





UNITED STATES  
ATOMIC ENERGY COMMISSION

OAK RIDGE OPERATIONS  
P.O. BOX E  
OAK RIDGE, TENNESSEE 37830

AREA CODE 615  
TELEPHONE 483-8611

March 28, 1974

Multiple Addressee

Gentlemen:

OPERATING LIMITS - RADIOACTIVE MATERIALS RELEASED TO THE ENVIRONMENT

Reference is made to AECM and ORIAD 0511 which was distributed January 25, 1974. Section 038 d.(1) requires that the responsible AEC office maintain suitable administrative control over the establishment and modification of the operating limits for quantities or concentrations of radioactive materials released to the environment.

In order to accomplish this procedural requirement and assure its full implementation, we would appreciate your providing the operating limits that you have developed for the release of radioactive materials to the environment which should include limit values for the following:

1. Quantities and types of radioactive materials placed in burial grounds.
2. Liquids released to streams, pits, settling basins, etc.
3. Gases released to the atmosphere.

Multiple Addressee

- 2 -

March 28, 1974

In order to achieve a formal agreement on these control measures as soon as possible we would appreciate your submitting the requested information to this office by mid-May 1974.

Any questions on this request should be directed to E. H. Hardison (Extension 3-4303) or H. W. Hibbitts (Extension 3-4176).

Sincerely,

  
Joseph A. Lenhard, Director

Research and Technical Support Division

ORW:EHH

cc: R. F. Hibbs, UCCND  
→ R. G. Jordan, UCCND  
E. W. Nitschke, Paducah  
C. L. Karl, CAO  
R. V. Anderson, Portsmouth  
J. H. Hill  
C. A. Keller  
W. H. Travis  
H. D. Hickman  
E. L. Keller

## INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

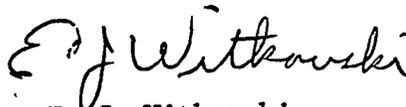
April 29, 1974

TO: F. T. Binford  
F. R. Bruce  
J. A. Cox  
D. M. Davis  
E. M. King  
Herman Postma  
M. E. Ramsey  
S. Siegel  
H. O. Weeren

SUBJECT: Operating Limits--Radioactive Materials Released to the Environment

In a letter dated March 29, 1974, from J. A. Lenhard to Herman Postma and others, we were asked to supply the AEC with information on the above subject. R. G. Jordan was asked by R. F. Hibbs to prepare a coordinated reply for all UCC-ND plants.

The attached is our portion of the reply that I am sending to Jordan for inclusion in his report. Please let me know if any of the information is in error so that corrections may be made before it is transmitted to the AEC.

  
E. J. Witkowski

EJW:sw

cc: R. G. Jordan ✓

## OPERATING LIMITS--RADIOACTIVE MATERIALS RELEASED TO THE ENVIRONMENT

### Off-Site Releases

#### Liquids

The final release point of all ORNL off-site liquid waste discharges is White Oak Dam. The receiving stream is the Clinch River. Under normal conditions, ORNL's discharges are operationally limited to result in less than the maximum permissible concentration for radioactive contaminants in an unrestricted body of water ( $MPC_W$ ), the Clinch River. The highest concentration in the Clinch River resulting from ORNL discharges occurred in 1960. It was 25% of  $MPC_W$ . In the last five years, the annual average concentration has been below 0.5% of  $MPC_W$ .

The only other off-site discharge limit for liquids is on the Process Waste Treatment Plant. The plant is only 80% efficient in its removal of  $^{90}\text{Sr}$ , the main contaminant released to the Clinch River and more than 95% efficient in the removal of alpha contaminants. Although we have never had a discharge into the system that was so high that the river would become seriously contaminated because of the low efficiency of the plant, it is conceivable that an accidental, high release could take place which would seriously contaminate the river. To prevent this from happening, a limit has been set on the amount of radioactive material that will be taken into the plant for treatment in the event of a high release into the system. Above that limit the waste will be pumped, bypassing the plant, to the emergency holding pond.

The maximum amount of radioactivity that will be processed through the Process Waste Treatment Plant is 50 curies of  $^{90}\text{Sr}$  or an equivalent of other beta and gamma activity, or 50 curies of  $^{239}\text{Pu}$  or an equivalent of other alpha activity. How this amount of activity will affect the concentration in the river will depend on the river flow at the time of the incident. Based on our past experience, it would be reasonable to assume that an accidental, high release into the process waste system would stretch out into a relatively high discharge into the river for

at least one week. Assuming that the rate of release into the river is uniform and the flow is normal at 4600 ft<sup>3</sup>/sec, the maximum release to the river would result in a concentration of activity in the river of 50% of MPC<sub>w</sub>.

