DOE/EA-0821

ENVIRONMENTAL ASSESSMENT FOR THE OPERATION OF THE GLASS MELTER THERMAL TREATMENT UNIT AT THE U.S. DEPARTMENT OF ENERGY'S MOUND PLANT, MIAMISBURG, OHIO

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U.S. DEPARTMENT OF ENERGY

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ACRONYMS AND ABBREVIATIONS

ACFM	actual cubic feet per minute
ACGIH	American Conference of Governmental Industrial Hygienists
ACN	acrylonitrile
ALARA	as low as reasonably achievable
aq.dis.	aqueous discharge
AQCR	Air Quality Control Region
atm	atmosphere
avg.	average
AZS	aluminum zirconium silicate
bldg.	building
Btu	British thermal unit
C	Celsius
^{14}C	carbon-14
carcin.	carcinogen
CCA	criticality control area
CDC	Centers for Disease Control
CDD	chlorinated dibenzo-p-dioxins
CDF	chlorinated dibenzofuran
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
Ci	curie(s)
CIF	consolidated incinerator facility
cm	centimeter
CNS	central nervous system
CO	carbon monoxide
Co	cobalt
CO_2	carbon dioxide
CO_x	oxide of carbon
$COCl_2$	phosgene
comb.	combustible
conc.	concentration
CRC	Chemical Rubber Company
Cs	cesium
CVS	cardiovascular system
d	day
DAPC	Division of Air Pollution Control, Ohio EPA
DCG	derived concentration guideline
decomp.	decomposition
d/min	disintegrations per minute
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
dP	differential pressure

ACRONYMS AND ABBREVIATIONS, continued

DRE	destruction and removal efficiency
DSm^3	dry standard cubic meter
E	east
EA	Environmental Assessment
EG&G	Edgerton, Germeshausen and Grier
EIS	Environmental Impact Statement
ENE	east - northeast
EPA	Environmental Protection Agency
ESE	east - southeast
F	Fahrenheit
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Act
FIRM	flood insurance rate map
FONSI	Finding of No Significant Impact
fps	feet per second
ft	foot (feet)
FWS	Fish and Wildlife Service
g	gram(s)
gal	gallon(s)
GI	gastrointestinal
GM	glass melter
gpd	gallons per day
gpm	gallons per minute
GSX	Chemical Services, Inc.
h	hour
^3H	tritium
HARM	Hazardous Atmospheric Release Model
H_c	heat of combustion
HCl	hydrogen chloride
HCN	hydrogen cyanide
HEPA	high efficiency particulate air
HMTA	Hazardous Materials Transportation Act
H_xCDD	hexachlorodibenzo-p-dioxins
ID	identification
IDLH	Immediately dangerous to life and health
in.	inch
INEL	Idaho National Engineering Laboratory
ISC	Industrial Source Complex
K	Kelvin
kcal	kilocalorie(s)
kg	kilogram(s)
km	kilometer(s)
^{85}Kr	krypton-85
kW	kilowatt(s)

ACRONYMS AND ABBREVIATIONS, continued

L	liter(s)
lb	pound(s)
LD_{50}	dose that is lethal for 50% of the test subjects
LSA	low specific activity
m	meter(s)
m, o, p	meta, ortho, para
MAGLC	maximum acceptable ground level concentration
max	maximum
mg	milligram(s)
mi	mile(s)
min	minute(s)
mL	milliliter
Mn	manganese
mph	miles per hour
MRC	Monsanto Research Corporation
mrem	millirem
MWI	municipal waste incinerators
N	north
NAAQS	National Ambient Air Quality Standards
nCi	nanocurie(s)
NE	northeast
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Act
NIOSH	National Institute of Occupational Safety and Health
NNE	north - northeast
NNW	north - northwest
NO	nitrous oxide
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NW	northwest
O_3	ozone
ORGDP	Oak Ridge Gaseous Diffusion Plant
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PAG	EPA Protective Action Guides
part.	particulate
Pb	lead
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran

ACRONYMS AND ABBREVIATIONS, continued

pCi	picocurie(s)
PEL	permissible exposure limit
pg	picogram
pH	symbol for degree of acidity or alkalinity of a solution
PHA	preliminary hazards analysis
PM-10	particulate matter of less than 10-micron diameter
PNS	peripheral nervous system
POHC	principal organic hazardous constituent
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
PTPLU	Point-Plume
Pu	plutonium
Pub. L.	public law
q_1	potency factor or unit cancer risk
RAPCA	Regional Air Pollution Control Agency
RBC	red blood cells
RCRA	Resource Conservation and Recovery Act
resp. sys.	respiratory system
R&D	research and development
S	south
sec	second(s)
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SCBA	self-contained breathing apparatus
SD	sanitary disposal
SE	southeast
SHPO	State Historic Preservation Office
SNLA	Sandia National Laboratory, Albuquerque
SO_2	sulfur dioxide
sp. wt.	specific weight
SRS	Savannah River Site
SSE	south - southeast
SSW	south - southwest
stnd.	standard
SW	southwest
TC	thermocouple
TCDD	tetrachlorodibenzo-p-dioxin
TEMA	Tennessee Emergency Management Agency
temp	temperature
Th	thorium
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TLV-TWA	threshold limiting value as a time weighted average

