Y/TS-597

Y-12

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OAK RIDGE Y-12 PLANT

LOCKHEED MARTIN

RCRA FACILITY INVESTIGATION PLAN MERCURY-USE AREAS (S-127) OAK RIDGE Y-12 PLANT OAK RIDGE, TENNESSEE

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LIST OF ACRONYMNS AND ABBREVIATIONS

ADMIS	Alpha-4 Decommissioning Management Information System
ALARA	As Low as Reasonably Achievable
ARARs	Applicable or Relevant and Appropriate Requirements
BMP	Best Management Practices
°C	degrees Celsius
CDM	Camp Dresser and McKee, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CM	Corrective Measures
cm	centimeter(s)
CRSDB	Chestnut Ridge Sediment Disposal Basin
d	day
DOE	Department of Energy
DQO	Data Quality Objectives
EDM	Electronic Distance Meter
EFPC	East Fork Poplar Creek
EPA	U.S. Environmental Protection Agency
ESD	Environmental Sciences Division
ESP	Environmental Surveillance Program
ft	feet
g	gram(s)
g/d	grams per day
gpm	gallons per minute
GSA	Government Services Administration
h	hour(s)
HSEAD	Y-12 Plant, Health, Safety, Environment and Accountability Division
HASRD	ORNL Health and Safety Research Division
HSWA	Hazardous and Solid Waste Amendments of 1984

IAG	Interagency Agreement
ICP	Inductively Coupled Plasma
in.	inch(es)
kg	kilogram(s)
LEL	lower explosive limit
lbs/d	pounds per day
m	meter(s)
MCL	maximum contaminant level
mgd	million gallons per day
mg	milligram(s)
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mL	milliliter(s)
mL/min	milliliters per minute
NCP	National Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHP	New Hope Pond
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
ORGDP	Oak Ridge Gaseous Diffusion Plant
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PCB(s)	polychlorinated biphenyl(s)
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PIDAS	Perimeter Intrusion Detection Assessment System
ppm	parts per million
PSS	Plant Shift Superintendent
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control

RCRA	Resource Conservation and Recovery Act of 1976
RD/RA	Remedial Design/Remedial Action
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation and Feasibility Study
RMPE	Reduction of Mercury in Plant Effluents Project
SARA	Superfund Amendments and Reauthorization Act
SHSO	Site Health and Safety Officer
SWMU(s)	Solid Waste Management Unit(s)
TDHE	Tennessee Department of Health and Environment
TLV	threshold limit value
TSCA	Toxic Substances Control Act
TSD	treatment, storage, and disposal
UEFPC	Upper East Fork Poplar Creek
μg	microgram(s)
μg/g	micrograms per gram
μg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
USEPA	U.S. Environmental Protection Agency
V	volts
VOC	volatile organic compounds

1. INTRODUCTION

The U. S. Department of Energy (DOE) Y-12 Plant in Oak Ridge, Tennessee, operates a number of hazardous waste treatment, storage, and disposal (TSD) units that are subject to regulations promulgated under the Resource Conservation and Recovery Act of 1976 (RCRA). The 1984 Hazardous and Solid Waste Amendments (HSWA) to RCRA require assessments to be conducted at all former and current solid waste management units (SWMUs) at RCRA-permitted facilities. A SWMU is defined as "any discernible unit at which solid or hazardous wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous wastes." The underlined phrase allows for the situation wherein an operating facility, routinely and systematically, releases hazardous waste or hazardous constituents. Under this scenario, any area suspected to be contaminated by a release of hazardous constituents may be considered a SWMU and is subject to investigation and corrective measures under RCRA. Accidental spills (which are not cleaned up) from production areas and units in which wastes have not been managed (e.g., product storage areas) are not considered to be SWMUs under RCRA, but are subject to investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Among the most significant provision of the HSWA is Section 3004(u), Corrective Action for Continuing Releases. This section of the HSWA states that permits issued after November 8, 1984, require corrective action for releases of hazardous waste or constituents from any SWMU at any TSD facility seeking permit under Section 3004 of RCRA, regardless of when waste was placed in the unit.

Based on information provided in the EPA Interim Final RCRA Facility Investigation Guidance, Volumes I,II,III, and IV (USEPA 1989a) (hereinafter referred to as the RFI Guidance), the corrective action program consists of three phases:

- the RCRA Facility Assessment (RFA), which is designed to identify SWMUs that are, or are suspected to be, the source of a release to the environment;

- the RCRA Facility Investigation (RFI), which fully characterizes the extent of releases at individual or grouped SWMUs; and
- a corrective measures (CM) assessment, which determines the need for, selects, and implements appropriate remedial actions at individual or grouped SWMUs.

The remedial process under CERCLA follows a very similar sequence of activities including a Preliminary Assessment (PA) (which corresponds closely with a RCRA RFA), a Remedial Investigation/Feasibility Study (RI/FS) and a Remedial Design/Remedial Action (RD/RA). A CERCLA RI/FS essentially combines the elements of a RCRA RFI and a RCRA CM assessment into a single activity. The EPA Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA 1988a) is hereinafter referred to as the RI/FS Guidance.

An RFA was conducted for the Y-12 Plant (Welch et al. 1987; Welch 1987a; Welch and Poore 1987; Wiggins and Welch 1988; Murphy 1989) but initially did not include the SWMU which is the subject of this RFI Plan. The SWMU currently identified as "Mercury-Use Areas (S-127)," including several buildings at the Y-12 Plant which contained either full- or pilot-scale production facilities for lithium isotope separation and ancilliary facilities where mercury or mercury-contaminated waste was handled or stored (Figure 1.1), was initially classified as an "inactive hazardous waste disposal site" under CERCLA. While under CERCLA, preliminary assessment documents were prepared (Kimbrough 1986; Allison 1988) for the Mercury-Use Areas. Following agreement between DOE, TDHE, and EPA in 1989, the Mercury-Use Areas were reclassified as a RCRA facility. The earlier RFA did result in the decision to perform RFIs or initiate closures for the following SWMUs, located in or near the Mercury-Use Areas, which have received liquid plant discharges and/or solid wastes containing hazardous constituents:

SWMU	Mercury Use Related	Unit Number	RFI Plan
Coal Pile Trench	No	D-104	December 1988
Building 81-10 Area	Yes	S-117	November 1988

Tank 2101-U	Yes	S-210	11/88;Withdrawn
Tank 2104-U	Yes	S-212	12/88;Withdrawn
Tank 2116-U	No	S-214	December 1988
Tank	No	S-216	No RFI
Tank (9204-4 Area)	No	S-217	July 1988
Tank (9204-4 Area)	No	S-218	July 1988
Tank	No	S-221	No RFI
Waste Machine Coolant Biodegradation Facility	No	T-003	Closure Complete

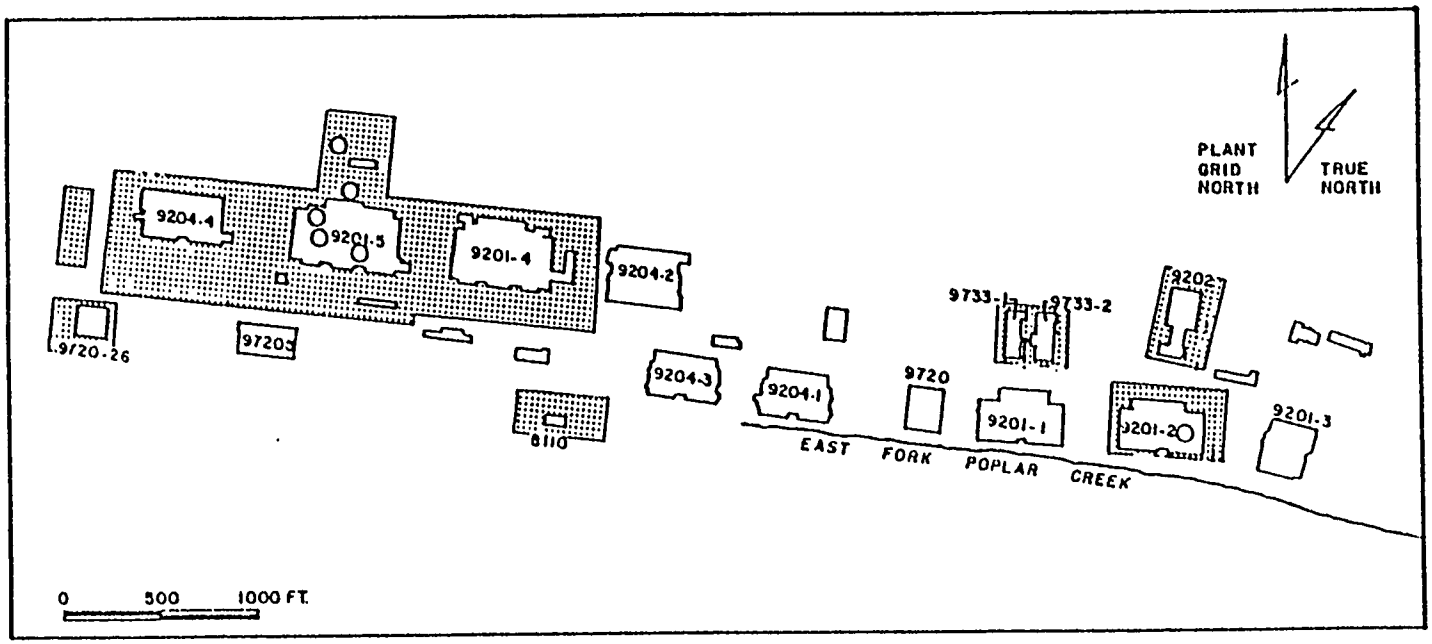
The SWMUs listed above and incorporated by Y-12 in the RFA and supplements to the RFA are all located within or adjacent to the Mercury-Use Areas (Figure 1.2). This RFI Plan will only address hazardous constituent releases from those SWMUs which are related generically to the historic lithium isotope separation programs, i.e., the SWMUs where mercury was used or stored. However, any relevant information available from any of the RFI Plans and Closure documents will be incorporated in this Plan and future documents pertaining to SWMU S-127 as appropriate.

The RFI Plan for the Mercury-Use Areas will address, characterize, and define the following:

- methods and specific actions necessary to determine whether a prior or continuing release has occurred and/or to characterize the nature and extent of releases;
- pathways of contaminant transport (air, soil/sediment, surface water); and
- current and future receptors.

1.1 CURRENT REGULATORY STATUS

Major installations located within the Oak Ridge Reservation (ORR) which contain presently operating TSD units are the Oak Ridge Gaseous Diffusion Plant (ORGDP), the Oak Ridge National Laboratory (ORNL), and the Y-12 Plant.



EXPLANATION

MERCURY USE AREAS

ACCIDENTAL SPILL

Figure 1.1 Location of areas of mercury and accidental spills, Y-12 Plant, Oak Ridge, Tennessee (from Geraghty & Miller, 1985).

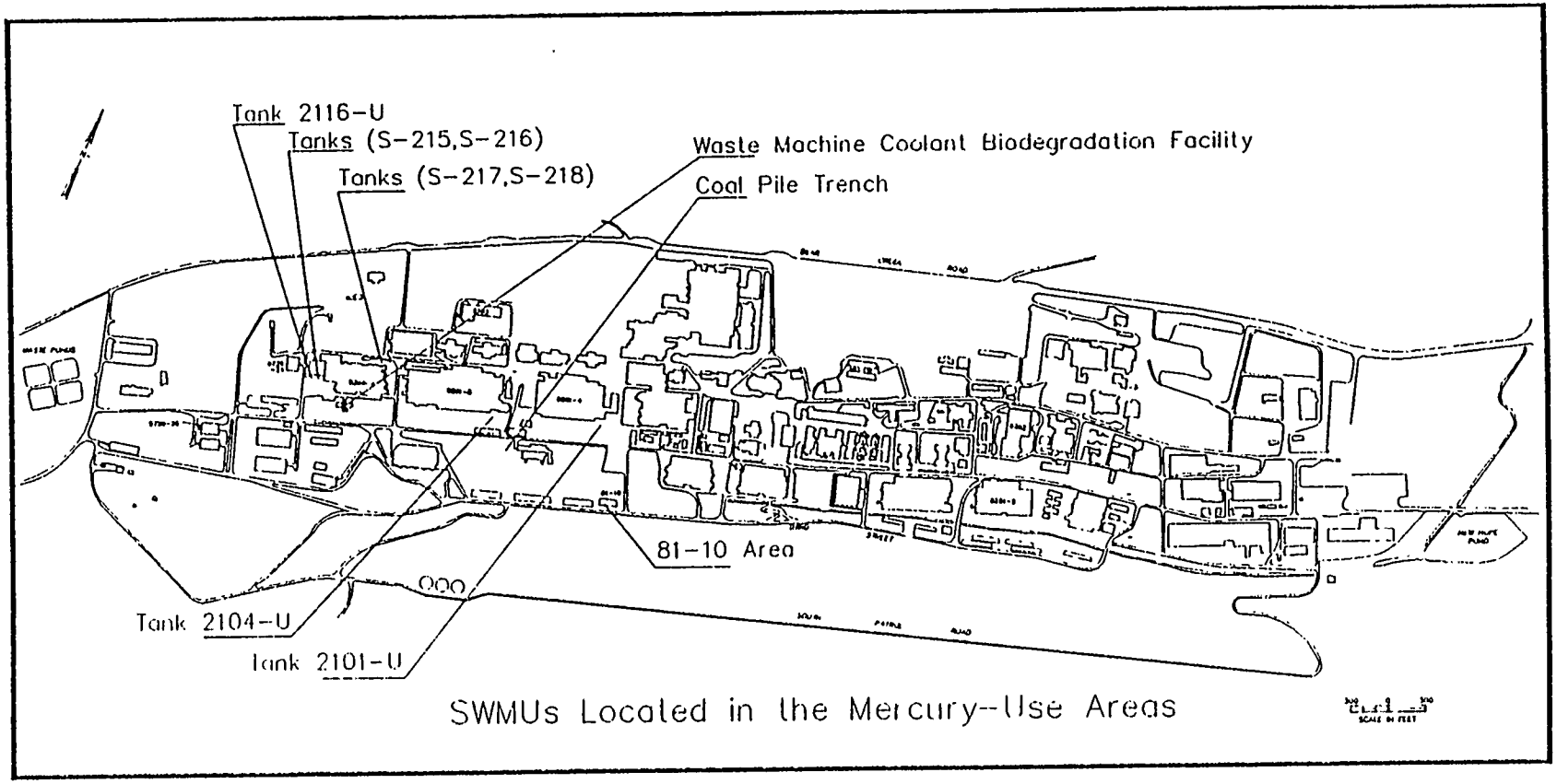


Figure 1.2 Location of SWMUs within or adjacent to the Mercury Use Areas.

The first RCRA permit to be approved for the ORR under the HSWA provisions became effective October 1986. The permit was for a hazardous waste storage building at ORNL. Section II.A.1 of this permit specified that general information for all ORR SWMUs was to be provided to the regulatory authority. For SWMUs at the Y-12 Plant, this information was to be provided by April 24, 1987, as part of the Y-12 Plant RFA (Welch et al. 1987). Under Section II.A.2 of the permit, an RFI Plan and a proposed schedule for implementation and completion of the RFI is to be prepared for each SWMU which is known, suspected, or presumed to have released hazardous wastes or hazardous constituents to the environment.

In order to meet these requirements, two types of RFI Plans have been prepared for the Y-12 Plant. The RCRA Facility Investigation Plan-General Document, Volumes I, II and III (Welch 1989a; Wiggins 1988a; and Wiggins et al. 1988) for the Y-12 Plant includes information applicable to all Y-12 Plant SWMUs and serves as a reference document for the second type of document, a site-specific RFI plan for each SWMU. The site-specific RFI Plan for the Mercury-Use Areas is based on the EPA guidance document, Interim Final RCRA Facility Investigation (RFI) Guidance, Volumes I, II, III, IV (USEPA 1989a).

The Oak Ridge Reservation (ORR) was placed on the CERCLA National Priorities List (NPL) on November 21, 1989. Therefore, Y-12 SWMUs also fall under the jurisdiction of the mandates of CERCLA as operable units. Requirements for remedial investigations or remediations of CERCLA units will be incorporated into an Interagency Agreement (IAG) between the EPA, TDHE, and DOE. Because of the overlap of CERCLA and RCRA requirements, this site-specific RFI also provides detailed information for field studies involving data collection for remedial decisions under CERCLA, the Superfund Amendments and Reauthorization Act (SARA), and the National Contingency Plan (NCP) (40 CFR 300), and meets the requirements thereof.

1.2 RFI PLAN FOR THE MERCURY-USE AREAS

This document is the site-specific RFI Plan for former Y-12 Plant process areas referred to as the Mercury-Use Areas (SWMU S-127). This SWMU includes the following buildings: 9201-2, 9201-5, 81-10, 9204-4, 9201-4, 9202, 9733-1, 9733-2, the old deflasking area near Building 9103, and the

old mercury storage area near Guard Portal 33 (see Figure 1.1). Several smaller buildings in these areas and the grounds around these buildings are considered part of the SWMU.

This RFI Plan will (1) evaluate the available data relevant to determining whether releases from these facilities have contaminated, or are contaminating, the surrounding environment; (2) characterize the nature and extent of any such contamination within the limits of the available data; and (3) propose an investigative plan to verify earlier findings and to complete the characterization. Contained within this RFI Plan are geographical, historical, operational, geological, and hydrological data specific to the Mercury-Use Areas. The potential for further release of contaminants from the Mercury-Use Areas is addressed. A sampling and sample analysis plan is proposed to further determine the extent of contaminant release to the surrounding environment. Included are health, safety, quality assurance, and quality control procedures to be followed when implementing the sampling plan. Procedures for managing and displaying data collected for the RFI are also summarized.

1.3 SPECIAL PROBLEMS

RFI Plans are generally prepared for discrete SWMUs and report formats are arranged accordingly. This RFI Plan addresses a group of sites known collectively as the Mercury-Use Areas. These sites include buildings and other facilities which have been designated as possible sources of contamination due to known, suspected, or presumed releases, both accidental and deliberate. The areas are not contiguous. In the CERCLA preliminary assessments (Kimbrough 1986, Allison 1988) conducted earlier for these sites, the mercury-contaminated buildings were considered to be "leaking containers" and the outdoor spill sites were considered to be "uncovered waste piles."

The various Mercury-Use Areas are not waste disposal areas *per se* but constitute areas where soil and building materials were, or may have been, contaminated as a result of being adjacent to facilities where hazardous substances, chiefly mercury, were handled. The areal extent of the Mercury-Use Areas can be only arbitrarily defined at this point as the facilities themselves plus the immediately surrounding areas. Extensive

previous sampling and analysis of soils at the Y-12 Plant have shown that elevated mercury concentrations are not exclusively confined to the Mercury-Use Areas. Demolition and new construction activities over the more than 35 years since mercury was used in large quantities at the Plant undoubtedly disturbed the original areal distribution of mercury contamination. The RFI Plan for the Mercury-Use Areas must necessarily focus on the most likely areas of contamination. In general, where contamination has been found previously beyond these areas, the sites will be investigated separately via the RCRA RFI or CERCLA RI/FS processes, or have already been subjected to corrective measures. Thus, the RFI Plan for the Mercury-Use Areas addresses only the source areas. Other plans have been prepared or are in preparation for areas which may have received releases from the buildings and other facilities via air, surface water or groundwater transport. The plans include the RFI Workplans for Bear Creek (Turner et al. 1988), East Fork Poplar Creek (Welch 1987b, 1989b), Upper East Fork Poplar Creek (Travis et al. 1989), and the RI/FS Plan for Offsite Areas (Clinch River and Watts Bar Reservoir, Kimmel 1989).

RFI and RI/FS plans are generally comprehensive in considering the universe of hazardous constituents which have, or may have been, released from a SWMU. Nearly all the Mercury-Use Areas have been converted to other uses since they were originally constructed and operated. Some facilities, especially Buildings 9404-4, 9201-4, and 9201-5 were employed for other processes (e.g., uranium isotope enrichment) prior to their use as lithium enrichment facilities. Therefore, these facilities may also have released hazardous constituents to the environment which were unrelated to the lithium isotope enrichment processes. Thus, this RFI Plan must address a wide variety of hazardous constituents, especially mercury and uranium, which were or may have been released from these facilities. Other investigations, monitoring, and facility closure activities also address former and subsequent uses of these facilities.

Because of the diverse and complex history of operations at the Y-12 Plant the evaluation of groundwater quality and transport is being addressed via the valley-wide Comprehensive Groundwater Monitoring Plan (DRAFT) for the Department of Energy Y-12 Plant (Geraghty & Miller 1989). Excerpts from this comprehensive plan are given in Appendix A.

2. OBJECTIVES OF THE RCRA FACILITY INVESTIGATION PLAN

The primary purpose of an RFI Plan is to summarize existing site information and to identify actions necessary to enable adequate evaluation and characterization of the nature and extent, if any, of contamination resulting from releases of hazardous wastes or constituents. Information generated during the RFI is then used to (1) determine the need for corrective measures, based on the need to protect human health and the environment, and (2) aid in the selection and implementation of corrective measures, including containment measures and contingency plans. The operational history of the Y-12 Plant, coupled with the known presence of soil and surface water contamination in the Mercury-Use Areas, requires that an RFI be conducted and remedial alternatives be identified for the site.

Generally, the RFI Plan is used as a basis for implementing an RFI at the individual SWMU. However, for the purpose of this project, the RFI Plan addresses several areas that received, or may have received, releases from buildings and areas used for chemical processes that are no longer operating.

This RFI Plan for the Mercury-Use Areas proposes, in detail, the manner in which the RFI will be conducted. The area of investigation encompasses the following buildings and adjoining areas at the Y-12 Plant: 9201-2, 9201-5, 81-10, 9204-4, 9201-4, 9202, 9733-1, 9733-2, the old deflasking area near Building 9103, and the old mercury flask storage area near Guard Portal 33.

2.1 PROJECT SCOPE AND OBJECTIVES

2.1.1 Project Scope

The RFI Plan summarizes previous studies and presents a strategy for collecting additional data, as necessary, in order to evaluate and characterize the extent of hazardous contamination in the Mercury-Use Areas and surroundings, and to facilitate selection of appropriate remedial alternatives.

2.1.2 Project Objectives

The first objective of the Mercury-Use Areas RFI Plan is the review of data gathered from various studies of the Mercury-Use Areas. Studies of the other SWMUs which may have contributed hazardous constituents to this area are reviewed only to the extent that hazardous constituents of concern can be identified. Hazardous constituents of concern include those known, suspected, or presumed to have been used, disposed, or spilled in the Mercury-Use Areas as a consequence of process development, process operations, and process decommissioning.

As a second objective of the RFI Plan, the data are assessed and any additional data needs are identified using the RFI and RI/FS guidances.

2.2 EVALUATION CRITERIA

Existing data are evaluated in terms of: (1) collection under appropriate standards and procedures, such as those described by EPA; (2) pertinence to data needs established by this study; and (3) applicability to appropriate government regulations. Where available, ARARs (applicable or relevant and appropriate requirements) will be used in the evaluation of existing data.

Where additional data are needed in order to effectively prepare and implement a comprehensive sampling plan and evaluate analytical results, evaluation criteria must first be established. Criteria for evaluating the extent of contaminant release are based generally on existing federal and state regulatory guidance (e.g., ARARs) and best technical judgement.

The primary media of concern for the Mercury-Use Areas are soil, air, and surface water. Groundwater monitoring and some surface water monitoring, as mentioned above, will be covered by the Comprehensive Groundwater Monitoring Plan for the Oak Ridge Y-12 Plant (Geraghty & Miller 1989; Appendix A is an excerpt from a DRAFT copy of this document). Criteria for evaluating the extent of release of contaminants are set forth in Section 8.8 of the RFI Guidance (USEPA 1989a) and in the ARARs guidance documents (USEPA 1988b, USEPA 1989c). Characterization levels are based on existing state and federal regulatory guidance, elevation of contamination above background levels, or best technical judgment. Types of criteria used include, but are not limited to, Maximum Contaminant

Levels (MCLs) promulgated under the Safe Drinking Water Act, Health-Based Criteria, or Water Quality Criteria (USEPA 1989a). Additional work may be required to characterize the extent of contamination if concentrations exceed the established levels.

2.3 SCHEDULES FOR SPECIFIC ACTIVITIES

A list of RFI sampling and analysis activities and their duration is provided in Table 2.1 for the Mercury-Use Areas. Characterization of contamination during the RFI will be conducted using a phased approach. The initial sampling phase will serve to confirm existing data on contaminant levels in the Mercury-Use Areas, to identify additional contaminants of concern within the area, and to provide approximations of the vertical and horizontal extent of soil contamination within these areas.

Subsequent sampling phases will depend upon the information obtained during the initial sampling phase. It is expected that subsequent phases will involve:

1. expanding the number of air, surface water, or soil sampling locations at particular sites to a larger area or depth, or increasing sampling density as needed;
2. institution of a random grid sampling approach to assess areas of soil contamination identified by first phase sampling; and
3. addition or deletion of specific monitoring constituents.

2.4 GENERAL RISK ASSESSMENT

Evaluation of the public health and environmental risk associated with existing contamination in the Mercury-Use Areas will begin in this RFI Plan (Section 7.0) and be continued as data gathered during the RFI becomes available. The Risk Assessment Guidance for Superfund document (USEPA 1989b) will be used as a guide in performing this assessment and in preparing a separate document summarizing risk information.

Table 2.1 Schedule of Phase I RFI Activities for the Mercury-Use Area.

Activities	Duration
1. Site preparation and establishment of sampling locations	
(a) Soil	10 days
(b) Air	10 days
(c) Surface Water	10 days
2. Collection of samples	
(a) Soil	60 days
(b) Air	90 days
(c) Surface Water	120 days
3. Analysis of samples	
(a) Soil	60 days
(b) Air	30 days
(c) Surface Water	60 days
4. Compilation of data and data presentation	45 days
5. Evaluation of results and recommendations	30 days
6. Preparation of RFI report and submittal to EPA	120 days
7. Additional sampling phases as needed	TBD

TBD - To be determined

2.5 FEASIBLE ALTERNATIVES

The RFI Plan is designed to obtain information necessary to support feasibility studies. The remedial action alternatives that will be evaluated will include those addressed in the EPA Handbook of Remedial Action at Waste Disposal Sites (Revised) (USEPA 1985). Evaluation of feasible alternatives for remediation of contaminated areas within the Mercury-Use Areas should include:

1. methods for elimination or containment of the contaminant source(s),
2. potential environmental impacts of proposed alternatives, and
3. provisions for worker health and safety during all phases of characterization and remediation.

Three general types of response actions exist for the remediation of the Mercury-Use Areas:

1. source removal
2. application of in situ corrective measures, and
3. no action

Different actions or combinations of actions may be appropriate at varying locations within the Mercury-Use Areas. However, guidance for selection of specific actions is not provided in this document. Instead, knowledge of feasible response actions was used during preparation of this RFI Plan. These response actions will be re-evaluated following completion of the RFI as part of the Corrective Measures assessment.

2.5.1 Source Removal

The primary sources of contaminants in the Mercury-Use Areas are thought to be contaminated soil and contaminated buildings and equipment. Source removal has already be widely practiced in the Mercury-Use Areas as discussed in Sections 3.0 and 6.0 of this plan and is likely to continue to be an appropriate remedial alternative for contaminated soil at the Y-12 Plant and for contaminated sludges and elemental mercury found in the storm drain system at the Y-12 Plant. Source removal is also appropriate for contaminated equipment, such as is known to exist in Building 9201-4.

2.5.2 Application of In Situ Corrective Measures

For the Mercury-Use Areas, corrective measures that minimize erosion of source constituents (soil/sediment), dissolution of source constituents (e.g., elemental mercury) or incidental direct contact, include the use of protective covers and lateral erosion barriers at selected locations, and various methods of containment or isolation of contaminated materials from surface water and groundwater. Protective covers can include the following:

- bituminous compounds
- vegetation
- clay, and
- polyethylene or polyvinyl chloride sheeting.

Lateral erosion barriers can include the following:

- riprap
- sheet piling
- concrete.

Containment/isolation techniques can include:

- Impervious relining of storm sewers
- Rerouting of clean water around contaminated conduits
- Lowering the water table to preclude groundwater contact with contaminated soil.

Other possible in situ alternatives could include (1) physical or chemical fixation and (2) biodegradation.

2.5.3 No Action

For the Mercury-Use Areas, the no action alternative can be enacted in areas where the source effect is minimal when compared to the effect on human health and the environment if removal or other corrective action are employed. For example, contaminated soils which are buried under fill and asphalt might not be removed from the Mercury-Use Areas if excavation would result in resuspension, vaporization or other redistribution of contaminants when none is currently being released from the area.

2.5.4 Alternatives Risk Assessment

The environmental and public health risks resulting from the remedial action alternatives presented in Section 2.5 will be evaluated by characterizing contaminant sources, the associated environmental setting, the magnitude of the release, and pathways to human exposures. Risk assessment will begin early in the RFI process since it will be useful for determining data requirements and may influence site sampling plans, and ultimately the selection of any remedial action. Risk information for the remedial alternatives will be summarized in documents associated with the Corrective Measures Study.

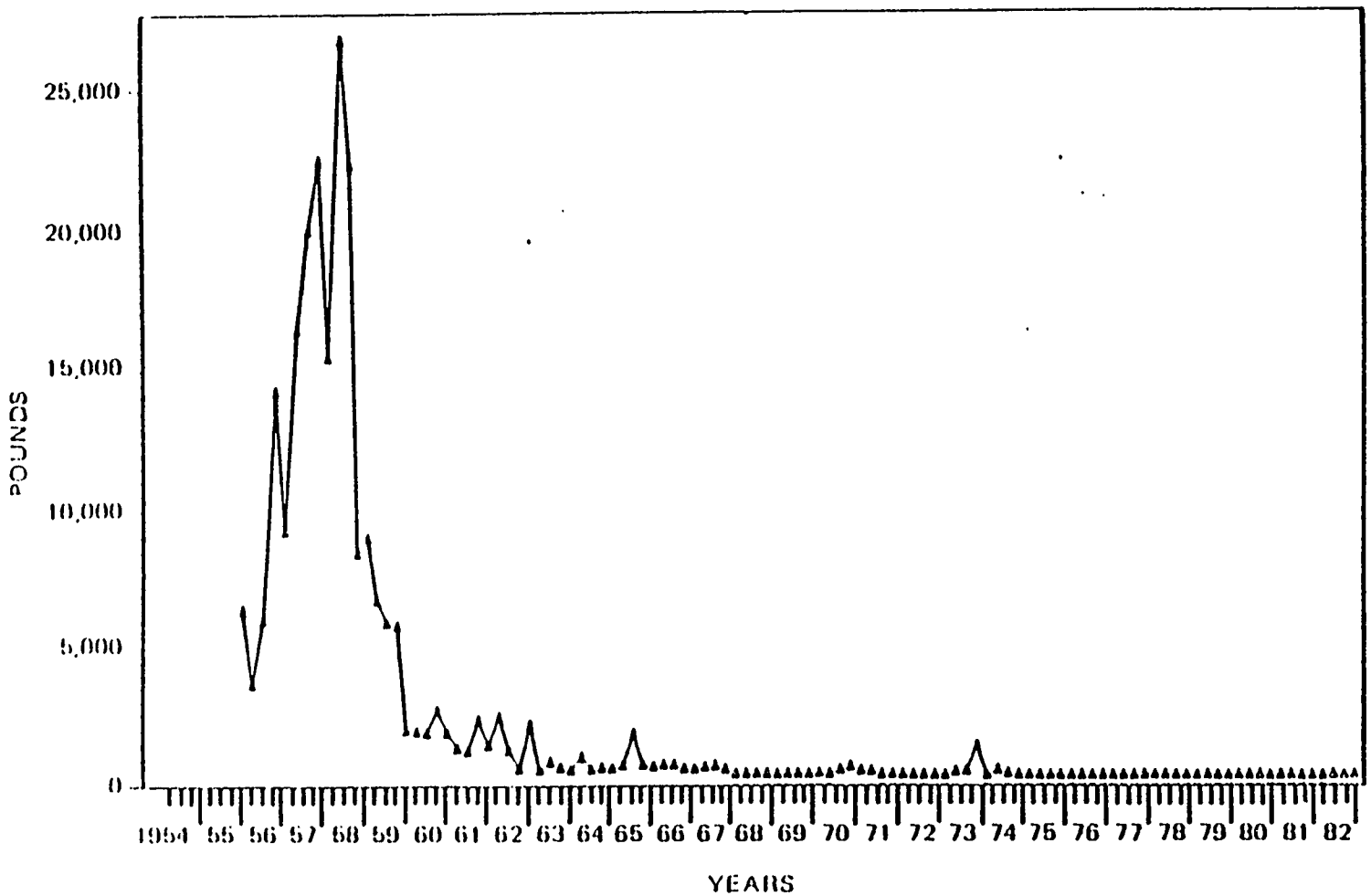


Figure 3.2 History of mercury losses to East Fork Poplar Creek (from Wilcox 1983).

Table 3.1 Estimated total releases of mercury to air, surface water and soil (from Wilcox 1983).

	Mercury (lbs)
Mercury lost, spilled, dumped to environment	
Lost to air (1950-1963)	51,000
Lost to East Fork Poplar Creek (1950-1982)	239,000
Lost to ground under Y-12	428,000
Lost to sediments in New Hope Pond	15,000
Mercury not accounted for[a]	1,300,000
Total	2,033,000

[a]Difference between amount charged to lithium isotope separation program and the amount accounted for as inventory, plus the amounts lost, spilled and dumped. Modified from Wilcox et al. (1983).

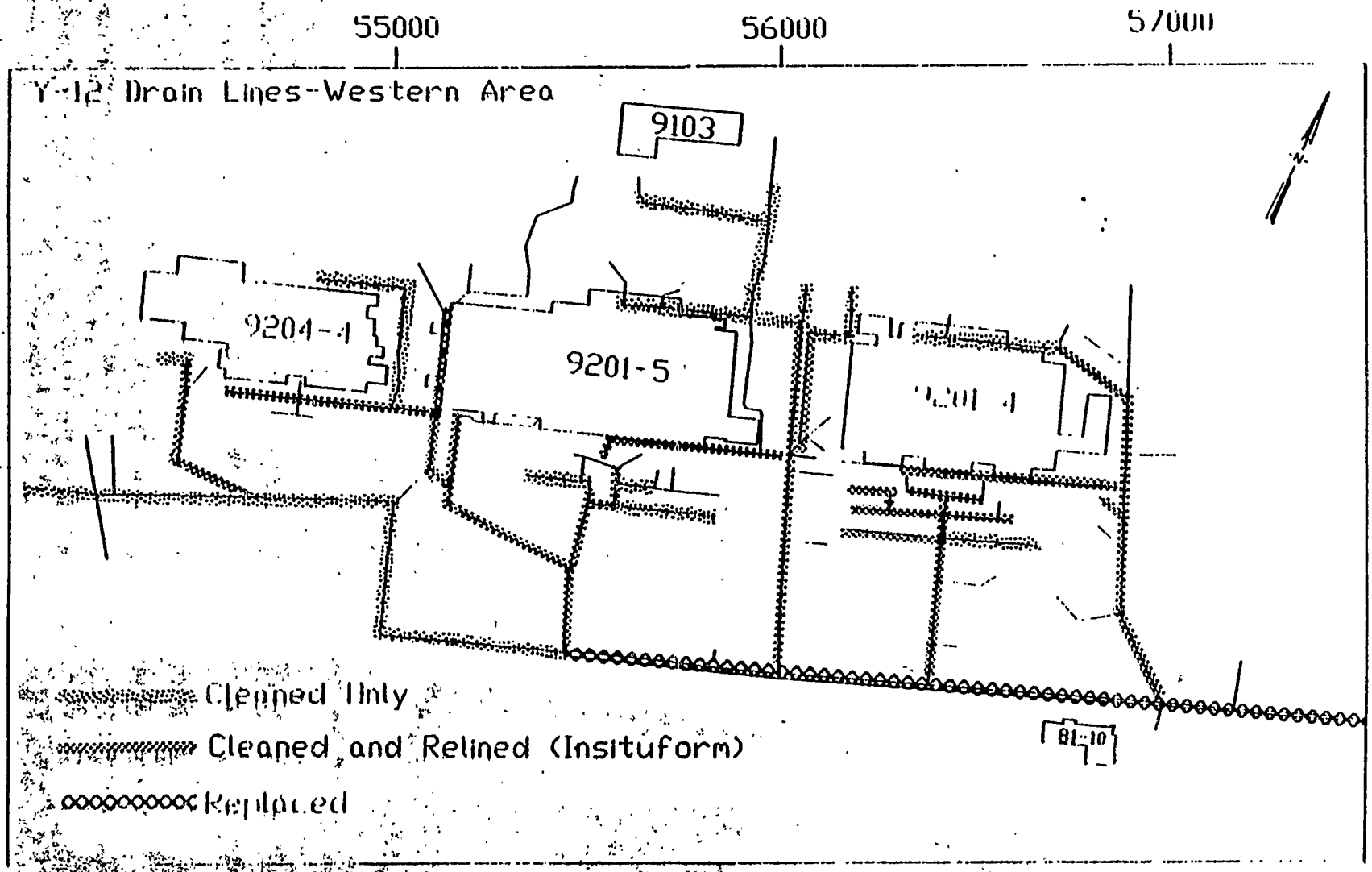


Figure 3.3. Storm sewer lines cleaned, lined, or replaced in the western plant area as part of the Reduction of Mercury in Plant Effluents Project.

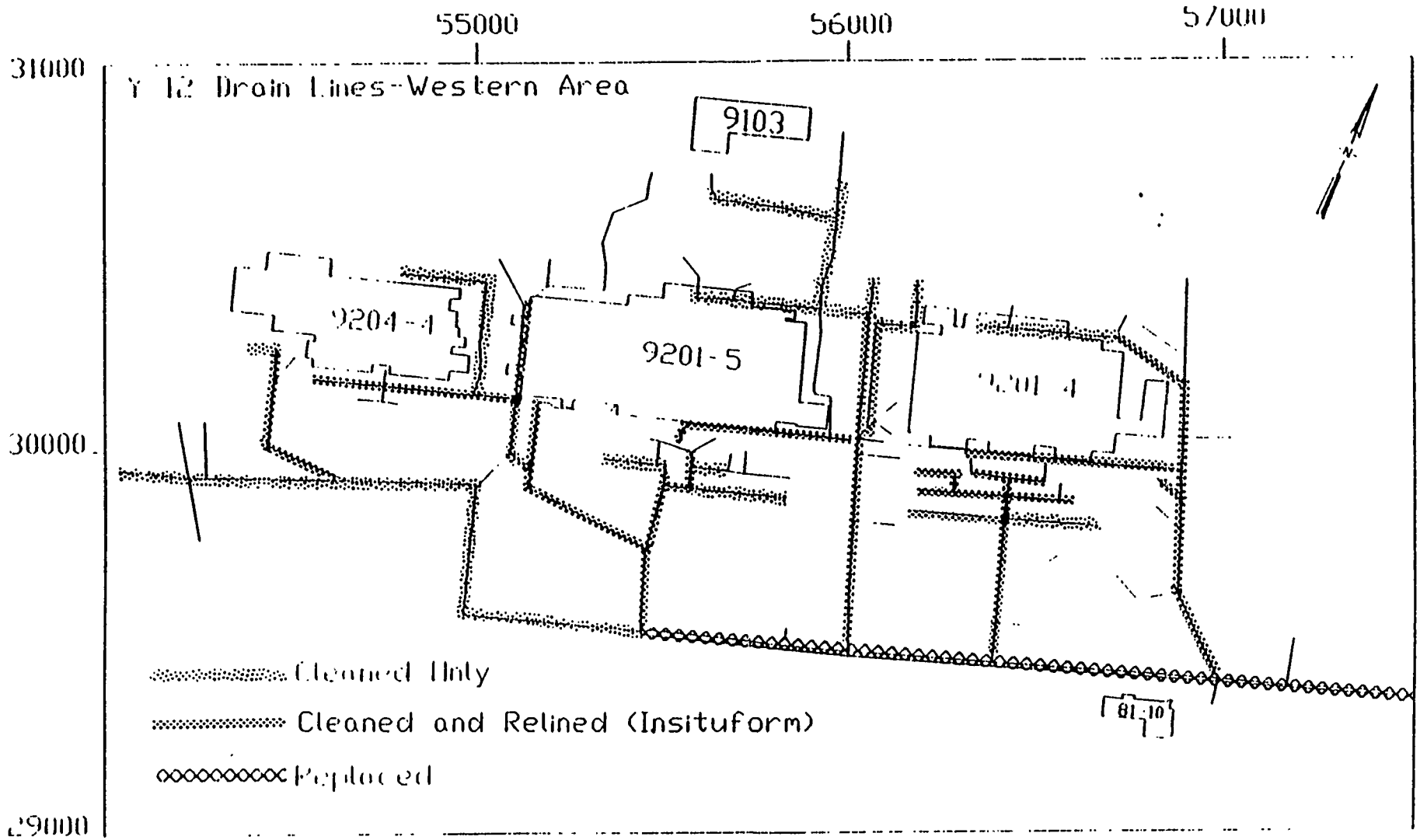


Figure 3.3 Storm sewer lines cleaned, lined, or replaced in the western plant area as part of the Reduction of Mercury in Plant Effluents Project.

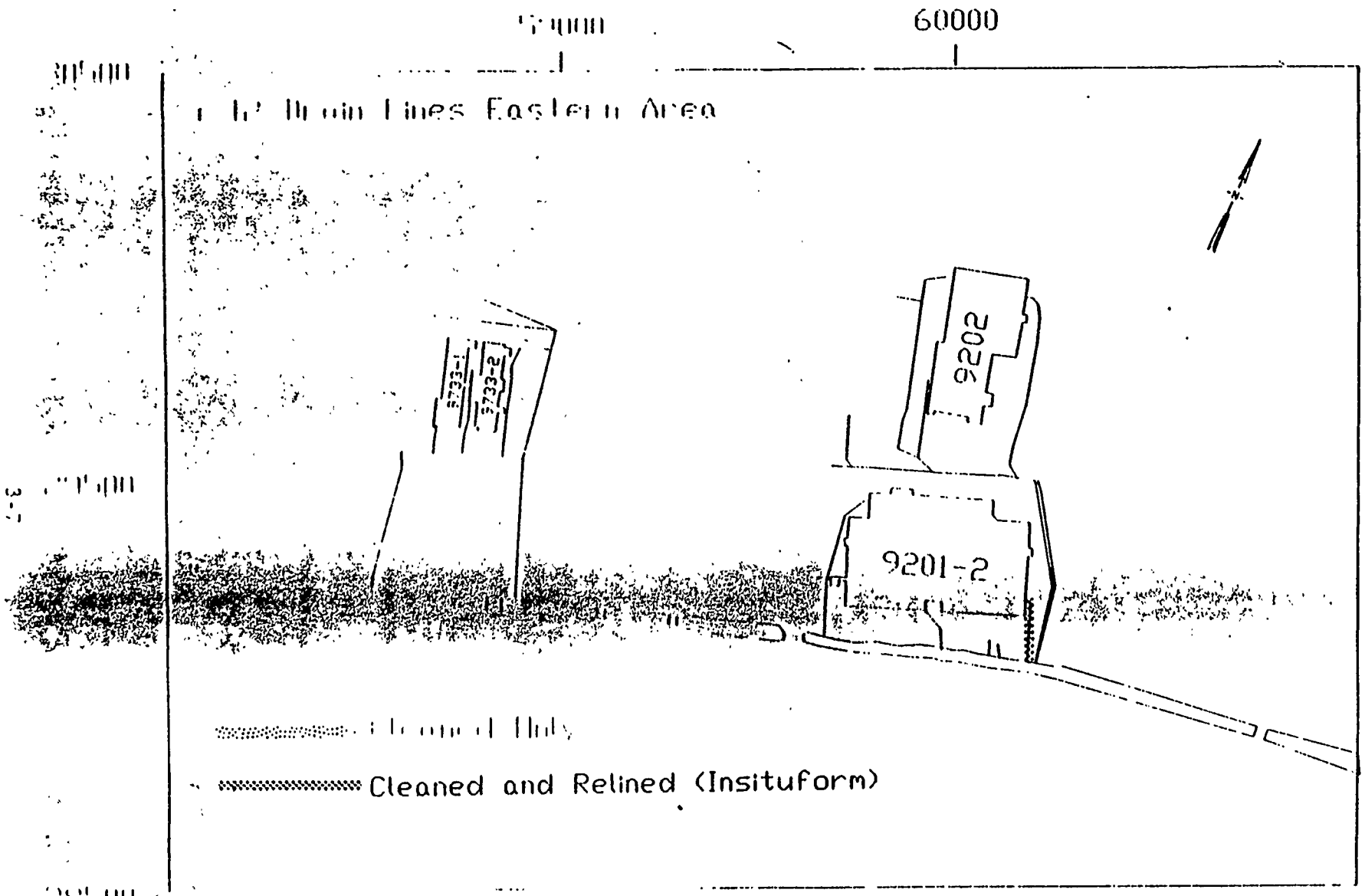


Figure 3.4 Storm sewer lines cleaned and lined in the eastern plant area as part of the Reduction of Mercury in Plant Effluents Project.

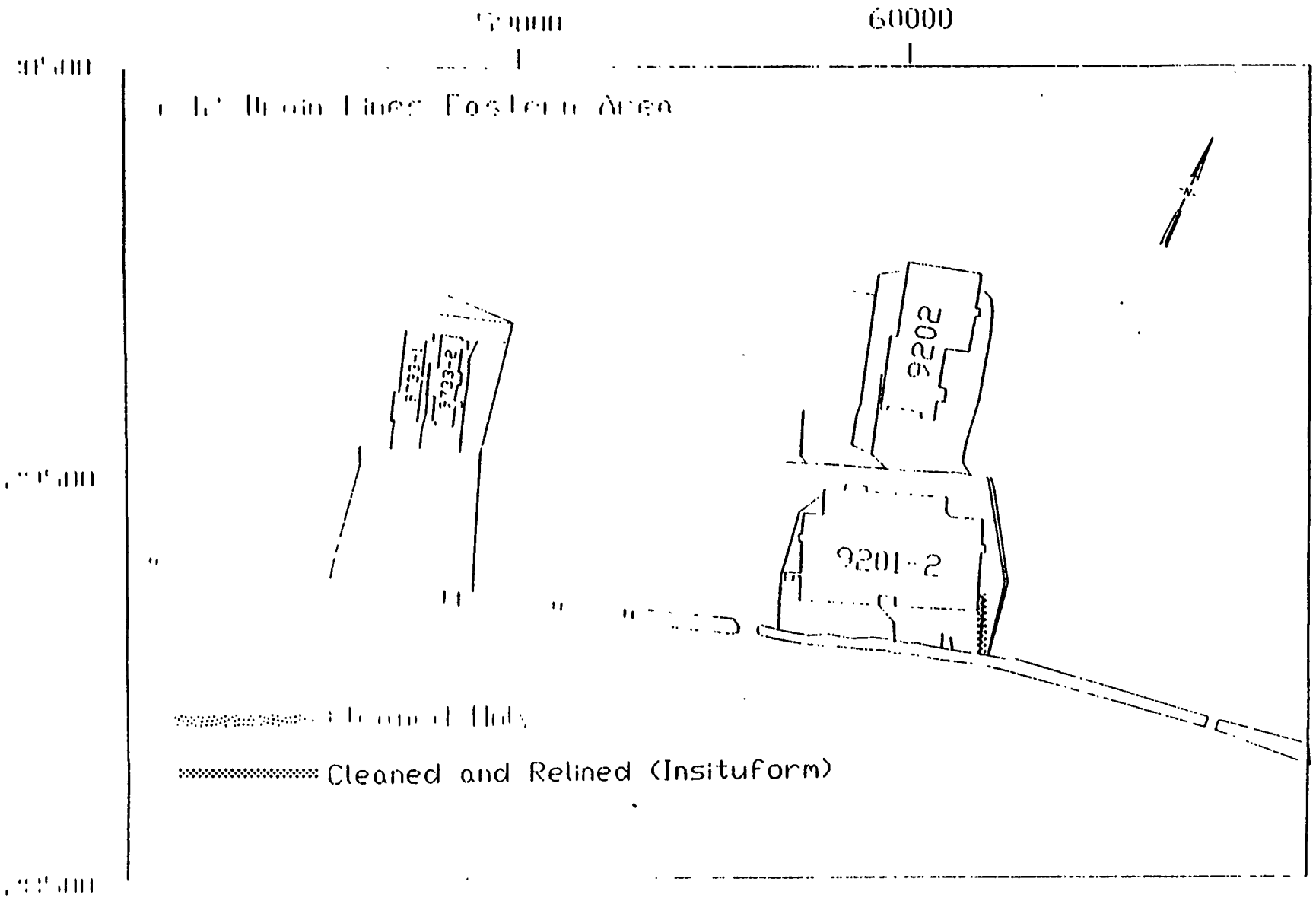


Figure 3.4 Storm sewer lines cleaned and lined in the eastern plant area as part of the Reduction of Mercury in Plant Effluents Project.

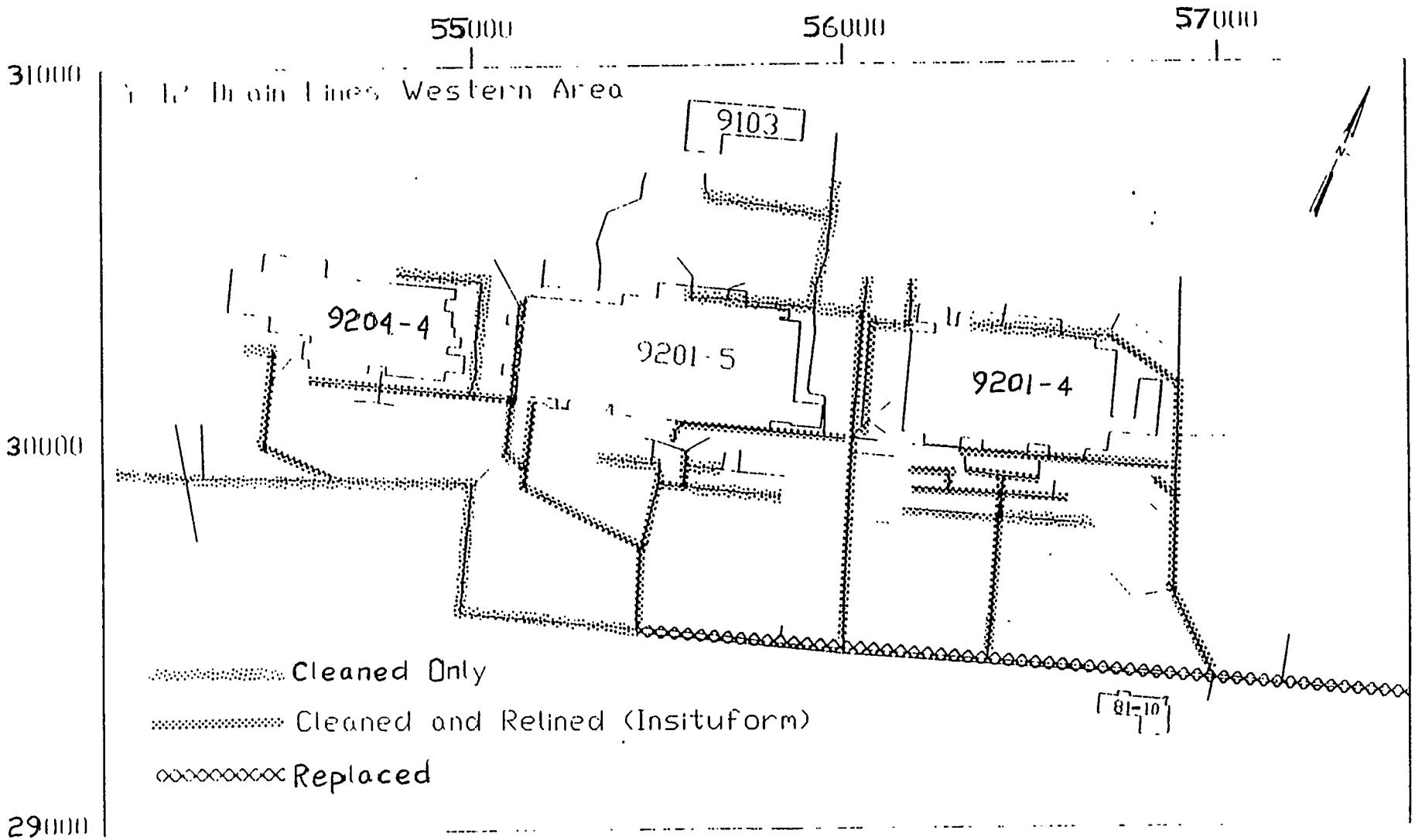


Figure 3.3 Storm sewer lines cleaned, lined, or replaced in the western plant area as part of the Reduction of Mercury in Plant Effluents Project.

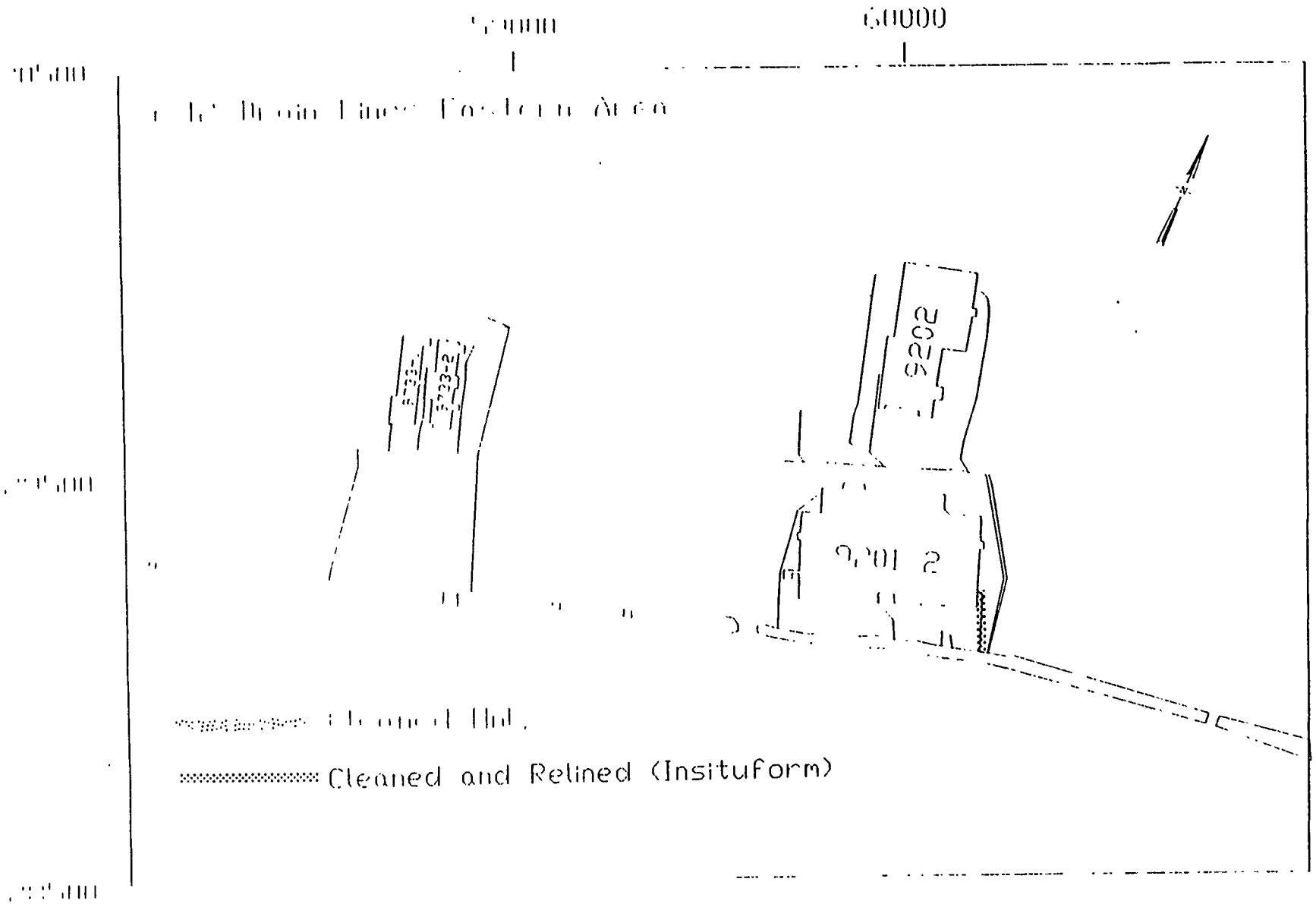


Figure 3.4 Storm sewer lines cleaned and lined in the eastern plant area as part of the Reduction of Mercury in Plant Effluents Project.

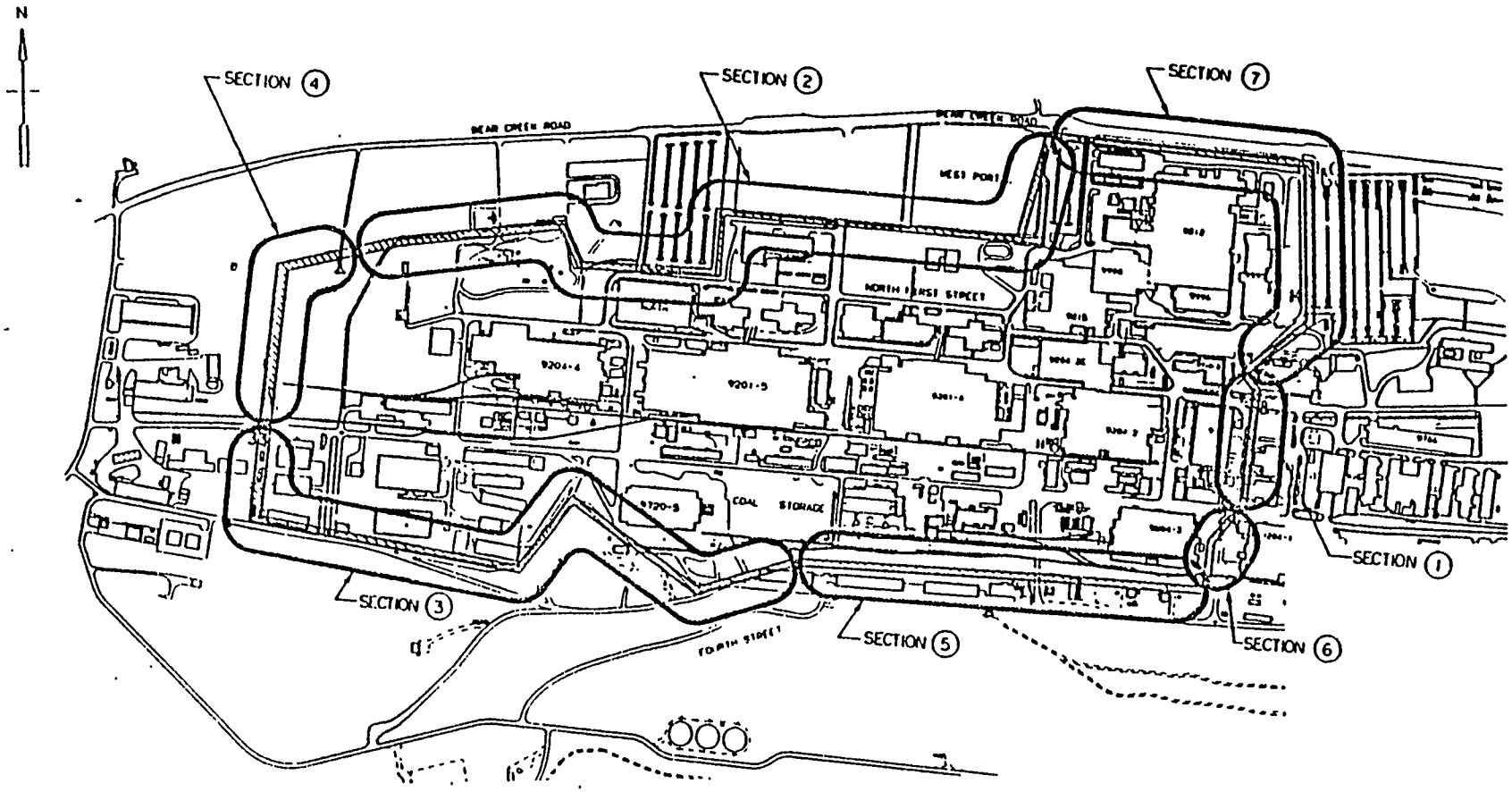


Figure 3.5 Outline of the PIDAS corridor.

4. CHARACTERIZATION OF THE ENVIRONMENTAL SETTING

4.1 GEOLOGY AND HYDROGEOLOGY OF THE STUDY AREA

Welch (1989a) gives general information on the geology and hydrogeology of the Y-12 Plant and adjacent areas. Information more specific to the Mercury-Use Areas is given in the RFI Plan for Upper East Fork Poplar Creek (Travis et al. 1989).

4.1.1 Geology

The rock strata of greatest interest, with respect to contaminant migration in the Y-12 Plant Mercury-Use Areas, include the Maynardville, Nolichucky, and Maryville Formations of the Conasauga Group. The southeastern part of the plant is underlain by the Maynardville Limestone with buildings 9201-2 and 81-10 being built on this formation. Buildings 9204-4, 9201-4, 9201-5, 9202, 9733-1 and 9733-2 are located over the Nolichucky Shale Formation, and the old Rust contractors deflasking area near Building 9103 is underlain by Maryville Limestone (Rothschild et al. 1984). Figures 4.1 and 4.2 illustrate the geology of the western and eastern Mercury-Use Areas, respectively.

4.1.2 Hydrogeology

The hydrologic regime underlying the Y-12 Plant is comprised of two major components:

- Regional flow system
- Local flow system

In general, a groundwater flow system of regional scale is defined by relatively deep circulation that is independent of local topography and small-scale surface water systems. The regional flow system underlying the Y-12 Plant is virtually undefined, primarily because of the limited number of deep wells that are available and have been included in past characterization studies. Currently, the only hint to the depth at which regionally controlled groundwater flow may predominate comes from examination of a few scattered chemical analyses that have been obtained in the deep wells located west of the Y-12 Plant in Bear Creek Valley.

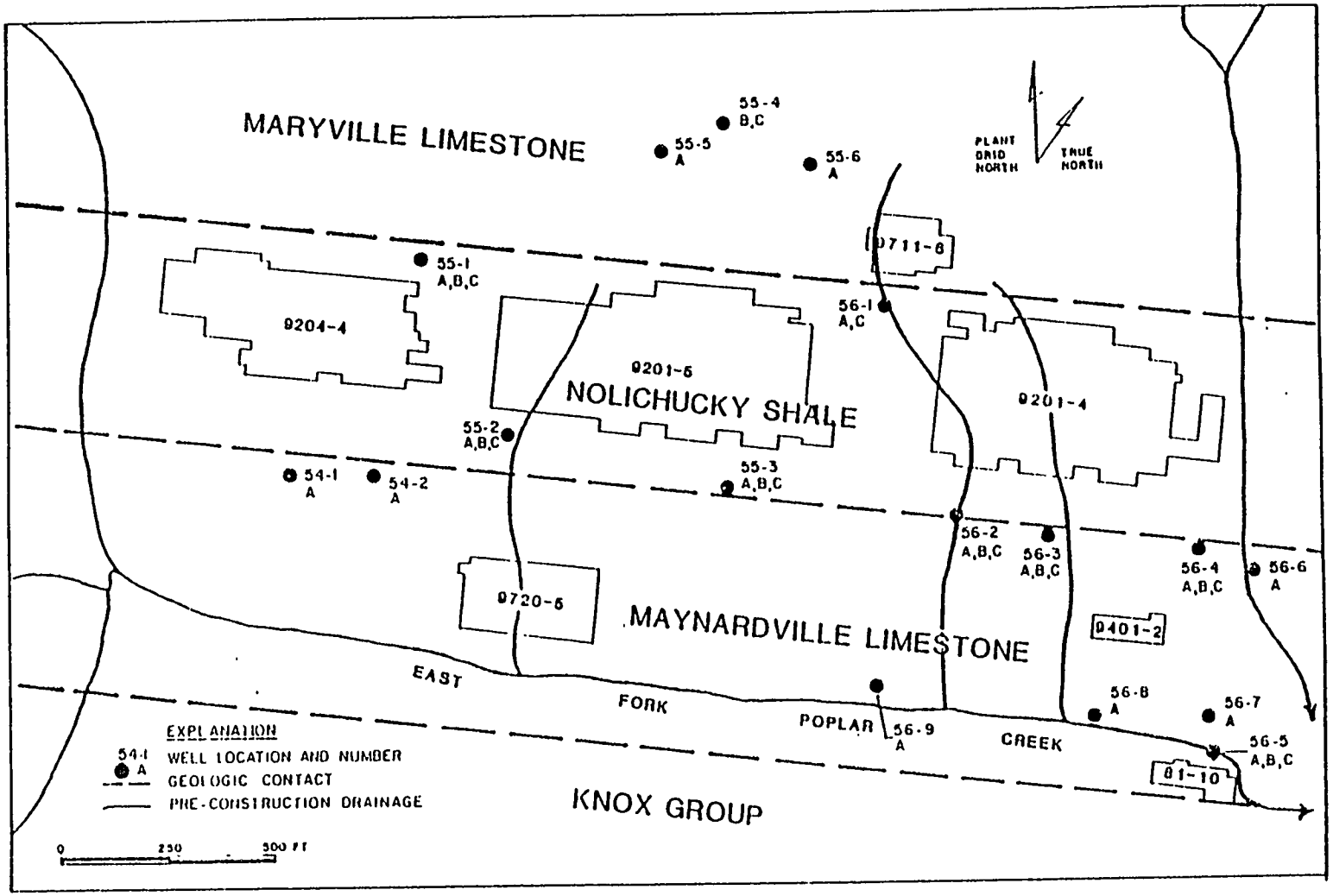


Figure 4.1 Geology, pre-construction drainage, and location of test wells in western area (from Geraghty & Miller, 1985).

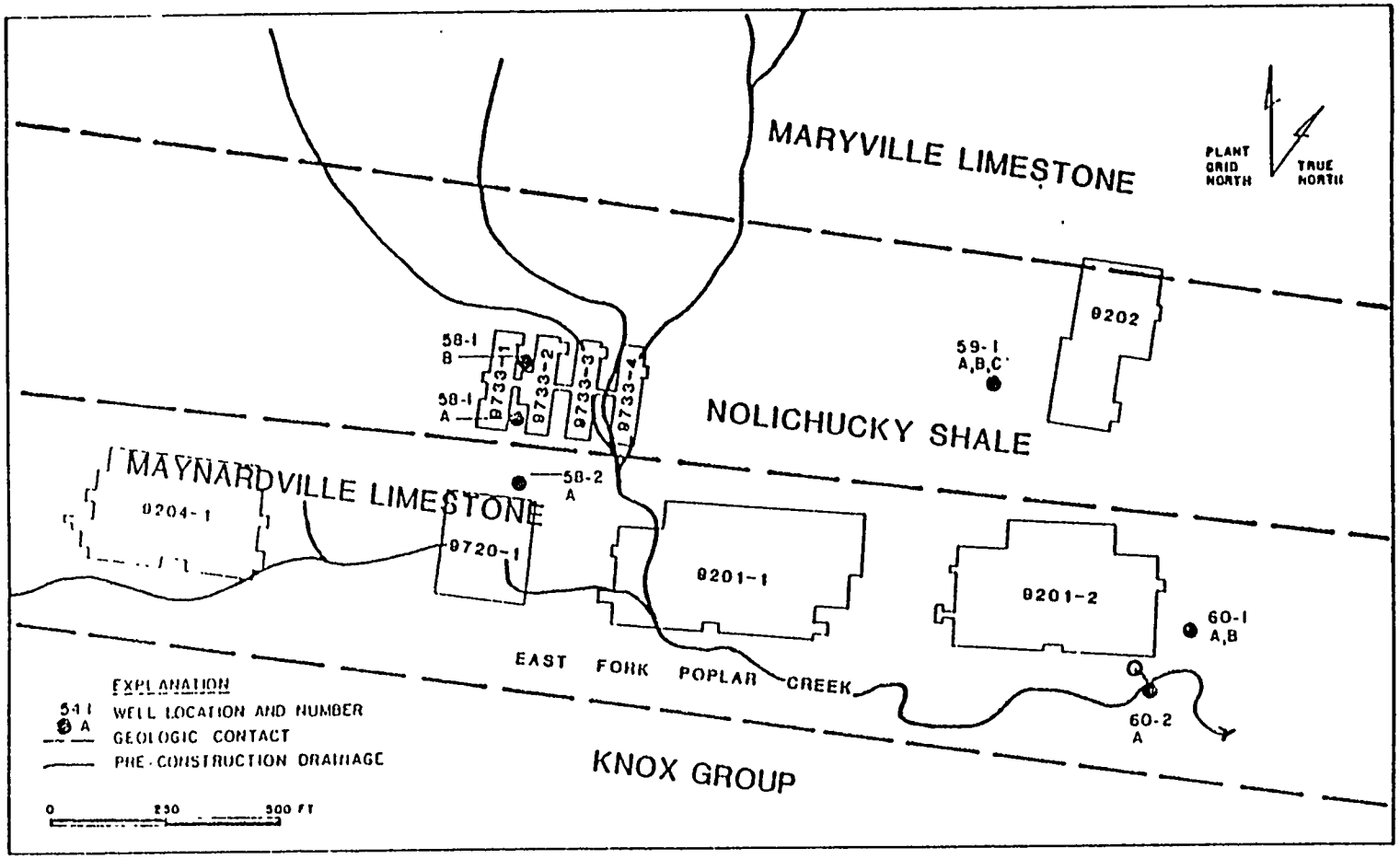


Figure 4.2 Geology, pre-construction drainage, and location of test wells in eastern area (from Geraghty & Miller, 1985).

For example, see the partial analyses presented in Geraghty and Miller (1988a and b) for wells GW-117, -118, -119, -123, and -125. These analyses show that below depths of approximately 500 ft, the groundwater appears to become more highly mineralized with sodium, chloride, and sulfate than the relatively dilute, shallow groundwaters typical of this region. The nature of any interaction between the compositionally distinguishable shallow and deep groundwaters beneath the Y-12 Plant is unknown at this time, but probably is limited.

The local flow system includes groundwater contained within the fill, unconsolidated weathered residuum, and the upper part of the underlying bedrock. Groundwater flow within this hydrologic system is strongly influenced by construction-modified topography and the storm sewer drainage net.

Results of numerous studies within Bear Creek Valley and along its bounding ridges demonstrate that recharge of this flow system occurs along the ridges through infiltration of precipitation. Groundwater flow paths typically are directed away from the bounding ridges and generally follow the topography, converging within the valley in the vicinity of Bear Creek and East Fork Poplar Creek (Figure 4.3).

Flow within the shallow groundwater system, while dominated by the the modified topography and subsurface drainage network, is also strongly influenced by structural properties of the bedrock. For example, several recent studies have investigated the fractures in bedrock material obtained from coreholes along a transect across Bear Creek Valley near the head of Bear Creek (Lutz and Dreier 1988). These studies demonstrate that several major fracture sets exist, dominated by a strike-parallel set. The results of these studies provide confirmation for observations from a pumping test performed in this area which showed that hydraulic properties of bedrock are not isotropic (Geraghty and Miller 1987). Rather, hydraulic conductivity values in the strike-parallel direction are at least several times larger than in any other direction. Anisotropy in hydraulic properties means that the direction of groundwater flow will deviate somewhat from that predicted by the potentiometric contours.

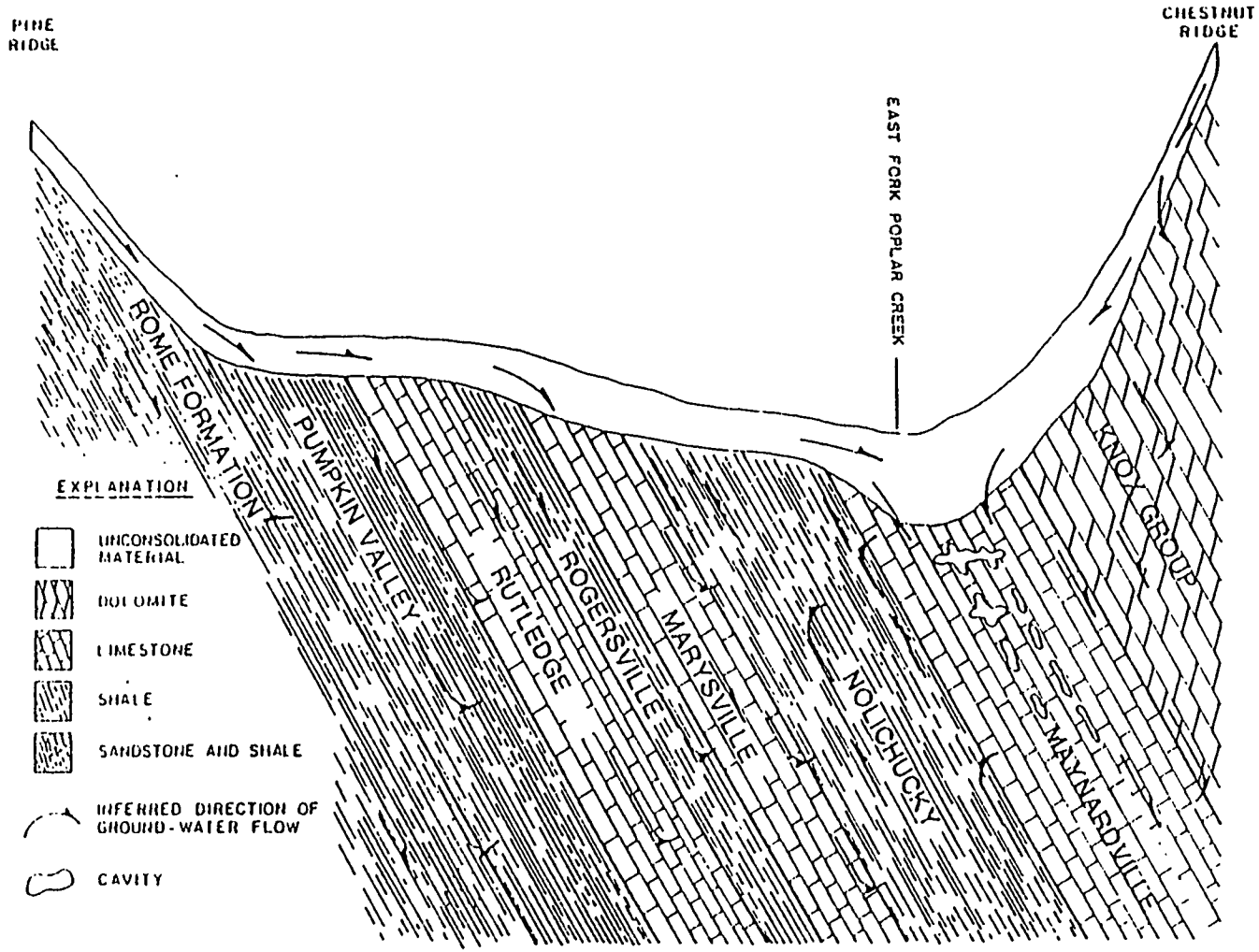


Figure 4.3 Generalized geologic section through Bear Creek Valley showing groundwater flow paths.

In addition to small-scale deformation features such as the fracture sets discussed above, it is probable that large-scale features including fracture zones and faults exist beneath the Y-12 Plant and influence groundwater flow.

Natural recharge patterns have been greatly modified by roofs and pavement, which now channel runoff to the storm drains. Recharge is limited to the slopes of the ridges north and south of the plant, unpaved areas within the plant, and places where leaky sections of the storm drains lie above the water table (Geraghty & Miller 1985).

Contours on the potentiometric surfaces in the unconsolidated material in the Mercury-Use Areas are shown in Figures 4.4 through 4.7 for May 4 and September 17, 1984. The May measurements were the highest of the year in most wells while those in September were generally the lowest. The figures illustrate the potential for groundwater movement downgradient, normal to the contours. The actual directions of flow are probably different locally, owing to the anisotropy discussed above. Figure 4.4 illustrates how the axis of the groundwater flow net has shifted northward from its its natural alignment along the former creek bed. This shift is due, in part, to leakage from the unconsolidated material into the storm drains and their surrounding gravel envelopes and, to an even greater extent, to the interception of recharge by the extensive areas of impervious surface which divert recharge water directly to the storm drainage system. As noted by Geraghty & Miller (1985), the contours on the water table are based on only 16 shallow wells, are highly generalized, and may not reflect the localized influences of the drains on the natural hydrologic regimen.

4.2 SURFACE WATER

4.2.1 Surface Water Network

The preconstruction surface water drainage for the Y-12 Plant area is shown in Figure 4.8. In general, streams drained from a series of hills in the northern part of the Y-12 Plant area to Upper East Fork Poplar Creek (UEFPC). The surface water divide between UEFPC and Bear

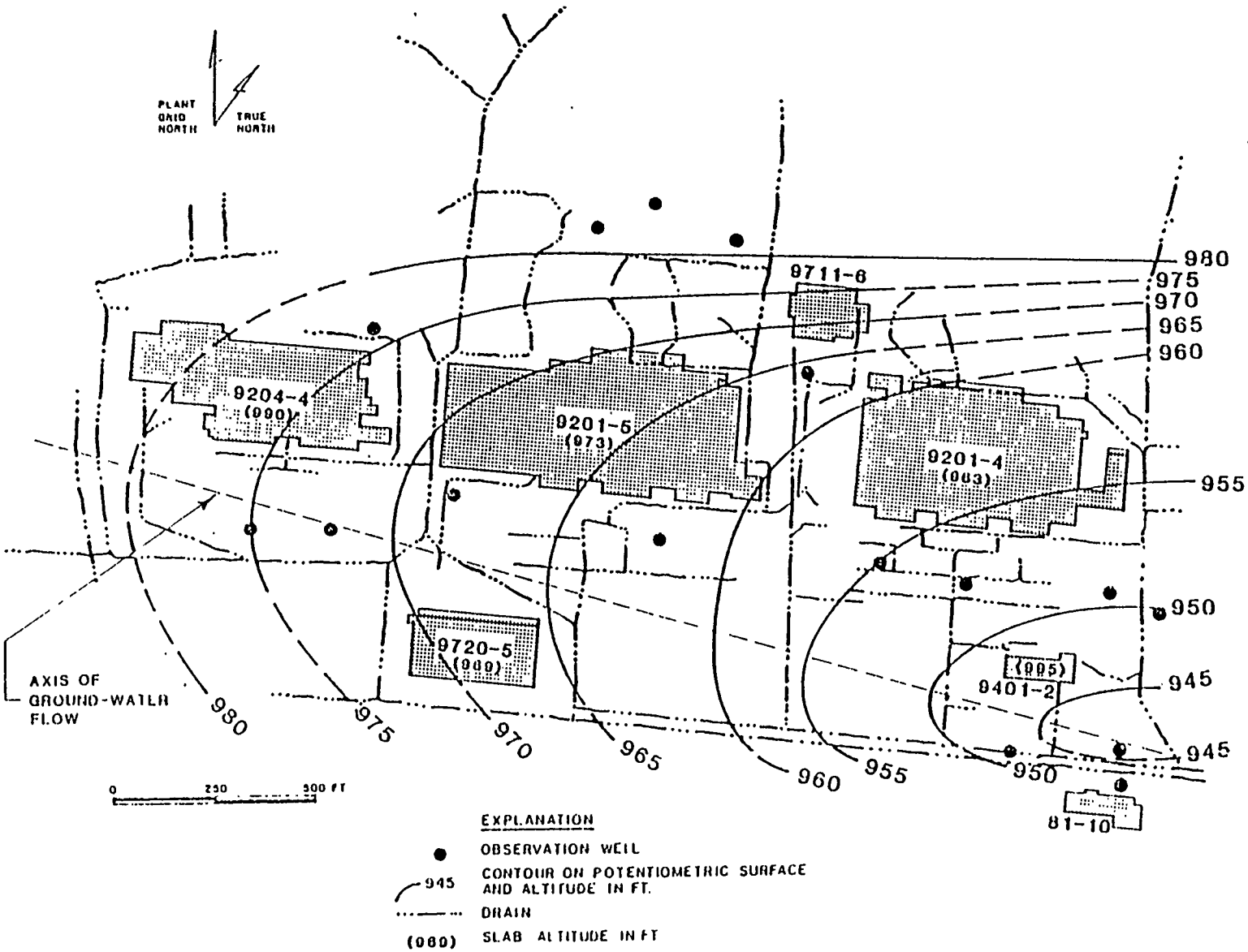


Figure 4.4 Potentiometric surface, unconsolidated material, western area, May 4, 1984 (from Geraghty & Miller, 1985).

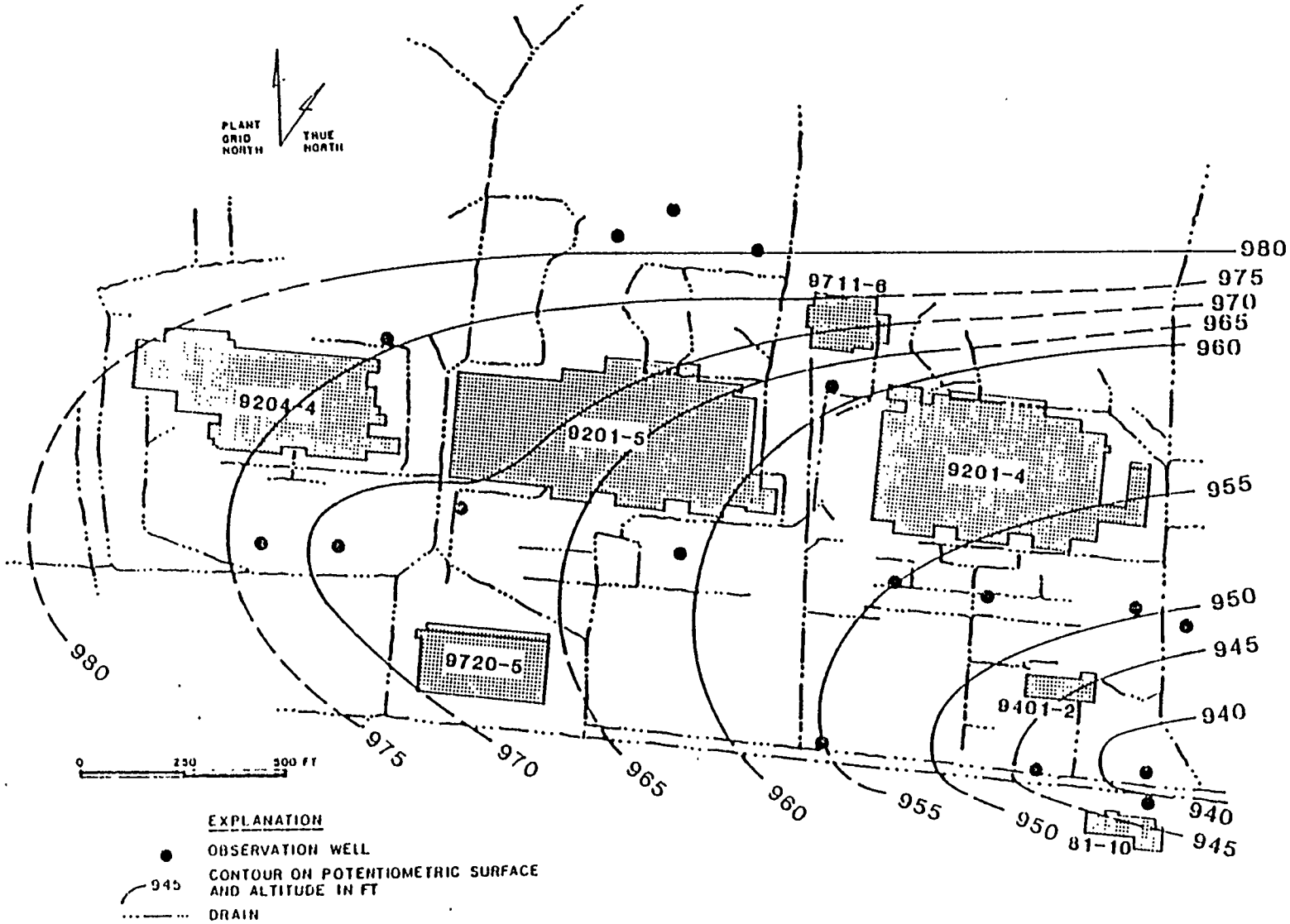
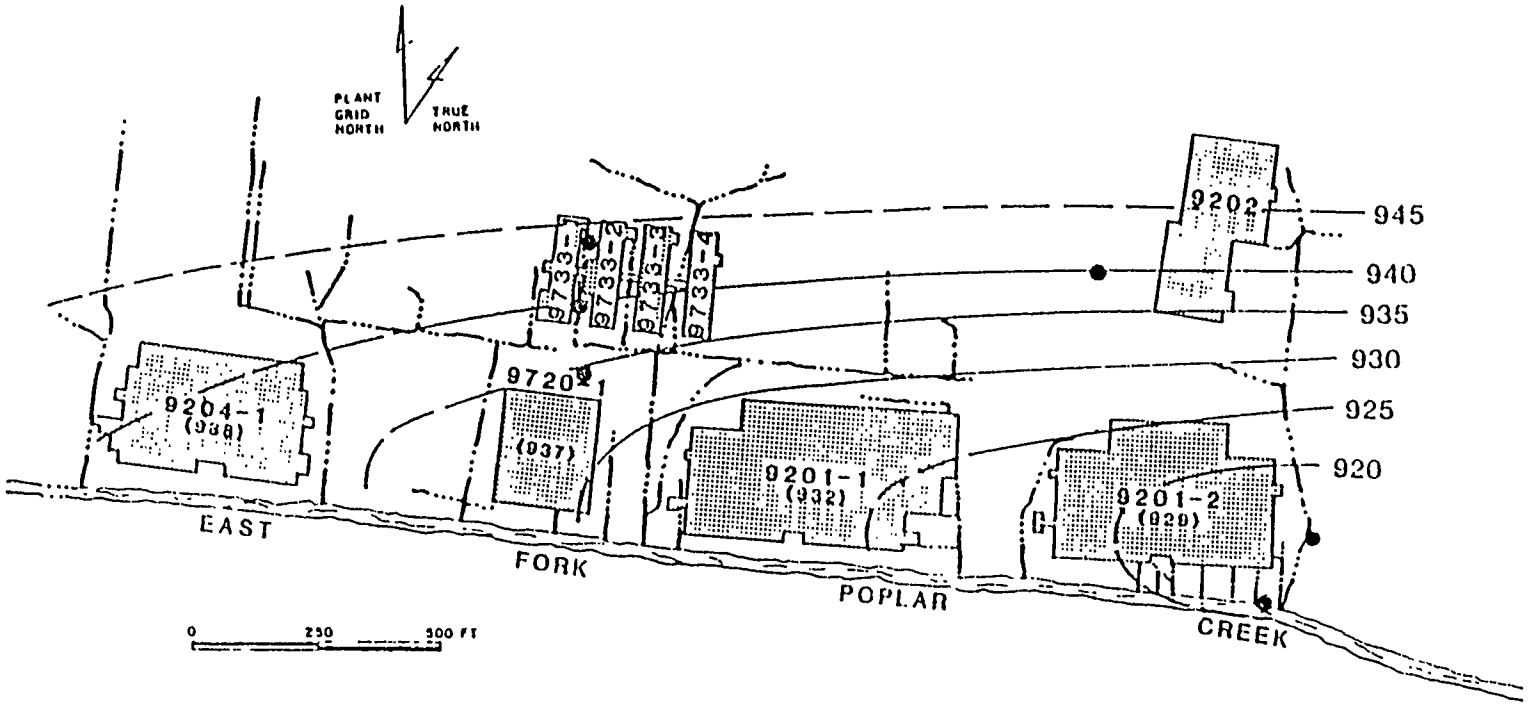


Figure 4.5 Potentiometric surface, unconsolidated material, western area, September 17, 1984 (from Geraghty & Miller, 1985).



EXPLANATION

- OBSERVATION WELL
- 920 CONTOUR ON POTENTIOMETRIC SURFACE AND ALTITUDE IN FT
- DRAIN
- (920) SLAB ALTITUDE IN FT

Figure 4.6 Potentiometric surface, unconsolidated material, eastern area, May 4, 1984 (from Geraghty & Miller, 1985).