#### Gases Released to the Atmosphere

The releases of airborne radioactivity at ORNL are limited so that the concentrations in the air at the boundary of the controlled area will not exceed the applicable Standards for Radiation Protection, AECM 0524. This is accomplished by continuous stack monitors and stack inventory samples, the results from which are compared to derived operating limits. As an example, those limits for <sup>131</sup>I, considered to be the only isotope of potential concern, stipulate that the weekly total for ORNL not exceed 1.0 curie, averaged over a period of 13 weeks, with no peak value for any week to exceed 3.0 curies. Actual performance is far below this limit; the totals for the year 1972 being 1.1 curie for Stack 3039 and 0.6 curie for Stack 7911. Similarly, values experienced for noble gases, based on conservative calibration techniques, indicate releases of the order of less than one percent of the applicable limits. The inventory samples are also analyzed for other mixed fission product particulates to determine any need for corrective action to contributing processes. Their average discharge is less than 0.5 millicurie per week.

#### On-Site Discharges

##### Process Waste Sludge

Waste pit No. 4 is currently used for disposal of lime-soda ash sludge from the Process Waste Treatment Plant. Approximately ten curies of <sup>90</sup>Sr and three curies of other fission products are dumped into the pit annually. We have placed no discharge limits on the activity being put into the pit with the sludge because the operation adds an insignificant amount of activity when compared to the many thousands of curies

disposed of at that location, with intermediate-level waste, years ago; also, because the disposal of the sludge will be discontinued in December, 1975, when the new Process Waste Treatment Plant is put into operation.

#### Shale Fracturing Disposal of Intermediate-Level Waste

The specific activity of waste solution that is disposed of by the shale fracturing facility is limited to a maximum of 2 Ci/gal beta and gamma activity and  $5 \times 10^{-3}$  Ci/gal transuranic activity. The limit on the beta and gamma activity was set to keep the exposure of personnel during inspection and maintenance operations within acceptable limits. The limit on transuranic activity was set to keep the concentration in the grout-shale disposal zone below 10  $\mu$ Ci/kg and to keep the concentration of transuranics in the ventilation system at a safe level. Originally, the transuranic activity in the waste solution was limited to a maximum of  $2 \times 10^{-3}$  Ci/gal (ORNL-4665). Subsequent analyses of grout sheet thicknesses, however, showed that a concentration of  $10 \times 10^{-3}$  Ci/gal would be required for the concentration in the zone to reach 10  $\mu$ Ci/kg.

#### Solid Waste Disposal

We have no set limits for the total quantities and types of radioactive materials placed in the burial grounds. However, we have rules governing the placement of radioactive material in the burial grounds to keep to a practical minimum the radioactive materials released to the environment. These may be summarized as follows (they are covered in more detail in the operating procedures--now in development):

1. Wastes containing transuranium isotopes or  $^{233}\text{U}$  in amounts exceeding 10  $\mu$ Ci/kg are stored retrievably as required by AEC 0511-044 d (4).

2. Limits on off-site shipments received for disposal at ORNL are determined on an individual basis and with the concurrence of AEC-ORO.
3. Fissile materials are stored: a) in retrievable storage, in approved containers not to exceed 5 g fissile isotopes/ft<sup>3</sup> or 200 g/container; b) in auger holes, retrievable and nonretrievable, not to exceed 200 g/auger hole; or c) in bulk quantities (trench burial), not to exceed 1 g/ft<sup>3</sup>. For values above these, approval of the ORNL Criticality Committee is required.
4. Retrievable waste (>10  $\mu$ Ci of <sup>233</sup>U or transuranic isotopes/kg of waste) packages must contain no liquids, no corrosives (that will corrode through container), no explosives, no pyrophoric materials.
5. No radioactive gases under pressure are stored or buried.
6. Large quantities (requiring shielding or special handling) of radioactive material are reviewed on an individual package basis for proper storage or disposal.
7. All waste is stored at least one foot above the water table.
8. Radioactive liquids (oils, other) are buried only when they cannot be disposed of any other way at ORNL.