ACRONYMS AND ABBREVIATIONS, continued

TNT	trinitrotoluene
T/S/D	treatment, storage and disposal
TSP	total suspended particulates
U	uranium
UCR	unit cancer risk
unsat. hy	unsaturated hydrocarbons
USGS	U.S. Geological Survey
W	west
WB	whole body
WD	waste disposal
wk	week
WNW	west - northwest
WSW	west - southwest
wt	weight
WTF	waste treatment facility
WWTF	waste water treatment facility
y	year(s)
mCi	microcurie(s)
mg	microgram(s)

PREFACE

The Department of Energy has prepared an environmental assessment, DOE/EA-0821, for the operation of the Glass Melter Thermal Treatment Unit at the Mound Plant in Miamisburg, Ohio. As originally proposed by the Department, and as analyzed in this environmental assessment, the glass melter would have processed mixed (radioactive and hazardous) waste stored at the Mound Plant ("backlog" waste) and hazardous and mixed waste generated from Plant operations. Since the analysis in the environmental assessment was conducted, however, the Department has decided to close the Mound Plant. The Department now proposes to use the glass melter only for mixed waste backlog.

The environmental assessment states that the backlog could have taken as long as six years to process. The backlog waste has not been fully characterized for radioactive contamination levels, however, and, if after characterization, the radiation level of the waste is low enough to be well within the National Emission Standards for Hazardous Air Pollutants and Mound's health physics limitations, the schedule for treatment of the backlog waste could be as short as one year (i.e., could be controlled by the capacity of the glass melter).

The environmental impacts of the proposed treatment of only Mound Plant mixed waste backlog are adequately covered and are bounded by the analysis in the environmental assessment, as calculations of radiological exposures and impacts were based on conservative assumptions of waste radioactivity content. (The annual source terms for tritium and plutonium-238 used in the analysis are greater than estimates of their total activity in the mixed waste backlog).

If the Department later proposed to use the glass melter to treat other than the mixed waste backlog, it will undertake further review under the National Environmental Policy Act.

1.0 INTRODUCTION

This environmental assessment evaluates the proposed use of an existing glass melter thermal treatment unit (also known as a Penberthy Pyro-Converter joule-heated glass furnace) for the treatment of hazardous and mixed wastes (waste containing both hazardous and radioactive material) at the U.S. Department of Energy's (DOE's) Mound Plant in Miamisburg, Ohio. The glass melter thermal treatment unit will be referred to hereafter as the glass melter.

In a series of test operations funded by the Department of Energy, Mound Plant has demonstrated the capability of the glass melter to thermally treat waste organic materials defined as hazardous by the Resource Conservation and Recovery Act (RCRA). Glass melter treatment not only destroys RCRA hazardous organics to the degree necessary to meet hazardous waste incinerator standards, but also immobilizes most toxic metals and radioactive isotopes by incorporating them into a glass by-product.

On the basis of these demonstrations, Mound Plant is proposing to apply this treatment technology to problem wastes which are currently in storage at Mound, and, as excess capacity and efficiency of operation dictates, to other wastes presently being generated at the plant.[1]

The analysis presented in this assessment considers the no-action alternative (continuance of existing practices at Mound for the handling of hazardous and mixed wastes), as well as other alternatives involving on-site treatment and off-site treatment and disposal.

1.1 PURPOSE AND NEED FOR ACTION

As will be described in Section 2, the Mound Plant has an inventory of radioactive mixed waste. Although being stored in a RCRA "interim status" storage facility, this material presents a degree of risk to human health and the environment, since most of the waste is in the liquid state and much of it is combustible. A fire, although an unlikely event, would present the danger of significant radioactivity and hazardous material

[1] Since this EA was written, DOE has decided to close the Mound Plant. The Glass Melter would, therefore, only be used for backlog waste. The impacts of the new proposed mission would be bounded by the impacts discussed in this EA.

release to the environment as a result both of the fire, and of ensuing fire fighting operations.

Mound's stored radioactive mixed waste not only poses environmental concerns, but also presents legal problems for the Plant. This RCRA hazardous waste is being stored at Mound for the sole reason that no treatment and disposal options for it have yet been identified. RCRA Land Disposal Restriction (LDR) regulations as recorded in 40 CFR 268.50 do not allow storage of LDR waste for this reason unless a specific storage extension for the waste has been granted by the Environmental Protection Agency. Such extensions, even if granted, are by law of limited duration.

Treatment of Mound radioactive mixed waste by means of the glass melter offers a route toward correction of Mound's RCRA waste storage violation, and also a means to greatly minimize hazards associated with temporary storage of mixed waste by destruction of organic material and immobilization of many inorganic RCRA hazardous and radioactive constituents.

1.2 BACKGROUND

The Mound Plant occupies a 306-acre site in Montgomery County in southwestern Ohio. The site is located on the southern boundary of the city of Miamisburg, 16 km (10 mi) south-southwest of Dayton, Ohio, and 50 km (31 mi) north-northeast of Cincinnati, Ohio, at 39° 37' 42"N, and 84° 17' 15"W (Figure 1.1-1). Mound was previously operated by Monsanto Research Corporation, a subsidiary of the Monsanto Company, for the DOE Albuquerque Operations Office. Since October 1, 1988, the facility has been operated by EG&G Mound Applied Technologies.