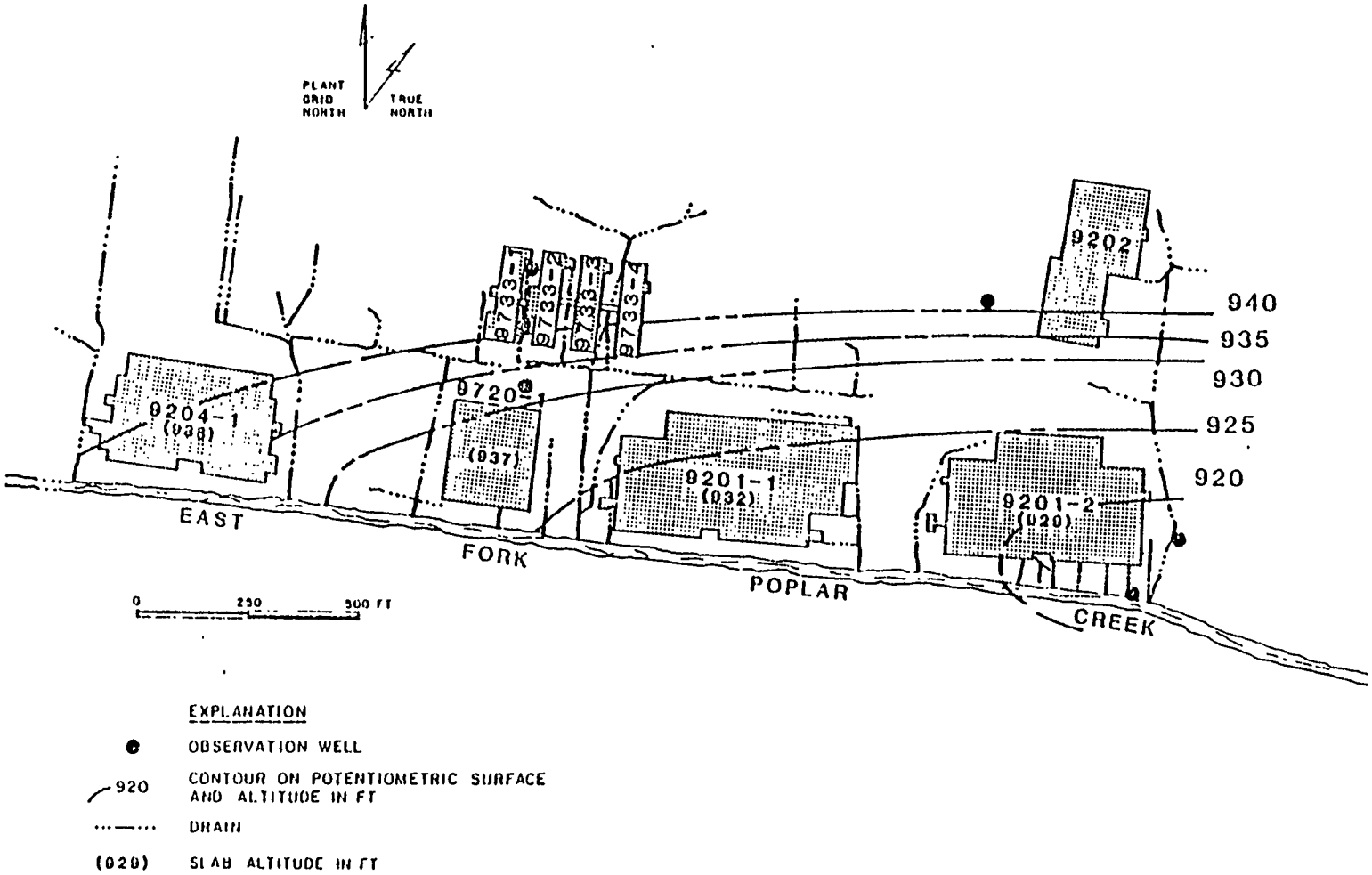


Figure 4.7 Potentiometric surface, unconsolidated material, eastern area, September 17, 1984 (from Geraghty & Miller, 1985).

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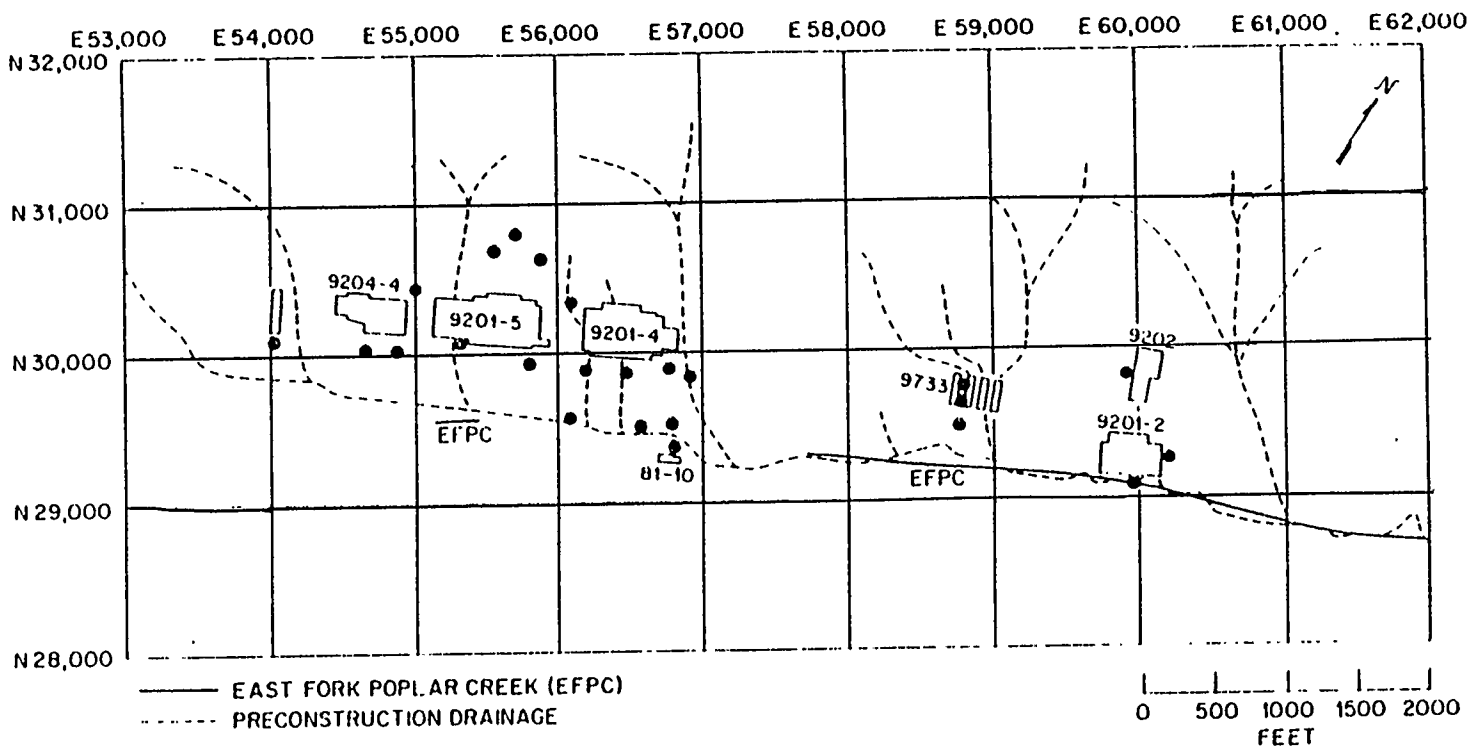

Figure 4.8 Surface water drainage before and after construction of the Y-12 Plant (from Rothschild et al. 1984).

Creek lies along the western edge of the Y-12 Plant. Based on experience in other areas underlain by the Conasauga Group, depth to groundwater in the Y-12 Plant area probably ranged from about 30 ft beneath the hills to essentially zero near streams. In general, the water table was probably a subdued image of the surface topography (Rothschild et al. 1984).

After construction of the Y-12 facilities, all north-south surface drainages were eliminated. In part, these have been replaced by subsurface drains in the Y-12 Plant area (see Figure 4.4 through 4.7). Upper East Fork Poplar Creek was also altered; the headwaters are now an underground drainageway (storm sewer system), and the channel has been significantly straightened in the Y-12 Plant area.

4.2.2 Surface Water Hydrology

Discharge in Upper East Fork Poplar Creek and the subsurface storm drainage system is regulated during dry weather largely by inputs of water from plant operations. For example, 6 to 8 mgd of water from Melton Hill Reservoir are imported for mostly nonconsumptive use at the Y-12 Plant. Natural dry weather flow from the Y-12 Plant is estimated to be on the order of 1 mgd (CDM 1989). Equipment cooling and air conditioning constitute the major uses for the water imported from Melton Hill Reservoir. Table 4.1 summarizes a 1983 water balance for the Y-12 Plant. In recent years construction and operation of several wastewater treatment plants have added additional water to Upper East Fork Poplar Creek. Detailed investigations of surface water hydrology within the Y-12 Plant have only recently been undertaken as part of the Comprehensive Sampling Program for East Fork Poplar Creek Area Source Pollution Assessment and Control Plan (Camp Dresser and McKee 1987). Only preliminary results of this investigations are currently available.

Table 4.1 Summary table for 1988 water balance for the Y-12 Plant (data from Camp Dresser and McKee, 1989).

INFLOWS	
DOE Water Treatment Plant	7.401 mgd
Groundwater Infiltration to EFPC[a]	1.300 mgd
Total Inputs	8.701 mgd
OUTFLOWS	
Losses	
Cooling Tower Evaporation	0.146 mgd
Steam Plant Evaporation	0.279 mgd
Plant Sewer Discharge	1.176 mgd
Distribution System Leakage	1.110 mgd
On-site Storage	
West Tank Farm	0.003 mgd
Discharged at EFPC Station 17	5.987 mgd
Total Outputs	8.701 mgd

[a] Calculated as the difference between measured inflows and outflows.

4.3 AIR

A detailed discussion of air is provided in Section 4.5 of the RFI Plan-General Document, Volume I (Welch 1989a).

4.4 SOIL

The Y-12 Plant is overlain primarily by residual soils, fill, and, to a much lesser extent, by alluvial soils. Soils have been derived from rocks of the Knox Group, Conasauga Group, and Rome Group. These are typically silt loams with variable amounts of clay and chert or shale depending on the parent rock type and slope position. Section 4.2.5 of the RFI Plan-General Document, Volume I (Welch 1989a) discusses each of the soil types found in the Y-12 Plant.

5. IDENTIFICATION OF POTENTIAL MIGRATION PATHWAYS AND POTENTIAL RECEPTORS

The migration of contaminants away from the Mercury-Use Areas is likely to occur via three primary pathways: (1) surface water (storm drain) transport, (2) subsurface (groundwater) transport and (3) atmospheric transport. As discussed previously the subsurface pathway is being addressed independently of the RFI for the Mercury-Use Areas due to the diverse and complex nature of potential contamination within the Y-12 Plant and due to earlier findings (Rothschild et al. 1984; Geraghty & Miller 1985) that transport of mercury in groundwater at the Y-12 Plant was likely to be inconsequential. Important factors in the transport of materials via surface water and air pathways are discussed in Section 5.1 of the RFI Plan-General Document, Volume I (Welch 1989a).

5.1 MIGRATION PATHWAYS

5.1.1 Surface Water Transport

Surface water tranport of mercury and other contaminants from the Mercury-Use Areas is well documented (Wilcox 1983; Turner et al. 1985).

5.1.2 Air Transport

Atmospheric emission of mercury from Hg-contaminated buildings, equipment and soil is very likely at the Y-12 Plant. Mercury was used in the elemental form which exhibits a relatively high vapor pressure. Indoor air monitoring in Building 9201-4 and outdoor ambient air monitoring within the Mercury-Use Areas have documented elevated mercury concentrations (See section 6.5). Thus, the air pathway must be considered in the RFI.

5.2 POTENTIAL RECEPTORS

Contaminants that are introduced into the biosphere are subject to the same biogeochemical processes that normally cycle elements within and among ecosystems. Contaminant concentrations in the soil can be incorporated into the plants by uptake through the root system.

Contaminants released into the atmosphere can be incorporated into plant systems by foliar deposition and absorption. When this occurs, the contaminant may then pass directly to humans or to grazing animals as superficial or metabolically absorbed contamination. Contaminants in surface water can be adsorbed to or incorporated into periphyton (attached algae) or other material that comprise the base level of the food chain. These pollutants can then pass rather quickly through higher levels of the food chain, often accumulating in tissues of organisms occupying these levels. In the case of inorganic mercury contamination such as has occurred at the Y-12 Plant, microorganisms in natural waters can convert very small quantities of mercuric ion to the far more toxic, and more readily bioaccumulatable, methylmercury (Jensen and Jernelöv 1967; Ridley et al. 1977). Due to very slow elimination rates of methylmercury in fish tissue, concentrations tend to increase with age of the organism (Kelly et al. 1975; Scott 1974).

Potential receptors (human populations, aquatic and terrestrial flora and fauna, and threatened and endangered species) are discussed in Section 5.2 of the RFI Plan-General Document, Volume I (Welch 1989a).

6. EXISTING MONITORING DATA

6.1 INTRODUCTION

As indicated in Section 3.0, Upper East Fork Poplar Creek has been monitored for mercury since 1954 and thus the history of releases of mercury from the Mercury-Use Areas is nearly completely documented. The quality of this record has improved steadily over the years with major improvements beginning in 1977 and again about 1983. The year 1983 also marked the beginning of a period of intensive and extensive environmental investigations of mercury at the Y-12 Plant, some of which continue at this time. For example, Rothschild et al. (1984) summarized results of the first subsurface investigation of mercury at the Y-12 Plant. This study generated analytical data from both soil borings and groundwater monitoring wells that were installed especially for this investigation. Some results of this study led to the excavation of mercury-contaminated soils at Buildings 9733-1/2.

Turner et al. (1985) summarized results of a comprehensive survey of mercury in the storm drain system of the Y-12 Plant. Results of this study were used to guide the Y-12 Plant corrective measures project known as "Reduction of Mercury in Plant Effluents," which is discussed in Section 3.0. A project entitled "Outdoor Radiological and Chemical Surface Characterization of the Y-12 Plant Site" resulted in the collection of 1866 soil samples that were analyzed for mercury and uranium isotopes. A smaller subset of these samples was also analyzed for PCBs. Soil along the Perimeter Intrusion Detection Assessment System (PIDAS) corridor was also intensively sampled (750 samples) and analyzed for mercury and PCBs. A project entitled "Area Source Pollution Assessment and Control Plan" resulted in collection of both wet- and dry-weather flow samples at critical locations in the Y-12 storm drain system. Modeling of area source discharge is currently underway by the contractor who designed the sampling program. Staff in the Analytical Development Group at the Y-12 Plant Laboratory developed and tested an automatic mercury analyzer that was subsequently installed and operated at three locations at the Y-12 Plant: (1) inlet to New Hope Pond, (2) outlet to New Hope

Pond, and (3) combined sump discharge from Building 9201-4. These instruments generated a mercury concentration for each of these effluent streams every 30 minutes that the instruments were operating. Monitoring for mercury in indoor air at the Y-12 Plant began in 1950 and continues to the present. Ambient (outdoor) monitoring for mercury in air began in 1986 and also continues at the present time. These examples represent only part of the previous and ongoing environmental monitoring programs. This section will summarize and evaluate these data in the context of the objectives of the RFI Plan.

Most of the data presented here have been published, but some were obtained from unpublished portions of large and small data bases maintained by the Y-12 Plant, contractors to the Y-12 Plant, or others (e.g., staff in the Health and Safety Research and Environmental Sciences Divisions of the Oak Ridge National Laboratory). Most of the unpublished data are included in the Appendices to this RFI Plan.

6.1.1 Contaminants of Concern

In discussing air, water, and soil data in subsequent subsections, references will be made to health and environmental assessment criteria. These include regulatory as well as guidance- and advisory-type criteria. For example, Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act represent one type of assessment criteria for use when evaluating monitoring data for surface water and groundwater. Concentrations of contaminants which are acutely or chronically toxic to aquatic life are another type of assessment criteria. Background concentrations of contaminants in an area of study, although not strictly criteria, can also be valuable in assessing environmental data.

To prepare for this RFI Plan, information on a variety of assessment criteria were assembled for the purpose of determining whether a given contaminant in a given medium needed further investigation. Initially, a list of contaminants was prepared which represented all contaminants which have been reported to have been associated with the lithium isotope separation program. This is a relatively short list due to the simplicity of the chemical process involved. The only chemicals used in significant

quantities were elemental mercury, lithium hydroxide, ethylenediamine (Orex only), and nitric acid. Electrical power requirements for the Elex and Colex processes were large and thus transformers were necessary. For this reason PCBs have been added tentatively to the list of contaminants. In addition, the uranium isotope separation program which preceded the lithium isotope program also had large electrical power requirements. PCBs represent a hazardous constituent which is not unique to the lithium or uranium isotope separation programs. This contaminant is likely to be associated with many other processes and facilities at the Y-12 Plant. Uses of the subject facilities after the lithium isotope program was terminated have been highly varied and suggest that many other hazardous constituents may currently be, or could have been, released.

The above list of contaminants associated with the lithium isotope separation program was compared with lists of health and environmental criteria given in Section 8.0 of the RFI Guidance (USEPA 1989a), and in various other documents. Contaminants that appeared in both lists, i.e., mercury, nitrate, and PCBs, were designated "contaminants of concern" for the Mercury-Use Areas. The health and environmental criteria for these contaminants of concern are summarized in Table 6.1. Where available, local background concentrations in each media are also given.

Other contaminants of concern for the Y-12 Plant area have been identified by others (Travis et al. 1989) as part of the RFI Plan for UEFPC using recent surface water monitoring data (NPDES and Area Source Control Program) for selected discharge points. These contaminants include beryllium, cadmium, silver, nickel, lead, arsenic, copper, chromium, phenols, several volatile organic compounds and benzo(a)pyrene. Comprehensive (Appendix IX constituents, 40 CFR Part 264) analyses of sediment in New Hope Pond (NHP) and the Chestnut Ridge Sediment Disposal Basin (CRSDB) can also be used to identify contaminants of concern for the Y-12 Plant area. These sediments represent an integrated record of sediment-bound contaminants that have been transported out of the plant area by UEFPC and trapped by NHP since 1963 when NHP was constructed. Some or all of the contaminants in these sediments could have originated in one of more of the facilities in the Mercury-Use Areas. Just prior to

Table 6.1 Health and Environmental Assessment Criteria.

	Reference	Mercury	Nitrate	PCBs
Air				
NESHAP Ambient 30-d Average ($\mu g/m^3$)	38 CFR 8820	1		
OSHA Workroom 8-h Average ($\mu g/m^3$)		50		
Global Background ($\mu g/m^3$)	Kaiser and Tolg (1980)	0.001-0.010		
Water				
Drinking Water (MCL, mg/L)	EPA 1989a	0.002	10	$4.5X10^{-6}$
Systemic Toxic (mg/L)	EPA 1989a	0.010[a]		
Aquatic Life	EPA 1989a			
Acute (mg/L)		0.0024		0.002
Chronic (mg/L)		$1.2X10^{-5}$		$1.4X10^{-5}$
Background(mg/L)	Turner(unpub.)	$5X10^{-6}$		
Soil/Sediment				
Systemic Toxic (mg/kg)	EPA 1989a	5[a]		
RCRA EP Tox (mg/L)		0.2		
EP Tox Equivalent (mg/kg)	Calculated	4		
TDHE Guideline (mg/kg)	Bashor and Turri(1983)	12		
Background (mg/kg)		0.05-0.5		

[a]As methylmercury

1988 closure of NHP and the CRSDB, extensive sampling and chemical analyses were performed on sediment from these facilities (Kimbrough and McMahon 1988a,b). A complete summary of these data are given in Appendix B. CFR Appendix IX (40 CFR Part 264) constituents were detected in these sediments above natural background concentrations in nearly every analytical category (e.g., metals, volatile organic compounds, etc.) but few exceeded any available assessment criteria. However, failure to exceed criteria at these downstream receiving facilities does not imply that criteria are not exceeded in the sources areas, such as the Mercury-Use Areas. Thus, for the purposes of this RFI Plan, detection of any Appendix IX constituent above the Practical Quantitation Level (PQL) was taken as evidence of an upstream release.

6.1.2 Assessment Criteria for Soil and Sediment

Assessment criteria for contaminants in soil and sediment are almost non-existent, although they may be calculated from allowable doses or intakes given assumptions about pathways and absorption. Criteria for PCBs, uranium, and mercury have been proposed. Under the Toxic Substances Control Act (TSCA) PCB Spill Cleanup Policy (40 CFR Part 761), a level of 25 μg/g has been proposed for sites with restricted access, such as industrial complexes and remote rural areas. The TDHE has also adopted this level as a cleanup level for waste facilities at the Y-12 Plant. The proposed criterion for uranium in soils is 32 pCi/g. The Y-12 Plant has established 12 μg/g as the maximum concentration of mercury allowed in soil and demolition spoil destined for disposal in the Y-12 Sanitary Landfill, the Y-12 Industrial Landfill, and other disposal facilities for non-hazardous solid waste. This concentration level was first proposed by the TDHE in 1983 (Bashor and Turri 1983) based on risk analysis with direct ingestion and inhalation as the exposure pathways.

More recent risk analyses directed towards developing a soil "action level" (Revis et al. 1989) have suggested that an acceptable limit for mercury in soils may be on the order of 700 μg/g. The main basis for the latter value is the observation that mercury in soils from the floodplain

of EFPC and sediment from NHP is predominantly (>90%) associated with the highly insoluble (and biologically unavailable) sulfide form of mercury, HgS. Whether mercury in soils from the Mercury-Use Areas exists predominantly in the sulfide or other forms has not been determined. However, many soil samples collected during the Rothschild et al. (1984) study and in subsequent investigations have exhibited high headspace mercury vapor concentrations in their sample containers (determined with a Jerome Model 411 Analyzer), suggesting that the elemental form may predominate in at least some of these samples.

It is also noteworthy that samples with visible beads of mercury or detectable headspace mercury vapor have a good possibility of yielding leachate mercury concentrations in the RCRA EP Toxicity (EP-Tox) test greater than 0.200 mg/l and thus a "toxicity hazardous" classification under RCRA. Table 6.2 illustrates the better correspondence between headspace mercury vapor and EP-Tox results than between total mercury in soil and EP-Tox results. These results suggest that any soil sample with detectable (Jerome Model 411) mercury vapor in the headspace is likely to be RCRA "toxic". However, other unpublished data (John Napier, Y-12 Development Division) suggests that the presence of elemental mercury in soil samples does not always result in a RCRA "toxic" classification. The EP Toxicity test has been applied to a large number of soil samples from the Y-12 Plant. The results for mercury have been used extensively by the Y-12 Plant to determine whether a soil or other solid waste should be handled and disposed of as a hazardous waste. Headspace mercury vapor analyses, which may indicate the presence of elemental mercury, have been generally limited to those shown in Table 6.2 and to some samples collected for the Subsurface Mercury Investigation (Rothschild et al. 1984).

Additional risk analysis performed by the Oak Ridge City Interim Action Group (Phil Walsh, unpublished document, See Appendix C) on mercury in surface soils indicated that the 12 $\mu g/g$ guideline proposed by Bashor and Turri (1983) was very conservative (See discussion in Appendix C) for the ingestion and inhalation pathways of exposure. In deciding which Hg-contaminated sites in the City of Oak Ridge required immediate corrective

Table 6.2 Comparison of EP Toxicity Results with Total Hg and Headspace Vapor Analyses for Soil Samples Collected Inside (81-10) and Outside (EFPC Floodplain) the Y-12 Plant.

Sample Location	Sample I.D.	Total Mercury ($\mu g/g$)	Headspace Hg Vapor (mg/m^3)	EP Toxicity (mg/L)	% Total Hg Extracted by EP[a]
81-10	659670	580	0.157	1.2	4.1
81-10	659671	4.0	<0.001	<0.02	<10
81-10	659672	130	0.003	0.23	3.5
81-10	659673	140	0.010	0.32	4.6
81-10	659674	790	0.086	2.6	6.6
81-10	659675	400	0.010	0.24	1.2
EFPC Floodplain	222461	3100	<0.001	0.021	1.4
EFPC Floodplain	222462	56	<0.001	0.010	36
EFPC Floodplain	222463	1000	<0.001	0.007	1.4
EFPC Floodplain	222464	2100	<0.001	0.012	1.1
EFPC Floodplain	222465	2500	<0.001	0.005	0.4
EFPC Floodplain	222466	140	<0.001	0.003	4.3

[a]Calculated as [(EP-Tox)·20/(Total Hg)]·100

measures, this group considered land use as well as mercury concentration in surface soils. Values less than 100 μg/g were not considered to be of immediate concern unless such values occurred in a garden or in an area where a small child might play. In view of the industrialized nature and access limitations of the Y-12 Plant the use of a preliminary soil guideline of 100 μg/g seems justified until a more defensible guideline is developed. For the purposes of this RFI Plan, soil concentrations in excess of 100 μg/g, or the presence of visible elemental mercury, will trigger further investigation and possible remedial action.

6.1.3 Y-12 Plant Monitoring

Y-12 staff have monitored selected contaminants, including mercury, in air, water, and soil in the Mercury-Use Areas and downstream for many years. The intensity of monitoring activities increased sharply in about 1983. In general, Y-12 staff have conducted both compliance (NPDES) and assessment monitoring of Upper East Fork Poplar Creek, basement sump water from Building 9201-4, groundwater within and near the perimeter of the Y-12 Plant, miscellaneous aquatic discharges, and air quality (ambient and indoor). Most of the results of this monitoring have been reported in the annual ORR Environmental Surveillance Report (e.g., Rogers et al. 1988) and in other documents.

6.1.4 ORNL Monitoring

Staff, mainly from the Environmental Sciences Division (ESD), but also from the Health and Safety Research Division (HASRD) and Energy Division, from ORNL have performed a variety of environmental monitoring tasks and special investigations on behalf of the Y-12 Plant. For example, ESD staff have conducted special investigations and monitoring of groundwater, surface water, air, sediment, soil and biota. HASRD staff have conducted soil surveys and risk assessments for the Y-12 Plant. Results of these studies which are related to the Mercury-Use Areas are discussed in subsequent sections.

6.1.5 Contractor Monitoring

As part of the Best Management Practices (BMP) Plan required by the Tennessee Department of Health and Environment (TDHE) and the U.S. Environmental Protection Agency (EPA), the Oak Ridge Y-12 Plant contracted Camp Dresser & McKee, Inc. (CDM) to perform an area source pollution assessment and control plan for the East Fork Poplar Creek (EFPC) Y-12 plant drainage area. The primary objective of the assessment program was to assess non-point sources of pollution, including mercury sources, to East Fork Poplar Creek. Preliminary results of this study, which is still in progress, are given in section 6.4.3 below.

6.2 GROUNDWATER DATA

This section will only very briefly summarize results of previous investigations of groundwater in the Mercury-Use Areas. Goundwater monitoring is not being proposed in this RFI and thus the summary presented here is for general information only. Groundwater is being investigated on a valley-wide scale as part of the Comprehensive Groundwater Monitoring Plan for the Department of Energy Y-12 Plant, Oak Ridge, Tennessee (Geraghty & Miller 1989).

6.2.1 Existing Well Locations and Descriptions

Table 6.3 and Figure 6.1 summarize information on the location and construction of wells installed in 1983-84 within the inner perimeter of the Y-12 Plant to investigate mercury contamination of groundwater. Rothschild et al. (1984) gives complete information on the installation of these wells. Figure 6.2 illustrates the location of these wells with respect to the Mercury-Use Areas. Wells 58-1A, 58-1B, 58-2A, 56-5A, 56-5B and 56-5C have been plugged and abandoned. Wells 55-4B and 55-4C cannot be located and are presumed to be destroyed. Well 56-9A is damaged and has been taken out of service, but has not been plugged and abandoned.

Additional wells (22) have been installed within the perimeter of the Y-12 Plant since the Rothschild study. Locations and descriptions of these additional wells, which were installed in strict accordance with RCRA specifications, along with the proposed locations of 63 additional

Table 6.3 Summary of wells installed within perimeter of the Y-12 Plant.

well nest	well ID	North coordinate	East coordinate	Total casing length (ft)	Elevation of measuring point (ft-MSL)	Elevation of ground surface (ft-MSL)	Note on zone of completion
53-1	A	30,176.21	53,814.62	22.05	993.65	990.67	
54-1	A	30,010.02	54,702.89	23.03	983.87	981.71	
54-2	A	30,009.19	54,855.11	26.31	983.77	981.07	
55-1	A	30,469.88	55,014.07	19.29	986.67	986.20	
55-1	B	30,469.23	55,009.99	38.78	986.26	986.05	
55-1	C	30,466.74	55,013.13	75.72	986.73	985.85	
55-2	A	30,085.32	55,194.96	14.11	976.74	976.17	Highly weathered rock
55-2	B	30,084.88	55,199.17	27.59	977.25	976.17	Highly weathered rock
55-2	C	30,085.20	55-202.96	75.89	976.85	976.07	
55-3	A	29,959.34	55,695.12	14.34	972.46	971.59	
55-3	B	29,958.73	55,698.77	38.09	973.32	971.57	
55-3	C	29,958.59	55,702.65	77.53	974.34	971.76	
55-4	B	30,762.67	55,694.55	25.49	1004.68	1003.92	
55-4	C	30,762.77	55,698.10	72.64	1004.86	1003.95	
55-5	A	30,697.60	55,556.53	10.86	988.58	986.67	
55-6	A	30,667.34	55,906.66	12.89	989.04	986.32	
56-1	A	30,350.69	56,079.34	19.03	969.25	968.72	
56-1	C	30,355.03	56,077.03	75.30	969.49	968.89	
56-2	A	29,880.85	56,228.72	15.12	963.30	962.52	
56-2	B	29,883.61	56,225.60	38.81	962.28	962.21	
56-2	C	29,884.63	56,230.51	77.30	964.94	962.44	
56-3	A	29,866.66	56,452.76	17.78	963.03	962.35	Possible solution cavity
56-3	B	29,867.20	56,447.67	33.43	963.40	962.36	Possible solution cavity
56-3	C	29,859.16	56,449.10	55.48	962.86	962.36	
56-4	A	29,819.59	56,802.01	12.14	962.07	960.10	Weathered rock
56-4	B	29,815.13	56,799.28	32.58	961.38	960.56	
56-4	C	29,815.06	56,804.51	76.28	962.62	959.05	
56-5	A	29,380.21	56,823.85	12.60	966.69	965.90	Fill
56-5	B	29,382.47	56,827.82	35.10	966.72	965.87	Solution cavity
56-5	C	29,375.47	56,818.57	71.59	967.30	966.34	
56-6	A	29,783.24	56,915.30	21.03	960.28	958.12	
56-7	A	29,449.16	56,814.30	21.10	958.45	956.62	
56-8	A	29,465.51	56,545.71	25.56	962.46	959.15	
56-9	A	29,532.83	56,043.39	17.29	965.86	963.84	
58-1	A	29,647.52	58,777.80	11.15	947.84	947.20	Installed in 58-1/8M
58-1	B			22.64			Installed in 58-1/80
58-2	A	29,500.33	58,772.32	9.94	938.16	936.23	
59-1	A	29,830.55	59,884.79	13.22	945.75	945.26	
59-1	B	29,835.10	59,885.47	35.94	945.69	945.07	
59-1	C	29,834.00	59,881.56	73.92	945.87	945.12	
60-1	A	29,225.67	60,199.87	23.20	929.56	929.29	Wells are shallow due to problems with well collapse
60-1	B	29,225.44	60,203.55	29.23	929.80	929.16	
60-2	A	29,097.06	60,118.58	13.52	929.69	927.77	

[a]All wells are completed with 5-ft stainless steel screen with the following exceptions: well 53-1A is an all-stainless steel, 2-in.-diam well, with a 5-ft screen; and wells 56-7 and 56-8 have 5-ft, 0.01-in. slot PVC screens.

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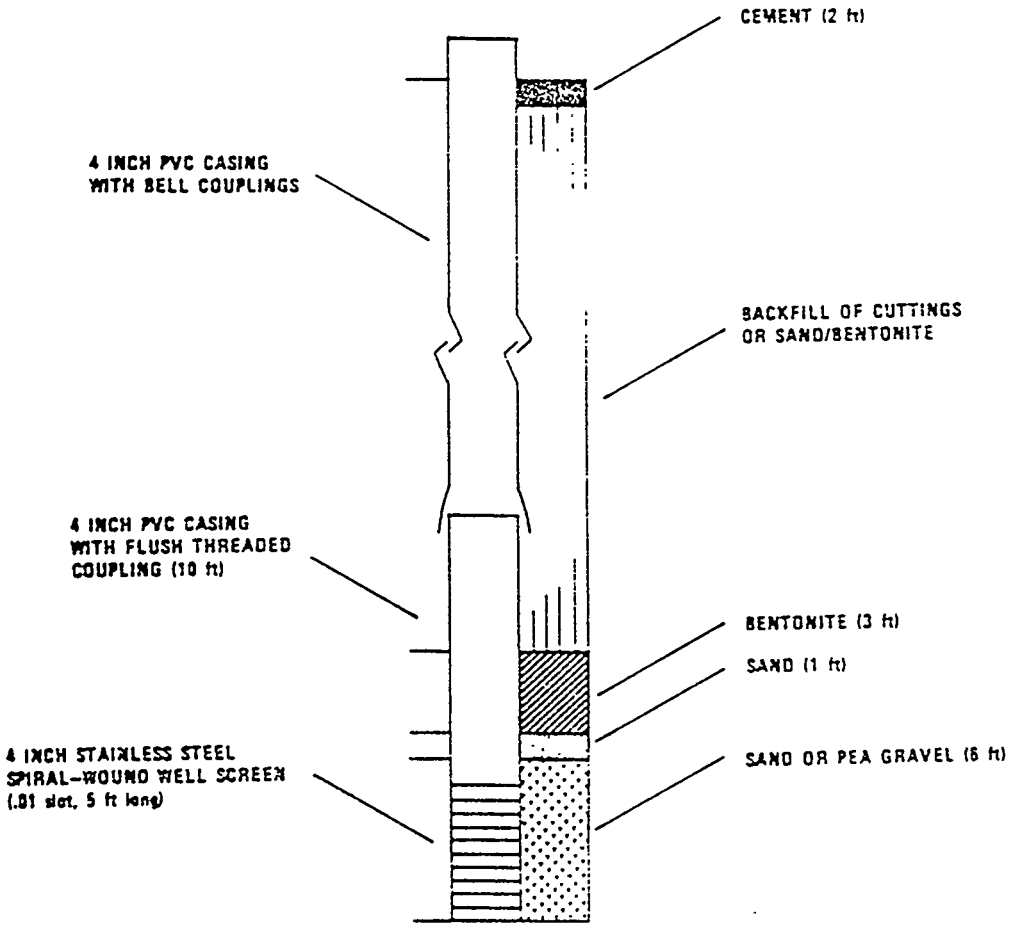


Figure 6.1 Diagram of a typical monitoring well installed at the Y-12 Plant (from Rothschild et al. 1984).

wells for the Comprehensive Groundwater Monitoring Plan (Geraghty & Miller 1989) are given in Appendix A.

6.2.2 Water Level Monitoring

Weekly water level data was collected for each well shown in Figure 6.2 over a two year period beginning in 1983. Results can be retrieved from the large computer data base maintained by H&R Technical Associates (Mercier 1988) and have been used to generate water table maps and hydrologic cross sections (Rothschild et al. 1984; Geraghty & Miller 1985, 1989).

6.2.3 Sampling Results

Results of groundwater quality monitoring are given in Rothschild et al. (1984) and in Allison (1988). With a few exceptions, the wells shown in Figure 6.2 have not been monitored regularly since they were installed (1983-84).

Sampling results have generally indicated that mercury is not mobile in the aqueous phase. Although many groundwater samples had above-background concentrations of mercury, Rothschild et al. (1984) concluded that the mercury content of most of these samples was due to excessive (visible) amounts of sediment in the samples. Although samples were not routinely filtered, one sample with a total mercury concentration of 145 μg/L contained only 0.04 μg/L after filtration. No wells yielding clear groundwater samples had mercury concentrations in excess of the MCL for drinking water (2 μg/L). Three wells (two south of buildings 9201-5 and 9201-4 and one north of 81-10) yielded clear groundwater samples that approached 50% of the drinking water MCL. Nine wells yielded concentrations suggestive of low level mercury contamination (0.1 to 1.0 μg/L), while 15 wells were essentially free of aqueous mercury contamination.

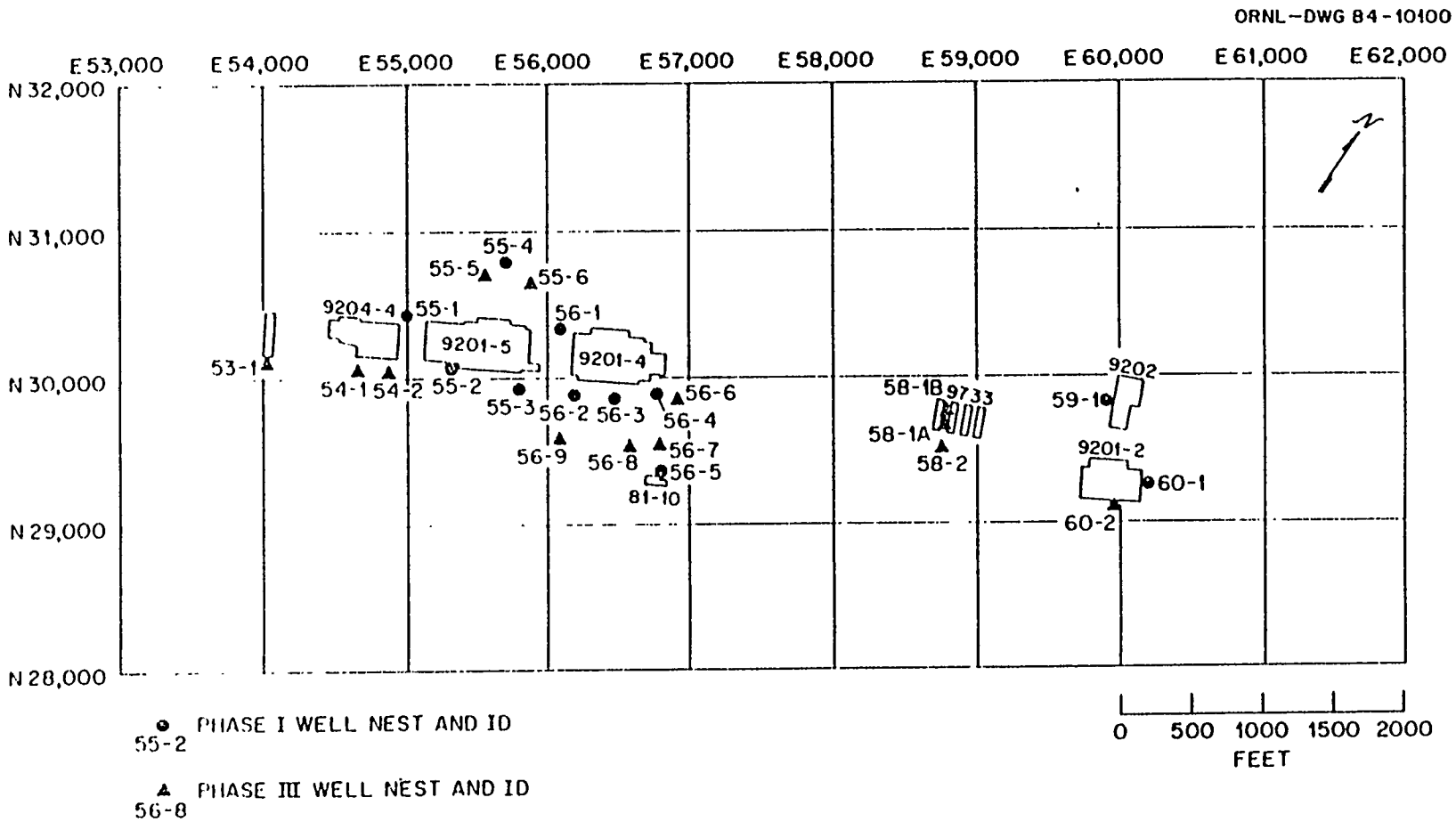


Figure 6.2 Location of monitoring wells with respect to the Mercury-Use Areas.

6.2.4 Conclusions and Recommendations

Although many issues related to shallow groundwater contamination at the Y-12 Plant, and specifically in the Mercury-Use Areas, remain to be resolved, the RFI for the Mercury-Use Areas will not be addressing these issues. Rather, the Comprehensive Groundwater Monitoring Program will address these issues. It is noteworthy that the previous studies do not indicate a pressing need to further investigate mercury in groundwater. However, in designing effective corrective measures to reduce surface water releases of mercury it will probably be necessary to investigate the mechanisms of surface water contamination in the sewered portions of the plant where groundwater infiltration almost certainly contributes to the storm sewer discharges (see conclusions by Geraghty & Miller 1985).

6.3 SOIL DATA

Soil mercury contamination has been investigated both intensively and extensively at the Y-12 Plant. Several sites with suspected or known mercury contamination have been intensively investigated. These include (1) the alcove between Buildings 9733-1 and 9733-2, (2) the area on the southeast corner of Building 9201-2, (3) the Building 81-10 area, and (4) the PIDAS corridor. Results of the first three of these investigations were published by Rothschild et al. (1984). Data for the PIDAS corridor are available only in computer database form but have been included in Appendix D of this RFI Plan. The only extensive (comprehensive) survey of mercury in soils at the Y-12 Plant was conducted by the ORNL Health and Safety Research Division in 1985-87. The results of this survey are currently available only in a computer database but are tabulated fully in the Appendix E of this RFI Plan.

6.3.1 Rothschild Results

6.3.1.1 9733-1/2 Alcove

Construction workers discovered visible mercury in the fill and weathered shale in 1983 in the process of digging French drains in the alcove between Buildings 9733-1 and 9733-2. This area had not previously been noted as a mercury spill site. The soil profiles exposed by hand digging the holes for the French drains revealed that mercury, occurring as fairly large beads (up to 0.25 in.) in a porous medium (coarse loamy sand to fine loamy gravel), had apparently not migrated significantly for 30 years.

A series of bucket auger samples was obtained in October 1983 at nine locations (A through I in Figure 6.3) in the south alcove between buildings 9733-1 and 9733-2. At each location, auger samples representing up to 12 in. of material were taken sequentially until the auger could not be advanced deeper. In addition, exposed material in the two French drain holes (TP1 and TP2) were sampled at 6-in. intervals. Mercury concentrations in the soil ranged from 4.8 to 10,600 $\mu g/g$; sites B and E had the highest concentraions. Except at location C where the boring extended to a depth of only 18 in., all of the profiles showed a decrease

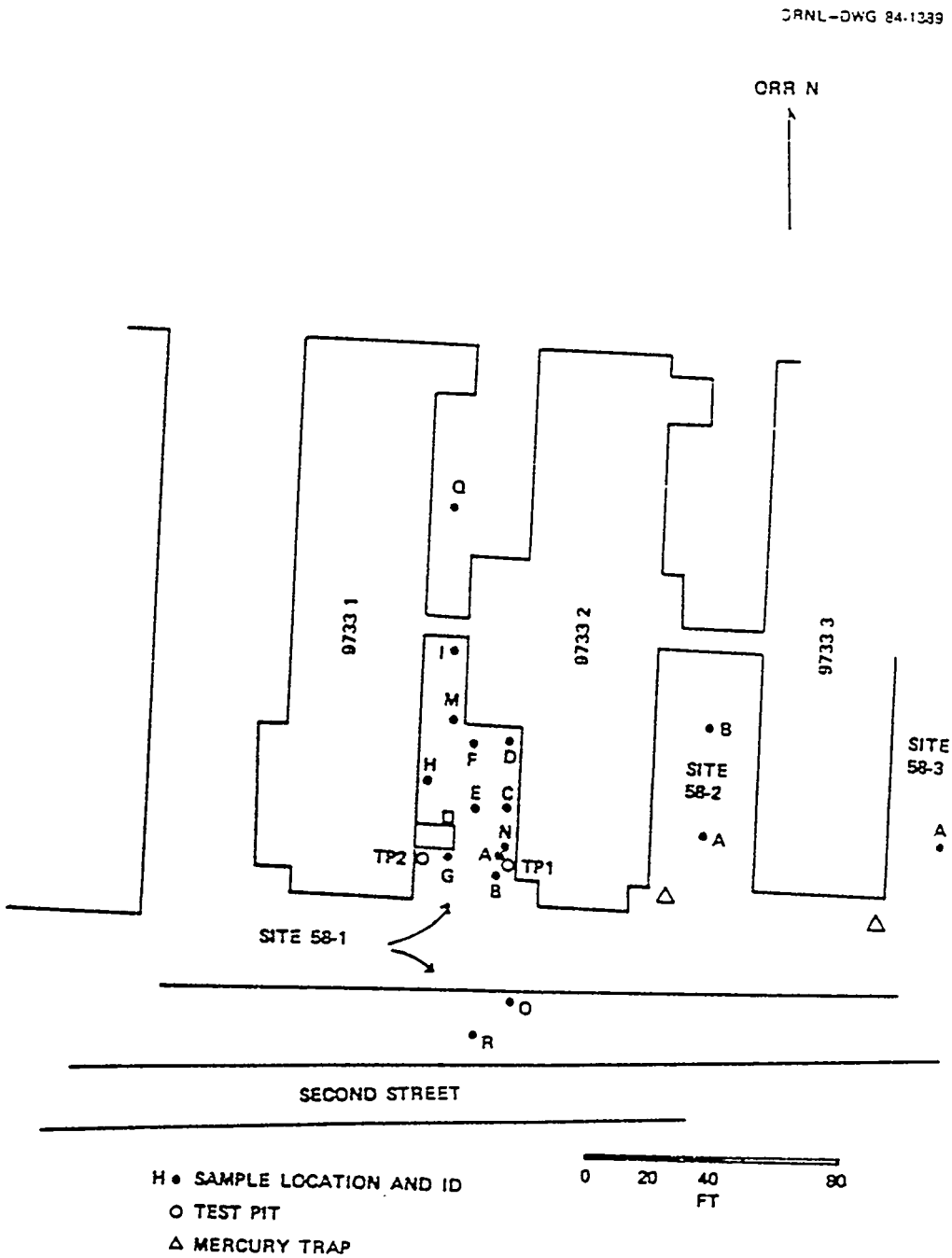


Figure 6.3 Soil sampling locations near Building 9733-1 (from Rothschild et al. 1984).

in mercury with depth. Although the bulk of the contamination appeared to be confined to the upper 2 ft, even the deepest samples obtained had greatly elevated concentrations (by a factor of 100) over natural background (<0.2 μg/g).

The use of the bucket augering method allowed for the possibility that contaminated material near the surface could be carried downward, thereby contaminating lower samples. To avert this situation, soil sampling with power hollow-stem auger and Shelby tubes was undertaken to better define the vertical limits of contamination and to allow for well installation. In December 1983, a drill rig was hoisted by crane into the enclosed south alcove, and two holes (58-1M, 58-1N) were augered to refusal (Figure 6.3). Shelby tube cores were obtained in the upper soil horizons, but only auger-tip samples could be obtained in the deeper shale saprolite. An additional hole (58-1Q) was augered and sampled in the north alcove between Buildings 9733-1 and 9733-2 (Figure 6.3). PVC casings (2-in. inside diameter), slotted in the lower 3 ft, were installed in holes 58-1N and 58-1Q to provide a means for groundwater sampling. Minimal investment was made in these wells because it was anticipated that they would be removed during excavation of the contaminated soil, which was to occur in the very near future.

Results of mercury analysis of soil samples from 58-1M, 58-1N, and 58-1Q are given in Table 6.4. Except for the surface sample (0 to 5 in.) from hole 58-1N, which had a mercury concentration of 561 μg/g, the samples from power augering were generally lower in mercury content than those from the earlier hand auguring. These results confirmed that elevated levels of mercury (10 times background or more) occurred down to auger refusal in the south alcove. A crude estimate of the quantity of mercury in the south alcove prior to excavation would be on the order of 1300 lbs or less. Most of this was thought to be recoverable by removing the top 2 to 6 ft of earth material. Analyses of samples from the boring in the north alcove (58-1Q) revealed elevated mercury levels (4.5 μg/g) in the upper 2 ft and at about 5 ft (1.0 μg/g). The remainder of the hole, which penetrated to 23 ft, had only background levels of mercury (<0.2 μg/g). Additional shallower borings were made across the road from

Table 6.4. Mercury in fill, soil and weathered rock samples collected during drilling at Buildings 9733-1/2.

BORING	TYPE	DATE	UP	DOWN	Hg
B	BA	26AUG83	.	0.2	5000.00
B	BA	26AUG83	0.2	0.4	2300.00
B	BA	26AUG83	0.4	0.7	10600.00
B	BA	26AUG83	0.7	0.9	5600.00
B	BA	26AUG83	0.9	1.1	9700.00
B	BA	26AUG83	1.1	1.4	370.00
B	BA	26AUG83	1.4	1.6	126.00
B	BA	26AUG83	1.6	1.8	138.00
B	BA	26AUG83	1.8	2.1	38.00
C	BA	26AUG83	.	0.3	39.00
C	BA	26AUG83	0.6	0.9	145.00
C	BA	26AUG83	1.2	1.5	3100.00
D	BA	02SEP83	.	0.2	43.00
D	BA	02SEP83	0.6	0.9	39.00
D	BA	02SEP83	1.2	1.3	30.00
E	BA	02SEP83	.	0.2	51.00
E	BA	02SEP83	0.2	0.5	16.00
E	BA	02SEP83	0.5	0.9	1300.00
E	BA	02SEP83	0.9	1.2	7900.00
E	BA	02SEP83	1.2	1.5	233.00
E	BA	02SEP83	1.5	2.0	425.00
E	BA	02SEP83	2.0	2.6	64.00
E	BA	02SEP83	2.6	3.3	50.00
E	BA	02SEP83	3.3	4.3	64.00
E	BA	02SEP83	4.3	5.7	37.00
F	BA	02SEP83	.	0.2	49.00
F	BA	02SEP83	0.7	1.0	49.00
F	BA	02SEP83	1.2	1.5	19.00
F	BA	02SEP83	1.8	2.2	20.00
G	BA	02SEP83	.	0.2	214.00
G	BA	02SEP83	0.8	1.0	12.00
G	BA	02SEP83	1.2	1.5	4.80
G	BA	02SEP83	1.9	2.2	4.80
H	BA	02SEP83	.	0.2	41.00
H	BA	02SEP83	0.8	1.8	15.00
H	BA	02SEP83	2.2	2.5	18.00
I	BA	02SEP83	.	0.2	52.00
I	BA	02SEP83	0.8	1.0	4.80

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon
UP, DOWN and DEPTH in feet below surface, Hg in $\mu g/g$ dry weight
U and Th in $\mu g/g$ dry weight, 6N HNO_3 digest
Negative prefix denotes "less than" value

Table 6.4. (continued)

BORING	TYPE	DATE	UP	DOWN	Hg
M	PS	29NOV83	.	0.2	6.80
M	PS	29NOV83	0.2	2.0	2.20
M	PS	29NOV83	2.0	4.0	0.40
M	CS	29NOV83	4.0	6.0	1.10
M	CS	29NOV83	6.0	8.0	1.30
M	CS	29NOV83	8.0	9.0	6.70
M	AB	29NOV83	.	12.0	0.26
M	AB	29NOV83	.	14.5	0.42
N	PS	29NOV83	.	0.5	561.00
N	PS	29NOV83	0.5	2.0	11.00
N	AB	29NOV83	2.0	2.5	17.00
N	AB	29NOV83	2.5	4.0	0.64
N	AB	29NOV83	.	4.0	44.00
N	AB	29NOV83	.	5.0	20.00
N	AB	29NOV83	.	7.0	15.00
N	AB	29NOV83	.	9.0	3.40
N	AB	29NOV83	.	11.0	17.00
N	AB	29NOV83	.	13.0	12.00
N	AB	29NOV83	.	15.0	7.60
N	AB	29NOV83	.	17.0	4.70
N	AB	29NOV83	.	19.0	7.20
N	AB	29NOV83	.	20.7	4.80
O	PS	01DEC83	2.0	2.5	7.10
O	PS	01DEC83	2.5	4.0	0.16
O	CS	01DEC83	4.6	5.6	3.30
Q	PS	02DEC83	.	2.0	4.50
Q	PS	02DEC83	2.0	4.0	0.17
Q	CS	02DEC83	4.0	4.8	1.00
Q	AB	02DEC83	4.8	5.2	0.41
Q	CS	02DEC83	5.2	7.2	0.71
Q	CS	02DEC83	7.2	8.2	0.29
Q	AB	02DEC83	8.2	9.1	0.37
Q	AB	02DEC83	9.1	9.8	0.07
Q	AB	02DEC83	9.8	11.8	0.29
Q	AB	02DEC83	11.8	14.0	0.15
Q	AB	02DEC83	14.0	16.0	0.08
Q	AB	02DEC83	16.0	18.0	0.31
Q	AB	02DEC83	18.0	20.0	0.44
Q	AB	02DEC83	.	22.0	0.33
Q	AB	02DEC83	.	23.0	0.11
R	SC	21JAN83	.	1.0	1.90
R	SC	21JAN83	1.0	2.0	0.47

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon. UP, DOWN and DEPTH in feet below surface, Hg in $\mu g/g$ dry weight, U and Th in $\mu g/g$ dry weight, 6N HNO_3 digest. Negative prefix denotes "less than" value.

the south alcove between buildings 9733-1 and 9733-2. Mercury concentrations up to 7.1 μg/g were found. Although borings were also made in the alcoves to the east (Sites 58-2 and 58-3 in Figure 6.3), no analyses for mercury were performed.

The mercury-contaminated soil in the alcove between these buildings was excavated for disposal in 1985. No verification sampling was performed, but the removed soil was replaced with fill and topsoil containing only natural background levels of mercury.

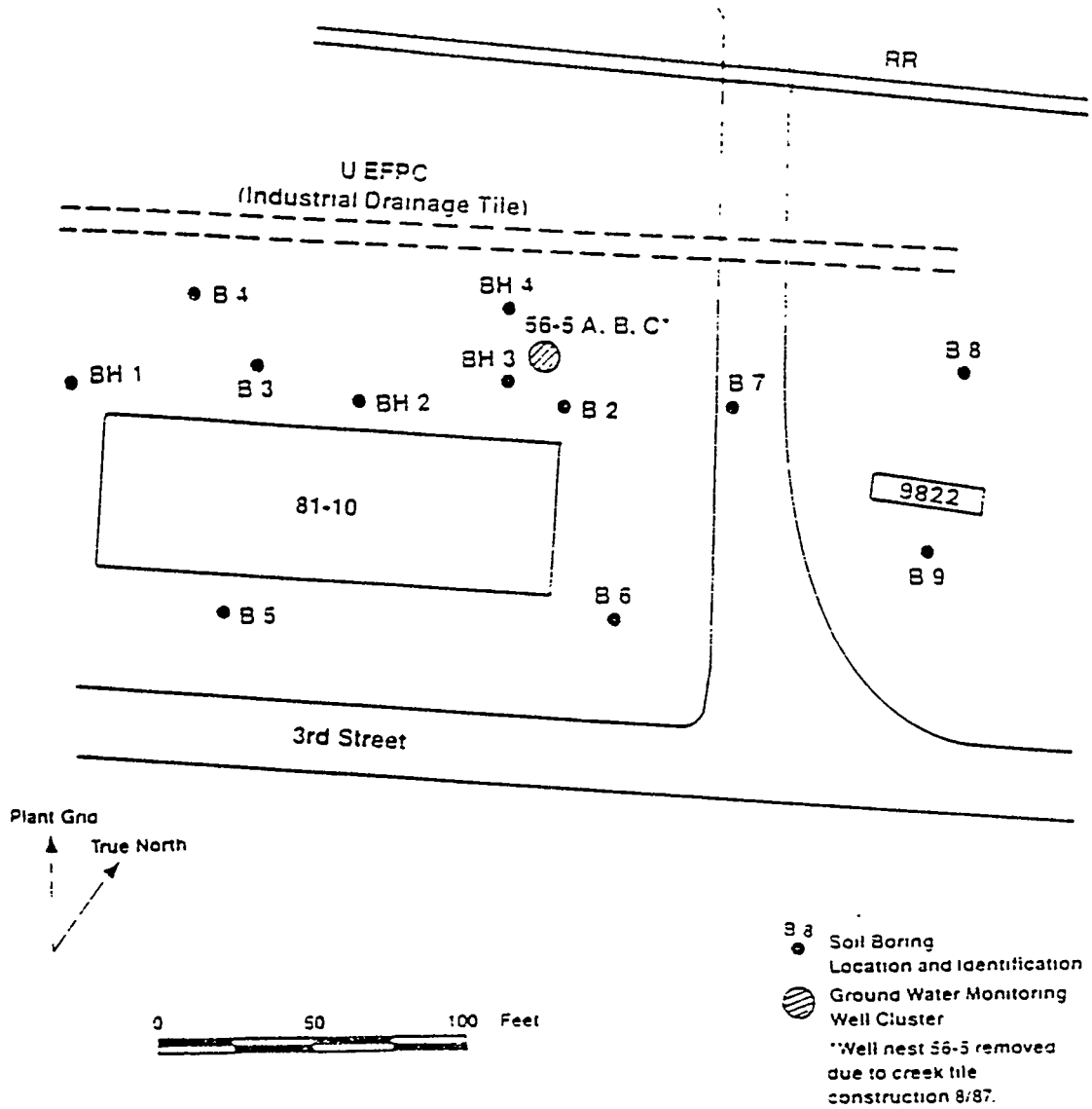
6.3.1.2 Building 81-10 Area

In December 1983 and again in December 1985, a series of soil borings was completed near Building 81-10 to obtain mercury and other contaminant data for this area. The location of the borings and the general site layout are illustrated in Figure 6.4. Complete results of mercury analyses (126 samples) of soils from the boreholes around Building 81-10 are included in Appendix F. Most of the highest mercury concentrations (up to 1436 μg/g) were found on the north side of the building and within the upper 15 feet of fill. Rothschild et al. (1984) estimated that the soils in the 81-10 area contained about 3000 lbs of mercury, an estimate which agreed well with that made earlier by Wilcox (1983).

Approximately 8400 (±500) cubic yards of soil (fill) were removed from the most contaminated area north of the building between November 1987 and April 1988 as part of the Utility System Restoration Phase III, creek tile replacement, and PIDAS corridor projects. The removed soil was disposed of in the Chestnut Ridge Sediment Disposal Basin. Clean soil was used to replace the removed soil and to construct the PIDAS corridor.

6.3.1.3 Building 9201-2 Area

A total of 10 soil borings were conducted at this site by Rothschild et al. (1984). Boring locations are shown in Figure 6.5. Analytical results from 75 samples, which are given in Table 6.5, reveal that mercury concentrations as high as 5000 μg/g were observed at this site in borehole B4 at the 3 to 4 foot depth. The 4 to 6 foot depth sample from the same boring contained 3000 μg/g mercury. Other borings also showed elevated



Source: Rothschild et al. 1984.
Turner 1986.

Figure 6.4 Location of boreholes near 81-10 (from Rothschild et al. 1984; Turner 1986).

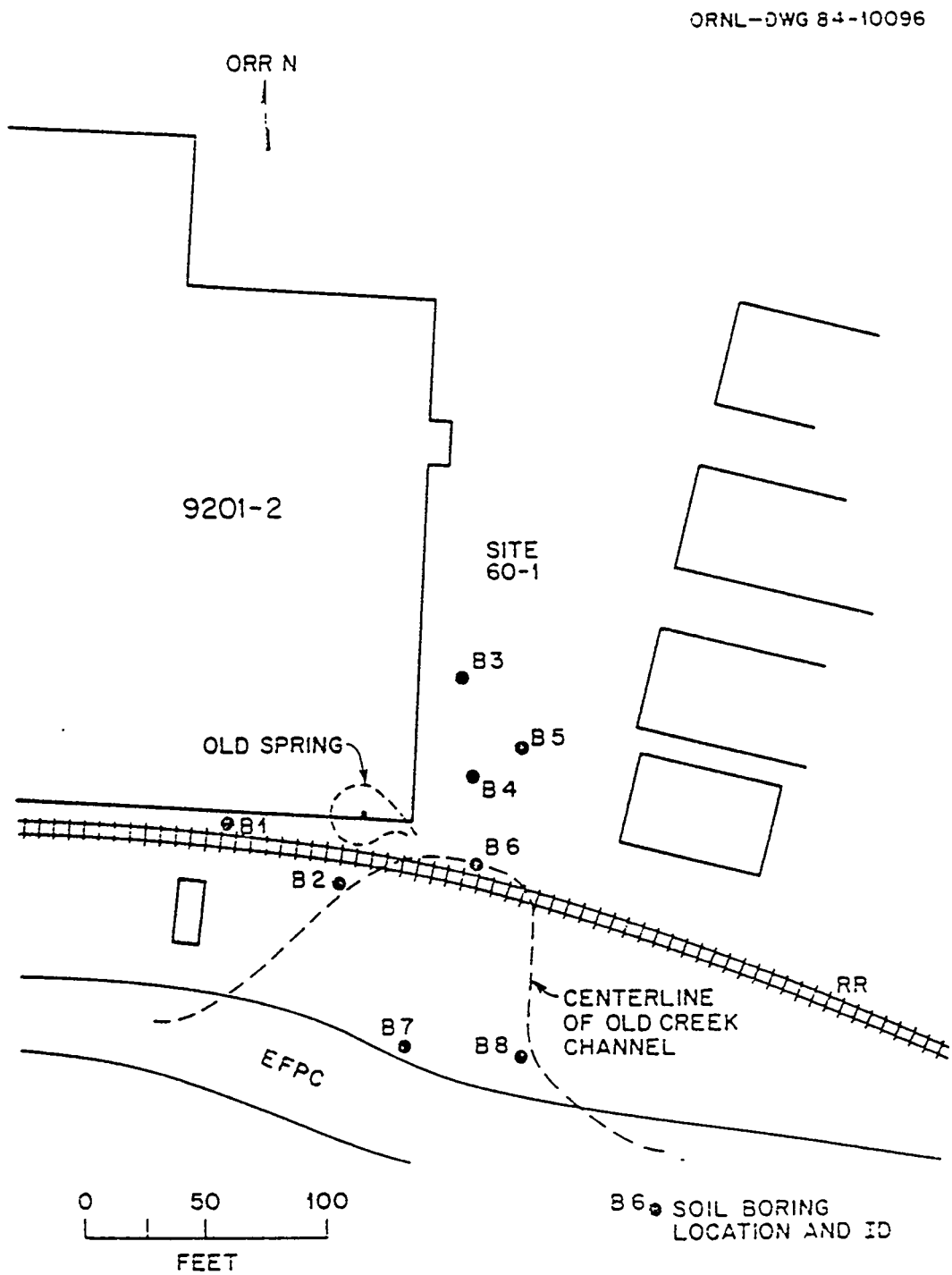


Figure 6.5 Sampling locations near Building 9201-2. Preconstruction hydrologic features are indicated with dashed lines (from Rothschild et al. 1984).

Table 6.5. Mercury in fill, soil and weathered rock samples during drilling near Building 9201-2.

BORING	TYPE	DATE	UP	DOWN	Hg
A	PS	12AUG83	2.0	4.0	1.10
A	CS	12AUG83	4.0	6.0	0.48
A	CS	12AUG83	6.0	8.0	0.33
A	CS	12AUG83	8.0	10.0	0.09
A	CS	12AUG83	10.0	12.0	0.09
A	CS	12AUG83	12.0	14.0	0.10
A	CS	12AUG83	14.0	16.0	0.05
A	CS	12AUG83	16.0	18.0	0.06
B	AB	12AUG83	.	5.0	1.30
B	AB	12AUG83	.	5.1	25.00
B	AB	12AUG83	.	10.0	1.00
B	AB	12AUG83	.	15.0	0.74
B	AB	12AUG83	.	16.5	2.30
B1	CS	.	2.0	4.0	12.00
B1	CS	.	4.0	6.0	5.50
B1	CS	.	6.0	8.0	4.30
B1	CS	.	8.0	10.0	3.60
B1	CS	.	10.0	12.0	7.40
B1	CS	.	12.0	14.0	9.80
B1	CS	.	14.0	15.0	13.00
B2	CS	.	2.0	4.0	0.27
B2	CS	.	4.0	6.0	0.04
B2	CS	.	6.0	8.0	0.27
B2	CS	.	8.0	8.5	0.30
B2	CS	.	8.5	10.0	0.13
B2	CS	.	10.0	12.0	0.06
B2	CS	.	12.0	12.3	1.50
B2	CS	.	12.3	14.0	1.20
B2	CS	.	14.0	16.0	0.81
B3	CS	.	4.0	6.0	4.00
B3	CS	.	6.0	8.0	4.10
B3	CS	.	8.0	10.0	3.50
B3	CS	.	10.0	12.0	1.40
B3	CS	.	12.0	14.0	6.70
B3	CS	.	14.0	16.0	8.60
B3	CS	.	16.0	17.2	7.90
B3	CS	.	17.6	18.0	1.30
B3	CS	.	18.0	20.0	0.17
B4	CS	.	2.0	2.9	20.00

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon.
UP, DOWN and DEPTH in feet below surface, Hg in $\mu g/g$ dry weight, U and Th in $\mu g/g$ dry weight, 6N HNO_3 digest.
Negative prefix denotes "less than" value.

Table 6.5. (continued)

BORING	TYPE	DATE	UP	DOWN	Hg
B4	CS	.	2.9	3.7	5000.00
B4	CS	.	3.7	4.0	39.00
B4	CS	.	4.0	6.0	3000.00
B4	CS	.	6.0	6.4	18.00
B4	CS	.	6.4	8.0	10.00
B4	CS	.	8.0	9.0	4.10
B4	CS	.	11.0	12.0	14.00
B4	CS	.	12.0	13.0	500.00
B5	CS	.	2.0	4.0	362.00
B5	CS	.	6.0	8.0	0.65
B5	CS	.	8.0	10.0	0.29
B5	CS	.	10.0	12.0	0.27
B5	CS	.	12.0	13.0	0.40
B6	CS	.	2.0	4.0	2.20
B6	CS	.	4.0	5.5	2.40
B6	CS	.	6.5	8.0	1.60
B6	CS	.	8.0	10.0	2.40
B6	CS	.	10.0	12.0	2.50
B6	CS	.	12.0	14.0	4.30
B6	CS	.	14.0	16.0	5.40
B6	CS	.	16.0	17.0	2.80
B7	CS	.	1.5	3.5	0.33
B7	CS	.	4.0	6.0	0.12
B7	CS	.	6.0	6.6	0.36
B7	CS	.	6.9	8.0	0.09
B7	CS	.	8.0	10.0	0.26
B7	CS	.	10.0	12.0	0.26
B7	CS	.	12.0	14.0	0.06
B7	CS	.	14.0	14.4	0.38
B7	CS	.	14.4	16.0	0.46
B7	CS	.	16.0	18.0	0.50
B8	CS	.	2.0	4.0	0.98
B8	CS	.	4.0	6.0	0.44
B8	CS	.	6.0	8.0	0.97
B8	CS	.	8.0	9.0	0.59

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon.
UP, DOWN and DEPTH in feet below surface, Hg in $\mu g/g$ dry weight, U and Th in $\mu g/g$ dry weight, 6N HNO_3 digest.
Negative prefix denotes "less than" value.

mercury concentrations but the highest levels appeared to be restricted to the area of boring B4 and B5 near a reported spill (See Section 3.3.4). Rothschild et al. (1984) estimated that 2700 lbs of mercury is contained in the unconsolidated earth materials at this site.

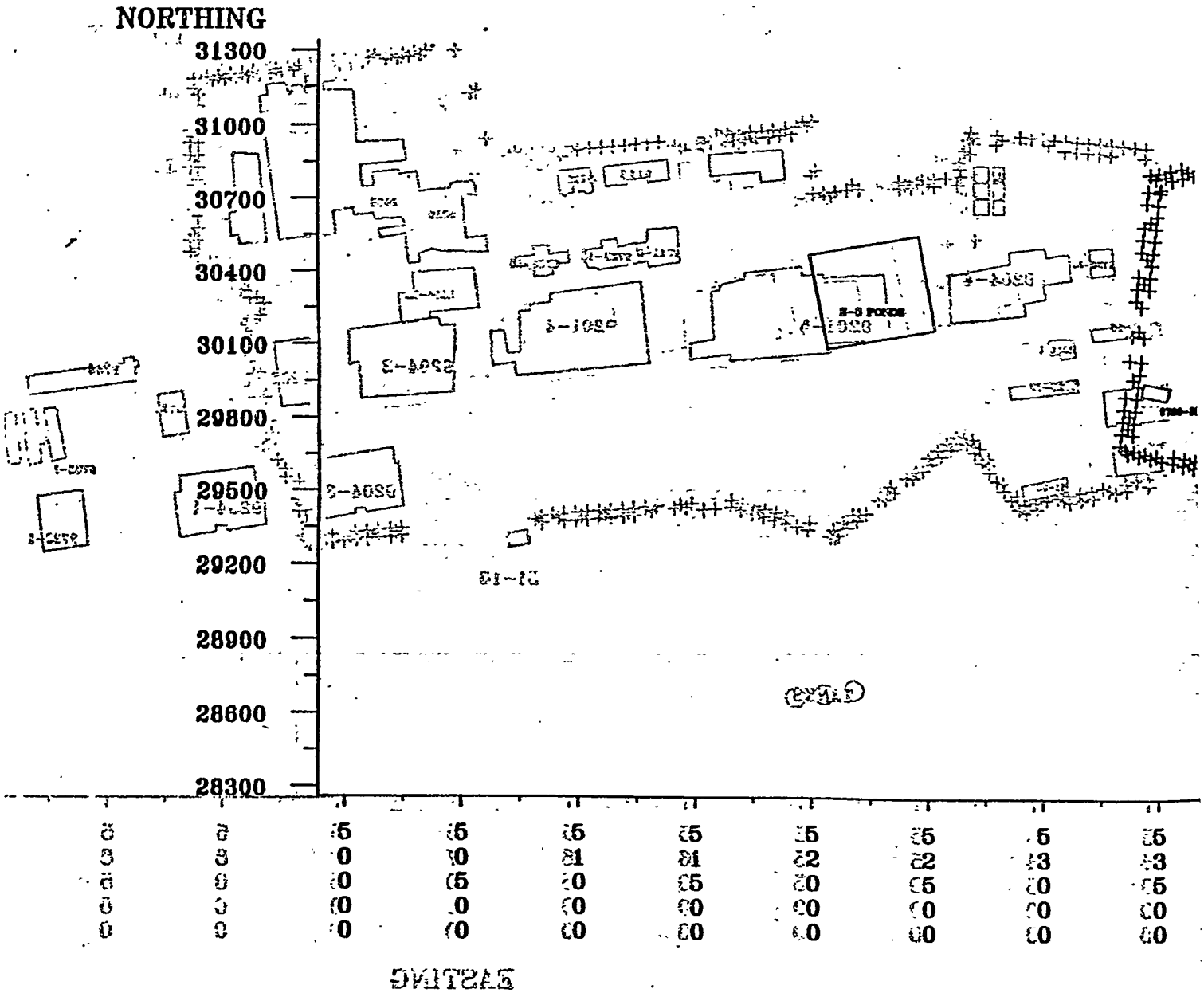
6.3.1.4 PIDAS Corridor

Approximately 750 soil samples were collected along the PIDAS corridor and analyzed for total mercury and PCBs. Figure 6.6 shows the sampling locations in the PIDAS corridor. Figure 6.7 shows results for mercury in soil >12 $\mu g/g$. The PIDAS corridor is generally outside the area of concern for this RFI Plan with the exception of the 81-10 area which is a Mercury-Use Area and is crossed by PIDAS. However, no additional sampling was conducted here due to the extensive previous sampling and analysis. The PIDAS corridor data is, nonetheless, important to consider in the RFI Plan. The PIDAS data show that mercury contamination of soils is not restricted to the Mercury-Use Areas. For example, twenty-three samples from the PIDAS corridor exceeded 12 $\mu g/g$ mercury and nine exceeded 100 $\mu g/g$ mercury. Two samples from PIDAS exceeded 1000 $\mu g/g$ (1550 and 5570 $\mu g/g$).

6.3.1.5 Comprehensive Soil Survey

At the request of Y-12 management, the Environmental Assessments group of the Health and Safety Research Division (HASRD) of ORNL conducted a comprehensive chemical and radiological characterization survey of the Y-12 Plant between September 1985 and May 1987. The purpose of this survey was to "characterize the surface environment over the entire site, locating and prioritizing areas of concern both from a worker health/safety and environmental standpoint" (excerpted from Foley and Carrier, unpublished). The primary objectives of the characterization survey were to assess the gamma activity status of the site using walk-over gamma scans and to identify through the analysis of surface soil samples the presence of selected contaminants, including mercury.

Sample site locations for the survey were based on a grid system. Initially the Y-12 Plant site was partitioned by Y-12 management into


NORTHING
31300
31000
30700
30400
30100
29800
29500
29200
28900
28600
28300
EASTING

SAMPLING LOCATIONS IN PIDAS SURVEY

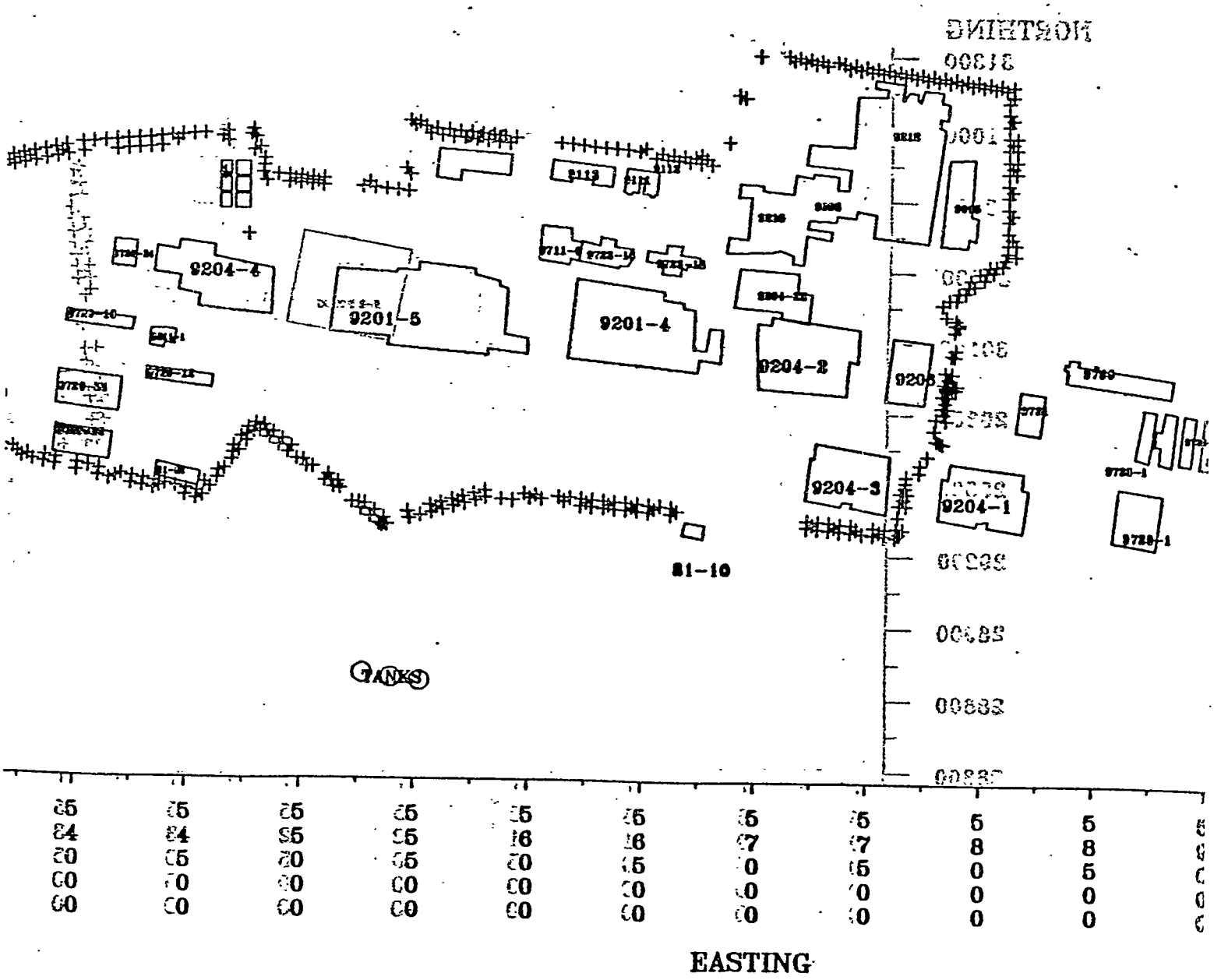
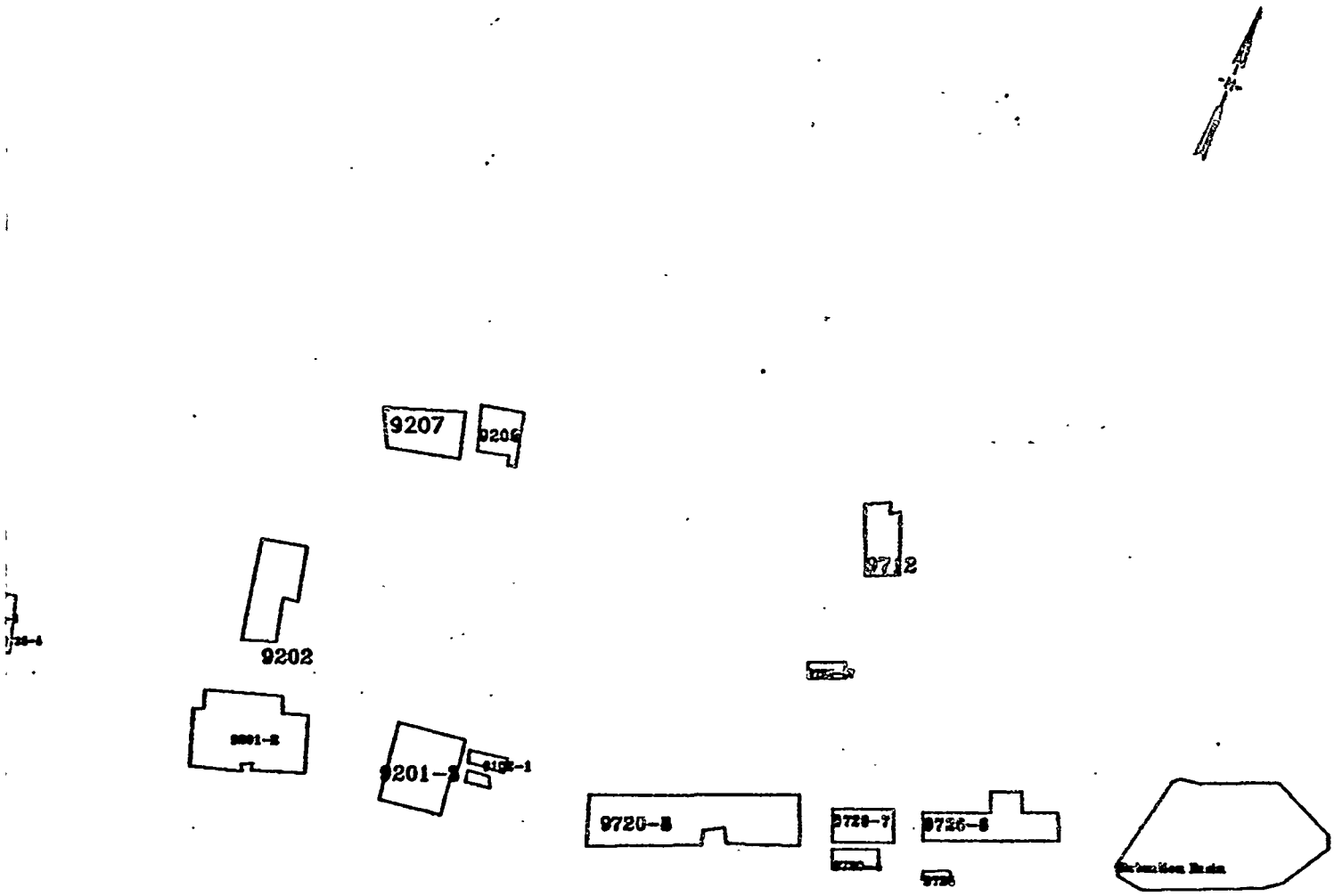
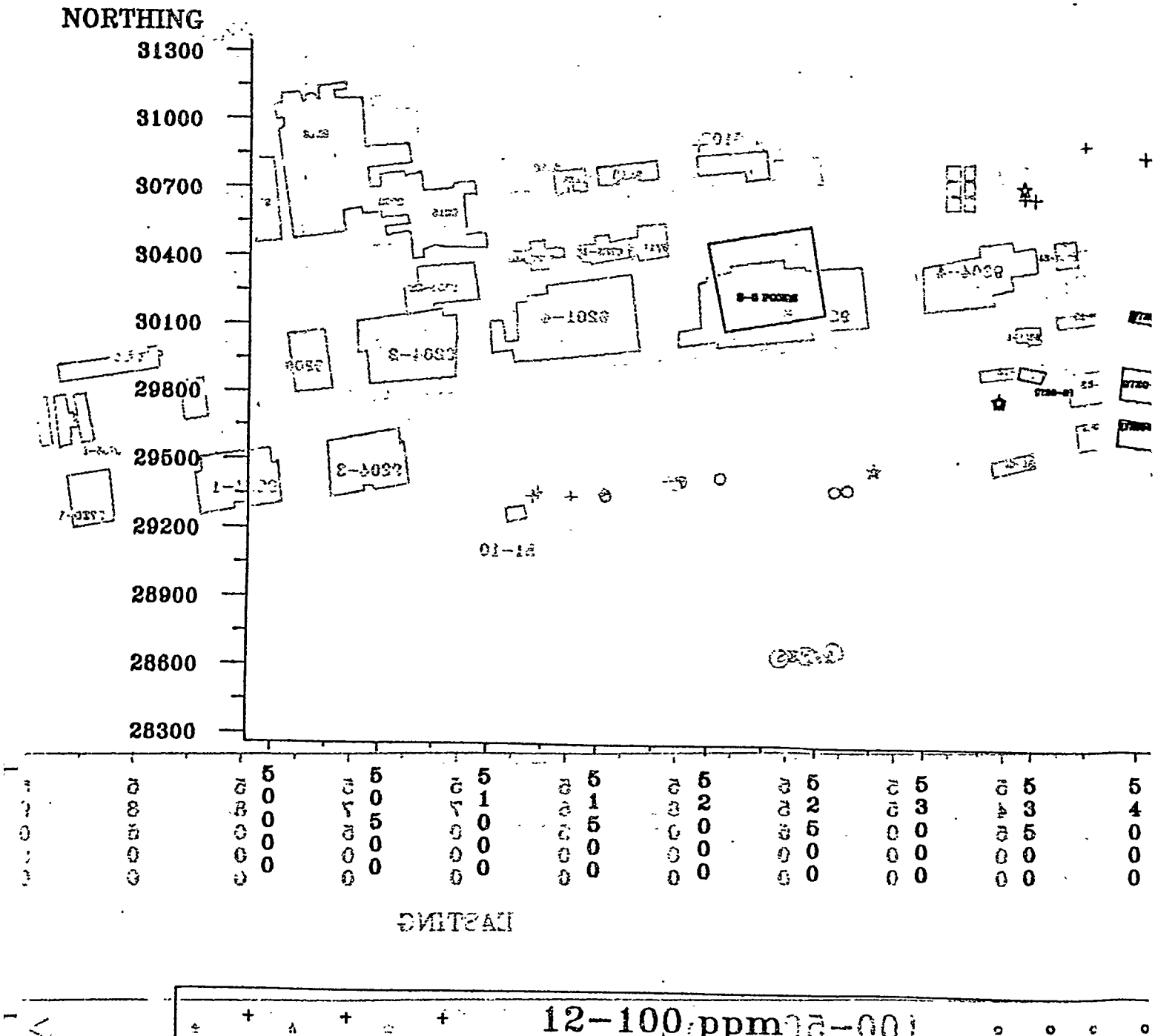


Figure 6.6 Soil sampling locations along the PIDAS route.