## INTERNAL CORRESPONDENCE

## NUCLEAR DIVISION

POST OFFICE BOX 1410, PADUCAH, KENTUCKY 42001

To (Name) Mr. R. G. Jordan  
 Division Y-12 Plant  
 Location Oak Ridge, Tennessee 37830

Date April 30, 1974

Originating Dept.

Answering letter date

Copy to Mr. R. C. Baker  
 Mr. J. L. Clark  
 Mr. G. T. Hull  
 Mr. A. M. Tuholsky  
 File

Subject Operating Limits - Radioactive  
 Materials Released to the  
 Environment

This information is provided in response to Mr. J. A. Lenhard's letter of March 28, 1974, requesting information on "Operating Limits - Radioactive Materials Released to the Environment".

Information for the three categories are as follows:

1. Quantities and types of radioactive materials placed in burial grounds.
  - a. C-749 (Uranium Scrap Burial Ground) - We have no set limits on quantities. Types of material consigned to this burial area consist of depleted uranium-bearing scrap deemed undesirable to store in the open pit area. The material is primarily pyrophoric uranium metal in the form of sawdust, shavings and turnings. Miscellaneous uranium bearing scrap metals include uranyl fluoride solutions, contaminated trichloroethylene, U-Zr alloys, slag, crucible burnout and  $U_3O_8$ .
  - b. C-404 (Solid Radioactive Waste Disposal Area) - We have no set limits on quantities. Types of material consigned to this area includes depleted Metals Plant scrap (reject slag, vacuum cleanings, black oxide, ball mill reject, reject liner, duds, and crucible burnout), scrap mostly depleted, from Chemical Processing (filter cake, reject  $UF_4$ , sludges, and miscellaneous other solids economically unworthy of recovery) and other miscellaneous solids ineligible for recovery, such as sewage plant sludge, laboratory waste and contaminated slag from the aluminum smelter.
  - c. In addition to these areas we have several burial plots in which we have placed miscellaneous uranium contaminated scrap metal and equipment. The associated uranium is either depleted or trace amounts left after decontamination was in excess of that permitted for salable contaminated scrap and further decontamination was not practical.

## 2. Liquids released to streams, pits settling basins, etc.

- a. C-404 (Holding Pond - converted to solid waste disposal in 1957) - This area was used from February 1953 through February 1957 as an equalization and holding pond for liquid uranium waste primarily from uranium decontamination and recovery operations. The concentration limit for uranium bearing solutions discharged to the pond was 500 ppm. The overflow from the holding pond during this period was to the Ohio River via Big Bayou Creek. While there was no specific assay limit, the  $^{235}\text{U}$  content is approximately that of normal uranium.
- b. C-400 (Uranium Decontamination and Recovery Waste Raffinate Solution discharged to Ohio River via Little Bayou Creek) - This method of disposal of this liquid waste has been used since February 1957. The concentration limit for uranium bearing solutions discharged is 500 ppm. While there is no specific assay limit, the  $^{235}\text{U}$  content is approximately that of normal uranium.

## 3. Gases released to atmosphere.

We have no specific operating limits for quantities or concentrations of radioactive materials.

Environmental monitoring data over the years has indicated that the Paducah Plant's discharge of radioactive materials to the environment has resulted in radioactive concentrations well within the requirements of AEC Appendix 0524 Standards for Radiation Protection. We have continually held our discharges to the streams and atmosphere as low as practical. Additional reductions have been made in some cases in view of limiting contributions to the environment. Our waste disposal practices have been included in various reports to the AEC.

*C. C. Hopkins*  
C. C. Hopkins

CCH:lr



INTERNAL CORRESPONDENCE

NUCLEAR DIVISION

POST OFFICE BOX P, OAK RIDGE, TENNESSEE 37830

To (Name) Mr. R. G. Jordan

Date May 13, 1974

Division

Originating Dept.

Location

Answering letter date

Copy to Mr. A. J. Legeay  
Mr. K. W. Sommerfeld  
Mr. S. S. Stief

Subject Operating Limits - Radioactive  
Materials Released to the  
Environment

The following information is provided in response to Mr. J. A. Lenhard's letter of March 28, 1974, requesting information on "Operating Limits - Radioactive Materials Released to the Environment".

