenylamine	10.00	10.0455	11.00	UG/L	22
		Naphthalene	10.00	10.0455	11.00	UG/L	22
		Nitrobenzene	10.00	10.0455	11.00	UG/L	22
		Pentachlorophenol	25.00	37.7727	56.00	UG/L	22
		Phenanthrene	10.00	10.0455	11.00	UG/L	22
		Phenol	10.00	10.0455	11.00	UG/L	22
		Pyrene	10.00	10.0455	11.00	UG/L	22
		bis(2-Chloroethoxy) methane	10.00	10.0455	11.00	UG/L	22
		bis(2-Chloroethyl) ether	10.00	10.0455	11.00	UG/L	22
Baseflow	Volatile Organics	1,1,2,2-Tetrachloroethane	5.00	7.5000	10.00	UG/L	22
		1,1,2-Trichloroethane	5.00	7.5000	10.00	UG/L	22
		1,1-Dichloroethane	5.00	7.5000	10.00	UG/L	22
		1,1-Dichloroethene	5.00	7.5000	10.00	UG/L	22
		1,2-Dichloroethane	5.00	7.5000	10.00	UG/L	22
		1,2-Dichloroethene (total)	5.00	7.5000	10.00	UG/L	22
		1,2-Dichloropropane	5.00	7.5000	10.00	UG/L	22
		2-Butanone	10.00	10.0000	10.00	UG/L	21
		2-Hexanone	10.00	10.0000	10.00	UG/L	22
		4-Methyl-2-Pentanone	10.00	10.0000	10.00	UG/L	22
		Benzene	5.00	7.5000	10.00	UG/L	22
		Bromodichloromethane	5.00	7.5000	10.00	UG/L	22
		Bromoform	5.00	7.5000	10.00	UG/L	22
		Bromomethane	10.00	10.0000	10.00	UG/L	22
		Carbon Disulfide	5.00	7.5000	10.00	UG/L	22
		Carbon Tetrachloride	5.00	7.5000	10.00	UG/L	22
		Chlorobenzene	5.00	7.5000	10.00	UG/L	22
		Chloroethane	10.00	10.0000	10.00	UG/L	22
		Chloromethane	10.00	10.0000	10.00	UG/L	22
		Dibromochloromethane	5.00	7.5000	10.00	UG/L	22
		Ethylbenzene	5.00	7.5000	10.00	UG/L	22
		Methylene Chloride	2.00	7.6818	17.00	UG/L	22
		Styrene	5.00	7.5000	10.00	UG/L	22
		Toluene	5.00	7.5000	10.00	UG/L	22
		Vinyl Acetate	10.00	10.0000	10.00	UG/L	11
		Vinyl Chloride	10.00	10.0000	10.00	UG/L	22
		Xylene (Total)	5.00	7.5000	10.00	UG/L	22
		cis-1,3-Dichloropropene	5.00	7.5000	10.00	UG/L	22
		trans-1,3-Dichloropropene	5.00	7.5000	10.00	UG/L	22

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximum Result	Measurement Units	Number of Measurements
Groundwater	Inorganic Compounds	Selenium	3.00	5.8117	30.000	UG/L	154
		Silver	4.00	5.6084	8.000	UG/L	166
Groundwater	Pesticides and PCBs	4,4'-DDD	0.10	0.1040	0.130	UG/L	80
		4,4'-DDE	0.10	0.1040	0.130	UG/L	80
		Aldrin	0.05	0.0521	0.067	UG/L	80
		Aroclor-1016	0.50	0.7948	1.300	UG/L	80
		Aroclor-1221	0.50	1.3073	2.700	UG/L	80
		Aroclor-1232	0.50	0.8335	2.200	UG/L	80
		Aroclor-1242	0.50	0.7948	1.300	UG/L	80
		Aroclor-1248	0.50	0.7948	1.300	UG/L	80
		Aroclor-1254	1.00	1.0400	1.300	UG/L	80
		Aroclor-1260	1.00	1.0400	1.300	UG/L	80
		Dieldrin	0.10	0.1040	0.130	UG/L	80
		Endosulfan I	0.05	0.0521	0.067	UG/L	80
		Endosulfan Sulfate	0.10	0.1040	0.130	UG/L	80
		Endrin Aldehyde	0.10	0.1071	0.130	UG/L	41
		Endrin Ketone	0.10	0.1040	0.130	UG/L	80
		Heptachlor	0.05	0.0521	0.067	UG/L	80
		Toxaphene	1.00	3.2400	6.700	UG/L	80
		alpha-BHC	0.05	0.0521	0.067	UG/L	80
		beta-BHC	0.05	0.0521	0.067	UG/L	80
		delta-BHC	0.05	0.0521	0.067	UG/L	80
		gamma-Chlordane	0.05	0.2761	0.620	UG/L	80