In October 1980, at the request of the Low-Level Waste Management Program branch office of DOE, Mound began a study to determine the feasibility of using a glass melter for treatment of low-level radioactive wastes generated at commercial nuclear power facilities (Alexander and Klingler, 1981). As a result of this study, the glass melter was put into operation at Mound in early January 1982. Except for a downtime of 24 weeks preparing for radioactive experiments and another downtime of 4 weeks for furnace repair, the melter was in operation or was being maintained at an idle temperature for a period of nearly 3 years. During that time, 2,000 kg (2.2 tons) of materials were successfully processed in the furnace (Klingler and Armstrong, 1985). This evaluation of the glass melter demonstrated that the unit, coupled with an appropriate offgas system, can provide an effective and desirable means of treating low-level radioactive wastes.

The use of the glass melter for treating hazardous wastes was evaluated in later studies. In January 1985, while operating under Resource Conservation and Recovery

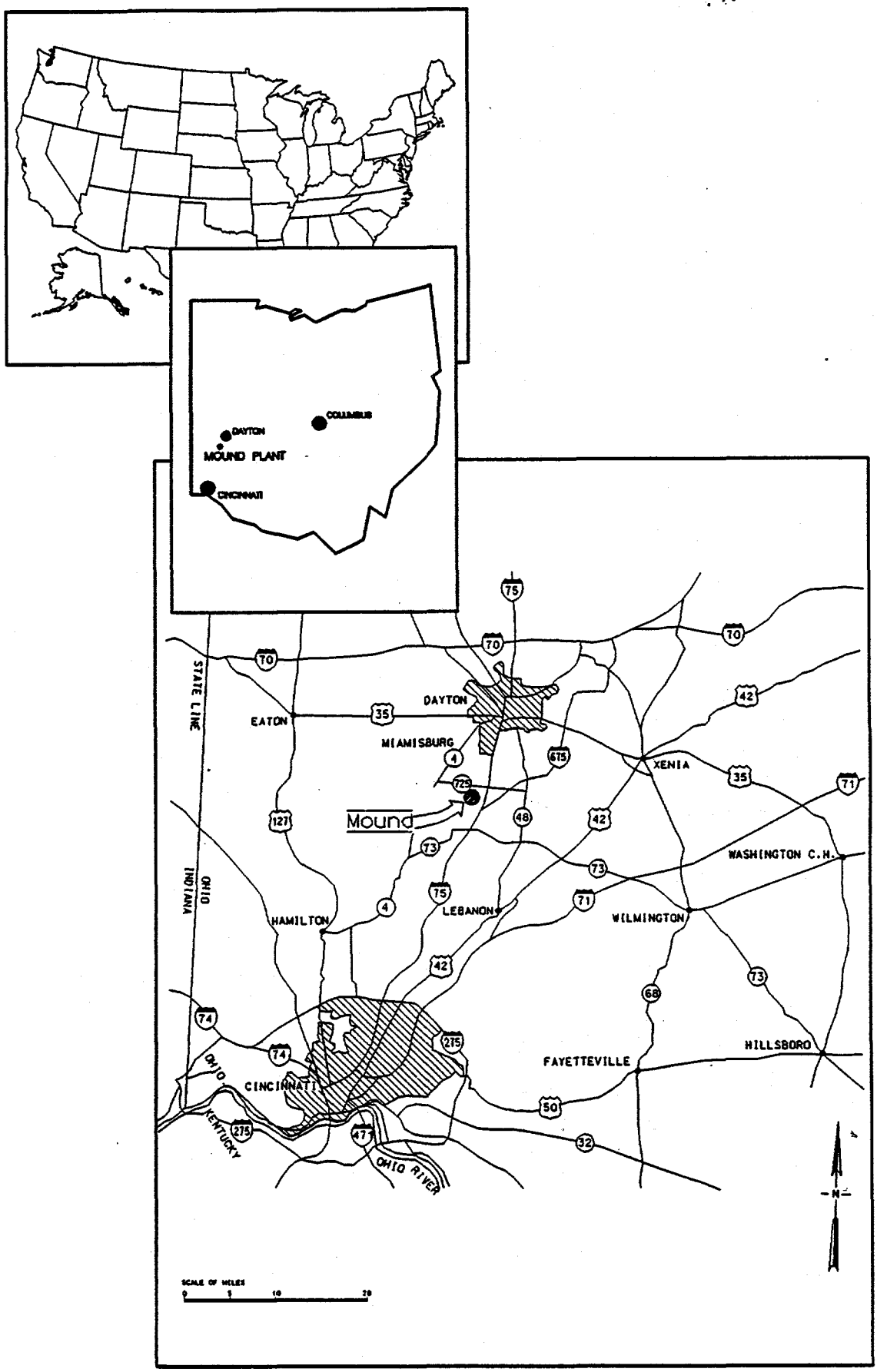

Figure 1.1-1. Southwestern Ohio and Location of Mound Plant

Act (RCRA) Interim Status, a series of experimental burns was conducted in which RCRA Appendix VIII-listed hazardous constituents were included in simulated wastes that were treated in the glass melter. During these experiments, full process monitoring and offgas monitoring were conducted, pursuant to Environmental Protection Agency (EPA) protocol for a trial burn. During these experimental burns, RCRA hazardous organic waste component destruction and removal efficiencies (DREs), as well as hydrogen chloride and particulate removal efficiencies, readily met regulatory requirements for incinerators.