Information for the three categories is as follows:

1. Quantities and types of radioactive materials placed in burial grounds

The ORGDP has one disposal area used only for the burial of radioactive material. We have no set limits on the quantities which may be buried. However, the quantities buried within a certain grave or section must be governed by nuclear safety considerations. Types of material buried in the area are low-grade, impure oxide material ( $U_3O_8$ ,  $UO_2$ , or  $UO_3$ ), which is less than normal assay; contaminated containers; and leached alumina from the alumina traps in the process cascade. The uranium has been leached from the alumina to the lowest practicable limit.

2. Liquids released to streams, pits, settling basins, etc.

We have no specific operating limits for quantities or concentrations of radioactive materials discharged to such areas.

3. Gases released to atmosphere

We have no specific operating limits for quantities or concentrations of radioactive materials discharged in our gaseous effluents.

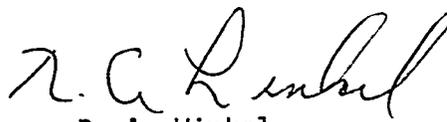
Environmental monitoring data have indicated that the Oak Ridge Gaseous Diffusion Plant's discharge of radioactive material to the environment has resulted in concentrations well within the requirements set forth in AEC Appendix 0524, Standards for Radiation Protection. We have continually held our discharges to a minimum, and future plans call for

To: Mr. R. G. Jordan

- 2 -

May 13, 1974

equipment and operating modifications which will result in a further reduction in the concentrations. The ORGDP's radioactive waste management programs and the results of our effluent and environmental sampling programs have been submitted in various reports to the AEC.



R. A. Winkel

RAW:mj

May 15, 1974

Report Number Y-DD-154

Union Carbide Corporation  
Nuclear Division  
Y-12 Plant

Contract W-7405-eng-26  
with the U. S. Atomic Energy Commission

Y-12 PLANT  
GUIDELINES FOR WASTE MANAGEMENT PROGRAMS

Prepared by: M. Sanders

Oak Ridge, Tennessee

## Disposal of Surplus and Waste Materials and Equipment

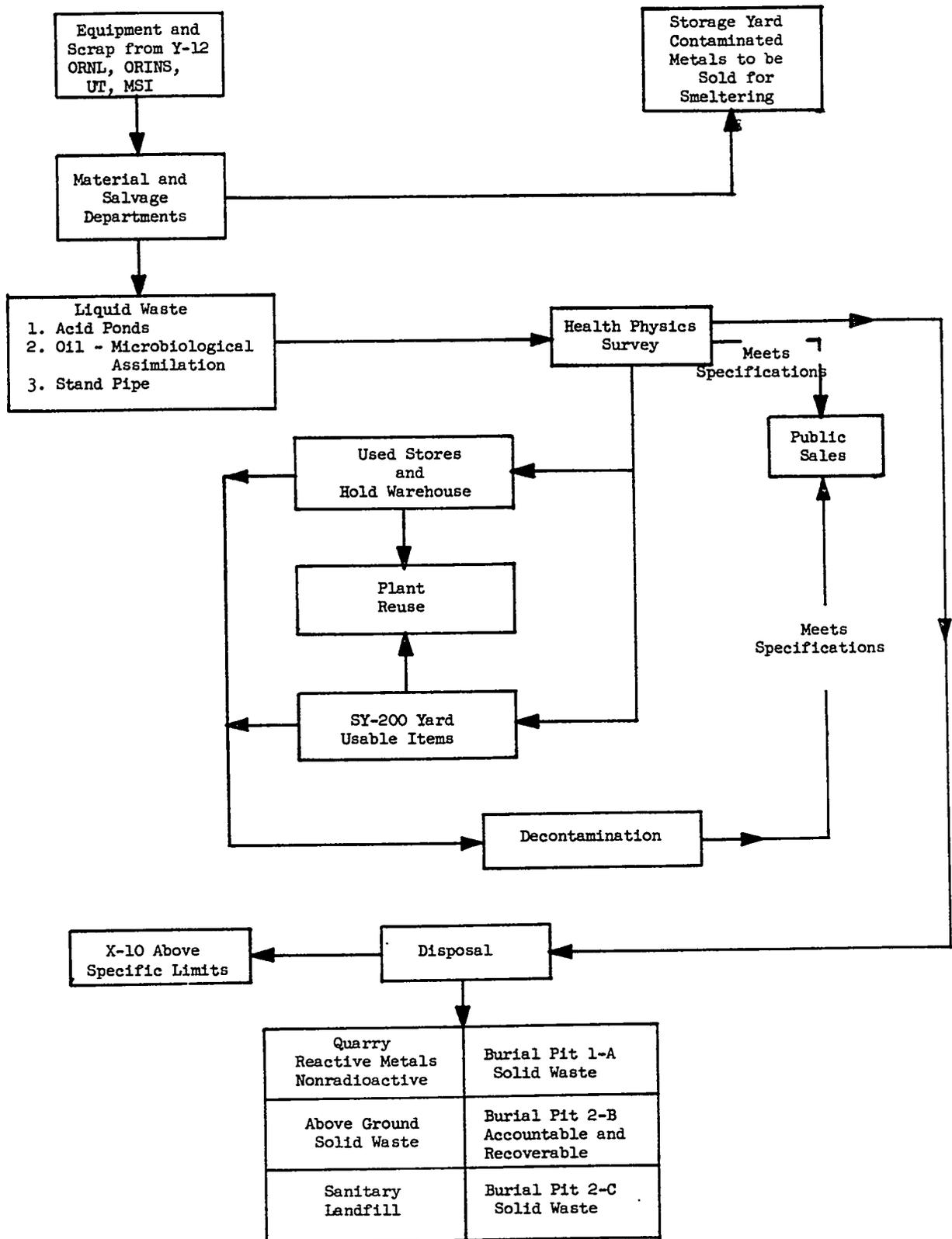
To prevent the release of radioactive or toxic materials to nonprocessing areas within the plant or to the general public, checks for contamination are made on all equipment, materials, and scrap which are salvaged or sold to the public. It is Company policy to offer for sale to the public only those materials which are not contaminated or which are within the AEC permissible limits for contamination. Limits and procedures for the proper disposal of such materials are specified in an internal procedure.<sup>(1)</sup> It is the responsibility of the Material Control Department to offer only those items of surplus material for sale to the public which fall within the established procedures and regulations.