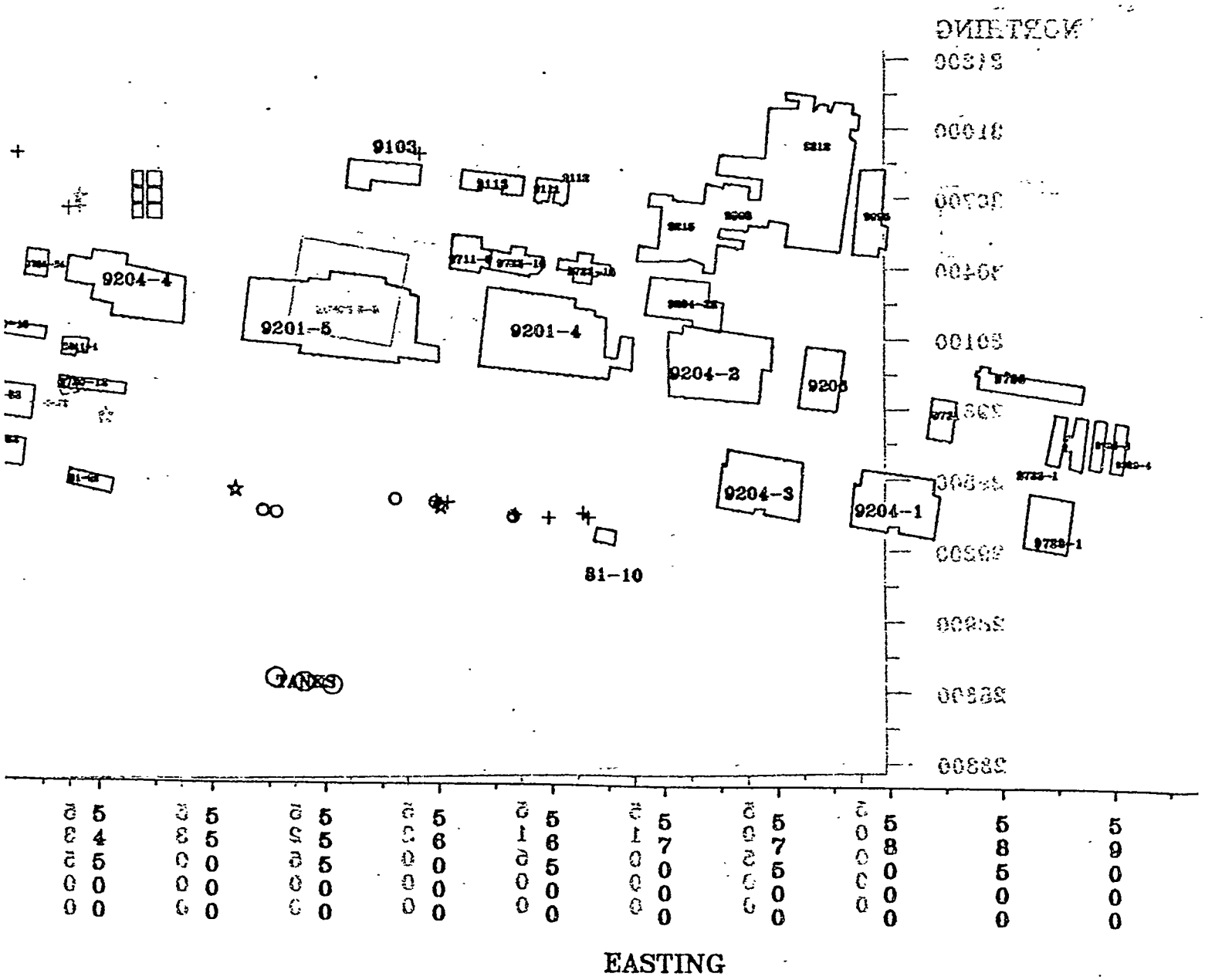
Scale: 1" = 650 ft



5	5	6	6	6	6	6	6	6	6
0	9	0	0	1	1	2	2	3	3	4
5	0	0	5	0	5	0	5	0	5	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0


NORTHING
31300
31000
30700
30400
30100
29800
29500
29200
28900
28600
28300
12-100 ppm

MERCURY VALUES ABOVE 12 PPM
PIDAS CORRIDOR



100-500 ppm

>500

Scale: 1" = 650 ft

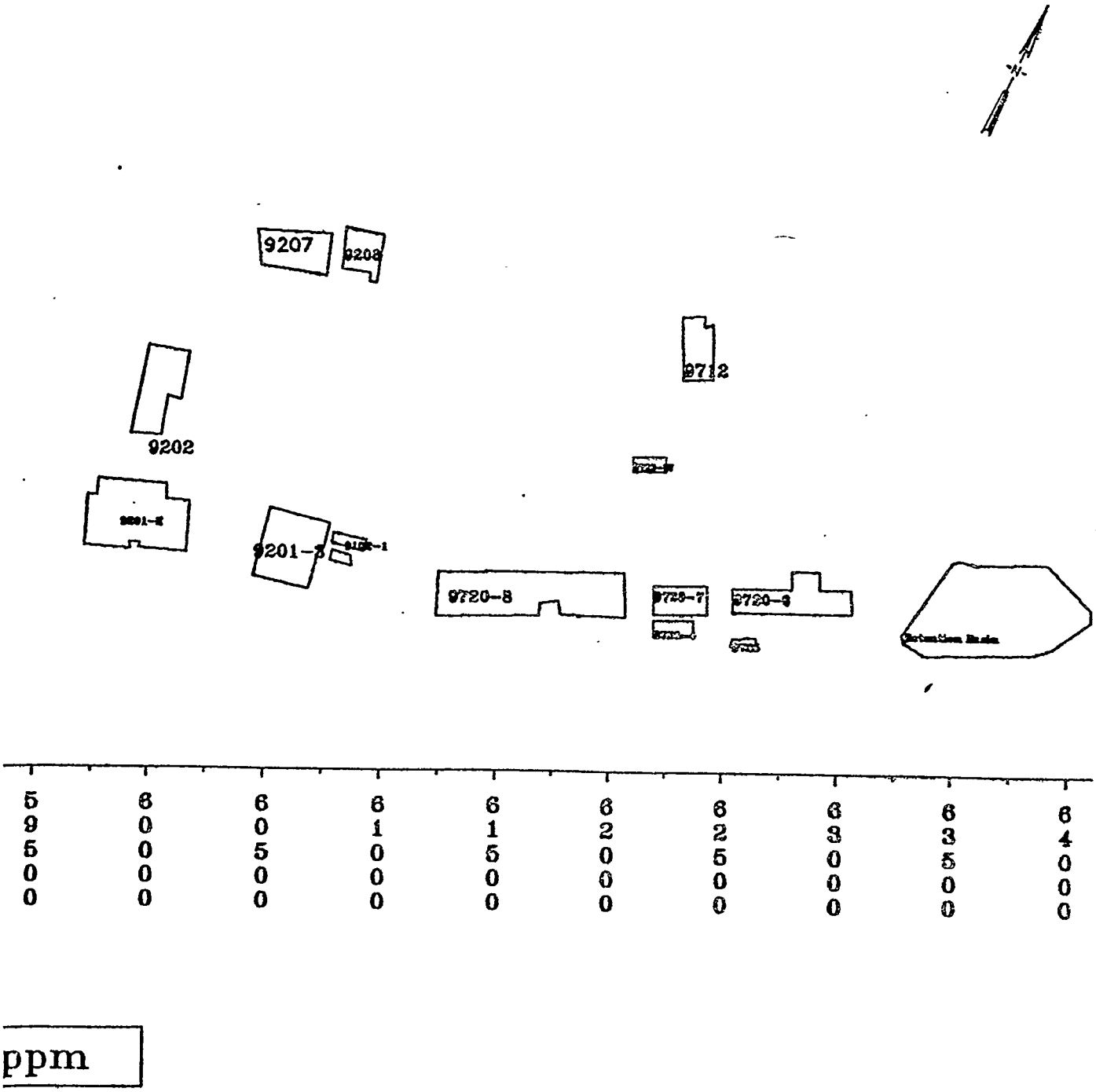
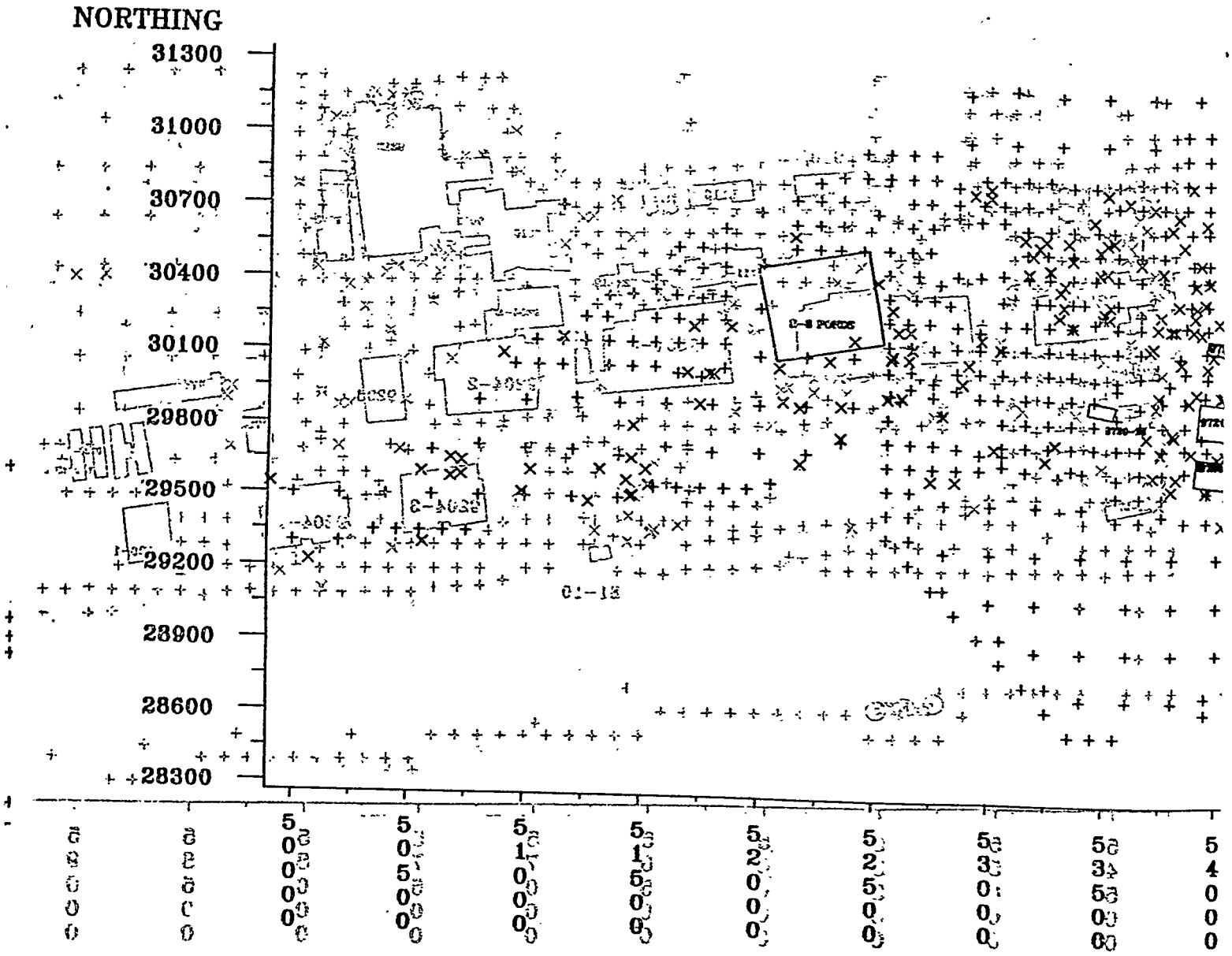


Figure 6.7 Locations of soil samples with mercury concentrations ≥12 μg/g along the PIDAS route.

"priority areas" numbered 1 through 22 based on tenative construction schedules at Y-12. With few exceptions, priority areas were surveyed in numeric order. The Y-12 Plant grid coordinates were used in the selection of both measurement and sampling locations within each priority area. Survey areas were blocked off in 100 or 200 ft^2 grids dependent on the degree of contamination expected within an area. During the survey, 1866 surface soil samples (0 to 5 cm deep and 0 to 10 cm in diameter) were collected for mercury analysis on both a systematic and biased basis. Figure 6.8 shows the sampling locations for all systematic and biased samples. Systematic samples were collected as close to the center of each 100 or 200 ft^2 grid block as possible. The location of biased samples was determined by the results of the walk-over gamma scans, with biased samples taken in all grid blocks where anomalous gamma readings were observed.

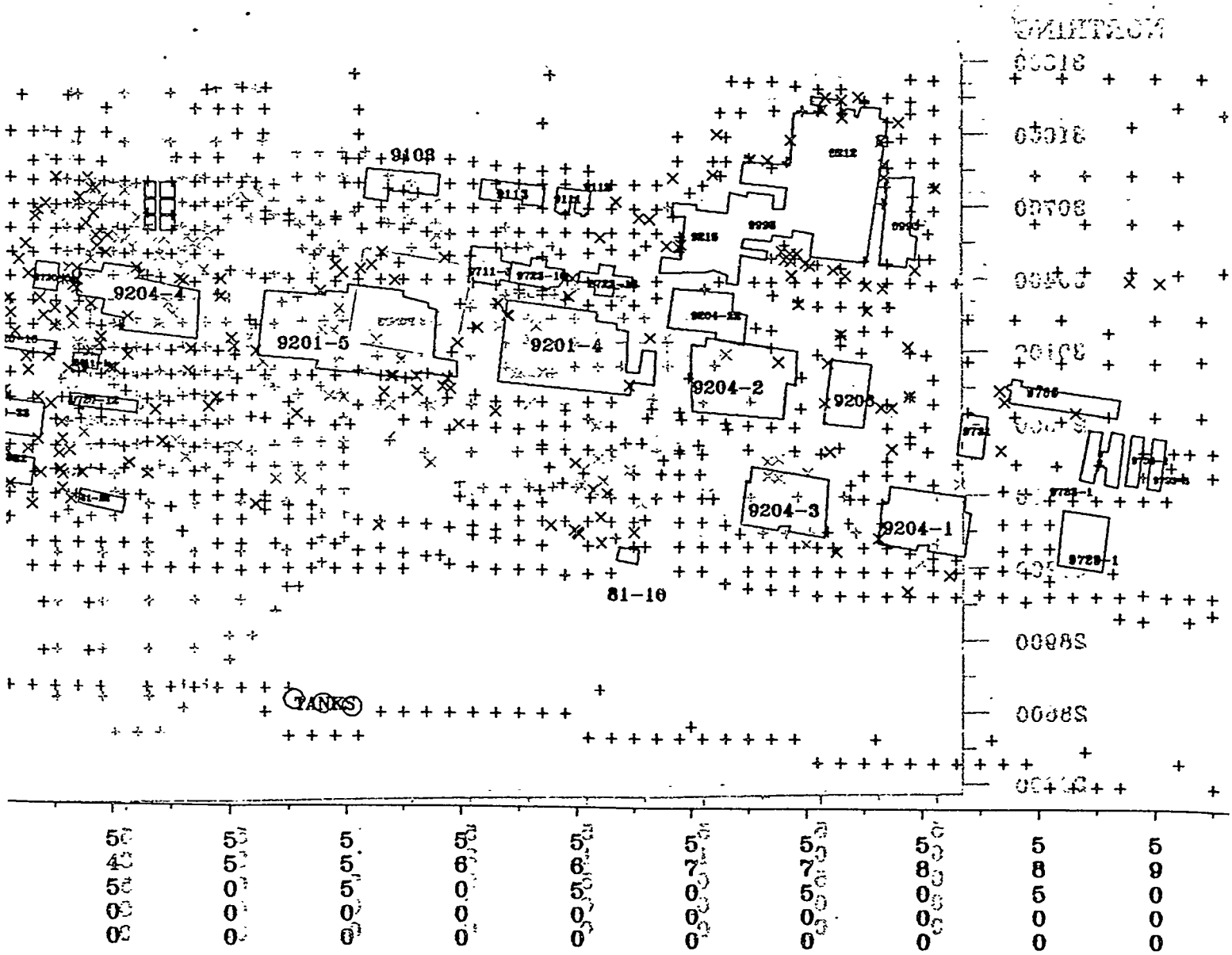
After collection, each soil sample was well mixed and air dried at room temperature before sub-sampling for the different analyses to be performed. Sub-samples to be analyzed for mercury were oven-dried at 50°C before analysis by the Analytical Chemistry Division of ORNL. Results of the survey have been included in an unpublished document by Foley and Carrier (1987) and have also been entered into a computerized database maintained by HASRD. Appendix E of this RFI Plan tabulates sampling location coordinates and analytical results for mercury.

A statistical summary of the soil analytical results for mercury is given in Table 6.6. For convenience, the results have been stratified by sample type (biased and systematic) and by mercury concentration ranges. The ranges were selected arbitrarily but do reflect an attempt to classify the results in relation to possible "clean-up" ranges (e.g. $\geq$100 μg/g), as well as background ranges (<1.0 μg/g) and ranges of insignificant (1-10 μg/g) and minimal (10-100 μg/g) concern. The same data are displayed as a histogram in Figure 6.9. Biased samples, which were selected based on high gamma readings, also averaged higher in mercury content (47 μg/g) than systematic samples (5.5 μg/g), suggesting a relationship between low level radioactive contamination and mercury contamination. This is likely to be only a coincidental spatial correlation due to the history of building use, and not due to a common process source.


NORTHING
31300
31000
30700
30400
30100
29800
29500
29200
28900
28600
28300

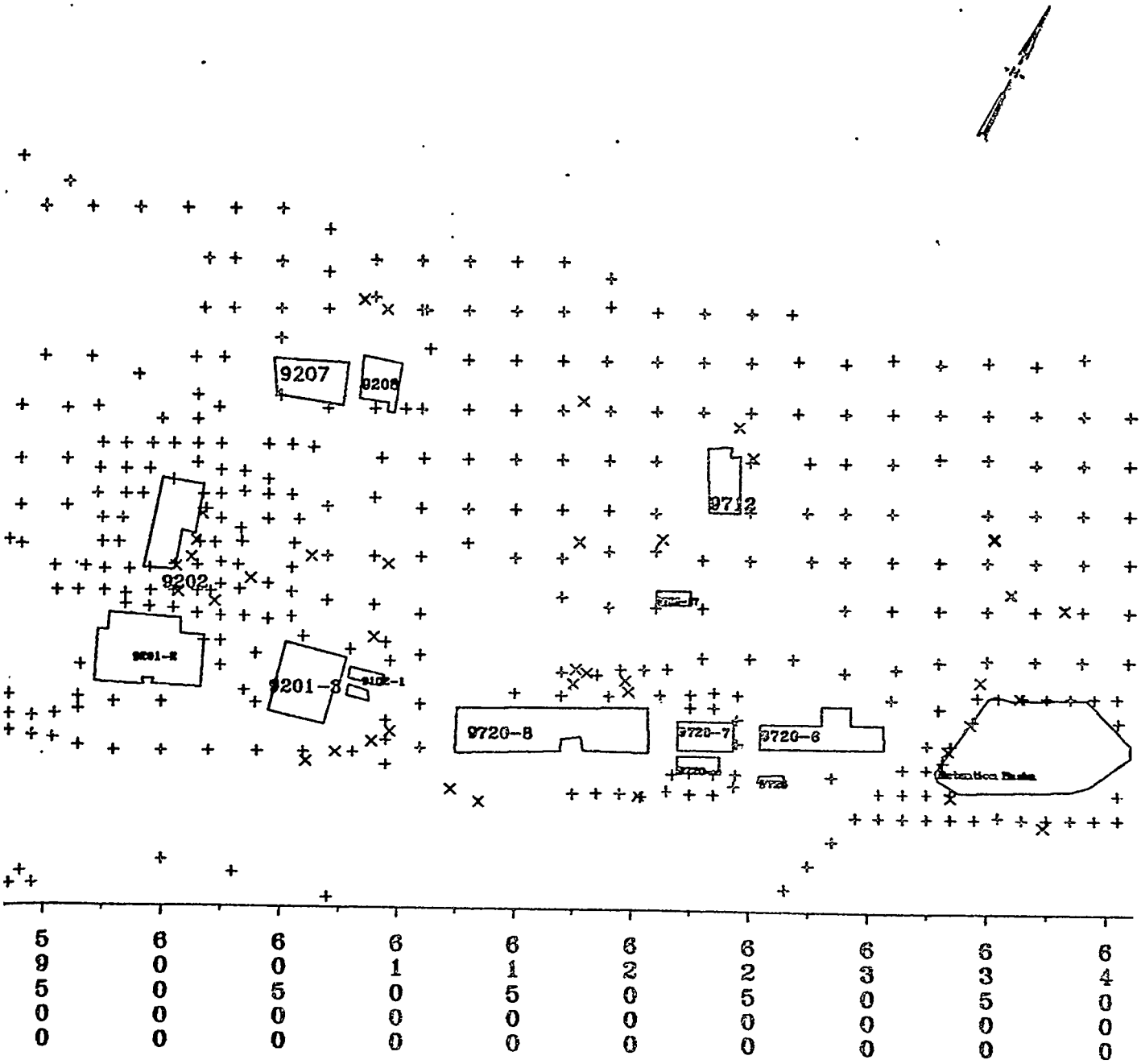
TYPE

SAMPLING LOCATIONS AT Y12 SITE
BIASED AND SYSTEMATIC SAMPLES



systematic

Scale: 1" = 650 ft



biased

Figure 6.8 Systematic and biased soil sampling locations during the HASRD comprehensive soil survey of the Y-12 Plant.

Table 6.6 Statistic summary of the comprehensive surface soil survey results.

		Mercury			
		N	MEAN	MIN	MAX
ALL		1866.00	13.13	0.01	7700.00
Sample Type	Concentration. ug/g				
Biased	< 0.1	6.00	0.05	0.01	0.08
	0.1-0.5	43.00	0.30	0.10	0.48
	0.5-1.0	38.00	0.71	0.50	0.99
	1.0-10	156.00	3.89	1.00	9.90
	10-100	77.00	27.30	10.00	94.00
	100-500	19.00	206.53	102.00	424.00
	1000-2000	1.00	1700.00	1700.00	1700.00
	> 5000	1.00	7700.00	7700.00	7700.00
	ALL	341.00	47.13	0.01	7700.00
Systematic	Concentration. ug/g				
	< 0.1	190.00	0.05	0.01	0.09
	0.1-0.5	649.00	0.26	0.10	0.49
	0.5-1.0	232.00	0.72	0.50	0.99
	1.0-10	363.00	2.87	1.00	9.80
	10-100	77.00	26.53	10.00	96.00
	100-500	12.00	193.33	103.00	347.00
	500-1000	1.00	777.00	777.00	777.00
	1000-2000	1.00	1900.00	1900.00	1900.00
	ALL	1525.00	5.53	0.01	1900.00
ALL	Concentration. ug/g				
	< 0.1	196.00	0.05	0.01	0.09
	0.1-0.5	692.00	0.26	0.10	0.49
	0.5-1.0	270.00	0.72	0.50	0.99
	1.0-10	519.00	3.17	1.00	9.90
	10-100	154.00	26.96	10.00	96.00
	100-500	31.00	201.42	102.00	424.00
	500-1000	1.00	777.00	777.00	777.00
	1000-2000	2.00	1800.00	1700.00	1900.00
	> 5000	1.00	7700.00	7700.00	7700.00
	ALL	1866.00	13.13	0.01	7700.00

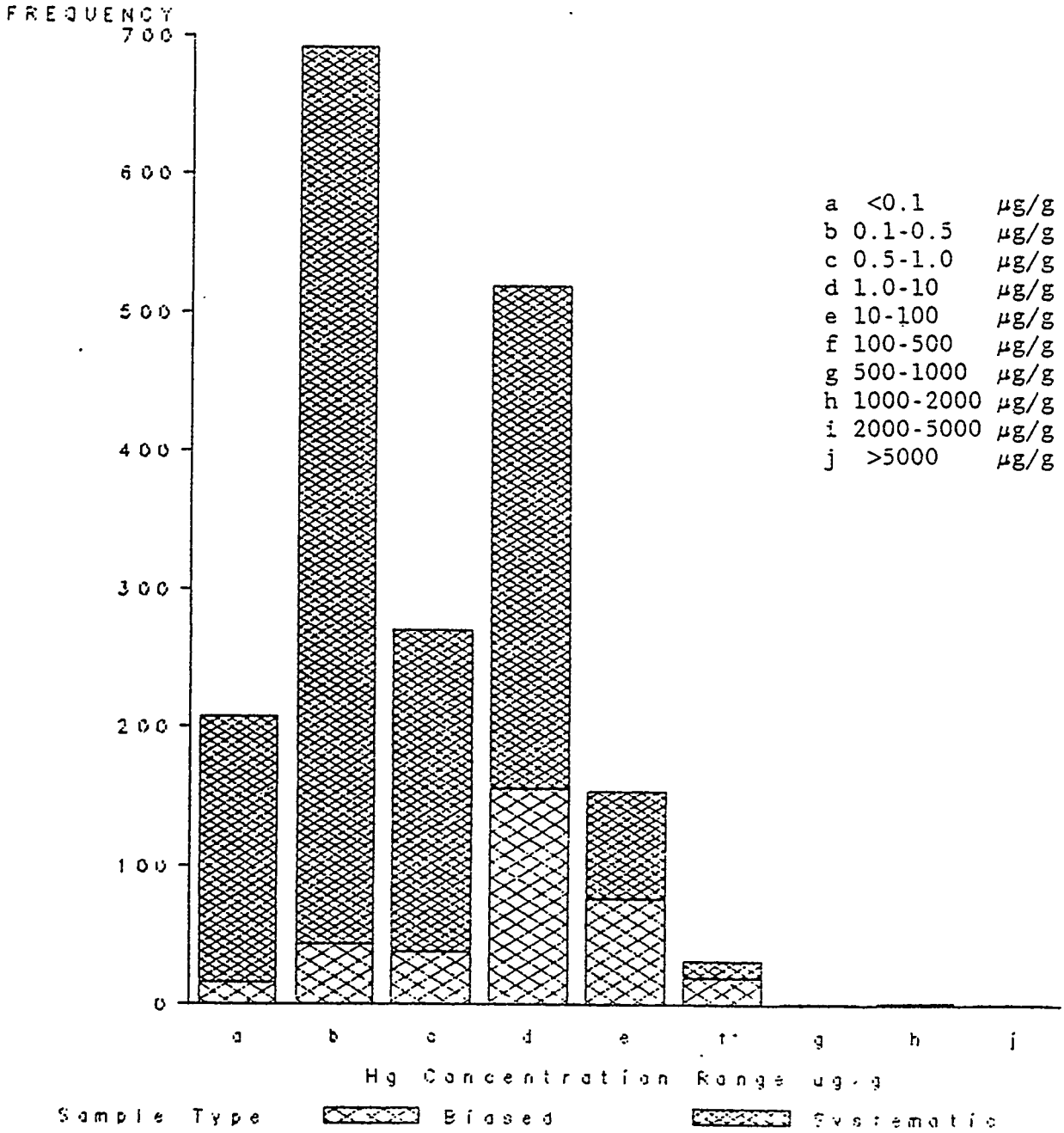
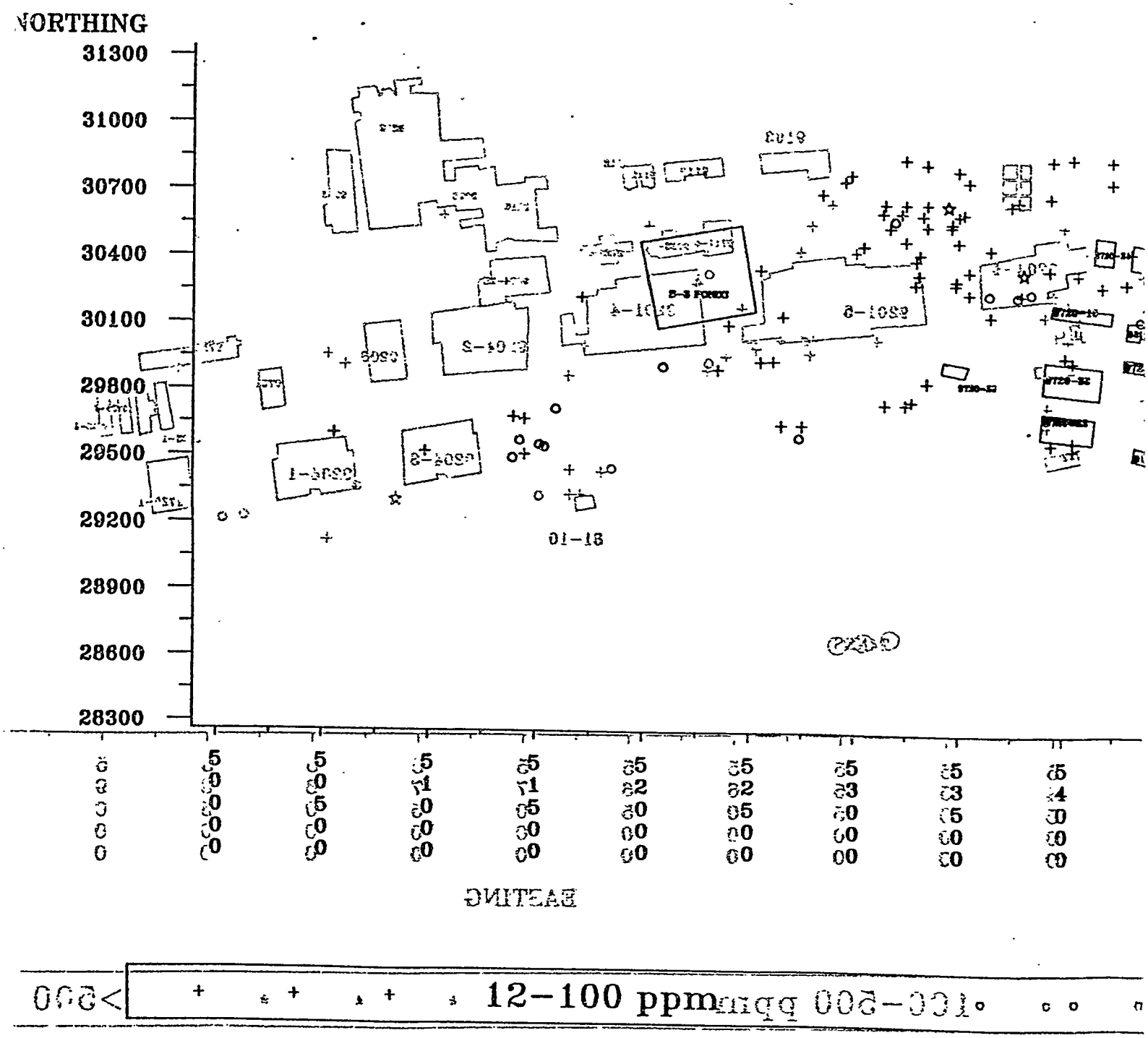


Figure 6.9 Frequency of mercury concentration ranges for samples collected during the HASRD comprehensive soil survey of the Y-12 Plant.

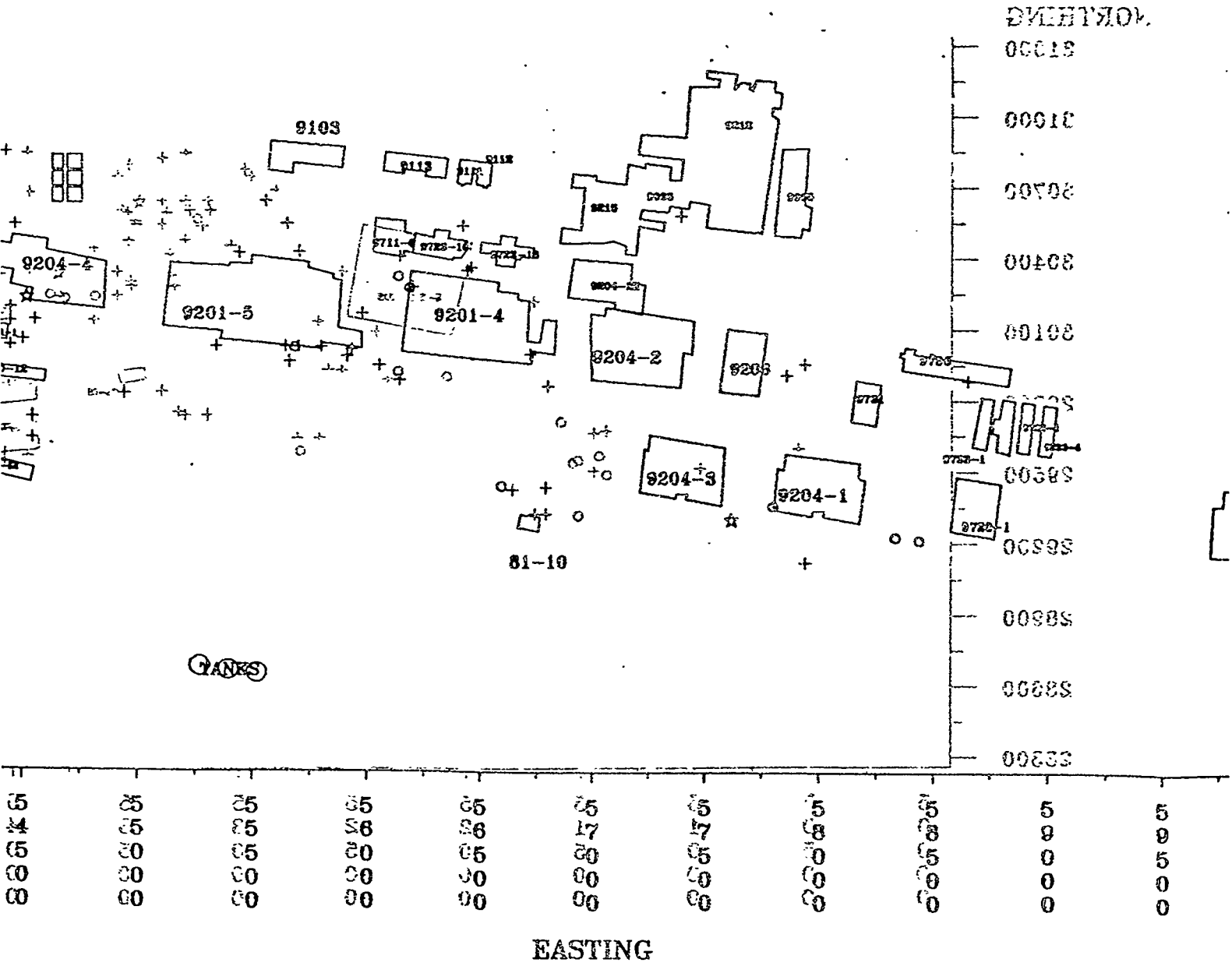
Mercury concentrations in excess of 12 μg/g are of special interest because this is the concentration suggested by TDHE (Bashor and Turri 1983) as representing the threshold for human health concern considering only ingestion and inhalation as the pathways of exposure. As discussed in Section 6.1.2, this concentration may be overly conservative. Among the 1866 soil mercury analyses summarized in Table 6.6, only 167 (9%) showed values in excess of 12 μg/g. Figure 6.10 shows the locations in the Y-12 Plant where mercury in surface soil exceeded 12 μg/g. The spatial distribution shows some clustering of values above 12 μg/g around the Mercury-Use Areas (e.g., 81-10) but also shows that elevated levels can occur nearly anywhere. The high values on the eastern end of the Plant appear to be related to New Hope Pond and the floodplain of East Fork Poplar Creek. The high values between the S-3 Ponds and 9204-4 may be the result of soil contamination in the scrap metal yard and mercury flask storage area which were formerly located in this area.

As discussed in Section 6.1.2, soil mercury concentrations in excess of 100 μg/g may represent a good candidate "action level" for initiating additional investigation, if not also for triggering corrective measures. It must be emphasized that the chemical form of mercury in soils is an important consideration in evaluating whether human health and environment are threatened. Mercury in the elemental state in soils constitutes potentially greater mobility in air and water than most other common forms of mercury. The comprehensive soil survey did not determine the chemical form of mercury. However, other experience (see discussion in Section 6.1.2) with mercury in soils from the Y-12 Plant area suggests that samples with mercury concentrations greater than about 100 μg/g often have a significant vapor in sample container headspace and are likely to be classified as hazardous using the EP Toxicity test. Only 35 (<2%) samples out of the 1866 collected during the comprehensive soil survey exceeded 100 μg/g total mercury. The areal distribution of these samples is shown in Figure 6.10. Again, the areal pattern suggests some association of values greater than 100 μg/g with Mercury-Use Areas but also that elevated concentrations may occur anywhere.

Figures 6.11 through 6.15 show the areal distribution of isotopic uranium, cesium-137 and thorium-232 in excess of 32 pCi/g.


NORTHING
31300
31000
30700
30400
30100
29800
29500
29200
28900
28600
28300
12-100 ppm

MERCURY > 12 PPM AT Y12 SITE
Y12 SAMPLE SURVEY



100–500 ppm | >500 ppm

Scale: 1" = 650 ft

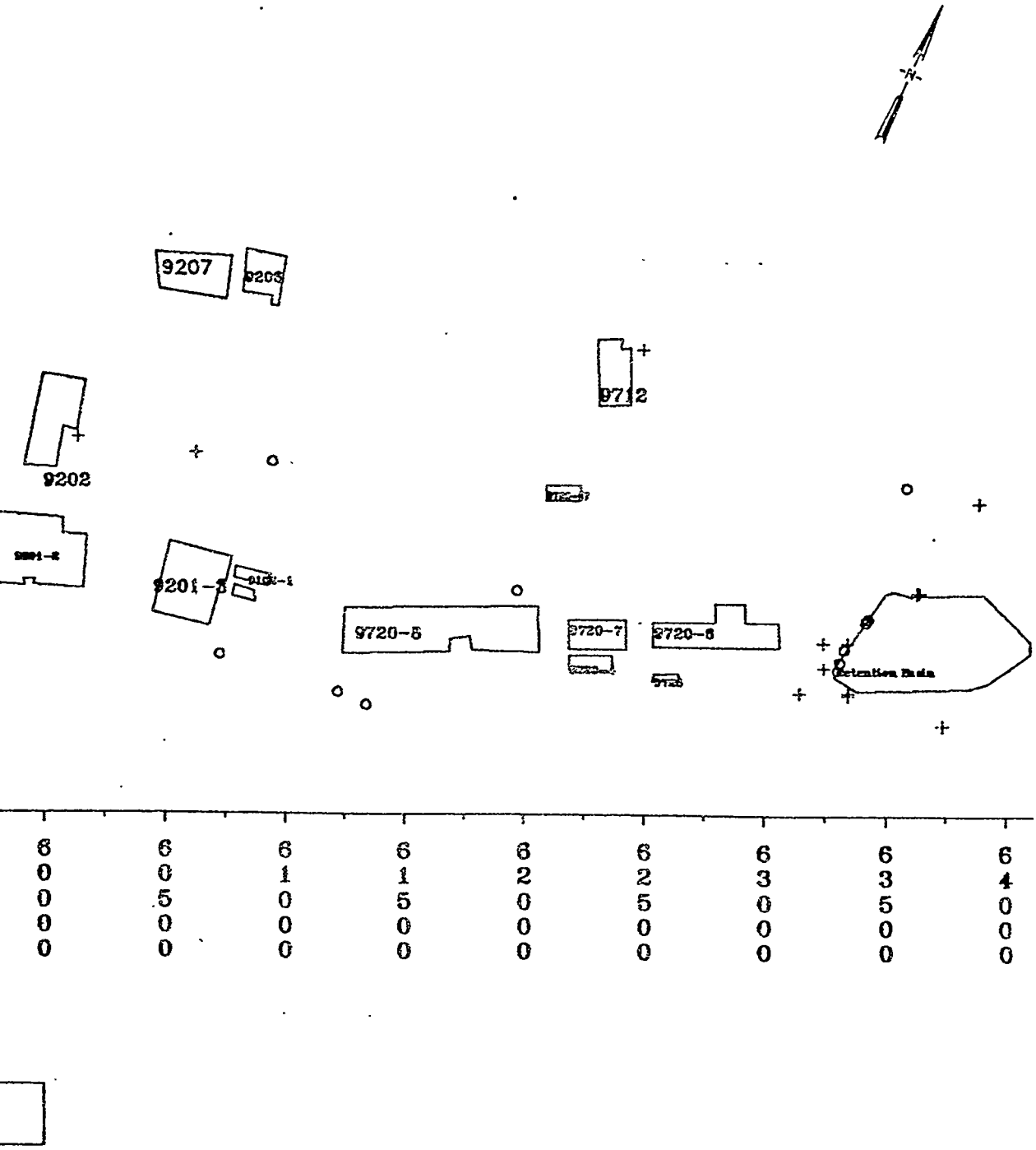
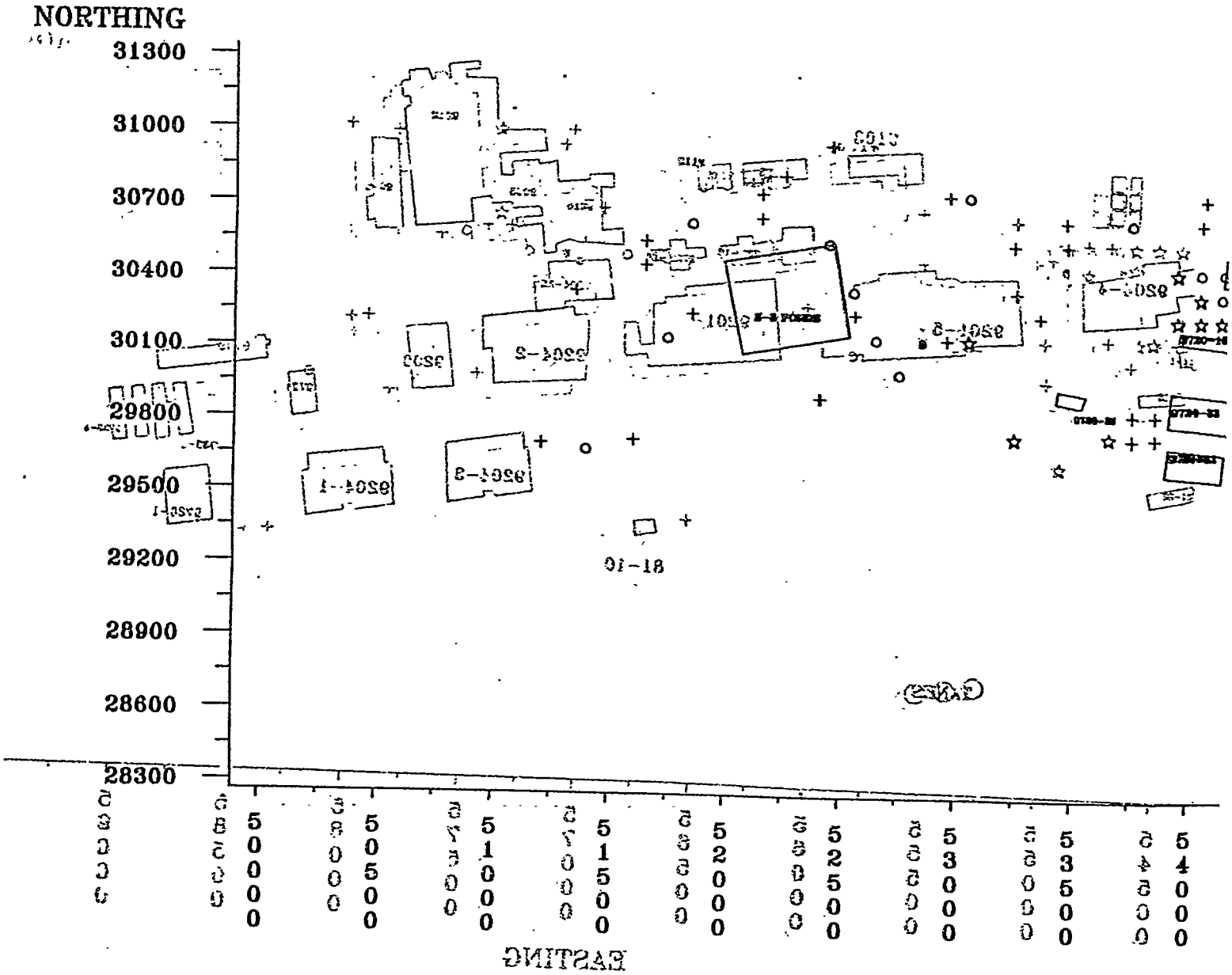
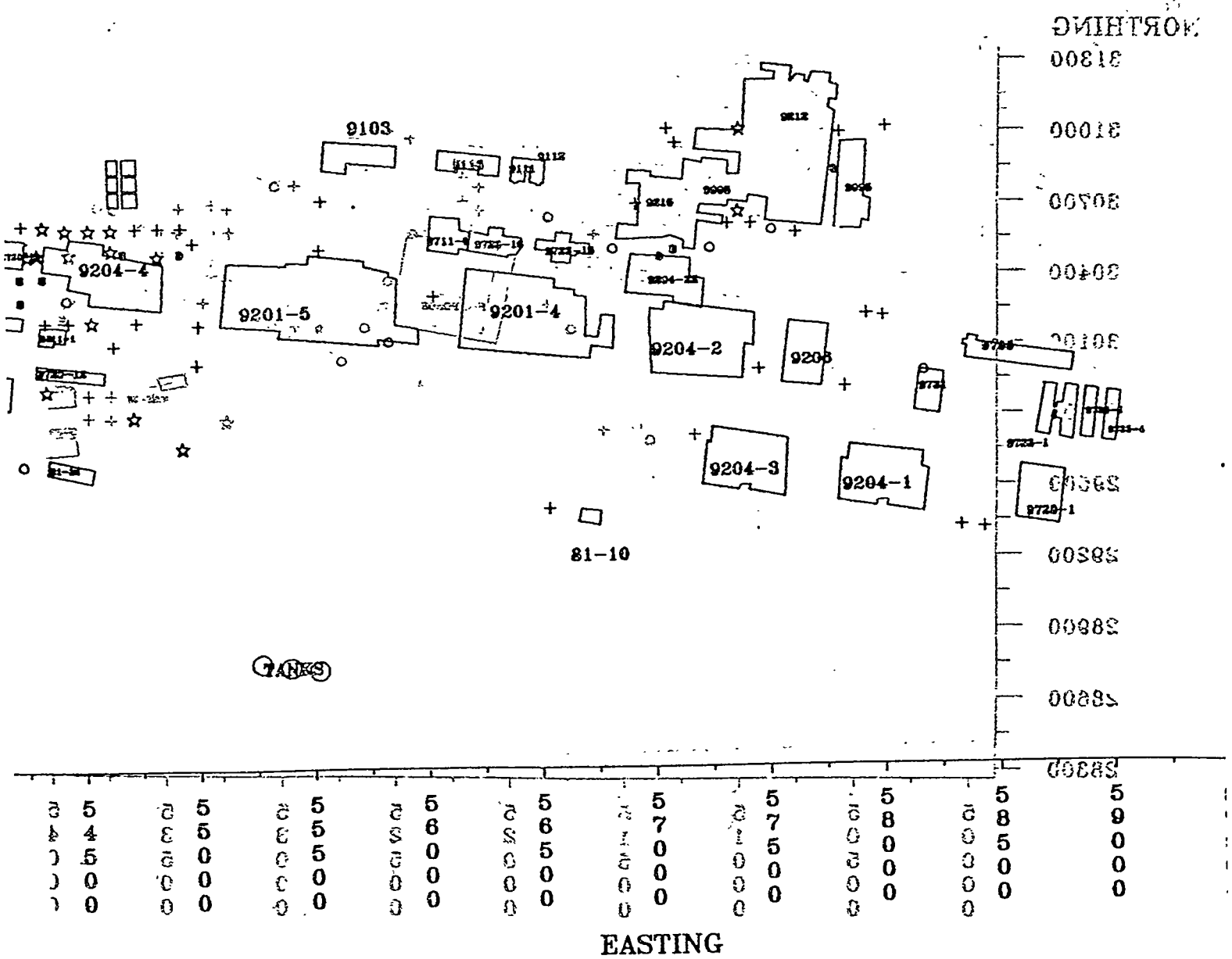


Figure 6.10 Locations of soil samples with mercury concentrations >12 $\mu g/g$.


NORTHING
31300
31000
30700
30400
30100
29800
29500
29200
28900
28600
28300
EASTING
50000
50500
51000
51500
52000
52500
53000
53500
54000

U236 > 32 pCi/g AT Y12 SITE
SYSTEMATIC SAMPLES



75–150 150–500

Scale: 1" = 650 ft

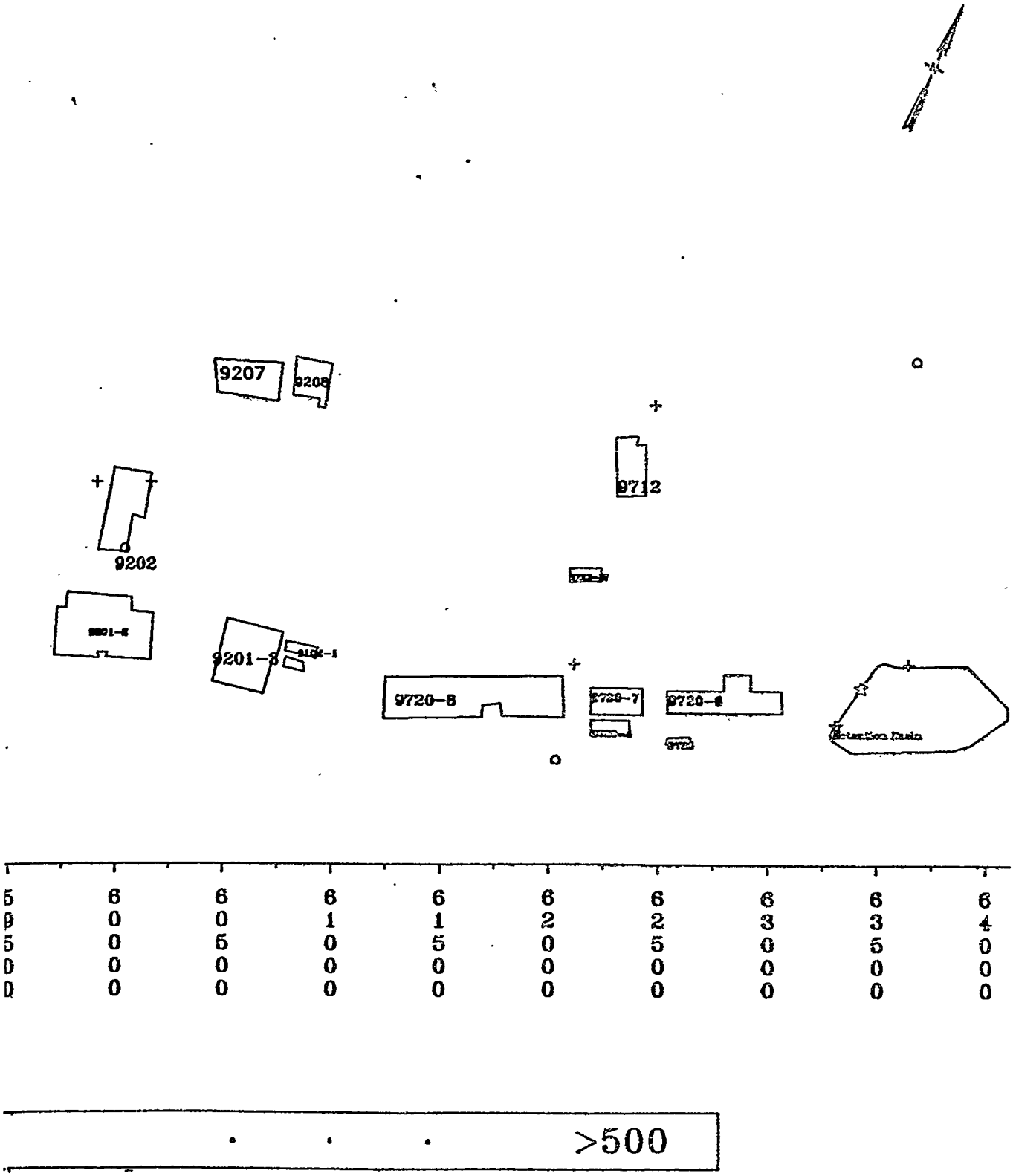
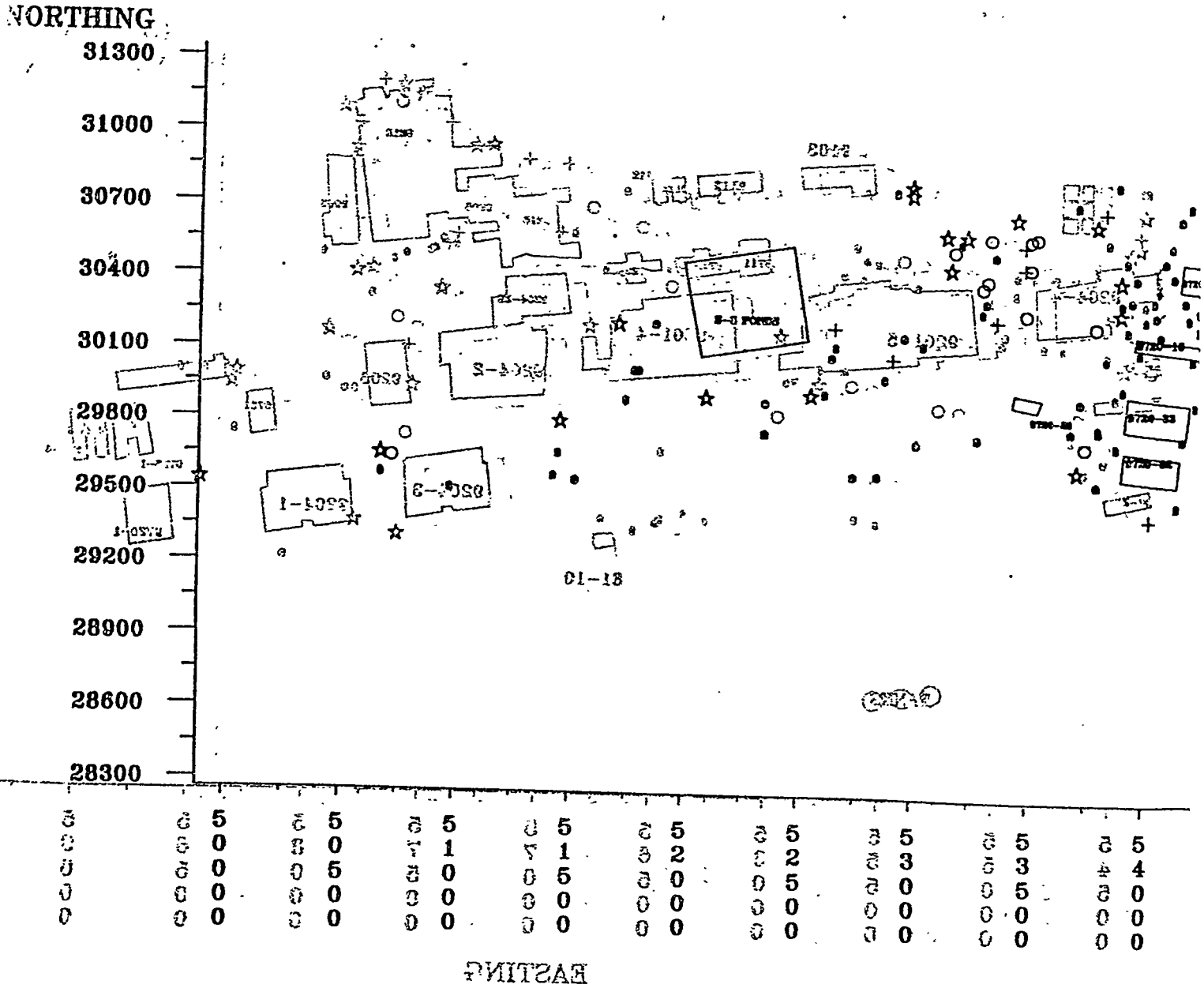
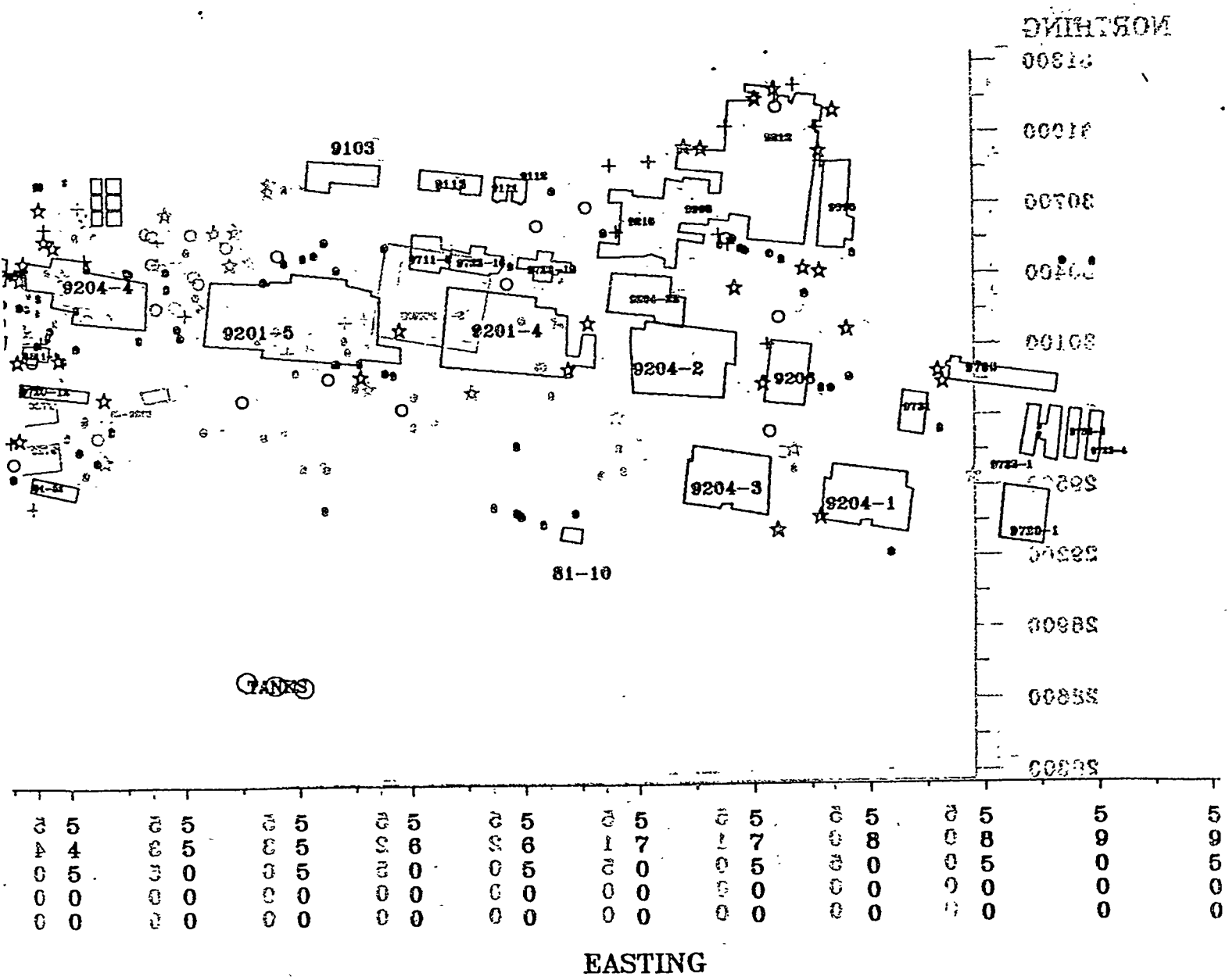


Figure 6.11 Locations of soil samples (systematic) with uranium-238 activity >32 pCi/g.


NORTHING
31300
31000
30700
30400
30100
29800
29500
29200
28900
28600
28300
5 5 5 5 5 5 5 5 5 5
0 0 0 1 1 2 2 3 3 4
0 0 5 0 5 0 5 0 5 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0

URANIUM 238 ABOVE 32 pCi/g
BIASED SAMPLES



75–150 150–500

Scale: 1" = 650 ft

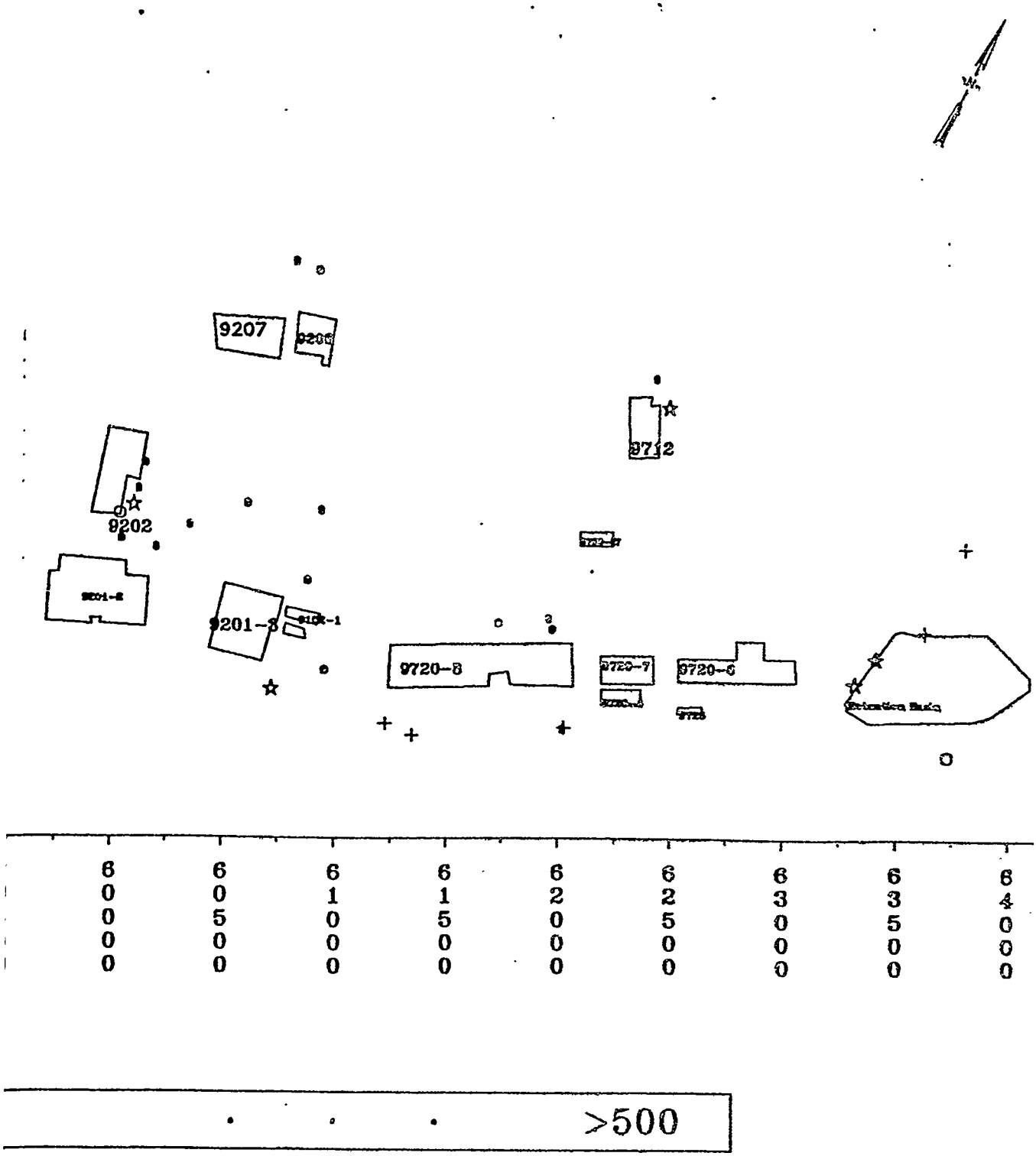
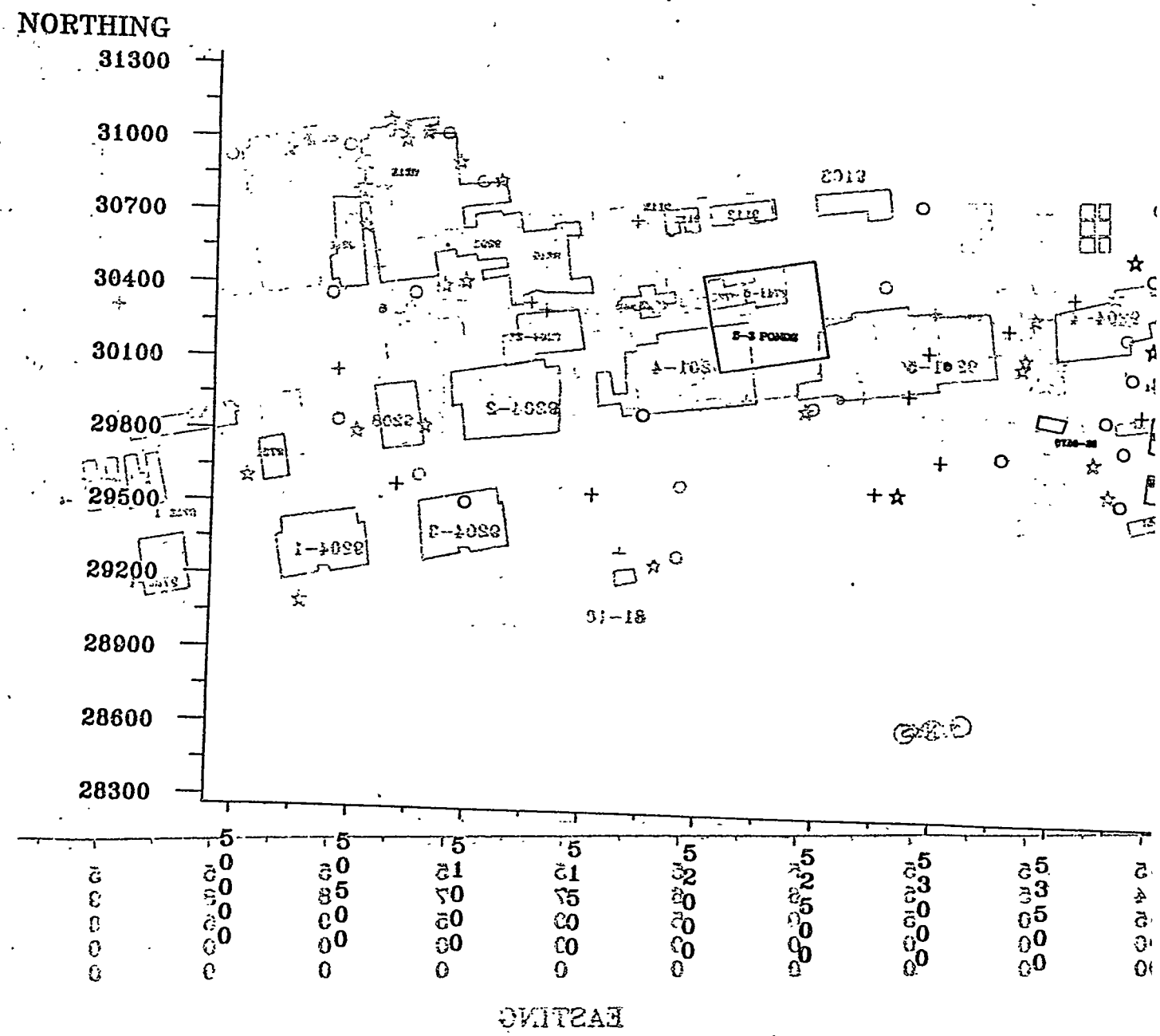
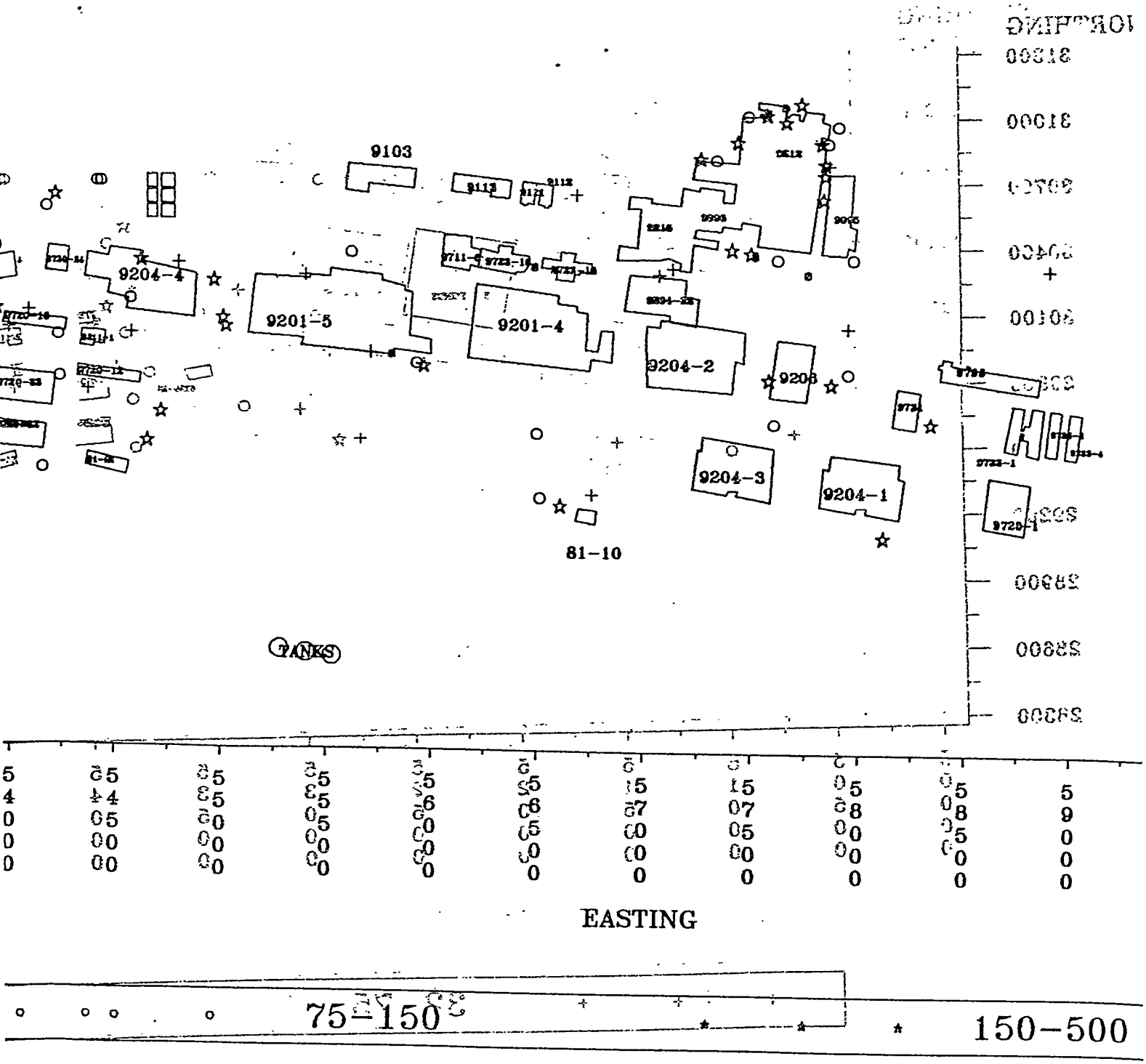


Figure 6.12 Locations of soil samples (biased) with uranium-238 activity >32 pCi/g.


NORTHING
31300
31000
30700
30400
30100
29800
29500
29200
28900
28600
28300

URANIUM 235 ABOVE 32 pCi/g
BIASED AND SYSTEMATIC SAMPLES



Scale: 1" = 650 ft

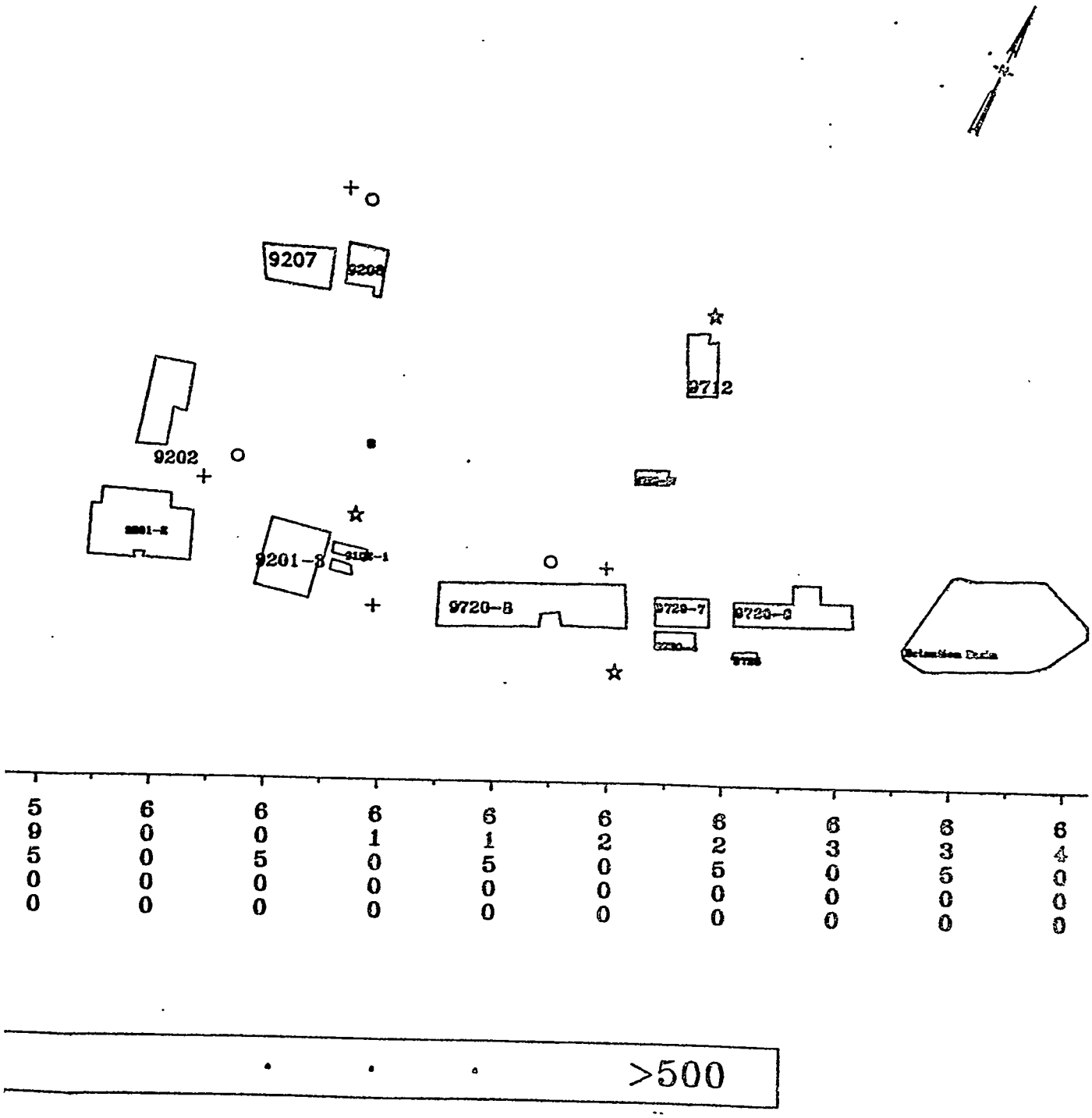
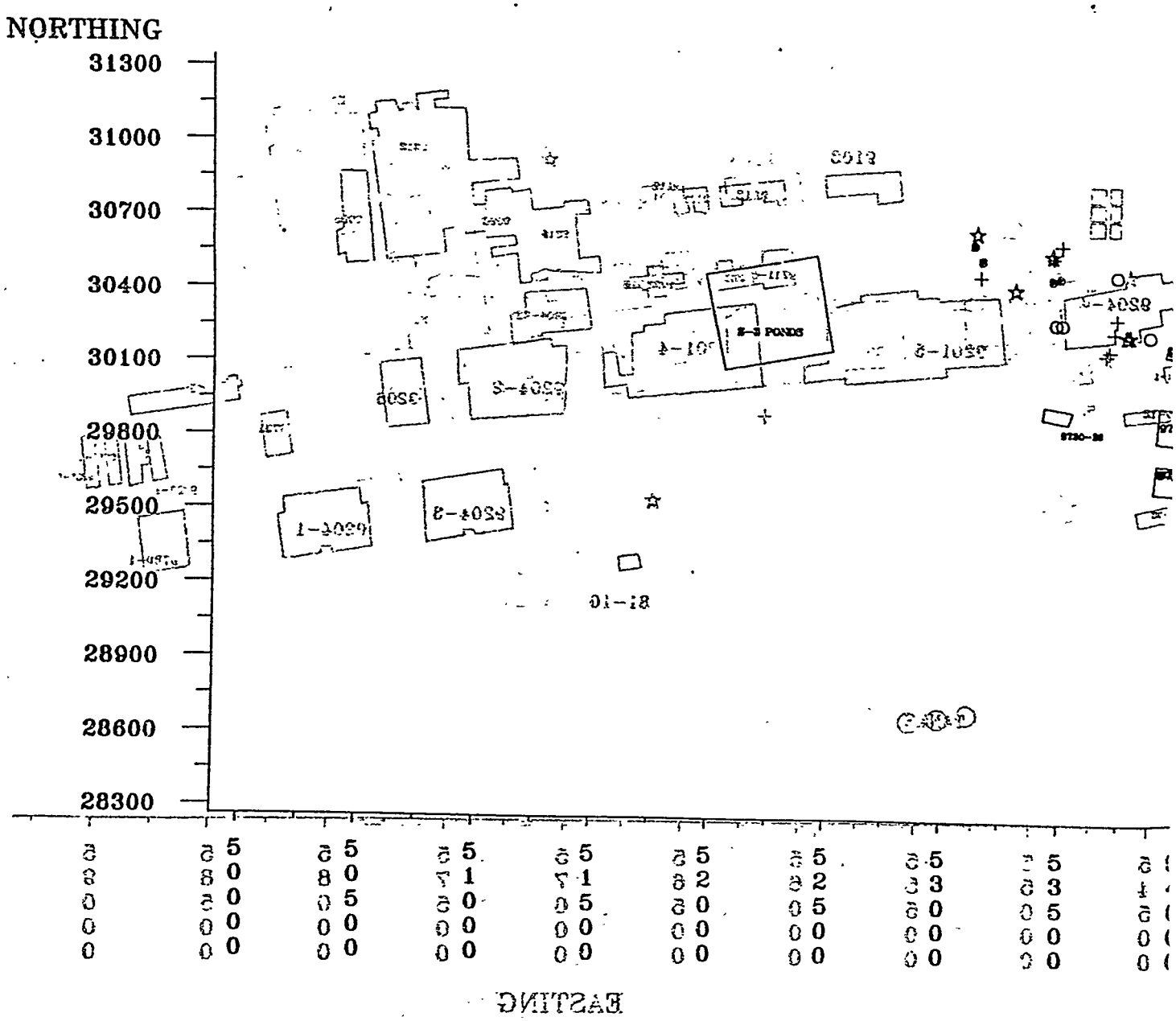
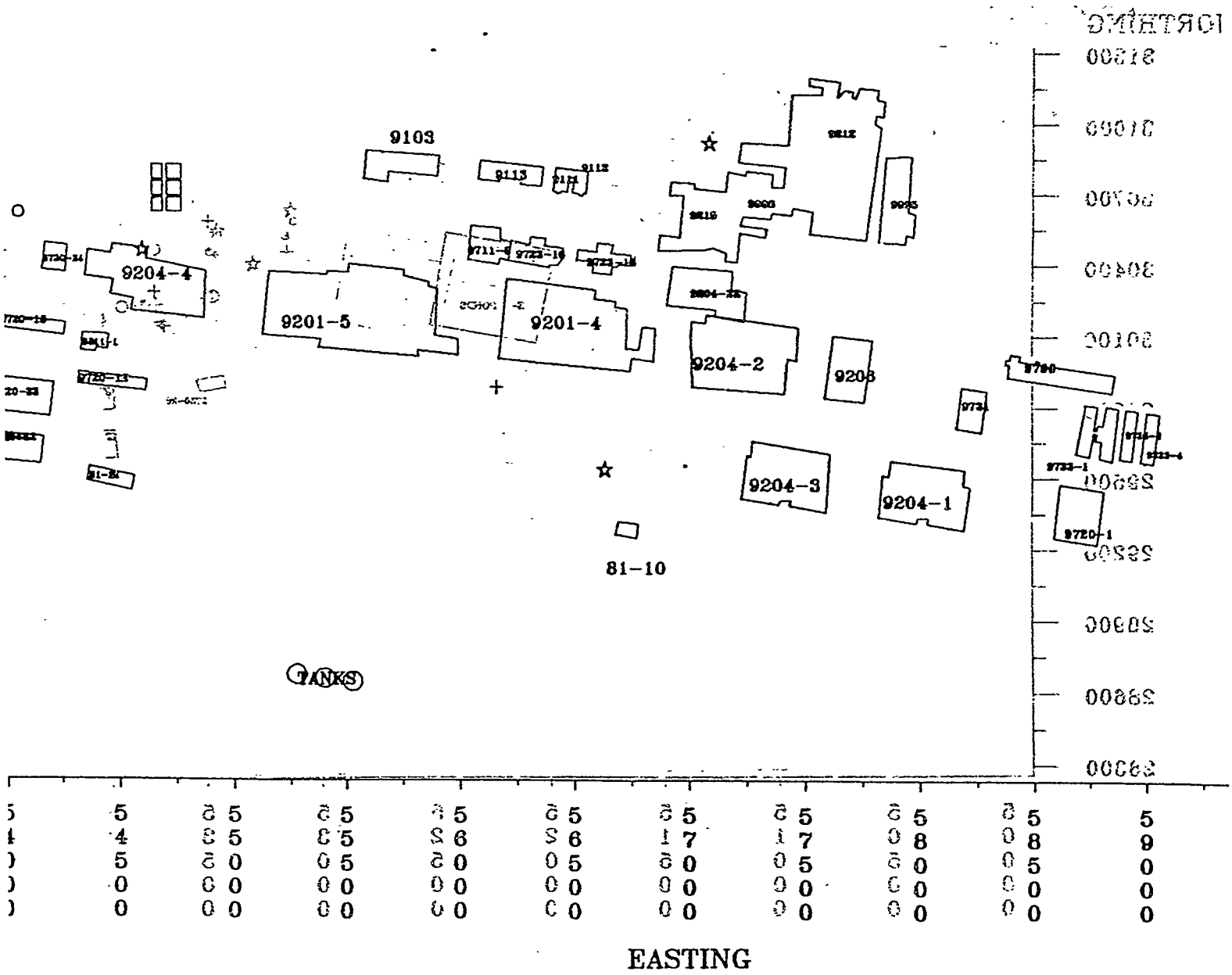


Figure 6.13 Locations of soil samples with uranium-235 activity >32 pCi/g.


NORTHING
31300
31000
30700
30400
30100
29800
29500
29200
28900
28600
28300
S-S PONDS
EASTING

CESIUM 137 ABOVE 32 pCi/g
BIASED AND SYSTEMATIC SAMPLES



75-150 | 150-500

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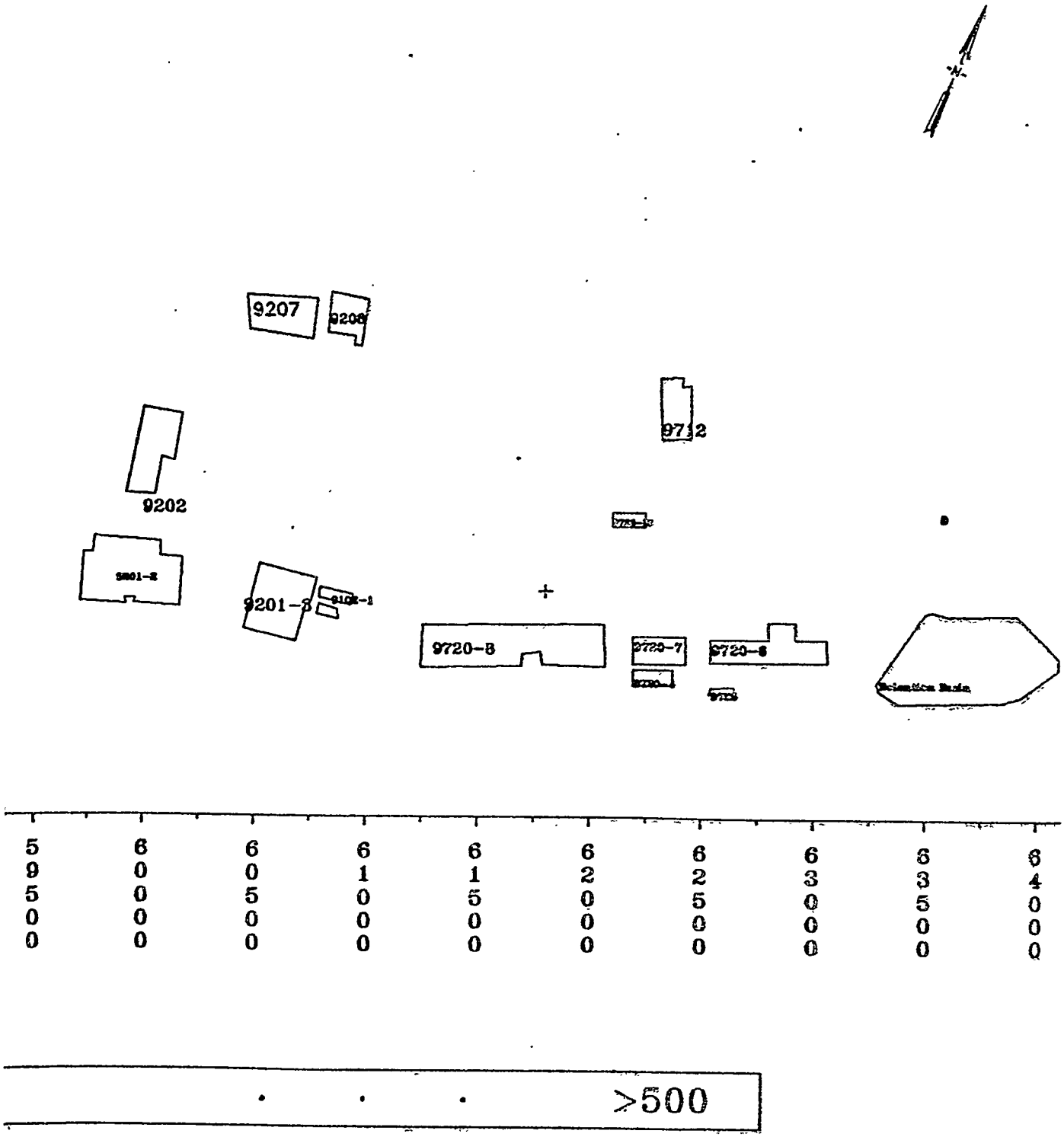
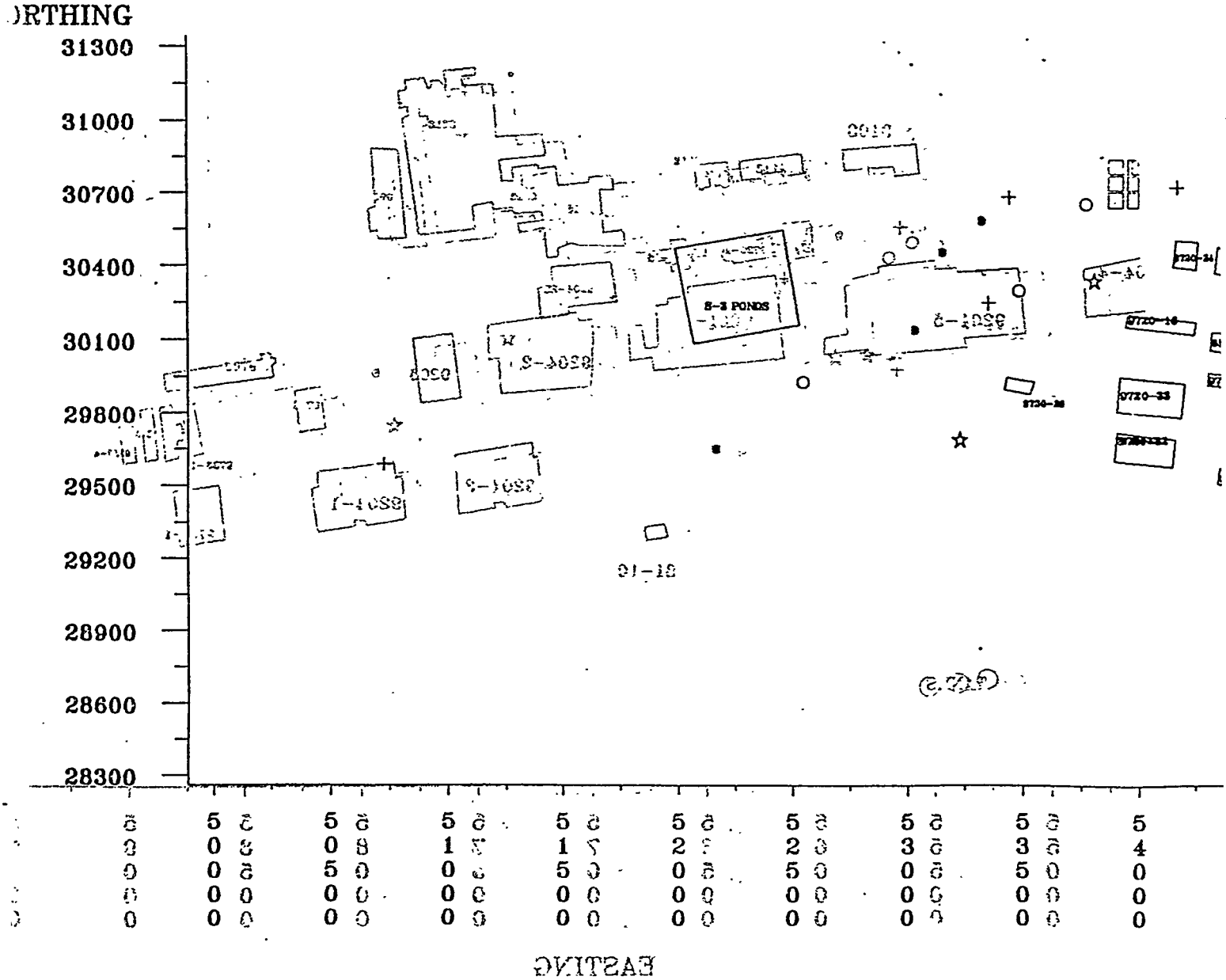


Figure 6.14 Locations of soil samples with cesium-137 activity >32 pCi/g.