In June 1987, Mound processed other mixtures in the glass melter which simulated the waste streams generated at the Mound Plant explosive powder production facility. Methylene chloride was selected as a principal organic hazardous constituent (POHC) for these tests. Results again showed that the glass melter could meet regulatory incinerator standards, including that of destruction of difficult-to-burn hazardous organics, even with highly aqueous waste. Destruction and removal efficiencies and hydrogen chloride removal efficiencies met regulatory standards (Mound, 1987). Following these studies the glass melter was placed in cold shutdown mode at Department of Energy direction pending completion of the NEPA process. It has been maintained in this state since June 1987.

Glass Melter test results effectively demonstrated the utility of the glass melter in the treatment of both hazardous and low-level radioactive wastes. While the glass melter has never been used to treat mixed wastes, the fact that it has been used successfully to treat both hazardous and low-level radioactive materials indicates that it will also be useful for treatment of mixed wastes.

1.3 THE PROPOSED ACTION

Because of the demonstrated effectiveness of the glass melter, DOE is now considering incorporating this facility into its hazardous and mixed-waste treatment and disposal program for Mound operations. The present document helps meet the National Environmental Policy Act (NEPA) compliance requirements by providing an evaluation of environmental impacts associated with the proposed action (the operation of the glass melter for hazardous and mixed-waste treatment) compared with the no-action alternative (the continuance of existing practices at Mound for the treatment of hazardous and mixed wastes) and other on-site treatment and off-site disposal alternatives.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

DOE operations at Mound Plant result in the generation of hazardous and radioactive mixed wastes. Hazardous wastes are currently being shipped off site for treatment and disposal. There are, however, no suitable disposal options for the radioactive mixed wastes, and this material is being stored on site. Since current mixed-waste storage capacity at Mound Plant has been exhausted and present storage of the waste is in violation of RCRA land disposal restriction regulations, other options for handling this material have been examined. One option available to DOE is to make use of the Mound Plant glass melter. This unit has been in cold shutdown mode since June 1987 when the last set of experimental tests of the unit were completed. Under the proposed action, DOE would bring this unit out of cold shutdown mode and use it for treating both hazardous and mixed wastes generated at Mound Plant. The following subsections provide a general engineering description of the proposed action, a detailed characterization of wastes to be processed, and resulting emissions and effluents (source terms).

2.1.1 Engineering Description

The glass melter is designed to destroy hazardous organic constituents in radioactive mixed waste and hazardous waste streams and to convert the waste residue into a form suitable for ultimate disposal. Its proposed operation is intended solely for use in the treatment of wastes generated at Mound Plant. The glass melter unit is housed in an annex of the liquid waste disposal (WD) building (Figure 2.1-1) and consists of a burn chamber of stainless steel lined with refractory material (Figure 2.1-2) connected to an offgas scrub train.

In the proposed operational mode, waste in sealed drums would be transported by truck as needed from either the hazardous waste storage building (Building 72) or the radioactive mixed-waste storage building (Building 23). The drums would be temporarily staged on a concrete pad adjacent to the annex, then moved individually to a fume hood in the WD annex (WDA) so that contents could be transferred into a feed system, ready for processing in the melter. Waste would be transferred to a glass melter feed system either manually or by pumping, depending on the drum's contents.