Hazardous chemicals, gases, and radioactive wastes are disposed of according to internal procedures.<sup>(2)</sup> The Radiation Safety Department makes appropriate investigations and submits recommendations and advice to the Maintenance Department which completes the arrangements for disposal.

All surplus or waste materials and equipment are disposed of through channels as diagrammed in Figure 1, using the suggested limits for waste disposal as given in Table 1 as guides.

Uncontaminated Material Disposal Locations - All materials, equipment, or scrap that are classed as uncontaminated are sent to one of the following locations (see Figure 1):

Used Stores - Materials or equipment that may be of future use in the Y-12 area are sent to Used Stores.



CHANNELS FOR SURPLUS AND WASTE MANAGEMENT Y-12 PLANT

FIGURE 1

Table 1

## Y-12 PLANT

## GUIDE LINES FOR WASTE DISPOSAL

Location	Contaminant	Limits		Comments
		Homogeneous Mixture	Surface Reading	
Above-Ground Storage	U	$< 2.7 \times 10^{-3} \mu\text{Ci/gm}^{(2)}$	<u>Solids</u> $< 3.5 \text{ mrad/hr} - \text{Beta, Gamma}$ $1.1 \times 10^{-2} \mu\text{Ci}/100\text{cm}^2 - \text{Alpha}$	For the storage of voluminous quantities of materials which are not economical to bury. (Scrap Metals)
Burial Ground 1-A	U	$< 0.068 \mu\text{Ci/gm}^{(2)}$	$< .068 \mu\text{Ci}/100\text{cm}^2$ No limit on Beta + Gamma as long as they are associated with uranium.	For the disposal of materials containing up to 10% by weight depleted uranium.
Burial Ground 2-B	U	$< 0.68 \mu\text{Ci/gm}^{(2)}$	No limit as long as the radiation is associated with uranium.	For the disposal of depleted uranium which may be accountable <sup>(1)</sup> and/or recoverable.
Burial Ground 2-C	U	$< 0.68 \mu\text{Ci/gm}^{(2)}$	No limit as long as the radiation is associated with uranium.	For the disposal of enriched uranium contaminated materials which are not recoverable. <sup>(1)</sup>
	Th	$< 0.15 \mu\text{Ci/gm}^{(2)}$	No specified limit	Thorium and beryllium greater than specified limits are disposed of at the ORNL Burial Ground.
	Be	$< 2 \times 10^4 \mu\text{gs/gm}^{(2)}$	No specified limit	
ORNL Burial Ground	All Contaminants	No upper limits	No upper limits	Materials which exceed limits for Burial Areas 2-B or 2-C. <sup>(1)</sup>