ORTHING
31300
31000
30700
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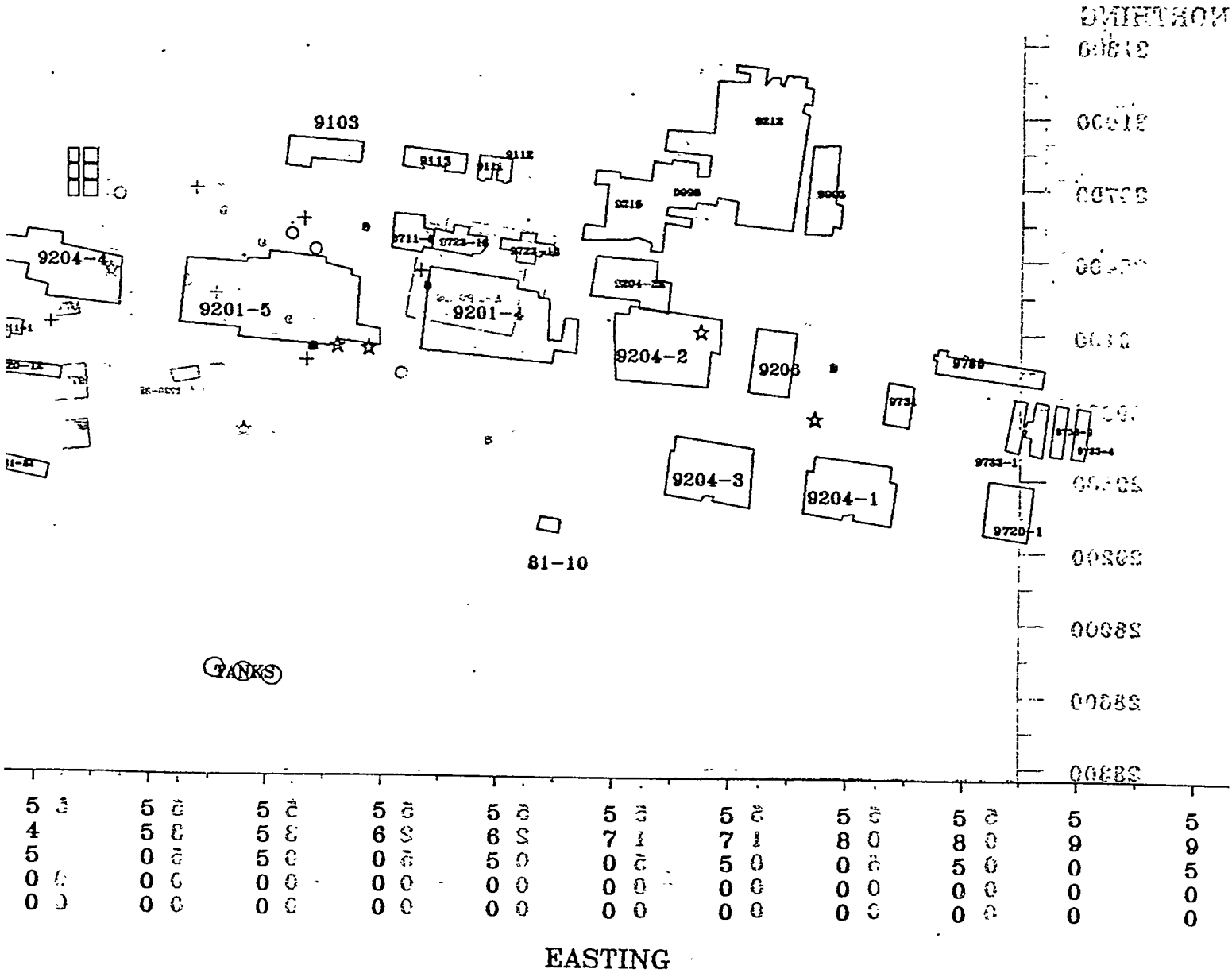
S-3 PONDS
EASTING

THORIUM 232 > 32 pCi/g IN Y12 SAMPLE SURVEY



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Scale: 1" = 650 ft

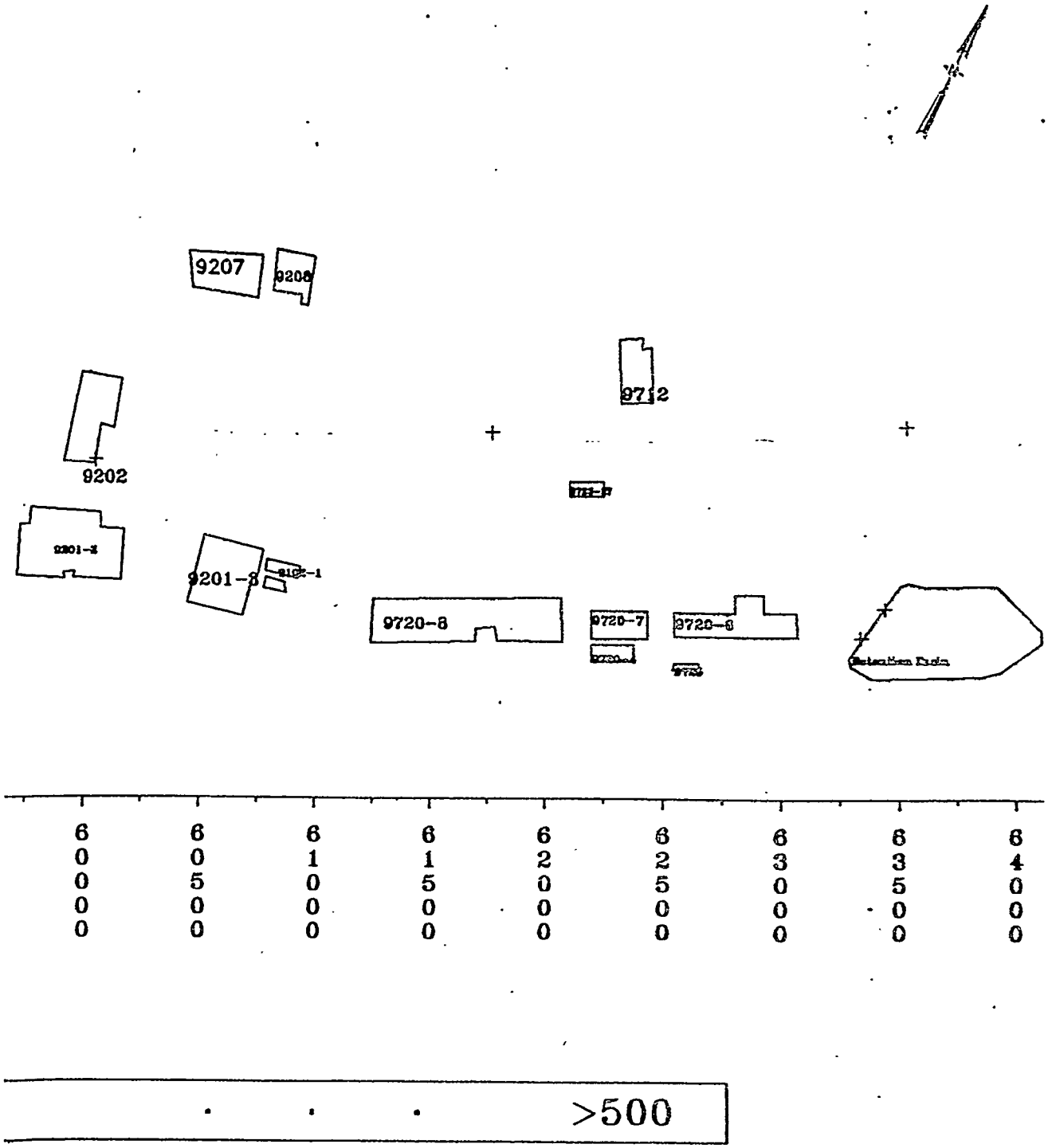

Figure 6.15 Locations of soil samples with thorium-232 activity >32 pCi/g.

6.3.2 Conclusions and Recommendations

Surface soil contamination with mercury has been rather extensively investigated at the Y-12 Plant. At selected sites associated with mercury spills more detailed investigations of the areal and depth distribution of mercury have been conducted. Several such sites (e.g. 9733-1/2 and 81-10) have already been subjected to removal of contaminated soil. Results of surface soil sampling have shown that elevated mercury levels are widely scattered throughout the Y-12 Plant and that most surface soils contain only background or slightly elevated mercury concentrations. Elevated mercury concentrations in soil have not been found consistently in association with Mercury-Use Areas.

The RFI should perform confirmatory sampling at all sites previously exhibiting surface soil concentrations in excess of 100 μg/g irrespective of whether the sites are located within the arbitrary bounds of the Mercury-Use Areas shown in Figure 1.1. The use of a portable mercury vapor monitor should be investigated and developed, if possible, as a method of guiding soil sampling for mercury. Areas exhibiting detectable soil mercury vapor should be mapped for the areal and depth distribution of mercury using EPA-approved sampling and analysis methods.

Surface contamination with isotopes of uranium and thorium and with ^{137}Cs have also been extensively investigated at the Y-12 Plant. These areal surveys have shown widely scattered areas with activities in excess of 32 pCi/g. The RFI should perform confirmatory sampling at all sites within the Mercury-Use Areas exhibiting greater than 32 pCi/g.

Comprehensive (e.g., 40 CFR Part 264 Appendix IX constituents) chemical analysis has not been applied to soil samples from the Mercury-Use Areas to detect the presence of other hazardous substances in addition to mercury and radioisotopes. To determine if any other hazardous constituents are present, a subset (10%) of the soil samples exceeding 100 μg/g in mercury concentration and 32 pCi/g in total activity, should be selected randomly and analyzed for Appendix IX (40 CFR Part 264) constituents. Additional soil samples should also be collected in the Mercury-Use Areas, at sites not previously identified as being contaminated with mercury or radioisotopes, and submitted for analysis of Appendix IX constituents.

6.4 SURFACE WATER DATA

As discussed above, Y-12 Plant staff began measuring mercury concentrations and streamflow in Upper East Fork Poplar Creek in 1954 when lithium isotope production began on a large scale (Wilcox 1983). Actual sampling location, sampling technique and analytical technique have changed several times since this monitoring was begun, but the monitoring has been more or less continuous for more than 35 years. The monitoring record (See Figure 3.2) documents very well the early high releases of mercury, and the continuing low releases of mercury, from the Mercury-Use Areas to Upper East Fork Poplar Creek.

No comprehensive surveys of mercury in surface water within the Y-12 Plant were conducted prior to 1983. The following subsections summarize results of several extensive and intensive surveys of mercury in surface water within the Y-12 Plant.

6.4.1 Comprehensive Drain Surveys of 1982-83

An investigation of sources and discharges of mercury in the Y-12 Plant drainage water was conducted in late 1982 and 1983. Complete results of this survey are given in Turner et al. (1985). In order to effectively plan and guide remedial actions to reduce the losses of mercury in Y-12 drainage waters, the investigation was conducted to determine where significant quantities of mercury were entering the Y-12 drainage waters, and to determine the mercury loading rate (g/d) for these sources. The primary objective of the study was to identify and quantify chronic and episodic sources of mercury that were contaminating Y-12 drainage waters.

Mercury was used at the Y-12 Plant in the metallic or elemental form, which is only sparingly soluble in pure water (approx. 60 μg/L). However, mercury is subject to a variety of chemical reactions, especially oxidation, complexation, and adsorption, which can greatly alter its solubility. Three reactions, (1) oxidation of elemental mercury by hypochlorite, (2) complexation of mercuric ion by hydroxide and chloride ions, and (3) adsorption by particulate matter, are likely to be of importance in increasing or decreasing Hg solubility in the Y-12 drainage

system. Oxidation by hypochlorite is of special interest at the Y-12 Plant because much of the water which enters Upper East Fork Poplar Creek has been chlorinated and contains some residual chlorine. These theoretical considerations suggested that mercury could enter Y-12 drainage water by either of two primary mechanisms:

(1) dissolution of metallic mercury trapped in sumps, catch basins, and pipes by water flowing through these structures, and

(2) erosion/resuspension of Hg-contaminated particulate matter by surface runoff, process effluents, cooling water discharge, and groundwater infiltration. Most dissolved mercury is likely to be rapidly adsorbed on suspended particulate matter, especially fine-grained, organic-rich particulate matter.

Identification of buildings and areas yielding mercury to drainage waters required systematic sampling of all pipes discharging water into the upper part of the creek upstream of NHP. Over 100 pipes of varying diameters provide continuous or episodic discharges of water into the creek upstream of NHP. Upstream of the open ditch, the drainage system is entirely underground and accessible only through manholes. During the survey, selected discharges were sampled repeatedly over various time scales and weather conditions to obtain an indication of variability. Because the number of discharge points was too large to be sampled simultaneously to give a truly synoptic sampling, several comprehensive surveys were conducted with up to 25 discharge points sampled during an 8-h period.

In addition to collecting water samples for mercury analysis, water flow rate was measured or estimated for most discharge points to permit calculation of a mercury loading rate (g/d). For correlative purposes, free chlorine, chloride, pH, electrical conductance, and temperature were also usually measured in each water sample collected.

Drain water sampling and flow measurement activity were classified, based on specific objectives, into two categories:

1. Intensive sampling of selected discharge points over 24-h to 48-h weekday period to quantify the "within-point" variability in mercury concentration and loading.

2. Extensive sampling (one to three times) of all discharges into the open portion of the open ditch and of selected discharges in underground pipes upstream of the open ditch to localize significant sources of mercury.

Figures 6.16 and 6.17 show the locations of all water sampling points used or considered for use during the survey. Water samples and data were coded as to location by one of two labeling schemes. Pipes along the upper creek were labeled with a number representing their respective distances in meters upstream from the chain-link fence at the west end of NHP. In the underground portion of the drainage system, water samples and data from pipes were coded first by reference to the location of the culvert with respect to a nearby building (i.e., "NW9720-5" means "the culvert located northwest of Building 9720-5"). Where multiple pipes entered a culvert, the coding was expanded to indicate the compass direction from which flow in each pipe originated (i.e., "NW9720-5/W" means "the flow in the pipe on the west side of the culvert located northwest of 9720-5"). Subsequently many, but not all, of these sampling points were assigned "outfall numbers". Turner et al. (1985) provides the cross reference for the pipe nomenclature.

Flow rate of water in pipes was obtained by one of two methods: (1) the area-velocity method, or (2) the volume-time method, with the choice of method largely dictated by the characteristics of each pipe. Flow rates determined by the area-velocity method were estimated to be accurate to within ±50% or better. In contrast, flow rates determined by the volume-time method were considered to be accurate within ±10% since this was a direct measurement requiring no assumptions or averaging of velocities. At one sampling location, NE9201-4, a hydraulic weir was present and was used to gage flow rate at this location. Accuracy of the weir measurements were estimated to be ±15%.

Water samples collected during the drain survey were all of the "grab" type and thus represented instantaneous rather than composite conditions. Water samples for mercury analysis were collected in specially cleaned and prepared containers. In most cases only a single water sample was collected at each location per sampling time. At selected times and locations, triplicate samples were collected to obtain

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Y12 DRAINAGE SYSTEM-WEST AREA
LINES AND MONITORING STATIONS

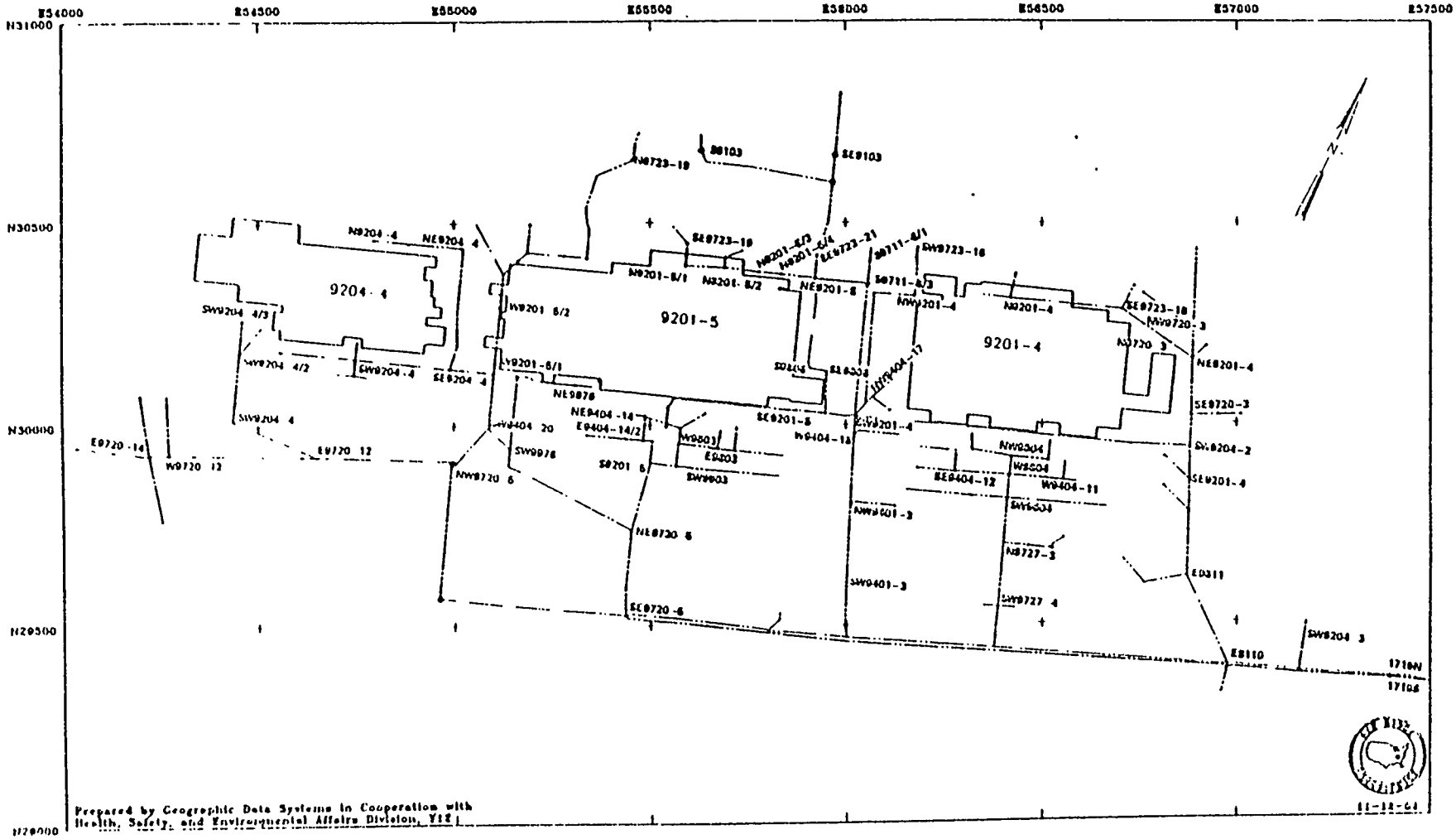

Figure 6.16 Drainage lines (partial) and water sampling stations in the western area of the Y-12 Plant.

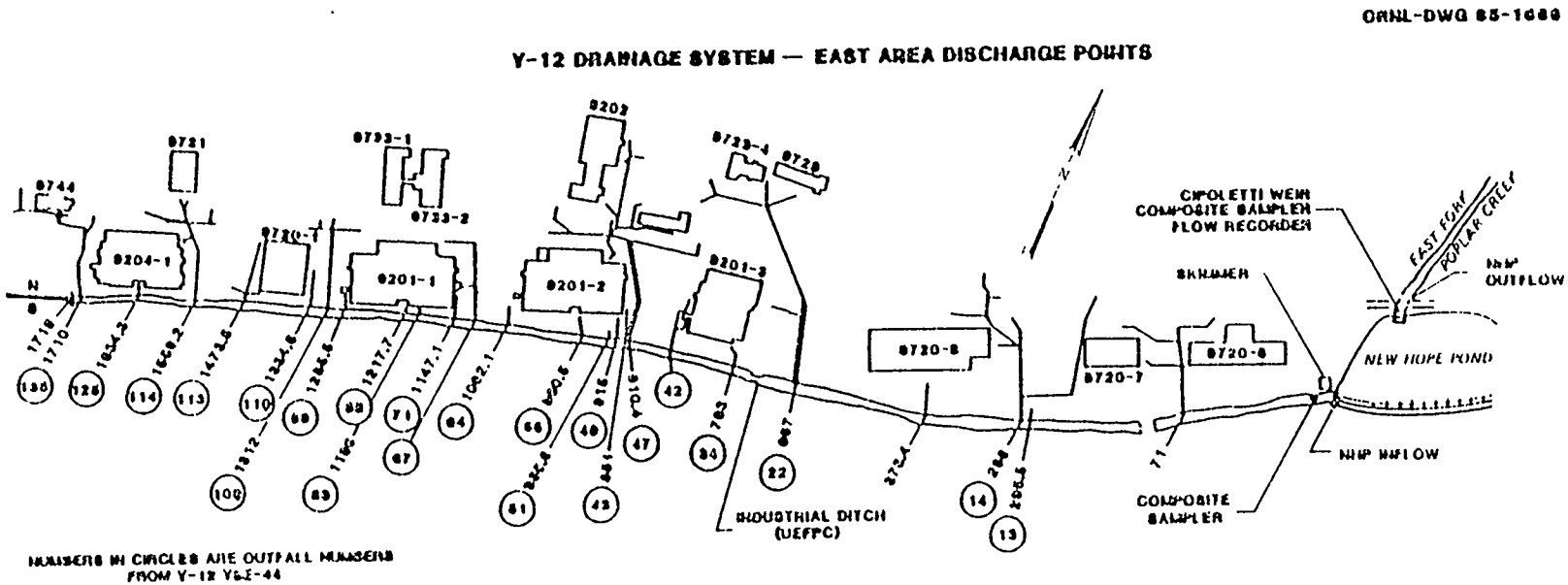

Figure 6.17 Drainage lines (partial) and water sampling stations in the eastern area of the Y-12 Plant. Numbers in circles are discharge points from Union Carbide (1983).

an estimate of sampling variability. Total mercury was analyzed at the laboratory using one of two basic procedures, the method developed by Feldman (1974), or the procedure recommended by the U.S. EPA (USEPA 1983). A comparison of results using the two methods showed close agreement.

Comprehensive sampling of selected discharge points began in October 1982 and continued at selected periods through December 1983. Despite difficulties encountered in sample location access, all discharge points which were significant sources of drainage water for Upper East Fork Poplar Creek were sampled at least once. Table 6.7 gives a summary of the dates, number of discharge points sampled, and areas covered by the comprehensive surveys. The early surveys confirmed that all buildings where mercury had been formerly used or spilled should be suspected as sources of mercury to drainage water. Elevated mercury concentrations and loadings in drainage waters were observed in the vicinity of nearly all buildings and areas where mercury had been formerly used or spilled. Prior to this study, it had been assumed that recent losses of mercury in Y-12 drainage waters could be traced primarily to Building 9201-4, the one process building which had not been stripped and decomtaminated. However, the two surveys conducted in 1982 showed that Building 9201-4 was not the most important source of mercury to the drainage waters. Instead, Buildings 9201-5 and 9204-4 were implicated as being the most important. The area around building 81-10 was also shown to contribute a significant mercury loading to drainage waters. The later surveys conducted in 1983 helped to confirm this finding. Table 6.8 summarizes the best estimates of mercury loading from various buildings or areas within the Mercury-Use Areas.

The comprehensive survey conducted between November 17, 1983 and December 21, 1983 consisted of a series of six smaller surveys in the Western Exclusion Area and was oriented toward tracing each main north-south trunkline upstream as far as possible. Results from this series were used to produce drainage diagrams with discharge, mercury concentration, and mercury loading indicated for each main trunkline. As shown in Figure 6.18, mercury loading rates did not always increase in the downstream direction as expected. This anomaly was attributed to variability in source strengths over the duration of the 8-h sampling.

Table 6.7 Inventory of comprehensive sampling of discharge points (from Turner et al., 1985).

Inclusive Dates	# of Discharge Points Sampled	Area Covered
October 28-29, 1982	10	Industrial Ditch and Western Exclusion Area
December 9-10, 1982	48	"
June 5-9, 1983	13	"
July 17-August 23, 1983*	40	"
November 17-December 21, 1983	93	Western Exclusion Area

*Investigation carried out by others (See Y-12 Report YSE-44).

Table 6.8 Summary of "best estimates" of mercury loading from various buildings or areas within the Mercury-Use Areas.

Discharge Point	Main Buildings/Areas Served	Estimated Hg Loading (g/d)	Building Totals
E9811	Other areas	5	
	9201-4	10	
SW9727-4	9201-4	10	25(9201-4)
SW9401-3	9201-4	5	
	9201-5	25	
NE9720-5/N	9201-5	10	40(9201-5)
NE9720-5/NW	9201-5	5	
	9204-4	50	
NW9720-5/N	9204-4	5	55(9204-4)
	Other areas	5	
1719S	81-10	30	30(81-10)
	Other areas		

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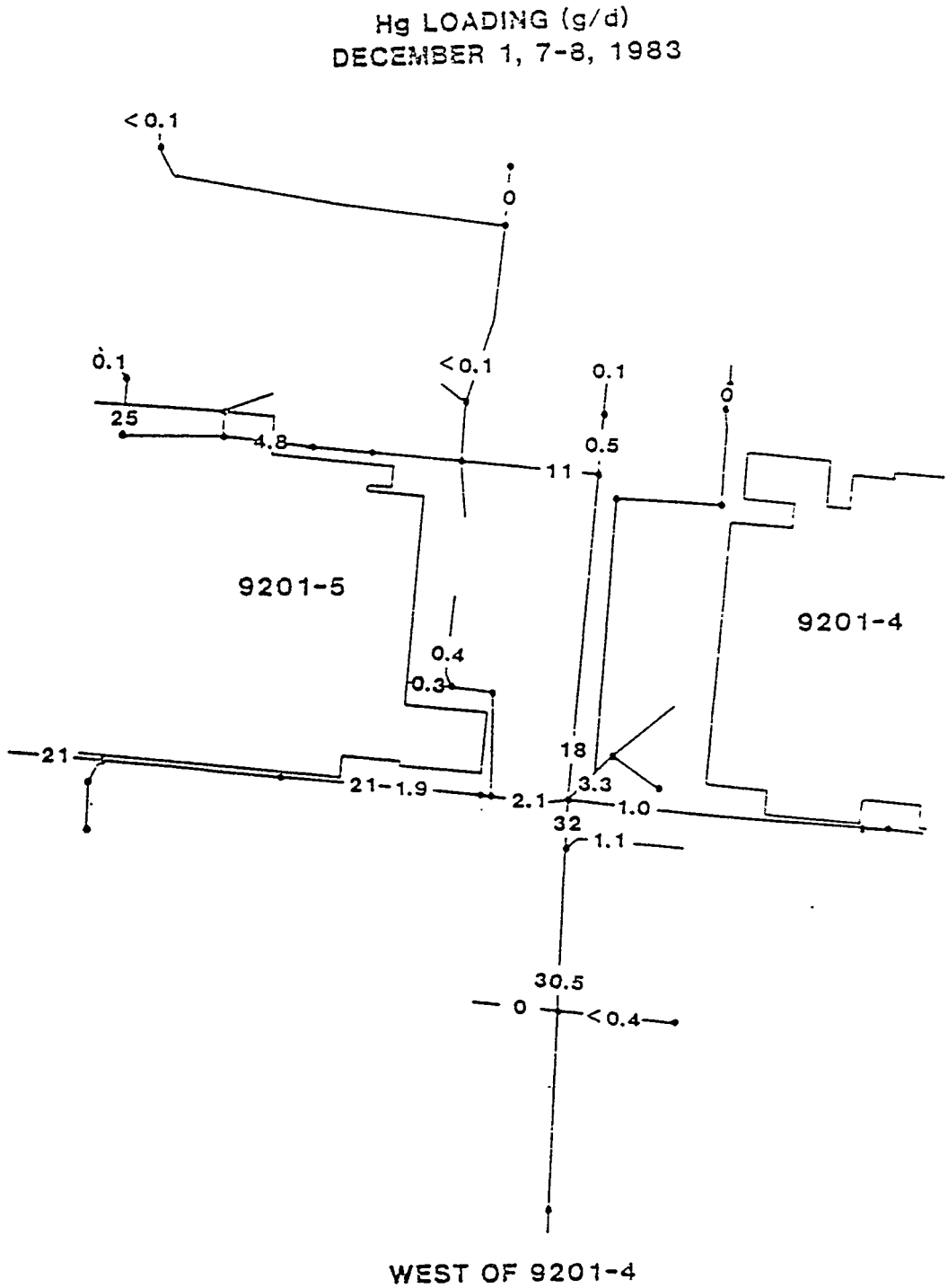


Figure 6.18 Mercury loadings for sampling points located west of Building 9201-4 (from Turner et al. 1985). Note that measurements were not made synoptically.

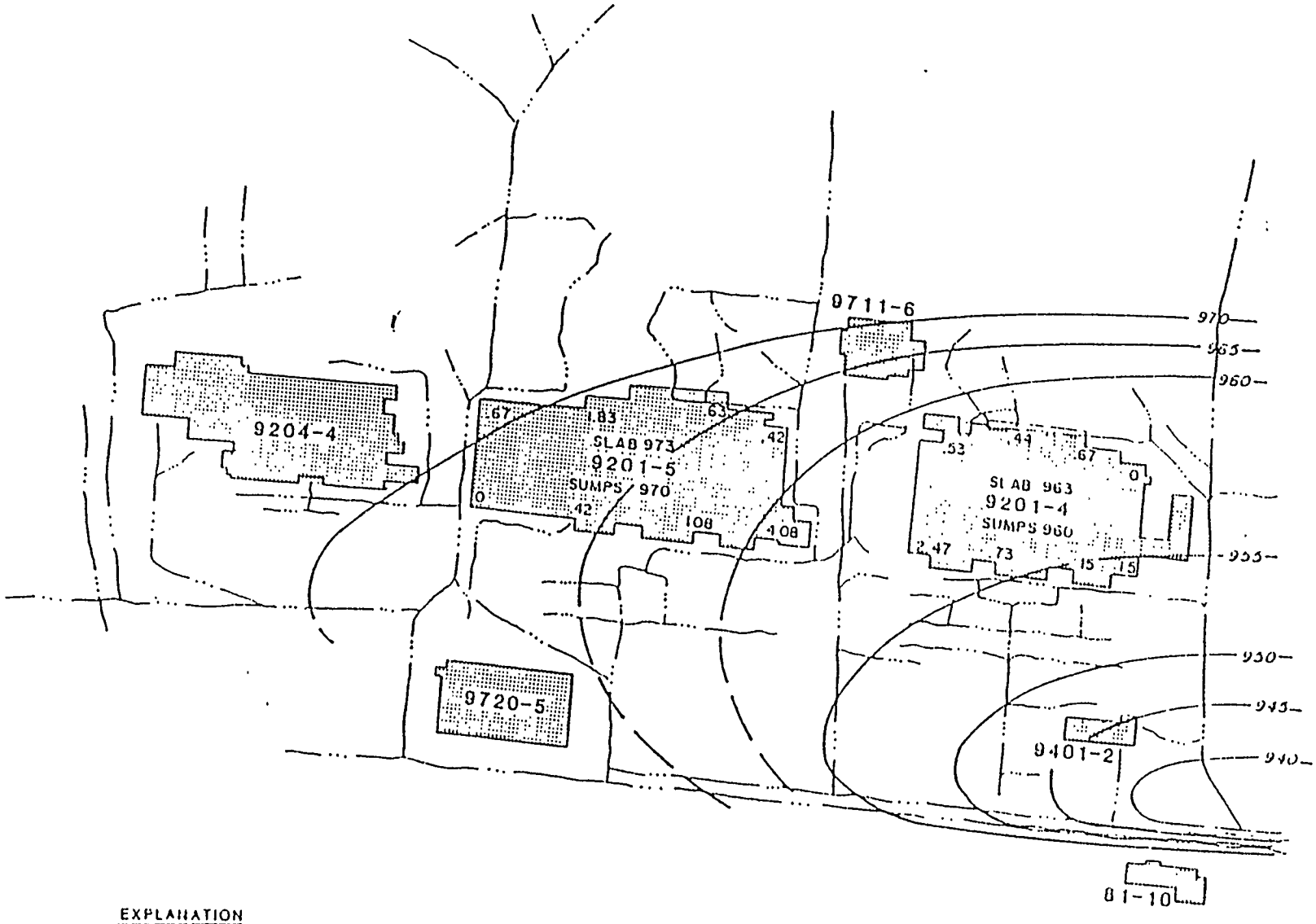
The survey conducted in October 1982 also entailed an evaluation of temporal variability of mercury concentration and loading. In this survey, six samples were collected at each location over a 24-h weekday period. Results of this survey and a second survey involving a single location sampled 24 times over a 48-h weekday period indicated that some individual sources of mercury were highly variable over short time periods (minutes to hours), apparently in response to cyclical plant operations (e.g., regeneration of water treatment system at the steam plant).

Detailed tabulations and discussions of survey results can be found in Turner et al. (1985).

6.4.2 Alpha-4 Sump Data of 1986 through 1988

Building 9201-4 has eight basement sumps which are used to dewater the basement of this building. Groundwater seeps into these sumps and activates the pump at intervals that are determined by the amount of recent rainfall. Prior to 1986, discharge from each sump was routed into the nearest storm drain. Figure 6.19 shows the sump locations and typical daily flows. These sumps have been observed to accumulate elemental mercury and have been systematically cleaned on several occasions. Concentrations of mercury in sump water can also be quite high (up to 100 μg/L).

As part of the Alpha-4 Decommissioning Management Project, discharges from the eight sumps in Building 9201-4 were collected into a single effluent on the southwest side of the building and routed into the storm drain system through a pipe which could be monitored for both flow and mercury concentration. Mercury concentrations have been monitored using the automated mercury monitor designed, constructed, and tested by Y-12 Plant Laboratory staff (Hinton et al. 1987). This mercury monitor collects and analyzes a water sample every 30 minutes. The monitor was operated more or less continuously on the combined sump discharge from August 1, 1986 through November 30, 1988. Daily average flow and mercury concentration for the monitoring period is tabulated in Appendix G of this Plan.



EXPLANATION

970 — CONTOUR ON POTENTIOMETRIC SURFACE AND ALTITUDE IN FT, MAY 17, 1985

1.08 SUMP DISCHARGE GPM, JULY 1, 1985.

Figure 6.19 Potentiometric surface, unconsolidated material, and sump discharge at Buildings 9201-4 and 9201-5.

The overall average mercury concentration in the combined sump discharge was 36 μg/L with daily averages ranging from 1 to 78 μg/L. The overall average flow was 16.7 L/min (4.4 gpm) which results in an overall average mercury loading of 0.85 g/d (0.0019 lbs/d). Figure 6.20 displays the average monthly sump discharge and mercury concentration.

The Alpha-4 sump discharge results are consistent with earlier findings (Turner et al. 1985) that the very low flows from these sumps limits the quantity of mercury which can be transported to the storm sewer. Mercury concentrations in sump water are very similar to the solubility values (20-61 μg/L) of elemental mercury in pure water at 25°C summarized by Onat (1974). This suggests that groundwater is in contact with elemental mercury, or mercury vapor, sufficiently long to become saturated with elemental mercury. Although higher flows would be expected to exhibit lower concentrations of mercury, the mercury loading to the storm sewer would be expected to be much higher because flow would change more than concentration, i.e., mercury loading from these sumps is flow-limited not solubility-limited.

Compared with the mercury loadings from other storm sewers which discharge into Upper East Fork Poplar Creek, the Alpha-4 sump loading is inconsequential. Only if the sumps were to experience increased flows, would mercury loadings become significant.

The sump results appear superficially to be inconsistent with results for groundwater (Section 6.2). Water seeping into the sumps is almost certainly local natural groundwater but has very high mercury concentrations compared with groundwater sampled by wells outside the building (nests 56-1, 56-2, 56-3, 56-4 and 56-6). The high mercury concentrations in sump water may be explained by proximity of the sumps to the mercury sources and low mobility of mercury in groundwater. It seems probable that elemental mercury spilled in the building has migrated into the gravel fill beneath the foundation. Groundwater contacts the mercury in this gravel fill and is then drawn towards the building sumps by the lowered piezometric surface in the vicinity of the sumps. Mercury concentrations in sump water approach solubility limits for elemental mercury in pure water because sorption to clays is limited or absent in

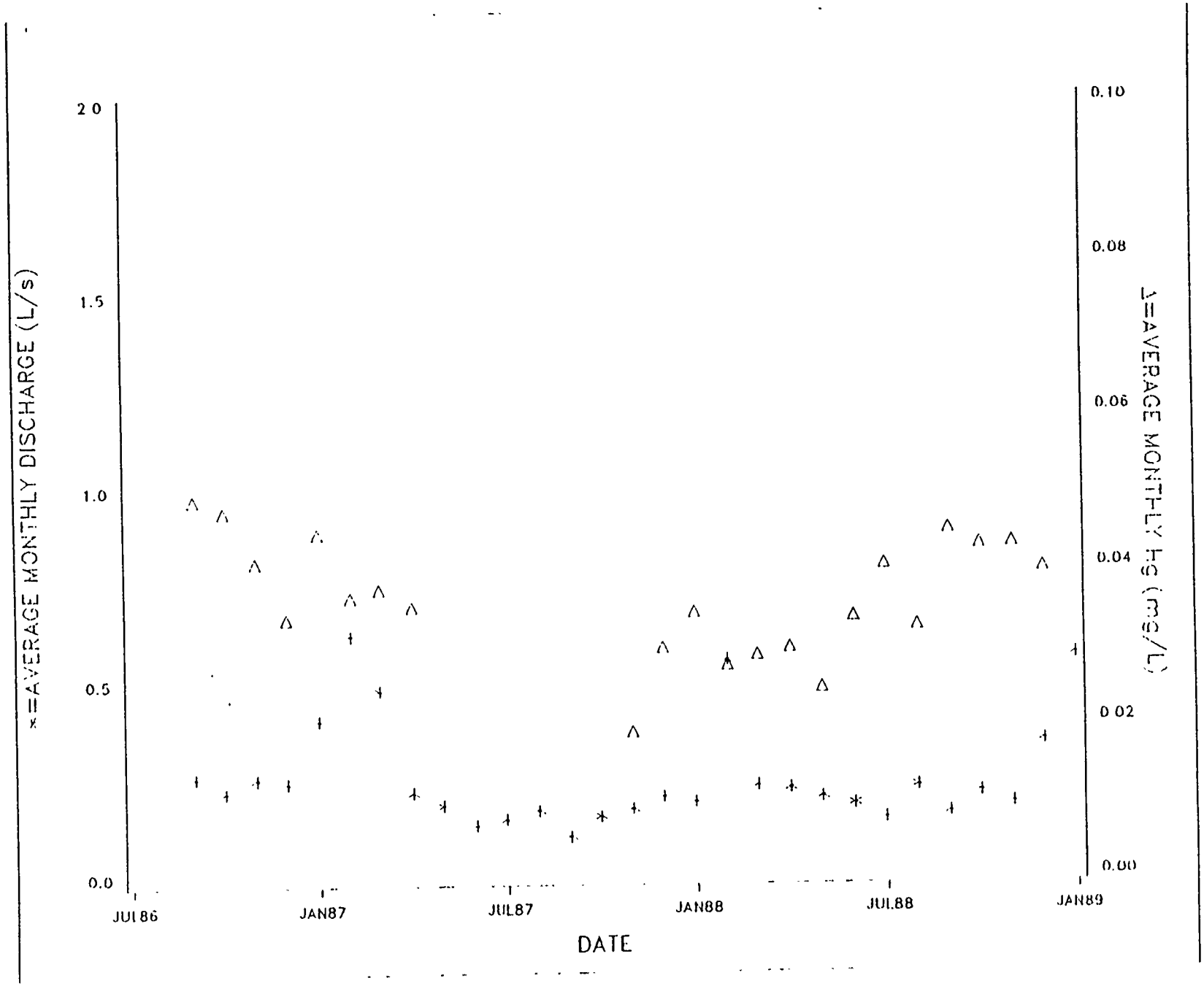


Figure 6.20 Average monthly discharge d mercury concentration for sumps in Building 9201-4 (Augu . 1986 t: January 1, 1989).

the porous gravel and because vapor exchange (evasion) with the atmosphere is restricted until sump waters enter the storm drain system.

6.4.3 Camp Dresser & McKee Comprehensive Surveys

As mentioned above in section 6.1.5, Camp Dresser & McKee, Inc. was contracted by the Oak Ridge Y-12 Plant to perform an area source pollution assessment and control plan for the EFPC/Y-12 Plant drainage area. The primary objective of the assessment program was to assess non-point sources of pollution, including mercury sources, to East Fork Poplar Creek. To do this, a two phase (preliminary and comprehensive) sampling program was developed with the major goals of the sampling program being: (1) the identification of locations of area source discharges, and (2) the determination of pollution loading from precipitation runoff. The preliminary sampling phase, conducted from September through December 1986, was established to gather data on flow and water quality of the EFPC watershed and to use those data to develop a more cost-effective comprehensive sampling program to address area source contamination to EFPC. Results of the preliminary sampling program have been published by MMES (Camp Dresser and McKee 1987) in a draft document.

As part of the preliminary sampling program, 17 water quality stations and two flow monitoring stations were established. The site selection of stations was guided by the necessity to use pipes with a significant outfall that were representative of major drainage areas. Sampling activities were conducted during both wet and dry weather with sample type (i.e., grab or composite) dictated by equipment availability (see Table 6.9 for a list of sampling dates and types). Sample analysis for mercury was performed by MMES staff using EPA methodology (EPA procedure 245.2). During the preliminary survey, average concentrations of mercury were found to exceed the USEPA ambient water quality criteria for human health (0.144 μg/L) and for chronic effects on freshwater biota (0.012 μg/L) at all sampling locations. Many stations were also found to exceed the drinking water maximum contaminant level (MCL) for mercury of 2.0 μg/L. Table 6.10 presents a statistical summary of mercury from the 17 stations sampled in the preliminary survey.

Table 6.9 Summary of sampling schedule for CDM preliminary survey.

Station #	Sample Date	Sample Type
1	09/10/86	Grab
	09/16/86	Grab
	09/19/86	Flow Composite
	09/24/86	Grab
	09/25/86*	Flow Composite
	10/01/86	Flow Composite
	10/08/86	Flow Composite
	10/15/86	Flow Composite
	10/22/86	Flow Composite
	10/25/86*	Flow Composite
2	09/10/86	Time Composite
	09/16/86	Time Composite
	09/19/86	Flow Composite
	09/24/86	Flow Composite
	09/25/86*	Flow Composite
	10/01/86	Flow Composite
	10/08/86	Flow Composite
	10/15/86	Flow Composite
	10/22/86	Flow Composite
	10/25/86*	Flow Composite
3	09/10/86	Grab
	09/16/86	Time Composite
	09/19/86	Grab
	09/24/86	Time Composite
	10/01/86	Time Composite
	10/08/86	Time Composite
	10/15/86	Time Composite
	10/25/86*	Time Composite
4-14	09/10/86	Grab
	09/16/86	Grab
	09/19/86	Grab
	09/24/86	Grab
	10/01/86	Grab
4	10/08/86	Time Composite
	10/15/86	Time Composite
	10/22/86	Time Composite
	10/25/86*	Time Composite
5	10/15/86	Time Composite
	10/22/86	Time Composite
	10/25/86*	Time Composite
15	08/29/86	Grab
16	08/29/86	Grab
17	08/29/86	Grab

* Wet Weather Events

Table 6.10 Mercury results of CDM preliminary (Phase I) survey.

		Hg (ug/L)		
Station	N	Maximum	Minimum	Mean
1	10	12.0	1.4	3.8
2	10	4.8	2.1	3.1
3	8	4.3	2.0	3.3
4	9	2.8	N.D.	0.6
5	8	2.2	0.3	1.5
6	5	1.5	N.D.	0.5
7	5	0.4	0.2	0.3
8	5	2.0	0.3	1.6
9	8	0.8	0.2	0.5
10	5	9.8	0.4	2.4
11	5	1.0	0.2	0.5
12	8	31.5	0.6	7.9
13	5	9.1	2.2	4.3
14	5	4.3	1.0	2.7
15	1			1.0*
16	1			13.0*
17	1			N.D.*

*Only sampled once

N.D. non-detectable

During the preliminary phase, dry and wet weather flow data were gathered from August 26, 1986 through January 6, 1987 at the two flow monitoring stations. Flow data were used to determine discharges to EFPC from both the eastern and western halves of the plant and, along with the analytical results, were used as inputs into a storm water runoff model of EFPC to produce estimates of the total pollutant loadings to EFPC. A preliminary conclusion of this analysis was that the majority of the load for mercury was being transported via storm runoff and that most of the load came from the eastern part of the plant.

As mentioned above, results of the preliminary survey were used to design a long-term comprehensive sampling program. The major objectives of the comprehensive program were to be (1) the characterization of precipitation runoff with respect to pollutant yield, and (2) the identification of specific locations of area source discharges. As part of the comprehensive sampling plan, eleven monitoring stations (designated Station A through Station K) were established in 1988 with an automatic flow-proportional sampler, flow meter, and plotter installed at each station. The sampling plan designated that flow and water quality would be measured at all stations during both wet and dry weather. General guidelines for deciding whether a storm event should be sampled were established based on a range of flows. If flows during a storm event were less or greater than this range, no samples were to be collected for analysis. Sampling during dry weather was to consist of a minimum of seven, 48-h sampling periods yielding two 24-h composite samples for each station. If rain occurred during the sampling period, the collected samples were discarded.

The comprehensive sampling program began in September 1988 and was completed in April 1989. Since its commencement, 13 dry-weather periods and 5 wet-weather periods have been sampled. Table 6.11 presents the preliminary summary statistics for mercury for each of the sampling sites during the comprehensive survey. A final report on the comprehensive sampling program has not been published.

Table 6.11 Mercury results of CDM comprehensive (Phase II) survey.

			Hg (µg/L)		
Station	Type	N	Maximum	Minimum	Mean
A	Dry	13	3.0	1.2	2.0
A	Wet	5	21.0	1.4	7.2
B	Dry	13	0.2	0.2	0.3
B	Wet	5	0.5	0.2	0.3
C	Dry	13	2.4	1.1	1.6
C	Wet	5	5.4	1.0	2.8
D	Dry	13	0.9	0.2	0.4
D	Wet	5	1.1	0.2	0.4
E	Dry	13	2.9	1.2	1.8
E	Wet	5	4.2	1.4	2.8
F	Dry	13	0.5	0.2	0.3
F	Wet	5	0.8	0.3	0.5
G	Dry	13	0.4	0.2	0.3
G	Wet	5	0.8	0.2	0.6
H	Dry	13	2.6	1.2	1.7
H	Wet	5	1.2	0.2	0.8
I	Dry	13	0.6	0.2	0.4
I	Wet	5	1.2	0.3	0.7
J	Dry	13	0.6	0.2	0.2
J	Wet	5	2.3	0.3	1.5
K	Dry	13	3.0	1.0	1.8
K	Wet	5	8.6	1.3	3.1

6.4.4 Conclusions and Recommendations

Surface (storm sewer) water concentrations of mercury have been investigated both intensively and extensively in the Mercury-Use Areas. Nearly all surface water samples from these areas have exhibited mercury concentrations in excess of background (0.005 μg/L) and in excess of the chronic criterion (0.012 μg/L) for protection of aquatic life. Surface water concentrations of mercury in the Mercury-Use Areas also frequently exceed the Maximum Concentration Limit (MCL) for drinking water of 2.0 μg/L. The effectiveness of an extensive remedial program aimed at reducing mercury in plant effluents (see Section 3.2.2) has not been rigorously evaluated yet but appears superficially to have had little effect on surface water mercury concentrations in East Fork Poplar Creek. The effectiveness of this project needs to be investigated in more detail. The RFI should address mainly the identification of sources of mercury in surface water. However, in concert with the UEFPC RFI (Travis et al. 1989), the Mercury-Use Area RFI should identify any additional hazardous constituents of concern in surface water. Thus, limited effort should also be directed at complete chemical analyses of surface water from sites selected to be representative of relatively large areas.

6.5 AIR DATA

6.5.1 Introduction

Both indoor and outdoor monitoring for mercury in air are carried out at the Y-12 Plant. Regular outdoor (ambient) monitoring has included two sites within the Mercury-Use Areas which have been monitored since 1986. The ambient air monitoring program has been a joint effort by the HSEA Division at the Y-12 Plant and the Environmental Sciences Division at ORNL (Turner et al. 1989). The Y-12 Industrial Hygiene Department also provides monitoring for outdoor construction sites where visible mercury is present. Recent regular indoor monitoring has included mainly Building 9201-4, although other buildings have been monitored sporadically for various periods of time by the Industrial Hygiene Department at Y-12. One example of the kind of mercury monitoring performed by Industrial Hygiene is the requirement for monitoring of mercury vapor during any wall penetration for construction projects in Building 9201-5.

6.5.2 Ambient Air Mercury Monitoring

The Y-12 Plant established four stations for ambient air mercury monitoring in 1986 (stations on the east and west ends of the plant and two stations near Building 9201-4) and added an additional site at New Hope Pond in late August of 1987 (Figure 6.21). With the closure of the pond in December 1988, this site was moved to a new location approximately 700 feet east of the original site. In February 1988, a control site was established at Rain Gage No. 2 (see Figure 6.21) on Chestnut Ridge at the Walker Branch Watershed, bringing to six the number of mercury air monitoring stations presently in operation. A complete description of the sites is given in Turner et al. (1989).

At each of these stations, airborne mercury was collected by pulling ambient air through a Teflon filter followed by a flow-limiting orifice and an iodated charcoal sampling tube (MSA No. 459003). Figure 6.22 illustrates the Hg collection device used. The flow-limiting orifice was used to restrict air flow through the collection system to approximately 1 L/min or less. Particulate mercury was collected for 28 days on the

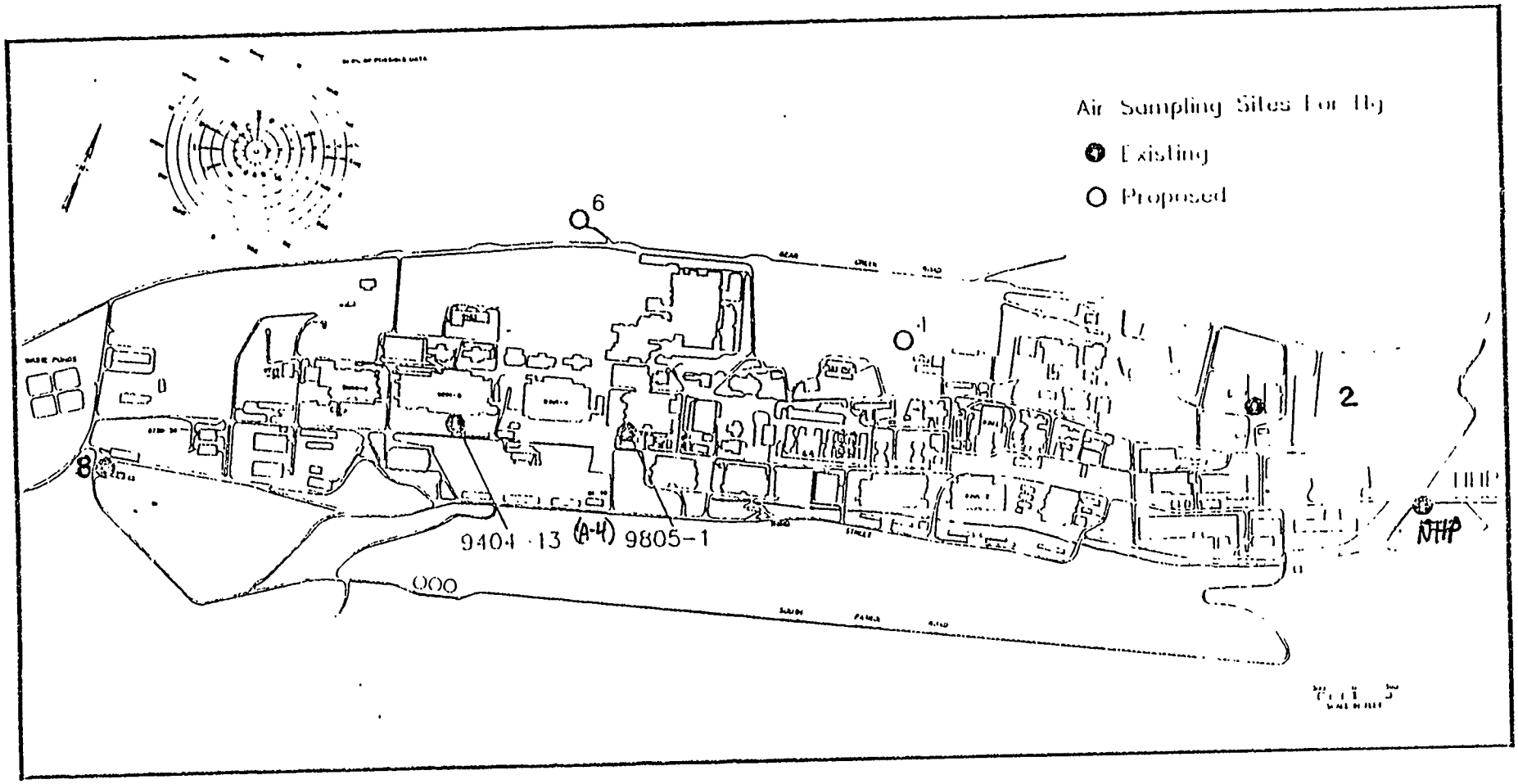


Figure 6.21 Locations of ambient air monitoring sites for mercury and the 1988 annual wind rose (from Turner et al. 1989).

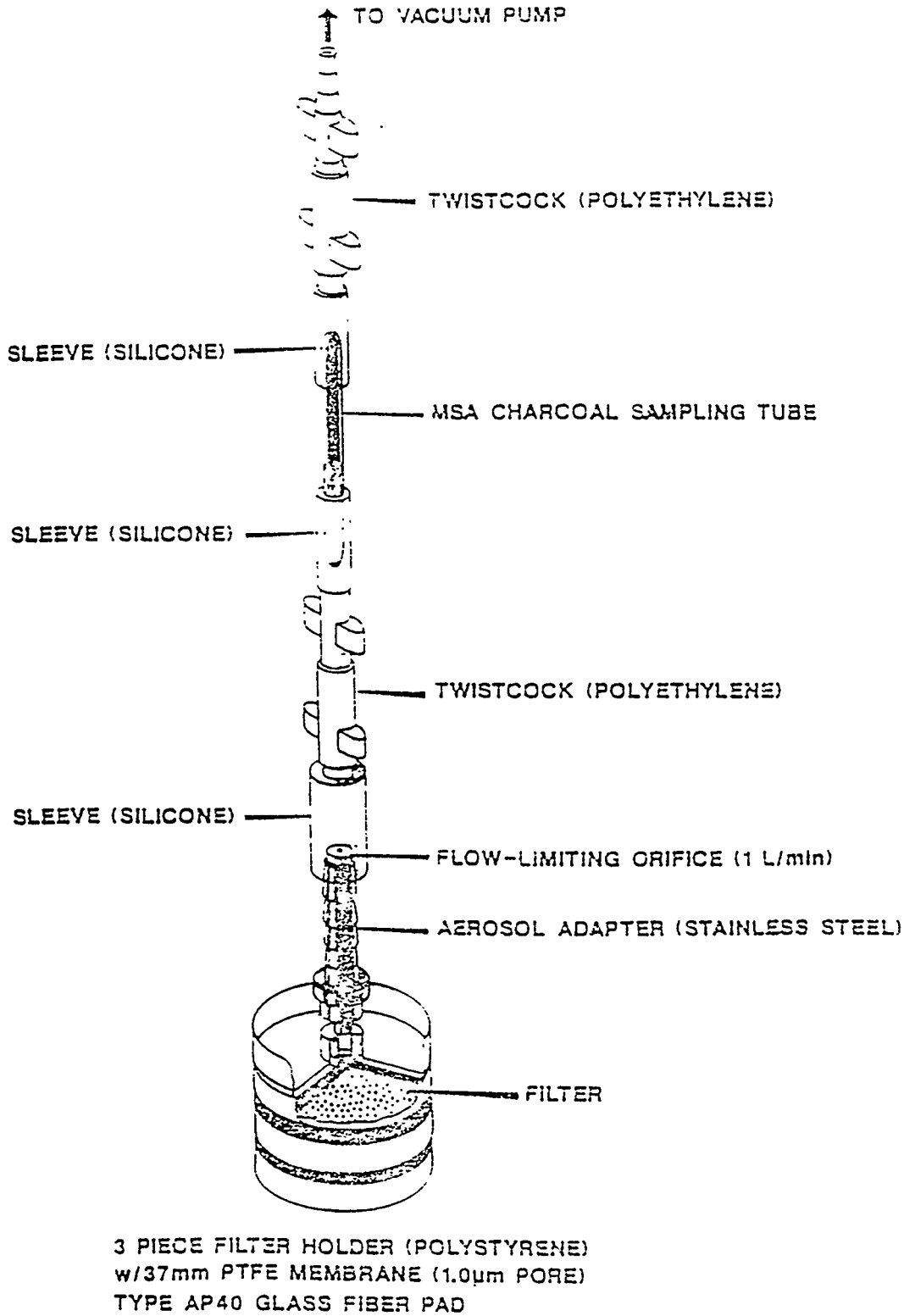


Figure 6.22 Assembly for ambient air mercury sampling at the Oak Ridge Y-12 Plant.

Teflon filter, while mercury vapor was collected for 7 days in the charcoal absorber before tube change-out.

The use of iodated charcoal to collect mercury vapor was first described by Moffitt and Kupel (1971) and has been evaluated by others (e.g., Braman and Johnson 1974; Schroeder and Jackson 1984; Lindberg 1980). Iodated, activated charcoal efficiently absorbs elemental mercury vapor and most other volatile species of mercury. Capacity of the 150 mg charcoal tubes used in this program are 0.5 to 1.0 % of the charcoal weight (75 to 150 μg of Hg). Using these tubes, Lindberg (1981) observed insignificant breakthrough at up to 20 μg total mercury loading per tube.

Mercury collected on the filters and charcoal was analyzed by cold vapor atomic absorption spectrophotometry after digestion in nitric-perchloric acid. The analytical detection limit by this method as applied in the ORNL Environmental Analysis Laboratory, which performed all the analyses, was 0.0005 μg. Tube blanks were measured with each new lot number of tubes and with every other batch of 24 to 30 tubes analyzed. Charcoal-tube blanks were typically 0.001 to 0.002 μg while filter blanks were always reported as <0.001 μg/filter. Comparisons of the charcoal tube absorbers with impingers and gold absorbers has been conducted to evaluate the equivalency of these absorbers. Results were very comparable (Turner et al. 1989).

Average air concentration during the sample collection period (7 days for vapor Hg, 28 days for particulate Hg) was calculated by dividing the total quantity of mercury collected on the charcoal and filters by the total volume (uncorrected to standard temperature and pressure) of air sampled during the sampling period. The volume of air sampled was calculated as the average of flow measurements, determined with a Gilmont Size No. 2 rotameter, taken at the beginning and end of each 7-d period.

6.5.2.1 Results

Table 6.12 gives the maximum, minimum, and average concentrations of ambient vapor and particulate mercury in air at the six sampling locations since installation. Figure 6.23 displays the time trends in mercury vapor concentration in ambient air at each site. The data indicate that on-site ambient mercury concentrations are below the EPA NESHAP guideline

Table 6.12 Results of the Y-12 Plant airborne mercury monitoring program (July 1986 through April 1989).

Site	Sampling Period	Vapor Hg Concentration ($\mu g/m^3$)				Particulate Hg Concentration ($\mu g/m^3$)			
		N	Max	Min	Av	N	Max	Min	Av
Ambient No. 2 (east end of Y-12)	18JUL86-18APR89	153	0.058	0.001	0.009	34	0.00079	0.00001	0.00006
Ambient No. 8 (west end of Y-12)	12AUG86-18APR89	146	0.407	0.0002	0.042	33	0.00068	0.00002	0.00007
Bldg. 9404-13 (SW of Bldg. 9201-4)	15JUL86-18APR89	149	0.465	0.028	0.137	34	0.00084	0.00002	0.00018
Bldg. 9805-1 (SE of Bldg. 9201-4)	23SEP86-18APR89	134	0.384	0.017	0.094	33	0.00039	0.00002	0.00011
New Hope Pond	19AUG87-18APR89	87	0.412	0.002	0.032	22	0.00082	0.00001	0.00024
Rain Gage No. 2 (Chestnut Ridge)	9FEB88-13APR89	62	0.016	0.001	0.006	15	0.00007	<0.00001	0.00003

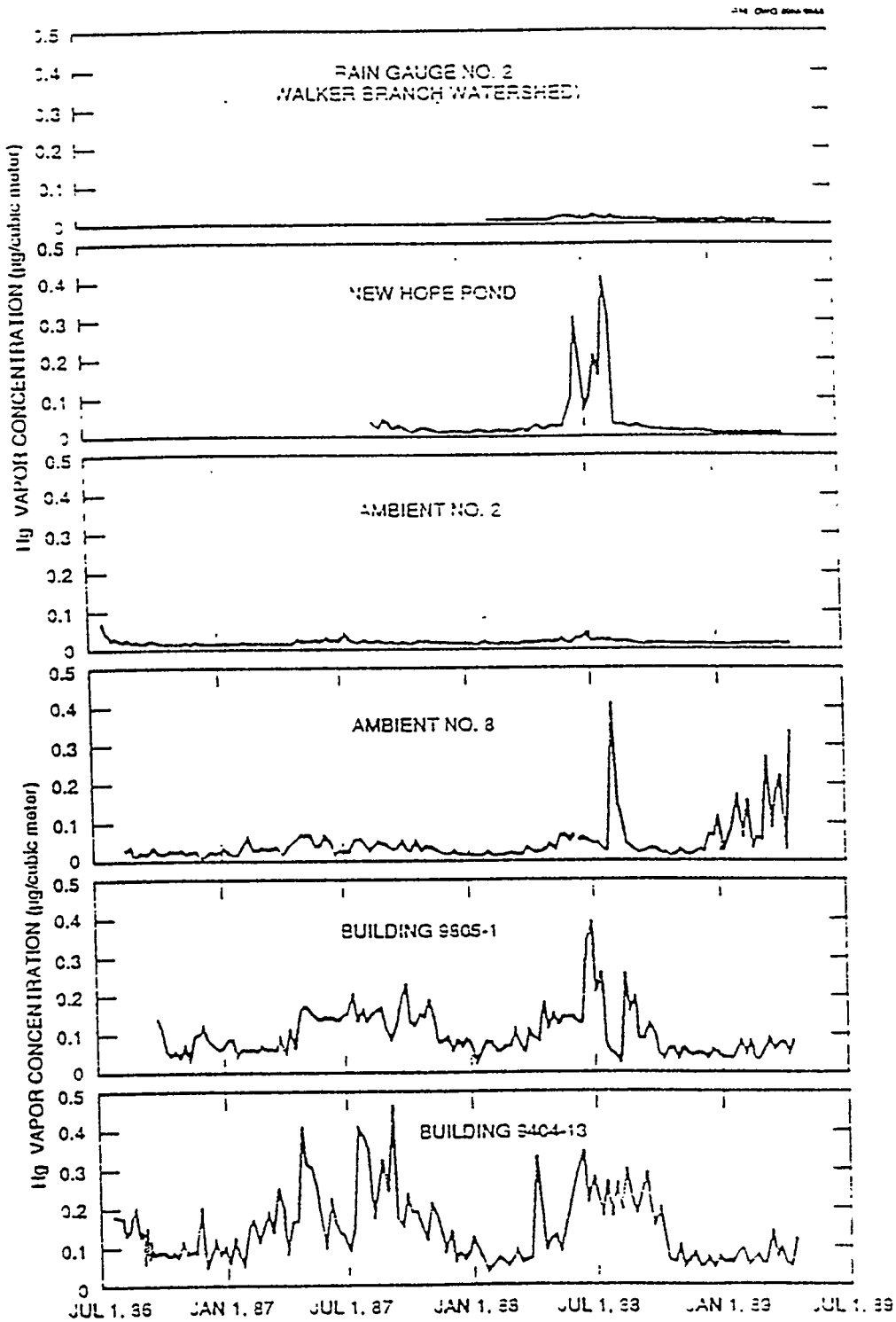


Figure 6.23 Time trends in mercury vapor concentrations for five monitoring sites at the Oak Ridge Y-12 Plant and Rain Gauge No. 2 at Walker Branch Watershed.

(28 CFR, No. 66, Part II) for mercury in ambient air of 1 $\mu g/m^3$ (30-d average) and the OSHA industrial hygiene standard of 50 $\mu g/m^3$. The monitoring sites located southeast and southwest of Building 9201-4 have usually shown the highest concentrations of vapor mercury among the five sites located in or on the perimeter of the Y-12 Plant though there are notable exceptions. As would be expected, the lowest concentrations of vapor mercury were measured for the control site (Rain Gage No. 2) located on Chestnut Ridge in the Walker Branch watershed. Concentrations of particulate mercury have consistently been less than 0.001 $\mu g/m^3$ at all sites.

Mercury concentrations in air at the Building 9404-13 and 9805-1 sites exhibited the highest average concentrations (0.137 and 0.094 $\mu g/m^3$) among all sites. Concentrations were typically higher during spring and summer than during the cooler periods. These monitoring sites are located, respectively, southwest and northeast of Building 9201-4, the former lithium isotope separation facility that still contains mercury-contaminated process equipment. The sites represent the nearest outdoor monitoring points for any fugitive emissions from Building 9201-4. They were deliberately located east and west of this building to be within the "plume" of this building whenever the wind was blowing up or down valley, which are the most common wind directions. Due to the very complex artificial terrain (buildings) in the Y-12 Plant area, it is not clear whether these monitoring points actually intercept the "plume" from Building 9201-4. The situation is further complicated by the fact that the Y-12 Steam Plant is located immediately south of Building 9201-4 and emits approximately 70 kilograms/year of mercury vapor through stacks which are only 100 feet tall. Fugitive and stack emissions from the Steam Plant may account for the elevated mercury concentrations in ambient air at the monitoring points at Buildings 9404-13 and 9805-1. Furthermore, beginning in 1986, efforts were begun to reduce or eliminate fugitive mercury emissions from Building 9201-4. These efforts included altered operations and removal of the ventilating fans. For much of the period of outdoor monitoring for mercury, no ventilating fans have been operated and the building has experienced relatively little air exchange.

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ref for 9201-4 indoor air from Y/TS-574

6.5.3 Indoor Air Monitoring

Indoor mercury vapor monitoring at the Y-12 Plant began in 1950 with the first use of mercury at the Plant. Indoor air monitoring in the large lithium isotope separation buildings (9201-4 and 9201-5) began in 1953 when these facilities first began operations and has continued until the present. Extensive results through about 1970 are summarized in Wilcox (1983). Currently, only Building 9201-4 is monitored regularly. The current monitoring program in 9201-4 consists of weekday monitoring of 20 zones (3 monitoring locations per zone) in the building with a Jerome Model 411 Gold Film Vapor Monitor. These data are entered into a large database called ADMIS, Alpha-4 Decommissioning Management Information System. ADMIS contains data covering the period from October 1, 1986 to the present.

6.5.3.1 Results

Monthly summary statistics for the air monitoring program in Building 9201-4 are given in Table 6.13 for the period July 1, 1988, through June 30, 1989. Average monthly vapor Hg concentrations in air for the building ranged from a low of 6.8 $\mu g/m^3$ to a high of 20.2 $\mu g/m^3$ for this period. Vapor mercury concentrations exhibited a seasonal trend (see Figure 6.24), with the highest average concentrations calculated for the warm weather months when the average building air temperature was also the highest. Average building air temperature and average vapor Hg concentration are positively correlated ($R^2 = 0.79$). Even though concentrations of vapor Hg in air do exceed OSHA respirator levels (50 $\mu g/m^3$) on occasion, the building, as discussed above, has been effectively sealed and access is strictly controlled. The building and its contents do remain, however, a potential source of vapor Hg to ambient air. Many steps have already been taken to reduce emissions of mercury from this facility. Some of these efforts have been related to simple housekeeping activities, such as picking up any visible mercury and general cleaning. One major effort was directed at the removal of all combustible material from the building to avert the possibility of fire which would result in a very large atmospheric release of mercury vapor. This project was completed in 1989.

Table 6.13 Monthly summary statistics for Hg air monitoring in Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

MONTH	N	Hg Concentration (μg/cubic meter) Maximum	Minimum	Mean	Temperature (°Celsius) Maximum	Minimum	Mean
JUL88	1140	163.0	0.0	20.2	32.2	21.1	27.4
AUG88	1380	150.0	0.0	18.8	33.3	21.7	28.0
SEP88	1260	89.0	0.0	10.6	31.1	20.0	24.6
OCT88	1260	63.0	0.0	8.0	26.1	11.7	18.8
NOV88	1200	119.9	0.0	6.8	25.6	9.4	17.9
DEC88	1200	134.0	0.0	11.6	26.7	6.7	18.9
JAN89	1320	71.9	0.0	7.2	27.8	3.9	16.8
FEB89	1080	96.0	0.0	9.2	28.9	4.4	20.4
MAR89	1320	75.0	0.0	7.8	28.3	10.0	20.4
APR89	1200	156.0	0.0	8.2	28.3	11.7	20.4
MAY89	1260	172.0	0.0	9.7	26.7	12.2	20.0
JUN89	780	172.9	0.0	15.4	29.4	16.1	23.3

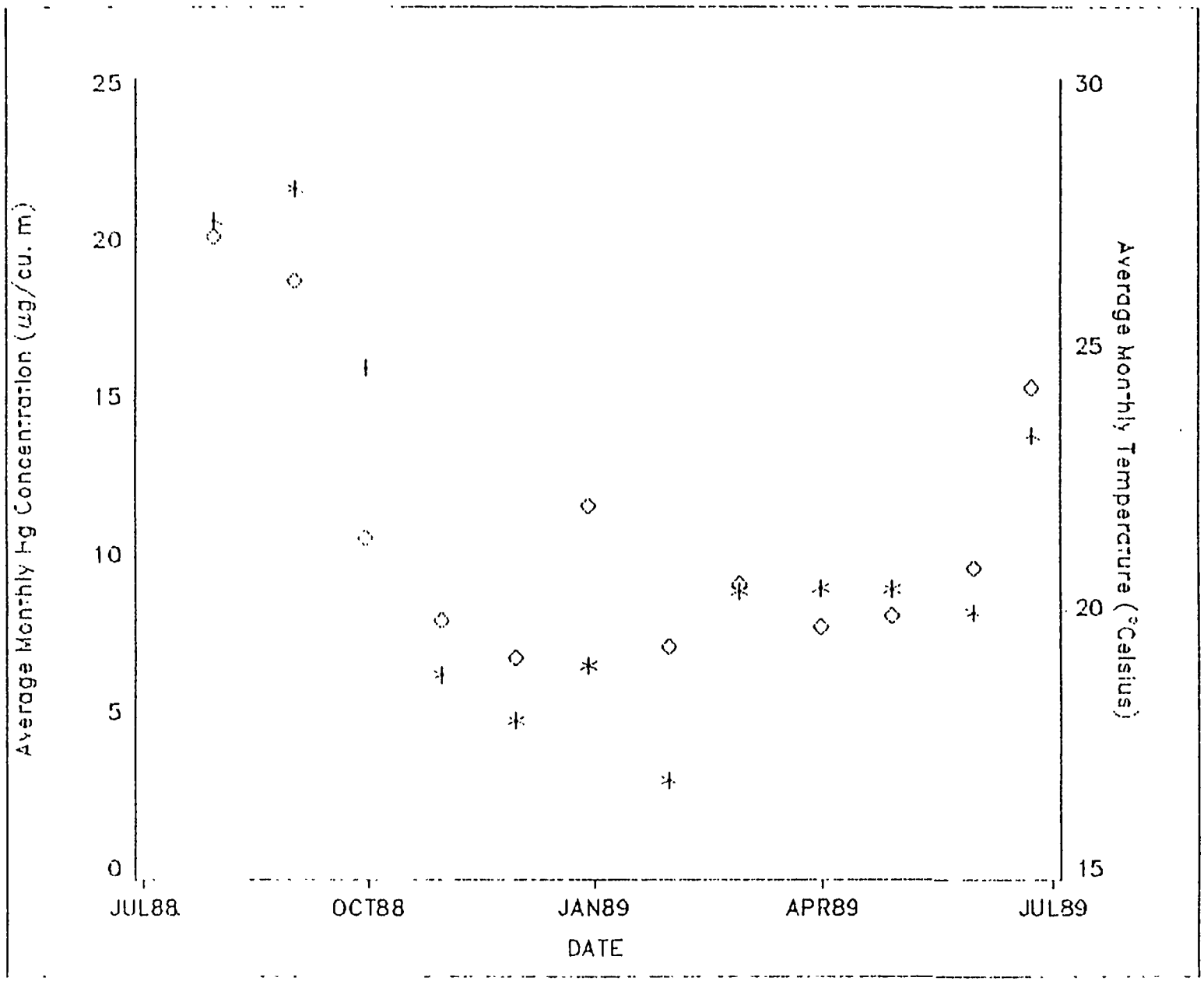

Figure 6.24 Time trends in average monthly mercury vapor concentration in Building 9201-4 (diamond - mer y in $\mu g/m^3$; star - temperature in °C).

Monthly summary statistics (July 1, 1988 through June 30, 1989) for each of the 20 monitoring zones within Building 9201-4 are presented in Appendix H.

6.5.4 Conclusions and Recommendations

The available data for mercury in ambient air at the Y-12 Plant suggests that the environment and human health are being protected from releases of mercury to the atmosphere. The highest observed concentrations (7-d average) at any monitored site have been <50% of the NESHAP criterion (1.0 $\mu g/m^3$) and <1% of the industrial hygiene standard of 50 $\mu g/m^3$. The data do show that ambient air mercury concentrations in the Y-12 Plant area are elevated above natural background and may reach greatly elevated concentrations for short periods in very localized areas. As illustrated by the indoor monitoring data for Building 9201-4, mercury concentrations in poorly ventilated areas with residual mercury-contaminated equipment can exceed levels requiring the use of respirators. Within Building 9201-4, these areas are well known, intensively monitored, and access-controlled to protect workers. The present outdoor (ambient) monitoring program is inadequate to pinpoint areas within the Plant where mercury concentrations are likely to be greatly elevated or to determine the magnitude and duration of these excursions. Additional monitoring sites operated on a weekly integration period would not improve this situation. Rather, a program aimed at obtaining 8-h samples at a large number of sites during hot weather would more likely pinpoint sources and yield better estimates of the magnitude and duration of excursions. If available, the use of a real time monitor with sufficient sensitivity to quantitate sub-microgram per cubic meter concentrations of mercury vapor would provide an even better evaluation of sources, magnitudes, and durations. At the present time, no such instrument is commercially available. Passive (no air pump) mercury vapor monitors intended for personnel monitoring are available and similar passive monitors for ambient air monitoring are under development by the private sector.

Based on this evaluation of the ambient air data for mercury the following recommendations are offered:

(1) The Y-12 Plant should adopt the ALARA approach with regard to mercury vapor in ambient air. Results from the existing monitoring program and from the special investigations suggested below, should be used to identify and reduce sources of atmospheric releases of mercury vapor. Although the existing data suggest that human health is being protected, the same sources of mercury that contribute to elevated ambient air levels may also contribute to soil and surface water contamination. Identifying and cleaning up these sources would be environmentally beneficial.

(2) The existing monitoring system (5 sites within the Y-12 Plant) should be expanded slightly to include one or two additional monitors along the base of Pine Ridge. (North of Bear Creek Road). Although wind direction is typically up or down valley, the nearest dense population center is northwest of the Y-12 Plant across Pine Ridge (i.e., Gamble Valley/Scarboro Community).

(3) Several comprehensive synoptic surveys of mercury in ambient air over 8-hour time intervals during hot weather should be conducted. These surveys should entail a sufficient number of air sampling points to permit identification of "hot spots" within the Plant. Perhaps 20 to 50 sites could be reasonably operated simultaneously for this kind of survey. The sites should initially be concentrated around buildings/areas associated with historic mercury use. A combination of 110V and battery-operated air pumps used to pull air through charcoal tubes represents one approach to this kind of survey.

(4) The use of passive mercury vapor monitors should be investigated as a simple means to identify mercury sources within the Y-12 Plant. The monitors require no air pump and can be hung nearly anywhere for days to weeks. Such passive monitors are already available for personnel monitoring and are under development for ambient air monitoring.

(5) Collection and analyses of samples for particulate mercury in ambient air at the Y-12 Plant have revealed only very low to undetectable particulate mercury. These analyses, which cost about $5000/year, should be discontinued but the air filters should continue to be used (changed monthly) (a) to provide samples in the event analysis seems warranted due to unusually dusty conditions, and (b) to protect the critical flow orifice from clogging.

MARTIN MARIETTA

MARTIN MARIETTA ENERGY SYSTEMS, INC.

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If you have any questions, please contact L. L. McCauley at (423) 574-7593 or S. W. Wiley at (423) 576-0263.

Very truly yours,

For R. M. Keyser, Director
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OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM

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Author(s) A. B. Perkins

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7. SAMPLING PLANS

7.1 SURFACE WATER

7.1.1 OBJECTIVES

Objectives of the surface water sampling program are to evaluate contaminant movement via the surface water pathway and to quantify the volumetric flow. The surface water pathway is judged to be the most significant route by which mercury and other contaminants released from the Mercury-Use Areas may reach human populations. The relative contributions of the various buildings and facilities to the mercury and other contaminant loading of Upper East Fork Poplar Creek has not been evaluated in detail since completion of the "Reduction of Mercury in Plant Effluents Project" (1988). Thus, the RFI can also serve to evaluate the effectiveness of an earlier corrective measure. However, the main thrust of the surface water plan will be to identify specific sources of mercury and other contaminants, ie., to trace elevated mercury concentrations to their source.

7.1.2 TECHNICAL APPROACH

A phased sampling approach will be employed to characterize the nature and extent of hydrologically dependent contaminant transport. This approach will enable modifications to the sampling program (e.g., addition or relocation of monitoring station locations) during subsequent sampling efforts, if previous data indicate such a need.

Many pipes of varying diameters that originate or pass through the Mercury-Use Areas discharge water into Upper East Fork Poplar Creek. Previous experience with pipe sampling at the Y-12 Plant has shown that not all pipes can be accessed for sampling and that only a few can be sampled on any given day. In Phase I of the surface water sampling plan, each pipe which originates or passes through a Mercury-Use Area will be sampled (grab-type) at the point of discharge into Upper East Fork Poplar Creek on at least four occasions representing dry weather flow (no rainfall prior 3 days) and on four occasions representing wet weather flow (significant runoff-producing rainfall prior 24 hours). Instantaneous

discharge will be measured simultaneously. As this activity is expected to overlap with the RFI to be conducted for Upper East Fork Poplar Creek (Travis et al. 1989), the timing of sampling will be closely coordinated whenever possible to minimize duplication of effort.

Phase II sampling will consist of progressive upstream sampling of each major trunkline which exhibited significant mercury loading (>1 g/d) in Phase I. At each accessible confluence with tributary pipes each tributary pipe will be sampled and its flow measured under dry-weather flow conditions. Relatively stable flow conditions are necessary for this kind of source tracing to be effective and thus no wet-weather sampling is planned for Phase II. This sampling scheme will be repeated at approximately one- to two-week intervals for each trunkline four times. More frequent sampling cannot be conducted because of practical limitations on the number (maximum of 10 to 15 per sampling team) of storm sewers which can be entered within a workday.

7.1.2.1 Monitoring Station Locations

Figures 7.1 and 7.2 display proposed Phase I sampling station locations. Characteristics of trunkline sites are summarized in Table 7.1. Some locations are approximate and may have to be shifted slightly if access to any trunkline is limited. Phase II locations will be determined by the results of the Phase I sampling. In most cases Phase II sampling will include as many of the upstream tributaries as can be accessed and which exhibit flow at the time of access.

7.1.2.2 Sampling and Analysis Plan

Phase I Sampling

During Phase I, a total of eight sets of flow measurements and water quality samples (grab-type) will be taken at 20 trunkline locations (Table 7.1) during four wet-weather and four dry-weather flow periods. The water quality samples will be analyzed for the parameters listed in Table 7.2.

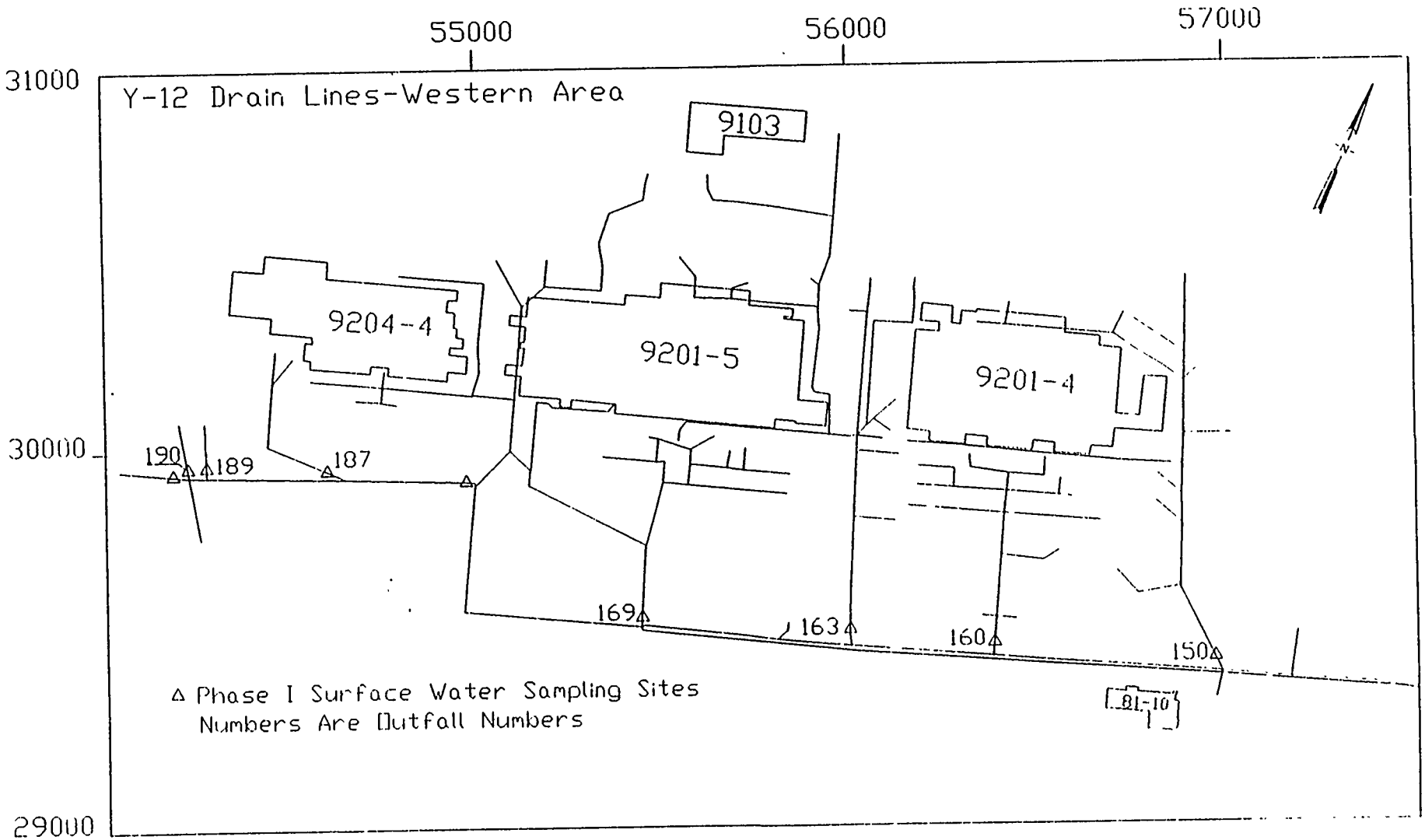

Figure 7.1 Proposed Phase I surface water sampling sites (western area).

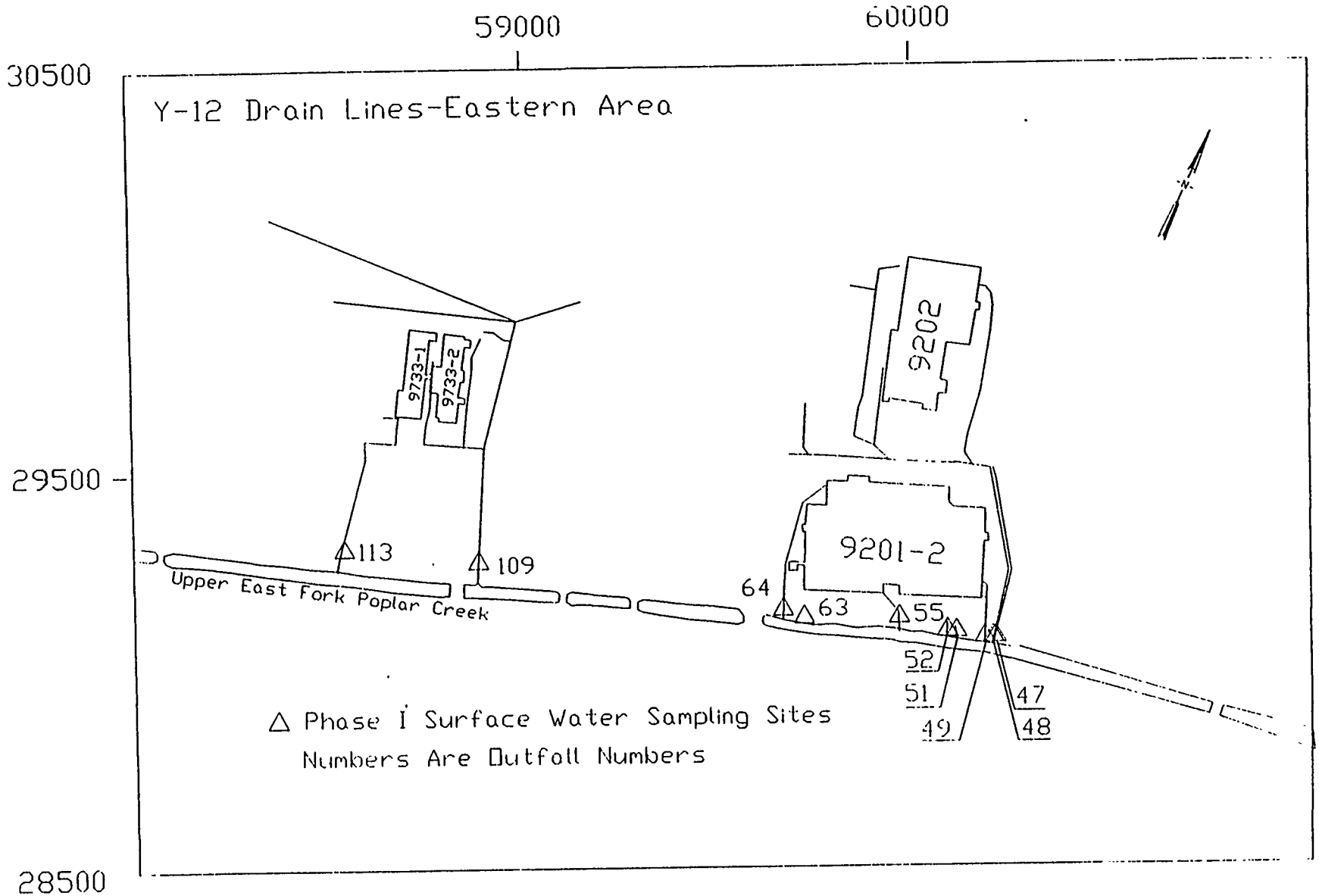

Figure 7.2 Proposed Phase I surface water sampling sites (eastern area).

Table 7.1. Characteristics of trunkline sampling sites.