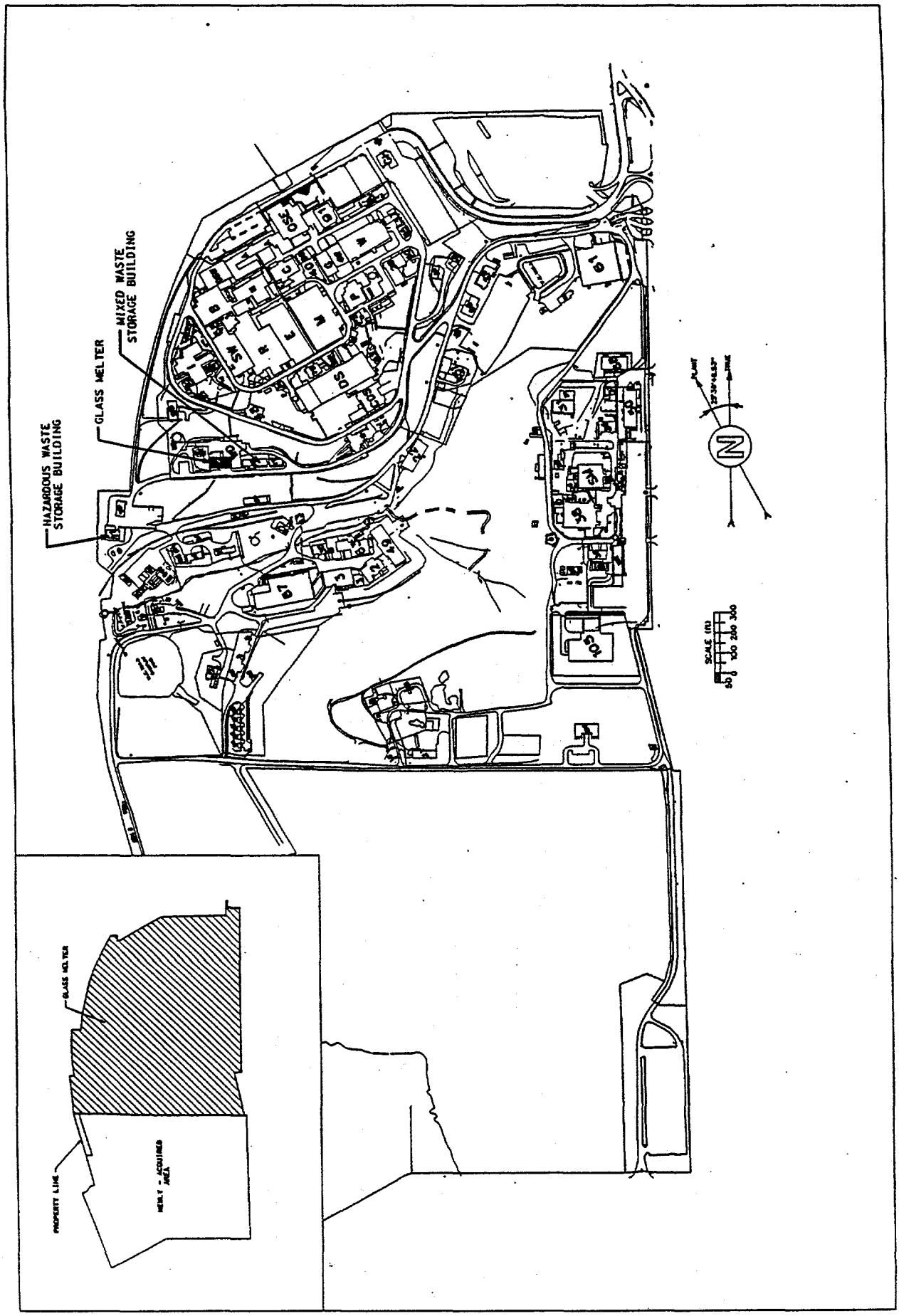

Figure 2.1-1. Location of Glass Melter System and Waste Storage Buildings

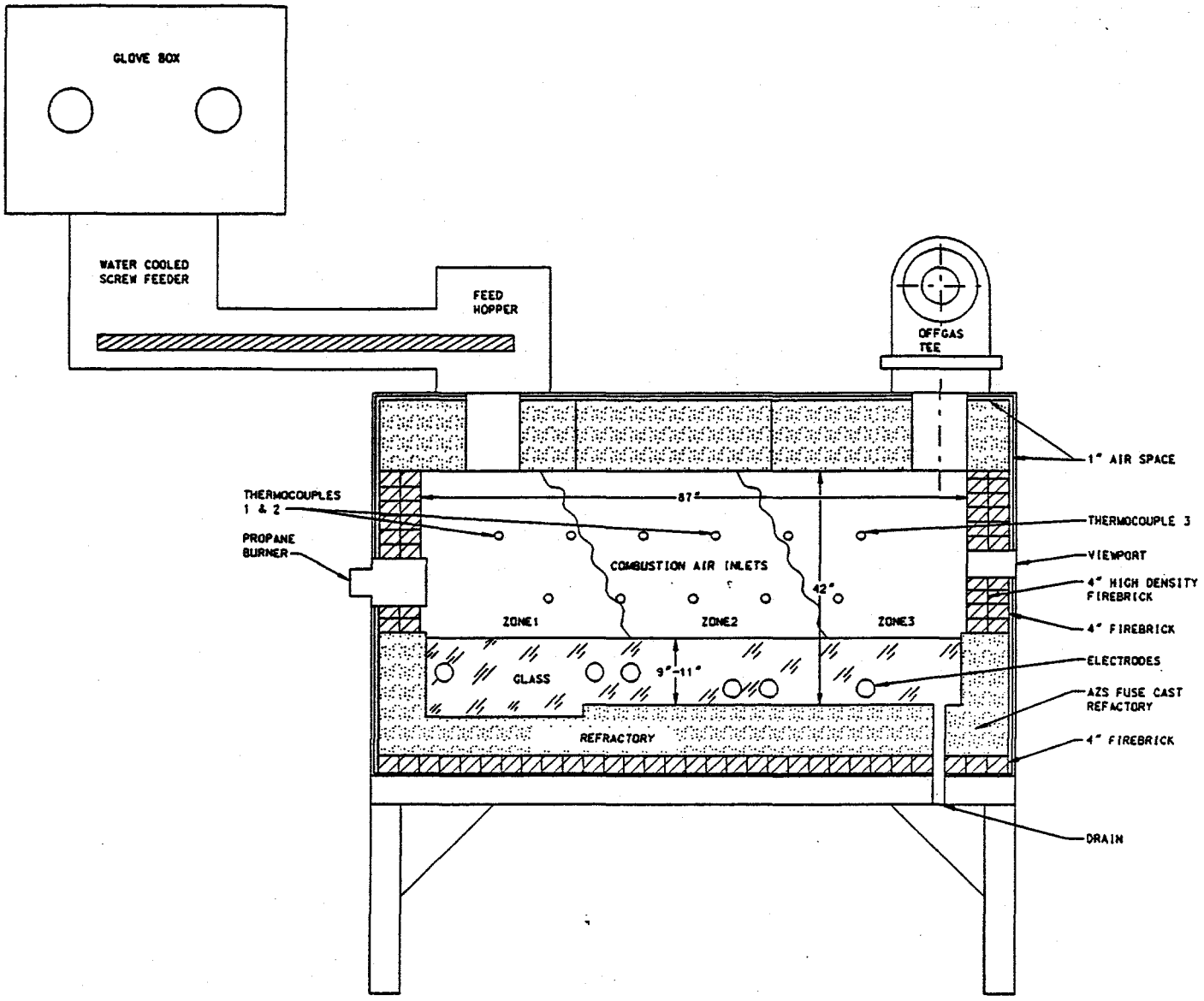

Figure 2.1-2. Schematic of Glass Melter

During cold startup of the glass melter, soda-lime silica glass cullet (glass manufacturing scrap) is heated in the burn chamber by means of a propane burner. Once the glass has been melted, it is maintained in the molten state by electrode heating. For waste processing, when the melt has reached a temperature of 1,800 - 2,400°F, waste would be introduced into the burn chamber via the feed-port opening on the glass melter roof. Ash from the combustion process falls to the glass surface, where it would be incorporated into the melt. When glass chemistry or radioactivity loading dictates, waste glass would be discharged from the melter into 5-gal containers.

The gaseous combustion products exit the furnace and continue on to the offgas wet scrubbing system. Scrubbed gases from the offgas system would be discharged through an existing high efficiency particulate air (HEPA) filter with a removal efficiency of 99.97% (0.3-micron particulates). Scrubbing solution would be filtered, cooled, pH adjusted, and recirculated to the scrubbing equipment. Particulate matter removed by the scrubbing system filter would be pressure backwashed from the filter. The sludge generated would be sampled for hazardous components as required on the basis of waste feed composition and relevant treatment standards, then transferred by pipeline 1) back to a glass melter feed port for reprocessing through the glass melter, 2) to an existing cementation process for immobilization in concrete, or 3) to container storage for any subsequent additional treatment required by RCRA land disposal restrictions (LDR).

Filtered liquid effluent would be characterized as required on the basis of feed composition and treatment standards. Depending on the components present, it would then be 1) pumped to an existing wastewater treatment facility, 2) pumped to a cementation process for immobilization as concrete, or 3) containerized for subsequent additional treatment as required to meet RCRA land disposal restrictions. For most waste processing it is anticipated that sludge would meet LDR treatment standards and could be land disposed as generated. It is expected that most liquid effluent could be treated at Mound's radioactive wastewater treatment facility and released via an NPDES regulated outfall. Liquid effluent cementation would be required for scrub liquid generated during the processing of waste with significant tritium contamination. Facilities for cementation of both scrubber system residue and tritium contaminated wastewater are currently in use at Mound Plant and would not be significantly impacted by the additional feed from glass melter operations.