<sup>(1)</sup> Requires Form UCN-2109<sup>(2)</sup> Average amount of contaminant per unit weight

Table 1  
Y-12 PLANT

GUIDE LINES FOR WASTE DISPOSAL (cont'd)

Location	Contaminant	Limits		Comments
		Homogeneous Mixture	Surface Reading	
Acid Pits (S-3 Ponds)	U	< 0.68 $\mu\text{Ci}/\text{gm}^{(1)}$ Average concentration of water in pit not to exceed $2.7 \times 10^{-3}$ $\mu\text{Ci}/\text{ml}$ .		Disposal of waste in water or acid solution.
Oil Farm	U and Th Be	< 0.068 $\mu\text{Ci}/\text{gm}^{(1)}$ < $2 \times 10^4$ $\mu\text{gs}/\text{gm}^{(1)}$		Contaminated machine oils - Disposed of by biodegrading.
Liquid Salvage Sump (Y-12 Burial Ground 1-A)	Be	< $2 \times 10^4$ $\mu\text{gs}/\text{ml}$		For the disposal of Be-contaminated liquid.
ORNL Burial Ground	Th	$7.3 \times 10^5$ $\mu\text{gs}/\text{ml}$		
ORNL Burial Ground	All contaminants	No upper limits		Materials which exceed limits for Acid Pit or Burial Ground 2-C.
Plant Ambient Air	U and Th	< $0.24 \times 10^{-6}$ $\mu\text{Ci}/\text{M}^3$		Plant Air Monitoring Network.
New Hope Pond	U	$3.0 \times 10^{-5}$ $\mu\text{Ci}/\text{ml}$		Uranium solutions may be disposed of in creek as long as they are in such quantity and released at such a rate that the creek concentration does not exceed $3.0 \times 10^{-5}$ $\mu\text{Ci}/\text{ml}$ alpha. Other materials should not be disposed of in this manner.

(1) Requires Form UCN-2109

(2) Average amount of contaminant per unit weight

Public Sales - Materials that have no future use in the plant and have been declared surplus are sent to the Public Sales Headquarters where they are offered for sale to the general public.

Sanitary Landfill - Uncontaminated combustible scrap or waste such as wood, paper, and rags are sent to the Y-12 Sanitary Landfill.

Contaminated Material Disposal Locations - Contaminated materials or equipment may be sent to one of the following locations, depending on their usefulness and the degree and type of contamination.

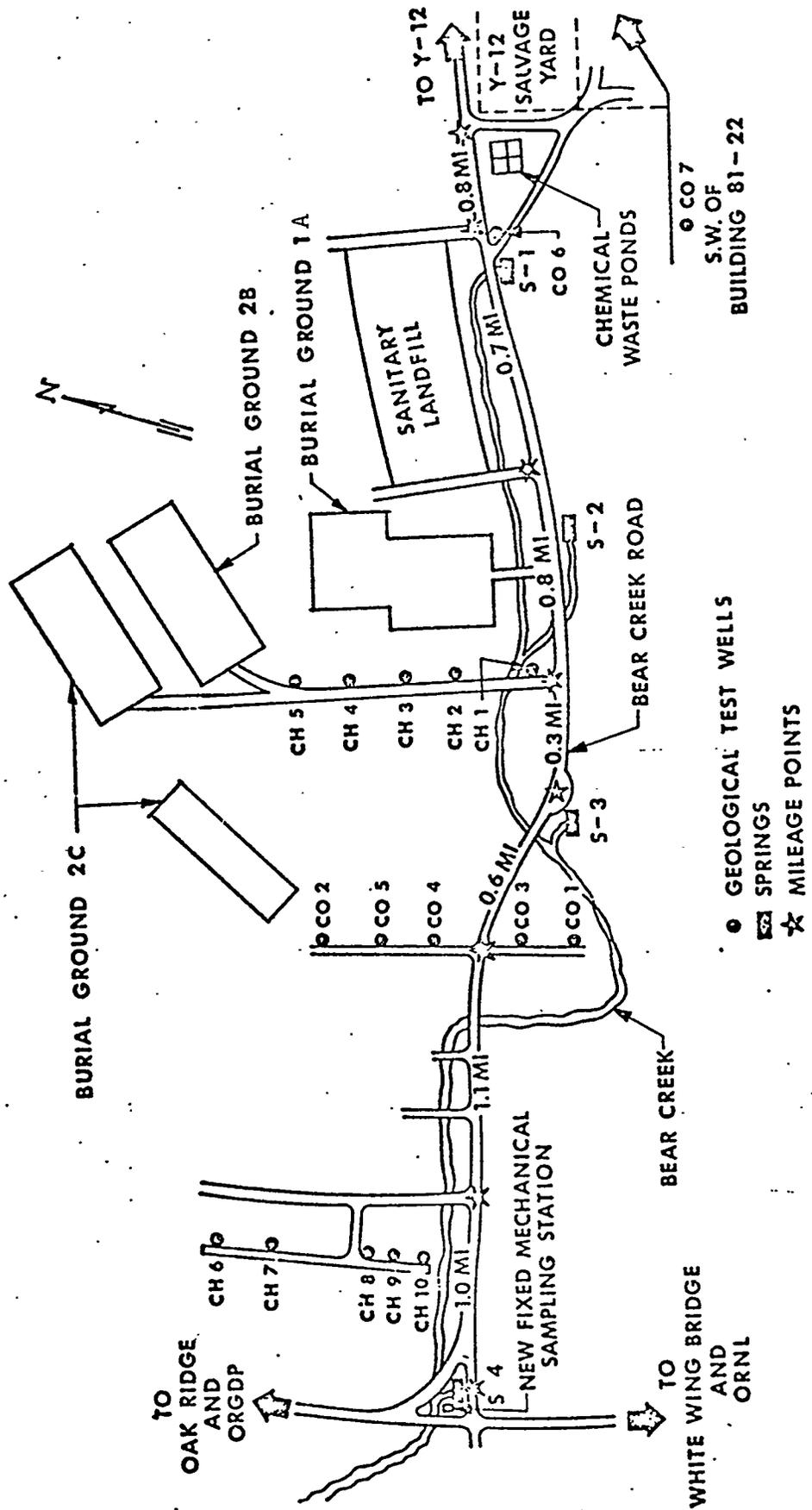
S-3 Acid Ponds - Four disposal ponds are located at the west end of Y-12. These ponds are holding ponds for acid waste and do not flow directly to a receiving stream.