Outfall No.	Diameter (in.)	Type*	Flow (gpm)	Area/Building Served	Outfall Category	UEFPC RFI Site
47	24	RCP	140	9202	-	No
48	24	RCP	50	9202,9201-2	-	No
49	15	VC	100	9201-2	-	No
51	15	RCP	40	9201-2	-	No
52	10	ST	0	9201-2	-	Yes
55	14	CI	100	9201-2	-	No
63	12	TC	5	9201-2	-	No
64	12	RCP	0	9201-2	-	Yes
109	48	RCP	334	9733-1/2	-	No
113	18	RCP	20	9733-1/2	-	No
150	48	RCP	458	E9201-4	III	No
160	36	RCP	100	C9201-4	III	No
163	36	RCP	50	W9201-4	-	No
169	48	RCP	207	SE9720-5	III	Yes
-	72	RCP	?	SE9720-5	-	No
-	72	RCP	?	NW9720-5	-	No
187	36	RCP	15	W9204-4	-	Yes
189	60	RCP	100	W9204-4	-	Yes
190	36	RCP	0	W9204-4	-	Yes
-	36	RCP	?	NE9720-33	-	No

* CI Cast Iron Pipe
RCP Reinforced Concrete Pipe
ST Steel Pipe
TC Terra-cotta Tile
VC Vitrified Clay Pipe

Table 7.2. Proposed analytical parameters for surface water samples during RFI in Mercury-Use Areas - Phase I

	Analytical method[a]	Reporting detection limit[b]
Inorganic Metals (Total and Dissolved)		
Arsenic	7060[c]	0.005 mg/L
Lead	7421[c]	0.005 mg/L
Mercury	7470[d]	0.002 mg/L
Selenium	7740[c]	0.005 mg/L
ICP Metals Sweep (Total and Dissolved)	6010	
Aluminum		0.2 mg/L[e]
Barium		0.200 mg/L[e]
Beryllium		0.005 mg/L[e]
Cadmium		0.005 mg/L[e]
Calcium		5.0 mg/L[e]
Chromium		0.010 mg/L[e]
Cobalt		0.050 mg/L[e]
Copper		0.025 mg/L[e]
Iron		0.100 mg/L[e]
Lead		0.005 mg/L[e]
Magnesium		5.0 mg/L[e]
Manganese		0.015 mg/L[e]
Nickel		0.040 mg/L[e]
Niobium		0.01 mg/L[e]
Phosphorus		0.5 mg/L[e]
Potassium		5.0 mg/L[e]
Silver		0.010 mg/L[e]
Sodium		5.0 mg/L[e]
Vanadium		0.050 mg/L[e]
Zinc		0.020 mg/L[e]
Other Inorganics		
Chloride	325.3[f] or 300	1.0 mg/L
Fluoride	340.1[f] or 300	1.0 mg/L
Nitrate	352.1[f] or 300	1.0 mg/L
Sulfate	375.4[f] or 300	1.0 mg/L

Table 7.2 (continued)

	Analytical method[a]	Reporting detection limit[b]
Volatile Organics	624[g]	
Chloromethane		10 μg/L
Bromomethane		10 μg/L
Vinyl chloride		10 μg/L
Chlorethane		10 μg/L
Methylene chloride		5 μg/L
Acetone		10 μg/L
Carbon disulfide		5 μg/L
1,1-Dichloroethene		5 μg/L
1,1-Dichloroethane		5 μg/L
Trans-1,2-dichloroethene		5 μg/L
Chloroform		5 μg/L
1,2-Dichloroethane		5 μg/L
2-Butanone		10 μg/L
1,1,1-Trichloroethane		5 μg/L
Carbon tetrachloride		5 μg/L
Vinyl acetate		10 μg/L
Bromodichloromethane		5 μg/L
1,1,2,2-Tetrachloroethane		5 μg/L
1,2-Dichloropropane		5 μg/L
Trans-1,2-dichloropropene		5 μg/L
Trichloroethene		5 μg/L
Dibromochloromethane		5 μg/L
1,1,2-Trichloroethane		5 μg/L
Benzene		5 μg/L
Cis-1,2-dichloropropene		5 μg/L
2-Chloroethyl vinyl ether		10 μg/L
Bromoform		5 μg/L
2-Hexanone		10 μg/L
4-Methyl-2-pentanone		10 μg/L
Tetrachloroethene		5 μg/L
Toluene		5 μg/L
Chlorobenzene		5 μg/L
Ethyl benzene		5 μg/L
Styrene		5 μg/L
Total Xylenes		5 μg/L
Total Phenolics	420.1[f]	5 μg/L

Table 7.2 (continued)

	Analytical method[a]	Reporting detection limit[b]
Other Organics		
Total Organic Carbon	415.1[f]	1.0 mg/L
Total Organic Halogen	9020	5.0 μg/L
Dissolved Organic Carbon	415.1[f]	1.0 mg/L
Radiologicals		
Gross alpha	900.0[h]	1.0 pCi/L
Gross beta	900.0[h]	4.0 pCi/L
Radium	903.0[h]	1.0 pCi/L
Total Uranium	EC-1940[i]	1 μg/L
Isotopic (% U-235)	EC-1940[i]	0.001 wt/%
Gamma spectrometry	EC-370[i]	All Values Reported
Polychlorinated Biphenyls	EC-162	5 μg/L
Miscellaneous		
pH	150.1[g]	NA[j]
Specific Conductance	120.1[g]	NA
Total Suspended Solids	160.2	4.0 mg/L
Total Dissolved Solids	160.1	10.0 mg/L
Alkalinity	310.1[g]	

[a]Reference number from Test Methods for Evaluating Solid Waste, III Edition (USEPA 1986b) unless noted otherwise.

[b]Specific detection limits are highly matrix dependent; the detection limits provided herein are provided for guidance and may not always be achievable.

[c]Analysis conducted by graphite furnace technique atomic absorption.

[d]Analysis conducted by manual cold vapor technique.

[e]Minimum reporting limits under CLP program.

[f]Reference: Methods for Chemical Analysis of Water and Wastes (USEPA 1983a),

Table 7.2 (continued)

[g]Reference: Guidelines Establishing Test Procedures for the Anaysis of Pollutants under the Clean Water Act, 40 CFR Part 136, 1984.

[h]Prescribed Procedures for Measurement of Radioactivity in Drinking Water (USEPA 1980).

[i]Reference: Martin Marietta Energy Systems Environmental and Effluent Analysis Manual (MMES 1986).

[j]NA = Not applicable.

Phase II Sampling

Data collected from the Phase I locations will be evaluated to determine the need for upstream tracking of mercury and other pollutant sources. In general, if any Phase I sampling event yields a mercury loading in excess of 1 g/d or a mercury concentration in excess of 2.4 μg/L, Phase II sampling will be conducted on the trunkline(s) exhibiting the excess mercury loading or concentration. Trunkline concentrations of other pollutants in excess of established water quality criteria will also trigger Phase II sampling of the subject trunkline. Phase II will also entail instantaneous discharge measurement and water quality sampling. Each line will be sampled four times at one week intervals, with an effort being made to sample each of the tributaries at different times of the week or hours of the day. Phase II chemical analyses will include only those constituents identified in Phase I as exceeding water quality criteria.

7.1.2.3 Field Documentation

Field documentation will be in accordance with the RFI Plan-General Document, Volume II: Quality Assurance Project Plan (QAPP) (Wiggins 1988a) and with Method ESP-400 and Method ESP-500 of the Environmental Surveillance Procedures Quality Control Program (QC Manual, Kimbrough et al. 1988).

7.1.2.4 Sample Collection Methodology

Sample collection methodology (grab-type) will be in accordance with the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a) and with methods detailed in the ESP-301 Series of the QC Manual (Kimbrough et al. 1988).

7.1.2.5 Data Analysis

Data collected during the first sampling phase will be reviewed for values of instantaneous mercury loading (discharge multiplied by concentration) in excess of 1 g/d and concentrations of other pollutants in excess of established water quality criteria. Additional data review

will entail comparison of analytical results for mercury with the chronic (0.012 μg/L) and acute (2.4 μg/L) aquatic life criteria. As most samples are likely to exceed the chronic criterion, only the acute criterion will be used to trigger Phase II sampling. Thus, mercury loading in excess of 1 g/d or mercury concentration in excess of 2.4 μg/L will trigger Phase II sampling.

7.1.2.6 Sample Preservation and Handling

Sample containers, preservation methods, and holding times required for each type of chemical analysis are discussed in the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a) and in Method ESP-701 of the QC Manual (Kimbrough et al. 1988).

7.1.2.7 Chain-of-Custody Procedures

Chain-of-custody procedures are discussed in the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a) and in Method ESP-500 of the QC Manual (Kimbrough et al. 1988).

7.1.2.8 Quality Assurance/Quality Control

Quality assurance/quality control procedures are described in the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a), the QC Manual (Kimbrough et al. 1988) and in Section 10.0 of this RFI Plan.

7.1.2.9 Sampling Equipment Decontamination Procedures

Decontamination procedures are described in the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a) and in Method ESP-901 of the QC Manual (Kimbrough et al. 1988).

7.1.2.10 Analytical Procedures

The data quality objective for water samples from the Mercury-Use Areas requires Level III analytical levels, ie., routine analytical services using EPA-approved procedures.Analytical procedures will be in accordance with those provided in Methods for Chemical Analysis of Water and Wastes (USEPA 1983), Guidelines Establishing Test Procedures for the

Analysis of Pollutants, 40 CFR Part 136, and Martin Marietta Energy Systems Environmental and Effluent Analysis Manual (MMES 1986). A listing of the methods and detection limits to be used for water samples is provided in Table 7.2.

7.2 SOIL SAMPLING PLAN

7.2.1 OBJECTIVES

The objectives of the Mercury-Use Areas soil sampling program are: (1) to confirm existing data on mercury levels in soils of the Mercury-Use Areas; (2) to define the spatial and depth distribution of mercury at sites with surface concentrations in excess of 100 $\mu g/g$; (3) to confirm existing data on isotopic uranium and other radionuclides in surface soils of the Mercury-Use Areas; (4) to determine whether other inorganic and organic contaminants occur in soils of the Mercury-Use Areas.

7.2.2 TECHNICAL APPROACH

Characterization of contaminants in Mercury-Use Area soils will employ a phased approach. For Phase I, a biased, or selective, design will serve to confirm, or refute, previous data on soil contamination. Results of the earlier comprehensive survey and field measurements of mercury vapor concentrations in soil gas will be used to guide selection of soil sampling locations. In Phase I, sites that exhibited the highest concentrations of mercury (>100 $\mu g/g$) will be surveyed for mercury in soil gas and then resampled for laboratory analysis for mercury and other contaminants. If the high concentrations of mercury in surface soils reported earlier are confirmed, Phase II sampling will be undertaken to define the full areal and depth distribution of contamination. As a part of Phase I, three sites identified earlier as SWMUs (Wiggins 1988b, Wiggins 1988c, Murphy 1988) will be surveyed for soil contamination with elemental mercury using a portable vapor analyzer. These sites are (1) the south side of 81-10, (3) Tank 2104-4 (SWMU S-212) located south of Building 9201-5, and (3) Tank 2101-U (SWMU S-210) located south of Building 9201-4. All soil samples collected in Phase I will also be subjected to metals analyses (ICP sweep) and radiological analyses for total uranium, total thorium, and gamma spectrometry. Approximately 10% of these samples will also be analyzed for the full suite of Appendix IX constituents.

For Phase II, a combination of grid sampling and biased sampling, the latter guided by soil gas analyses for mercury vapor, will be employed to select soil sampling locations and depths. Depending on results of the comprehensive chemical analyses (Appendix IX), Phase II may entail sampling to define the areal and depth distribution of other hazardous constituents.

7.2.2.1 Sampling Locations

In Phase I, the soil sampling sites will correspond with the 35 sites which previously exhibited mercury concentrations in excess of the proposed Y-12 Plant Action Level (100 $\mu g/g$), plus additional sites associated with SWMUs S-210, S-212 and S-117. Figure 6.10 (Section 6.3.1.5) displays these locations. Plant grid coordinates for these locations are given in Table 7.3 and will be used to relocate the previous sampling sites. Phase II sampling locations will correspond with some or all of the sites shown in Figure 6.10 depending on whether the previous high mercury concentrations in surface soil are confirmed. Soil vapor analyses, if demonstrated to be reliable in Phase I, will guide the exact location of Phase II sampling. Vapor analyses will be performed on a radial grid pattern to define the apparent areal limits of surface contamination. Once areal limits are established, sites for soil boring to define the depth limits of contamination will be selected randomly within each mercury vapor "halo".

7.2.2.2 Sampling and Analysis Plan

Soil sampling in both Phase I and Phase II will entail soil borings at each location to define the depth limits of contamination. Soil borings will be advanced until sample headspace mercury vapor is undetectable using the Jerome Model 411 Gold Film Monitor, or until a depth of 25 cm is reached. All soil samples will be analyzed for the contaminants shown in Table 7.4. In addition, 10% of all soil samples will be selected randomly for analysis of Appendix IX (40 CFR Part 264) hazardous constituents.

Table 7.3 Plant grid coordinates of the proposed soil sampling sites.

SITE	NORTHING	EASTING	HG
1	29578	51433	102
2	30250	53650	103
3	30140	54391	106
4	29390	57815	113
5	29470	56605	116
6	30580	53203	119
7	29250	58450	124
8	29040	63430	126
9	28880	63320	127
10	29500	51400	127
11	30350	56150	129
12	29915	52100	141
13	29160	61985	142
14	28900	60736	143
15	29720	51600	163
16	29050	63440	167
17	28750	61230	173
18	28930	63340	185
19	29260	58350	219
20	29550	51550	237
21	30245	53785	243
22	28700	61350	254
23	29560	51527	257
24	30303	56197	259
25	29350	56950	260
26	29600	52740	290
27	29950	56150	317
28	29670	60960	340
29	30260	53852	347
30	30050	55695	391
31	29570	63600	424
32	30650	53460	777
33	29333	57633	1700
34	30250	54530	1900
35	30348	53818	7700

Table 7.4 Proposed analytical parameters for soil samples during RFI at Y-12 Plant Mercury-Use Areas - Phase I.

	Analytical method[a]	Reporting detection limit[b]
% Moisture	-	-
Inorganic Metals		
Arsenic	3050 (prep), 7060 (analysis)	0.5 mg/kg
Lead	7421	0.5 mg/kg
Mercury	7471	0.2 mg/kg
Selenium	3050 (prep), 7740 (analysis)	0.1 mg/kg
ICP Metals Sweep	6010	
Aluminum		12 mg/kg
Barium		10 mg/kg
Beryllium		1 mg/kg
Cadmium		3 mg/kg
Calcium		100 mg/kg
Chromium		10 mg/kg
Cobalt		2 mg/kg
Copper		2 mg/kg
Iron		100 mg/kg
Lead		20 mg/kg
Magnesium		50 mg/kg
Manganese		2 mg/kg
Nickel		10 mg/kg
Niobium		10 mg/kg
Phosphorus		50 mg/kg
Potassium		500 mg/kg
Silver		4 mg/kg
Sodium		50 mg/kg
Vanadium		5 mg/kg
Zinc		2 mg/kg
Radiologicals		
Gross alpha	EC-101[c]	All values reported
Gross beta	EC-101[c]	All values reported
Total thorium	EC-360[c]	3.0 mg/kg
Total uranium	EC-370[c]	0.2 mg/kg
Gamma spectrometry	EC-134[c]	All values reported

Table 7.4 (cont.)

	Analytical method[a]	Reporting detection limit[b]
Polychlorinated Biphenyl	EC-340[c]	0.1 μg/g
Acid Base-Neutral Extractable Organics	8270	
N-nitrosodimethylamine		330 μg/kg
Phenol		330 μg/kg
Aniline		330 μg/kg
Bis(2-chloroethyl) ether		330 μg/kg
2-Chlorophenol		330 μg/kg
1,3-Dichlorobenzene		330 μg/kg
1,4-Dichlorobenzene		330 μg/kg
Benzyl alcohol		330 μg/kg
1,2-Dichlorobenzene		330 μg/kg
2-Methylphenol		330 μg/kg
Bis(2-chloroisopropyl)ether		330 μg/kg
4-Methylphenol		330 μg/kg
N-nitroso-dipropylamine		330 μg/kg
Hexachloroethane		330 μg/kg
Nitrobenzene		330 μg/kg
Isophorone		330 μg/kg
2-Nitrophenol		330 μg/kg
2,4-Dimethylphenol		330 μg/kg
Benzoic acid		1600 μg/kg
Bis(2-chloroethoxy) methane		330 μg/kg
2,4-Dichlorophenol		330 μg/kg
1,2-4-Trichlorobenzene		330 μg/kg
Naphthalene		330 μg/kg
4-Chloroaniline		330 μg/kg
Hexachlorobutadiene		330 μg/kg
4-Chloro-e-methylphenol (para-chloro-meta-cresol)		330 μg/kg
2-Methylnaphthalene		330 μg/kg
Hexachlorocyclopentadiene		330 μg/kg
2,4,6-Trichlorophenol		330 μg/kg
2,4,5-Trichlorophenol		1600 μg/kg
2-Chloronaphthalene		330 μg/kg
2-Nitroaniline		1600 μg/kg
Dimethyl phthalate		330 μg/kg
Acenaphthylene		1600 μg/kg
3-Nitroaniline		330 μg/kg
Acenaphthene		330 μg/kg

Table 7.4 (cont.)

	Analytical method[a]	Reporting detection limit[b]
Acid Base-Neutral Extractable Organics (Continued)		
2,4-Dinitrophenol		1600 µg/kg
4-Nitrophenol		330 µg/kg
Dibenzofuran		330 µg/kg
2,4-Dinitrotoluene		330 µg/kg
2,6-Dinitrotoluene		330 µg/kg
Diethylphthalate		330 µg/kg
4-Chlorophenyl phenyl ether		330 µg/kg
Fluorene		330 µg/kg
4-Nitroaniline		1600 µg/kg
4,6-Dinitro-2-methylphenol		1600 µg/kg
N-Nitrosodiphenylamine		330 µg/kg
4-Bromophenyl phenyl ether		330 µg/kg
Hexachlorobenzene		330 µg/kg
Pentachlorophenol		1600 µg/kg
Phenanthrene		330 µg/kg
Anthracene		330 µg/kg
Di-n-butylphthalate		330 µg/kg
Fluroanthene		1600 µg/kg
Benzidine		330 µg/kg
Pyrene		330 µg/kg
Butyl benzyl phthalate		330 µg/kg
3,3'-Dichlorobenzidine		660 µg/kg
Benzo (a) anthracene		330 µg/kg
Bis(2-ethylhexyl)phthalate		330 µg/kg
Chrysene		330 µg/kg
Di-n-octyl phthalate		330 µg/kg
Benzo (b) fluoranthene		330 µg/kg
Benzo (k) fluroanthene		330 µg/kg
Benzo (a) pyrene		330 µg/kg

[a]Reference number from Test Methods for Evaluating Solid Waste, III Edition (USEPA 1986b) unless noted otherwise.

[b]Specific detection limits are highly matrix dependent; the detection limits provided herein are provided for guidance and may not always be achievable.

[c]Reference: Martin Marietta Energy Systems Environmental and Effluent Analysis Manual (MMES 1986).

7.2.2.3 Field Documentation

Field documentation is described fully in the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a) and in Method ESP-400 and MethodESP-500 of the QC Manual (Kimbrough et al. 1988). Locations of all sampling points will be surveyed by measuring the distance and bearing to a nearby well-defined and mapped landmark. This information will be recorded in the field notebook. The exact location of earlier sampling points will be determined by relocating the site with a transit or EDM. In the case of contaminated areas which are possible candidates for remedial action, each soil boring location will be temporarily marked with a stake or flagging and then rigorously surveyed using a transit and steel tape or an electronic distance meter (EDM).

7.2.2.4 Sample Collection Methodology

General procedures of soil sampling are described fully in the ESP-303 Series of the Environmental Surveillance Procedures Quality Control Program (Kimbrough et al. 1988). Soil sampling will employ bucket augers or short push tubes advanced into the soil in 5-cm intervals. A "Little Beaver" hydraulic auger may be used for soil sampling. In the absence of visible mercury in samples or detectable mercury vapor in sample container headspace, soil borings will be terminated after 5 depth intervals per boring have been sampled.

7.2.2.5 Data Analysis

Data collected during Phase I will be reviewed for concentrations of mercury and other contaminants greater than proposed Y-12 Plant Action Levels or other health and environmental criteria given by regulatory agencies. Sample locations where mercury or other measured contaminants exceed these criteria will investigated further in Phase II to better define the areal and depth distribution of the contamination.

7.2.2.6 Sample Preservation and Handling

Procedures for sample preservation and handling are fully described in Method ESP-701 of the QC Manual (Kimbrough et al. 1988). Aliquots of

all soil samples collected for the RFI will be air-dried and archived in refrigerated storage for at least one year following completion of sampling.

7.2.2.7 Chain-of Custody Procedures

Procedures for chain-of-custody are fully described in Method ESP-500 of the QC Manual (Kimbrough et al. 1988).

7.2.2.8 Quality Assurance/Quality Control

Quality assurance/quality control procedures are fully described in the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a), the QC Manual (Kimbrough et al. 1988) and in Section 14.0 of this RFI Plan.

7.2.2.9 Sampling Equipment Decontamination Procedures

Sampling equipment decontamination procedures are fully described in Method 901 of the QC Manual (Kimbrough et al. 1988).

7.2.2.10 Analytical Procedures

The data quality objective for soil samples from the Mercury-Use Areas generally requires Level III analytical levels, ie., routine analytical services using EPA approved procedures. Field screening for the presence of mercury vapor entails Level I analytical levels with confirmation by Level III. Analytical procedures will be in accordance with those provided in Test Methods for Evaluating Solid Waste (USEPA 1986), Methods for Chemical Analysis of Waters and Wastes (USEPA 1983), Guidelines Establishing Test Procedures for the Analysis of Pollutants, 40 CFR Part 136, and Martin Marietta Energy Systems Environmental and Effluent Analysis Manual (MMES 1986). A listing of the methods and detection limits to be used for soil samples is provided in Table 7.4.

7.3 AIR MONITORING PLAN

7.3.1 OBJECTIVES

The objectives of the air monitoring plan are (1) to increase the number of locations used for mercury monitoring in ambient air to provide further assurance of the protection of the health of persons in the nearest community, and (2) to locate significant sources of airborne mercury within the Y-12 Plant.

7.3.2 TECHNICAL APPROACH

Routine ambient air monitoring for mercury will be expanded by adding two sampling stations along the northern perimeter of the Y-12 Plant. Existing air monitoring stations numbered 4 and 6 (see Welch 1989a, Figure 4.11) will be modified to accommodate mercury monitoring. The sites will be operated in accordance with procedures already established for the other five ambient mercury monitoring stations (see Turner et al. 1989).

Comprehensive synoptic air monitoring for mercury around suspected sources (buildings and spill sites) will be conducted during hot weather. The surveys will entail short-term (8-h sampling interval) monitoring at up to 20 locations simultaneously. Portable windsets will be used to measure wind speeds and direction during each sampling period. The purpose of these surveys will be to identify significant fugitive emissions of mercury in the Mercury-Use Areas which may also be contributing to surface water contamination.

7.3.2.1 Sampling Locations

Figure 7.3 shows existing and proposed locations for continuous monitoring of mercury in ambient air. The comprehensive short-term monitoring sites will be distributed initially in a radial pattern around suspected sources of fugitive mercury emissions (e.g. Building 9201-4). Spacings along each radius will be geometric, ie., monitoring sites will be closer together near suspected sources.

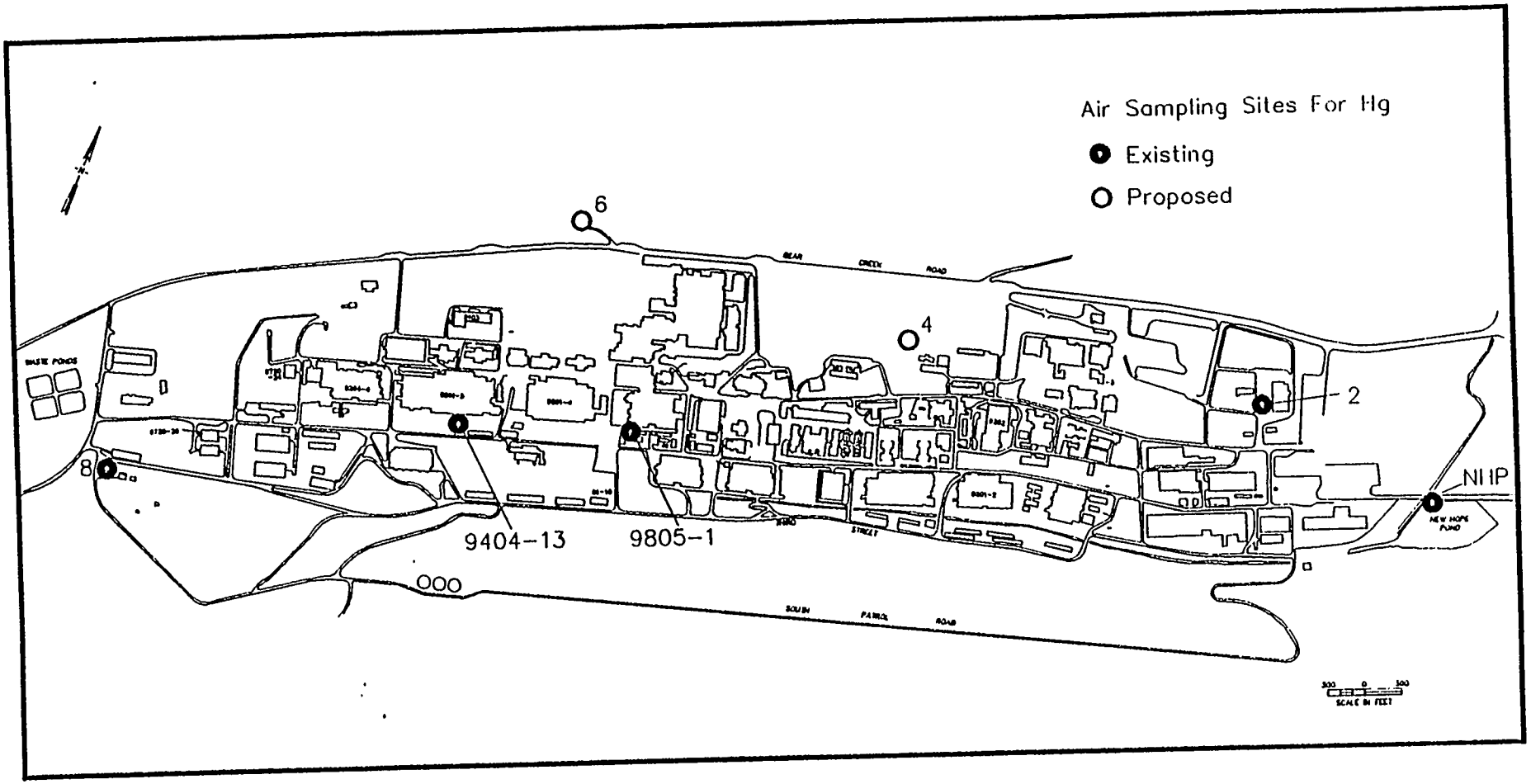

Figure 7.3 Existing and proposed locations for the monitoring of mercury in ambient air.

7.3.2.2 Sampling and Analysis Plan

Air sampling procedures for mercury at the proposed additional routine sites will correspond with those already in use under development at the existing sites (Turner and Bogle 1989). The synoptic surveys for mercury will employ techniques similar to those used to monitor worker exposure to mercury vapor over 8-h work shifts. These include use of battery-powered air pumps and mercury traps composed of iodated activated charcoal or gold. It is expected that at the higher summer temperatures when these surveys will be conducted, these sampling techniques will yield sufficient mercury for reliable analytical detection. An very sensitive technique of measuring mercury in air employing trapping of mercury on gold , thermal desorption and detection by atomic fluorescence spectrometry (Bloom and Fitzgerald 1988) is now available and will be applied in the synoptic surveys. If available and proven, passive mercury monitors (no air pump required) may be employed in the synoptic surveys instead of the active monitors.

7.3.2.3 Field Documentation

Field documentation is described fully in the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a) and in Method ESP-400 and Method ESP-500 of the QC Manual (Kimbrough et al. 1988). Locations of all sampling points during the synoptic surveys will be surveyed by measuring the distance and bearing to a nearby well-defined and mapped landmark. This information will be recorded in the field notebook.

7.3.2.4 Sample Collection Methodology

Collection of continuous ambient air samples for mercury analysis will be in accordance with procedures described in detail in Turner et al. (1989). Gold traps may be substituted for the charcoal traps and analyzed by thermal desorption with detection by atomic absorption or atomic fluorescence.

7.3.2.5 Data Analysis

Results of the additional routine monitoring for mercury in ambient air will be compared with the NESHAP criterion of 1 $\mu g/m^3$. Results of the

synoptic surveys will be evaluated in concert with the meteorological data from the windsets to estimate the mercury source strength and location.

7.3.2.6 Sample Preservation and Handling

Mercury air samples will be handled in accordance with procedures described in Turner et al. (1989).

7.3.2.7 Chain-of Custody Procedures

Procedures for chain-of-custody are fully described in Method ESP-500 of the QC Manual (Kimbrough et al. 1988).

7.3.2.8 Quality Assurance/Quality Control

Quality assurance/quality control procedures are fully described in the RFI Plan-General Document, Volume II: QAPP (Wiggins 1988a), the QC Manual (Kimbrough et al. 1988) and in Section 10.0 of this RFI Plan.

7.3.2.9 Analytical Procedures

The data quality objective for air samples from the Mercury-Use Areas generally requires Level III analytical levels, ie., routine analytical services using EPA-approved procedures. Field screening for the presence of mercury vapor entails Level I analytical levels with confirmation by Level III. Analytical procedures will be in accordance with those provided in Turner et al. (1989) or Bloom and Fitzgerald (1988), as appropriate.

7.4 BIOTA MONITORING PLAN

No monitoring of biota is being proposed in the RFI Plan due to the industrialized nature of, and absence of suitable terrestrial habitat in, the Mercury-Use Areas, and because a biological monitoring program is already in progress in East Fork Poplar Creek (Loar et al. 1989), including in Upper East Fork Poplar Creek.

8. DATA MANAGEMENT PROCEDURES

Characterization of contaminant releases from a solid waste management unit may produce significant amounts of data, including sampling data and results of chemical, physical, and biological analyses. Data management procedures have been established to effectively process these data so that relevant data descriptions such as sample numbers, locations, methods, analytical results, etc. are accurately maintained and readily accessible. The RFI Plan-General Document, Volume III: Data Management Plan (Wiggins et al. 1988) establishes the procedures that will be used to evaluate the data generated during the RCRA Facility Investigations at the Y-12 Plant.

Foundations for a data management plan were developed in the RFI Plan-General Document, Volume II: Quality Assurance Project Plan (QAPP) (Wiggins 1988a), which will be implemented to document and track investigation data and results. Among the documents that are controlled in accordance with the QAPP are the RFI sampling and analysis plan, project and field logbooks, chain of custody records, audit and evaluation reports, analytical data, RFI sampling and analyses reports, RFI training records, and other miscellaneous information and documentation. Primary records will be maintained by the laboratories, drillers, field geologists, etc. Copies of the records will be available to the Y-12 Document Custodian for the permanent Y-12 project record.

Data reporting and review will be conducted according to quality assurance procedures discussed in the QAPP and the MMES Environmental Surveillance Procedures-Quality Control Program (Kimbrough et al. 1988). After being received, reviewed, and evaluated by the Environmental Management Department Assessment Group at the Y-12 Plant, all data will be reported to the RFI Project Manager, who will be responsible for the preparation of the RFI Report.

For statistical analysis, reported levels will be compared to typical levels found within the Oak Ridge Reservation. Comparisons of data will be made using statistical methods. An 80% confidence limit will be established initially; the limit can be further defined if necessary.

9. HEALTH AND SAFETY PROCEDURES

9.1 INTRODUCTION

Specific requirements and procedures to protect the health and safety of the investigating team, the Y-12 Plant personnel, and the general public during the RCRA Facility Investigation (RFI) of the Mercury-Use Areas are addressed in this section.

The RFI Plan - General Document, Volume I (Welch 1989a) describes the Health, Safety, Environmental, Security, Plant Protection, and Emergency Response organizations at the Y-12 Plant. These organizations provide support to the Y-12 Plant line organization to meet the requirements for health and safety during the RFIs. They provide 1) communications, response, and reporting for any plant emergency; 2) on-site medical facilities with medical surveillance, treatment, monitoring, and periodic physical examinations; 3) health physics and industrial hygiene surveillance; 4) hazard evaluation and control; 5) operational safety accident prevention and control; and 6) plant security and visitor control. A Site Health and Safety Officer (SHSO), who will be present during the on-site RFI activities, will be responsible for determining the level of protection required for sampling personnel. The SHSO also will be responsible for implementing the Health and Safety Plan onsite and for providing site-specific health and safety training.

The General Document also identifies the organizational responsibilities for health and safety at the Solid Waste Management Unit (SWMU) sites during RFIs. The document details the potential hazards that may be encountered, the methodology for establishing the work zones of each SWMU, the level of personal protection required, decontamination procedures, personnel exposure limits, monitoring requirements, and site emergency procedures.

9.2 KNOWN HAZARDS AND RISKS

9.2.1 Mercury-Use Areas

The Y-12 Plant is a large industrial complex with many chemical processing facilitiies and metal casting/machining/plating shops.

Potential hazards at the Plant include many hazardous compounds such as mercury, asbestos, uranium metal, beryllium oxide (BeO), PCBs, and a host of volatile and semivolatile organic compounds. However, these hazards have been minimized through use of specified handling procedures developed for each type of material.

9.2.2 Substance Summary List

The following list identifies hazardous contaminants found previously at elevated concentrations in Mercury-Use Area soils and sediment, surface water and air:

- Metals (especially Hg, Cd, Ag, Be, U, Th)
- Volatile Organic Compounds
- Semi-volatile Organic Compounds
- Radionuclides (chiefly isotopes of U and Th)
- Cyanide
- Fluoride
- Polychlorinated Biphenyls (PCBs)

9.3 LEVEL OF PROTECTION

The level of personnel protection required for RFI sampling activities in the Mercury-Use Areas will be dictated by the location and type of sampling to be conducted. The activities planned consist of soil sampling, air sampling, and surface water sampling. Sampling activities are not expected to penetrate waste deposits in any of the SWMUs but may penetrate historical deposits of contaminant releases. The personnel protection level recommended is Level D, with the exception of confined-space entries (e.g., storm sewers), where the level recommended is Level C (Welch 1989a). Workers will be required to wear steel-toed boots and safety glasses for foot and eye protection and, in the case of confined-space entry, respirators.

During sampling activities, the work areas will be monitored for mercury vapor, organic airborne pollutants and total particulates. Monitoring for radiation will also be done as a precaution, although a radiation hazard is not expected to occur at the Mercury-Use Area sites.

During sample collection in confined spaces, monitoring of oxygen levels and the lower explosive limit (LEL) will be performed in addition to those performed for Level D protection. All monitoring will be conducted in accordance with procedures described in the Energy Systems QC Manual (Kimbrough et al. 1988).

If there is a need for increased protection, the protection level can be upgraded as described by Welch (1989a).

LEVEL OF PROTECTION

Level Designation		Monitoring Parameters	
A		Organic Airborne Pollutants	X
B		Lower Explosive Level	X*
C	X*	Radiation	X
D	X	Total Particulates	X
		Mercury Vapor	X
		Oxygen Level	X*

* in instances of confined space entry

9.4 DESIGNATION OF WORK AREA ZONES

Because contamination which would pose a health hazard is not expected and the protection level is Level D, establishment of work area zones to control contamination is not required. If, however, the protection level is upgraded, three work area zones (Exclusion, Contamination Reduction, and Support) will be established in accordance with the methodology developed by Welch (1989a).

9.5 EXPOSURE LIMITS

If any of the following conditions occur, the SHSO will order work stopped, the work area will be evacuated, and the Y-12 Industrial Hygiene Department will be contacted to determine actions needed to mitigate health and safety concerns:

- Organic vapor levels exceeded background conditions for more than 1 min. At that time, the SHSO will determine whether an upgrading of the protection is necessary to complete work.

- Significant dusting (≥ 5 mg/m^3, which is 1/2 of the TLV for nuisance dust) occurs anywhere in the immediate sampling location.

- Mercury vapor exceeds ≥ 0.05 mg/m^3 (or ≥ 0.001 mg/m^3 using the Jerome Model 411).

- Oxygen levels in confined space entry <16.5%.

9.6 DECONTAMINATION PROCEDURES

There are no specific decontamination procedures required for Level D protection. However, workers should follow the standard safety practice of washing hands and face upon leaving the work area and before eating, drinking, or smoking.

9.7 TRAINING REQUIRED

The OSHA basic 40-h health and safety course, and annual 8-h refresher, will be provided for all field personnel prior to going onsite during the field investigation. This is required by OSHA for all employees engaged in hazardous waste activities (29 CFR Part 1910).

Because radiation is known to occur at low levels in the Mercury-Use Areas, the field team will be given radiation safety training (including such topics as radiological hazards, appropriate protective clothing, operation and use of field survey instruments, and decontamination procedures) to ensure their safety in the event that radiation is detected.

9.8 PROCEDURES FOR WEATHER-RELATED PROBLEMS

Depending on the time of year, the SHSO must monitor all field team members for symptoms of heat stress or cold exposure. Procedures to minimize weather-related problems are discussed by Welch (1989a).

9.9 SITE EMERGENCY PROCEDURES

In the event of an emergency the SHSO must immediately contact the Plant Shift Superintendent (PSS). At that time, all directives for safety and well-being will be initiated by the PSS. A form providing other important emergency information and contacts will be completed and made available to the field team. Table 9.1 is the emergency reference form.

Table 9.1 Emergency reference form

SITE: _____ PROJ. NO. _____

Emergency Information:

Local Resources: _____

Ambulance (Name): _____

Hospital (Name): _____

Police (Local or State): _____

Fire Department (Name): _____

Radio Channel: _____

Nearest Phone: _____

Project Manager: _____

Site Health and
Safety Officer: _____

Emergency Contacts (Medical and Health):

-
-
-
- Poison Information Center:
- National Response Center
  (FOR ENVIRONMENTAL EMERGENCY ONLY) - 1-800-424-8802
- Office

Directions to Hospital:

10. SITE-SPECIFIC QUALITY ASSURANCE PROCEDURES

Strict quality assurance/quality control (QA/QC) procedures will be adhered to during the RCRA Facility Investigation for the Mercury-Use Areas. General QA/QC requirements have been specified in the RCRA Facility Investigation Plan - General Document, Volume II: Quality Assurance Project Plan (QAPP) (Wiggins 1988a), the Environmental Surveillance Procedures Quality Control Program (QC Manual) (Kimbrough et al. 1988), and the RCRA Facility Investigation Plan - General Document, Volume III: Data Management Plan (Wiggins et al. 1988). Additional requirements are outlined below.

As a means to organize this section of the RFI Plan for the Mercury-Use Areas the sixteen point outline for quality assurance project plans specified in the Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (USEPA 1980a) has been used. Of those sixteen elements, two have been omitted (Title Page/Introduction, Table of Contents) from this RFI Plan.

10.1 PROJECT DESCRIPTION

Because of the many activities that make up the 3004(u) RFI Program and the impact the sites could have on human health and the environment, it is necessary that a QA/QC program be established for the overall 3004(u) Program as well as the individual site-specific RFI projects. The QC Manual (Kimbrough et al. 1988) has been developed for use by all three DOE-Oak Ridge Operations (ORO) facilities. Outlined therein are the proper procedures for sampling methods, chain-of-custody, and other activities that are common to the Remedial Action Programs at the three facilities. The RFI QAPP and RFI Data Management Plan (Wiggins 1988a and Wiggins et al. 1988, respectively) are companion documents that set forth QA and data management requirements specific to the Y-12 3004(u) Program. Finally, additional QA/QC procedures are included in the site-specific RFI plans. These four documents, the QC Manual, RFI QAPP, RFI Data Management Plan, and the site-specific RFI plan, comprise the QA/QC Program for each RFI Project.

The development of the four QA/QC documents is based on the USEPA document Interim Final RCRA Facility Investigation (RFI) Guidance, Volume I: Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations (USEPA 1989a).

10.2 PROJECT ORGANIZATION

The combined and organized efforts of several organizations within the Y-12 Plant are necessary for a successful RCRA 3004(u) Facility Investigation Program. The organizational structures for the RFI Program and for Facilities Quality Assurance are shown in Section 1.0 of the RFI QAPP (Wiggins 1988a).

10.3 QUALITY ASSURANCE OBJECTIVES FOR DATA MEASUREMENT

The quality of data necessary to fulfill the requirements of this investigation will follow guidance suggested in Data Quality Objectives for Remedial Response Activities (USEPA 1987). The Data Quality Objectives (DQOs) set forth for the Mercury-Use Areas will provide for the collection of field and analytical data of known quality that can be used for the phased site characterization and for risk assessment, if necessary. A risk assessment will be conducted only if the presence of environmental contamination poses a threat to public health and the environment.

10.3.1 Data Quality Levels

Data of two different quality levels will be generated during field investigations of the Mercury-Use Areas. Data quality Levels I and III, as defined in Data Quality Objectives for Remedial Response Activities (USEPA 1987), will be used. Field data, such as those data collected during mercury vapor, organic vapor, and radiation monitoring, will meet the requirements for Level I data quality. Analytical laboratory data generated from the analysis of soil and surface water samples will meet the requirements for Level III data quality. The elements of Level I and Level III data quality are discussed below.

Level I requirements for field screening are designed to provide real-time data that may be used to refine sampling plans and to determine the extent of contamination at the site. Level I field analytical techniques will provide the following information during field investigations:

- Identification of soil which has a high likelihood of showing contamination through subsequent analysis.
- Real-time data to be used for health and safety considerations during site investigations.
- Quantitative data of total contaminants detected. Identification of contaminants at this site are unlikely.
- The presence or absence of contamination.

There are no data quality criteria specified for Level I because this level is characterized by the use of hand-held instruments and is not conducive to the generation of quantitative data. Documentation for field screening will be recorded in a field logbook. Information recorded should include sample identification, location, instrument reading, and calibration and blanks information.

Level III requirements for analytical laboratory support are designed to provide laboratory analysis using standard USEPA approved procedures. Specific laboratory QA/QC protocols are derived by the EPA approved methods. Analysis procedures for metals and organics may be similar to Contract Lab Program (CLP) procedures, but usually do not include the extent of validation and documentation required by CLP. Analyses conducted on samples collected from the Mercury-Use Areas are designed to confirm identification and quantification of organic and inorganic compounds in the surface water, soil, and air in Mercury-Use Areas. Level III provides data of adequate quality for site characterizations and confirmation of field data, and can also provide data for risk assessment requirements. Level III laboratory analyses provide the following information from samples collected in the Mercury-Use Areas:

- Data for use in evaluating the site for further action; and
- Data for use in risk assessments.

Data quality criteria specified for Level III are as follows:

•Detection limits for each analytical method will be consistent with USEPA approved methods.

•Laboratory QA/QC procedures will follow method specific requirements.

•Field QA/QC procedures will be assessed by reviewing data generated from the analysis of equipment blanks, and duplicate samples.

The type and amount of documentation for laboratory analysis will be determined by the requirements of each analytical procedure. Documentation for both analytical and field procedures are discussed in the RFI QAPP (Wiggins 1988a) and the Martin Marietta Energy Systems QC Manual (Kimbrough et al. 1988).

10.4 SAMPLING PROCEDURES

Sampling and analysis activities provide quantitative and qualitative data that will be used to determine the nature and extent of contaminant releases. Sampling data generated by this investigation must be of acceptable quality and must be comparable to other data. To ensure the quality and consistency of data, specific sampling procedures should be followed. These procedures can be found in the ESP-300 series methods of the QC Manual (Kimbrough et al. 1988).

10.4.1 Location, Types, and Numbers of Samples

Samples collected the Mercury-Use Areas for the RFI investigation will include samples from surface water, soil and air locations, as discussed in Section 7.0 of this plan. The numbers of samples collected and analysis to be conducted are shown in Tables 10.1 and 10.2. In addition, field quality control samples will be collected and sent to the analytical laboratory.

Table 10.1 Analytical Methods, Numbers of Samples and Quality Control for Water Samples

Medium	Parameter	Method[a]	Number of Sites	Number of Sampling Events	Number of Samples	QC Samples: Duplicates[c]	QC Samples: Trip Blanks[d]	QC Samples: Field Blanks[d]	QC Samples: Equipment Rinsate Blanks[d]	Total Samples
Surface Water	Drinking Water Metals[f]									
	Arsenic	7060	20	8	160	20				180
	Barium	7080								
	Cadmium	7131								
	Chromium	7191								
	Lead	7421								
	Mercury	7470								
	Selenium	7440								
	Silver	7460								
	Metals-ICP Scan[f]	6010	20	8	160	10				170
	Radiologicals		20	8	160	10				170
	Radium	903.0								
	Gross Alpha	900.0								
	Gross Beta	900.0								
	Total Uranium									
	% Uranium-235									
	Gamma Spectrometry									
	Inorganics		20	8	160	10				170
	Sulfate	375.1								
	Fluoride	340.1								
	Nitrate	352.1								
	Chloride	325.1								
	Volatile Organic Compounds	624	20	8	160	10	8	8		186
	PCBs		20	8	160	10				170
	Others		20	8	160	10				170
	Alkalinity	310.1								
	Total Organic Carbon	415.1								
	Total Organic Halogen	9020								
	Total Suspended Solids	160.2								
	Total Phenolics	420.1								
	pH									
	Specific Conductance									
	Dissolved Oxygen									

Table 10.1 (continued)

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[a]Methods cited are referenced in EPA (1986).

[b]Includes collection of 2 wet weather and 2 dry weather samples.

[c]Minimum 10% of field samples.

[d]One trip blank per cooler, one set of samples per cooler.

[e]One per piece of equipment used.

[f]Both filtered and unfiltered samples for metals analysis will be collected

Table 10.2 Analytical Methods, Numbers of Samples and Quality Control for Soil.

Medium	Parameter	Method[a]	Number of Sites	Number of Sampling Events	Number of Samples	QC Samples: Duplicates[b]	QC Samples: Trip Blanks[c]	QC Samples: Field Blanks[c]	QC Samples: Equipment Rinsate Blanks[d]	Total Samples
Soil	Drinking Water Metals		35	1	525[e]	53			5	583
	Arsenic	7060								
	Barium	6010								
	Cadmium	6010								
	Chromium	6010								
	Lead	7421								
	Mercury	7471								
	Selenium	7740								
	Silver									
	Metals-ICP Scan	6010	35	1	525[e]	53			5	583
	Radiologicals		35	1	525[e]	53			5	583
	Gross Alpha	EC-101								
	Gross Beta	EC-101								
	Gamma Spectrometry	EC-134								
	Total Uranium	EC-370								
	Total Thorium	EC-360								
	PCBs	EC-340	35	1	525[e]	53			5	583
	Semi-volatiles	8270	35	1	525[e]	53			5	583

[a]Methods cited are referenced in EPA (1986).

[b]Minimum of 10% of field samples.

[c]One trip blank per cooler, one set of samples per cooler.

[d]One per piece of equipment used.

[e]Assumes an average of 3 cores per site and 5 depth intervals per core.

10.4.2 Sample Preservation

Appropriate sample preservatives, sample containers, and analytical holding times are found in Method ESP-701 of the QC Manual (Kimbrough et al. 1988). Preservatives specific to analytical procedures selected for use in the Mercury-Use Areas will be added to the sample containers by a laboratory technician before the containers are provided to the field sampling team.

10.5 SAMPLE AND DOCUMENT CUSTODY PROCEDURES

An essential part of any program that requires sampling and analysis is ensuring the sample integrity from collection to data reporting. This includes the ability to trace the possession and handling of samples from the time of collection through analysis and final disposition. This documentation of the history of the sample is referred to as chain-of-custody. Specific chain-of-custody procedures for the RFI Program can be found in Method No. ESP-500 in the QC Manual (Kimbrough et al. 1988) and in Section 8.5 of the RFI QAPP (Wiggins 1988a).

10.6 CALIBRATION PROCEDURES AND FREQUENCY

An important consideration in any environmental measurement is the calibration of the measurement system. An improperly and/or infrequently calibrated system may have a serious negative impact on the precision and accuracy of the determinations. The result will be erroneous data and the need to repeat the measurements (USEPA 1989a). Field instrumentation will be calibrated according to the frequencies specified in Table 10.3 and according to the procedures specified in the manufacturer's operating manual for the particular instrument. Laboratory analysis instrumentation will be calibrated according to the procedures specified in the analytical methods and operating manual for the particular instrument and will be fully documented in the laboratory's specific quality control manual. When measuring and test equipment (M&TE) is found to be out of tolerance, an evaluation shall be made of the validity of previous inspections or test results and of the acceptability of items previously inspected or tested. M&TE found to be consistently out of calibration shall be removed

Table 10.3. Quality Assurance Procedures for Field Analysis and Equipment

Instrument	General	Daily	Quarterly
1. pH			
Electrode Method	Enter the make, model serial and/or identification (ID) number for each in a logbook.	1. Calibrate the system against standard buffer solution of known pH value at the start of a sampling run. 2. Periodically check the buffers during the sample run and record the data in the log sheet or book. 3. Be on the alert for erratic meter response arising from weak batteries, cracked electrode, and fouling, etc.	Take all meters to laboratory for for maintenance, calibration and quality control checks.
2. Conductivity	Enter the make, model, serial and/or ID number for each meter in a logbook.	1. Standardize with potassium chloride standards having similar specific conductance values to those anticipated in the samples. Calculate the cell constant using two different standards. Cell Constant = Standard Value Actual Value Specific Conductance = Reading multiplied by Cell Constant Rinse cell after each sample to prevent carryover.	Take all meters to lab for maintenance, calibration and quality control checks. Check date of last platinizing and replatinize if necessary. Analyze National Bureau of Standards or USEPA reference standard and record actual vs. observed readings in the log.
3. Organic Vapor Analyzer	For operational check, take background and felt tip marker readings.	Conduct operational check.	
4. Toxic gases and vapors--Photoionization detector.	For operational check, take background and felt tip marker readings.	Conduct operational check.	
5. Measuring Devices	Enter model and serial or ID number in log book.		
6. Mercury vapor analyzer	Enter make model and serial or ID number in log book.	Conduct operational check. Calibrate according to manufacturer's instructions.	Take analyzer to laboratory for maintenance, calibration, and quality control checks.

Source: Taken from White Oak Dam Project Quality Assurance Project Plant (ORNL, 1988).

from service. M&TE shall be suitably marked to indicate calibration status.

10.7 ANALYTICAL PROCEDURES

Analytical procedures will be in accordance with those provided in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, USEPA Publication SW-846, Third Edition (USEPA 1986), Methods for Chemical Analysis of Waters and Wastes, USEPA Manual 600/4-79-020 (USEPA 1983), Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act, USEPA 40 CFR Part 136, and Martin Marietta Energy Systems Environmental and Effluent Analysis Manual (MMES 1986).

10.8 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction, validation and reporting applies to all measurements performed in support of the RFI. Data reduction methods will be identified early in the investigation and will include all equations used to calculate the concentration or value of the measured parameter and the reporting units. Data validation is the process of reviewing data and accepting or rejecting it based on sound criteria. These criteria must be appropriate for each type of data and for the purpose of the measurement. Records of all data will be maintained. Specific data management procedures and criteria to address these issues can be found in the RFI Data Management Plan (Wiggins et al. 1988).

10.9 INTERNAL QUALITY CONTROL CHECKS

Several quality control checks will be utilized during this investigation. These will help to insure that the data collected during this investigation is as complete, accurate,and precise as possible. Quality control checks will be conducted to assess both field and laboratory procedures.

10.9.1 Field Quality Control Checks

Three types of field blanks are normally collected, each measuring the quality of different phases of sampling. The three types include:

10.9.2 Trip Blanks

Trip blanks are used predominantly during the sampling and analysis of volatile organic compounds (VOCS). Trip blanks will be carried along with the sample containers throughout the sample preparation and analytical process. Each trip blank will consist of two septum vials that will be filled with deionized water of known purity. No headspace will be left in the vials. The vials will be sealed in a ziploc bag with other VOC samples and transported to the laboratory. A trip blank will be placed in each sample transportation container (cooler, ice chest, etc.), and will be analyzed by the laboratory for the appropriate constituents. Trip blanks are useful in determining if cross contamination has occurred during sample collection or while in transport to the field or to the laboratory. As a minimum, one trip blank will be prepared and transported with every packed cooler containing VOC samples.

10.9.3 Field Blanks

If on-site monitoring indicates the presence of organic vapors, a field blank may be taken at the discretion of the field supervisor or project manager. Field blanks are prepared at the sampling site. Field blanks are taken by filing two 50 ml septum vials with deionized water while in the field. The vials will then be sealed in a ziploc bag, placed on ice, and transported to the laboratory with the other collected samples. The field blanks will be analyzed by the laboratory for the appropriate constituents. Field blanks are used to measure the influence of ambient conditions at a particular sampling location or site.

10.9.4 Equipment Rinsate Blanks

Equipment rinsate blanks will be utilized during the investigation to determine the effectiveness of decontamination procedures and to insure that samples are not being biased in any way by the equipment used to collect them. One equipment blank will be taken from each type of equipment used per sampling event or one blank for every 20 field samples collected. Deionized water will be used to rinse decontaminated field equipment. The rinsate will be collected into sample containers and

preserved and handled in the same manner as the environmental samples. The field supervisor or project manager will determine which particular piece of equipment from each equipment type will require rinse blanks. Cleaning and decontamination procedures for sample containers, sampling devices, and other equipment can be found in Procedures ESP-900 and ESP-901 in the QC Manual (Kimbrough et al. 1988).

10.9.5 Duplicate Samples

Duplicate samples will be utilized to determine the variability in sampling technique or method. Duplicate samples are co-located samples taken in the same manner at the same time. The sample load will dictate the frequency of samples to be duplicated. A minimum of 5 percent of the samples taken will be duplicates per sampling event and per sample matrix (soil, surface water, etc.). When groundwater is being sampled, one well will be duplicated per sampling event. The field supervisor or project manager will determine the sampling location that is to be duplicated.

10.9.6 Field Calibration

To insure the accuracy of field measurements such as pH, temperature, conductivity, mercury vapor, etc., field instruments will be calibrated according to the guidelines in Table 10.3. Actual calibration procedures will follow those in the manufacturer's operating manual for a particular instrument. The concentration of all standards used in calibration should be verified against samples of known concentration which are obtained from a laboratory or other outside source. If the instrument's response varies by more than 10 percent from the predicted response for that parameter, the measurement will be repeated using a fresh calibration standard. A logbook of all calibrations data for field instruments will be kept up to date at all times.

10.10 LABORATORY QUALITY CONTROL CHECKS

Laboratory accuracy and precision can be assessed by utilizing laboratory quality control checks. Analytical instrument performance and analytical technique must be monitored on a routine basis. Since

laboratory quality control checks are in many cases method specific, such procedures to be used by the laboratory must be documented in the analytical Laboratory QA/QC Manual. These procedures must be consistent with protocol suggested in appropriate USEPA methodologies and guidance documents.

10.11 PERFORMANCE AND SYSTEMS AUDITS

Systems audits are qualitative evaluations of all components of measurement systems to determine their proper selection and use. These audits include a careful review of all data-gathering activities and their appropriate quality control procedures. These are normally performed prior to, or shortly after, systems are operational. The primary objective of systems audits is to ensure that QA/QC procedures are being adhered to (USEPA 1989a).

After systems are operational and are generating data, performance audits are conducted periodically to determine the accuracy of the total measurement system or component parts thereof. Performance audits are quantitative evaluations of the measurement parameter where all measurement systems are included (USEPA 1989a).

Audits should be performed by personnel who have no direct responsibility for the activities being audited. They should be performed in accordance with written procedures or checklists. Results of audits should be reported to, and reviewed by, the management responsible for the program. If follow up activities are indicated, they shall be taken.

Specific auditing procedures are specified in Section 18.0 of the RFI QAPP (Wiggins 1988a).

10.12 PREVENTIVE MAINTENANCE

Preventive maintenance schedules assure the maximum amount of active time for analytical and field instruments and computer hardware over the course of the RFI program. A schedule will be made of important preventive maintenance tasks that will be carried out to minimize downtime of all measurement systems. Also, a critical spare parts inventory will be maintained to minimize downtime. Manufacturer's operating manuals will be used to establish schedules for preventive maintenance on instruments

and other equipment. The manuals will also be used to provide specifications for ordering critical spare parts.

10.13 DATA MEASUREMENT ASSESSMENT PROCEDURES

Quality assurance objectives for measurement data are expressed in terms of accuracy, precision, completeness, representativeness, and comparability. QA objectives provide the mechanism for ongoing control and assessment of data throughout the RFI project and will be used to define data quality of the measured parameters. Each of the quality assurance objectives and their uses are further defined in the RFI Plan - General Document, Volume III: Data Management Plan (Wiggins et al. 1988).

10.14 CORRECTIVE ACTION

Corrective actions are those measures taken to rectify a measurement system that is out of control that may adversely impact either the reliability of the RFI project data or the environment, safety, or health. Procedures for corrective action are detailed in Section 16.0 of the RFI QAPP (Wiggins 1988a).

10.15 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Communication between the Y-12 Facilities Quality Assurance and the RCRA 3004(u) management organization will be maintained. Regular appraisal by the RFI management of the quality aspects related to the ongoing data gathering efforts provides the mechanism whereby the established objectives may be met. Reports to management should include: periodic assessment of measurement data accuracy, precision, and completeness; results of performance audits; results of systems audits; significant QA/QC problems and recommended solutions; and resolutions of previously stated problems (USEPA 1989a).

Further information on reporting of quality assurance data to management can be found in Section 2.4 of the RFI Plan - General Document, Volume II: Quality Assurance Project Plan (Wiggins 1988a).

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APPENDIX A. EXCERPT FROM " COMPREHENSIVE GROUND-WATER MONITORING PLAN FOR THE DEPARTMENT OF ENERGY Y-12 PLANT OAK RIDGE, TENNESSEE (DRAFT:Y/SUB/89-00206C/)"

Y/SUB/89-00206C/

DRAFT REPORT

COMPREHENSIVE GROUND-WATER MONITORING PLAN FOR THE DEPARTMENT OF ENERGY Y-12 PLANT OAK RIDGE, TENNESEE

August 1989

Environmental Management Department
Health/Safety, Environment, and
Accountability Division

Prepared for

Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U S.DEPARTMENT OF ENERGY
Under Contract No.DE-AC05-84OR21400

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As noted in Section 2.3, however, site-specific reports have become increasing cumbersome and inadequate forums for presentation of ground-water conditions in areas where contaminant plumes have overlapped or intermingled. To alleviate this problem, a single report will be prepared annually for the entire Bear Creek hydrogeologic regime.

A proposed outline for this report is shown on Table 5-7. Note that the extent of ground-water contamination will be presented in a "contaminant specific" framework. For example, the section regarding nitrate contamination will present the extent of nitrate contamination throughout the Bear Creek hydrogeologic regime, irrespective of individual source areas. This approach, however, will in no way affect the presentation of site-specific conditions; the site-specific extent of contamination will be thoroughly discussed, but will be presented in a context in which the contribution of the site to the watershed-wide extent of contamination can be more easily demonstrated.

5.2 UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME

As noted in Section 2.3, efforts to determine the extent of ground-water contamination at the Y-12 Plant have generally been directed at RCRA interim status TSD units located in Bear Creek Valley and on Chestnut Ridge. In the UEFPC hydrogeologic regime, contamination assessment activities have concentrated on three primary areas; near the west end of the watershed at SWMUs included in the S-3 Site WMA, at mercury contaminated areas generally located in the west-central portion of the Y-12 Plant , and at New Hope Pond near the east end of the watershed. Thus, comparatively little information is available regarding the extent of ground-water contamination in a major portion of the UEFPC hydrogeologic regime. Compounding this situation is the large number of potential contaminant source areas (e.g. SWMUs, CERCLA sites, and USTs) located in the UEFPC hydrogeologic regime.

Contaminant source identification plays a key role in the monitoring program for the UEFPC hydrogeologic regime because all the wastes sites which have released contaminants to the environment in the regime have not yet been identified. As per regulatory requirements, specific actions that will be initiated to determine if contaminants have been released at each site must be presented in a site-specific work plan (e.g. RFI work plans for SWMUs) to be submitted for approval by the EPA or TDHE. Although work plans have already been prepared for several SWMUs and USTs in the UEFPC hydrogeologic regime, work plans for most of the sites have not been prepared, or are in the preliminary stages of development. Work plans not previously submitted will employ the standardized technical approach outlined in Sections 5.2.1 and 5.2.2, and where possible, those work plans which have already been submitted to the EPA will be modified, if necessary, to reflect this proposed approach.

The monitoring program designed to assess the extent of ground-water contamination throughout the UEFPC hydrogeologic regime is intended to collectively address releases from all leaking waste sites. Thus, no ground-water investigation will be outlined in site-specific work plans; each plan should reference this program as the mechanism for ground-water investigation. This monitoring program will be accomplished in three phases; an initial phase intended to delineate the horizontal extent of contamination, a second phase directing at determining the vertical extent of contamination, and a final phase in which all hazardous constituents present in the contaminant plumes are identified and further delineation of the horizontal and vertical extent of the plumes is performed where needed. Details for this approach are provided in Section 5.2.2.

Current efforts to monitor the quality of surface water exiting the UEFPC hydrogeologic regime are extensive and no additional efforts are proposed. Furthermore, there are currently several monitor wells located near the exit pathway that are suitable for monitoring ground-water quality exiting the system. Thus, much of the exit pathway

monitoring activities included in the UEFPC contamination assessment program generally involve data reporting and presentation. Details for these activities are provided in Section 5.2.3.

5.2.1 Contaminant Source Identification

A phased investigative approach will be employed to identify sites which have released contaminants to the surrounding soils, surface water, and ground water in the UEFPC hydrogeologic regime. During the RFI for each individual site, soil samples will be collected and analyzed for the waste products or constituent handled at the site. If these analyses indicate that contaminants are present in the soils, ground-water samples will be collected from piezometers to determine if the contaminants have also entered the ground-water system underlying the site. Results of the analyses will then be used to evaluate the need to further investigate contaminant releases to the ground-water system. Details for this approach are provided in the following sections.

5.2.1.1 Soil Sampling

The collection and analysis of soil samples is the first step in identifying waste sites which have released contaminants into the UEFPC hydrogeologic regime. This approach is generally consistent with work plans for SWMUs and USTs that have already been submitted to the EPA and TDHE. Specific details, such as sampling locations, are therefore reserved for these site-specific plans. Soil boring methods and soil sampling procedures which are to be utilized at each site are discussed in Section 6.1.1.

The soil samples collected at each site have been or will be analyzed for the constituents specified in the site-specific work plan (e.g. an RFI). In general, selection of analytes is based upon the types of wastes handled at the site. Results of these analyses will be utilized on a site-by-site basis to evaluate closure options, interim corrective

measures (e.g removal of contaminated soils or free product recovery), and the need for investigation for releases to ground-water. However, if the soil samples are free of contamination, then further investigation of contaminant releases at the site will be terminated.

5.2.1.2 Piezometer Installation and Ground-Water Sampling

If results of the analyses of the soil samples indicate that contaminants have been released at a particular site, piezometers will be installed at that site to determine if these contaminants have entered the ground-water system. To accomplish this objective, one piezometer will be installed immediately upgradient of the site and a second piezometer will be located immediately downgradient of the site. Each piezometer will be drilled to the top of bedrock and screened in unconsolidated materials. If bedrock is encountered at shallow depths, the piezometers should be installed at least 10 ft below the water-table. In addition, if separate-phase contaminants are expected to be encountered at a site (e.g. petroleum USTs), the piezometers should be screened across the water-table such that free product thickness can be measured.

As soon as possible after piezometer installation and development, ground-water samples will be collected and analyzed for the contaminants detected in soils at the site. Each piezometer will be sampled at least twice; once to initially identify potential ground-water contaminants and a second time to confirm initial findings and help identify results which may be artifacts of the sampling or analysis process. A third sampling event also may be needed to resolve conflicting results. Since these sampling events are only directed at detecting ground-water contaminants, delays between sampling events needed to evaluate temporal fluctuations in contaminant concentrations will not be necessary. The ground-water sampling activities at each site can therefore be completed in a relatively short time frame.

Because piezometers will be constructed of PVC well casing and screens, sampling results may be considered qualitative or quantitative depending upon the types of contaminants present in the ground water. Qualitative data can be utilized to determine the presence of a contaminants, but cannot be used to quantify their concentrations; quantitative data is suitable for both purposes. If high concentrations of VOCs are detected, the data for these constituents will be considered qualitative as PVC well construction may influence sample chemistry. Data for all other types of contaminants (e.g. metals) will be considered quantitative because PVC well materials are not expected to impact sample chemistry with respect to these constituents.

Assuming contamination is present, water-quality data obtained from the piezometers will be utilized to determine (1) if ground-water contamination at the site is the result of the migration of contaminants released from a source area located upgradient of the site, (2) if the site itself is a source of contamination, and (3) if the site has contributed to a contamination plume originating from other source areas. These determinations will be accomplished through comparing the types of contaminants present in the upgradient and downgradient piezometers with those detected in the soils at the site. If quantitative water-quality data is obtained from the well, a comparison of contaminant concentrations may also be performed.

If the analytical data for the soil and ground-water samples indicate that the site has not contributed contaminants to the ground-water system, further investigation of ground-water quality at the site will be terminated. However, if the data indicates that the site has released contaminants to the ground-water system, further investigation of ground-water quality will be included as part of the contamination assessment program for the UEFPC hydrogeologic regime described in the following section.

5.2.2 Contaminant Plume Assessment

To effectively evaluate the extent of ground-water contamination throughout the UEFPC hydrogeologic regime, an investigative approach consisting of three phases will be implemented: Phase I directed at delineating the overall horizontal extent of ground-water contamination in the unconsolidated and shallow bedrock aquifer zones, and identifying all hazardous constituents in the plumes; Phase II directed at delineating the overall vertical extent of ground-water contamination in a deeper bedrock aquifer zone, and Phase III involving a more refined delineation of the perimeter of the contaminant plumes (if needed) by installing additional wells between clean and contaminated well-clusters within each zone.

The monitor-well network will be installed in a rectangular grid pattern that is consistent with the ground-water flow anisotropy associated with the UEFPC hydrogeologic regime. Wells are more widely spaced parallel with strike because this is a more permeable flow path, and more closely spaced across strike where flow is restricted. This configuration is appropriate because aquifer pumping tests have resulted in ellipsoidal cones of drawdown elongate along strike yet restricted across strike. Thus, if recovery wells are needed, the assumed horizontal well distribution would be similar, although probably less dense, than that of the monitor wells once Phase III is completed.

This approach has several advantages. First, it will significantly reduce the total number of wells needed to assess the extent of ground-water contamination from that which would be needed if a site-by-site approach were employed. Second, it will provide the maximum areal coverage of the UEFPC hydrogeologic regime with the minimum number of wells. Third, it provides the most efficient means of determining the three-dimensional extent of ground-water contamination. Finally, this approach will enable more

effective planning and allocation of available resources since the total number of wells to be installed will be known from the outset of each phase of the investigation.

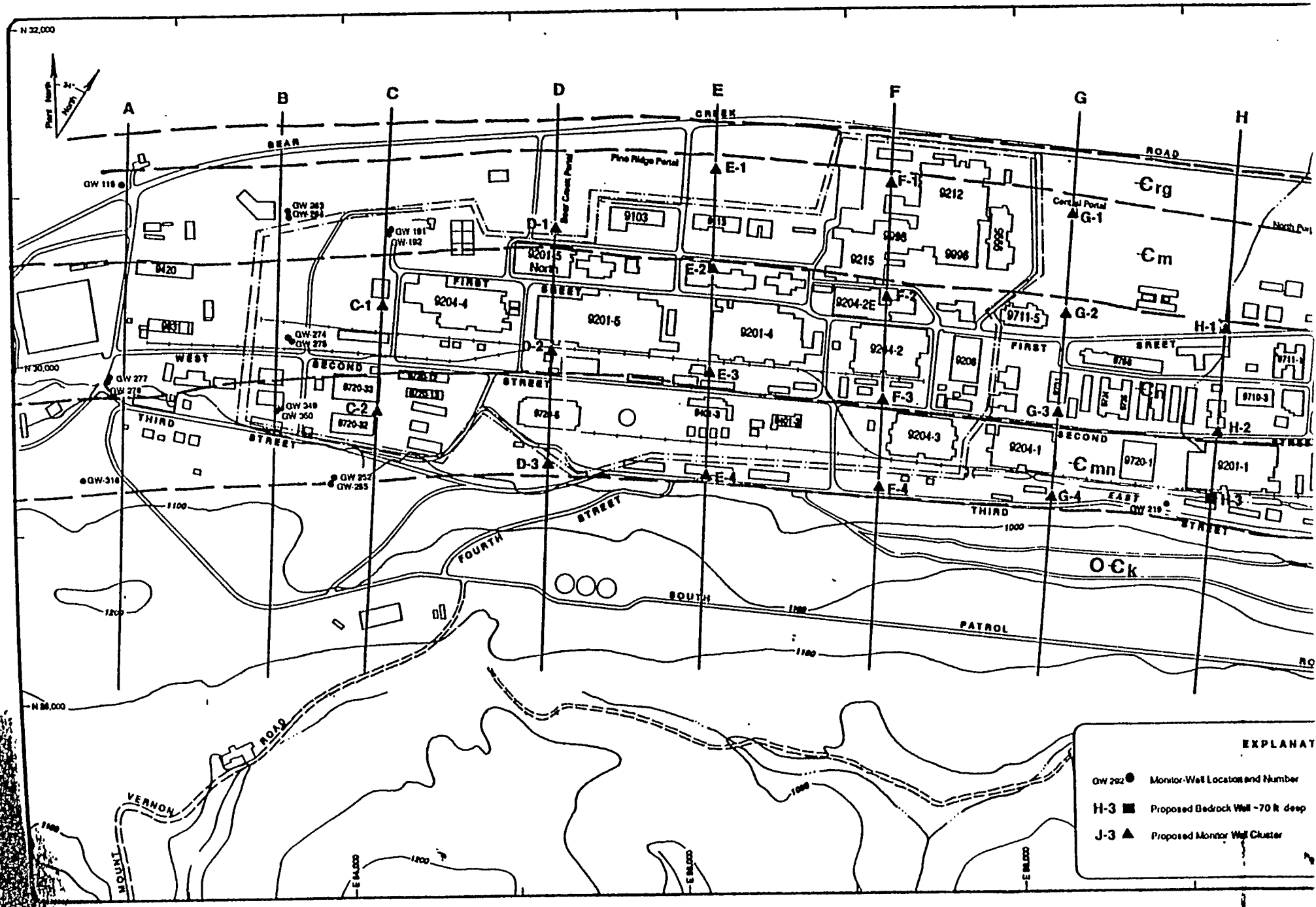
5.2.2.1 Phase I. Horizontal Plume Delineation

As noted above, the first phase of the proposed ground-water contamination assessment program is intended to establish the overall horizontal extent of ground-water contamination in the UEFPC hydrogeologic regime in the unconsolidated and shallow bedrock aquifer zones, and to identify all hazardous constituents present in the contaminant plumes. Details regarding the proposed monitor-well network, monitored parameters and constituents, sampling frequency, and an estimated schedule for implementation of these activities are provided in the following sections.

5.2.2.1.1 Monitor-Well Network

The Phase I monitor well grid pattern for the UEFPC hydrogeologic regime is shown on Figure 5-7. As shown, the grid consists of 13 vertical (north-south) axes, designated A through M, and four horizontal (east-west) axes represented by the contacts between geologic formations. Well locations are spaced about 1000 ft apart in the east-west (strike) direction and approximately 500 ft apart in north-south (dip) direction. In most cases, each location represents a two-well cluster consisting of an unconsolidated well and a bedrock well.

A total of 90 wells will be needed to complete the proposed monitor-well network. Although 22 existing monitor wells are incorporated into the network, the lack of monitor-well coverage in the UEFPC hydrogeologic regime will require the installation of 68 new wells (32 unconsolidated zone wells and 34 bedrock wells). Information regarding existing or proposed well depths, monitored formations, and existing or proposed screened



A
B
C
D
E
F
G
H
CREEK
BEAR
ROAD
Pine Ridge Portal
Bear Creek Portal
Central Portal
North Portal
Ꞓrg
Ꞓm
Ꞓmn
O Ꞓk
FIRST
SECOND
THIRD
STREET
WEST
EAST
FOURTH
SOUTH
PATROL
VERNON
MOUNT
ROAD
9103
9212
9215
9996
9201-5 North
9201-5
9201-4
9204-4
9204-2E
9204-2
9204-3
9204-1
9201-1
9720-1
9720-32
9720-33
9711-5
9710-3
9420
9831
9208
GW 116
GW 191
GW 192
GW 274
GW 275
GW 277
GW 349
GW 350
GW 252
GW 285
GW 316
GW 219
N 32,000
N 30,000
N 28,000
E 64,000
E 66,000
E 68,000
1100
1200
1000
EXPLANAT
GW 292 Monitor-Well Location and Number
H-3 Proposed Bedrock Well ~70 ft deep
J-3 Proposed Monitor Well Cluster

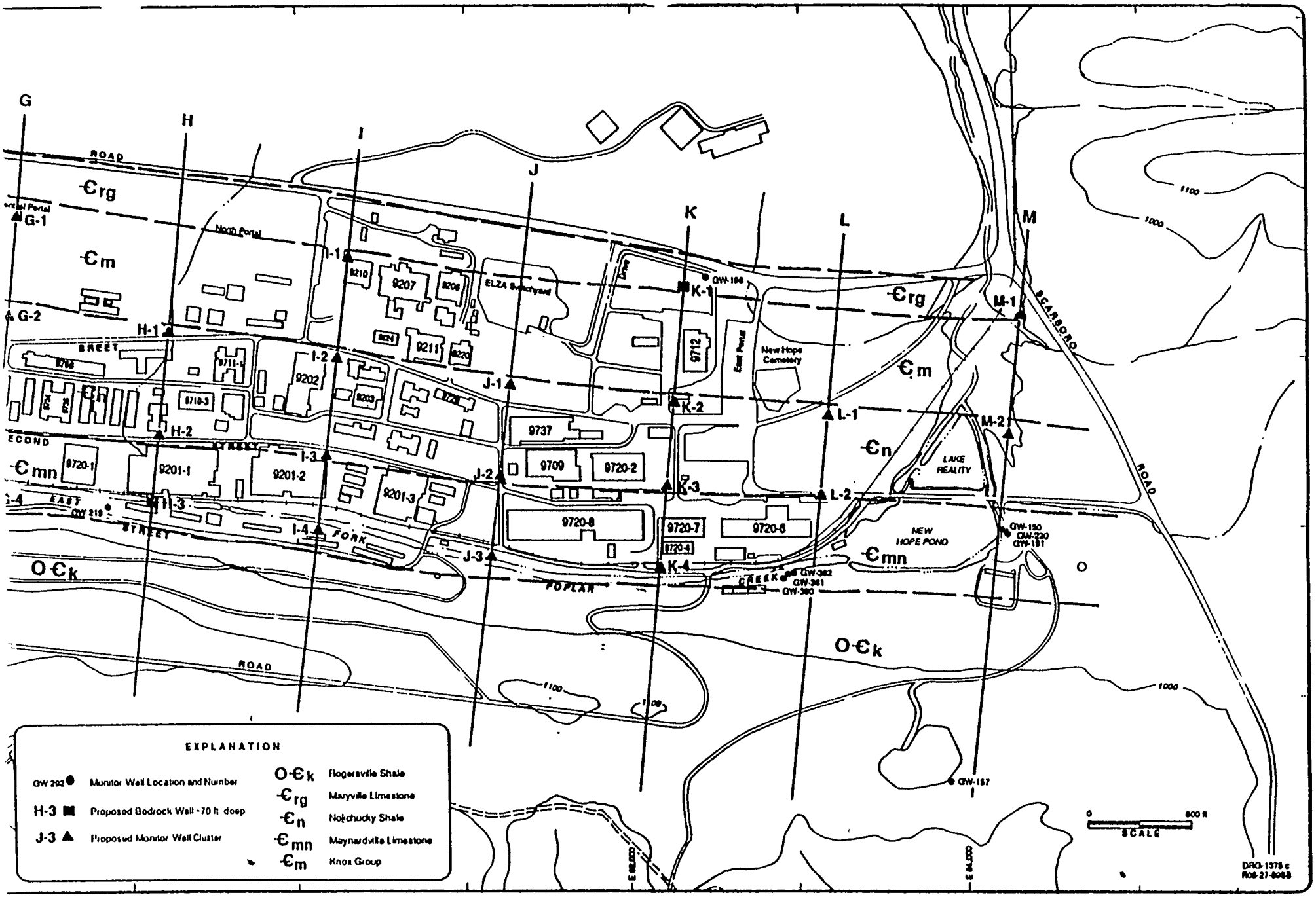


Figure 5-7 Proposed Phase I Monitor-Well Network for the Ground-Water Contamination Assessment Program in the Upper East Fork Poplar Creek Hydrogeologic Regime

intervals is summarized on Table 5-8. Methods for monitor-well installation and construction are discussed in Section 6.1.3.

The unconsolidated zone wells are to be drilled to the top of rock (about 30 ft below grade). It is recognized that the effectiveness of these wells for contamination assessment purposes may be influenced by the re-worked land surface in the UEFPC hydrogeologic regime associated with construction of the Y-12 Plant. In particular, utility line excavations and subsurface drains which extend below the water table may function as permeable conduits for ground-water flow that are unrelated to the hydrologic characteristics of the surrounding "undisturbed" materials. Nonetheless, the unconsolidated wells will provide important hydrologic and water-quality information, and may be especially useful in evaluating the effects of underground utilities and other man-made features on ground-water flow in UEFPC hydrogeologic regime.

As shown on Figure 5-7, the formation monitored by each well is generally dependent upon its location; bedrock wells located more than approximately 500 ft north of UEFPC will monitor either the Nolichucky Shale, the Maryville Limestone, or the Rogersville Shale and wells in close proximity to UEFPC will monitor the Maynardville Limestone. Bedrock wells in each proposed well cluster are to be drilled to a standard depth of 70 ft in the shale formations. The depths of the wells in the Maynardville may vary from the proposed 70 ft standard, however, depending upon the presence of fractures or solution cavities encountered during their installation.

The proposed wells will be installed in a pre-determined sequence. The primary concern is protection of human health and the environment and since the most sensitive receptors are associated with East Fork Poplar Creek and the City of Oak Ridge, well installation activities will proceed from east (near the exit pathway) to west and from south (in the Maynardville Limestone) to north.

Table 5-8. Existing and Proposed Wells Included in the Monitor-Well Network for the Upper East Fork Poplar Creek Hydrogeologic Regime

Profile	Well No.	Depth (ft)	Aquifer Zone	Screen/Open Interval (ft)	Formation Monitored: Fill and/or Residuum	Rogersville Shale	Maryville Limestone	Nolichucky Shale	Maynardville Limestone
A	GW-115	57.0	BDR	42.0 - 52.0			X		
	GW-276	18.5	UNC	10.0 - 18.5	X				
	GW-277	77.4	BDR	67.0 - 77.4				X	
	GW-316	80.0	BDR	68.7 - 79.4					X
B	GW-263	30.8	UNC	25.5 - 30.8	X				
	GW-264	71.0	BDR	60.5 - 70.7			X		
	GW-274	35.0	UNC	25.8 - 33.9	X				
	GW-275	65.5	BDR	54.8 - 65.2				X	
	GW-349	25.5	UNC	9.0 - 24.0	X				
	GW-350	49.0	BDR	33.4 - 43.4					X
C	GW-191	60.5	BDR	49.5 - 59.5			X		
	GW-192	17.5	UNC	7.5 - 17.5	X				
	C1a	30	UNC	20 - 30	X				
	C1b	70	BDR	60 - 70				X	
	C2a	30	UNC	20 - 30	X				
	C2b	70	BDR	60 - 70					X
	GW-252	49.0	UNC	43.8 - 48.8	X				
	GW-255	81.5	BDR	71.3 - 81.3					X
D	D1a	30	UNC	20 - 30	X				
	D1b	70	BDR	60 - 70			X		
	D2a	30	UNC	20 - 30	X				
	D2b	70	BDR	60 - 70				X	
	D3a	30	UNC	20 - 30	X				
	D3b	70	BDR	60 - 70					X
E	E1a	30	UNC	20 - 30	X				
	E1b	70	BDR	60 - 70			X		
	E2a	30	UNC	20 - 30	X				
	E2b	70	BDR	60 - 70			X		
	E3a	30	UNC	20 - 30	X				
	E3b	70	BDR	60 - 70				X	
	E4a	30	UNC	20 - 30	X				
	E4b	70	BDR	60 - 70					X
F	F1a	30	UNC	20 - 30	X				
	F1b	70	BDR	60 - 70			X		
	F2a	30	UNC	20 - 30	X				
	F2b	70	BDR	60 - 70				X	
	F3a	30	UNC	20 - 30	X				
	F3b	70	BDR	60 - 70				X	
	F4a	30	UNC	20 - 30	X				
	F4b	70	BDR	60 - 70					X
G	G1a	30	UNC	20 - 30	X				
	G1b	70	BDR	60 - 70			X		
	G2a	30	UNC	20 - 30	X				
	G2b	70	BDR	60 - 70				X	
	G3a	30	UNC	20 - 30	X				
	G3b	70	BDR	60 - 70				X	
	G4a	30	UNC	20 - 30	X				
	G4b	70	BDR	60 - 70					X
H	H1a	30	UNC	20 - 30	X				
	H1b	70	BDR	60 - 70				X	
	H2a	30	UNC	20 - 30	X				
	H2b	70	BDR	60 - 70				X	
	GW-219	11.3	UNC	5.7 - 11.3	X				
	H3	70	BDR	60 - 70					X

UNC = Unconsolidated Zone
BDR = Bedrock

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Table 5-8. Existing and Proposed Wells Included in the Monitor-Well Network for the Upper East Fork Poplar Creek Hydrogeologic Regime

Profile	Well No.	Depth (ft)	Aquifer Zone	Screen/Open Interval (ft)	Formation Monitored: Fill and/or Residuum	Rogersville Shale	Maryville Limestone	Nolichucky Shale	Maynardville Limestone
I	I1a	30	UNC	20 - 30	X				
	I1b	70	BDR	60 - 70			X		
	I2a	30	UNC	20 - 30	X				
	I2b	70	BDR	60 - 70				X	
	I3a	30	UNC	20 - 30	X				
	I3b	70	BDR	60 - 70				X	
	I4a	30	UNC	20 - 30	X				
	I4b	70	BDR	60 - 70					X
J	J1a	30	UNC	20 - 30	X				
	J1b	70	BDR	60 - 70				X	
	J2a	30	UNC	20 - 30	X				
	J2b	70	BDR	60 - 70				X	
	J3a	30	UNC	20 - 30	X				
	J3b	70	BDR	60 - 70					X
K	GW-198	26.6	UNC	16.5 - 26.5	X				
	K1	70	BDR	60 - 70		X			
	K2a	30	UNC	20 - 30	X				
	K2b	70	BDR	60 - 70				X	
	K3a	30	UNC	20 - 30	X				
	K3b	70	BDR	60 - 70				X	
	K4a	30	UNC	20 - 30	X				
	K4b	70	BDR	60 - 70					X
L	L1a	30	UNC	20 - 30	X				
	L1b	70	BDR	60 - 70				X	
	L2a	30	UNC	20 - 30	X				
	L2b	70	BDR	60 - 70				X	
	GW-380	15.5	UNC	9.8 - 15.2	X				
	GW-381	60.4	BDR	49.3 - 60.4					X
	GW-382	175.0	BDR	125.0 - 175.0					X
M	M1a	30	UNC	20 - 30	X				
	M1b	70	BDR	60 - 70		X			
	M2a	30	UNC	20 - 30	X				
	M2b	70	BDR	60 - 70				X	
	GW-150	11.7	BDR	6.2 - 11.2					X
	GW-151	96.5	BDR	86.0 - 96.0					X
	GW-220	45.2	BDR	34.7 - 44.7					X

UNC = Unconsolidated Zone
BDR = Bedrock

R08-25-89Ba

5.2.2.1.2 Monitored Parameters

During Phase I of the contamination assessment program in the UEFPC, ground-water samples will be analyzed for the Base Program parameters and constituents (Table 4-7), including the optional suite of VOCs (Table 4-8). As with the contamination assessment program proposed for the Bear Creek Bear Creek hydrogeologic regime, utilization of a standard suite of contamination assessment parameters will work to simplify the organization, management, and implementation of the monitoring activities. Moreover, utilization of the Base Program will enable a more accurate estimation of the total analytical costs associated with this phase of the investigation.

Since all the new and proposed Phase I wells are or will be constructed with stainless steel well casing and screens, data obtained from these wells will be considered quantitative. Sample collection procedures and analytical methods are discussed in Sections 6.2 and 6.3, respectively.

5.2.2.1.3 Monitoring Frequency

Ground-water samples will be collected quarterly for one year from all the Phase I wells. This sampling frequency complies with applicable regulations governing ground-water contamination assessment and is needed to evaluate temporal changes in water quality. In addition, quarterly sampling will generate the data needed for the screening procedure described in Section 6.5. To expedite the Phase I investigation, new wells should be sampled as soon as possible after their development.

5.2.2.1.4 Hazardous Constituent Identification

After all the Phase I wells have been sampled quarterly for one year, and an evaluation of the analytical results is completed, ground-water samples will be collected from selected wells and analyzed for the hazardous constituents listed in Appendix IX to 40

CFR Part 264. The purpose of these analyses will be to identify all hazardous constituents and their maximum concentrations (excluding statistical outliers) in the contaminant plumes in the UEFPC hydrogeologic regime.

Several factors will be evaluated in selecting wells for Appendix IX sampling. These include the degree of contamination in the well, the proximity of the wells to contaminant source areas, surrounding ground-water quality conditions, and the location of the wells with respect to the exit pathways of the ground-water system. This selection process will work to ensure that wells with the largest variety of contaminants and the highest contaminant concentrations are sampled such that all hazardous constituents are identified and the need for future Appendix IX analyses is avoided.

Results of these analyses, along with the quarterly sampling results, will then be processed through the data-validation procedure described in Section 6.5. This procedure will be used to identify those hazardous constituents that are present in the contaminant plumes at concentrations which may pose a threat to human health and the environment. Risk assessment studies can then be focused on these contaminants.

5.2.2.1.5 Implementation Schedule

Based upon past experience with ground-water investigations at the Y-12 Plant, it is estimated that the above described Phase I drilling and sampling activities can be accomplished in about 46 weeks (Figure 5-8). This time frame is based upon the following assumptions: (1) concurrent well installation using one auger rig for unconsolidated wells and two air rotary type drilling rigs for bedrock wells, (2) the installation of two unconsolidated zone wells every 3 working days, (3) the installation of two bedrock well every three working days (one well per drilling rig), (4) no significant problems involving the containment of water, soil, and rock removed from the boreholes, (5) utilization of a separate well development/completion crew, (6) development of 4 wells per working week,

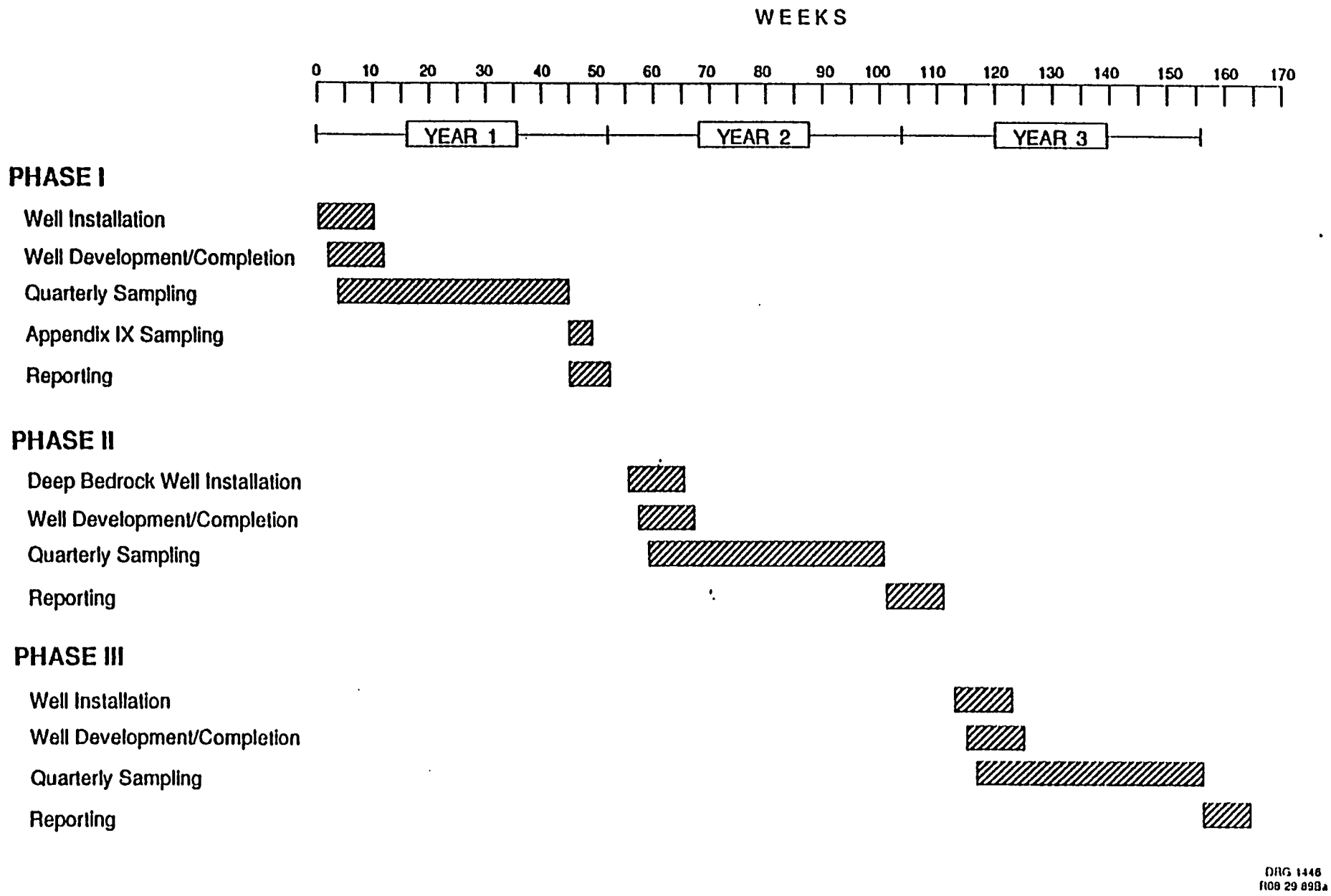

Figure 5-8. Proposed Schedule for Completion of the Ground-Water Contamination Assessment Program for the Upper East Fork Poplar Creek Hydrogeologic Regime

(7) the sampling of new wells within one week after their development, and (8) sampling of 20 wells per working week during subsequent quarterly sampling events.