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximum Result	Measurement Units	Number of Measurements
Groundwater	Semivolatile Organics	1,2,4-Trichlorobenzene	10.00	10.1169	17.000	UG/L	77
		1,2-Dichlorobenzene	10.00	10.1169	17.000	UG/L	77
		1,3-Dichlorobenzene	10.00	10.1169	17.000	UG/L	77
		1,4-Dichlorobenzene	10.00	10.1169	17.000	UG/L	77
		2,2'-oxybis(1-Chloropropane)	10.00	10.1169	17.000	UG/L	77
		2,4,5-Trichlorophenol	25.00	35.3913	50.000	UG/L	69
		2,4,6-Trichlorophenol	10.00	10.1014	17.000	UG/L	69
		2,4-Dichlorophenol	10.00	10.1000	17.000	UG/L	70
		2,4-Dimethylphenol	10.00	10.1014	17.000	UG/L	69
		2,4-Dinitrophenol	25.00	35.3284	50.000	UG/L	67
		2,4-Dinitrotoluene	10.00	10.1169	17.000	UG/L	77
		2,6-Dinitrotoluene	10.00	10.1169	17.000	UG/L	77
		2-Chloronaphthalene	10.00	10.1169	17.000	UG/L	77
		2-Chlorophenol	10.00	10.1014	17.000	UG/L	69
		2-Methylnaphthalene	10.00	10.1169	17.000	UG/L	77
		2-Methylphenol	10.00	10.1014	17.000	UG/L	69
		2-Nitroaniline	25.00	37.0260	59.000	UG/L	77
		2-Nitrophenol	10.00	10.1014	17.000	UG/L	69
		3,3'-Dichlorobenzidine	10.00	14.8182	24.000	UG/L	77
		3-Nitroaniline	25.00	37.0260	59.000	UG/L	77
		4,6-Dinitro-2-methylphenol	25.00	35.1765	50.000	UG/L	68
		4-Bromophenyl-phenylether	10.00	10.1169	17.000	UG/L	77
		4-Chloro-3-methylphenol	10.00	10.1014	17.000	UG/L	69
		4-Chloroaniline	10.00	10.1169	17.000	UG/L	77
		4-Chlorophenyl-phenylether	10.00	10.1169	17.000	UG/L	77
		4-Nitroaniline	25.00	37.0260	59.000	UG/L	77
		Acenaphthene	10.00	10.1169	17.000	UG/L	77
		Acenaphthylene	10.00	10.1169	17.000	UG/L	77
		Anthracene	10.00	10.1169	17.000	UG/L	77
		Benzo(g,h,i)perylene	10.00	10.1169	17.000	UG/L	77
		Benzyl Alcohol	10.00	10.0556	12.000	UG/L	36
		Carbazole	10.00	10.1707	17.000	UG/L	41
		Di-n-octylphthalate	10.00	10.1169	17.000	UG/L	77
		Dibenzo(a,h)anthracene	10.00	10.1169	17.000	UG/L	77
		Dibenzofuran	10.00	10.1169	17.000	UG/L	77
		Dimethylphthalate	10.00	10.1169	17.000	UG/L	77
		Fluorene	10.00	10.1169	17.000	UG/L	77
		Hexachlorobenzene	10.00	10.1169	17.000	UG/L	77
		Hexachlorobutadiene	10.00	10.1169	17.000	UG/L	77
		Hexachlorocyclopentadiene	10.00	10.1169	17.000	UG/L	77
		Hexachloroethane	10.00	10.1169	17.000	UG/L	77
		Indeno(1,2,3-c,d)pyrene	10.00	10.1169	17.000	UG/L	77
		Isophorone	10.00	10.1169	17.000	UG/L	77
		N-Nitroso-di-n-propylamine	10.00	10.1169	17.000	UG/L	77
		N-Nitrosodiphenylamine	10.00	10.1169	17.000	UG/L	77
		Naphthalene	10.00	10.1169	17.000	UG/L	77
		Nitrobenzene	10.00	10.1169	17.000	UG/L	77
		Phenanthrene	10.00	10.1169	17.000	UG/L	77
		Phenol	1.00	9.7391	17.000	UG/L	69
		bis(2-Chloroethoxy)methane	10.00	10.1169	17.000	UG/L	77
		bis(2-Chloroethyl)ether	10.00	10.1169	17.000	UG/L	77

Table L.89. (continued)

Media	Contaminant Type	Parameter	Minimum Result	Average Result	Maximim Result	Measurement Units	Number of Measurements
Groundwater	Volatile Organics	1,1,1-Trichloroethane	5.00	11.6000	250.000	UG/L	80
		1,1,2,2-Tetrachloroethane	5.00	11.6000	250.000	UG/L	80
		1,1,2-Trichloroethane	5.00	11.6000	250.000	UG/L	80
		1,1-Dichloroethane	5.00	11.6000	250.000	UG/L	80
		1,1-Dichloroethene	5.00	11.6000	250.000	UG/L	80
		1,2-Dichloroethane	5.00	11.6000	250.000	UG/L	80
		1,2-Dichloroethene	5.00	11.6000	250.000	UG/L	80
		1,2-Dichloropropane	5.00	11.6000	250.000	UG/L	80
		2-Hexanone	10.00	17.1750	500.000	UG/L	80
		4-Methyl-2-pentanone	10.00	17.1750	500.000	UG/L	80
		Benzene	5.00	11.6000	250.000	UG/L	80
		Bromodichloromethane	5.00	11.6000	250.000	UG/L	80
		Bromoform	5.00	11.6000	250.000	UG/L	80
		Bromomethane	10.00	17.1750	500.000	UG/L	80
		Carbon Tetrachloride	5.00	11.6000	250.000	UG/L	80
		Chlorobenzene	5.00	11.6000	250.000	UG/L	80
		Chloroethane	10.00	17.1750	500.000	UG/L	80
		Chloromethane	10.00	17.1750	500.000	UG/L	80
		Dibromochloromethane	5.00	11.6000	250.000	UG/L	80
		Ethylbenzene	5.00	11.6000	250.000	UG/L	80
		Styrene	5.00	11.6000	250.000	UG/L	80
		Toluene	5.00	11.6000	250.000	UG/L	80
		Trichloroethene	5.00	11.6000	250.000	UG/L	80
		Vinyl Acetate	10.00	22.8718	500.000	UG/L	39
		Vinyl Chloride	10.00	17.1750	500.000	UG/L	80
		cis-1,3-Dichloropropene	5.00	11.6000	250.000	UG/L	80
		trans-1,3-Dichloropropene	5.00	11.6000	250.000	UG/L	80