By-products of radioactive mixed waste treatment would in some cases also be defined as radioactive mixed waste by application of the RCRA "derived from" rule [45 Fed. Reg. 33096 (May 19, 1980)]. Present planning calls for the shipment of some glass and other solidified by-product waste to a radioactive mixed waste land disposal facility as treatment by-product meeting LDR requirements. Since no land disposal facilities meeting DOE requirements are currently available, it might be necessary to temporarily store this by-product waste on site until suitable facilities are permitted (see Section 2.2.2). Storage of RCRA hazardous waste which has been treated to meet LDR treatment standards, however, would no longer be subject to LDR storage time limitations, and would, in addition, no longer present fire, explosion, or leakage concerns.

As an alternative to the need to dispose of certain radioactive mixed waste by-products in a mixed waste landfill, regulations provide the opportunity to petition the EPA to "delist" the waste, allowing it to be disposed of at a site authorized to accept low-level wastes. Unless the delisting process is modified, however, the process is so cumbersome at present as to be an impractical option. Modifications to the RCRA "derived from" rule currently under EPA consideration are expected to offer new alternatives for glass melter treatment residue disposal.

Table 2.1-1 summarizes operational conditions which have been set for the glass melter, based on past performance experience (Mound, 1987). The glass melter and offgas system process parameters would be monitored on a continuous basis during operation. Waste feed cutoff would be initiated automatically when selected measurements fall outside prescribed ranges. Table 2.1-2 summarizes proposed cutoff limits for the process safeguard system. Final limits would be established as part of the RCRA permitting process. System ventilation is designed to ensure that negative pressures relative to the glass melter room are maintained at all times in the hoppers, furnace chamber, and offgas system.

2.1.2 Source Terms

Mound Plant currently generates approximately 39,000 kg/year of mixed wastes and nonradioactive solvent wastes suitable for processing by the glass melter. Table 2.1-3 characterizes these wastes. Mound Plant has an existing backlog of approximately 43,000 kg of mixed wastes (Table 2.1-4). It is Mound Plant's proposal to use the glass melter to process this backlog mixed waste at a rate consistent with radioactive safety requirements, and to use excess treatment capacity to process suitable newly generated plant wastes.[2] Annual capacity of the glass melter is estimated at 48,000 kg of wastes (based on an average throughput of 23 kg/h, and a 2,080-h work year). On the basis of conservative estimates of backlog waste radioactivity content, and applicable worker safety standards and emission limits, it is anticipated that the backlog can be eliminated within approximately 6 years, while continuing to process new wastes as generated.