There may be a significant time-delay before the Phase I contamination assessment program can be implemented. Until that time, Energy Systems should continue site specific monitoring efforts, such as contamination assessment monitoring at New Hope Pond. However, future expansion of these site-specific monitoring programs, particularly the installation of new monitoring wells, will be designed and implemented in the context of the overall contamination assessment program for the UEFPC hydrogeologic regime.

5.2.2.2 Phase II. Vertical Plume Delineation

Phase II of the proposed ground-water contamination assessment program for UEFPC hydrogeologic regime will involve the vertical delineation of ground-water contamination. Specific investigative details for Phase II, however, will be determined after a complete evaluation of the data obtained during Phase I.

5.2.2.2.1 Deep Bedrock Well Network

To determine the overall vertical extent of ground-water contamination in the UEFPC hydrogeologic regime, a deep bedrock well will be installed at each new and existing Phase I well-cluster with contaminated ground-water in the shallow bedrock (70 ft) well. Each deep bedrock well will be drilled to a total depth of 250 ft and completed with a 50 ft open interval. This depth is based upon permeability data obtained from wells located throughout the Bear Creek hydrogeologic regime. Review of these data suggests that the "floor" of the most active portion of the ground-water system is approximately between 200 and 500 ft below grade. Although there is undoubtedly some ground-water flow at greater depths, the permeability data indicate the flow rate is generally very slow and consequently may not play a significant role in contaminant transport. Since the ultimate

objective of the investigation is to determine the extent and rate of contaminant migration, the contamination assessment program should be focused where a significant degree of contaminant transport is most likely to occur.

5.2.2.2.2 Monitored Parameters

During Phase II of the contamination assessment program in the UEFPC, ground-water samples collected from the deep monitor wells will be analyzed for the Base Program parameters and constituents (Table 4-7), including the optional suite of VOCs (Table 4-8). Other constituents may also be included (e.g. Base Neutral Extractable Organics) depending upon the results of the Appendix IX sampling conducted during Phase I. Sample collection procedures and analytical methods are discussed in Sections 6.2 and 6.3, respectively.

5.2.2.2.3 Monitoring Frequency

Ground-water samples from the deep-bedrock wells installed during Phase II will be collected quarterly for one year. The rationale for this sampling frequency is the same as that stated for the Phase I wells. To expedite the Phase II investigation, wells should be sampled as soon as possible after their development.

5.2.2.2.4 Implementation Schedule

The primary factor influencing the implementation of Phase II investigation will be the number of deep wells to be installed. This determination cannot be made until the Phase I investigation is complete. However, assuming that deep bedrock wells will not have to be installed at each Phase I well-cluster location and that two air-rotary type drilling rigs will concurrently install the Phase II wells, it is estimated that Phase II of the ground-water contamination assessment program for the UEFPC hydrogeologic regime will take about 50 weeks to complete (Figure 5-8).

5.2.2.3 Phase III. Final Plume Assessment

Phase III of the proposed ground-water contamination assessment program for the UEFPC hydrogeologic regime is directed at completing the horizontal and vertical contaminant plume delineation. Details regarding the proposed monitor-well network, monitored parameters and constituents, sampling frequency, and an estimated schedule for implementation of these activities are provided in the following sections.

5.2.2.3.1 Monitor-Well Network

Additional monitor wells may be installed to complete the horizontal delineation of of ground-water contamination within each of the vertical aquifer zones. To accomplish this goal, the Phase III monitor wells will be located halfway between non-contaminated well clusters and contaminated well clusters. This approach to the location of the Phase III wells is based upon two fundamental assumptions: (1) ground-water contamination is continuous between contaminated well clusters, and (2) ground water between non-contaminated well clusters is clean. Accordingly, no Phase III wells will be installed between well clusters that are either both contaminated or both non-contaminated.

As illustrated on Figure 5-9, the approach to the location of the Phase III wells will result in a final grid resolution of roughly 500 ft (east-west) by 250 ft (north-south) within each aquifer zone. This will include the installation of individual unconsolidated zone wells, shallow bedrock (70 ft) wells, and deep bedrock wells (250 ft). The type of well installed at each Phase III location will be determined by the water-quality conditions observed in adjacent wells of the same depth. For example, a Phase III unconsolidated zone well will be installed halfway between a well cluster with a clean unconsolidated zone well and a well cluster with a contaminated unconsolidated zone well. Likewise for the shallow and deep bedrock wells. Thus, individual wells of each type, or well clusters

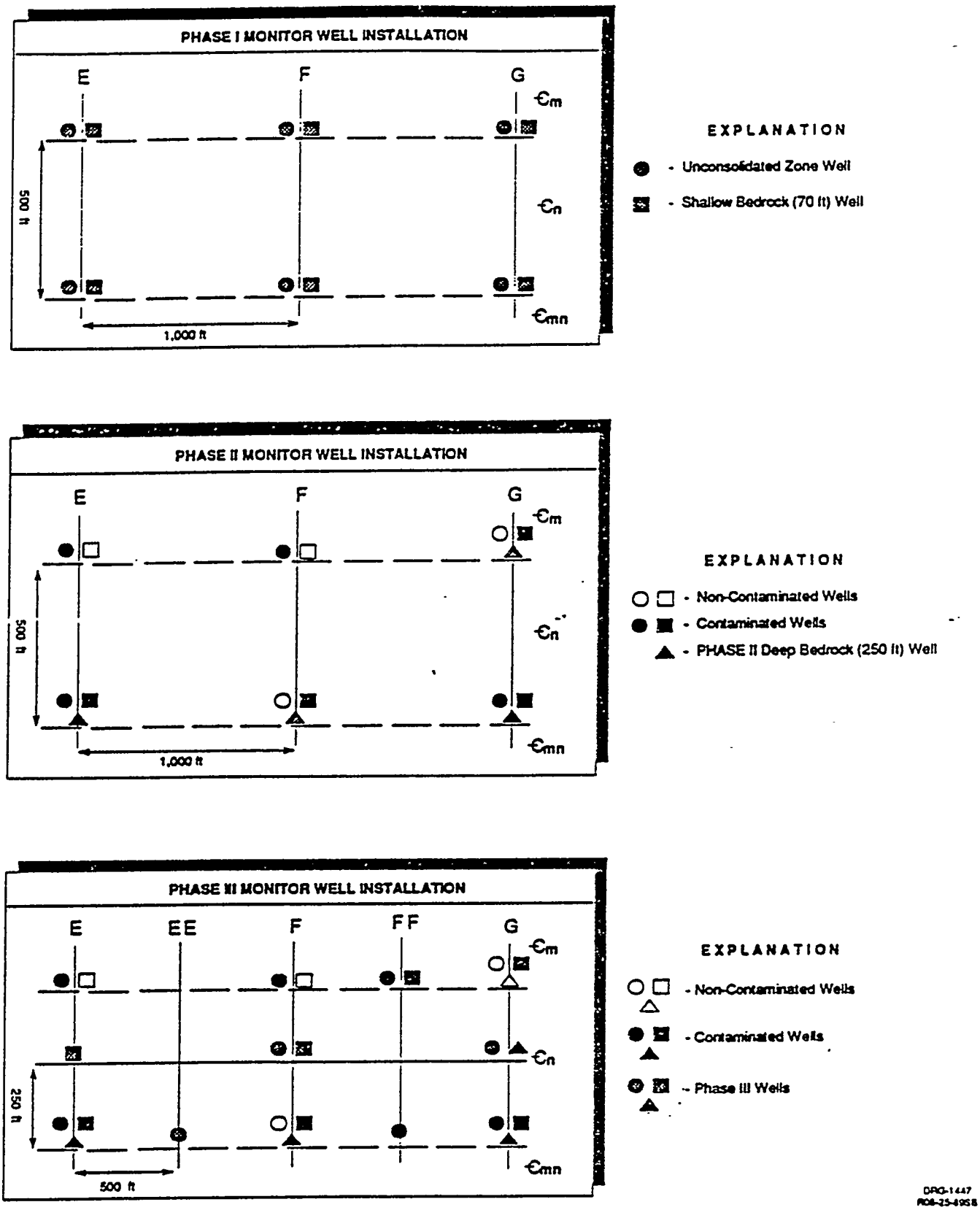

Figure 5-9. Proposed Monitor-Well Installation Sequence for the Upper East Fork Poplar Creek Hydrogeologic Regime

consisting of various combinations of the three well types, may be installed at any given Phase III location.

5.2.2.3.2 Monitored Parameters

Ground-water samples collected from the Phase III monitor wells will be analyzed for the Base Program parameters and constituents (Table 4-7), including the optional suite of VOCs (Table 4-8). Other constituents may also be included (e.g. Base Neutral Extractable Organics) depending upon the results of the Appendix IX sampling conducted during Phase I. Sample collection procedures and analytical methods are discussed in Sections 6.2 and 6.3, respectively.

5.2.2.3.3 Monitoring Frequency

Ground-water samples from the wells installed during Phase III will be collected quarterly for one year. The rationale for this sampling frequency is the same as that stated for the Phase I and II wells. To expedite the Phase III investigation, wells should be sampled as soon as possible after their development.

5.2.2.3.4 Implementation Schedule

Implementation of Phase III is completely dependent upon the results obtained during Phases I and II. However, if the number of Phase III monitor wells (as determined from the Phase I and II results) is not excessive (i.e. more than those installed during Phase I) it is anticipated the Phase III program will take about 50 weeks to complete (Figure 5-8).

5.2.3 Exit Pathway Monitoring

Exit pathway monitoring for the UEFPC hydrogeologic regime primarily involves ground water in the Maynardville Limestone which, as in the Bear Creek hydrogeologic regime, serves as the primary conduit for the migration of ground-water contaminants. The

emphasis is on ground water because NPDES associated monitoring of surface water quality in UEFPC is extensive, and little additional surface water monitoring efforts are judged necessary.

5.2.3.1 Ground Water

In order to monitor the quality of ground water exiting the UEFPC hydrogeologic regime, quarterly samples will be obtained from wells GW-167 and GW-239 (Figure 5-10). These wells will monitor the quality of ground water in the Maynardville Limestone located at the far east end of the UEFPC hydrogeologic regime near the base of Chestnut Ridge. No new wells are recommended at this time because the installation of the Phase I wells at the M-1 and M-2 grid locations (Figure 5-10), along with GW-167 and GW-239, will provide adequate exit point monitoring locations. Samples from all the exit-pathway wells will be analyzed for the Base Program parameters and constituents (Table 4-7) including the optional suite of VOCs (Table 4-8).. Other constituents may also be included (e.g. Base Neutral Extractable Organics) depending upon the results of the Appendix IX sampling conducted during Phase I. Sample collection procedures and analytical methods are discussed in Sections 6.2 and 6.3, respectively.

5.2.3.2 Surface Water

Current efforts to monitor the quality of water discharged to and flowing in UEFPC are extensive. These efforts involve water-quality monitoring in accordance with NPDES requirements at 236 separate locations. Of these, 77 are classified as Category 1 NPDES outfalls, 83 are classified as Category 2 NPDES outfalls, and 84 are classified as Category 3 outfalls. The Category 1 and 2 NPDES outfalls represent storm water drainages and drainages from buildings with no associated process effluents. Only the Category 3 outfalls represent drainages from buildings and areas with associated process effluents containing radioactive and chemical liquid wastes (Peer Consultants P.C. 1988).

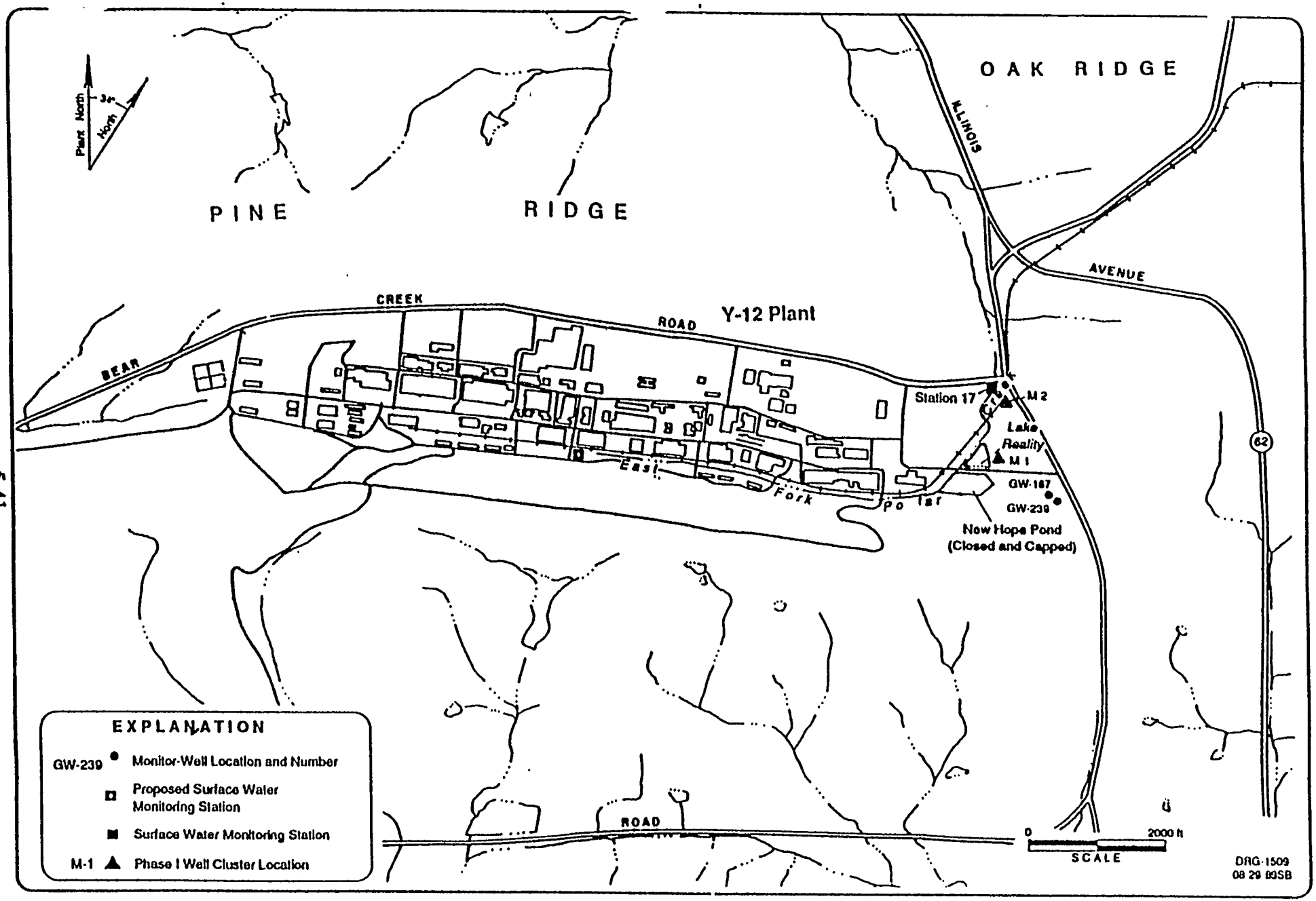

Figure 5-10. Monitor-Wells and Surface Water Sampling Stations Included in the Exit Pathway Monitoring Program for the Upper East Fork Poplar Creek Hydrogeologic Regime

Until November 8, 1988, New Hope Pond served to regulate the flow and quality of water in UEFPC where it exited the Y-12 Plant to flow toward the City of Oak Ridge. Discharge from the pond averaged approximately 8 million gallons per day (mgd) and was monitored at an NPDES station located at the pond outfall. The pond has since been closed in accordance with RCRA standards and replaced by Lake Reality (Figure 5-10). Lake Reality is a lined surface impoundment covering approximately 2.5 acres.

Discharge from Lake Reality is monitored at Station 17 located near the intersection of UEFPC and Bear Creek Road (Figure 5-10). As part of the monitoring efforts at Station 17, grab samples are collected two times a day for mercury analysis, 24-hour composite samples are collected weekly and analyzed for the parameters and constituents included in the first year of the Y-12 Plant Base Program (Table 4-7), and 7-day composite samples are collected weekly for radionuclide analyses (Personal Communication, W. McMahon, August 29, 1989).

The above described monitoring efforts far exceed what is needed for exit-pathway monitoring of surface water quality in UEFPC. For exit-pathway monitoring purposes, surface water quality will be conducted only at two locations; one where UEFPC emerges from the Y-12 Plant storm-sewer drainage system about 1 mile west of New Hope Pond, and Station 17 (Figure 5-10). The first sampling location represents the farthest upstream point at which potential receptors may be exposed to contaminants in UEFPC and will therefore provide data needed for risk-assessment studies. Surface water samples will be collected from this sampling point quarterly and analyzed for the parameters and constituents included in the first year of the Y-12 Plant Base Program (Table 4-7) including the optional suite of VOCs. Other constituents may also be included (e.g. Base Neutral Extractable Organics) depending upon the results of the Appendix IX sampling conducted during Phase I.

Continued surface-water monitoring at Station 17 will ensure that the quality of water leaving the Y-12 Plant via UEFPC is adequately monitored. However, in addition to the regular monitoring efforts, surface water samples collected at Station 17 will be analyzed for the optional suite of VOCs included in the Base Program (Table 4-8) at least once every quarter.

5.2.4 Recordkeeping and Reporting

Energy Systems currently employs recordkeeping practices that have proven acceptable to the regulatory agencies and no changes to these practices is recommended. Two types of forums will be utilized for the presentation and interpretation of monitoring data collected during investigations in the UEFPC hydrogeologic regime; (1) site-specific reports and (2) reports concerning the entire UEFPC hydrogeologic regime. Soils data collected during contaminant-source identification activities described in Section 5.2.1.1 will be presented and interpreted in site-specific reports (e.g. RFI reports for SWMUs). However, all ground water and surface water data collected during contaminant-plume assessment and exit-pathway monitoring activities will be presented in a single GWQAR for the entire UEFPC hydrogeologic regime. The format for this GWQAR will be similar to that shown on Table 5-7 for the Bear Creek hydrogeologic regime.

5.3 CHESTNUT RIDGE

Of the three hydrogeologic regimes at the Y-12 Plant, Chestnut Ridge contains the least number of potential contaminant source areas; three RCRA interim status TSD units (Table 4-1), six SWMUs (Table 4-3,) and one UST (Table 4-4). These sites are generally spaced widely apart and current data indicate that only one site, the Chestnut Ridge Security Pits, has released contaminants to the ground-water system. For these reasons, the current site-specific approach to the identification and assessment of contaminant releases on Chestnut Ridge should be continued.

APPENDIX B. STATISTICAL SUMMARY OF ANALYTICAL RESULTS (APPENDIX IX HAZARDOUS CONSTITUENTS) FOR SLUDGES FROM NEW HOPE POND AND THE CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN. SITES WERE SAMPLED IN NOVEMBER 1987.

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 1

FIELD MEASUREMENT & INORGANICS
UNIT IS MG/KG FOR SEDIMENT SAMPLES
UNIT IS MG/L FOR WATER SAMPLES
UNLESS OTHERWISE STATED IN VARIABLE NAME

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=INTERSTITIAL WATER SAMPLE= SITE=NEW HOPE POND ----------					
TEMP	WATER TEMP. (IN DEGREES CENTIGRADE)	0	.	.	.
DO	DISSOLVED OXYGEN (PPM)	0	.	.	.
CON1	FIELD CONDUCTIVITY (UMHOS/CM), REP. 1	0	.	.	.
CON2	FIELD CONDUCTIVITY (UMHOS/CM), REP. 2	0	.	.	.
CON3	FIELD CONDUCTIVITY (UMHOS/CM), REP. 3	0	.	.	.
PH1	FIELD PH (PH UNIT), REP. 1	0	.	.	.
PH2	FIELD PH (PH UNIT), REP. 2	0	.	.	.
PH3	FIELD PH (PH UNIT), REP. 3	0	.	.	.
RED1	FIELD REDOX (MV), REP. 1	0	.	.	.
RED2	FIELD REDOX (MV), REP. 2	0	.	.	.
RED3	FIELD REDOX (MV), REP. 3	0	.	.	.
CY	CYANIDE	9	0.0050	0.0062	0.0051
CORR	CORROSIVITY (PH UNIT)	0	.	.	.
MS11	FLUORIDE	9	0.5800	0.9100	0.7556
MS6IDE	SULFIDE	9	0.0500	0.0500	0.0500
---------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----------					
TEMP	WATER TEMP. (IN DEGREES CENTIGRADE)	0	.	.	.
DO	DISSOLVED OXYGEN (PPM)	0	.	.	.
CON1	FIELD CONDUCTIVITY (UMHOS/CM), REP. 1	0	.	.	.
CON2	FIELD CONDUCTIVITY (UMHOS/CM), REP. 2	0	.	.	.
CON3	FIELD CONDUCTIVITY (UMHOS/CM), REP. 3	0	.	.	.
PH1	FIELD PH (PH UNIT), REP. 1	0	.	.	.
PH2	FIELD PH (PH UNIT), REP. 2	0	.	.	.
PH3	FIELD PH (PH UNIT), REP. 3	0	.	.	.
RED1	FIELD REDOX (MV), REP. 1	0	.	.	.
RED2	FIELD REDOX (MV), REP. 2	0	.	.	.
RED3	FIELD REDOX (MV), REP. 3	0	.	.	.
CY	CYANIDE	16	0.5500	2.5000	0.9344
CORR	CORROSIVITY (PH UNIT)	16	4.7000	7.9000	7.2937
MS11	FLUORIDE	16	1.9000	37.8000	24.6187
MS6IDE	SULFIDE	16	0.1450	0.1800	0.1606

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 1

ELEMENTAL ANALYSES
UNIT IS MG/KG FOR SEDIMENT SAMPLES
UNIT IS MG/L FOR WATER SAMPLES

VARIABLE	LABEL		N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----------						
M21	SILVER	(ICAP)	16	0.9000	82.6000	46.0750
M1	ALUMINUM	(ICAP)	16	4920.0000	12800.0000	9602.5000
M3A	ARSENIC	(AAS)	16	3.3000	19.9000	13.1312
M4	BARIUM	(ICAP)	16	45.4000	257.0000	167.7375
M5	BERYLLIUM	(ICAP)	16	0.4450	9.2000	5.4403
M8	CALCIUM	(ICAP)	16	442.5000	42700.0000	24077.6562
M7	CADMIUM	(ICAP)	16	0.4450	18.2000	11.4341
M10	COBALT	(ICAP)	16	5.0000	20.6000	13.7875
M9	CHROMIUM	(ICAP)	16	14.7000	858.0000	542.2750
M11	COPPER	(ICAP)	16	11.4000	487.0000	311.2000
M12	IRON	(ICAP)	16	11300.0000	31400.0000	21937.5000
HG	MERCURY		16	0.4400	139.0000	77.3400
M35	POTASSIUM		16	44.2500	505.0000	93.2875
M15	MAGNESIUM	(ICAP)	16	442.5000	7350.0000	4268.9062
M16	MANGANESE	(ICAP)	16	385.0000	990.0000	569.8125
M22A	SODIUM	(AAS)	16	442.5000	780.0000	532.1562
M18	NICKEL	(ICAP)	16	3.5500	210.0000	139.1969
M13A	LEAD	(AAS)	16	16.5000	269.0000	154.7125
M2A	ANTIMONY	(AAS)	16	5.3000	9.4000	6.3937
M19A	SELENIUM	(AAS)	16	0.3850	1.5000	0.7259
M25	TIN	(ICAP)	16	8.8500	61.3000	42.5375
M24A	THALLIUM	(AAS)	16	0.7500	1.2500	1.0437
M27	VANADIUM	(ICAP)	16	15.8000	2190.0000	162.1187
M28	ZINC	(ICAP)	16	26.2000	817.0000	545.6375

200

— 0.143

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

ELEMENTAL ANALYSES
UNIT IS MG/KG FOR SEDIMENT SAMPLES
UNIT IS MG/L FOR WATER SAMPLES

MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND

VARIABLE	LABEL		N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
M21	SILVER	(ICAP)	29	8.6000	126.0000	58.8103
M1	ALUMINUM	(ICAP)	29	6170.0000	15200.0000	10764.8276
M3A	ARSENIC	(AAS)	29	5.7000	36.4000	21.9310
M4	BARIUM	(ICAP)	29	169.0000	325.0000	232.0000
M5	BERYLLIUM	(ICAP)	29	0.7000	11.7000	3.4810
M8	CALCIUM	(ICAP)	29	16600.0000	62100.0000	33210.3448
M7	CADMIUM	(ICAP)	29	3.7000	20.2000	11.3724
M10	COBALT	(ICAP)	29	5.7000	19.5000	10.8431
M9	CHROMIUM	(ICAP)	29	38.4000	571.0000	249.1724
M11	COPPER	(ICAP)	29	112.0000	485.0000	303.0000
M12	IRON	(ICAP)	29	14100.0000	37700.0000	28000.0000
HG	MERCURY		29	20.6000	134.0000	69.5345
M35	POTASSIUM		29	570.0000	1475.0000	1050.3448
M15	MAGNESIUM	(ICAP)	29	3890.0000	13500.0000	7148.6207
M16	MANGANESE	(ICAP)	29	241.0000	731.0000	522.5862
M22A	SODIUM	(AAS)	29	570.0000	1475.0000	1050.3448
M18	NICKEL	(ICAP)	29	42.2000	211.0000	130.0414
M13A	LEAD	(AAS)	29	10.7000	214.0000	108.6690
M2A	ANTIMONY	(AAS)	29	6.8500	17.7000	12.6034
M19A	SELENIUM	(AAS)	29	0.7000	3.4000	1.4241
M25	TIN	(ICAP)	29	11.4000	69.4000	22.7345
M24A	THALLIUM	(AAS)	29	1.5000	13.3000	2.5845
M27	VANADIUM	(ICAP)	29	6.9000	22.5000	12.8017
M28	ZINC	(ICAP)	29	336.0000	1390.0000	932.1034

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 1

HERBICIDES
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=GROUNDWATER SAMPLE=TOTAL SITE=URANIUM VAULT ----------					
PP21	2,4-D (UG/L)	1	0	0	0
PP20	SILVEX (UG/L)	1	0	0	0
PP23	2,4,5-T	1	0	0	0
----- MEDIUM=GROUNDWATER SAMPLE=TOTAL SITE=USGS-2EW/UNION VALLEY AT SR #62 ------					
PP21	2,4-D (UG/L)	1	0	0	0
PP20	SILVEX (UG/L)	1	0	0	0
PP23	2,4,5-T	1	0	0	0
---------- MEDIUM=INTERSTITIAL WATER SAMPLE= SITE=NEW HOPE POND ----------					
PP21	2,4-D (UG/L)	9	0	0	0
PP20	SILVEX (UG/L)	9	0	0	0
PP23	2,4,5-T	9	0	0	0
----- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ------					
PP21	2,4-D (UG/L)	16	0	0	0
PP20	SILVEX (UG/L)	16	0	0	0
PP23	2,4,5-T	16	0	0	0
---------- MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND ----------					
PP21	2,4-D (UG/L)	28	0	0	0
PP20	SILVEX (UG/L)	28	0	0	0
PP23	2,4,5-T	28	0	0	0
-- MEDIUM=SEDIMENT SAMPLE=LEACHATE SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN --					
PP21	2,4-D (UG/L)	16	0	0	0
PP20	SILVEX (UG/L)	16	0	0	0
PP23	2,4,5-T	16	0	0	0
---------- MEDIUM=SEDIMENT SAMPLE=LEACHATE SITE=NEW HOPE POND ----------					
PP21	2,4-D (UG/L)	29	0	0	0
PP20	SILVEX (UG/L)	29	0	0	0
PP23	2,4,5-T	29	0	0	0
---------- MEDIUM=SPRING WATER SAMPLE= SITE=BEAR CREEK VALLEY ----------					
PP21	2,4-D (UG/L)	7	0	0	0
PP20	SILVEX (UG/L)	7	0	0	0
PP23	2,4,5-T	7	0	0	0

SAS

OP PESTICIDES
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=INTERSTITIAL WATER SAMPLE= SITE=NEW HOPE POND ----------					
APP9_82	SULFOTEPP	9	0	0	0
APP9_68	PHORATE	9	0	0	0
APP9_69	DIMETHOATE	9	0	0	0
APP9_70	DIOXATHION	9	0	0	0
APP9_71	DIAZINON	9	0	0	0
APP9_72	DISULFOTON	9	0	0	0
APP9_73	DEMETON	9	0	0	0
APP9_74	METHYL PARATHION	9	0	0	0
APP9_75	MALATHION	9	0	0	0
APP9_76	ETHYL PARATHION	9	0	0	0
APP9_77	DEF	9	0	0	0
APP9_78	ETHION	9	0	0	0
APP9_79	AZINPHOS-METHYL	9	0	0	0
APP9_80	THIONAZIN	9	0	0	0
PP15	ENDRIN ALDEHYDE	9	0	0	0
APP9_67	CHLORDECONE	9	0	0	0
APP9_81	FAMPHUR	9	0	0	0
------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN -------					
APP9_82	SULFOTEPP	16	0	0.0000	0.0000
APP9_68	PHORATE	16	0	0.0000	0.0000
APP9_69	DIMETHOATE	16	0	0.0000	0.0000
APP9_70	DIOXATHION	16	0	0.0000	0.0000
APP9_71	DIAZINON	16	0	0.0000	0.0000
APP9_72	DISULFOTON	16	0	81.0000	5.0625
APP9_73	DEMETON	16	0	0.0000	0.0000
APP9_74	METHYL PARATHION	16	0	0.0000	0.0000
APP9_75	MALATHION	16	0	0.0000	0.0000
APP9_76	ETHYL PARATHION	16	0	0.0000	0.0000
APP9_77	DEF	16	0	0.0000	0.0000
APP9_78	ETHION	16	0	0.0000	0.0000
APP9_79	AZINPHOS-METHYL	16	0	0.0000	0.0000
APP9_80	THIONAZIN	16	0	0.0000	0.0000
PP15	ENDRIN ALDEHYDE	16	0	0.0000	0.0000
APP9_67	CHLORDECONE	16	0	0.0000	0.0000
APP9_81	FAMPHUR	16	0	0.0000	0.0000

OP PESTICIDES
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND ----------					
APP9_82	SULFOTEPP	29	0	0.0000	0.0000
APP9_68	PHORATE	29	0	0.0000	0.0000
APP9_69	DIMETHOATE	29	0	0.0000	0.0000
APP9_70	DIOXATHION	29	0	0.0000	0.0000
APP9_71	DIAZINON	29	0	0.0000	0.0000
APP9_72	DISULFOTON	29	0	0.0000	0.0000
APP9_73	DEMETON	29	0	0.0000	0.0000
APP9_74	METHYL PARATHION	29	0	28.0000	1.7931
APP9_75	MALATHION	29	0	120.0000	4.1379
APP9_76	ETHYL PARATHION	29	0	110.0000	3.7931
APP9_77	DEF	29	0	0.0000	0.0000
APP9_78	ETHION	29	0	0.0000	0.0000
APP9_79	AZINPHOS-METHYL	29	0	780.0000	120.0000
APP9_80	THIONAZIN	29	0	0.0000	0.0000
PP15	ENDRIN ALDEHYDE	27	0	0.0000	0.0000
APP9_67	CHLORDECONE	27	0	0.0000	0.0000
APP9_81	FAMPHUR	29	0	0.0000	0.0000
--- MEDIUM=SEDIMENT SAMPLE=LEACHATE SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----					
APP9_82	SULFOTEPP	0	.	.	.
APP9_68	PHORATE	0	.	.	.
APP9_69	DIMETHOATE	0	.	.	.
APP9_70	DIOXATHION	0	.	.	.
APP9_71	DIAZINON	0	.	.	.
APP9_72	DISULFOTON	0	.	.	.
APP9_73	DEMETON	0	.	.	.
APP9_74	METHYL PARATHION	0	.	.	.
APP9_75	MALATHION	0	.	.	.
APP9_76	ETHYL PARATHION	0	.	.	.
APP9_77	DEF	0	.	.	.
APP9_78	ETHION	0	.	.	.
APP9_79	AZINPHOS-METHYL	0	.	.	.
APP9_80	THIONAZIN	0	.	.	.
PP15	ENDRIN ALDEHYDE	0	.	.	.
APP9_67	CHLORDECONE	0	.	.	.
APP9_81	FAMPHUR	0	.	.	.

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

PESTICIDES & PCB'S
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
-------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ---------					
PP2	ALPHA-BHC	16	0	0.0000	0.0000
PP3	BETA-BHC	16	0	24.0000	1.5000
PP5	DELTA-BHC	16	0	5.4000	0.3375
PP4	LINDANE (UG/L)	16	0	0.0000	0.0000
PP16	HEPTACHLOR	16	0	0.0000	0.0000
PP1	ALDRIN	16	0	0.0000	0.0000
PP17	HEPTACHLOR EPOXIDE	16	0	0.0000	0.0000
PP11	ALPHA-ENDOSULFAN	16	0	0.0000	0.0000
PP10	DIELDRIN	16	0	0.0000	0.0000
PP8	4,4'-DDE	16	0	0.0000	0.0000
PP14	ENDRIN (UG/L)	16	0	0.0000	0.0000
PP12	BETA-ENDOSULFAN	16	0	0.0000	0.0000
PP9	4,4'-DDD	16	0	0.0000	0.0000
PP15	ENDRIN ALDEHYDE	16	0	0.0000	0.0000
PP13	ENDOSULFAN SULFATE	16	0	0.0000	0.0000
PP7	4,4'-DDT	16	0	0.0000	0.0000
PP19	METHOXYCHLOR (UG/L)	16	0	0.0000	0.0000
PP22	ENDRIN KETONE	16	0	0.0000	0.0000
PP6	CHLORDANE	16	0	0.0000	0.0000
PP6A	ALPHA CHLORDANE	0	.	.	.
PP6G	GAMMA CHLORDANE	0	.	.	.
APP9_67	CHLORDECONE	16	0	0.0000	0.0000
PP18	TOXAPHENE (UG/L)	16	0	0.0000	0.0000
P11	PCB-(AROCLOR)-1016	16	0	0.0000	0.0000
P9	PCB-(AROCLOR)-1221	16	0	0.0000	0.0000
P10	PCB-(AROCLOR)-1232	16	0	0.0000	0.0000
P8	PCB-(AROCLOR)-1242	16	0	0.0000	0.0000
P4	PCB-(AROCLOR)-1248	16	0	0.0000	0.0000
P2	PCB-(AROCLOR)-1254	16	0	67000.0000	26821.8750
P3	PCB-(AROCLOR)-1260	16	0	0.0000	0.0000

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

PESTICIDES & PCB'S
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND ----------					
PP2	ALPHA-BHC	27	0	0.0000	0.0000
PP3	BETA-BHC	27	0	0.0000	0.0000
PP5	DELTA-BHC	27	0	0.0000	0.0000
PP4	LINDANE (UG/L)	27	0	0.0000	0.0000
PP16	HEPTACHLOR	27	0	0.0000	0.0000
PP1	ALDRIN	27	0	0.0000	0.0000
PP17	HEPTACHLOR EPOXIDE	27	0	0.0000	0.0000
PP11	ALPHA-ENDOSULFAN	27	0	0.0000	0.0000
PP10	DIELDRIN	27	0	0.0000	0.0000
PP8	4,4'-DDE	27	0	0.0000	0.0000
PP14	ENDRIN (UG/L)	27	0	0.0000	0.0000
PP12	BETA-ENDOSULFAN	27	0	600.0000	31.4815
PP9	4,4'-DDD	27	0	0.0000	0.0000
PP15	ENDRIN ALDEHYDE	27	0	0.0000	0.0000
PP13	ENDOSULFAN SULFATE	27	0	0.0000	0.0000
PP7	4,4'-DDT	27	0	170.0000	6.2963
PP19	METHOXYCHLOR (UG/L)	27	0	0.0000	0.0000
PP22	ENDRIN KETONE	6	0	0.0000	0.0000
PP6	CHLORDANE	6	0	60.0000	10.0000
PP6A	ALPHA CHLORDANE	21	0	0.0000	0.0000
PP6G	GAMMA CHLORDANE	21	0	0.0000	0.0000
APP9_67	CHLORDECONE	27	0	0.0000	0.0000
PP18	TOXAPHENE (UG/L)	27	0	0.0000	0.0000
P11	PCB-(AROCLOR)-1016	27	0	0.0000	0.0000
P9	PCB-(AROCLOR)-1221	27	0	0.0000	0.0000
P10	PCB-(AROCLOR)-1232	27	0	0.0000	0.0000
P8	PCB-(AROCLOR)-1242	27	0	39000.0000	8288.5185
P4	PCB-(AROCLOR)-1248	27	0	0.0000	0.0000
P2	PCB-(AROCLOR)-1254	27	0	23000.0000	7570.3704
P3	PCB-(AROCLOR)-1260	27	0	0.0000	0.0000

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

SEMI-VOLATILE ORGANICS - HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----------					
A10	PHENOL (UG/L)	16	0	0.0000	0.0000
B10	BIS(2-CHLOROETHYL)ETHER (UG/L)	16	0	0.0000	0.0000
A1	2-CHLOROPHENOL (UG/L)	16	0	0.0000	0.0000
B20	1,3-DICHLOROBENZENE (UG/L)	16	0	0.0000	0.0000
B21	1,4-DICHLOROBENZENE (UG/L)	16	0	0.0000	0.0000
ABNP24	BENZYL ALCOHOL (UG/L)	16	0	0.0000	0.0000
B19	1,2-DICHLOROBENZENE (UG/L)	16	0	0.0000	0.0000
ABNP3	2-METHYLPHENOL (UG/L)	16	0	73.0000	4.5625
B11	BIS(2-CHLOROISOPROPYL)ETHER (UG/L)	16	0	0.0000	0.0000
ABNP2	4-METHYLPHENOL (UG/L)	16	0	210.0000	86.4375
B41	N-NITROSODI-N-PROPYLAMINE (UG/L)	16	0	0.0000	0.0000
B35	HEXACHLOROETHANE (UG/L)	16	0	0.0000	0.0000
B39	NITROBENZENE (UG/L)	16	0	0.0000	0.0000
B37	ISOPHORONE (UG/L)	16	0	0.0000	0.0000
A6	2-NITROPHENOL (UG/L)	16	0	0.0000	0.0000
A3	2,4-DIMETHYLPHENOL (UG/L)	16	0	730.0000	251.8125
ABNP27	BENZOIC ACID (UG/L)	16	0	0.0000	0.0000
B9	BIS(2-CHLOROETHOXY)METHANE (UG/L)	16	0	0.0000	0.0000
A2	2,4-DICHLOROPHENOL (UG/L)	16	0	0.0000	0.0000
B45	1,2,4-TRICHLOROBENZENE (UG/L)	16	0	160.0000	62.9375
B38	NAPHTHALENE (UG/L)	16	0	2300.0000	985.6250
ABNP25	4-CHLOROANILINE (UG/L)	16	0	0.0000	0.0000
B33	HEXACHLOROBUTADIENE (UG/L)	16	0	0.0000	0.0000
A8	4-CHLORO-3-METHYLPHENOL	16	0	0.0000	0.0000
ABNP22	2-METHYLNAPHTHALENE (UG/L)	16	0	4000.0000	2124.3750
B34	HEXACHLOROCYCLOPENTADIENE (UG/L)	16	0	0.0000	0.0000
A11	2,4,6-TRICHLOROPHENOL (UG/L)	16	0	0.0000	0.0000
ABNP19	2,4,5-TRICHLOROPHENOL (UG/L)	16	0	0.0000	0.0000
B15	2-CHLORONAPHTHALENE (UG/L)	16	0	0.0000	0.0000
ABNP20	2-NITROANILINE (UG/L)	16	0	0.0000	0.0000
B24	DIMETHYLPHTHALATE (UG/L)	16	0	0.0000	0.0000
B2	ACENAPHTHYLENE (UG/L)	16	0	230.0000	68.5625
ABNP23	3-NITROANILINE (UG/L)	16	0	0.0000	0.0000
B1	ACENAPHTHENE (UG/L)	16	0	610.0000	83.1875
A5	2,4-DINITROPHENOL (UG/L)	16	0	0.0000	0.0000
A7	4-NITROPHENOL (UG/L)	16	0	0.0000	0.0000
ABNP26	DIBENZOFURAN (UG/L)	16	0	1100.0000	386.2500
B26	2,4-DINITROTOLUENE (UG/L)	16	0	0.0000	0.0000
B27	2,6-DINITROTOLUENE (UG/L)	16	0	0.0000	0.0000
B23	DIETHYLPHTHALATE (UG/L)	16	0	0.0000	0.0000
B16	4-CHLOROPHENYL PHENYL ETHER (UG/L)	16	0	0.0000	0.0000
B31	FLUORENE (UG/L)	16	0	790.0000	154.7500
ABNP21	4-NITROANILINE (UG/L)	16	0	0.0000	0.0000
A4	4,6-DINITRO-2-METHYLPHENOL (UG/L)	16	0	0.0000	0.0000
B42	N-NITROSODIPHENYLAMINE (UG/L)	16	0	0.0000	0.0000
B13	4-BROMOPHENYL PHENYL ETHER (UG/L)	16	0	0.0000	0.0000
B32	HEXACHLOROBENZENE (UG/L)	16	0	0.0000	0.0000
A9	PENTACHLOROPHENOL (UG/L)	16	0	440.0000	49.3750
B43	PHENANTHRENE (UG/L)	16	0	5600.0000	1210.6250

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 1

SEMI-VOLATILE ORGANICS - HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----------					
B3	ANTHRACENE (UG/L)	16	0	2000.0000	356.8750
B25	DI-N-BUTYLPHTHALATE (UG/L)	16	0	290.0000	73.8125
B30	FLUORANTHENE (UG/L)	16	0	2100.0000	395.6250
B44	PYRENE (UG/L)	16	0	6800.0000	1320.0000
B14	BUTYL BENZYL PHTHALATE (UG/L)	16	0	0.0000	0.0000
B22	3,3'-DICHLOROBENZIDINE (UG/L)	16	0	0.0000	0.0000
B5	BENZO(A)ANTHRACENE (UG/L)	16	0	3400.0000	730.6250
B12	BIS(2-ETHYLHEXYL)PHTHALATE (UG/L)	16	0	820.0000	162.1250
B17	CHRYSENE (UG/L)	16	0	3600.0000	763.7500
B28	DI-N-OCTYLPHTHALATE (UG/L)	16	0	0.0000	0.0000
B51	BENZO(B)FLUORANTHENE (UG/L)	16	0	2600.0000	395.0000
B47	BENZO(K)FLUORANTHENE (UG/L)	16	0	2300.0000	308.7500
B6	BENZO(A)PYRENE (UG/L)	16	0	2900.0000	515.3125
B36	INDENO(1,2,3-CD)PYRENE (UG/L)	16	0	1700.0000	383.1250
B18	DIBENZO(A,H)ANTHRACENE (UG/L)	16	0	540.0000	50.0000
B8	BENZO(G,H,I)PERYLENE (UG/L)	16	0	1700.0000	408.7500

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

SEMI-VOLATILE ORGANICS - HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
A10	PHENOL (UG/L)	29	0	0.0000	0.0000
B10	BIS(2-CHLOROETHYL)ETHER (UG/L)	29	0	0.0000	0.0000
A1	2-CHLOROPHENOL (UG/L)	29	0	0.0000	0.0000
B20	1,3-DICHLOROBENZENE (UG/L)	29	0	0.0000	0.0000
B21	1,4-DICHLOROBENZENE (UG/L)	29	0	0.0000	0.0000
ABNP24	BENZYL ALCOHOL (UG/L)	29	0	0.0000	0.0000
B19	1,2-DICHLOROBENZENE (UG/L)	29	0	0.0000	0.0000
ABNP3	2-METHYLPHENOL (UG/L)	29	0	0.0000	0.0000
B11	BIS(2-CHLOROISOPROPYL)ETHER (UG/L)	29	0	0.0000	0.0000
ABNP2	4-METHYLPHENOL (UG/L)	29	0	0.0000	0.0000
B41	N-NITROSODI-N-PROPYLAMINE (UG/L)	29	0	0.0000	0.0000
B35	HEXACHLOROETHANE (UG/L)	29	0	0.0000	0.0000
B39	NITROBENZENE (UG/L)	29	0	0.0000	0.0000
B37	ISOPHORONE (UG/L)	29	0	0.0000	0.0000
A6	2-NITROPHENOL (UG/L)	29	0	0.0000	0.0000
A3	2,4-DIMETHYLPHENOL (UG/L)	29	0	0.0000	0.0000
ABNP27	BENZOIC ACID (UG/L)	29	0	0.0000	0.0000
B9	BIS(2-CHLOROETHOXY)METHANE (UG/L)	29	0	0.0000	0.0000
A2	2,4-DICHLOROPHENOL (UG/L)	29	0	0.0000	0.0000
B45	1,2,4-TRICHLOROBENZENE (UG/L)	29	0	1900.0000	65.5172
B38	NAPHTHALENE (UG/L)	29	0	3000.0000	279.3103
ABNP25	4-CHLOROANILINE (UG/L)	29	0	0.0000	0.0000
B33	HEXACHLOROBUTADIENE (UG/L)	29	0	0.0000	0.0000
A8	4-CHLORO-3-METHYLPHENOL	29	0	0.0000	0.0000
ABNP22	2-METHYLNAPHTHALENE (UG/L)	29	0	5500.0000	444.8276
B34	HEXACHLOROCYCLOPENTADIENE (UG/L)	29	0	0.0000	0.0000
A11	2,4,6-TRICHLOROPHENOL (UG/L)	29	0	0.0000	0.0000
ABNP19	2,4,5-TRICHLOROPHENOL (UG/L)	29	0	0.0000	0.0000
B15	2-CHLORONAPHTHALENE (UG/L)	29	0	0.0000	0.0000
ABNP20	2-NITROANILINE (UG/L)	29	0	0.0000	0.0000
B24	DIMETHYLPHTHALATE (UG/L)	29	0	0.0000	0.0000
B2	ACENAPHTHYLENE (UG/L)	29	0	0.0000	0.0000
ABNP23	3-NITROANILINE (UG/L)	29	0	0.0000	0.0000
B1	ACENAPHTHENE (UG/L)	29	0	5700.0000	237.9310
A5	2,4-DINITROPHENOL (UG/L)	29	0	0.0000	0.0000
A7	4-NITROPHENOL (UG/L)	29	0	0.0000	0.0000
ABNP26	DIBENZOFURAN (UG/L)	29	0	3600.0000	124.1379
B26	2,4-DINITROTOLUENE (UG/L)	29	0	0.0000	0.0000
B27	2,6-DINITROTOLUENE (UG/L)	29	0	0.0000	0.0000
B23	DIETHYLPHTHALATE (UG/L)	29	0	88000.0000	3034.4828
B16	4-CHLOROPHENYL PHENYL ETHER (UG/L)	29	0	0.0000	0.0000
B31	FLUORENE (UG/L)	29	0	6300.0000	217.2414
ABNP21	4-NITROANILINE (UG/L)	29	0	0.0000	0.0000
A4	4,6-DINITRO-2-METHYLPHENOL (UG/L)	29	0	0.0000	0.0000
B42	N-NITROSODIPHENYLAMINE (UG/L)	29	0	0.0000	0.0000
B13	4-BROMOPHENYL PHENYL ETHER (UG/L)	29	0	0.0000	0.0000
B32	HEXACHLOROBENZENE (UG/L)	29	0	0.0000	0.0000
A9	PENTACHLOROPHENOL (UG/L)	29	0	0.0000	0.0000
B43	PHENANTHRENE (UG/L)	29	0	26000.0000	4631.0345

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

SEMI-VOLATILE ORGANICS - HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND ----------					
B3	ANTHRACENE (UG/L)	29	0	8400.0000	712.7586
B25	DI-N-BUTYLPHTHALATE (UG/L)	29	0	6400.0000	270.6897
B30	FLUORANTHENE (UG/L)	29	0	44000.0000	9755.1724
B44	PYRENE (UG/L)	29	0	30000.0000	6034.4828
B14	BUTYL BENZYL PHTHALATE (UG/L)	29	0	3700.0000	275.8621
B22	3,3'-DICHLOROBENZIDINE (UG/L)	29	0	0.0000	0.0000
B5	BENZO(A)ANTHRACENE (UG/L)	29	0	22000.0000	1931.0345
B12	BIS(2-ETHYLHEXYL)PHTHALATE (UG/L)	29	0	40000.0000	16913.7931
B17	CHRYSENE (UG/L)	29	0	26000.0000	2827.5862
B28	DI-N-OCTYLPHTHALATE (UG/L)	29	0	510.0000	17.5862
B51	BENZO(B)FLUORANTHENE (UG/L)	29	0	22000.0000	1720.6897
B47	BENZO(K)FLUORANTHENE (UG/L)	29	0	1100.0000	88.6207
B6	BENZO(A)PYRENE (UG/L)	29	0	1100.0000	37.9310
B36	INDENO(1,2,3-CD)PYRENE (UG/L)	29	0	9800.0000	540.0000
B18	DIBENZO(A,H)ANTHRACENE (UG/L)	29	0	1300.0000	49.3103
B8	BENZO(G,H,I)PERYLENE (UG/L)	29	0	9400.0000	535.8621

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

SEMI-VOLATILE ORGANICS - NON-HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----------					
APP9_11	ACETOPHENONE	16	0	0	0
APP9_12	2-ACETYLAMINOFLUORENE	16	0	0	0
APP9_13	4-AMINOBIPHENYL	16	0	0	0
ABNPI	ANILINE	16	0	0	0
APP9_14	ARAMITE	16	0	0	0
APP9_15	2-SEC-BUTYL-4,6-DINITROPHENOL	16	0	0	0
APP9_16	CHLOROBENZILATE	16	0	0	0
APP9_17	META-CRESOL	16	0	0	0
APP9_18	DIALLATE	16	0	0	0
APP9_19	2,6-DICHLOROPHENOL	16	0	0	0
APP9_20	P-(DIMETHYLAMINO)AZOBENZENE	16	0	0	0
APP9_21	7,12-DIMETHYLBENZ(A)ANTHRACENE	16	0	0	0
APP9_22	3,3'-DIMETHYLBENZIDINE	16	0	0	0
APP9_23	ALPHA,ALPHA-DIMETHYLPHENETHYLAMINE	16	0	0	0
APP9_24	META-DINITROBENZENE	16	0	0	0
APP9_25	1,4-DIOXANE	16	0	0	0
APP9_26	DIPHENYLAMINE	16	0	0	0
APP9_27	ETHYL METHACRYLATE	16	0	0	0
APP9_28	ETHYL METHANESULFONATE	16	0	0	0
APP9_29	HEXACHLORODIBENZO-P-DIOXINS	16	0	0	0
APP9_30	HEXACHLORODIBENZOFURANS	16	0	0	0
APP9_31	HEXACHLOROPHENE	16	0	0	0
APP9_32	HEXACHLOROPROPENE	16	0	0	0
APP9_33	ISODRIN	16	0	0	0
APP9_34	ISOSAFROLE	16	0	0	0
APP9_35	METHAPYRILENE	16	0	0	0
APP9_36	3-METHYLCHOLANTHRENE	16	0	0	0
APP9_37	METHYL METHACRYLATE	16	0	0	0
APP9_38	METHYL METHANESULFONATE	16	0	0	0
APP9_39	1,4-NAPHTHOQUINONE	16	0	0	0
APP9_40	1-NAPHTHYLAMINE	16	0	0	0
APP9_41	2-NAPHTHYLAMINE	16	0	0	0
APP9_42	4-NITROQUINOLINE-1-OXIDE	16	0	0	0
APP9_43	N-NITROSODI-N-BUTYLAMINE	16	0	0	0
APP9_44	N-NITROSODIETHYLAMINE	16	0	0	0
B40	N-NITROSODIMETHYLAMINE	16	0	0	0
APP9_45	N-NITROSOMETHYLETHYLAMINE	16	0	0	0
APP9_46	N-NITROSOMORPHOLINE	16	0	0	0
APP9_47	5-NITRO-O-TOLUIDINE	16	0	0	0
APP9_48	N-NITROSOPIPERIDINE	16	0	0	0
APP9_49	N-NITROSOPYRROLIDINE	16	0	0	0
APP9_50	PENTACHLOROBENZENE	16	0	0	0
APP9_51	PENTACHLORODIBENZO-P-DIOXINS	16	0	0	0
APP9_52	PENTACHLORODIBENZOFURANS	16	0	0	0
ABNP42	PENTACHLOROETHANE	16	0	0	0
APP9_53	PENTACHLORONITROBENZENE	16	0	0	0
APP9_54	PHENACETIN	16	0	0	0
APP9_55	P-PHENYLENEDIAMINE	16	0	0	0
APP9_56	2-PICOLINE	16	0	0	0

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

SEMI-VOLATILE ORGANICS - NON-HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----------					
APP9_57	PRONAMIDE	16	0	0	0
APP9_58	PYRIDINE	16	0	0	0
APP9_59	SAFROLE	16	0	0	0
B46	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	16	0	0	0
APP9_60	1,2,4,5-TETRACHLOROBENZENE	16	0	0	0
APP9_61	TETRACHLORODIBENZO-P-DIOXINS	16	0	0	0
APP9_62	TETRACHLORODIBENZOFURANS	16	0	0	0
APP9_63	2,3,4,6-TETRACHLOROPHENOL	16	0	0	0
APP9_64	O-TOLUIDINE	16	0	0	0
APP9_65	O,O,O-TRIETHYL PHOSPHOROTHIOATE	16	0	0	0
APP9_66	SYM-TRINITROBENZENE	16	0	0	0

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

SEMI-VOLATILE ORGANICS - NON-HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
APP9_11	ACETOPHENONE	29	0	0	0
APP9_12	2-ACETYLAMINOFLUORENE	29	0	0	0
APP9_13	4-AMINOBIPHENYL	29	0	0	0
ABNP1	ANILINE	29	0	0	0
APP9_14	ARAMITE	29	0	0	0
APP9_15	2-SEC-BUTYL-4,6-DINITROPHENOL	29	0	0	0
APP9_16	CHLOROBENZILATE	29	0	0	0
APP9_17	META-CRESOL	29	0	0	0
APP9_18	DIALLATE	29	0	0	0
APP9_19	2,6-DICHLOROPHENOL	29	0	0	0
APP9_20	P-(DIMETHYLAMINO)AZOBENZENE	29	0	0	0
APP9_21	7,12-DIMETHYLBENZ(A)ANTHRACENE	29	0	0	0
APP9_22	3,3'-DIMETHYLBENZIDINE	29	0	0	0
APP9_23	ALPHA,ALPHA-DIMETHYLPHENETHYLAMINE	29	0	0	0
APP9_24	META-DINITROBENZENE	29	0	0	0
APP9_25	1,4-DIOXANE	29	0	0	0
APP9_26	DIPHENYLAMINE	29	0	0	0
APP9_27	ETHYL METHACRYLATE	29	0	0	0
APP9_28	ETHYL METHANESULFONATE	29	0	0	0
APP9_29	HEXACHLORODIBENZO-P-DIOXINS	29	0	0	0
APP9_30	HEXACHLORODIBENZOFURANS	29	0	0	0
APP9_31	HEXACHLOROPHENE	29	0	0	0
APP9_32	HEXACHLOROPROPENE	29	0	0	0
APP9_33	ISODRIN	29	0	0	0
APP9_34	ISOSAFROLE	29	0	0	0
APP9_35	METHAPYRILENE	29	0	0	0
APP9_36	3-METHYLCHOLANTHRENE	29	0	0	0
APP9_37	METHYL METHACRYLATE	29	0	0	0
APP9_38	METHYL METHANESULFONATE	29	0	0	0
APP9_39	1,4-NAPHTHOQUINONE	29	0	0	0
APP9_40	1-NAPHTHYLAMINE	29	0	0	0
APP9_41	2-NAPHTHYLAMINE	29	0	0	0
APP9_42	4-NITROQUINOLINE-1-OXIDE	29	0	0	0
APP9_43	N-NITROSODI-N-BUTYLAMINE	29	0	0	0
APP9_44	N-NITROSODIETHYLAMINE	29	0	0	0
B40	N-NITROSODIMETHYLAMINE	29	0	0	0
APP9_45	N-NITROSOMETHYLETHYLAMINE	29	0	0	0
APP9_46	N-NITROSOMORPHOLINE	29	0	0	0
APP9_47	5-NITRO-O-TOLUIDINE	29	0	0	0
APP9_48	N-NITROSOPIPERIDINE	29	0	0	0
APP9_49	N-NITROSOPYRROLIDINE	29	0	0	0
APP9_50	PENTACHLOROBENZENE	29	0	0	0
APP9_51	PENTACHLORODIBENZO-P-DIOXINS	29	0	0	0
APP9_52	PENTACHLORODIBENZOFURANS	29	0	0	0
ABNP42	PENTACHLOROETHANE	29	0	0	0
APP9_53	PENTACHLORONITROBENZENE	29	0	0	0
APP9_54	PHENACETIN	29	0	0	0
APP9_55	P-PHENYLENEDIAMINE	29	0	0	0
APP9_56	2-PICOLINE	29	0	0	0

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 1

SEMI-VOLATILE ORGANICS - NON-HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND ----------					
APP9_57	PRONAMIDE	29	0	0	0
APP9_58	PYRIDINE	29	0	0	0
APP9_59	SAFROLE	29	0	0	0
B46	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	29	0	0	0
APP9_60	1,2,4,5-TETRACHLOROBENZENE	29	0	0	0
APP9_61	TETRACHLORODIBENZO-P-DIOXINS	29	0	0	0
APP9_62	TETRACHLORODIBENZOFURANS	29	0	0	0
APP9_63	2,3,4,6-TETRACHLOROPHENOL	29	0	0	0
APP9_64	O-TOLUIDINE	29	0	0	0
APP9_65	O,O,O-TRIETHYL PHOSPHOROTHIOATE	29	0	0	0
APP9_66	SYM-TRINITROBENZENE	29	0	0	0

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

VOLATILE ORGANICS - HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN	Systemic · Carcinog
---------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----------						
V21	CHLOROMETHANE	16	0.0000	0.0000	0.0000	
V20	BROMOMETHANE	16	0.0000	0.0000	0.0000	
V31	VINYL CHLORIDE	16	0.0000	0.0000	0.0000	
V8	CHLOROETHANE	16	0.0000	0.0000	0.0000	
V22	METHYLENE CHLORIDE	16	15.0000	730.0000	265.5000	
VNP7	ACETONE	16	13.0000	1400.0000	368.5625	8000×10^3
VNP8	CARBON DISULFIDE	16	0.0000	60.0000	5.1875	
V15	1,1-DICHLOROETHENE	16	0.0000	0.0000	0.0000	
V13	1,1-DICHLOROETHANE	16	0.0000	0.0000	0.0000	
V26	TRANS-1,2-DICHLOROETHENE	16	0.0000	0.0000	0.0000	
V10	CHLOROFORM	16	0.0000	0.0000	0.0000	
V14	1,2-DICHLOROETHANE	16	0.0000	0.0000	0.0000	
VNP9	2-BUTANONE	16	0.0000	330.0000	20.6250	
V27	1,1,1-TRICHLOROETHANE	16	0.0000	0.0000	0.0000	
V5	CARBON TETRACHLORIDE	16	0.0000	0.0000	0.0000	
VNP4	VINYL ACETATE	16	0.0000	0.0000	0.0000	
V11	BROMODICHLOROMETHANE	16	0.0000	0.0000	0.0000	
V16	1,2-DICHLOROPROPANE	16	0.0000	0.0000	0.0000	
V18	TRANS-1,3-DICHLOROPROPENE	16	0.0000	0.0000	0.0000	
V29	TRICHLOROETHENE	16	0.0000	0.0000	0.0000	
V7	CHLORODIBROMOMETHANE	16	0.0000	0.0000	0.0000	
V28	1,1,2-TRICHLOROETHANE	16	0.0000	0.0000	0.0000	
V3	BENZENE	16	0.0000	0.0000	0.0000	
V17	CIS-1,3-DICHLOROPROPENE	16	0.0000	0.0000	0.0000	
V9	2-CHLOROETHYLVINYL ETHER	16	0.0000	0.0000	0.0000	
V4	BROMOFORM	16	0.0000	0.0000	0.0000	
VNP1	4-METHYL-2-PENTANONE	16	0.0000	0.0000	0.0000	
VNP2	2-HEXANONE	16	0.0000	0.0000	0.0000	
V24	TETRACHLOROETHENE	16	0.0000	63.0000	10.8750	
V23	1,1,2,2-TETRACHLOROETHANE	16	0.0000	0.0000	0.0000	
V25	TOLUENE	16	0.0000	6.0000	0.4375	20000×10^3
V6	CHLOROBENZENE	16	0.0000	0.0000	0.0000	
V19	ETHYLBENZENE	16	0.0000	0.0000	0.0000	
VNP3	STYRENE	16	0.0000	0.0000	0.0000	
VNP17	XYLENES	16	0.0000	0.0000	0.0000	
V1	ACROLEIN	16	0.0000	0.0000	0.0000	
V2	ACRYLONITRILE	16	0.0000	0.0000	0.0000	
V30	FLUOROTRICHLOROMETHANE	16	0.0000	0.0000	0.0000	

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 19

VOLATILE ORGANICS - HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN	Systemic	Carcinog
MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND							
V21	CHLOROMETHANE	29	0.0000	0.0000	0.0000		
V20	BROMOMETHANE	29	0.0000	0.0000	0.0000		
V31	VINYL CHLORIDE	29	0.0000	33.0000	1.9655		
V8	CHLOROETHANE	29	0.0000	0.0000	0.0000		
V22	METHYLENE CHLORIDE	29	22.0000	890.0000	230.7931	5000×10^3	
VNP7	ACETONE	29	48.0000	1800.0000	651.4138	8000×10^3	
VNP8	CARBON DISULFIDE	29	0.0000	31.0000	3.1379		
V15	1,1-DICHLOROETHENE	29	0.0000	0.0000	0.0000		
V13	1,1-DICHLOROETHANE	29	0.0000	0.0000	0.0000		
V26	TRANS-1,2-DICHLOROETHENE	29	0.0000	0.0000	0.0000		
V10	CHLOROFORM	29	0.0000	30.0000	7.6897		
V14	1,2-DICHLOROETHANE	29	0.0000	0.0000	0.0000		
VNP9	2-BUTANONE	29	0.0000	590.0000	59.3103		
V27	1,1,1-TRICHLOROETHANE	29	0.0000	22.0000	2.1724		
V5	CARBON TETRACHLORIDE	29	0.0000	130.0000	4.4828		
VNP4	VINYL ACETATE	29	0.0000	0.0000	0.0000		
V11	BROMODICHLOROMETHANE	29	0.0000	0.0000	0.0000		
V16	1,2-DICHLOROPROPANE	29	0.0000	0.0000	0.0000		
V18	TRANS-1,3-DICHLOROPROPENE	29	0.0000	0.0000	0.0000		
V29	TRICHLOROETHENE	29	0.0000	96.0000	3.5862		
V7	CHLORODIBROMOMETHANE	29	0.0000	0.0000	0.0000		
V28	1,1,2-TRICHLOROETHANE	29	0.0000	0.0000	0.0000		
V3	BENZENE	29	0.0000	7.0000	0.2414		
V17	CIS-1,3-DICHLOROPROPENE	29	0.0000	0.0000	0.0000		
V9	2-CHLOROETHYLVINYL ETHER	29	0.0000	0.0000	0.0000		
V4	BROMOFORM	29	0.0000	0.0000	0.0000		
VNP1	4-METHYL-2-PENTANONE	29	0.0000	0.0000	0.0000		
VNP2	2-HEXANONE	29	0.0000	0.0000	0.0000		
V24	TETRACHLOROETHENE	29	0.0000	510.0000	17.5862		
V23	1,1,2,2-TETRACHLOROETHANE	29	0.0000	0.0000	0.0000		
V25	TOLUENE	29	0.0000	620.0000	155.4138		
V6	CHLOROBENZENE	29	0.0000	0.0000	0.0000		
V19	ETHYLBENZENE	29	0.0000	2700.0000	97.3103	8000×10^3	
VNP3	STYRENE	29	0.0000	1400.0000	48.2759	20000×10^3	
VNP17	XYLENES	29	0.0000	200.0000	24.1379		
V1	ACROLEIN	29	0.0000	27.0000	0.9310		
V2	ACRYLONITRILE	29	0.0000	500.0000	17.2414		1300
V30	FLUOROTRICHLOROMETHANE	29	0.0000	650.0000	74.5172		

SUMMARY OF APPENDIX 9 SAMPLING BY ROY F. WESTON 12:23 THURSDAY, AUGUST 17, 1

VOLATILE ORGANICS - NON-HSL
UNIT IS UG/KG FOR SEDIMENT SAMPLES
UNIT IS UG/L FOR WATER SAMPLES

VARIABLE	LABEL	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN
---------- MEDIUM=INTERSTITIAL WATER SAMPLE= SITE=NEW HOPE POND ----------					
VNP13	DICHLORODIFLUOROMETHANE	0	.	.	.
APP9_01	ACETONITRILE	0	.	.	.
APP9_02	IODOMETHANE	0	.	.	.
APP9_03	ETHYL CYANIDE	0	.	.	.
APP9_04	3-CHLOROPROPENE	0	.	.	.
APP9_05	METHACRYLONITRILE	0	.	.	.
VNP6	DIBROMOMETHANE	0	.	.	.
APP9_06	ISOBUTYL ALCOHOL	0	.	.	.
VNP12	1,2-DIBROMOETHANE	0	.	.	.
VNP56	1,1,1,2-TETRACHLOROETHANE	0	.	.	.
APP9_07	1,2,3-TRICHLOROPROPANE	0	.	.	.
APP9_08	TRANS-1,4-DICHLORO-2-BUTENE	0	.	.	.
APP9_09	1,2-DIBROMO-3-CHLOROPROPANE	0	.	.	.
APP9_10	2-CHLORO-1,3-BUTADIENE	0	.	.	.
---------- MEDIUM=SEDIMENT SAMPLE= SITE=CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN ----------					
VNP13	DICHLORODIFLUOROMETHANE	16	0	0.0000	0.0000
APP9_01	ACETONITRILE	16	0	770.0000	165.6250
APP9_02	IODOMETHANE	16	0	0.0000	0.0000
APP9_03	ETHYL CYANIDE	16	0	0.0000	0.0000
APP9_04	3-CHLOROPROPENE	16	0	0.0000	0.0000
APP9_05	METHACRYLONITRILE	16	0	0.0000	0.0000
VNP6	DIBROMOMETHANE	16	0	0.0000	0.0000
APP9_06	ISOBUTYL ALCOHOL	16	0	0.0000	0.0000
VNP12	1,2-DIBROMOETHANE	16	0	0.0000	0.0000
VNP56	1,1,1,2-TETRACHLOROETHANE	16	0	0.0000	0.0000
APP9_07	1,2,3-TRICHLOROPROPANE	16	0	0.0000	0.0000
APP9_08	TRANS-1,4-DICHLORO-2-BUTENE	16	0	0.0000	0.0000
APP9_09	1,2-DIBROMO-3-CHLOROPROPANE	16	0	0.0000	0.0000
APP9_10	2-CHLORO-1,3-BUTADIENE	16	0	0.0000	0.0000
---------- MEDIUM=SEDIMENT SAMPLE= SITE=NEW HOPE POND ----------					
VNP13	DICHLORODIFLUOROMETHANE	29	0	1900.0000	65.5172
APP9_01	ACETONITRILE	29	0	0.0000	0.0000
APP9_02	IODOMETHANE	29	0	0.0000	0.0000
APP9_03	ETHYL CYANIDE	29	0	0.0000	0.0000
APP9_04	3-CHLOROPROPENE	29	0	0.0000	0.0000
APP9_05	METHACRYLONITRILE	29	0	0.0000	0.0000
VNP6	DIBROMOMETHANE	29	0	0.0000	0.0000
APP9_06	ISOBUTYL ALCOHOL	29	0	0.0000	0.0000
VNP12	1,2-DIBROMOETHANE	29	0	0.0000	0.0000
VNP56	1,1,1,2-TETRACHLOROETHANE	29	0	0.0000	0.0000
APP9_07	1,2,3-TRICHLOROPROPANE	29	0	0.0000	0.0000
APP9_08	TRANS-1,4-DICHLORO-2-BUTENE	29	0	0.0000	0.0000
APP9_09	1,2-DIBROMO-3-CHLOROPROPANE	29	0	0.0000	0.0000
APP9_10	2-CHLORO-1,3-BUTADIENE	29	0	0.0000	0.0000

APPENDIX C. "IMMEDIATE REMEDIAL ACTION GUIDELINES FOR MERCURY IN SOIL IN THE CITY OF OAK RIDGE"

Author: Phil Walsh
ORNL

City of Oak Ridge
INTERIM ACTION COMMITTEE

Immediate Remedial Action Guidelines

The guidelines for mercury in soil to protect human health developed by the Tennessee Department of Health and Environment is based on allowable daily intakes (ADI) recommended by the World Health Organization (WHO) and by the U.S. Food and Drug Administration. With an inherent safety factor of about 10, they selected an ADI of 40 µg/d for total mercury. Since measurements so far indicate that methylmercury is less than 0.1% of total mercury, an additional safety factor is built in. This is because the WHO recommended a weekly intake of methylmercury of 200 µg (~30 µg/day) and 300 µg (~40 µg/day) total mercury. Methylmercury concentrations in Oak Ridge soil samples never approach the soil limit implied by an allowed 30 µg/d intake.

The ADI selected by the Tennessee Department of Health and Environment represents the best basis available for derivation of soil guidelines. However, they represent allowable intakes, not amounts absorbed. Thus absorbed fractions of organic and inorganic mercury should not have been calculated. Also, any safety factors should have been applied after consideration of all intakes including background. In addition, ingestion of food grown on contaminated soil was treated as a constant in their derivation even though this may be the critical pathway of those considered from a potential health effects perspective. The direct ingestion of soil turned out to be the critical pathway in their analysis because of the inherent assumption that all ingested soil was contaminated. This is thus the critical assumption of their entire analysis since it does not allow for any considerations of fraction of soil contaminated or for fraction of time spent on contaminated soil.

Because of the above considerations, allowable soil concentrations have been derived allowing for variable plant uptake factions, variable resuspension factors and variable fractions of contaminated soil. Since background intake of mercury was set constant at about 10 µg/day, we will use 30 µg/d as the allowable additional intake. Without the safety factor of 10, the result is 300 µg/d.

Considering the same pathways used in deriving the Tennessee guideline, the over all equation is

$$C_S K_{SV} I_V + C_S f_{SC} I_S + C_S K_{SA} I_A = 300 \ \mu g/d \qquad (1)$$

where

C_S = limiting concentration in soil

I_V = intake of vegetables (food from gardens)

I_S = direct ingestion of soil (1 g/d)

I_A = intake of air

K_{SV} = transfer factor for mercury from soil to plants

K_{SA} = transfer factor from soil to air

f_{SC} = fraction of ingested soil contaminated

Similar to the calculations given by the Tennessee Department of Health, it may be shown that $K_{SA} I_A = 2.4 \times 10^6 R$ where R is the resuspension factor. We also adopt 1 g/d for the direct ingestion of soil and about 200 g/d for the consumption rate of garden vegetables.

Solving equation (1) for C_S, we have

$$C_S = \frac{300}{200K_{SV} + f_{SC} + 2.4\times10^6 R} \ \mu g/g \qquad (2)$$

Table 1 and 2 give values for C_S for the three pathways separately and for the combined pathways. The results display the sensitivity of the results for limiting soil concentration to uptake and resuspension factors and to fraction of ingested soil contaminated. It may be reasonable to ignore the safety factor when considering the need for immediate remedial action. Under this condition no value in Tables 1 and 2 is below 100 ppm even for what is considered to be upper limit values for the key parameters given in the first row of tables. Based on limited information on mercury from the literature, on limited measurements in Oak Ridge and on knowledge of contaminaed sites, "most likely" values are $<10^{-3}$ for uptake by plants, 10^{-8} for the resuspension factor and <0.1 for fraction of ingested soil contaminated. Using these

values (see the second rows in the tables) the values for limiting soil concentrations are not less than 100 ppm even with a safety factor of 10.

Given the above results, the following guidelines for "immediate" remedial action were adobted.

Greater than 500 ppm -	remedial action indicated
100-500 ppm -	remedial action may be recommended depending on potential exposure pathways
Less than 100 ppm -	referred to Oak Ridge Task Force for potential long term remedial action

Other potential pathways may become evident as contaminated sites are evaluated. For example, cattle grazing on contaminated pastures or chickens raised in contaminated areas may be important. The survey team will need to be alert to identify any special conditions that may merit special consideration.

The Interim Action Committee has developed the attached survey report that will be completed for each site in Oak Ridge that exceeds the Tennessee State Health Department Guidelines.

Only mercury as been considered in the present guidelines and survey report. Other materials may need to be considered as more data are made available. For example, cadmium is readily taken up in the food chain and may be of more significance than mercury in some situations. The Swedish Board of Health and Welfare has recommended that sludge (sewage) containing greater than 25 ppm not be used for food crops. They also recommended that sludge additions greater than 1 ton/hectare should not be made to food cropland where sludge contains 5 to 15 ppm cadmium. Since some screening data indicate that creek sediments used to amend garden soils are in this range of cadmium concentrations, the Interim Action committee is investigating further.

Table 1

PATHWAY: Consumption of contaminated vegetables.

Uptake Factor	Limiting Soil Concentration	
	No Safety Factor	X-10 Safety Factor
10^{-2}	150	15
10^{-3}	1500	150
10^{-4}	15,000	1500

PATHWAY: Resuspension of contaminated soil.

Resuspension Factor	Limiting Soil Concentration	
	No Safety Factor	X-10 Safety Factor
10^{-7}	600	60
10^{-8}	6000	600
10^{-9}	60,000	6000

PATHWAY: Direct ingestion of contaminated soil.

Fraction of Soil Contaminated	Limiting Soil Concentration	
	No Safety Factor	X-10 Safety Factor
1	300	30
0.1	3000	300
0.01	30,000	3000

Table 2

PATHWAYS: Soil, Vegetables, Air

$$C_{SL} = \frac{300}{200K_{SV} + f_{SC} + 2.4x10^6 R} \quad : \text{ No Safety Factor}$$

			Limiting Soil Concentration	
K_{SV}	f_{SC}	R	No Safety Factor	X-10 Safety Factor
10^{-2}	1	10^{-7}	100	10
10^{-3}	0.1	10^{-8}	1000	100
10^{-4}	0.01	10^{-9}	10,000	1000
10^{-2}	0.1	10^{-7}	130	13
10^{-3}	0.1	10^{-7}	600	60
10^{-4}	0.1	10^{-7}	1000	100
10^{-2}	0.01	10^{-7}	~130	13
10^{-3}	0.01	10^{-7}	680	68
10^{-3}	0.01	10^{-8}	1300	130

CITY OF OAK RIDGE

Survey Report

Property Address _____

Property Owner _____

Owner address (if different from above) _____

_____

I. [] No indication of mercury contaminated soil has been found on this property.

[] Mercury contaminated soil is indicated on this property and is located:

[] in yard only

[] in gardening areas

[] in pastures

[] under or around garage or patio only

[] under or around house

[] under or around house and in yard

[] under or around building (business, church school, etc.)

[] on building grounds

[] in playgrounds or ball fields

[] other _____

II. Results of the survey on the property indicate

[] Mercury levels of _____ ppm in soil.

[] _____

[] _____

[] _____

[] _____

[] Potential human exposures involving:

[] suspension of soil and inhalation

[] direct ingestion of soil

[] ingestion of food crops grown in contaminated soil

[] milk from cattle grazing on contaminated pastures

[] beef from cattle grazing on contaminated pastures

[] other _____

III. The above results compare to the following guidelines developed to identify areas requiring immediate remedial action.*

[] Greater than 500 ppm - remedial action indicated

[] 100-500 ppm - remedial action may be recommended depending on potential exposure pathways

[] Less than 100 ppm - referred to Oak Ridge Task Force for potential long term remedial action

IV. RECOMMENDATION:

The location of and levels of mercury in soil on your property and the potential exposure pathways indicate:

[] Removal of soil

[] Cover of soil

[] Restrict access

[] Restrict uses

[] Stabilize against erosion (mulch, barrier, catch basin, etc.)

[] Alternative control _____

_____

* Guidelines based on applicable information from the World Health Organization.

[] No interim action needed. However, studies by the Oak Ridge Task Force may indicate remedial action(s) in the future.

[] Recommendations will be developed when soil or other analysis and/or an on-site survey of subject property is completed.

If you have questions concerning this survey, please contact James Harless, City of Oak Ridge, Oak Ridge, Tennessee.

APPENDIX D. RESULTS OF SOIL SAMPLING IN THE PIDAS CORRIDOR

SECTION 1 PIDAS

Hole No.	North Coord.	East Coord.	PCB 1254 (µg/g)	PCB 1260 (µg/g)	Hg (µg/g)	VOC (ppm)
185 (A)	29887.49814	57842.57848	<0.1	<0.1	0.512	
185 (B)	29887.49814	57842.57848	0.1	<0.1	0.273	
468	30194.27370	57899.08440	0.04	0.01	0.084	
472	30210.54477	57884.25340	<0.1	<0.1	0.217	<1
473	30224.34378	57843.19956	<1	<1	0.21	
474	30190.54268	57883.44558	0.05	0.01	0.337	
475 (A)	29698.85500	57802.00330	0.73	<0.1	0.051	
475 (B)	29698.85500	57802.00330	<0.1	<0.1	0.100	
476 (A)	29686.08020	57830.55210	<0.1	<0.1	0.198	
476 (B)	29686.08020	57830.55210	<0.1	<0.1	0.050	
# 480*	29988.60574	57841.07752	240	<0.1	0.069	115
481 (A)	29939.05427	57834.39528	<0.1	<0.1	0.013	
481 (B)	29939.05427	57834.39528	<0.1	<0.1	0.061	
482 (A)	29889.50281	57827.71303	0.30	0.2	0.016	
482 (B)	29889.50281	57827.71303	<0.1	<0.1	0.014	
483 (A)	29839.28312	57825.98594	<0.1	<0.1	0.304	
483 (B)	29839.28312	57825.98594	<0.1	<0.1	0.007	
484 (A)	29792.40455	57799.48311	<0.1	<0.1	3.2	
484 (B)	29792.40455	57799.48311	<0.1	<0.1	0.03	
485	29742.85309	57792.80086	<0.1	<0.1	3.8	<1
487 (A)	30083.69932	57884.17292	<1	<1	0.03	
487 (B)	30083.69932	57884.17292	<1	<1	0.01	
# 489	29984.59639	57870.80842	0.63	<0.1	0.098	39
490	29935.04493	57864.12617	0.15	<0.1	0.051	
491	29885.49346	57857.44392	<0.1	<0.1	0.058	
492 (A)	29835.94200	57850.76167	<0.1	<0.1	0.107	
492 (B)	29835.94200	57850.76167	<0.1	<0.1	0.013	
493 (A)	29786.39053	57844.07942	<1	<1	0.11	
493 (B)	29786.39053	57844.07942	<1	<1	0.03	
495	30182.80224	57897.53742	0.02	0.01	0.162	<1
496	30160.03118	57879.33083	0.04	0.01	0.762	
498 (A)	30060.92826	57865.96634	<1	<1	0.03	
498 (B)	30060.92826	57865.96634	<1	<1	0.02	
500	29961.82533	57852.60185	0.34	0.01	0.596	
501	29912.27386	57845.91960	0.05	<0.01	0.091	<1
502 (A)	29862.72240	57839.23735	2.5	<0.1	0.190	
502 (B)	29862.72240	57839.23735	0.19	<0.1	0.038	
503	29813.17094	57832.55511	<1	<1	0.03	
503 (A)	29813.17094	57832.55511	0.21	<0.1	0.040	
503 (B)	29813.17094	57832.55511	<0.1	<0.1	0.037	
505 (A)	29692.46753	57816.27785	<0.1	<0.1	0.058	
505 (B)	29692.46753	57816.27785	<0.1	<0.1	0.062	<1

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
632 (A)‡	30056.35	57880.49	<1	<1	0.02	
632 (B)	30056.35	57880.49	<1	<1	0.02	
480-1**	29928	57841	<1	<1	0.15	2.4
480-2	29918	57841	46	<1	1.06	<1
480-3	29923	57856	<1	<1	0.06	1.4
480-4	29938	57851	<1	<1	0.33	<1
480-5 (A)	29938	57861	14	<1	1.44	27
480-5 (B)	29938	57861	<1	<1	0.13	
489-6 (A)	29919	57885	<1	<1	2.07	3.0
489-6 (B)	29919	57885	<1	<1	0.20	
489-7	29914	57870	<1	<1	0.17	<1
489-8 (A)	29934	57880	<1	<1	0.16	119
489-8 (B)	29934	57880	<1	<1	0.12	
489-9 (A)	29924	57870	1	<1	0.45	40
489-9 (B)	29924	57870	<1	<1	0.15	
489-10 (A)	29934	57890	<1	<1	0.21	141
489-10 (B)	29934	57890	<1	<1	0.07	

*Recheck value = 68 μg/g

†Adjacent to holes (A) and (B)

‡Point 632 is an old point from a previous survey

**Additional samples 480-1 through 480-5 and 498-6 through 498-10 were taken from around concrete pad (9720-12) to define area of elevated PCB levels.

NOTE: Samples listed as (B) were taken from depths that ranged from 18-36 inches. All other samples were taken from 0-18 inches. Shaded entries are possible confirmation levels or higher for PCB, Hg, or VOC.

June 26, 1987

SECTION 2 PIDAS

Hole No.	North Coord.	East Coord.	PCB 1254 (µg/g)	PCB 1260 (µg/g)	Hg (µg/g)	VOC (ppm)
4 (A)	31313.13	57006.28	<1	<1	0.03	4.8
4 (B)	31313.13	57006.28	<1	<1	0.02	
2A (A)	31025.84	55462.86	<1	<1	0.01	
2A (B)	31025.84	55462.86	<1	<1	0.01	
20	30540.00	54761.00	<1	<1	0.07	
21	30767.00	54835.00	<1	<1	0.08	
21A (A)	30795.67	54655.36	<1	<1	0.03	
21A (B)	30795.67	54655.36	<1	<1	0.05	
20A (A)	30981.41	54775.91	<1	<1	0.05	
20A (B)	30981.41	54775.91	<1	<1	0.02	
177 (A)	30971.49479	55548.23897	<1	<1	3.6	<1
177 (B)	30971.49479	55548.23897	<1	<1	6.3	
178 (A)	30966.64670	55598.00328	<1	<1	1.2	
178 (B)	30966.64670	55598.00328	<1	<1	0.21	
179 (A)	30961.79860	55647.76759	<1	<1	0.21	<1
179 (B)	30961.79860	55647.76759	<1	<1	0.38	
180 (A)	30956.95050	55697.53189	<1	<1	1.9	
180 (B)	30956.95050	55697.53189	<1	<1	0.41	
181	30952.10241	55747.29620	<1	<1	2.3	
182 (A)	30947.25431	55797.06051	<1	<1	2.0	<1
182 (B)	30947.25431	55797.06051	<1	<1	0.29	
183 (A)	30942.40621	55846.82482	<1	<1	0.15	
183 (B)	30942.40621	55846.82482	<1	<1	0.40	
# 184 (A)	30937.55812	55896.58912	<1	<1	14	<1
184 (B)	30937.55812	55896.58912	<1	<1	5.0	
211 (A)	30826.15900	55445.04489	<1	<1	0.02	
211 (B)	30826.15900	55445.04489	<1	<1	0.01	
215	30799.48059	55462.74410	<1	<1	0.02	
219 (A)	31008.91974	55481.43020	<1	<1	0.02	
219 (B)	31008.91974	55481.43020	<1	<1	0.02	
242 (A)	30881.35603	56544.19574	<1	<1	0.04	
242 (B)	30881.35603	56544.19574	<1	<1	0.04	
243 (A)	30876.55074	56593.96409	<1	<1	0.08	
243 (B)	30876.55074	56593.96409	<1	<1	0.01	
244 (A)	30871.74545	56643.73245	<1	<1	0.10	
244 (B)	30871.74545	56643.73245	<1	<1	0.03	
245	30866.94016	56693.50081	<1	<1	0.24	
246	30862.13488	56743.26916	<1	<1	0.07	
247 (A)	30857.32959	56793.03752	<1	<1	0.09	
247 (B)	30857.32959	56793.03752	<1	<1	0.02	
248	31021.85286	55502.96743	<1	1.0 -	0.22	<1
268	30922.93822	56498.06335	<0.1	<0.1	0.02	

Hole No.	North Coord.	East Coord.	PCB 1254 (µg/g)	PCB 1260 (µg/g)	Hg (µg/g)	VOC (ppm)
273	30898.20956	56746.83733	VOC only	VOC only	VOC only	<1
275	31004.45356	55526.36111	<1	<1	0.15	
276 (A)	30995.44011	55575.72071	<0.1	<0.1	2.5	
276 (B)	30995.44011	55575.72071	<0.21	<0.10	1.4	
277 (A)	30990.60509	55625.48626	<0.1	<0.1	0.08	<1
277 (B)	30990.60509	55625.48626	<0.1	<0.1	0.02	
278 (A)	30985.77008	55675.25181	<0.1	<0.1	0.14	
278 (B)	30985.77008	55675.25181	<0.1	<0.1	0.07	
279 (A)	30980.93506	55725.01736	<0.1	<0.1	0.09	<1
279 (B)	30980.93506	55725.01736	<0.1	<0.1	0.04	
280 (A)	30976.10005	55774.78292	<0.1	<0.1	0.12	
280 (B)	30976.10005	55774.78292	<0.1	<0.1	0.06	
281 (A)	30971.26503	55824.54847	<0.1	<0.1	0.11	<1
281 (B)	30971.26503	55824.54847	<0.1	<0.1	0.05	
282 (A)	30966.43002	55874.31402	<0.1	<0.1	0.37	
282 (B)	30966.43002	55874.31402	<0.1	<0.1	0.10	
283	30961.59500	55924.07958	<0.1	<0.1	0.08	<1
287	30941.82780	56123.09869	<0.1	<0.1	0.50	<1
288	30936.97379	56172.86277	<0.1	<0.1	0.16	
289	30932.11981	56222.62652	<1	<1	0.37	
290	30927.26584	56272.39026	<1	<1	0.15	<1
291	30922.41186	56322.15401	<0.1	<0.1	0.03	
292	30920.37623	56372.19266	<0.1	<0.1	0.02	1.3
293	30915.43050	56421.94745	<0.1	<0.1	0.03	
294 (A)	30910.48477	56471.70225	<0.1	<0.1	0.01	<1
294 (B)	30910.48477	56471.70225	<0.1	<0.1	0.01	
296 (A)	30900.59332	56571.21184	<1	<1	0.03	1.2
296 (B)	30900.59332	56571.21184	<1	<1	0.02	
297 (A)	30895.64760	56620.96664	<1	<1	0.05	
297 (B)	30895.64760	56620.96664	<1	<1	0.03	
298 (A)	30890.70187	56670.72144	<1	<1	0.03	
298 (B)	30890.70187	56670.72144	<1	<1	0.03	
299 (A)	30885.75615	56720.47623	<1	<1	0.03	
299 (B)	30885.75615	56720.47623	<1	<1	0.09	
300 (A)	30880.81042	56770.23103	<1	<1	0.03	
300 (B)	30880.81042	56770.23103	<1	<1	0.03	
305 (A)	30952.82476	56871.51152	<1	<1	0.02	4.0
305 (B)	30952.82476	56871.51152	<1	<1	0.01	
309 (A)	31140.17968	56941.49818	<1	<1	0.02	<1
309 (B)	31140.17968	56941.49818	<1	<1	0.02	
318 (A)	31150.67769	56913.39492	<1	<1	0.01	<1
318 (B)	31150.67769	56913.39492	<1	<1	0.02	
666 (A)	30729.57639	55456.49056	<1	<1	0.29	<1
666 (B)	30729.57639	55456.49056	<1	<1	0.06	
889	30932.13837	54668.65713	<1	<1	0.02	

Hole No.	North Coord.	East Coord.	PCB 1254 (µg/g)	PCB 1260 (µg/g)	Hg (µg/g)	VOC (ppm)
911 (A)	30959.26992	54515.80466	<1	<1	0.09	<1
911 (B)	30959.26992	54515.80466	<1	<1	0.10	
912 (A)	30963.51134	54565.62444	<1	<1	0.07	
912 (B)	30963.51134	54565.62444	<1	<1	0.04	
914	30971.99416	54665.26400	<1	<1	0.02	<1
938	30949.94556	54642.05067	<1	<1	0.04	
940	30960.70720	54768.45720				<1
941 (A)	30894.02901	54780.66388	<1	<1	0.06	
941 (B)	30894.02901	54780.66388	<1	<1	0.03	
943 (A)	30802.08704	54819.99166	<1	<1	0.04	
943 (B)	30802.08704	54819.99166	<1	<1	0.09	
944	30951.79832	54788.58256	<1	<1	0.11	
945 (A)	30905.82734	54808.24647	<1	<1	0.04	<1
945 (B)	30905.82734	54808.24647	<1	<1	0.06	
946 (A)	30859.85636	54827.91038	<1	<1	0.04	
946 (B)	30859.85636	54827.91038	<1	<1	0.05	
950 (A)	30830.97171	54823.95102	<1	<1	0.09	
950 (B)	30830.97171	54823.95102	<1	<1	0.04	
953	30760.15184	54934.76523	0.21	<0.1	0.05	<1
954 (A)	30756.72776	54984.64785	<0.1	<0.1	0.09	
954 (B)	30756.72776	54984.64785	<0.1	<0.1	0.07	
955 (A)	30753.30368	55034.53047	<0.1	<0.1	0.11	
955 (B)	30753.30368	55034.53047	<0.1	<0.1	0.03	
956	30749.87960	55084.41309	<0.1	<0.1	0.43	
964 (A)	30793.50548	54886.93706	<0.1	<0.1	0.08	<1
964 (B)	30793.50548	54886.93706	<0.1	<0.1	0.04	
965	30790.08140	54936.81968	<0.1	<0.1	0.05	
966	30786.65732	54986.70230	<0.1	<0.1	0.06	
967	30783.23325	55036.58492	<0.1	<0.1	0.04	
968 (A)	30779.80917	55086.46754	<0.1	<0.1	0.06	
968 (B)	30779.80917	55086.46754	<0.1	<0.1	0.12	
972 (A)	30766.11285	55285.99801	<1	<1	0.03	
972 (B)	30766.11285	55285.99801	<1	<1	0.02	
976	30773.40458	54960.73377	<0.1	<0.1	0.03	
977 (A)	30769.98050	55010.61638	<0.1	<0.1	0.05	<1
977 (B)	30769.98050	55010.61638	<0.1	<0.1	0.11	
978 (A)	30766.55642	55060.49900	<0.1	<0.1	0.05	
978 (B)	30766.55642	55060.49900	<0.1	<0.1	0.05	

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
982 (A)	30747.48819	55259.54093	<1	<1	0.18	1.4
982 (B)	30747.48819	55259.54093	<1	<1	0.04	
983 (A)	30742.96068	55309.32319	<1	<1	0.23	
983 (B)	30742.96068	55309.32319	<1	<1	0.25	
984 (A)	30738.43318	55359.10546	<1	<1	0.29	<1
984 (B)	30738.43318	55359.10546	<1	<1	0.05	
985 (A)	30733.90568	55408.88773	<1	<1	0.03	
985 (B)	30733.90568	55408.88773	<1	<1	0.23	

NOTE: Samples listed as (B) were taken from depths that ranged from 18-36 inches. All other samples were taken from 0-18 inches. Shaded entries are possible confirmation levels or higher for PCB, Hg, or VOC.