Used Stores - Some items of equipment that appear to have further usefulness are retained by Used Stores and made available for plant use. Such items are properly tagged to indicate the type and amount of contamination.

Storage Yard - Contaminated scrap metals are stored in the Storage Yard for future sale.

Y-12 Burial Grounds - Y-12 has three burial areas. (See Figure 2)

1. Yard 1-A is used for burying low-level (or < 10% by weight of normal uranium) materials.
2. Large lots of uranium which may be accountable or reclaimable are put into Yard 2-B.



SCHEMATIC DIAGRAM OF BEAR CREEK AREA

Figure 2

3. Material contaminated with medium-level contamination (equivalent to 100% normal uranium) are disposed of in Yard 2-C. This yard is also used for the disposal of thorium and beryllium-contaminated materials.

X-10 Burial Ground - Contaminated materials that cannot be disposed of in any of the other areas are sent to the X-10 Burial Ground. Some elements with the limits that require burial at X-10 are:

Uranium -  $> 1.5 \times 10^6$  d/m/g

Thorium -  $> 3.4 \times 10^5$  d/m/g

Plutonium - any detectable

Neptunium - any detectable

Beryllium -  $> 2 \times 10^4$   $\mu$ g/g

All other materials with high specific activity and/or high health-hazard index.

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(1) UCNC Standard Practice Procedure D-2-5, "The Sale of Contaminated Materials."

(2) Y-12 Plant Standard Practice Procedure No. 68, "Disposal of Hazardous Chemicals, Gases, and Radioactive Wastes."

ChemRisk Document Request Transmittal Form

(This section to be completed by ChemRisk)

Name S. Sandberg / 1 Division is requested to provide the following document

Address \_\_\_\_\_

Date of Request 12/10 Expected receipt of document 12/21

Title of requested document Operating Limits - Radioactive Materials to the Env.

Document Number 800802

Access Number of Document \_\_\_\_\_ Date of Document 4/3/74

(This section to be completed by Derivative Classifier)

Derivative Classifier T.R.G. Jordan Phone 41645

Date document transmitted to Dr. Quist 1/15/73

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Signature: \_\_\_\_\_ Date \_\_\_\_\_

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Document number UNNUMBERED/800802 Pages 20

Document title OPERATING LIMITS - RADIOACTIVE MATERIALS RELEASED TO THE ENVIRONMENT

Author(s) (indicate other divisions or organizations, if applicable) RG JORDAN

Document type (See Doc. Prep. Guide, Chs. 1 and 2, for definitions of document types):

- Formal Report
- Progress Report
- Informal R&D Report
- Abstract
- Drawing
- Administrative
- Correspondence
- Internal Technical Data
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Will oral presentation be published in program, booklet, brochure, etc.?  Yes  No  Not Known  
Will copies of the oral presentation be distributed  before,  after,  during the meeting?  No distribution will be made.