Routine operation of the glass melter will result in the generation of treated offgas, caustic scrubber liquid effluent, and several solid waste streams. Mound personnel have generated substantial data characterizing the discharges from glass melter operation. These data are presented in several documents, notably Klingler and Armstrong (1985) and Klingler (1990). Table 2.1-5 summarizes the results of these studies as applied to the proposed operation of the glass melter. The following subsections further characterize the gaseous and solid waste discharges from the glass melter, and the heavy metal and radioactive material content of the discharges.

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[2] Since this EA was written, DOE has decided to close the Mound Plant. The Glass Melter would, therefore, only be used for backlog waste. The impacts of the new proposed mission would be bounded by the impacts discussed in this EA.

2.1.2.1 Gaseous Emissions

Gaseous emissions (i.e., offgas) from the glass melter vary depending on the composition of the wastes being fed to the glass melter. Table 2.1-6 summarizes the results of a series of tests conducted using a range of feed materials characteristic of wastes generated at Mound, as reported by Klingler and Armstrong (1985). This study indicated that for every kilogram of waste processed, the glass melter will generate 10 kg of offgas. These results serve to provide an upper bound on the chemical composition of the offgas. With respect to particulate matter entering the offgas scrubber system, the highest concentration reported was 2,499 mg/DSm^3. Based on observed scrubber removal efficiencies in the range of 61 to 95% (Mound, 1987), the discharge to the HEPA filters will be in the 1,000 to 125 mg/DSm^3 range. The HEPA filters have a rated efficiency of 99.97% removal for 0.3 micron particulates (Mound, 1987). Assuming an overall efficiency of 99.9%, after the HEPA filter the particulate levels for atmospheric emission will be in the 1.0 to 0.1 mg/DSm^3 range.

The RCRA Part B Permit Application reports results of a series of test runs conducted to investigate the POHC destruction by the glass melter. Various hazardous waste mixtures (acetonitrile, kerosene, xylene, chlorobenzene, carbon tetrachloride, phenol, and water), wastewater sludges, and solvent wastes (ethylene chloride, acetone, ethanol, and water) were evaluated. DREs were at least 99.999% for all materials tested except for xylene. The averaged xylene DREs ranged from 99.99 to 99.999%. The EPA performance standard for POHCs is >99.99% DRE [40 CFR Part 264.343 (a) (i)].

The removal efficiencies for gaseous hydrogen chloride (HCl) and other chlorides were also measured during these tests. Minimum removal efficiencies were 99.5% for HCl and 99.9% for chlorides. The EPA performance minimum is 99% for HCl removal [40 CFR Part 264.343 (b)].

2.1.2.2 Solid Wastes

Operation of the glass melter results in four solid waste streams: glass blocks, scrubber sludge, scrubber effluent liquid, and maintenance wastes. The ratio of by-product generated to waste feed varies greatly as a function of the chemical composition of the waste feed. Data from a study by Klingler and Armstrong (1985) for one waste stream indicated that for every 1,000 kg (1,036 L volume for this waste) of waste feed processed, the glass melter will produce 66 kg (26 L) of waste glass block, 16 kg (14 L) of 25% solids sludge, and 750 kg (600 L) of scrubber liquid effluent. Based on this data, if 48,000 kg of Mound waste were treated per year, 3,168 kg (1,248 L) of glass, 768 kg (672 L) of 25% solids sludge, and 36,000 kg (28,800 L) of liquid scrubber effluent would be generated. It is anticipated that the glass by-product of the process would meet treatment standards for land disposal for most waste components and be suitable for radioactive disposal in either a Subtitle C or a Subtitle D landfill, depending on waste feed composition. Residual sludge from offgas scrubbing would either be piped back to the glass melter for reprocessing or immobilized by means of a cementation process. It is anticipated that the cement product would meet treatment standards for most feeds, and

would be suitable for land disposal in either a Subtitle C or Subtitle D landfill. The cementation process would generate approximately 1,309 kg (923 L) of immobilized sludge.

Scrubber liquid disposition would be dependent on waste radioactivity contamination. It is expected that scrubber liquid generated from the processing of waste contaminated with transuranic isotopes could be effectively treated in Mound's wastewater treatment facility, and then could be subsequently released via an NPDES outfall. Tritium-contaminated scrubber effluent liquid, however, would require immobilization of the liquid in cement prior to disposal in a radioactive Subtitle C or Subtitle D landfill. Based on an assumption that one-half of Mound Plant's radioactive waste contains tritium, and one-sixth of this waste would be treated per year, approximately 5,670 kg (4,894 L) of cement immobilized tritium scrub liquid would be generated annually. Residue from treatment of other wastewater would generate approximately 1,947 kg (1,681 L) of cement immobilized sludge at the treatment facility. In addition to these process streams, historical data for the offgas system (Klingler, 1981), and projections of glass melter refractory life indicate that routine maintenance of the melter would result in an annual production of 1,926 kg (6,714 L) of maintenance wastes (filters, replacement parts, etc.). Thus, operation of the glass melter at full capacity could be expected to result in an approximated total of 14,020 kg (15,460 L) of wastes. By the RCRA by-product rule, some of this by-product waste would potentially be listed as hazardous, and require disposal in a RCRA regulated Subtitle C radioactive landfill. Until such time as a mixed waste disposal facility is available for DOE wastes, RCRA hazardous by-product wastes resulting from the processing of listed mixed wastes would be stored onsite (see section 2.2.2). The immediate value of glass melter treatment for this waste would be its conversion from a form which is primarily liquid and combustible to a safe, stable, inorganic state, which can be stored onsite indefinitely without violation of RCRA land disposal regulations.