June 18, 1987

SECTION 3 PIDAS

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
187 (A)	29696.36635	53327.32940	<1	<1	0.19	<1
187 (B)	29696.36635	53327.32940	<1	<1	0.16	
193	29395.12641	55587.32944	<1	<1	0.65	
195	29421.05936	55683.90833	1.0	1.0	2.1	
197 (A)	29322.29044	55373.91688	<1	<1	1.1	
197 (B)	29322.29044	55373.91688	<1	<1	0.44	
199	29348.22339	55470.49577	<1	<1	0.29	
200 (A)	29361.18987	55518.78521	<1	<1	0.08	
200 (B)	29361.18987	55518.78521	<1	<1	0.12	
* 582 (A)	29467.96240	55800.74200	<1	<1	240	
582 (B)	29467.96240	55800.74200	<1	<1	0.57	
583 (A)	29437.67260	55803.62040	<1	<1	0.89	
583 (B)	29437.67260	55803.62040	<1	<1	1.0	
597 (A)	29436.94247	56225.85612	<1	<1	0.17	<1
597 (B)	29436.94247	56225.85612	<1	<1	0.25	
598	29440.58122	56175.98871	<1	<1	0.86	<1
599 (A)	29444.21997	56126.12129	<1	<1	1.0	<1
599 (B)	29444.21997	56126.12129	<1	<1	0.31	
* 601	29451.49747	56026.38645	<1	<1	15	<1
* 602 (A)	29455.13622	55976.51903	<1	1.0	440	<1
* 602 (B)	29455.13622	55976.51903	<1	1.0	21	
619 (A)	29407.02203	56223.67288	<1	<1	0.97	<1
619 (B)	29407.02203	56223.67288	<1	<1	1.2	
625 (A)	29428.85451	55924.46836	<1	<1	2.6	<1
625 (B)	29428.85451	55924.46836	<1	<1	3.2	
626 (A)	29432.49326	55874.60094	<1	<1	0.49	
626 (B)	29432.49326	55874.60094	<1	<1	0.36	
642	29427.44027	56149.96315	<1	<1	0.72	<1
644 (A)	29434.71777	56050.22831	<1	<1	2.4	<1
644 (B)	29434.71777	56050.22831	<1	<1	1.0	
* 645 (A)	29438.35651	56000.36090	1.0	<1	1550	<1
645 (B)	29438.35651	56000.36090	<1	<1	6.8	
650 (A)	29349.44150	55359.34940	<1	<1	7.40	
650 (B)	29349.44150	55359.34940	<1	<1	0.65	
651	29316.72570	55353.19280	<1	<1	0.77	
654 (A)	29454.04970	54543.54480	<1	<1	0.03	1.6
654 (B)	29454.04970	54543.54480	<1	<1	0.03	
667 (A)	29379.07403	55319.07641	<1	<1	0.58	<1
667 (B)	29379.07403	55319.07641	<1	<1	0.17	
* 668	29408.70656	55278.80343	<1	<1	115	
671 (A)	29497.60416	55157.98449	<1	6.9	0.68	
671 (B)	29497.60416	55157.98449	<1	<1	0.03	

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
672 (A)	29527.23669	55117.71151	<1	<1	0.05	
672 (B)	29527.23669	55117.71151	<1	<1	0.08	
676	29645.76682	54956.61959	<1	<1	1.1	
677 (A)	29675.39936	54916.34661	<1	<1	1.3	<1
677 (B)	29675.39936	54916.34661	<1	<1	2.0	
678 (A)	29705.03189	54876.07362	<1	<1	0.04	
678 (B)	29705.03189	54876.07362	<1	<1	0.03	
679 (A)	29734.66442	54835.80064	<1	<1	0.42	
679 (B)	29734.66442	54835.80064	<1	<1	0.12	
680 (A)	29325.27773	55341.56989	<1	<1	1.2	<1
680 (B)	29325.27773	55341.56989	<1	<1	0.21	
681 (A)	29354.91026	55301.29691	<1	<1	0.50	
681 (B)	29354.91026	55301.29691	<1	<1	0.32	
682 (A)	29384.54280	55261.02393	<1	<1	1.1	
682 (B)	29384.54280	55261.02393	<1	<1	0.25	
* 683	29414.17533	55220.75095	<1	<1	367	
685	29473.44040	55140.20499	<1	<1	0.20	
686	29503.07293	55099.93201	VOC only	VOC only	VOC only	<1
687	29532.70546	55059.65903	<1	<1	0.06	
688 (A)	29562.33799	55019.38605	<1	<1	1.6	
688 (B)	29562.33799	55019.38605	<1	<1	0.25	
689	29591.97053	54979.11306	<1	<1	0.94	
690	29621.60306	54938.84008	<1	<1	2.20	
691	29651.23559	54898.56710	<1	<1	0.30	
692	29680.86812	54858.29412	<1	<1	0.86	
693	29710.50066	54818.02114	<1	<1	0.09	
696	29411.44095	55249.77719	<1	<1	2.5	
698 (A)	29470.70601	55169.23123	<1	1	0.25	<1
698 (B)	29470.70601	55169.23123	<1	<1	1.2	
699	29500.33854	55128.95825	<1	3	0.37	
701 (A)	29559.60361	55048.41229	<1	<1	0.55	
* 701 (B)	29559.60361	55048.41229	<1	<1	11	
702	29589.23614	55008.13931	<1	<1	0.53	<1
706 (A)	29707.76627	54847.04738	<1	<1	0.04	<1
706 (B)	29707.76627	54847.04738	<1	<1	0.02	
707 (A)	29742.07664	54800.41685	<1	<1	1.5	<1
707 (B)	29742.07664	54800.41685	<1	<1	0.46	
708 (A)	29723.99066	54766.06827	<1	<1	0.03	
708 (B)	29723.99066	54766.06827	<1	<1	0.03	
709 (A)	29685.40952	54734.26425	<1	<1	0.07	<1
709 (B)	29685.40952	54734.26425	<1	<1	0.07	
710	29646.82839	54702.46023	<1	<1	0.03	<1
714	29492.50384	54575.24413	<1	<1	0.25	<1

Hole No.	North Coord.	East Coord.	PCB 1254 (µg/g)	PCB 1260 (µg/g)	Hg (µg/g)	VOC (ppm)
715 (A)	29704.90825	54789.21695	<1	<1	0.12	
715 (B)	29704.90825	54789.21695	<1	<1	0.04	
716	29666.32711	54757.41293	<1	<1	0.03	3.0
717 (A)	29627.74597	54725.60890	1.0	<1	0.02	2.6
717 (B)	29627.74597	54725.60890	<1	<1	0.03	
718	29589.16484	54693.80488	<1	<1	0.05	<1
719 (A)	29550.58370	54662.00086	<1	<1	0.04	3.4
719 (B)	29550.58370	54662.00086	<1	<1	0.04	
720	29512.00256	54630.19684	<1	<1	0.05	5.8
721	29473.42142	54598.39282	<1	<1	0.96	
722	29434.84029	54566.58879	<1	<1	2.30	
723	29695.15888	54761.74060	<1	<1	0.04	
725 (A)	29617.99661	54698.13255	<1	<1	0.05	<1
725 (B)	29617.99661	54698.13255	<1	<1	0.04	
727 (A)	29540.83434	54634.52451	<1	<1	0.04	<1
727 (B)	29540.83434	54634.52451	<1	<1	0.06	
731 (A)	29463.97631	54494.54008	<1	<1	0.03	
731 (B)	29463.97631	54494.54008	<1	<1	0.03	
732	29473.90293	54445.53536	<1	<1	0.03	<1
733	29483.82955	54396.53065	<1	<1	0.21	<1
734 (A)	29493.75617	54347.52593	<1	<1	0.12	<1
734 (B)	29493.75617	54347.52593	<1	<1	0.15	
735	29503.68279	54298.52121	<1	<1	0.26	1.1
736	29513.60941	54249.51650	<1	<1	0.20	
737 (A)	29523.53603	54200.51178	<1	<1	0.03	1.0
737 (B)	29523.53603	54200.51178	<1	<1	0.04	
739 (A)	29543.38926	54102.50235	<1	<1	0.11	
739 (B)	29543.38926	54102.50235	<1	<1	0.18	
740	29553.31588	54053.49763	<1	<1	4.5	
741	29563.24250	54004.49291	<1	<1	4.4	
743	29583.09574	53906.48348	<1	<1	0.29	
744	29593.02236	53857.47876	<1	<1	1.6	
747 (A)	29622.80221	53710.46461	<1	<1	0.13	
747 (B)	29622.80221	53710.46461	<1	<1	0.11	
748	29632.72883	53661.45990	<1	<1	0.69	<1
749 (A)	29642.65545	53612.45518	<1	<1	0.13	2.9
749 (B)	29642.65545	53612.45518	<1	<1	0.21	
750 (A)	29652.58207	53563.45046	<1	<1	0.12	
750 (B)	29652.58207	53563.45046	<1	<1	0.08	
754	29424.64683	54537.58882	<1	<1	0.42	
755	29434.57345	54488.58410	<1	<1	0.16	1.3
758 (A)	29464.35330	54341.56995	<1	<1	0.20	
758 (B)	29464.35330	54341.56995	<1	<1	0.34	

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
759 (A)	29474.27922	54292.56523	<1	<1	0.25	
759 (B)	29474.27922	54292.56523	<1	<1	0.40	
760 (A)	29484.20654	54243.56052	<1	<1	0.09	
760 (B)	29484.20654	54243.56052	<1	<1	0.14	
762 (A)	29504.05978	54145.55108	<1	<1	0.16	1.1
762 (B)	29504.05978	54145.55108	<1	<1	0.16	
763	29513.98639	54096.54637	<1	<1	0.15	
765	29533.83963	53998.53693	<1	<1	0.19	
767 (A)	29553.69287	53900.52750	<1	<1	0.16	1.5
767 (B)	29553.69287	53900.52750	<1	<1	0.18	
767 (C)*	29553.69287	53900.52750	<1	<1	0.20	
768	29563.61949	53851.52278	<1	<1	0.12	
769 (A)	29573.54610	53802.51807	<1	<1	0.11	<1
769 (B)	29573.54610	53802.51807	<1	<1	0.07	
770*	29583.47272	53753.51335	<1	<1	0.13	
770 (A)	29583.47272	53753.51335	<1	<1	0.23	<1
770 (B)	29583.47272	53753.51335	<1	<1	0.13	
772	29603.32596	53655.50392	<1	<1	0.13	
773 (A)	29613.25257	53606.49920	<1	<1	0.33	
773 (B)	29613.25257	53606.49920	<1	<1	0.92	
774 (A)	29623.17917	53557.49448	<1	<1	1.6	
774 (B)	29623.17917	53557.49448	<1	<1	1.9	
775 (A)	29633.10581	53508.48977	<1	<1	1.1	<1
775 (B)	29633.10581	53508.48977	<1	<1	0.24	
776 (A)	29643.03243	53459.48505	<1	<1	1.3	
776 (B)	29643.03243	53459.48505	<1	<1	0.84	
777 (A)	29652.95904	53410.48033	<1	<1	0.62	<1
777 (B)	29652.95904	53410.48033	<1	<1	0.72	
778	29662.88566	53361.47562	<1	<1	2.0	
782	29474.09143	54369.05030	<1	<1	0.21	
786	29513.79790	54173.03143	1.0	<1	0.62	<1
794	29593.21085	63780.99370	<1	<1	0.11	
795 (A)	29603.13746	53731.98898	<1	<1	0.31	<1
795 (B)	29603.13746	53731.98898	<1	<1	0.26	
797 (A)	29622.99070	53633.97955	<1	<1	0.15	<1
797 (B)	29622.99070	53633.97955	<1	<1	0.22	
800 (A)	29652.77056	53486.96540	1.3	<1	4.7	
800 (B)	29652.77056	53486.96540	<1	<1	0.15	
801	29662.69718	53437.96068	<1	<1	4.9	<1
802	29672.62379	53388.95597	<1	<1	0.59	<1
803 (A)	29680.39850	53350.57460	<1	<1	0.20	
803 (B)	29680.39850	53350.57460	<1	<1	0.14	
804	29739.99356	53382.98566	<1	<1	0.36	<1

*(C) Soil taken from deeper than 3 feet.

Hole No.	North Coord.	East Coord.	PCB 1254 (µg/g)	PCB 1260 (µg/g)	Hg (µg/g)	VOC (ppm)
* 805 (A)	29789.62983	53389.00572	<1	1.0	12	<1
805 (B)	29789.62983	53389.00572	<1	<1	2.0	
806 (A)	29839.26609	53395.02578	<1	<1	0.06	1.6
806 (B)	29839.26609	53395.02578	<1	<1	0.03	
807	29888.90236	53401.04584	1.0	<1	1.5	<1
808	29938.53862	53407.06590	1.0	<1	2.3	1.2
809	29988.17489	53413.08596	1.4	<1	0.19	<1
810 (A)	30037.81115	53419.10603	<1	<1	0.06	<1
810 (B)	30037.81115	53419.10603	<1	<1	0.09	
825 (A)	29746.01361	53333.34946	<1	<1	0.51	<1
825 (B)	29746.01361	53333.34946	<1	<1	1.8	
* 826 (A)	29795.64988	53339.36952	1.5	1.6	738	21.2
* 826 (B)	29795.64988	53339.36952	<1	1.8	185	
827 (A)	29845.28614	53345.38958	<1	<1	3.8	<1
827 (B)	29845.28614	53345.38958	<1	<1	0.24	
828	29894.92241	53351.40964	<1	<1	3.1	
831 (A)	30043.83121	53369.46982	<1	<1	1.0	<1
831 (B)	30043.83121	53369.46982	<1	<1	0.12	
846	29767.82172	53361.17759	<1	<1	0.10	<1
847 (A)	29817.45798	53367.19765	<1	<1	0.14	<1
847 (B)	29817.45798	53367.19765	<1	<1	0.16	
850	29966.36678	53385.25783	<1	<1	0.15	<1
986 (A)	29454.99591	55752.45255	<1	<1	0.37	
986 (B)	29454.99591	55752.45255	<1	<1	0.12	
987	29442.02943	55704.16311	<1	<1	0.34	
988	29429.06295	55655.87366	<1	<1	0.30	
989 (A)	29416.09647	55607.58422	<1	<1	3.4	
989 (B)	29416.09647	55607.58422	<1	<1	0.30	
990 (A)	29403.12999	55559.29478	<1	<1	0.17	
990 (B)	29403.12999	55559.29478	<1	<1	0.11	
992	29377.19703	55462.71589	<1	<1	0.08	
995 (A)	29426.02225	55760.23244	<1	<1	0.18	
995 (B)	29426.02225	55760.23244	<1	<1	0.65	
996	29413.05577	55711.94299	<1	<1	0.12	
997	29400.08929	55663.65355	<1	<1	0.13	
998	29387.12282	55615.36410	<1	<1	0.76	
999	29374.15634	55567.07466	<1	<1	0.1	1.0

*Adjacent to holes (A) and (B).

NOTE: Samples listed as (B) were taken from depths that ranged from 18-36 inches. All other samples were taken from 0-18 inches. Shaded entries are possible confirmation levels or higher for PCB, Hg, or VOC.

June 26, 1987

SECTION 4 PIDAS

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
18	30744.30	53508.43	1.2	<1	9.63	2.1
18A	30805.77	53461.82	<1	<1	3.86	<1
19 (A)	30877.00	54021.00	3.0	1.0	7.7	
19A	30916.66	54015.29	<1	<1	1.3	
* 19 (B)	30877.00	54021.00	1.9	1.0	15	
812 (A)	30137.08368	53431.14615	<1	1.0	1.2	
812 (B)	30137.08368	53431.14615	<1	<1	0.29	
816 (A)	30335.62875	53455.22640	<1	<1	0.43	
816 (B)	30335.62875	53455.22640	<1	<1	0.58	
817 (A)	30385.26501	53461.24646	<1	<1	0.97	
817 (B)	30385.26501	53461.24646	<1	<1	1.3	
818	30434.90128	53467.26652	<1	<1	1.1	
819 (A)	30484.53754	53473.28658	1.0	<1	0.49	
819 (B)	30484.53754	53473.28658	<1	<1	0.09	
820 (A)	30534.17381	53479.30664	<1	<1	1.2	
820 (B)	30534.17381	53479.30664	<1	<1	0.62	
821	30583.81007	53485.32670	<1	<1	0.19	<1
822	30633.44634	53491.34677	<1	<1	1.00	
* 823	30683.08261	53497.36683	8.5	<1	40	
824 (A)	30732.71887	53503.38689	<1	<1	1.46	6.8
824 (B)	30732.71887	53503.38689	<1	<1	0.50	
833 (A)	30143.10374	53381.50994	<1	<1	0.19	
833 (B)	30143.10374	53381.50994	<1	<1	0.02	
836	30292.01254	53399.57012	<1	1.4	1.83	1.4
837	30341.6488	53405.5902	*	*	*	2.1
838	30391.28507	53411.61024	<1	<1	0.50	1.0
840	30490.55760	53423.65036	<1	<1	1.4	<1
841	30540.19387	53429.67042	<1	<1	6.2	<1
842	30589.83013	53435.69048	<1	1.0	3.3	<1
* 844	30689.10266	53447.73060	7.7	<1	64	
* 845	30738.73893	53453.75066	21	<1	5570	7.3
850	29966.36678	53385.25783	*	*	*	<1
854	30164.91184	53409.33808	<1	<1	0.74	
856	30264.18438	53421.37820	<1	<1	0.09	
858	30363.45691	53433.41832	<1	<1	0.79	<1
860	30462.72944	53445.45844	<1	<1	5.8	
863 (A)	30611.63824	53463.51862	<1	<1	0.12	1.3
863 (B)	30611.63824	53463.51862	1.0	<1	4.9	
866 (A)	30790.03404	53485.15510	<1	<1	0.41	1.5
866 (B)	30790.03404	53485.15510	<1	<1	0.05	
867	30784.12291	53557.45560	<1	<1	3.80	<1

Hole No.	North Coord.	East Coord.	PCB 1254 (µg/g)	PCB 1260 (µg/g)	Hg (µg/g)	VOC (ppm)
868 (A)	30793.94582	53606.48121	<1	<1	0.30	1.7
868 (B)	30793.94582	53606.48121	<1	<1	0.28	
869 (A)	30803.76873	53655.50682	<1	<1	0.42	6.4
869 (B)	30803.76873	53655.50682	<1	<1	0.15	
870	30813.59164	53704.53243	<1	<1	0.51	
871	30823.41456	53753.55804	<1	<1	0.03	
872	30833.23747	53802.58365	<1	<1	0.21	
873	30843.06038	53851.60926	<1	<1	0.09	
874 (A)	30852.88329	53900.63487	<1	<1	0.14	
874 (B)	30852.88329	53900.63487	<1	<1	0.04	
875	30862.70620	53949.66048	<1	<1	2.6	<1
879 (A)	30889.72424	54170.45933	<1	<1	5.1	
879 (B)	30889.72424	54170.45933	1.7	1.0	8.8	
880 (A)	30893.96565	54220.27911	<1	1.0	6.7	
880 (B)	30893.96565	54220.27911	<1	1.0	1.3	
881 (A)	30898.20706	54270.09889	<1	<1	3.3	<1
881 (B)	30898.20706	54270.09889	<1	<1	2.0	
882 (A)	30902.44848	54319.91867	<1	<1	2.2	
882 (B)	30902.44848	54319.91867	<1	<1	0.55	
883 (A)	30906.68989	54369.73845	<1	<1	4.9	
883 (B)	30906.68989	54369.73845	<1	<1	5.8	
891 (A)	30813.52043	53500.57168	<1	<1	0.31	1.9
891 (B)	30813.52043	53500.57168	<1	<1	0.05	
892	30823.34335	53549.59728	<1	<1	3.4	1.0
893 (A)	30833.16626	53598.62289	<1	<1	0.35	
893 (B)	30833.16626	53598.62289	<1	<1	0.09	
895	30852.81209	53696.67411	<1	<1	0.40	<1
896 (A)	30862.63501	53745.69972	<1	<1	0.10	1.4
896 (B)	30862.63501	53745.69972	<1	<1	0.04	
897 (A)	30872.45793	53794.72533	<1	<1	0.70	1.5
897 (B)	30872.45793	53794.72533	<1	<1	0.27	
898	30882.28084	53843.75094	<1	<1	0.12	1.1
899	30892.10376	53892.77655	<1	<1	0.82	
900	30901.92667	53941.80216	<1	<1	0.38	1.5
902	30921.09721	54067.42665	<1	<1	10	
* 903 (A)	30925.33862	54117.24642	<1	<1	29	
* 903 (B)	30925.33862	54117.24642	<1	<1	87	
904 (A)	30929.58004	54167.06620	<1	2.4	3.6	
904 (B)	30929.58004	54167.06620	<1	1.7	3.9	
905 (A)	30933.82145	54216.88598	<1	<1	0.68	
905 (B)	30933.82145	54216.88598	<1	<1	0.11	
906 (A)	30938.06286	54266.70576	<1	<1	0.58	
906 (B)	30938.06286	54266.70576	<1	<1	0.11	
907 (A)	30942.30427	54316.52554	<1	<1	0.31	
907 (B)	30942.30427	54316.52554	<1	<1	0.09	

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
908	30946.54569	54366.34532	<1	<1	0.15	
909 (A)	30950.78710	54416.16510	<1	<1	0.46	
909 (B)	30950.78710	54416.16510	<1	<1	0.06	
910	30955.02851	54465.98488	<1	<1	0.15	<1
916	30798.82167	53529.01364	1.0	<1	2.13	<1
918	30818.46750	53627.06486	<1	<1	0.59	15
919	30828.29041	53676.09047	<1	<1	0.08	
920	30838.11333	53725.11608	<1	<1	0.15	23
921	30847.93624	53774.14169	<1	<1	0.09	
924	30877.40498	53921.21851	<1	<1	0.05	<1
934	30932.97991	54442.77156	<1	1.0	0.76	

*no soil taken

NOTE: Samples listed as (B) were taken from depths that ranged from 18-36 inches. All other samples were taken from 0-18 inches. Shaded entries are possible confirmation levels or higher for PCB, Hg, or VOC.

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Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
511	29546.85049	57672.02394	<1	<1	0.15	<1
514 (A)	29565.35473	57727.31945	<1	<1	0.16	
514 (B)	29565.35473	57727.31945	<1	<1	0.12	
517	29632.10485	57764.66138	<1	<1	0.13	
518	29594.10373	57732.16653	<1	<1	0.11	4.5
520	29519.98540	57668.78747	<1	<1	0.08	
523 (A)	29476.76362	57648.03054	<1	<1	0.11	
523 (B)	29476.76362	57648.03054	<1	<1	0.02	
524	29427.18254	57641.57169	1.0	<1	0.63	<1
525	29377.60146	57635.12284	1.0	<1	0.50	
526	29328.02038	57628.65399	<1	<1	4.4	
527 (A)	29472.88831	57677.77918	<1	<1	0.15	
527 (B)	29472.88831	57677.77918	<1	<1	0.15	
528 (A)	29423.30723	57671.32033	<1	<1	0.21	
528 (B)	29423.30723	57671.32033	<1	<1	0.81	
530	29324.14507	57658.40264	<1	<1	4.2	
531	29499.61650	57666.13428	<1	<1	0.03	<1
532	29450.03543	57659.67544	<1	<1	0.51	
535 (A)	29306.77550	57641.01319	<1	<1	0.43	<1
535 (B)	29306.77550	57641.01319	<1	<1	0.22	
538 (A)	29327.45662	57578.19901	<1	<1	3.2	
538 (B)	29327.45662	57578.19901	<1	<1	7.5	
539 (A)	29331.91324	57528.39802	1.0	<1	1.5	
539 (B)	29331.91324	57528.39802	<1	<1	2.0	
541 (A)	29340.82649	57428.79604	<1	<1	2.3	
541 (B)	29340.82649	57428.79604	1.0	<1	1.6	
542 (A)	29345.28311	57378.99505	<1	<1	1.9	
542 (B)	29345.28311	57378.99505	<1	<1	2.0	
543 (A)	29349.73973	57329.19406	<1	<1	1.1	
543 (B)	29349.73973	57329.19406	<1	<1	2.1	
544 (A)	29354.19635	57279.39307	<1	<1	3.1	
544 (B)	29354.19635	57279.39307	<1	<1	4.2	
545	29358.65298	57229.59208	<1	<1	2.8	
552 (A)	29293.11936	57625.32602	<1	<1	1.5	
552 (B)	29293.11936	57625.32602	<1	<1	3.1	
553 (A)	29297.57598	57575.52503	<1	<1	7.7	
553 (B)	29297.57598	57575.52503	<1	<1	1.5	
554 (A)	29302.03261	57525.72404	<1	<1	0.79	<1
554 (B)	29302.03261	57525.72404	<1	<1	0.13	

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
555 (A)	29306.48924	57475.92305	<1	<1	0.17	
555 (B)	29306.48924	57475.92305	<1	<1	0.10	
556 (A)	29310.94587	57426.12206	<1	<1	0.44	<1
556 (B)	29310.94587	57426.12206	<1	<1	0.09	
557 (A)	29315.40250	57376.32107	<1	<1	1.7	
557 (B)	29315.40250	57376.32107	<1	<1	0.27	
558	29319.85913	57326.52009	<1	<1	0.47	<1
559 (A)	29324.31575	57276.71910	<1	<1	2.9	
559 (B)	29324.31575	57276.71910	<1	<1	0.10	
560 (A)	29328.77238	57226.91811	<1	<1	2.5	<1
560 (B)	29328.77238	57226.91811	<1	<1	0.68	
568	29314.74461	57551.96152	<1	<1	0.83	<1
570	29323.65776	57452.35934	1.0	<1	2.2	<1
572	29332.57100	57352.75736	<1	<1	1.2	<1
574 (A)	29341.48425	57253.15538	<1	<1	3.5	
574 (B)	29341.48425	57253.15538	<1	<1	1.8	
* 589	29407.83249	56624.79548	<1	1	19	
590 (A)	29411.47123	56574.92806	<1	<1	0.46	
590 (B)	29411.47123	56574.92806	<1	<1	0.53	
591 (A)	29415.10998	56525.06064	<1	<1	1.5	<1
591 (B)	29415.10998	56525.06064	<1	<1	1.1	
592	29418.74873	56475.19322	<1	2.4	2.3	
593 (A)	29422.38748	56425.32580	<1	<1	0.43	<1
593 (B)	29422.38748	56425.32580	<1	<1	0.19	
594	29426.02623	56375.45838	<1	<1	1.3	
595	29429.66498	56325.59056	<1	<1	2.2	
596 (A)	29433.30373	56275.72354	<1	<1	1.5	
596 (B)	29433.30373	56275.72354	<1	<1	0.20	
611	29377.91206	56622.61223	<1	<1	1.8	
613 (A)	29385.18955	56522.87739	<1	<1	3.0	
613 (B)	29385.18955	56522.87739	<1	<1	4.2	
* 614 (A)	29388.82830	56473.00997	<1	<1	30	
614 (B)	29388.82830	56473.00997	<1	<1	1.2	
* 615	29392.46704	56423.14255	<1	<1	11.7	
616 (A)	29396.10579	56373.27513	<1	<1	0.34	1.2
616 (B)	29396.10579	56373.27513	<1	<1	0.41	
* 617 (A)	29399.74454	56323.40771	<1	<1	139	
* 617 (B)	29399.74454	56323.40771	<1	<1	26	
618 (A)	29403.38328	56273.54030	<1	<1	0.26	<1
618 (B)	29403.38328	56273.54030	<1	<1	0.12	

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
632	29391.05279	56648.63734	<1	<1	47	
634	29398.33029	56548.70251	<1	<1	0.77	
636	29405.60789	56449.16789	<1	<1	0.61	
638	29412.88527	56349.43283	<1	<1	0.31	
640 (A)	29420.16277	56249.69799	<1	<1	0.11	
640 (B)	29420.16277	56249.69799	<1	<1	0.48	

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Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
6	30497.00	58110.93	1.0	<1	0.14	
6A	30485.16	58145.88	<1	<1	0.13	
8A	30194.27	57899.08	<1	<1	0.04	
335	31295.78337	57155.22118	<1	<1	0.24	
336 (A)	31289.83990	57204.86667	<1	<1	0.06	
336 (B)	31289.83990	57204.86667	<1	<1	0.05	
337	31283.89642	57254.51217	<1	<1	3.2	<1
338 (A)	31277.95295	57304.15766	<1	<1	0.09	
338 (B)	31277.95295	57304.15766	<1	<1	0.04	
339	31292.00947	57353.80316	<1	<1	0.10	<1
340 (A)	31266.06600	57403.44865	<1	<1	0.07	
340 (B)	31266.06600	57403.44865	<1	<1	0.04	
341 (A)	31260.12252	57453.09414	<1	<1	0.39	<1
341 (B)	31260.12252	57453.09414	<1	<1	0.07	
342 (A)	31252.17905	57502.73964	<1	<1	0.06	
342 (B)	31252.17905	57502.73964	<1	<1	0.06	
343 (A)	31248.23558	57552.38513	<1	<1	0.03	<1
343 (B)	31248.23558	57552.38513	<1	<1	0.07	<1
344 (A)	31242.29210	57602.03063	<1	<1	0.13	
344 (B)	31242.29210	57602.03063	<1	<1	0.06	
345 (A)	31236.34863	57651.67612	<1	<1	0.21	
345 (B)	31236.34863	57651.67612	<1	<1	0.04	
346	31230.40515	57701.32162	<1	<1	0.25	
347 (A)	31224.46168	57750.96711	<1	<1	0.04	
347 (B)	31224.46168	57750.96711	<1	<1	0.08	
348 (A)	31218.51820	57800.61260	<1	<1	2.64	
348 (B)	31218.51820	57800.61260	<1	<1	0.33	
349 (A)	31212.57473	57850.25810	<1	<1	0.13	
349 (B)	31212.57473	57850.25810	<1	<1	0.07	
350 (A)	31206.63125	57899.90359	<1	<1	0.08	
350 (B)	31206.63125	57899.90359	<1	<1	0.16	
351 (A)	31200.68778	57949.54909	<1	<1	0.07	
351 (B)	31200.68778	57949.54909	<1	<1	0.17	
352 (A)	31194.74430	57999.19458	<1	<1	0.27	
352 (B)	31194.74430	57999.19458	<1	<1	0.48	
353 (A)	31188.80083	58048.84008	<1	<1	0.56	
353 (B)	31188.80083	58048.84008	<1	<1	0.86	
354	31182.85736	58098.48557	<1	<1	0.10	<1
379	31313.64876	57132.18147	<1	<1	0.16	
380	31307.70528	57181.82697	<1	<1	0.25	<1
381 (A)	31301.76180	57231.47246	<1	<1	0.05	
381 (B)	31301.76180	57231.47246	<1	<1	0.06	

Hole No.	North Coord.	East Coord.	PCB 1254 (µg/g)	PCB 1260 (µg/g)	Hg (µg/g)	VOC (ppm)
382 (A)	31295.81832	57281.11795	<1	<1	0.13	2.1
382 (B)	31295.81832	57281.11795	<1	<1	0.16	
384 (A)	31283.93137	57380.40894	<1	<1	0.07	<1
384 (B)	31283.93137	57380.40894	<1	<1	0.14	
385 (A)	31277.98789	57430.05444	<1	<1	0.11	
385 (B)	31277.98789	57430.05444	<1	<1	0.04	
386 (A)	31272.04441	57479.69993	<1	<1	0.37	<1
386 (B)	31272.04441	57479.69993	<1	<1	0.09	
387 (A)	31266.10093	57529.34542	<1	<1	0.42	
387 (B)	31266.10093	57529.34542	<1	<1	0.14	
388 (A)	31260.15745	57578.90092	<1	<1	0.11	1.6
388 (B)	31260.15745	57578.90092	<1	<1	0.25	1.6
389 (A)	31254.21397	57628.63641	<1	<1	0.55	
389 (B)	31254.21397	57628.63641	<1	<1	0.15	
390	31248.27050	57678.28191	<1	<1	0.06	<1
391 (A)	31242.32702	57727.92740	<1	<1	0.09	
391 (B)	31242.32702	57727.92740	<1	<1	0.07	
392 (A)	31236.38354	57777.57289	<1	<1	0.21	
392 (B)	31236.38354	57777.57289	<1	<1	0.07	
393 (A)	31230.44006	57827.21839	<1	<1	0.07	
393 (B)	31230.44006	57827.21839	<1	<1	0.06	
394 (A)	31224.49658	57876.86388	<1	<1	0.26	
394 (B)	31224.49658	57876.86388	<1	<1	0.07	
395 (A)	31218.55310	57926.50938	<1	<1	0.29	
395 (B)	31218.55310	57926.50938	<1	<1	0.05	
396 (A)	31212.60962	57976.25487	<1	<1	0.17	
396 (B)	31212.60962	57976.25487	<1	<1	0.06	
397	31206.66615	58025.80036	<1	<1	0.25	
398 (A)	31200.72267	58075.44586	<1	<1	0.33	
398 (B)	31200.72267	58075.44586	<1	<1	0.29	
399	31194.00491	58131.55832	VOC only	VOC only	VOC only	<1
402	31081.00100	58113.55156	<1	1.0	0.46	
403 (A)	31031.00150	58113.32735	<1	<1	0.15	
403 (B)	31031.00150	58113.32735	<1	<1	0.10	
404 (A)	30981.00201	58113.10313	<1	<1	0.10	
404 (B)	30981.00201	58113.10313	<1	<1	0.26	
405	30931.00241	58112.87892	<1	<1	0.09	
406	30881.00301	58112.65470	<1	<1	0.25	
407	30831.00351	58112.43049	1.0	<1	0.12	
408 (A)	30781.00402	58112.20627	<1	<1	1.8	<1
408 (B)	30781.00402	58112.20627	<1	<1	2.9	<1
409 (A)	30781.00402	58112.20617	<1	<1	0.04	
409 (B)	30731.00452	58111.98205	<1	<1	0.07	
410	30681.00502	58111.75784	<1	<1	0.27	

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
411 (A)	30631.00553	58111.53362	<1	<1	0.07	
411 (B)	30631.00553	58111.53362	<1	<1	0.10	
412 (A)	30581.00603	58111.30941	<1	<1	0.06	
412 (B)	30581.00603	58111.30941	1.0	<1	0.09	
413	31180.84304	58148.99965	VOC only	VOC only	VOC only	<1
417	30980.84505	58148.10280	<1	<1	0.08	
418	30930.84556	58147.87859	<1	<1	0.07	
419 (A)	30880.84606	58147.65438	<1	<1	0.05	
419 (B)	30880.84606	58147.65438	<1	<1	0.04	
420	30830.84656	58147.43017	<1	<1	0.07	
426 (A)	30530.84958	58146.08489	<1	<1	0.08	
426 (B)	30530.84958	58146.08489	<1	1.0	0.07	
427	31155.92177	58131.38772	<1	<1	0.12	<1
429	31055.92278	58130.93928	<1	<1	0.13	<1
431	30955.92378	58130.49085	<1	<1	0.71	<1
433	30855.92479	58130.04241	<1	<1	0.02	<1
435	30755.92579	58129.59397	<1	<1	0.97	<1
437	30655.92680	58129.14554	<1	<1	0.08	<1
439	30555.92780	58128.69710	<1	<1	0.09	<1
440 (A)	31131.00050	58113.77578	<1	<1	0.50	
440 (B)	31131.00050	58113.77578	<1	<1	0.15	
442 (A)	30531.00653	58111.08519	<1	<1	0.10	<1
442 (B)	30531.00653	58111.08519	<1	<1	0.10	<1
446 (A)	30438.68645	58029.69535	1.0	<1	0.04	
446 (B)	30438.68645	58029.69535	<1	<1	0.14	
447 (A)	30409.52957	57989.07667	<1	<1	0.08	1.0
447 (B)	30409.52957	57989.07667	<1	<1	0.04	
448 (A)	30380.37270	57948.45800	1.3	<1	0.11	<1
448 (B)	30380.37270	57948.45800	<1	1.8	0.71	
453 (A)	30443.47204	58087.80820	<1	<1	0.06	
453 (B)	30443.47204	58087.80820	1.0	<1	0.20	
454 (A)	30414.31518	58047.18952	<1	<1	0.38	
454 (B)	30414.31518	58047.18952	<1	<1	0.11	
455 (A)	30385.15831	58006.57084	<1	<1	0.52	1.0
455 (B)	30385.15831	58006.57084	<1	1.0	0.20	
456	30356.00144	57965.95216	<1	1.7	0.35	
457 (A)	30326.84458	57925.33348	<1	1.0	0.79	<1
457 (B)	30326.84458	57925.33348	<1	<1	0.09	
458	30297.68771	57884.71480	1.0	<1	3.7	<1
459	30470.23612	58099.37044	<1	<1	4.1	
460	30441.07922	58058.75178	<1	<1	0.16	<1
461	30411.92233	58018.13312	1.1	<1	0.26	<1

Hole No.	North Coord.	East Coord.	PCB 1254 (μg/g)	PCB 1260 (μg/g)	Hg (μg/g)	VOC (ppm)
463 (A)	30353.60855	57936.89580	<1	<1	0.19	
463 (B)	30353.60855	57936.89580	<1	<1	0.22	
464 (A)	30324.45165	57896.27714	<1	<1	0.20	
464 (B)	30324.45165	57896.27714	<1	1.7	1.60	
465 (A)	30295.29476	57855.65848	<1	<1	0.07	
465 (B)	30295.29476	57855.65848	<1	<1	0.06	<1
466	30274.02755	57826.03099	<1	<1	0.03	

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APPENDIX E. RESULTS OF THE COMPREHENSIVE SURFACE SOIL SURVEY

Appendix E. Results of the comprehensive surface soil survey.

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1321	27950	61250	0.19
YS1322	27950	61350	0.64
YS1323	27950	61450	0.16
YS1324	27950	61550	0.02
YS1325	27940	61650	0.25
YS1326	27950	61750	0.03
YS1327	27950	61850	0.18
YS1328	27950	61950	0.15
YS1329	27950	62050	0.12
YS1330	27950	62150	0.17
YS1344	27950	62250	0.20
YS1313	27950	62350	0.16
YS1314	27950	62450	0.49
YS1316	28050	60850	0.35
YS1318	28050	61950	0.16
YS1319	28050	61050	0.11
YS1320	28050	61150	0.13
YS1315	28050	62450	0.10
YS1331	28150	59550	0.18
YS1332	28150	59650	0.25
YS1333	28150	59750	0.17
YS1334	28150	59850	0.11
YS1335	28150	59950	0.05
YS1336	28150	60050	0.25
YS1337	28150	60150	0.37
YS1338	28150	60250	0.30
YS1339	29150	60350	0.21
YS1340	28150	60450	0.24
YS1341	28150	60550	0.25
YS1342	28150	60650	0.26
YS1343	28150	60750	0.23
YS1317	28150	60850	0.18
YS1352	28100	61600	0.45
YS1351	28100	62000	0.31
YS1345	28150	62450	0.18
YS1400	28250	58950	0.23
YS1401	28240	59050	0.23
YS1402	28215	59150	0.16
YS1353	28200	61200	0.49
YS1346	28250	62550	0.23
YS1394	28350	58550	0.29
YS1395	28350	58650	0.37
YS1398	28350	58750	0.33
YS1399	28350	58850	0.37
YS1404	28350	59250	0.43
YS1405	28350	59350	0.41
YS14Q6	28350	59450	0.42

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1354	28300	60700	0.34
YS1347	28350	62650	0.22
YS1380	28450	57550	0.30
YS1381	28450	57650	0.27
YS1382	28450	57750	0.21
YS1383	28450	57850	0.23
YS1384	28450	57950	0.33
YS1389	28450	58050	0.21
YS1390	28450	58150	0.78
YS1391	28450	58250	0.18
YS1392	28450	58350	0.33
YS1393	28450	58450	0.27
YS1403	28450	59100	0.55
YS1407	28400	59400	0.60
YS1356	28450	60000	0.30
YS1355	28400	60300	0.64
YS1348	28450	62750	0.29
YS0733	28550	53350	0.36
YS0735	28550	53450	0.21
YS0736	28550	53550	0.23
YS1417	28550	55250	0.27
YS1416	28550	55350	3.60
YS1415	28550	55450	0.19
YS1414	28550	55550	0.29
YS1370	28550	56550	0.43
YS1371	28550	56650	0.38
YS1372	28550	56750	0.31
YS1373	28550	56850	0.29
YS1374	28550	56950	0.25
YS1375	28550	57050	0.32
YS1376	28550	57150	0.42
YS1377	28550	57250	0.32
YS1378	28550	57350	0.36
YS1379	28550	57450	0.24
YS1388	28550	57800	0.13
YS1396	28550	58300	0.90
YS1397	28500	58700	1.30
YS1349	28550	62850	0.15
YS0732	28650	53250	0.51
YS0737	28700	53400	0.13
YS0751	28700	53600	0.46
YS0752	28700	53800	1.60
YS0754	28650	53950	0.31
YS1418	28650	55150	0.17
YS1369	28650	55650	0.25
YS1368	28650	55750	0.18
YS1367	28650	55850	0.32

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1366	28650	55950	0.30
YS1365	28650	56050	0.34
YS1364	28650	56150	0.43
YS1363	28650	56250	0.91
YS1362	28650	56350	0.36
YS1361	28650	56450	0.52
YS1386	28600	57000	1.90
YS1350	28650	62950	0.20
YS1257	28650	63050	0.40
YS1258	28650	63150	0.38
YS1259	28650	63250	0.34
YS1260	28650	63350	0.49
YS1261	28650	63450	0.18
YS1262	28660	63550	0.19
YS1263	28650	63650	0.24
YB0298	28620	63740	66.00
YS1264	28650	63750	1.00
YS1265	28650	63850	0.16
YS1266	28650	63950	1.40
YS1267	28650	64050	0.08
YS1268	28650	64150	0.15
YS0731	28750	53150	0.40
YS0734	28750	53250	0.02
YS0755	28720	53950	0.14
YS0762	28750	54050	0.46
YS0761	28750	54150	0.35
YS0763	28750	54250	0.42
YS0760	28750	54350	0.88
YS0759	28750	54450	0.71
YS1408	28750	54650	0.26
YS1409	28750	54750	0.27
YS1410	28750	54850	2.40
YS1411	28750	54950	0.61
YS1412	28750	55050	0.46
YS1413	28750	55150	0.39
YS1419	28750	55250	0.34
YS1385	28750	56600	0.28
YB0308	28750	61230	173.00
YB0307	28700	61350	254.00
YS1187	28737	61750	0.21
YS1186	28740	61850	0.26
YS1185	28740	61950	4.70
YB0289	28731	62030	0.31
YB0290	28731	62030	2.00
YS1184	28727	62039	0.28
YS1188	28750	62150	0.43
YS1189	28740	62250	0.30

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1190	28740	62350	0.19
YS1191	28774	62436	0.05
YS1225	28750	63050	0.46
YS1226	28750	63150	52.00
YS1241	28750	63250	5.40
YB0309	28740	63350	50.00
YS1242	28750	63350	13.00
YS1243	28750	64050	0.60
YS1283	28750	64150	0.14
YS0730	28850	53050	0.86
YS0748	28900	53200	1.70
YS0747	28900	53400	1.10
YS0749	28900	53600	1.20
YS0750	28900	53800	0.30
YS0753	28900	54000	0.92
YS0756	28900	54200	0.35
YS0758	28900	54400	1.20
YS1153	28900	59800	0.47
YS1154	28900	60000	0.06
YS1162	28900	60200	0.39
YS1161	28900	60406	0.30
YB0282	28860	60610	1.40
YS1163	28900	60600	1.50
YB0283	28900	60736	143.00
YB0284	28945	60890	1.00
YS1164	28900	60810	0.12
YS1174	28850	60950	0.14
YS1177	28920	61100	0.68
YS1192	28821	62176	1.70
YS1193	28827	62250	3.00
YS1194	28824	62350	0.08
YS1195	28824	62442	0.30
YS1216	28815	62850	0.64
YS1231	28850	63150	5.50
YS1230	28850	63250	17.00
YS1229	28880	63320	127.00
YS1244	28850	64150	0.84
YS0728	28950	52950	0.25
YS0729	28950	53050	0.52
YS0706	28980	59350	0.51
YS0707	28960	59450	0.78
YS0704	28950	59540	0.37
YS0708	28920	59650	0.69
YB0286	28985	60970	2.10
YS1172	28950	60950	0.35
YS1215	28950	62448	0.31
YS1227	28950	63250	33.00

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YB0294	28930	63340	185.00
YS1228	28950	63350	13.00
YS1245	28950	64150	0.34
YS0692	29050	52850	0.66
YS0722	29100	53000	0.18
YS0723	29100	53200	0.10
YS0724	29100	53400	0.09
YS0725	29100	53600	0.15
YS0726	29100	53800	0.22
YS0727	29100	54000	0.26
YS0738	29100	54200	0.14
YS0757	29100	54400	0.75
YS0697	29060	58850	0.36
YS0698	29050	58950	0.75
YS0700	29050	59150	0.13
YS0701	29080	59250	1.20
YS0702	29050	59350	0.24
YS0703	29040	59450	0.23
YS0705	29050	59550	0.02
YS0709	29070	59650	0.05
YS1155	29100	59800	0.28
YS1156	29100	60000	0.19
YS1160	29100	60400	0.17
YS1173	29030	60950	0.10
YS1176	29100	61100	0.29
YS1178	29150	61500	0.04
YB0287	29190	61750	1.50
YS1179	29140	61700	0.01
YB0291	29160	61985	142.00
YS1180	29140	61900	0.15
YS1210	29096	62250	0.90
YS1211	29097	62350	1.50
YS1214	29050	62448	0.14
YS1218	29136	63100	0.96
YS1217	29100	63300	0.11
YB0296	29040	63430	126.00
YS1248	29050	63440	167.00
YS1247	29050	64055	0.17
YS1246	29050	64130	0.08
YS0690	29150	52750	0.15
YS0691	29150	52800	1.50
YS0743	29180	57250	2.40
YS0744	29175	57350	1.60
YS0745	29170	57450	1.10
YS0746	29150	57550	2.00
YS0783	29150	57650	0.51
YS0721	29150	57750	0.37

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0780	29150	57850	0.52
YB0214	29170	57940	0.85
YS0779	29150	57950	19.00
YS0774	29150	58050	1.20
YS0773	29150	58150	0.54
YS0776	29160	58250	0.76
YS0775	29150	58350	0.26
YS0777	29130	58450	0.38
YS0693	29150	58550	0.60
YS0694	29150	58650	0.07
YS0695	29150	58750	0.13
YS0696	29150	58850	0.04
YS0699	29160	58950	0.95
YS0594	29150	59050	4.30
YS0591	29150	59150	1.70
YS0592	29150	59250	12.00
YS0593	29130	59350	3.20
YS0710	29120	59650	0.06
YS1204	29148	62120	0.66
YS1209	29150	62250	0.15
YS1212	29160	62350	2.00
YS1213	29150	62450	0.64
YS1249	29150	63460	10.00
YB0297	29149	63639	63.00
YS1250	29150	63550	0.23
YS1251	29150	63650	22.00
YS1252	29150	63750	1.40
YS1253	29150	63850	2.10
YS1254	29150	63950	1.30
YS1255	29150	64050	1.20
YS1256	29150	64150	0.64
YS1291	29150	64250	0.10
YS1292	29150	64350	0.20
YS1293	29150	64450	0.33
YS1294	29115	64550	0.08
YS1295	29130	64650	0.09
YS1296	29150	64750	0.11
YS1297	29150	64850	0.10
YS1298	29150	64950	0.09
YS1420	29300	49600	0.34
YS1421	29300	49800	0.36
YB0335	29225	50070	0.60
YS1422	29300	50000	0.39
YS1423	29300	50200	0.46
YS0678	29250	52650	0.65
YS0679	29300	52800	6.00
YS0680	29300	53000	0.11

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0681	29300	53200	0.29
YS0682	29300	53400	0.31
YS0683	29300	53600	0.37
YS0684	29300	53800	0.31
YS0685	29300	54000	0.27
YS0689	29250	54150	0.03
YS0688	29250	54250	0.10
YS0687	29250	54350	0.04
YS0686	29250	54450	0.04
YS0574	29240	54550	0.30
YS0571	29250	54650	0.20
YS0572	29250	54750	0.37
YS0562	29250	54850	0.19
YS0561	29250	54950	0.41
YS0560	29240	55050	0.26
YS0559	29250	55150	0.35
YS0557	29250	55250	0.32
YS0558	29250	55350	0.16
YS1360	29250	55450	0.28
YS1359	29250	55550	0.23
YS1358	29250	55650	0.39
YS1357	29250	55750	0.57
YS0425	29270	55950	1.10
YS0426	29260	56050	1.20
YS0427	29250	56150	0.90
YS0428	29250	56250	1.90
YS0429	29250	56350	1.40
YS0433	29230	56450	0.96
YS0434	29235	56550	7.90
YS0432	29240	56650	0.84
YS0435	29250	56950	0.54
YS0437	29250	57050	1.20
YS0447	29200	57150	0.43
YS0739	29250	57250	0.64
YS0740	29250	57350	1.60
YS0741	29250	57450	0.59
YS0742	29250	57550	1.40
YS0782	29250	57650	1.30
YS0720	29250	57750	0.15
YS0781	29250	57850	1.40
YS0778	29250	57950	1.30
YS0772	29260	58050	2.30
YB0213	29240	58120	2.70
YS0771	29250	58150	1.30
YS0770	29250	58250	1.50
YS0769	29260	58350	219.00
YS0768	29250	58450	124.00

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0595	29215	58550	4.00
YS0606	29250	58820	0.16
YS0711	29250	59660	0.60
YS1157	29250	60250	1.30
YS1159	29300	60400	2.30
YS1165	29370	60600	1.20
YS1166	29320	60800	0.26
YS1171	29275	60970	1.60
YS1175	29300	61100	0.27
YB0288	29250	61760	0.40
YS1206	29236	61700	0.33
YB0293	29235	61805	0.26
YS1203	29227	61849	0.89
YB0292	29206	61970	1.80
YS1202	29250	61950	0.18
YS1205	29250	62050	0.67
YS1207	29254	62150	0.06
YS1112	29300	62300	0.45
YS1113	29300	62500	0.16
YS1114	29300	62685	0.17
YS1115	29245	62900	0.11
YS1116	29260	63120	0.21
YS1238	29290	63300	0.52
YB0299	29212	63473	6.50
YS1269	29300	63500	0.29
YS1275	29300	63700	2.30
YS1276	29300	63900	1.00
YS1284	29300	64100	2.30
YS1289	29300	64300	0.17
YS1290	29300	64500	0.83
YS1300	29300	64700	0.13
YS1299	29300	64900	0.07
YS1426	29350	50350	0.34
YS1427	29350	50450	0.36
YB0310	29303	50565	2.60
YS1428	29350	50550	0.79
YS1429	29350	50650	0.62
YS1430	29350	50750	0.54
YS0676	29350	52550	0.65
YS0677	29350	52650	0.54
YS0582	29350	54150	0.04
YS0580	29350	54250	0.03
YS0579	29350	54350	0.04
YS0575	29350	54450	0.14
YS0573	29350	54550	0.05
YS0570	29350	54650	0.10
YS0667	29400	54800	0.15

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0664	29350	54950	0.27
YS0661	29350	55050	0.89
YS0659	29350	55195	1.80
YS0556	29350	55350	9.50
YS0554	29350	55450	0.22
YS0553	29325	55550	0.15
YS0430	29335	55650	0.02
YS0422	29315	55750	0.14
YS0424	29303	55850	0.21
YS0423	29306	55910	2.00
YS0416	29390	56050	4.20
YS0418	29380	56150	0.26
YS0421	29370	56250	0.19
YS0431	29350	56350	0.39
YB0186	29399	56512	0.27
YS0410	29350	56550	0.84
YB0185	29365	56608	0.39
YS0407	29385	56670	0.47
YS0411	29350	56750	22.00
YS0406	29350	56800	29.00
YS0436	29350	56950	260.00
YS0438	29350	57050	0.11
YS0448	29350	57150	3.00
YS0548	29350	57250	2.60
YS0547	29350	57350	0.95
YS0546	29350	57450	4.80
YS0544	29350	57550	0.70
YB0204	29333	57633	1700.00
YS0545	29350	57618	1.20
YS0715	29350	57750	0.18
YB0212	29390	57815	113.00
YS0716	29350	57850	0.93
YS0717	29330	57950	0.43
YS0718	29310	58050	1.60
YS0719	29305	58150	0.25
YS0764	29340	58350	1.60
YS0765	29350	58450	1.10
YS0596	29350	58550	0.37
YS0620	29350	60180	0.26
YS1158	29350	60250	0.32
YB0285	29370	60900	1.60
YS1170	29350	60950	0.02
YB0314	29546	49900	8.70
YS1433	29500	49800	2.50
YS1425	29500	50000	0.69
YS1424	29500	50200	0.57
YS1432	29500	50400	0.34

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YB0311	29580	50680	0.63
YS1431	29500	50600	0.57
YB0316	29590	50725	6.10
YS1437	29500	50800	0.23
YB0317	29520	50985	35.00
YS1438	29500	51000	6.00
YB0318	29485	51270	3.30
YS1439	29500	51200	0.79
YB0319	29578	51433	102.00
YB0320	29510	51450	14.00
YB0321	29515	51460	5.80
YS1440	29500	51400	127.00
YS0651	29450	52550	1.40
YS0653	29450	52650	0.14
YS0654	29500	52800	0.11
YS0655	29500	53000	0.21
YS0656	29500	53200	0.49
YS0672	29500	53400	0.92
YS0674	29450	53550	0.30
YS0673	29450	53650	0.20
YS0675	29476	53750	0.13
YS0584	29450	53850	0.56
YS0583	29450	53950	0.99
YB0206	29440	54020	1.60
YS0581	29450	54050	0.23
YS0578	29450	54250	0.15
YS0577	29450	54250	0.20
YS0576	29430	54350	0.27
YS0668	29450	54650	0.12
YS0665	29450	54950	0.25
YS0662	29450	55050	0.78
YS0660	29490	55150	0.63
YS0658	29450	55250	2.80
YS0657	29450	55350	0.17
YS0555	29450	55550	0.31
YB0187	29430	55640	2.00
YS0412	29445	55650	1.50
YS0413	29440	55750	3.70
YS0414	29435	55850	0.91
YS0415	29420	55950	1.00
YS0417	29430	56050	1.80
YS0419	29415	56150	0.18
YS0420	29450	56250	4.10
YB0182	29435	56390	0.26
YS0408	29450	56350	0.28
YB0183	29415	56490	0.38
YS0409	29450	56450	1.50

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YB0184	29405	56505	0.35
YS0402	29450	56550	8.40
YB0180	29470	56605	116.00
YS0403	29450	56650	23.00
YB0181	29410	56750	12.00
YS0405	29450	56750	10.00
YS0404	29460	56800	21.00
YS0440	29450	56950	2.00
YS0439	29450	57050	1.50
YS0449	29440	57150	0.43
YS0615	29405	57215	1.20
YS0614	29415	57595	1.10
YS0549	29450	57685	0.72
YS0714	29450	57825	0.04
YS0767	29450	58350	1.30
YS0766	29450	58450	2.30
YS0597	29450	58550	3.20
YS0627	29495	59850	0.36
YS0629	29485	59950	0.61
YS0628	29480	60050	0.18
YS0623	29460	60150	0.15
YS0624	29450	60250	0.15
YS0621	29450	60350	0.20
YS0622	29440	60450	0.39
YS0625	29450	60550	0.33
YS1169	29518	60700	0.12
YS1168	29500	60900	0.04
YS1167	29464	61100	0.34
YS1183	29540	61700	0.21
YS1182	29500	61900	0.20
YS1181	29500	62100	0.35
YS1111	29500	62300	0.25
YS1118	29500	62900	0.13
YS1117	29500	63100	0.49
YS1239	29500	63300	0.56
YS1270	29500	63500	0.48
YB0302	29570	63600	424.00
YS1273	29500	63700	0.21
YB0352	29510	63823	2.23
YS1312	29503	63900	38.00
YS1285	29500	64100	1.90
YS1288	29500	64300	12.00
YB0304	29580	64506	0.22
YS1307	29500	64500	0.17
YB0303	29445	64615	0.36
YS1301	29500	64700	0.16
YS1302	29500	64860	0.01

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YB0329	29560	51527	257.00
YS1453	29550	51550	237.00
YS1455	29550	51650	2.10
YS1456	29550	51750	5.30
YS1457	29550	51850	7.60
YS1458	29550	51950	1.60
YS1461	29575	52050	1.00
YS0650	29550	52550	1.10
YS0652	29550	52650	0.62
YS0587	29550	53550	0.32
YS0586	29550	53650	1.30
YB0067	29585	53792	1.20
YS0585	29550	53750	1.20
YB0068	29576	53945	14.00
YS0067	29575	53950	7.70
YB0069	29589	54050	33.00
YS0068	29550	54050	14.00
YB0070	29505	54150	1.80
YS0070	29550	54150	6.20
YB0083	29575	54280	1.10
YS0081	29550	54250	6.30
YB0084	29530	54318	0.68
YS0079	29550	54340	2.90
YS0100	29550	54550	0.95
YS0099	29550	54620	0.03
YS0669	29500	54750	0.09
YS0671	29550	54850	0.16
YS0666	29550	54950	0.88
YS0297	29555	55050	0.15
YS0308	29525	55150	0.03
YS0309	29510	55250	0.07
YS0310	29510	55350	0.39
YS0634	29550	55995	0.23
YS0633	29515	56050	0.17
YS0632	29515	56150	0.05
YS0631	29515	56250	0.10
YS0396	29529	56350	0.20
YS0630	29580	56340	0.11
YS0398	29550	56560	0.70
YB0179	29570	56633	0.06
YS0400	29550	56650	0.35
YS0399	29550	56750	0.84
YS0401	29550	56850	0.08
YS0442	29560	56950	0.27
YS0441	29550	57050	0.06
YS0450	29550	57100	0.34
YS0550	29550	57690	0.28

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0551	29550	57750	0.35
YS0712	29535	57830	0.04
YS0599	29590	58350	0.83
YS0598	29580	58450	0.45
YS0600	29550	58550	0.91
YS0601	29550	58650	1.10
YS0603	29550	58750	11.00
YS0602	29550	58850	4.60
YS0604	29550	58950	3.00
YS0605	29550	59050	2.80
YS0609	29550	59560	0.25
YS0608	29550	59650	1.60
YS0495	29550	59760	0.27
YS0616	29540	59850	0.21
YS0505	29550	59955	1.00
YB0197	29545	60070	1.70
YS0504	29550	60050	4.10
YS0499	29550	60150	3.00
YB0198	29508	60225	1.10
YS0503	29550	60208	0.89
YS0515	29580	60250	1.20
YS0516	29560	60330	0.61
YS0517	29585	60450	0.27
YS0626	29550	60550	0.94
YS1434	29625	49850	1.90
YB0312	29660	50680	9.30
YB0313	29600	50555	14.00
YS1435	29690	50600	4.00
YB0315	29650	50727	6.20
YS1436	29715	50800	1.70
YB0327	29612	51021	4.90
YS1448	29700	51000	12.00
YS1442	29700	51200	2.50
YB0322	29670	51452	44.00
YB0323	29621	51318	0.61
YS1441	29680	51400	63.00
YB0330	29625	51515	7.40
YS1454	29720	51600	163.00
YS1459	29700	51800	0.66
YS1460	29700	52000	4.10
YB0331	29660	52175	1.70
YS1462	29700	52200	0.54
YS0642	29650	52550	2.70
YS0643	29650	52650	56.00
YB0210	29600	52740	290.00
YS0644	29650	52750	54.00
YB0211	29601	52845	2.00

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0645	29650	52850	0.42
YS0646	29650	52950	0.25
YS0647	29670	53050	0.75
YS0649	29650	53150	0.43
YB0259	29698	53237	6.50
YS0648	29630	53295	1.20
YS0590	29660	53350	0.85
YS0588	29650	53400	1.50
YS0589	29625	53550	4.10
YS0833	29650	53650	1.90
YB0050	29640	53710	1.00
YS0047	29650	53750	0.08
YB0065	29633	53812	1.30
YS0066	29660	53850	11.00
YB0074	29637	54185	2.00
YS0072	29640	54160	7.40
YB0081	29654	54272	5.60
YB0082	29634	54282	4.60
YS0078	29650	54250	1.80
YB0085	29641	54366	0.33
YS0082	29650	54350	0.54
YS0083	29655	54450	3.80
YB0086	29686	54570	1.30
YS0084	29660	54550	15.00
YB0090	29640	54650	0.96
YS0098	29650	54650	0.02
YS0670	29650	54850	0.04
YS0663	29620	54950	0.50
YS0395	29676	56382	0.61
YB0177	29695	56495	0.64
YS0392	29610	56440	0.69
YS0393	29650	56530	0.49
YS0394	29650	56750	0.11
YS0397	29650	56870	0.70
YS0443	29650	56950	0.23
YS0444	29650	57040	0.14
YS0552	29610	57695	0.48
YS0476	29650	57750	2.90
YS0475	29650	57850	0.85
YS0474	29650	57950	2.20
YS0473	29615	58050	2.00
YS1018	29700	58155	1.10
YB0295	29760	58340	6.50
YS1015	29700	58406	0.46
YS1016	29695	58580	0.90
YS1017	29700	58760	1.00
YS1022	29650	58950	2.40

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0613	29690	59070	0.99
YS0612	29650	59120	1.30
YS0611	29650	59250	8.30
YS0497	29650	59550	0.67
YS0494	29650	59679	0.43
YS0496	29640	59760	0.13
YS0493	29640	59865	0.74
YS0498	29645	59950	0.33
YB0196	29654	60060	1.30
YS0500	29660	60055	0.85
YB0200	29690	60125	1.70
YS0501	29658	60150	0.20
YS0502	29670	60250	0.17
YB0199	29606	60376	0.39
YS0506	29660	60324	4.70
YS0514	29650	60550	0.08
YB0280	29700	60635	13.00
YS1109	29700	60700	0.34
YB0281	29670	60960	340.00
YS1110	29700	60900	0.76
YS1093	29700	61100	5.80
YS1036	29760	61300	0.59
YS1037	29700	61500	0.28
YB0272	29770	61773	1.80
YS1038	29700	61700	0.45
YS1041	29730	61900	6.90
YB0276	29785	62130	0.56
YS1099	29735	62100	0.55
YS1100	29700	62300	0.53
YS1105	29700	62500	0.11
YS1121	29700	62760	0.17
YS1120	29700	62900	0.23
YS1119	29700	63100	0.13
YS1240	29700	63300	0.29
YB0300	29798	63530	2.60
YS1271	29700	63500	0.13
YS1274	29700	63700	0.17
YS1280	29700	63900	0.26
YS1286	29700	64100	0.70
YS1287	29700	64300	0.42
YB0305	29645	64465	0.24
YS1303	29700	64500	0.16
YS1304	29700	64700	0.11
YB0333	29770	52350	2.20
YS1463	29750	52350	1.10
YS0636	29750	52550	1.50
YS0637	29750	52650	2.30

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0639	29750	52750	0.58
YS0638	29740	52850	0.62
YS0641	29718	52950	4.00
YB0260	29740	53015	12.00
YS0640	29718	53050	1.10
YS0911	29750	53050	0.84
YS0908	29750	53150	28.00
YB0258	29765	53280	15.00
YS0907	29750	53250	80.00
YS0843	29750	53350	0.52
YS0839	29750	53450	4.00
YS0840	29750	53550	8.00
YS0832	29750	53650	6.50
YB0051	29740	53740	3.20
YS0048	29750	53750	1.60
YB0063	29742	53876	1.20
YS0064	29755	53850	1.30
YB0066	29719	53997	0.06
YS0118	29750	53950	5.40
YB0071	29731	54033	3.00
YS0069	29750	54050	1.80
YB0072	29779	54173	0.24
YB0073	29736	54131	0.10
YS0071	29750	54150	1.20
YB0080	29720	54265	2.20
YB0103	29780	54280	2.20
YS0077	29750	54250	2.80
YB0087	29733	54310	0.74
YS0097	29761	54450	0.49
YS0096	29750	54550	20.00
YS0095	29771	54650	1.10
YB0089	29775	54712	0.63
YS0119	29750	54740	1.90
YS0101	29750	54850	1.20
YS0102	29750	54950	0.69
YS0311	29750	55485	0.20
YS0256	29770	56350	0.34
YS0635	29750	56350	1.50
YS0255	29750	56450	0.05
YS0257	29750	56550	0.17
YS0258	29750	56650	0.20
YS0260	29780	56715	0.49
YS0259	29710	56880	3.20
YS0445	29740	56950	0.71
YS0451	29750	56950	1.00
YS0446	29735	57050	2.00
YS0452	29774	57034	0.89

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0453	29755	57250	0.85
YS0466	29750	57450	0.22
YS0467	29740	57565	2.00
YB0190	29750	57605	1.60
YS0470	29765	57645	0.97
YB0195	29763	57870	1.60
YS0479	29710	57850	2.80
YS0472	29785	57950	0.30
YS0471	29750	58025	0.52
YS1023	29750	58950	1.00
YS1013	29750	59080	0.86
YS1012	29750	59150	0.42
YS1011	29750	59250	2.10
YS1010	29760	59350	0.33
YS0610	29742	59405	0.40
YS0531	29750	59750	0.15
YS0489	29750	59820	0.83
YB0202	29760	60145	31.00
YS0518	29750	60160	0.94
YS0519	29750	60225	1.30
YS0521	29755	60340	1.90
YS0513	29750	60560	0.37
YS1450	29900	50800	1.30
YS1449	29900	51000	1.00
YS1447	29915	51215	0.44
YB0326	29805	51460	3.40
YS1446	29900	51400	7.90
YS1445	29900	51600	0.12
YB0324	29900	51746	0.15
YS1443	29900	51800	0.07
YB0325	29915	52100	141.00
YS1444	29900	52000	0.09
YB0332	29895	52170	4.60
YS1464	29900	52200	2.70
YB0334	29900	52350	31.00
YS1465	29900	52400	4.50
YS0914	29850	52550	0.23
YB0261	29875	52790	3.00
YS0912	29879	52784	1.30
YS0910	29850	53050	1.70
YS0909	29850	53150	2.00
YS0906	29850	53250	2.30
YS0842	29850	53350	48.00
YS0841	29850	53450	0.77
YS0838	29880	53550	0.95
YB0250	29802	53680	3.00
YS0831	29850	53650	0.69

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YB0052	29820	53795	0.32
YS0049	29850	53750	2.70
YB0064	29808	53800	0.37
YS0065	29850	53850	1.20
YS0063	29802	53924	1.20
YB0079	29850	54275	0.30
YS0076	29860	54250	0.81
YS0094	29864	54358	8.20
YS0090	29870	54450	1.50
YS0089	29860	54550	0.65
YS0088	29850	54650	0.28
YS0087	29850	54750	0.35
YS0121	29840	54850	0.51
YS0122	29850	54950	19.00
YS0317	29880	55090	0.41
YS0316	29875	55150	0.80
YB0129	29895	55285	0.81
YS0313	29850	55250	0.36
YS0314	29860	55340	3.30
YS0312	29845	55450	0.42
YS0315	29850	55515	0.90
YS0216	29870	55750	1.10
YS0217	29860	55850	0.11
YB0130	29855	55992	9.60
YS0218	29830	55950	0.54
YS0222	29850	56050	0.93
YS0223	29840	56150	0.26
YS0224	29835	56250	0.07
YS0225	29850	56350	1.10
YS0226	29850	56450	0.48
YS0227	29880	56550	1.00
YS0261	29850	56650	0.05
YS0263	29780	56785	0.46
YS0262	29885	56810	75.00
YS0266	29880	56960	2.50
YS0456	29880	57050	3.20
YS0454	29840	57160	0.89
YS0455	29865	57150	0.87
YS0465	29855	57250	0.34
YS0469	29850	57350	0.08
YS0468	29850	57450	1.90
YS0478	29850	57850	0.18
YS0481	29815	57950	1.00
YS0483	29855	58015	0.07
YS1019	29915	58200	0.45
YB0270	29960	58355	2.80
YS1004	29900	58400	3.50

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YB0271	29915	58660	28.00
YS1020	29880	58600	0.74
YS1021	29900	58800	1.70
YS1014	29900	59000	0.34
YS1009	29900	59200	0.39
YS1008	29900	59400	0.22
YS1007	29900	59600	0.48
YS0530	29850	59750	7.50
YS0487	29850	59835	2.60
YB0201	29870	60173	2.10
YS0520	29890	60188	2.40
YS0522	29850	60250	0.32
YS0523	29810	60335	1.10
YS0527	29850	60450	0.38
YS0512	29850	60580	0.27
YS1066	29904	60700	0.54
YS1067	29940	60900	1.10
YS1068	29900	61100	0.34
YS1024	29900	61300	0.23
YS1035	29900	61500	0.22
YS1039	29900	61700	0.30
YS1040	29900	61900	1.20
YS1098	29890	62100	0.08
YS1106	29900	62500	0.14
YS1124	29900	62740	0.09
YS1123	29900	62900	0.34
YS1122	29900	63100	0.19
YB0301	29802	63527	1.20
YS1277	29900	63500	0.18
YS1278	29900	63700	0.13
YS1279	29900	63900	1.50
YS1311	29900	64100	0.87
YB0306	29870	64201	18.00
YS1308	29900	64300	0.61
YS1305	29900	64500	0.08
YB0262	29935	52550	17.00
YS0931	29950	52560	0.72
YB0263	29940	52612	19.00
YS0913	29930	52605	0.06
YS0929	29980	52650	0.45
YS0928	29950	52750	0.24
YS0925	29980	52850	0.60
YS0924	29950	52950	0.20
YS0922	29950	53030	0.01
YS0919	29950	53150	0.09
YS0917	29950	53250	0.57
YS0845	29950	53350	0.12

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0837	29950	53450	2.10
YS0834	29997	53550	0.38
YS0830	29925	53650	1.30
YB0053	29928	53720	0.27
YB0054	29970	53732	0.69
YS0050	29950	53750	0.73
YB0061	29950	53868	0.68
YS0058	29950	53850	0.98
YB0062	29985	53900	1.30
YS0059	29975	53940	11.00
YB0075	29971	54012	35.00
YB0076	29976	54024	0.77
YS0073	29950	54050	14.00
YB0077	29950	54173	7.90
YS0074	29944	54150	8.20
YB0078	29925	54230	1.60
YS0075	29951	54277	5.90
YS0091	29906	54350	2.20
YS0092	29906	54450	1.40
YS0093	29980	54557	5.40
YB0088	29906	54682	0.81
YS0086	29950	54650	0.49
YS0085	29940	54740	0.29
YS0120	29970	54850	0.96
YB0091	29921	54910	0.54
YB0092	29960	54942	0.35
YS0104	29950	54950	6.10
YS0195	29966	55010	10.40
YB0120	29515	55112	1.20
YS0200	29550	55150	0.09
YS0201	29940	55250	0.04
YS0205	29930	55550	0.84
YB0122	29985	55665	20.00
YS0207	29950	55650	0.34
YS0209	29960	55750	0.37
YB0125	29990	55810	7.00
YS0211	29940	55850	0.39
YB0126	30000	55955	9.90
YS0214	29960	55940	0.89
YS0267	29975	56060	78.00
YB0142	29910	56150	54.00
YS0230	29950	56150	317.00
YS0228	29950	56250	1.20
YS0229	29950	56350	2.40
YS0231	29915	56450	2.70
YS0232	29950	56550	2.10
YS0264	29950	56650	0.95

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0265	29925	56830	0.66
YS0458	29910	56950	0.18
YS0461	29928	57476	1.30
YB0191	29952	57680	8.00
YB0193	29935	57825	1.90
YB0194	29935	57870	13.00
YS0482	29950	57850	0.46
YB0192	29982	57948	29.00
YS0477	29979	57950	0.34
YS0480	29950	58050	1.00
YS0529	29950	59730	1.20
YS0484	29950	59850	1.00
YS0488	29950	59920	1.10
YS0491	29950	60175	0.91
YS0524	29950	60250	0.25
YS0526	29960	60350	0.40
YS0511	29950	60450	0.39
YS0510	29950	60550	0.20
YB0328	30093	50900	3.90
YS1452	30050	50950	1.20
YS1451	30050	51050	0.61
YS1510	30050	51150	0.08
YS1511	30050	51350	0.03
YS1512	30050	51450	0.67
YS1513	30050	51550	0.28
YB0349	30028	51690	0.06
YS1514	30025	51650	0.03
YB0350	30025	51785	2.10
YS1532	30012	51750	0.26
YB0351	30024	51805	4.50
YS1533	30050	51850	0.70
YS1477	30100	52000	7.00
YS1476	30100	52200	9.60
YS1475	30100	52400	49.00
YS1471	30040	52550	2.90
YB0266	30096	52640	0.37
YS0930	30050	52650	0.12
YS0927	30006	52750	2.20
YB0265	30006	52875	8.60
YS0926	30050	52850	0.20
YB0264	30086	52901	11.00
YS0923	30050	52950	0.26
YS0921	30050	53050	0.27
YS0920	30050	53150	0.27
YS0918	30050	53250	0.20
YS0844	30050	53350	0.22
YS0835	30030	53450	0.29

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0836	30030	53550	0.17
YS0829	30050	53650	0.20
YS0051	30020	53780	2.30
YS0052	30070	53850	4.80
YB0055	30090	53950	5.50
YS0053	30050	53950	1.30
YS0055	30050	54050	0.11
YB0060	30060	54130	0.84
YB0096	30070	54306	11.00
YB0097	30070	54370	2.20
YS0110	30055	54350	11.00
YB0095	30075	54488	1.10
YS0109	30050	54450	15.00
YB0094	30075	54506	16.00
YS0108	30050	54550	0.51
YS0107	30050	54650	9.80
YS0106	30050	54750	2.20
YB0093	30066	54824	1.30
YS0105	30050	54850	6.00
YS0103	30050	54950	10.00
YS0197	30036	55030	0.57
YS0213	30050	55150	0.24
YS0204	30050	55280	0.32
YS0203	30050	55350	72.00
YS0202	30050	55450	0.76
YS0206	30070	55550	3.80
YB0121	30050	55695	391.00
YS0208	30050	55650	14.00
YB0123	30050	55705	68.00
YS0210	30040	55760	11.00
YB0124	30050	55805	34.00
YS0212	30060	55855	2.00
YB0127	30040	55940	19.00
YB0128	30010	55920	36.00
YS0215	30050	55950	0.44
YB0141	30020	56730	23.00
YS0457	30050	56990	0.05
YS0460	30056	57480	0.02
YS0617	30050	58050	1.10
YS1000	30125	58200	1.80
YB0269	30006	58335	12.00
YS1001	30125	58420	0.34
YS1002	30120	58600	0.21
YS1003	30118	58800	0.32
YS0998	30120	59000	0.54
YS0999	30130	59200	0.12
YS1005	30085	59400	3.90

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1006	30085	59600	0.38
YS0528	30050	59740	1.20
YS0485	30050	59850	2.90
YS0486	30050	59950	1.30
YS0490	30006	60050	5.60
YS0492	30075	60150	0.49
YS0507	30045	60250	0.64
YS0508	30040	60350	0.78
YS0509	30010	60450	0.32
YS1089	30140	60640	0.24
YS1069	30100	60930	0.28
YS1070	30100	61110	1.20
YS1051	30100	61300	0.26
YS1050	30100	61500	0.21
YS1052	30100	61700	0.13
YS1097	30100	61900	0.35
YS1095	30100	62100	0.08
YB0278	30115	62510	14.00
YS1104	30100	62500	0.32
YS1141	30100	62750	0.41
YS1126	30100	62900	0.32
YS1125	30100	63100	2.40
YS1144	30120	63300	2.80
YS1143	30120	63500	0.06
YS1145	30100	63700	0.08
YS1149	30100	63900	0.38
YS1281	30100	64100	0.08
YS1309	30100	64300	0.29
YS1306	30100	64500	0.04
YS1509	30150	51040	0.63
YB0348	30165	51155	0.05
YS1508	30150	51150	0.02
YS1507	30150	51250	0.05
YS1506	30150	51350	0.30
YS1505	30150	51450	1.30
YS1504	30150	51550	0.15
YS1503	30150	51650	4.10
YS1502	30150	51750	4.30
YS1501	30150	51850	2.00
YS1472	30150	52550	5.80
YB0257	30140	52656	14.00
YS0916	30150	52650	5.50
YS0915	30140	52750	0.21
YS0905	30150	52850	2.20
YB0256	30188	52956	1.50
YS0904	30150	52950	0.75
YB0255	30152	53040	9.50

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0903	30150	53050	5.50
YS0870	30150	53150	0.04
YS0869	30150	53250	0.38
YS0868	30150	53350	1.59
YS0880	30150	53450	3.30
YS0879	30150	53550	7.10
YB0249	30160	53692	5.60
YS0828	30150	53650	39.00
YB0239	30173	53705	5.70
YB0028	30110	53830	0.83
YB0056	30142	53975	0.24
YS0054	30154	53945	3.00
YB0057	30116	54121	0.01
YS0056	30130	54150	0.07
YB0059	30118	54218	0.13
YS0057	30150	54245	0.70
YB0023	30140	54391	106.00
YS0023	30150	54350	2.90
YB0098	30145	54405	2.70
YB0099	30176	54442	7.70
YS0111	30150	54450	24.00
YB0101	30128	54564	0.35
YS0113	30155	54560	24.00
YS0114	30150	54650	5.00
YS0115	30150	54750	0.60
YB0102	30160	54836	1.10
YS0116	30150	54850	7.40
YS0117	30150	54950	0.70
YB0117	30170	55016	7.10
YS0196	30132	55021	4.90
YB0119	30150	55110	1.00
YB0131	30190	55985	21.00
YS0219	30150	55960	0.80
YB0188	30120	57380	11.00
YS0459	30176	57350	0.80
YB0189	30115	57594	0.22
YS0462	30150	57550	0.17
YS0463	30190	57650	2.20
YS0464	30160	57740	0.35
YB0209	30185	57940	3.50
YS0618	30160	57950	1.90
YS0619	30150	58020	2.40
YS0994	30150	59750	0.35
YS0995	30150	59850	0.13
YS0996	30150	59960	0.17
YS0997	30150	60050	0.27
YS1082	30150	60150	0.20

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1086	30150	60250	0.33
YS1087	30150	60450	0.32
YS1088	30150	60550	0.46
YS1531	30710	51150	1.20
YS1530	30250	51250	0.06
YS1529	30250	51340	0.04
YS1516	30250	51550	0.05
YS1500	30250	51650	0.36
YB0345	30220	51715	17.00
YS1498	30250	51750	1.50
YB0346	30221	51876	6.00
YS1499	30250	51850	4.10
YS1478	30300	52000	0.52
YS1473	30250	52550	7.20
YB0254	30212	52645	0.52
YS0890	30250	52635	3.70
YS0896	30250	52730	0.83
YS0897	30239	52850	0.08
YS0902	30220	52950	0.10
YS0901	30250	53060	1.10
YS0871	30250	53150	0.12
YB0241	30290	53295	37.00
YS0819	30250	53250	8.60
YB0242	30252	53352	5.00
YS0818	30250	53350	5.30
YB0243	30290	53485	13.00
YS0817	30267	53450	2.70
YB0240	30290	53510	11.00
YS0816	30250	53550	18.00
YS0815	30250	53650	103.00
YB0026	30245	53785	243.00
YB0238	30250	53726	2.50
YB0004	30300	53890	6.50
YB0025	30245	53800	57.00
YB0029	30245	53882	8.20
YS0004	30260	53852	347.00
YB0006	30278	54000	8.10
YB0030	30233	53921	7.40
YS0006	30250	53950	11.00
YB0008	30298	54050	4.00
YB0058	30220	54070	0.80
YS0008	30250	54050	1.70
YB0014	30288	54196	23.00
YS0014	30250	54150	0.18
YB0018	30245	54245	6.10
YS0018	30250	54250	1.40
YB0017	30204	54450	27.00

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0022	30250	54450	0.51
YB0100	30290	54566	8.20
YS0112	30250	54530	1900.00
YB0118	30205	55005	7.00
YS0198	30279	55084	3.60
YS0199	30260	55110	0.09
YB0132	30255	56070	12.00
YS0220	30250	56050	2.50
YB0138	30215	56820	2.30
YS0367	30260	57282	0.08
YS0366	30250	57350	0.18
YB0163	30235	57650	4.80
YS0370	30230	57650	0.30
YS0371	30250	57750	2.10
YS0389	30250	57850	0.31
YS0957	30300	58200	0.47
YS0958	30300	58400	0.63
YS0986	30300	58600	0.16
YS0987	30245	58800	0.38
YS0988	30300	59000	0.26
YS0989	30300	59200	0.48
YS0990	30300	59400	0.37
YS0991	30290	59600	0.31
YS0992	30300	59730	0.08
YS0993	30250	60000	0.41
YS1080	30250	60150	0.13
YS1085	30300	60240	0.04
YS1092	30350	60500	1.10
YS1091	30300	60700	0.96
YS1090	30300	60900	0.27
YS1064	30300	61100	0.19
YS1081	30300	61030	0.71
YS1063	30300	61300	0.15
YS1062	30300	61500	0.06
YB0273	30340	61785	0.67
YS1053	30300	61700	0.17
YS1094	30300	61900	0.24
YS1096	30300	62100	0.61
YS1101	30300	62300	0.25
YB0279	30240	62450	9.60
YS1103	30300	62500	1.40
YS1108	30300	62700	0.21
YS1128	30300	62900	0.07
YS1127	30300	63100	0.33
YS1142	30300	63300	0.20
YS1146	30300	63500	0.05
YS1147	30300	63700	0.07

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1148	30300	63900	0.12
YS1282	30300	64100	0.05
YS1310	30300	64300	0.24
YS1528	30340	51350	0.78
YS1525	30350	51450	0.06
YS1524	30370	51550	0.04
YS1527	30350	51640	0.13
YS1497	30340	51750	0.02
YS1496	30350	51850	0.58
YS1474	30350	52550	32.00
YS0889	30350	52670	5.50
YS0893	30350	52750	0.96
YS0895	30330	52818	0.30
YS0900	30350	53050	0.28
YS0872	30350	53194	0.75
YB0245	30397	53297	34.00
YS0822	30350	53250	7.60
YB0244	30335	53312	13.00
YS0820	30350	53350	11.00
YB0215	30310	53490	21.00
YS0784	30350	53400	3.20
YB0219	30342	53515	2.50
YS0788	30350	53550	16.00
YS0814	30305	53650	7.90
YB0237	30305	53737	2.40
YB0002	30340	53895	11.00
YB0024	30348	53818	7700.00
YS0002	30350	53870	3.00
YB0010	30358	53936	58.00
YS0010	30350	53950	2.70
YB0012	30356	54040	12.00
YS0012	30350	54050	0.11
YB0015	30360	54180	9.60
YS0015	30350	54150	0.10
YB0027	30320	54246	1.40
YS0024	30350	54250	0.13
YB0011	30302	54318	17.00
YS0021	30350	54350	0.68
YB0013	30340	54403	29.00
YB0104	30375	54960	3.30
YS0123	30385	54950	0.26
YS0221	30350	55995	0.23
YB0133	30303	56197	259.00
YB0134	30355	56160	2.00
YS0233	30350	56150	129.00
YB0135	30303	56205	38.00
YS0234	30395	56250	2.00

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0235	30390	56350	1.60
YB0136	30385	56465	14.00
YS0236	30370	56450	81.00
YS0237	30350	56550	1.70
YS0240	30350	56650	0.72
YS0243	30350	56750	1.30
YS0241	30380	56850	0.30
YS0356	30395	57355	0.49
YB0159	30360	57465	0.92
YS0358	30370	57464	0.18
YS0364	30350	57550	0.38
YS0365	30350	57650	0.29
YB162A	30336	57764	0.23
YB162B	30336	57764	0.33
YS0368	30350	57750	0.18
YS0390	30350	57850	0.80
YS0391	30350	57860	0.63
YS1079	30350	60150	0.15
YS1523	30430	51550	0.39
YS1522	30450	51650	0.28
YS1526	30465	51750	0.05
YS1517	30470	51850	0.03
YS1479	30485	52010	7.70
YS1468	30450	52550	0.19
YS0888	30450	52679	0.24
YS0892	30415	52776	3.60
YS0894	30450	52850	1.90
YS0899	30450	52950	8.90
YS0898	30460	53050	21.00
YB0248	30470	53160	7.80
YS0824	30450	53160	11.00
YB0247	30485	53250	24.00
YS0823	30450	53250	8.20
YB0246	30424	53315	88.00
YS0821	30450	53350	7.30
YB0216	30472	53470	2.90
YS0785	30450	53450	9.50
YB0220	30480	53501	15.00
YS0789	30450	53550	12.00
YB0235	30492	54600	1.30
YS0812	30450	53650	51.00
YB0236	30485	53745	3.10
YS0813	30450	53750	2.50
YB0001	30433	53892	2.50
YS0001	30446	53881	0.76
YB0003	30446	53956	0.70
YS0007	30450	53950	1.40