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Purpose of release HEALTH STUDY FEASIBILITY PROJECT.

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 No  Yes (Name of program: \_\_\_\_\_)

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If yes, list the patent significance and identify page number(s) and line number(s) in the space immediately following (or attach separate pages).

**PATENT SECTION ACTION (completed by Patent Section upon request by the Classification and Information Control Office)**

- Document may be released for publication  Document must be reviewed by DOE Patent Group before release  
 Document contains patentable information and may not be released at this time

Remarks \_\_\_\_\_

Patent Section Representative \_\_\_\_\_ Date \_\_\_\_\_

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- Classification Office Action Taken:  Not approved for release (see below)  Approved for release with changes (see below)  
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- Technical Information Office Action Taken:  Not approved for release (see below)  Approved for release with changes (see below)  
 Approved for release without change

*to ChemRisk.*

Technical Information Officer Signature Arvin J. Fuist Date 1/29/93

Send to OSTI?  Yes  No

Category Distribution: \_\_\_\_\_

DOCUMENT NUMBER: UNNUMBERED/800802

DOCUMENT TITLE: OPERATING LIMITS - RADIOACTIVE MATERIALS RELEASED TO  
THE ENVIRONMENT

AUTHORS: JA LENHARD (DOE)

DOCUMENT TYPE: CORRESPONDENCE

DOCUMENT DATE: 03-28-74

PURPOSE OF RELEASE: HEALTH STUDY FEASIBILITY REPORT

COPY RIGHTED MATERIAL: NO

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DOCUMENT NUMBER: UNNUMBERED/800802

DOCUMENT TITLE: OPERATING LIMITS--RADIOACTIVE MATERIALS RELEASED TO  
THE ENVIRONMENT

AUTHORS: EJ WITKOWSKI

DOCUMENT TYPE: CORRESPONDENCE

DOCUMENT DATE: 04-29-74

PURPOSE OF RELEASE: HEALTH STUDY FEASIBILITY REPORT

COPY RIGHTED MATERIAL: NO

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DOCUMENT NUMBER: UNNUMBERED/800802

DOCUMENT TITLE: OPERATING LIMITS--RADIOACTIVE MATERIALS RELEASED TO  
THE ENVIRONMENT

AUTHORS: NO AUTHOR GIVEN

DOCUMENT TYPE: PROGRESS REPORT

DOCUMENT DATE: NOT DATED

PURPOSE OF RELEASE: HEALTH STUDY FEASIBILITY REPORT

COPY RIGHTED MATERIAL: NO

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DOCUMENT NUMBER: UNNUMBERED/800802

DOCUMENT TITLE: OPERATING LIMITS - RADIOACTIVE MATERIALS RELEASED TO  
THE ENVIRONMENT

AUTHORS: CC HOPKINS

DOCUMENT TYPE: CORRESPONDENCE

DOCUMENT DATE: 04-30-74

PURPOSE OF RELEASE: HEALTH STUDY FEASIBILITY REPORT

COPY RIGHTED MATERIAL: NO

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DOCUMENT NUMBER: UNNUMBERED/800802

DOCUMENT TITLE: OPERATING LIMITS - RADIOACTIVE MATERIALS RELEASED TO  
THE ENVIRONMENT

AUTHORS: RA WINKEL

DOCUMENT TYPE: CORRESPONDENCE

DOCUMENT DATE: 05-13-74

PURPOSE OF RELEASE: HEALTH STUDY FEASIBILITY REPORT

COPY RIGHTED MATERIAL: NO

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DOCUMENT NUMBER: Y-DD-154/800802

DOCUMENT TITLE: Y-12 GUIDELINES FOR WASTE MANAGEMENT PROGRAMS

AUTHORS: M SANDERS

DOCUMENT TYPE: REPORT

DOCUMENT DATE: 05-15-74

PURPOSE OF RELEASE: HEALTH STUDY FEASIBILITY REPORT

COPY RIGHTED MATERIAL: NO

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