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0009	30450	54050	0.60
YB0009	30461	54130	5.20
YS0017	30450	54159	0.15
YB0016	30438	54282	2.60
YS0016	30440	54280	0.16
YB0019	30415	54324	5.70
YB0020	30405	54342	2.20
YB0021	30439	54342	23.00
YB0022	30485	54340	11.00
YS0020	30445	54324	0.10
YB0108	30464	54616	1.60
YS0127	30460	54650	0.19
YB0107	30448	54785	5.10
YS0126	30452	54705	0.32
YB0106	30441	54801	2.30
YS0125	30434	54850	0.93
YB0105	30447	54959	0.47
YS0124	30450	54950	0.50
YS0162	30483	55001	0.11
YS0163	30450	55150	0.64
YS0164	30450	55250	0.27
YB0110	30400	55385	11.00
YS0165	30450	55350	0.19
YB0112	30480	55480	7.30
YS0166	30440	55450	17.00
YB0111	30496	55560	4.90
YS0167	30450	55550	0.20
YS0185	30450	55650	0.50
YB0113	30448	55710	63.00
YS0183	30450	55750	3.90
YS0182	30450	55850	6.40
YS0181	30450	55950	0.78
YS0303	30440	56050	2.30
YS0305	30430	56150	29.00
YS0306	30412	56250	3.50
YS0307	30408	56350	0.90
YB0137	30460	56482	0.91
YS0239	30450	56460	1.60
YS0238	30445	56550	1.50
YS0245	30420	56660	1.20
YS0247	30430	56750	0.15
YS0250	30450	56850	0.29
YS0354	30420	57060	0.30
YS0353	30450	57122	0.90
YS0355	30450	57275	0.13
YS0357	30450	57350	0.33
YB0160	30480	57435	4.00

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0359	30450	57450	0.45
YS0369	30450	57550	0.29
YB0164	30480	57670	0.82
YS0372	30450	57650	0.30
YB0166	30440	57760	0.23
YS0373	30450	57750	0.26
YB0165	30430	57830	8.60
YS0374	30450	57850	0.72
YS0375	30450	57950	0.35
YS0377	30440	58040	0.16
YS0376	30450	58150	0.15
YS0969	30500	58584	0.16
YS0960	30500	58700	0.21
YB0268	30460	58890	2.70
YS0961	30500	58900	0.29
YB0267	30454	59020	1.30
YS0981	30490	59100	0.12
YS0985	30500	59300	0.38
YS0984	30500	59500	0.25
YS0983	30499	59700	0.10
YS0982	30430	59900	0.12
YS0980	30500	60140	0.16
YS1084	30500	60260	1.30
YS1083	30580	60500	0.27
YS1060	30543	61137	0.09
YS1059	30500	61300	0.01
YS1061	30500	61500	0.01
YS1054	30500	61700	0.18
YS1055	30500	61885	0.11
YS1065	30500	62100	0.15
YS1102	30500	62300	0.15
YS1107	30500	62500	0.10
YS1129	30510	62700	0.24
YS1130	30500	62900	0.03
YS1131	30520	63100	0.07
YS1139	30500	63300	0.12
YS1151	30510	63500	0.05
YS1152	30500	63700	0.04
YS1150	30530	63900	0.03
YS1521	30550	51650	0.85
YS1520	30550	51750	0.13
YS1518	30550	51850	0.10
YB0344	30600	52145	0.13
YS1492	30550	52150	0.29
YS1493	30550	52250	0.25
YS1494	30550	52340	0.17
YS1495	30550	52440	5.20

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1467	30550	52550	0.15
YS1540	30550	52650	0.17
YS0887	30550	52730	3.20
YB0233	30545	53175	22.00
YS0811	30550	53150	11.00
YB0232	30580	53203	119.00
YS0809	30550	53240	6.20
YB0230	30530	53350	6.50
YS0806	30550	53350	13.00
YB0217	30567	53470	41.00
YS0786	30550	53467	24.00
YB0221	30599	53502	72.00
YS0790	30550	53550	5.20
YB0226	30520	53650	2.10
YS0796	30550	53650	6.80
YS0800	30550	53750	2.40
YB0032	30594	53836	6.00
YS0003	30519	53881	2.60
YB0031	30519	53915	8.20
YS0005	30521	53953	0.82
YB0005	30521	54088	0.21
YS0011	30551	54059	0.32
YB0007	30585	54118	8.70
YS0019	30550	54150	0.10
YS0039	30565	54250	0.90
YS0038	30565	54350	1.70
YB0048	30580	54430	1.80
YB0049	30555	54470	17.00
YS0046	30550	54450	2.60
YS0128	30550	54550	1.00
YS0131	30550	54650	1.20
YS0132	30550	54750	1.10
YS0146	30550	54850	0.73
YS0148	30550	54950	0.12
YS0160	30550	55360	0.10
YB0109	30510	55450	4.20
YS0161	30545	55440	0.09
YB0114	30565	55655	94.00
YB0115	30510	55610	2.70
YS0186	30550	55650	0.10
YS0184	30520	55730	0.20
YB0116	30542	55927	6.60
YS0180	30550	55950	0.14
YS0304	30550	56040	1.10
YS0302	30585	56150	0.60
YS0301	30585	56240	1.10
YS0299	30550	56350	0.33

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0300	30560	56430	16.00
YS0242	30565	56550	4.50
YS0244	30580	56650	0.08
YS0246	30560	56750	0.69
YB0139	30598	56894	0.17
YS0251	30598	56802	1.10
YB0143	30595	56945	0.33
YS0270	30576	56950	0.03
YB0174	30580	57392	1.80
YS0385	30550	57350	0.62
YB0169	30545	57405	0.56
YB0170	30540	57433	0.52
YB0171	30570	57430	3.90
YB0172	30530	57495	0.37
YB0173	30570	57460	0.35
YS0383	30550	57450	0.74
YB0168	30520	57515	0.64
YS0382	30525	57550	1.00
YB0167	30503	57618	0.47
YS0381	30510	57650	0.32
YS0378	30540	57750	0.02
YS0379	30530	57850	0.18
YB0158	30505	57970	3.20
YS0352	30550	57988	0.18
YS0363	30550	58035	0.32
YS1519	30630	51850	0.37
YS1480	30700	52000	0.56
YS1491	30650	52150	0.22
YS1469	30650	52250	2.80
YS1470	30650	52350	0.37
YS1466	30700	52500	0.09
YS1539	30650	52650	0.09
YS0886	30650	52740	3.10
YS0891	30695	52850	13.00
YS0877	30680	52950	0.31
YS0878	30680	53050	3.90
YB0234	30610	53140	17.00
YS0807	30650	53150	14.00
YB0231	30608	53230	26.00
YS0808	30650	53250	16.00
YB0229	30601	53330	16.00
YS0805	30650	53350	32.00
YB0218	30688	53442	9.30
YS0787	30650	53460	777.00
YB0223	30608	53527	23.00
YS0792	30650	53530	2.50
YS0791	30610	53650	7.40

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YB0222	30665	53785	17.00
YS0795	30650	53750	17.00
YS0026	30650	53870	2.80
YB0034	30685	53940	42.00
YS0027	30650	53950	8.00
YS0060	30650	54050	1.30
YB0036	30700	54160	7.80
YS0029	30650	54150	3.50
YS0037	30650	54250	0.87
YB0040	30675	54380	1.60
YS0040	30650	54350	1.50
YB0046	30625	54425	0.87
YB0047	30625	54475	1.00
YS0045	30650	54450	1.00
YS0129	30650	54550	0.48
YS0130	30650	54650	0.62
YS0139	30650	54750	0.80
YS0147	30650	54850	0.57
YS0149	30650	54950	0.07
YS0153	30696	55150	0.12
YS0154	30690	55250	0.02
YS0328	30630	55350	0.01
YS0159	30696	55450	0.21
YS0168	30660	55565	25.00
YS0169	30685	55650	0.71
YS0173	30660	55750	0.60
YS0178	30650	55850	5.00
YS0179	30640	55950	2.20
YS0286	30650	56050	0.03
YS0288	30650	56150	0.01
YS0282	30650	56250	0.12
YS0283	30650	56350	0.11
YS0249	30650	56450	0.09
YS0248	30650	56550	0.08
YB0140	30630	56601	0.08
YS0253	30650	56650	0.21
YS0252	30650	56750	0.08
YS0254	30650	56850	0.08
YB0144	30605	56955	0.23
YS0271	30636	56950	2.60
YS0384	30605	57405	25.00
YS0360	30695	57985	2.50
YS0362	30655	58027	0.17
YS0959	30700	58485	0.02
YS0964	30700	58700	0.06
YS0965	30700	58900	0.24
YS0970	30700	59100	0.06

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0979	30700	60175	0.27
YS1071	30700	60300	1.10
YS1072	30700	60500	0.21
YS1075	30700	60700	0.74
YB0274	30740	60850	3.90
YB0275	30700	60950	3.20
YS1077	30750	60900	0.17
YS1058	30700	61120	0.17
YS1078	30700	61100	0.16
YS1057	30700	61300	0.15
YS1056	30700	61500	0.11
YS1134	30700	61700	0.34
YS1135	30720	61900	0.13
YS1136	30700	62100	0.05
YS1137	30700	62300	0.04
YS1138	30700	62500	0.08
YS1140	30700	62670	0.16
YS1515	30750	52150	0.14
YS1486	30750	52250	0.27
YS1487	30750	52350	0.88
YS1538	30750	52650	0.06
YS0883	30750	52730	2.40
YS0882	30750	52850	3.00
YB0252	30780	52990	22.00
YB0253	30790	52920	1.40
YS0873	30750	52960	25.00
YS0876	30750	53050	12.00
YS0827	30750	53150	1.10
YS0810	30750	53250	0.89
YB0224	30770	53595	0.68
YS0793	30750	53550	72.00
YS0797	30750	53650	1.30
YB0228	30748	53705	3.60
YS0798	30750	53750	0.26
YB0227	30715	53815	12.00
YS0799	30750	53850	5.40
YS0028	30750	53950	0.35
YS0031	30750	54065	0.01
YB037A	30730	54170	6.30
YB037B	30730	54170	6.30
YS0034	30750	54150	7.60
YB0038	30755	54204	9.50
YS0036	30750	54250	19.00
YB0041	30782	54350	1.80
YS0041	30750	54350	0.46
YB0045	30718	54412	4.10
YS0044	30750	54450	5.00

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0133	30750	54550	0.59
YS0135	30716	54650	0.08
YS0136	30712	54750	0.09
YS0145	30750	54850	0.11
YS0150	30750	54950	0.09
YS0151	30750	55050	0.06
YS0155	30730	55150	0.15
YS0156	30720	55250	0.11
YS0157	30710	55350	0.12
YS0158	30710	55450	0.14
YS0170	30750	55550	0.90
YS0171	30750	55650	2.00
YS0172	30750	55750	0.70
YS0177	30750	55850	2.10
YS0194	30750	55950	0.43
YS0287	30750	56050	0.07
YS0289	30750	56150	0.01
YS0284	30750	56250	0.01
YS0285	30750	56350	0.14
YS0268	30725	56450	0.07
YS0277	30750	56550	0.04
YB0146	30780	56670	1.70
YS0276	30750	56650	0.09
YB0147	30715	56770	0.99
YS0278	30750	56750	0.45
YB0145	30709	56818	0.44
YS0273	30750	56850	0.66
YS0269	30720	56920	0.14
YS0380	30780	57830	1.60
YS0361	30750	57950	0.21
YS0349	30750	58050	0.23
YS1485	30825	52250	0.22
YS1484	30850	52350	0.21
YS1488	30850	52450	0.73
YS1489	30850	52550	0.29
YS1490	30850	52650	2.40
YS0884	30850	52750	0.09
YS0881	30820	52850	12.00
YB0251	30815	52990	10.00
YS0874	30850	52970	0.66
YS0875	30850	53050	0.92
YS0826	30850	53150	0.38
YS0825	30850	53250	14.00
YS0804	30830	53350	13.00
YS0803	30830	53450	1.50
YB0225	30801	53501	22.00
YS0794	30835	53550	2.40

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0801	30850	53650	0.51
YS0802	30850	53750	0.08
YB0203	30835	53875	2.20
YS0525	30850	53850	0.06
YS0030	30850	53950	24.00
YS0032	30860	54050	13.00
YS0033	30850	54150	6.00
YB0039	30865	54250	4.70
YS0035	30850	54250	96.00
YB0042	30865	54388	0.61
YS0042	30850	54350	1.90
YB0043	30821	54402	0.83
YB0044	30821	54422	2.80
YS0043	30850	54460	0.35
YS0134	30850	54550	0.30
YS0137	30850	54650	0.08
YS0138	30850	54750	0.13
YS0141	30850	54850	0.12
YS0144	30850	54950	0.17
YS0152	30850	55050	0.46
YS0847	30850	55110	0.91
YS0538	30850	55490	0.40
YS0187	30850	55550	0.39
YS0174	30830	55680	0.67
YS0175	30820	55750	1.20
YS0176	30810	55810	1.00
YS0193	30850	55950	0.34
YS0294	30850	56050	0.01
YS0293	30850	56150	0.04
YS0298	30850	56250	0.02
YS0292	30850	56350	0.31
YS0280	30850	56450	0.10
YS0279	30850	56550	0.05
YS0281	30850	56650	0.03
YS0275	30850	56750	0.05
YS0274	30850	56850	1.10
YB0205	30880	56920	0.63
YS0272	30820	56995	0.14
YB0208	30894	57094	2.00
YS0318	30850	57050	0.15
YS0319	30890	57130	1.40
YB0175	30890	57835	0.66
YS0386	30850	57840	0.76
YS0351	30810	57960	0.19
YB0161	30845	58055	0.31
YS0350	30850	58050	0.33
YS0962	30900	58485	0.07

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0966	30900	58700	0.07
YS0967	30900	58900	0.10
YS0968	30900	59100	0.06
YS0978	30900	60190	0.22
YS1073	30900	60300	0.17
YS1074	30890	60500	0.20
YS1076	30850	60700	0.39
YS1132	30900	60900	0.09
YS1133	30900	61100	0.04
YS1234	30900	61300	0.07
YS1235	30900	61500	0.07
YS1236	30900	61700	0.08
YS1237	30835	61900	0.05
YS1483	30950	52450	0.31
YS1481	30950	52550	0.41
YS1482	30950	52650	3.60
YS0885	30950	52750	0.04
YS0932	31000	52900	0.07
YS0934	31000	53100	0.02
YS0936	31000	53300	0.02
YS0938	31000	53500	0.02
YS0937	31000	53700	0.91
YS0946	30950	53850	0.20
YS0536	30950	53950	3.00
YS0533	30930	54150	2.30
YS0535	30935	54250	0.52
YS0534	30935	54350	0.02
YS0532	30930	54450	0.41
YS0140	30950	54770	0.04
YS0142	30950	54850	0.03
YS0143	30950	54950	0.04
YS0846	30950	55120	0.19
YS0539	30950	55496	1.80
YS0189	30950	55550	0.19
YS0188	30950	55650	0.12
YS0190	30950	55750	0.30
YS0191	30950	55850	0.35
YS0192	30950	55950	1.40
YS0295	30940	56050	0.56
YS0296	30925	56150	1.30
YS0290	30915	56250	0.60
YS0291	30905	56350	1.00
YS0542	30915	56450	0.02
YS0543	30904	56550	0.10
YS0567	30950	56940	0.39
YS0607	30950	57095	0.73
YS0320	30950	57150	0.41

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YB0148	30960	57255	1.50
YS0322	30965	57250	0.50
YB0149	30955	57330	1.50
YS0325	30925	57350	0.42
YS0326	30950	57415	2.10
YB0176	30942	57835	1.20
YS0388	30930	57850	6.60
YS0387	30950	57950	0.15
YS0347	30950	58050	0.82
YS0947	31050	53850	0.84
YS0948	31050	53950	2.90
YS0949	31050	54050	0.58
YS0950	31050	54150	1.30
YS0951	31050	54250	1.80
YS0952	31050	54350	0.12
YS0867	31050	54470	0.16
YS0863	30050	54850	0.05
YS0864	30050	54950	0.02
YS0865	31050	55030	0.04
YS0848	31050	55140	0.57
YS0537	31050	55550	0.54
YS0856	31100	56350	0.30
YS0566	31050	56940	0.20
YB0207	31060	57110	1.10
YS0321	31050	57150	0.24
YB0151	31040	57430	4.20
YB0157	31036	57820	2.10
YS0343	31036	57850	0.09
YS0345	31050	57910	0.05
YS0348	31050	58054	1.80
YS0963	31100	58485	0.05
YS0971	31100	58900	0.20
YS0972	31180	59100	0.35
YS0973	31150	59300	0.73
YS0974	31100	59500	0.24
YS0975	31100	59700	0.17
YS0976	31100	59900	0.13
YS0977	31100	60100	0.04
YS1224	31100	60300	0.05
YS1232	31100	60500	0.11
YS1233	31020	60700	0.08
YS0933	31200	52900	0.28
YS0935	31220	53100	0.68
YS0944	31200	53300	0.87
YS0945	31200	53500	1.30
YS0956	31200	53700	0.37
YS0953	31200	53900	0.10

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS0954	31200	54100	1.10
YS0955	31200	54300	0.10
YS0866	31150	54470	0.09
YS0860	31150	54850	0.12
YS0861	31150	54950	0.17
YS0862	31150	55030	0.06
YS0849	31150	55145	2.30
YS0853	31150	55550	0.41
YS0327	31150	57125	0.06
YS0323	31150	57215	0.17
YS0324	31160	57360	0.23
YS0334	31160	57480	6.10
YB0152	31165	57565	0.75
YS0335	31160	57550	0.29
YB0155	31132	57655	0.20
YS0339	31150	57655	0.67
YS0338	31195	57750	0.30
YB0156	31115	57898	0.35
YS0340	31115	57850	0.57
YS0342	31150	57950	0.16
YS0344	31165	58050	0.15
YS1221	31200	59600	0.03
YS0858	31230	54900	0.05
YS0851	31240	55050	0.06
YS0850	31240	55150	0.36
YS0855	31398	55300	0.33
YS0854	31300	55530	0.32
YS0857	31300	56380	0.81
YS0329	31280	57176	0.14
YS0330	31275	57250	0.07
YS0331	31280	57350	0.05
YS0332	31261	57450	0.29
YB0150	31215	57582	0.48
YS0333	31250	57550	0.27
YB0153	31206	57650	0.50
YS0336	31250	57650	0.19
YB0154	31218	57724	0.50
YS0337	31204	57750	0.04
YS0341	31216	57850	1.40
YS0346	31201	57950	0.73
YS0568	31292	57950	0.10
YS0569	31288	58050	0.10
YS1200	31300	58400	0.25
YS1201	31300	58600	0.11
YS1219	31300	58800	0.08
YS1220	31300	59000	0.05
YS1223	31300	59200	0.12

Appendix E. (continued)

Sample I.D.	Plant Grid Northing (ft)	Plant Grid Easting (ft)	Hg (μg/g)
YS1222	31300	59400	0.09
YS0939	31400	52900	1.30
YS0940	31400	53100	0.89
YS0941	31400	53300	2.40
YS0942	31400	53500	0.19
YS0943	31400	53700	0.15
YS1025	31400	53900	0.79
YS1026	31400	54100	0.36
YS1027	31400	54300	0.22
YS1028	31400	54500	0.41
YS1029	31400	54700	0.42
YS0852	31390	55050	0.46
YS0563	31388	57250	0.09
YS0565	31360	57350	0.06
YS0564	31350	57450	0.05
YS1196	31400	57600	0.09
YS1197	31400	57800	0.23
YS1198	31400	58000	0.13
YS1199	31400	58200	0.02
YS1034	31450	54850	0.18
YS0859	31500	55000	0.19
YS1033	31500	55200	0.24
YS1032	31500	55400	0.07
YS1031	31500	55600	0.14
YS1030	31500	55800	0.24
YS1042	31500	56000	0.26
YS1043	31500	56200	0.27
YS1044	31500	56300	0.23
YS1045	31500	56600	0.37
YS1046	31500	56800	0.16
YS1047	31500	57000	0.18
YS1048	31500	57200	0.11
YS1049	31500	57600	0.39

APPENDIX F. MERCURY IN FILL, SOIL AND WEATHERED ROCK SAMPLES COLLECTED DURING DRILLING NEAR BUILDING 81-10

Appendix F. Mercury in fill, soil and weathered rock samples collected during drilling near Building 81-10.

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon. UP, DOWN and DEPTH in feet below surface, Hg in μg/g dry weight, U and Th in μg/g dry weight, 6N HNO_3 digest. Negative prefix denotes "less than" value.

BORING	TYPE	DATE	UP	DOWN	Hg	U	TH	DESCRIPTION
2	AB	.	.	1.0	100.00	.	.	FILL
2	CS	.	1.0	3.0	25.00	0.96	3.0	FILL
2	CS	.	3.0	4.0	9.80	0.47	3.0	FILL
2	CS	.	4.0	6.0	12.00	0.51	3.1	FILL
2	CS	.	6.0	8.0	5.00	0.50	3.0	FILL
2	CS	.	8.0	10.0	1.90	0.32	2.7	FILL
2	CS	.	10.0	12.0	2.00	0.27	2.6	FILL
2	CS	.	12.0	14.0	2.30	0.31	3.3	FILL
2	CS	.	14.0	16.0	0.51	0.32	2.9	FILL
2	CS	.	16.0	18.0	0.38	0.27	3.2	FILL
2	CS	.	18.0	20.0	1.30	0.33	3.5	FILL
2	CS	.	20.0	22.0	4.20	0.33	3.1	FILL
2	CS	.	22.0	23.2	1.30	0.52	4.0	FILL
2	CS	.	23.2	24.0	0.88	0.41	1.7	FILL
2	CS	.	24.0	26.0	0.79	0.43	2.4	
2	CS	.	26.0	28.0	0.45	0.61	3.3	
2	CS	.	28.0	30.0	0.97	0.86	5.4	W SHALE
2	CS	.	30.0	32.0	0.89	0.71	5.1	W SHALE
3	PS	.	0.0	0.3	30.00	2.20	3.0	FILL
3	PS	.	0.3	2.0	4.30	0.46	3.8	FILL
3	CS	.	2.0	3.0	15.00	6.80	4.2	FILL
3	CS	.	3.0	4.0	1436.00	2.00	3.6	FILL
3	CS	.	6.0	6.7	164.00	5.40	4.0	FILL
3	CS	.	6.7	8.0	11.00	0.44	2.0	FILL
3	CS	.	10.0	12.0	1.40	0.26	3.0	FILL
3	CS	.	12.0	14.0	1.10	0.28	2.9	FILL
3	CS	.	14.0	15.2	3.00	0.36	4.2	FILL
3	CS	.	15.2	16.0	1.50	0.30	3.0	FILL
3	CS	.	16.0	18.0	3.00	0.43	3.4	FILL
3	CS	.	18.0	20.0	8.20	0.33	2.9	FILL
3	CS	.	20.0	22.0	2.00	0.35	4.4	FILL
3	CS	.	22.0	24.0	4.10	0.31	4.2	FILL
3	CS	.	24.0	26.0	0.60	0.50	2.9	
3	CS	.	26.0	28.0	2.60	0.56	3.0	
3	CS	.	28.0	30.0	1.90	0.40	3.0	W SHALE
3	CS	.	30.0	32.0	1.30	0.54	3.8	W SHALE
3	CS	.	32.0	34.0	0.56	0.63	5.7	W SHALE
4	PS	.	0.0	1.5	21.00	12.00	3.9	FILL
4	AB	.	.	3.0	19.00	15.00	4.1	FILL
4	CS	.	3.0	5.0	11.00	13.00	4.1	FILL

Appendix F. (continued)

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon. UP, DOWN and DEPTH in feet below surface, Hg in $\mu g/g$ dry weight, U and Th in $\mu g/g$ dry weight, 6N HNO_3 digest. Negative prefix denotes "less than" value.

BORING	TYPE	DATE	UP	DOWN	Hg	U	TH	DESCRIPTION
4	PS	.	5.0	7.0	2.90	8.30	3.1	FILL
4	PS	.	7.0	9.0	7.20	7.00	4.0	FILL
4	PS	.	9.0	9.7	8.20	4.20	4.1	FILL
4	CS	.	10.5	11.0	1040.00	181.00	14.3	FILL
4	CS	.	11.0	11.5	515.00	143.00	11.2	
4	PS	.	13.0	15.0	4.90	1.60	4.1	W SHALE
4	AB	.	.	19.0	39.00	15.00	4.7	
4	A5	.	.	19.5	56.00	10.00	4.4	
5	CS	.	2.0	4.0	1.40	.	.	
5	CS	.	4.0	6.0	1.60	.	.	
5	CS	.	6.0	6.3	44.00	.	.	
5	CS	.	6.3	8.0	2.90	.	.	
5	CS	.	8.0	10.0	1.20	.	.	
5	CS	.	10.0	11.0	0.15	.	.	
5	CS	.	11.0	12.0	0.33	.	.	
5	CS	.	12.0	14.0	0.11	.	.	
5	CS	.	14.0	16.0	0.06	.	.	
5	CS	.	16.0	18.0	0.03	.	.	
5	CS	.	18.0	20.0	0.05	.	.	
5	CS	.	20.0	22.0	0.06	.	.	
5	CS	.	22.0	24.0	0.10	.	.	
5	CS	.	24.0	26.0	0.12	.	.	
5	CS	.	26.0	28.0	0.09	.	.	
5	CS	.	28.0	30.0	0.25	.	.	
5	CS	.	30.0	31.0	0.44	.	.	
6	CS	.	3.0	5.0	2.20	.	.	
6	CS	.	5.0	6.0	135.00	.	.	
6	CS	.	6.0	7.0	0.14	.	.	
6	CS	.	7.0	9.0	0.27	.	.	
6	CS	.	9.0	11.0	0.26	.	.	
6	CS	.	11.0	13.0	0.10	.	.	
6	CS	.	13.0	15.0	0.13	.	.	
6	CS	.	15.0	17.0	0.09	.	.	
6	CS	.	17.0	19.0	0.09	.	.	
6	CS	.	19.0	21.0	0.24	.	.	
6	CS	.	21.0	23.0	0.09	.	.	
6	CS	.	23.0	25.0	0.12	.	.	
6	CS	.	25.0	27.0	0.06	.	.	

Appendix F. (continued)

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon. UP, DOWN and DEPTH in feet below surface, Hg in μg/g dry weight, U and Th in μg/g dry weight, 6N HNO_3 digest. Negative prefix denotes "less than" value.

BORING	TYPE	DATE	UP	DOWN	Hg	U	TH	DESCRIPTION
6	CS	.	27.0	29.0	0.07	.	.	
6	CS	.	29.0	30.2	0.14	.	.	
7	AB	.	.	2.0	134.00	.	.	FILL
7	CS	.	2.0	4.0	199.00	0.30	2.8	FILL
7	CS	.	4.0	6.0	23.00	0.50	4.7	FILL
7	CS	.	6.0	8.0	0.62	0.32	3.4	FILL
7	CS	.	8.0	10.0	0.37	0.32	3.1	FILL
7	CS	.	10.0	12.0	0.28	0.33	2.6	FILL
7	CS	.	12.0	14.0	0.29	1.41	4.0	FILL
7	CS	.	14.0	14.6	0.14	0.30	3.2	FILL
7	CS	.	14.6	16.0	2.10	0.26	3.5	FILL
7	CS	.	16.0	16.6	0.75	0.75	3.2	FILL
7	CS	.	16.6	18.0	0.36	0.94	4.0	FILL
7	CS	.	18.0	18.5	0.28	0.33	4.2	
7	CS	.	18.5	20.0	0.10	0.49	2.9	
7	CS	.	20.0	22.0	0.35	0.88	6.2	
7	CS	.	22.0	24.0	0.26	0.38	2.9	
7	CS	.	24.0	26.0	0.36	0.33	4.6	
8	CS	.	1.0	3.0	0.63	0.38	4.3	FILL
8	CS	.	3.0	5.0	0.23	0.25	2.9	FILL
8	CS	.	5.0	5.8	84.00	0.70	4.1	FILL
8	CS	.	6.5	7.0	0.30	0.27	3.9	FILL
8	CS	.	7.0	9.0	0.19	0.22	3.8	FILL
8	CS	.	9.0	9.3	0.27	0.53	2.9	FILL
8	CS	.	10.3	11.0	0.25	0.92	4.4	FILL
8	CS	.	11.0	11.6	0.39	0.29	3.9	FILL
8	CS	.	12.2	13.0	0.33	0.49	3.5	
9	CS	.	2.0	4.0	39.00	.	.	
9	CS	.	4.0	6.0	20.00	.	.	
9	CS	.	6.0	7.0	3.60	.	.	
9	CS	.	7.0	9.0	3.00	.	.	
9	CS	.	9.0	11.0	11.00	.	.	
9	CS	.	11.0	11.9	4.60	.	.	
9	CS	.	12.7	13.0	2.00	.	.	
9	CS	.	13.0	15.0	1.20	.	.	
9	CS	.	15.0	17.0	3.50	.	.	
B	AB	10AUG83	.	5.0	144.00	32.00	6.3	FILL
B	AB	10AUG83	.	10.0	48.00	13.00	4.8	FILL
B'	AB	10AUG83	.	5.0	33.00	21.00	4.6	FILL

Appendix F. (continued)

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon. UP, DOWN and DEPTH in feet below surface, Hg in μg/g dry weight, U and Th in μg/g dry weight, 6N HNO_3 digest. Negative prefix denotes "less than" value.

BORING	TYPE	DATE	UP	DOWN	Hg	U	TH	DESCRIPTION
BH1	PS	10DEC85	0.0	2.0	6.50	4.48	18.2	
BH1	PS	10DEC85	2.0	4.0	0.16	13.10	4.6	
BH1	CS	10DEC85	4.0	5.7	2.20	27.40	7.7	
BH1	CS	10DEC85	6.0	8.0	17.00	5.18	6.7	
BH1	CS	10DEC85	8.0	10.0	12.00	11.20	6.8	
BH1	CS	10DEC85	10.0	12.0	8.20	16.00	5.7	
BH1	CS	10DEC85	12.0	14.0	71.00	13.50	4.9	
BH1	CS	10DEC85	15.0	16.0	51.00	4.95	11.3	
BH1	CS	10DEC85	16.0	18.0	78.00	33.00	9.7	
BH1	CS	10DEC85	18.0	20.0	3.50	2.36	3.6	
BH1	SP	10DEC85	20.0	22.0	1.40	0.60	3.3	
BH1	SP	10DEC85	22.0	24.0	0.06	0.50	3.0	
BH1	SP	10DEC85	24.0	26.0	0.17	0.63	4.2	
BH1	SP	10DEC85	26.0	28.0	0.13	0.55	1.6	
BH1	SP	10DEC85	28.0	30.0	0.09	0.55	1.8	
BH1	SP	10DEC85	30.0	32.0	0.13	0.64	1.9	
BH1	CS	10DEC85	32.0	34.0	0.59	0.67	4.0	
BH1	CS	10DEC85	34.0	36.0	0.20	1.00	4.6	
BH1	CS	10DEC85	36.0	38.0	0.06	0.59	4.6	
BH1	CS	10DEC85	38.0	40.0	0.09	0.48	4.1	
BH2	PS	11DEC85	0.0	2.0	82.00	52.60	11.6	
BH2	PS	11DEC85	2.0	4.0	2.60	221.00	10.8	
BH2	CS	11DEC85	4.0	6.0	6.60	16.40	2.8	
BH2	CS	11DEC85	6.0	8.0	20.00	13.00	3.6	
BH2	CS	11DEC85	8.0	10.0	19.00	31.10	5.9	
BH2	CS	11DEC85	10.0	12.0	55.00	3.76	5.3	
BH2	CS	11DEC85	12.0	14.0	33.00	4.85	6.7	
BH2	CS	11DEC85	14.0	14.5	31.00	12.50	6.6	
BH2	CS	11DEC85	15.0	16.0	12.00	3.16	10.8	
BH2	CS	11DEC85	16.0	18.0	12.00	1.87	8.1	
BH2	CS	11DEC85	18.0	20.0	44.00	2.30	6.8	
BH2	CS	11DEC85	20.0	22.0	17.00	0.80	2.9	
BH2	CS	11DEC85	22.0	24.0	0.28	0.33	1.6	
BH2	CS	11DEC85	24.0	26.0	0.26	0.52	1.6	
BH2	CS	11DEC85	26.0	28.0	0.26	0.42	3.4	
BH2	CS	11DEC85	28.0	30.0	0.24	0.33	3.1	
BH2	CS	11DEC85	30.0	30.5	0.11	0.20	4.6	
BH3	PS	12DEC85	0.0	1.7	130.00	41.30	8.5	
BH3	PS	12DEC85	2.0	4.0	36.00	13.10	6.6	

Appendix F. (continued)

TYPE is AB=Auger bit, PS=Push Shelby, CS=Continuous Shelby, BA=Bucket auger, SC=Soil corer, T=Trowel, SP=Split spoon. UP, DOWN and DEPTH in feet below surface, Hg in $\mu g/g$ dry weight, U and Th in $\mu g/g$ dry weight, 6N HNO_3 digest. Negative prefix denotes "less than" value.

BORING	TYPE	DATE	UP	DOWN	Hg	U	TH	DESCRIPTION
BH3	CS	12DEC85	4.0	6.0	11.00		6.49	3.0
BH3	CS	12DEC85	6.0	8.0	28.00		16.40	6.5
BH3	CS	12DEC85	8.0	10.0	16.00		13.40	6.2
BH3	CS	12DEC85	10.0	12.0	113.00		10.60	7.5
BH3	CS	12DEC85	12.0	13.3	10.00		3.16	6.3
BH3	CS	12DEC85	14.0	14.2	34.00		6.02	6.0
BH3	CS	12DEC85	14.5	16.0	52.00		1.41	3.2
BH3	CS	12DEC85	16.0	18.0	13.00		1.45	2.0
BH3	CS	12DEC85	18.0	20.0	0.41		3.20	2.7
BH3	CS	12DEC85	20.0	21.5	1.60		0.24	1.1
BH3	CS	12DEC85	21.5	22.0	0.04		0.50	1.1
BH3	CS	12DEC85	22.0	24.0	0.06		0.54	1.5
BH3	CS	12DEC85	24.0	26.0	0.18		0.57	3.1
BH3	CS	12DEC85	26.0	28.0	0.07		0.35	2.2
BH3	CS	12DEC85	28.0	28.5	0.08		0.23	6.0
BH4	SP	16DEC85	17.0	19.0	79.00		27.70	9.2
BH4	SP	16DEC85	19.0	21.0	239.00		57.60	8.2
BH4	SP	16DEC85	21.0	23.0	169.00		15.20	5.1
C	CS	10AUG83	4.0	6.0	303.00		31.00	5.7 FILL
C	CS	10AUG83	5.5	6.0	303.00		8.80	4.5 FILL
C	CS	10AUG83	6.0	8.0	49.00		7.30	4.1 FILL
C	CS	10AUG83	8.0	10.0	20.00		11.0	5.3 FILL
C	CS	10AUG83	10.0	12.0	18.00		8.9	4.9 FILL
C	CS	10AUG83	12.0	14.0	32.00		2.6	5.1 FILL
C	CS	10AUG83	14.0	15.0	198.00		12.0	5.9 FILL
C	AB	10AUG83	15.0	17.0	105.00		12.0	5.6 FILL

APPENDIX G. BUILDING 9201-4 SUMP DATA FOR 1986 THROUGH 1988

Appendix G. Building 9201-4 Sump Data For 1986 Through 1988.

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
08/01/86 to 08/31/86

Date	Water Discharge (gal/day)	Mercury (lbs/day)
08/01/86	7,800	.005029
08/02/86	5,500	.002053
08/03/86	7,000	.001900
08/04/86	5,800	.002493
08/05/86	5,600	.002382
08/06/86	5,300	.002301
08/07/86	4,000	.001611
08/08/86	5,900	.002371
08/09/86	6,100	.000000
08/10/86	6,200	.000000
08/11/86	6,100	.002611
08/12/86	7,000	.003203
08/13/86	7,000	.002430
08/14/86	6,600	.001734
08/15/86	6,900	.002635
08/16/86	6,200	.000000
08/17/86	6,300	.000000
08/18/86	5,800	.002896
08/19/86	6,100	.000000
08/20/86	6,600	.000000
08/21/86	6,600	.002526
08/22/86	4,700	.001648
08/23/86	5,100	.000000
08/24/86	5,200	.000000
08/25/86	4,400	.001967
08/26/86	4,800	.002443
08/27/86	4,800	.002368
08/28/86	6,500	.003297
08/29/86	7,900	.001498
08/30/86	6,700	.002506
08/31/86	6,000	.002432
Monthly Total:	186,500	.056329
Monthly Discharge Average:	6,016	
Monthly Mercury Average:		.001828

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
09/01/86 to 09/30/86

Date	Water Discharge (gal/day)	Mercury (lbs/day)
09/01/86	5,500	.001603
09/02/86	5,700	.002321
09/03/86	9,600	.004410
09/04/86	6,300	.002883
09/05/86	8,600	.002970
09/06/86	5,000	.001252
09/07/86	6,200	.001909
09/08/86	4,800	.002113
09/09/86	4,800	.001549
09/10/86	5,000	.001627
09/11/86	4,900	.001556
09/12/86	4,600	.001645
09/13/86	5,200	.001891
09/14/86	4,500	.001942
09/15/86	4,700	.001819
09/16/86	4,400	.002879
09/17/86	5,200	.002538
09/18/86	4,500	.001977
09/19/86	5,300	.002098
09/20/86	4,900	.001867
09/21/86	4,700	.001770
09/22/86	5,000	.001718
09/23/86	3,500	.001419
09/24/86	5,900	.002536
09/25/86	3,600	.001663
09/26/86	4,000	.001667
09/27/86	2,600	.000975
09/28/86	5,300	.002517
09/29/86	5,000	.001731
09/30/86	4,600	.002005
Monthly Total:	153,900	.060850
Monthly Discharge Average:	5,130	
Monthly Mercury Average:		.002033

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
10/01/86 to 10/31/86

Date	Water Discharge (gal/day)	Mercury (lbs/day)
10/01/86	5,200	.002569
10/02/86	3,400	.001079
10/03/86	5,700	.002167
10/04/86	5,000	.001888
10/05/86	4,500	.002094
10/06/86	4,800	.001666
10/07/86	3,700	.001142
10/08/86	4,300	.002031
10/09/86	4,500	.001656
10/10/86	4,100	.001252
10/11/86	4,300	.001530
10/12/86	4,500	.001542
10/13/86	5,200	.001741
10/14/86	7,800	.002687
10/15/86	7,500	.002558
10/16/86	6,900	.002041
10/17/86	5,000	.001370
10/18/86	8,000	.002317
10/19/86	6,700	.002151
10/20/86	5,900	.002556
10/21/86	3,800	.001378
10/22/86	10,700	.004217
10/23/86	9,000	.002780
10/24/86	5,800	.001821
10/25/86	5,500	.001607
10/26/86	8,500	.002573
10/27/86	8,700	.002588
10/28/86	6,000	.001493
10/29/86	7,700	.002103
10/30/86	5,700	.002018
10/31/86	5,200	.001434
Monthly Total:	183,600	.062049
Monthly Discharge Average:	5,923	
Monthly Mercury Average:		.002024

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
11/01/86 to 11/30/86

Date	Water Discharge (gal/day)	Mercury (lbs/day)
11/01/86	8,600	.001900
11/02/86	1,900	.000538
11/03/86	3,000	.000780
11/04/86	2,600	.000760
11/05/86	5,600	.001135
11/06/86	1,800	.000324
11/07/86	3,500	.000584
11/08/86	4,200	.001202
11/09/86	5,000	.001657
11/10/86	4,800	.001545
11/11/86	5,600	.002187
11/12/86	5,000	.001513
11/13/86	4,600	.001328
11/14/86	5,200	.001701
11/15/86	8,200	.002304
11/16/86	5,600	.001622
11/17/86	6,700	.001912
11/18/86	5,100	.001442
11/19/86	5,500	.001550
11/20/86	7,300	.002223
11/21/86	8,800	.002764
11/22/86	7,500	.002199
11/23/86	7,000	.002125
11/24/86	7,800	.002409
11/25/86	7,100	.002168
11/26/86	6,900	.001957
11/27/86	8,600	.002753
11/28/86	5,500	.001229
11/29/86	4,300	.001159
11/30/86	6,300	.001403
Monthly Total:	169,600	.048373
Monthly Discharge Average:	5,653	
Monthly Mercury Average:		.001587

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page: 1
12/01/86 to 12/31/86

Date	Water Discharge (gal/day)	Mercury (lbs/day)
12/01/86	5,400	.001794
12/02/86	6,600	.001481
12/03/86	9,200	.003057
12/04/86	7,200	.001616
12/05/86	9,400	.001971
12/06/86	11,000	.002842
12/07/86	8,100	.002516
12/08/86	5,400	.002170
12/09/86	8,500	.002625
12/10/86	9,300	.003722
12/11/86	17,900	.008753
12/12/86	18,100	.008079
12/13/86	12,900	.006061
12/14/86	11,600	.004178
12/15/86	8,600	.003112
12/16/86	5,200	.001692
12/17/86	10,100	.003559
12/18/86	6,700	.002739
12/19/86	3,700	.001761
12/20/86	6,200	.003021
12/21/86	3,800	.001696
12/22/86	5,200	.002112
12/23/86	3,800	.001256
12/24/86	8,200	.003310
12/25/86	11,600	.005147
12/26/86	12,000	.004260
12/27/86	10,300	.004346
12/28/86	12,300	.005501
12/29/86	13,900	.005877
12/30/86	12,100	.004095
12/31/86	15,900	.005741
Monthly Total:	290,200	.110090
Monthly Discharge Average:	9,361	
Monthly Mercury Average:		.003490

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
01/01/87 to 01/31/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
01/01/87	11,700	.004194
01/02/87	13,900	.006652
01/03/87	13,300	.005230
01/04/87	14,300	.005810
01/05/87	14,600	.005246
01/06/87	12,800	.005022
01/07/87	13,500	.004205
01/08/87	3,100	.000998
01/09/87	22,400	.007445
01/10/87	12,200	.003577
01/11/87	10,400	.003067
01/12/87	19,100	.005600
01/13/87	14,100	.004146
01/14/87	6,600	.001946
01/15/87	18,200	.005400
01/16/87	11,800	.003039
01/17/87	11,700	.002148
01/18/87	14,500	.001614
01/19/87	14,900	.002605
01/20/87	17,700	.003696
01/21/87	12,500	.004578
01/22/87	16,900	.005337
01/23/87	17,300	.005494
01/24/87	16,500	.004594
01/25/87	16,100	.004805
01/26/87	17,200	.004070
01/27/87	15,100	.004296
01/28/87	16,200	.006103
01/29/87	15,900	.004966
01/30/87	15,100	.003915
01/31/87	14,700	.004553
Monthly Total:	444,300	.134351
Monthly Discharge Average:	14,332	
Monthly Mercury Average:		.004352

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page: 1
02/01/87 to 02/28/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
02/01/87	15,300	.004726
02/02/87	14,400	.003144
02/03/87	15,500	.003007
02/04/87	14,700	.002340
02/05/87	5,400	.000897
02/06/87	26,400	.007465
02/07/87	13,200	.004019
02/08/87	14,800	.005357
02/09/87	17,000	.003697
02/10/87	17,800	.004336
02/11/87	13,600	.004129
02/12/87	11,100	.003534
02/13/87	11,000	.003780
02/14/87	8,500	.002662
02/15/87	13,100	.004103
02/16/87	11,700	.004784
02/17/87	13,500	.005520
02/18/87	12,800	.008197
02/19/87	10,200	.004437
02/20/87	10,700	.003327
02/21/87	4,100	.001275
02/22/87	4,200	.001306
02/23/87	4,000	.001243
02/24/87	4,100	.001275
02/25/87	4,300	.001337
02/26/87	4,200	.001297
02/27/87	6,400	.003140
02/28/87	8,200	.001041
Monthly Total:	310,200	.095375
Monthly Discharge Average:	11,079	
Monthly Mercury Average:		.003456

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page: 1
03/01/87 to 03/31/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
03/01/87	8,600	.002619
03/02/87	8,500	.002366
03/03/87	5,700	.001735
03/04/87	2,500	.000739
03/05/87	2,400	.000939
03/06/87	5,200	.001131
03/07/87	1,500	.000365
03/08/87	1,300	.000395
03/09/87	2,000	.000435
03/10/87	2,500	.000848
03/11/87	2,500	.000674
03/12/87	8,000	.002227
03/13/87	7,900	.002130
03/14/87	9,500	.002645
03/15/87	7,700	.002143
03/16/87	3,900	.000950
03/17/87	7,400	.001738
03/18/87	7,200	.001816
03/19/87	4,500	.001213
03/20/87	6,300	.002083
03/21/87	6,300	.001863
03/22/87	6,300	.001863
03/23/87	6,300	.001918
03/24/87	6,300	.002083
03/25/87	6,600	.002354
03/26/87	6,300	.002192
03/27/87	3,000	.001096
03/28/87	2,600	.000678
03/29/87	2,300	.000740
03/30/87	2,200	.000708
03/31/87	3,600	.001002
Monthly Total:	156,900	.045688
Monthly Discharge Average:	5,061	
Monthly Mercury Average:		.001483

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
04/01/87 to 04/30/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
04/01/87	5,700	.000000
04/02/87	6,000	.000000
04/03/87	11,000	.000000
04/04/87	12,000	.000000
04/05/87	9,100	.000000
04/06/87	10,800	.000000
04/07/87	5,500	.000000
04/08/87	5,800	.000000
04/09/87	3,900	.000000
04/10/87	4,600	.000000
04/11/87	5,200	.000000
04/12/87	3,000	.000000
04/13/87	2,200	.000000
04/14/87	3,800	.000000
04/15/87	2,300	.000000
04/16/87	3,000	.000000
04/17/87	3,000	.000000
04/18/87	3,000	.000000
04/19/87	3,000	.000000
04/20/87	3,000	.000000
04/21/87	3,000	.000000
04/22/87	1,500	.000000
04/23/87	2,000	.000000
04/24/87	2,600	.000000
04/25/87	2,800	.000000
04/26/87	2,900	.000000
04/27/87	2,500	.000000
04/28/87	1,800	.000000
04/29/87	1,500	.000000
04/30/87	2,100	.000000
Monthly Total:	128,600	.000000
Monthly Discharge Average:	4,287	
Monthly Mercury Average:		.000000

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/03/89 Sump Discharge by Date Span Page:
05/01/87 to 05/31/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
05/01/87	4,300	.000000
05/02/87	3,500	.000000
05/03/87	2,900	.000000
05/04/87	3,000	.000000
05/05/87	1,600	.000000
05/06/87	5,400	.000000
05/07/87	1,900	.000000
05/08/87	2,500	.000000
05/09/87	2,000	.000000
05/10/87	2,600	.000000
05/11/87	3,200	.000000
05/12/87	2,000	.000000
05/13/87	3,000	.000000
05/14/87	3,000	.000000
05/15/87	3,000	.000000
05/16/87	3,000	.000000
05/17/87	3,100	.000000
05/18/87	3,000	.000000
05/19/87	3,000	.000000
05/20/87	3,100	.000000
05/21/87	3,100	.000000
05/22/87	2,600	.000000
05/23/87	3,400	.000000
05/24/87	3,100	.000000
05/25/87	3,000	.000000
05/26/87	3,100	.000000
05/27/87	4,200	.000000
05/28/87	3,600	.000000
05/29/87	3,600	.000000
05/30/87	3,600	.000000
05/31/87	3,600	.000000
Monthly Total:	96,000	.000000
Monthly Discharge Average:	3,097	
Monthly Mercury Average:		.000000

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/03/89 Sump Discharge by Date Span Page:
06/01/87 to 06/30/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
06/01/87	3,600	.000000
06/02/87	2,900	.000000
06/03/87	3,000	.000000
06/04/87	5,000	.000000
06/05/87	700	.000000
06/06/87	4,900	.000000
06/07/87	3,500	.000000
06/08/87	1,200	.000000
06/09/87	3,000	.000000
06/10/87	5,500	.000000
06/11/87	2,800	.000000
06/12/87	2,800	.000000
06/13/87	2,900	.000000
06/14/87	3,300	.000000
06/15/87	3,300	.000000
06/16/87	3,300	.000000
06/17/87	3,300	.000000
06/18/87	3,400	.000000
06/19/87	3,300	.000000
06/20/87	4,000	.000000
06/21/87	4,000	.000000
06/22/87	4,000	.000000
06/23/87	4,000	.000000
06/24/87	4,000	.000000
06/25/87	4,000	.000000
06/26/87	3,800	.000000
06/27/87	3,900	.000000
06/28/87	3,500	.000000
06/29/87	3,600	.000000
06/30/87	3,300	.000000
Monthly Total:	103,800	.000000
Monthly Discharge Average:	3,460	
Monthly Mercury Average:		.000000

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/03/89 Sump Discharge by Date Span Page:
07/01/87 to 07/31/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
07/01/87	3,200	.000000
07/02/87	4,900	.000000
07/03/87	4,900	.000000
07/04/87	4,900	.000000
07/05/87	4,900	.000000
07/06/87	4,900	.000000
07/07/87	4,900	.000000
07/08/87	4,900	.000000
07/09/87	4,900	.000000
07/10/87	4,900	.000000
07/11/87	5,000	.000000
07/12/87	4,900	.000000
07/13/87	4,900	.000000
07/14/87	4,900	.000000
07/15/87	4,900	.000000
07/16/87	4,900	.000000
07/17/87	9,800	.000000
07/18/87	4,900	.000000
07/19/87	2,300	.000000
07/20/87	2,400	.000000
07/21/87	2,400	.000000
07/22/87	2,000	.000000
07/23/87	2,700	.000000
07/24/87	2,400	.000000
07/25/87	2,300	.000000
07/26/87	2,400	.000000
07/27/87	2,400	.000000
07/28/87	2,400	.000000
07/29/87	2,300	.000000
07/30/87	2,400	.000000
07/31/87	2,400	.000000
Monthly Total:	122,300	.000000
Monthly Discharge Average:	3,945	
Monthly Mercury Average:		.000000

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/03/89 Sump Discharge by Date Span Page:
08/01/87 to 08/31/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
08/01/87	2,400	.000000
08/02/87	1,800	.000000
08/03/87	2,200	.000000
08/04/87	2,100	.000000
08/05/87	2,700	.000000
08/06/87	2,000	.000000
08/07/87	2,200	.000000
08/08/87	2,700	.000000
08/09/87	3,100	.000000
08/10/87	3,800	.000000
08/11/87	3,400	.000000
08/12/87	2,200	.000000
08/13/87	2,200	.000000
08/14/87	4,400	.000000
08/15/87	3,000	.000000
08/16/87	2,000	.000000
08/17/87	2,000	.000000
08/18/87	2,000	.000000
08/19/87	1,700	.000000
08/20/87	2,200	.000000
08/21/87	2,000	.000000
08/22/87	1,900	.000000
08/23/87	2,200	.000000
08/24/87	2,200	.000000
08/25/87	2,700	.000000
08/26/87	2,300	.000000
08/27/87	1,600	.000000
08/28/87	2,700	.000000
08/29/87	2,100	.000000
08/30/87	2,800	.000000
08/31/87	2,100	.000000
Monthly Total:	74,700	.000000
Monthly Discharge Average:	2,410	
Monthly Mercury Average:		.000000

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/03/89 Sump Discharge by Date Span Page:
09/01/87 to 09/30/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
09/01/87	3,300	.000000
09/02/87	2,600	.000000
09/03/87	2,800	.000000
09/04/87	2,000	.000000
09/05/87	2,000	.000000
09/06/87	3,500	.000000
09/07/87	2,000	.000000
09/08/87	2,800	.000000
09/09/87	2,200	.000000
09/10/87	3,500	.000000
09/11/87	3,900	.000000
09/12/87	5,600	.000000
09/13/87	8,000	.000000
09/14/87	6,500	.000000
09/15/87	4,800	.000000
09/16/87	3,200	.000000
09/17/87	4,000	.000000
09/18/87	3,200	.000000
09/19/87	3,700	.000000
09/20/87	4,700	.000000
09/21/87	4,700	.000000
09/22/87	2,800	.000000
09/23/87	3,200	.000000
09/24/87	2,900	.000000
09/25/87	3,800	.000000
09/26/87	3,600	.000000
09/27/87	2,300	.000000
09/28/87	3,500	.000000
09/29/87	3,200	.000000
09/30/87	3,500	.000000
Monthly Total:	107,800	.000000
Monthly Discharge Average:	3,593	
Monthly Mercury Average:		.000000

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/03/89 Sump Discharge by Date Span Page:
10/01/87 to 10/31/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
10/01/87	5,200	.000814
10/02/87	4,500	.000704
10/03/87	4,700	.000736
10/04/87	3,300	.000516
10/05/87	2,800	.000438
10/06/87	2,900	.000454
10/07/87	2,800	.000438
10/08/87	2,900	.000454
10/09/87	2,900	.000681
10/10/87	2,900	.000454
10/11/87	1,600	.000132
10/12/87	1,700	.000266
10/13/87	3,800	.000595
10/14/87	3,900	.000610
10/15/87	3,800	.000595
10/16/87	2,100	.000328
10/17/87	2,600	.000407
10/18/87	10,100	.001072
10/19/87	11,600	.001816
10/20/87	4,000	.000626
10/21/87	8,400	.001315
10/22/87	2,100	.000529
10/23/87	4,900	.001151
10/24/87	4,000	.000852
10/25/87	4,000	.000556
10/26/87	3,000	.000287
10/27/87	5,100	.000621
10/28/87	3,700	.000466
10/29/87	3,300	.000516
10/30/87	3,400	.000532
10/31/87	3,400	.000532
Monthly Total:	125,400	.019493
Monthly Discharge Average:	4,045	
Monthly Mercury Average:		.000638

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
11/01/87 to 11/30/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
11/01/87	3,900	.001224
11/02/87	3,300	.000803
11/03/87	5,100	.001242
11/04/87	3,300	.001119
11/05/87	3,900	.000950
11/06/87	3,600	.000877
11/07/87	5,000	.001218
11/08/87	6,900	.001681
11/09/87		.000000
11/10/87	3,000	.000574
11/11/87	6,200	.001618
11/12/87	7,000	.001583
11/13/87	5,000	.001261
11/14/87	5,500	.001339
11/15/87	3,500	.000883
11/16/87	5,600	.001656
11/17/87	6,700	.001340
11/18/87	1,900	.000429
11/19/87	2,600	.000633
11/20/87	9,200	.002241
11/21/87	7,900	.001924
11/22/87	5,700	.001388
11/23/87	7,100	.001729
11/24/87	8,300	.002022
11/25/87	1,800	.000438
11/26/87	3,100	.000755
11/27/87	3,400	.000828
11/28/87	2,900	.000706
11/29/87	3,300	.000803
11/30/87	3,300	.000803
Monthly Total:	138,000	.034066
Monthly Discharge Average:	4,600	
Monthly Mercury Average:		.001130

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
12/01/87 to 12/31/87

Date	Water Discharge (gal/day)	Mercury (lbs/day)
12/01/87	6,300	.001814
12/02/87	3,900	.001123
12/03/87	3,900	.001102
12/04/87	3,900	.001092
12/05/87	3,900	.000984
12/06/87	3,700	.001055
12/07/87	3,800	.001157
12/08/87	3,800	.001248
12/09/87	3,900	.001153
12/10/87	3,800	.001157
12/11/87	3,900	.001119
12/12/87	3,800	.001058
12/13/87	3,900	.001051
12/14/87	3,900	.000984
12/15/87	2,000	.000556
12/16/87	2,700	.000770
12/17/87	5,400	.001503
12/18/87	5,500	.001674
12/19/87	5,100	.001508
12/20/87	5,500	.001674
12/21/87	4,400	.001071
12/22/87	2,200	.000669
12/23/87	4,900	.001279
12/24/87	4,900	.001620
12/25/87	5,000	.001479
12/26/87	7,000	.001827
12/27/87	6,600	.001952
12/28/87	7,600	.001322
12/29/87	7,100	.002471
12/30/87	2,300	.000700
12/31/87	2,300	.000660
Monthly Total:	136,900	.038832
Monthly Discharge Average:	4,416	
Monthly Mercury Average:		.001260

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
01/01/88 to 01/31/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
01/01/88	34,600	.010236
01/02/88	100	.000027
01/03/88	35,300	.008600
01/04/88	16,100	.003922
01/05/88	16,200	.004369
01/06/88	17,800	.004181
01/07/88	7,000	.001492
01/08/88	10,100	.001889
01/09/88	35,300	.001228
01/10/88	4,600	.000040
01/11/88	12,000	.003028
01/12/88	8,200	.001926
01/13/88	27,400	.007343
01/14/88	25,700	.006350
01/15/88	25,800	.006375
01/16/88	7,100	.001754
01/17/88	9,000	.002036
01/18/88	7,300	.002032
01/19/88	7,300	.002540
01/20/88	7,400	.001996
01/21/88	7,300	.002159
01/22/88	7,400	.001996
01/23/88	7,300	.001778
01/24/88	7,300	.001587
01/25/88	7,400	.001609
01/26/88	7,300	.001587
01/27/88	7,400	.001609
01/28/88	7,400	.001480
01/29/88	8,800	.001148
01/30/88	7,000	.001601
01/31/88	7,000	.001601
Monthly Total:	395,900	.089519
Monthly Discharge Average:	12,771	
Monthly Mercury Average:		.002923

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
02/01/88 to 02/29/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
02/01/88	7,100	.001701
02/02/88	6,200	.001486
02/03/88	5,900	.002438
02/04/88	5,700	.001066
02/05/88	6,900	.002041
02/06/88	6,100	.001836
02/07/88	6,100	.001687
02/08/88	6,200	.001769
02/09/88	4,700	.001010
02/10/88	4,600	.001076
02/11/88	5,800	.001312
02/12/88	4,800	.001420
02/13/88	4,600	.001188
02/14/88	4,600	.000994
02/15/88	4,700	.001016
02/16/88	4,600	.000800
02/17/88	5,800	.000933
02/18/88	5,800	.000857
02/19/88	4,900	.000942
02/20/88	4,500	.000865
02/21/88	4,500	.000865
02/22/88	4,600	.001088
02/23/88	4,900	.001172
02/24/88	4,500	.001268
02/25/88	5,900	.001416
02/26/88	5,700	.001408
02/27/88	5,800	.001473
02/28/88	5,700	.001450
02/29/88	5,100	.001211
Monthly Total:	156,300	.037788
Monthly Discharge Average:	5,390	
Monthly Mercury Average:		.001292

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page: 1
03/01/88 to 03/31/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
03/01/88	5,200	.001266
03/02/88	5,400	.001268
03/03/88	4,600	.000000
03/04/88	5,600	.001413
03/05/88	5,400	.001315
03/06/88	5,400	.001174
03/07/88	5,600	.001461
03/08/88	6,100	.001486
03/09/88	4,700	.001226
03/10/88	5,600	.001364
03/11/88	7,100	.001976
03/12/88	7,200	.001754
03/13/88	7,200	.001754
03/14/88	7,300	.002032
03/15/88	5,300	.001383
03/16/88	5,500	.001196
03/17/88	4,900	.001193
03/18/88	5,500	.001435
03/19/88	4,800	.001420
03/20/88	4,800	.000000
03/21/88	5,000	.000000
03/22/88	4,400	.000918
03/23/88	4,400	.001148
03/24/88	4,600	.001200
03/25/88	3,900	.001018
03/26/88	4,500	.001135
03/27/88	4,500	.001174
03/28/88	4,700	.000000
03/29/88	5,300	.000968
03/30/88	4,300	.001085
03/31/88	3,000	.000626
Monthly Total:	161,800	.035387
Monthly Discharge Average:	5,219	
Monthly Mercury Average:		.001123

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
04/01/88 to 04/30/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
04/01/88	3,100	.000620
04/02/88	4,500	.000939
04/03/88	4,600	.001280
04/04/88	4,300	.000897
04/05/88	3,300	.000631
04/06/88	4,000	.000835
04/07/88	4,900	.001108
04/08/88	5,600	.000828
04/09/88	4,800	.000459
04/10/88	4,500	.000430
04/11/88	5,300	.001152
04/12/88	6,200	.001402
04/13/88	3,800	.000892
04/14/88	5,200	.001131
04/15/88	5,000	.000565
04/16/88	4,900	.000042
04/17/88	4,900	.000042
04/18/88	4,900	.000085
04/19/88	6,600	.000057
04/20/88	6,100	.000902
04/21/88	5,300	.001521
04/22/88	5,300	.001521
04/23/88	4,300	.001346
04/24/88	4,300	.001309
04/25/88	4,400	.001301
04/26/88	4,400	.001416
04/27/88	4,400	.001416
04/28/88	4,500	.001370
04/29/88	3,600	.001065
04/30/88	3,600	.001190
Monthly Total:	140,600	.027752
Monthly Discharge Average:	4,687	
Monthly Mercury Average:		.000957

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page: 1
05/01/88 to 05/31/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
05/01/88	6,600	.002124
05/02/88	4,700	.001513
05/03/88	4,000	.001252
05/04/88	4,500	.001409
05/05/88	4,000	.001252
05/06/88	5,300	.001521
05/07/88	4,300	.001384
05/08/88	4,300	.000710
05/09/88	4,400	.000727
05/10/88	5,200	.000859
05/11/88	4,600	.000760
05/12/88	4,600	.001520
05/13/88	4,600	.001440
05/14/88	4,300	.001346
05/15/88	4,300	.001272
05/16/88	4,400	.000842
05/17/88	3,200	.000612
05/18/88	4,400	.000842
05/19/88	3,500	.001004
05/20/88	4,800	.001336
05/21/88	3,100	.000944
05/22/88	2,700	.000775
05/23/88	5,000	.001522
05/24/88	3,300	.001062
05/25/88	4,300	.001384
05/26/88	4,300	.001346
05/27/88	4,300	.001346
05/28/88	3,700	.001287
05/29/88	4,000	.001252
05/30/88	3,700	.001126
05/31/88	3,700	.001191
Monthly Total:	132,100	.036960
Monthly Discharge Average:	4,261	
Monthly Mercury Average:		.001195

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page: 1
06/01/88 to 06/30/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
06/01/88	4,000	.001113
06/02/88	3,700	.001255
06/03/88	2,900	.001110
06/04/88	5,000	.001348
06/05/88	3,200	.001030
06/06/88	2,000	.000696
06/07/88	3,200	.001225
06/08/88	3,800	.001421
06/09/88	3,100	.001159
06/10/88	3,200	.001197
06/11/88	3,200	.001197
06/12/88	3,300	.001234
06/13/88	3,300	.001234
06/14/88	3,400	.001242
06/15/88	3,600	.001158
06/16/88	5,400	.001879
06/17/88	2,500	.000804
06/18/88	3,700	.001191
06/19/88	3,400	.000976
06/20/88	3,400	.001272
06/21/88	4,100	.001569
06/22/88	5,100	.001508
06/23/88	4,500	.001605
06/24/88	2,700	.000751
06/25/88	2,900	.000883
06/26/88	2,700	.000775
06/27/88	2,800	.000925
06/28/88	2,900	.000933
06/29/88	2,800	.000852
06/30/88	2,800	.000925
Monthly Total:	102,600	.034467
Monthly Discharge Average:	3,420	
Monthly Mercury Average:		.001151

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
07/01/88 to 07/31/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
07/01/88	4,100	.001212
07/02/88	1,300	.000339
07/03/88	3,100	.000620
07/04/88	4,300	.000785
07/05/88	2,300	.000640
07/06/88	4,700	.001267
07/07/88	4,000	.000139
07/08/88	4,500	.001213
07/09/88	3,600	.000971
07/10/88	3,600	.000971
07/11/88	3,700	.000998
07/12/88	15,100	.004073
07/13/88	9,800	.002643
07/14/88	10,700	.002886
07/15/88	8,800	.002373
07/16/88	5,200	.001402
07/17/88	5,200	.001402
07/18/88	5,900	.002258
07/19/88	5,900	.001591
07/20/88	4,500	.001213
07/21/88	4,100	.001105
07/22/88	6,600	.001780
07/23/88	5,700	.001537
07/24/88	5,700	.001537
07/25/88	5,700	.001934
07/26/88	4,300	.001421
07/27/88	4,000	.001218
07/28/88	5,800	.002069
07/29/88	5,100	.001553
07/30/88	4,600	.001240
07/31/88	2,300	.000620
Monthly Total:	164,200	.045010
Monthly Discharge Average:	5,297	
Monthly Mercury Average:		.001434

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page: 1
08/01/88 to 08/31/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
08/01/88	4,200	.001571
08/02/88	2,800	.001047
08/03/88	4,200	.001498
08/04/88	3,900	.001425
08/05/88	3,500	.001400
08/06/88	3,700	.001480
08/07/88	3,700	.001384
08/08/88	3,900	.001527
08/09/88	3,700	.001352
08/10/88	3,400	.001301
08/11/88	3,400	.001272
08/12/88	4,900	.001875
08/13/88	3,600	.001346
08/14/88	3,600	.001315
08/15/88	3,600	.001346
08/16/88	3,800	.001520
08/17/88	2,900	.001059
08/18/88	3,600	.001440
08/19/88	2,500	.001022
08/20/88	4,800	.001962
08/21/88	4,900	.001748
08/22/88	4,900	.001790
08/23/88	4,000	.001601
08/24/88	3,600	.001190
08/25/88	3,800	.001421
08/26/88	4,100	.001534
08/27/88	3,300	.001177
08/28/88	3,300	.001119
08/29/88	3,300	.001062
08/30/88	3,600	.001284
08/31/88	3,200	.001197
Monthly Total:	115,700	.043265
Monthly Discharge Average:	3,732	
Monthly Mercury Average:		.001395

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
09/01/88 to 09/30/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
09/01/88	3,400	.001212
09/02/88	3,100	.001213
09/03/88	5,400	.001973
09/04/88	5,400	.002020
09/05/88	5,400	.002020
09/06/88	5,700	.002182
09/07/88	5,500	.002344
09/08/88	4,500	.001722
09/09/88	4,500	.001683
09/10/88	4,200	.001534
09/11/88	4,200	.001461
09/12/88	4,400	.001493
09/13/88	4,200	.001352
09/14/88	4,700	.000858
09/15/88	4,300	.000972
09/16/88	4,600	.001681
09/17/88	5,000	.001827
09/18/88	5,000	.001827
09/19/88	5,100	.001775
09/20/88	4,100	.001569
09/21/88	4,600	.001641
09/22/88	5,300	.001844
09/23/88	5,600	.002046
09/24/88	5,700	.002083
09/25/88	5,700	.002083
09/26/88	5,700	.002182
09/27/88	5,700	.002182
09/28/88	5,500	.002057
09/29/88	5,500	.001962
09/30/88	6,000	.002297
Monthly Total:	148,000	.053095
Monthly Discharge Average:	4,933	
Monthly Mercury Average:		.001762

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
10/01/88 to 10/31/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
10/01/88	5,900	.002156
10/02/88	4,900	.001790
10/03/88	4,300	.001459
10/04/88	4,900	.001875
10/05/88	5,600	.002192
10/06/88	4,100	.001534
10/07/88	3,600	.001096
10/08/88	4,600	.001761
10/09/88	4,600	.001761
10/10/88	4,600	.001601
10/11/88	3,200	.001169
10/12/88	4,000	.001392
10/13/88	4,500	.001644
10/14/88	4,200	.001571
10/15/88	3,200	.001197
10/16/88	3,200	.000974
10/17/88	3,400	.001183
10/18/88	3,500	.001218
10/19/88	4,200	.001607
10/20/88	4,300	.001534
10/21/88	4,100	.001569
10/22/88	4,200	.001534
10/23/88	4,500	.001644
10/24/88	4,100	.001498
10/25/88	4,200	.001461
10/26/88	4,200	.001352
10/27/88	2,600	.000927
10/28/88	4,600	.001560
10/29/88	4,600	.001641
10/30/88	4,600	.001641
10/31/88	4,800	.001754
Monthly Total:	131,300	.047295
Monthly Discharge Average:	4,235	
Monthly Mercury Average:		.001520

Appendix G. (continued)

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
11/01/88 to 11/30/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
11/01/88	4,800	.001712
11/02/88	5,200	.001900
11/03/88	4,600	.001681
11/04/88	5,000	.001696
11/05/88	11,700	.003766
11/06/88	11,700	.003155
11/07/88	11,700	.003563
11/08/88	7,400	.002511
11/09/88	7,500	.002871
11/10/88	7,400	.002704
11/11/88	7,500	.002610
11/12/88	7,400	.002511
11/13/88	7,500	.002414
11/14/88	7,600	.001917
11/15/88	7,600	.001983
11/16/88	7,600	.003108
11/17/88	7,700	.002612
11/18/88	8,600	.003142
11/19/88	9,200	.003041
11/20/88	9,200	.002401
11/21/88	9,200	.002881
11/22/88	9,100	.002850
11/23/88	7,900	.002818
11/24/88	6,600	.002297
11/25/88	6,600	.002182
11/26/88	6,600	.002239
11/27/88	6,600	.002239
11/28/88	6,800	.002366
11/29/88	7,800	.002443
11/30/88	14,600	.004573
Monthly Total:	238,700	.078186
Monthly Discharge Average:	7,957	
Monthly Mercury Average:		.002640

ADMRPT060 ALPHA-4 DECOMMISSIONING MANAGEMENT INFORMATION SYSTEM
Date: 8/04/89 Sump Discharge by Date Span Page:
12/01/88 to 12/31/88

Date	Water Discharge (gal/day)	Mercury (lbs/day)
12/01/88	11,400	.000000
12/02/88	11,600	.000000
12/03/88	11,100	.000000
12/04/88	11,100	.000000
12/05/88	11,200	.000000
12/06/88	10,900	.000000
12/07/88	10,600	.000000
12/08/88	13,400	.000000
12/09/88	13,100	.000000
12/10/88	14,700	.000000
12/11/88	14,700	.000000
12/12/88	14,800	.000000
12/13/88	15,100	.000000
12/14/88	15,000	.000000
12/15/88	14,600	.000000
12/16/88	14,400	.000000
12/17/88	15,900	.000000
12/18/88	16,000	.000000
12/19/88	16,000	.000000
12/20/88	13,700	.000000
12/21/88	12,400	.000000
12/22/88	13,100	.000000
12/23/88	11,900	.000000
12/24/88	11,900	.000000
12/25/88	11,900	.000000
12/26/88	12,000	.000000
12/27/88	11,800	.000000
12/28/88	11,900	.000000
12/29/88	11,300	.000000
12/30/88	11,900	.000000
12/31/88	13,600	.000000
Monthly Total:	403,000	.000000
Monthly Discharge Average:	13,000	
Monthly Mercury Average:		.000000

APPENDIX H. RESULTS OF MERCURY AIR MONITORING IN ALPHA-4
JULY 1, 1988 THROUGH JUNE 31, 1989

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 1 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-1							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	97.9	17.0	57.9	27.8	24.4	25.6
AUG88	69	150.0	6.0	63.7	30.0	24.4	26.9
SEP88	63	89.0	0.0	34.0	30.0	21.1	23.7
OCT88	63	63.0	6.0	26.7	22.2	12.2	16.2
NOV88	60	82.9	0.0	22.0	18.9	9.4	14.3
DEC88	60	64.9	1.0	28.3	23.3	11.7	15.6
JAN89	66	50.0	4.0	23.9	26.1	6.7	13.9
FEB89	54	61.0	9.9	27.0	20.6	7.8	14.4
MAR89	66	64.9	2.0	29.8	20.6	12.2	16.5
APR89	60	156.0	0.0	32.3	23.3	12.2	17.3
MAY89	63	172.0	0.0	37.0	23.3	13.3	18.4
JUN89	39	111.0	7.0	28.9	24.4	17.8	22.5

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 2 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-2							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	67.0	1.0	21.3	26.7	24.4	25.4
AUG88	69	57.0	0.0	15.6	31.1	23.9	26.7
SEP88	63	35.9	0.0	10.0	28.9	21.1	23.2
OCT88	63	28.0	0.0	9.5	22.2	13.3	17.0
NOV88	60	28.0	0.0	8.9	18.9	12.8	15.4
DEC88	60	134.0	0.0	13.2	21.1	13.3	16.0
JAN89	66	23.0	0.0	5.4	18.9	11.1	13.8
FEB89	54	32.0	0.0	10.1	20.6	12.2	16.5
MAR89	66	50.0	0.0	11.3	21.1	15.6	17.9
APR89	60	57.9	0.0	10.4	22.2	14.4	18.0
MAY89	63	83.9	0.0	14.9	22.2	14.4	18.4
JUN89	39	76.9	0.0	12.7	23.9	19.4	22.1

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 3 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-3							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	23.0	0.0	4.0	28.9	25.6	26.7
AUG88	69	20.9	0.0	3.9	29.4	25.0	27.2
SEP88	63	17.9	0.0	3.1	30.0	22.2	24.3
OCT88	63	21.9	0.0	2.6	23.3	15.0	18.3
NOV88	60	17.9	0.0	2.5	21.1	13.9	17.5
DEC88	60	17.9	0.0	2.1	20.6	12.8	15.6
JAN89	66	6.0	0.0	0.7	17.2	11.1	14.3
FEB89	54	25.0	0.0	1.5	21.1	12.2	17.8
MAR89	66	20.9	0.0	3.0	23.9	16.1	20.1
APR89	60	28.0	0.0	4.0	24.4	16.1	20.4
MAY89	63	35.0	0.0	3.2	22.8	13.3	19.2
JUN89	39	28.9	0.0	4.6	24.4	17.2	22.2

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 4 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-4							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	9.9	0.0	3.2	27.8	24.4	26.2
AUG88	69	27.0	0.0	5.7	28.9	24.4	26.9
SEP88	63	17.0	0.0	3.8	30.0	22.2	24.2
OCT88	63	8.9	0.0	2.6	25.0	15.0	18.5
NOV88	60	12.0	0.0	2.7	20.6	15.0	17.7
DEC88	60	14.0	0.0	2.7	19.4	13.3	15.8
JAN89	66	6.0	0.0	1.0	18.3	12.2	14.2
FEB89	54	14.0	0.0	1.2	25.6	13.3	17.9
MAR89	66	14.9	0.0	1.9	22.8	15.6	19.4
APR89	60	13.0	0.0	3.0	23.3	16.1	19.3
MAY89	63	16.0	0.0	2.4	22.2	13.3	18.8
JUN89	39	21.9	0.0	3.7	23.3	17.8	21.8

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 5 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE=5							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	75.0	0.0	16.1	29.4	25.6	27.5
AUG88	69	70.0	0.0	8.2	30.6	25.6	27.8
SEP88	63	82.9	0.0	8.5	31.1	22.2	24.6
OCT88	63	21.9	0.0	5.6	23.9	13.9	17.8
NOV88	60	54.0	0.0	4.3	19.4	11.7	15.7
DEC88	60	45.0	0.0	5.3	18.3	9.4	14.3
JAN89	66	41.9	0.0	2.9	17.2	8.9	12.7
FEB89	54	65.9	0.0	4.6	20.6	7.2	14.7
MAR89	66	37.9	0.0	4.2	22.2	12.2	17.3
APR89	60	52.0	0.0	5.4	24.4	13.9	18.6
MAY89	63	71.9	0.0	7.9	23.3	13.3	19.1
JUN89	39	172.9	0.0	22.1	25.6	19.4	23.2

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 6 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-6							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	68.0	1.0	20.6	28.3	24.4	26.4
AUG88	69	64.9	0.0	18.1	30.6	23.9	27.4
SEP88	63	30.9	0.0	10.1	25.6	20.0	23.2
OCT88	63	14.9	0.0	5.3	21.7	11.7	16.1
NOV88	60	17.0	0.0	3.9	18.3	11.7	14.7
DEC88	60	25.0	0.0	4.9	16.1	6.7	12.3
JAN89	66	9.9	0.0	1.4	16.7	3.9	11.3
FEB89	54	18.9	0.0	2.2	20.6	4.4	13.3
MAR89	66	19.9	0.0	3.3	20.6	10.6	15.1
APR89	60	19.9	0.0	4.2	22.8	11.7	16.7
MAY89	63	45.0	0.0	7.7	22.8	13.3	18.3
JUN89	39	94.9	2.0	27.6	23.9	18.3	22.4

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 7 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-7							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	68.9	4.9	18.5	30.6	25.0	27.5
AUG88	69	59.9	4.0	20.3	30.0	25.6	28.1
SEP88	63	41.9	0.0	12.4	26.7	22.2	24.7
OCT88	63	23.0	1.0	6.6	24.4	14.4	18.1
NOV88	60	9.9	0.0	3.0	25.0	12.2	17.1
DEC88	60	28.0	0.0	6.6	26.7	17.8	22.1
JAN89	66	10.9	0.0	3.5	24.4	13.9	19.9
FEB89	54	14.0	0.0	2.4	27.8	18.3	22.7
MAR89	66	12.0	0.0	2.9	28.3	15.6	20.8
APR89	60	12.0	0.0	3.9	26.1	14.4	20.2
MAY89	63	19.9	0.0	7.2	25.0	15.6	19.9
JUN89	39	70.0	2.0	11.2	25.6	19.4	23.2

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 8 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE=8							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	79.9	4.9	19.0	29.4	25.6	27.4
AUG88	69	41.9	4.0	14.9	30.0	24.4	27.9
SEP88	63	29.9	0.0	7.9	26.7	21.1	24.4
OCT88	63	16.0	0.0	6.0	23.3	13.9	18.0
NOV88	60	19.9	0.0	4.8	20.0	13.9	16.9
DEC88	60	41.9	0.0	11.5	23.3	15.6	19.4
JAN89	66	14.0	0.0	2.7	21.1	13.9	16.5
FEB89	54	37.9	0.0	5.9	27.8	15.6	21.0
MAR89	66	20.9	0.0	4.6	23.9	16.7	20.3
APR89	60	20.9	0.0	5.9	25.6	14.4	20.0
MAY89	63	37.0	0.0	7.2	24.4	14.4	19.4
JUN89	39	41.0	4.9	16.5	25.0	17.8	22.6

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 9 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE=9							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	25.0	0.0	8.9	30.6	26.7	28.8
AUG88	69	21.9	2.0	8.6	31.1	25.6	29.2
SEP88	63	23.0	0.0	6.2	27.8	22.2	26.0
OCT88	63	12.0	1.0	4.1	25.6	16.1	20.7
NOV88	60	12.0	0.0	3.8	23.9	16.7	20.4
DEC88	60	20.9	0.0	6.1	25.6	16.7	21.0
JAN89	66	4.0	0.0	0.6	21.1	15.0	17.1
FEB89	54	9.9	0.0	1.8	28.9	20.6	24.5
MAR89	66	17.0	0.0	2.7	27.8	18.3	23.3
APR89	60	10.9	0.0	3.7	26.7	17.8	22.5
MAY89	63	20.9	0.0	2.4	24.4	16.7	20.5
JUN89	39	25.0	0.0	8.2	25.0	20.0	23.3

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 10 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE=10							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	16.0	0.0	5.8	30.6	26.1	28.2
AUG88	69	18.9	0.0	5.0	30.6	27.2	28.7
SEP88	63	12.0	0.0	4.5	27.8	23.9	25.4
OCT88	63	8.0	1.0	3.6	24.4	17.8	20.5
NOV88	60	8.0	0.0	3.0	23.3	17.2	20.0
DEC88	60	14.9	0.0	3.7	25.0	14.4	19.6
JAN89	66	4.0	0.0	1.0	20.0	13.3	16.1
FEB89	54	8.0	0.0	0.6	26.7	19.4	22.8
MAR89	66	4.9	0.0	0.6	27.8	17.8	22.9
APR89	60	8.9	0.0	1.7	26.7	17.2	22.0
MAY89	63	4.0	0.0	0.1	25.6	14.4	20.0
JUN89	39	9.9	0.0	2.0	25.0	21.7	23.0

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 11 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE=11							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	57.9	0.0	10.2	30.0	26.7	28.3
AUG88	69	34.0	1.0	7.2	31.1	25.6	28.8
SEP88	63	23.0	0.0	4.4	27.2	23.9	25.8
OCT88	63	7.0	0.0	3.6	25.0	18.3	21.2
NOV88	60	9.9	0.0	3.0	22.2	16.7	20.2
DEC88	60	14.0	0.0	4.9	25.0	16.7	20.9
JAN89	66	10.9	0.0	1.4	27.8	15.6	18.0
FEB89	54	14.0	0.0	2.6	26.7	17.2	23.5
MAR89	66	9.9	0.0	1.3	26.1	18.3	23.4
APR89	60	8.0	0.0	3.0	26.7	18.3	22.4
MAY89	63	17.9	0.0	3.0	24.4	16.7	20.9
JUN89	39	27.0	0.0	6.2	25.6	21.7	23.5

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 12 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-12							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	18.9	4.0	10.6	31.7	27.2	29.3
AUG88	69	41.9	4.9	12.2	32.8	26.7	29.4
SEP88	63	32.0	0.0	8.1	27.8	23.3	25.7
OCT88	63	41.0	0.0	6.0	24.4	16.1	19.6
NOV88	60	28.0	0.0	5.4	22.2	15.6	18.9
DEC88	60	19.9	0.0	7.8	25.0	14.4	19.6
JAN89	66	13.0	0.0	2.3	22.2	13.9	17.3
FEB89	54	24.0	0.0	4.0	25.0	16.7	21.6
MAR89	66	8.9	0.0	2.3	25.6	13.9	21.5
APR89	60	28.0	0.0	4.2	27.2	15.6	21.8
MAY89	63	17.0	0.0	3.9	25.0	16.1	21.1
JUN89	39	20.9	2.0	7.7	27.2	21.1	24.7

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 13 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-13							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	63.0	2.0	16.7	31.1	26.7	28.3
AUG88	69	90.9	0.0	14.4	31.7	25.6	28.6
SEP88	63	52.9	0.0	9.5	26.1	21.1	24.0
OCT88	63	13.0	0.0	3.6	22.2	13.3	17.2
NOV88	60	18.9	0.0	3.3	22.2	14.4	17.2
DEC88	60	26.0	0.0	5.2	26.7	13.3	20.9
JAN89	66	9.9	0.0	1.8	23.9	15.6	19.7
FEB89	54	10.9	0.0	1.3	27.8	13.3	21.5
MAR89	66	6.0	0.0	0.7	23.9	10.0	19.1
APR89	60	8.9	0.0	2.3	24.4	11.7	19.7
MAY89	63	17.9	0.0	4.1	23.9	14.4	19.6
JUN89	39	59.9	0.0	12.3	26.7	20.0	23.7

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 14 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-14							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	4.9	0.0	1.0	23.3	21.1	22.6
AUG88	69	7.0	0.0	0.9	29.4	21.7	23.7
SEP88	63	6.0	0.0	1.1	23.3	21.1	22.6
OCT88	63	2.0	0.0	0.7	26.1	17.2	22.6
NOV88	60	2.0	0.0	0.4	25.6	17.8	23.2
DEC88	60	4.0	0.0	0.9	26.7	22.2	24.1
JAN89	66	7.0	0.0	0.7	25.0	18.3	23.6
FEB89	54	1.0	0.0	0.0	26.1	16.7	23.8
MAR89	66	1.0	0.0	0.0	25.6	22.2	23.5
APR89	60	4.0	0.0	0.6	23.9	22.8	23.2
MAY89	63	0.0	0.0	0.0	23.3	16.1	21.8
JUN89	39	1.0	0.0	0.1	23.3	16.1	22.2

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 15 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE=15							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	163.0	9.9	41.6	28.3	24.4	26.2
AUG88	69	115.9	10.9	37.9	30.6	25.0	27.7
SEP88	63	64.9	0.0	22.9	26.1	21.1	23.7
OCT88	63	35.0	2.0	15.3	22.2	13.9	17.2
NOV88	60	37.9	0.0	11.6	20.0	10.0	16.1
DEC88	60	74.0	6.0	33.7	24.4	13.9	19.3
JAN89	66	48.9	9.9	24.5	22.2	14.4	18.4
FEB89	54	75.0	3.0	23.4	25.6	16.1	20.3
MAR89	66	41.0	0.0	16.7	24.4	14.4	19.2
APR89	60	43.0	0.0	15.7	26.1	12.2	19.0
MAY89	63	48.9	0.0	20.2	24.4	12.2	18.8
JUN89	39	79.9	4.0	28.4	26.7	18.3	22.6

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 16 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-16							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	48.0	8.0	19.8	31.1	26.7	28.2
AUG88	69	82.9	3.0	23.2	31.7	26.1	28.8
SEP88	63	25.0	0.0	10.2	27.2	22.2	24.7
OCT88	63	17.0	1.0	9.5	25.0	16.1	19.0
NOV88	60	17.9	0.0	7.5	21.1	15.0	18.2
DEC88	60	130.9	1.0	20.9	23.3	17.2	20.0
JAN89	66	18.9	4.0	10.8	21.1	15.0	17.3
FEB89	54	28.9	4.9	13.5	24.4	18.3	21.8
MAR89	66	26.0	4.0	11.8	25.0	16.1	21.2
APR89	60	25.0	0.0	11.2	26.7	15.6	20.8
MAY89	63	25.0	0.0	13.8	25.0	15.6	20.3
JUN89	39	41.9	8.0	20.2	26.7	19.4	23.6

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 17 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-17							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	83.9	3.0	30.9	31.1	26.7	28.1
AUG88	69	78.0	2.0	27.8	32.2	26.1	28.6
SEP88	63	71.0	0.0	15.7	28.3	22.8	26.0
OCT88	63	28.0	7.0	16.3	26.1	17.2	20.4
NOV88	60	119.9	0.0	18.4	23.3	16.7	19.7
DEC88	60	54.0	8.9	27.5	23.9	17.8	20.9
JAN89	66	52.0	4.0	17.3	21.1	15.6	18.0
FEB89	54	59.9	12.0	35.1	27.8	21.1	24.1
MAR89	66	75.0	2.0	26.1	28.3	18.3	23.5
APR89	60	70.0	0.0	20.3	27.8	17.2	22.8
MAY89	63	57.0	0.0	22.8	26.7	16.1	21.9
JUN89	39	71.9	14.0	31.9	28.9	23.3	25.4

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 18 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE-18							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	119.9	14.0	38.8	32.2	27.2	29.4
AUG88	69	103.0	4.0	32.2	31.7	26.7	29.3
SEP88	63	39.9	0.0	15.4	27.8	23.9	26.2
OCT88	63	54.9	3.0	13.8	24.4	16.7	19.9
NOV88	60	35.0	0.0	10.8	21.7	16.7	19.3
DEC88	60	59.9	0.0	17.1	25.6	15.0	20.9
JAN89	66	32.9	4.0	13.0	20.0	13.9	16.7
FEB89	54	37.0	6.0	17.1	26.7	18.3	22.6
MAR89	66	34.0	0.0	14.1	26.1	15.6	22.2
APR89	60	28.9	0.0	12.7	27.8	16.1	21.6
MAY89	63	32.9	0.0	14.4	26.1	16.1	21.3
JUN89	39	79.0	2.0	28.2	28.3	23.3	24.8

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 19 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE=19							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	59.9	4.9	21.2	32.2	27.8	30.2
AUG88	69	89.0	6.0	24.8	33.3	25.6	29.9
SEP88	63	35.0	0.0	11.8	28.9	23.3	26.3
OCT88	63	19.9	1.0	9.2	25.0	16.7	19.8
NOV88	60	37.9	0.0	7.5	21.1	16.7	18.9
DEC88	60	28.0	2.0	9.4	25.0	14.4	20.5
JAN89	66	18.9	1.0	6.0	22.2	14.4	18.0
FEB89	54	21.9	2.0	7.3	25.0	17.8	22.2
MAR89	66	17.9	0.0	6.9	25.6	13.9	21.8
APR89	60	19.9	0.0	7.5	28.3	15.6	21.9
MAY89	63	27.0	0.0	8.8	26.7	16.7	21.8
JUN89	39	29.9	2.0	15.1	29.4	23.3	25.8

Appendix H. Monthly summary statistics for Hg air monitoring in monitoring zone 20 of Building 9201-4 (Alpha-4) for the period July 1, 1988 through June 31, 1989.

ZONE=20							
		Hg Concentration (μg/cubic meter)			Temperature (°Celsius)		
MONTH	N	Maximum	Minimum	Mean	Maximum	Minimum	Mean
JUL88	57	82.9	13.0	38.7	31.7	26.1	28.5
AUG88	69	93.0	7.0	31.7	32.2	24.4	29.1
SEP88	63	34.0	0.0	12.9	25.6	21.1	23.8
OCT88	63	20.9	3.0	9.9	22.2	13.3	17.2
NOV88	60	57.9	0.0	9.4	18.9	13.3	16.5
DEC88	60	70.0	2.0	21.2	23.3	14.4	19.6
JAN89	66	71.9	4.0	22.5	22.2	15.6	18.3
FEB89	54	96.0	4.0	21.8	25.6	13.9	20.8
MAR89	66	39.0	0.0	12.1	23.9	10.0	19.3
APR89	60	29.9	0.0	11.5	26.1	11.7	19.9
MAY89	63	41.0	0.0	12.9	25.0	14.4	19.9
JUN89	39	57.0	6.0	20.9	27.2	22.2	24.2

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