Most of the waste generated by glass melter processing would eventually require transportation to a radioactive waste land disposal facility. The projected transport would require one partial shipment (approximately 76 drums) per year. The trip distance would be approximately 2,750 km (1,709 miles) if the waste is shipped to the Nevada Test Site (see subsection 2.2.2.8).

2.1.2.3 Stack Emissions of Heavy Metals and Radioactivity

Table 2.1-7 provides data on heavy metals and Table 2.1-8 lists radionuclide species which may be present in wastes processed by the glass melter. Some data are available for certain species whose redistribution was studied in radioactive-waste burning tests (Klingler and Armstrong, 1985, 1988). Table 2.1-9 presents data from these experiments. The mass balance boundary for the purposes of these radionuclide distribution runs is at the furnace proper. The offgas was sampled as it left the furnace prior to entering the offgas treatment system. No sampling was done downstream of the offgas treatment system. By comparing metal vaporization temperatures for the four species considered in these tests with those for the species potentially

present in the waste, some idea of the redistribution of heavy metal and radionuclide species through the glass melter system can be obtained. On this basis, two primary distribution types can be recognized. These are:

Cs distribution type — arsenic, mercury, osmium, cesium, selenium, silver, polonium;

Co/Mn distribution type — antimony, cadmium, copper, lead, manganese, iridium; and nonvolatile elements as barium, beryllium, chromium, cobalt, nickel, thallium, vanadium, zinc, plutonium, thorium, uranium, actinium, americium, californium, and curium.

Based on these groupings, one can project metal behavior for distribution throughout the glass melter/offgas system. The heavy metal and radionuclide species distribution should parallel the corresponding results given in Table 2.1-9. The nonvolatile type should follow the Co/Mn grouping. The unknown vapor-pressure metals would most likely fall in the Co/Mn grouping. Although not quantifiable with the available data, the result of metal solubility in the sodium hydroxide aqueous offgas spray solution would be to remove metals from the offgas stream.

The potential exists for radionuclide-contaminated offgas scrub solution to be entrained in the exiting offgas. In particular, the cesium-type metals would be potentially susceptible to such entrainment. The venturi scrubber system has been shown to have a particulate removal efficiency in the 61 to 95% range (Mound, 1987). Downstream of this scrubber system is a HEPA filter system with 99.97% removal efficiency for 0.3 micron particles. In order to upper bound the offgas release of metals by entrainment, a worst-case-condition scenario approach was taken. It was assumed that all of the metal not trapped in the glass or scrub solution would be released to the environment by offgas entrainment. Thus, no credit was given for refractory retention of metals or scrubber system removal of refractory released metals. It was further assumed that the overall HEPA particulate removal efficiency was 99.9% instead of 99.97%. Under this conservative worst-case scenario, the percentage metal stack release to the atmosphere would be:

Cs-type: 0.02%

Co/Mn-type: 0.02%

Thus, downstream of the HEPA system the worst-case level for metals release would be 0.02% of the glass melter waste-feed level.

The tritium (^{3}H) radionuclide component of Mound waste would also leave the glass melter as a gas or vapor. This gaseous species would be effectively captured by the offgas scrub system, but could be re-entrained as water vapor in flue gases. Losses would be relative to scrub liquor concentration and offgas temperatures. Based on a series of test runs using ^{3}H-contaminated dry solid waste (Klingler and Armstrong, 1988),

the tritium distribution was characterized for the system. Tritium loss to the stack is estimated at 14% of feed (Table 2.1-9).

In light of the waste metal and radioactive constituent levels estimates in Tables 2.1-7 and 2.1-8, the distribution predictions provided in Table 2.1-9, the above grouping and assumptions, and a system throughput of approximately 48,000 kg of waste per year (2,080 h/year x 23 kg/h), release quantities resulting from glass melter operation should not exceed the values provided in Table 2.1-5. It should be noted that the expected waste feed influent ^{3}H and plutonium-238 (^{238}Pu) curies (Ci) per year, based on burning one-sixth of the backlog per year (Table 2.1-4) combined with the annual waste volume (Table 2.1-3), are at the 47 and 0.09 Ci levels, respectively, as compared to the respective upper boundary 240 and 0.5 Ci levels assumed by the Table 2.1-5 approach. Thus, the source terms for ^{3}H and ^{238}Pu in Table 2.1-5 are a factor of five higher than the planned waste inventory burning.

2.1.3 Maximum Credible Accident Scenario

Possible accident scenarios were developed to identify the conditions and the event which would result in the most harmful releases to the environment. The accident with the maximum harmful release is termed the maximum credible accident. From an analysis of potential events, the maximum credible accident scenario was determined to be that which would involve the largest accumulation of waste materials, at the location providing the least protection for waste containers. Under planned operation, the only point at which waste will accumulate outside of permitted storage facilities at Buildings 23 and 72 (locations where the wastes are currently stored), is at the staging pad adjacent to WDA. The maximum credible number of waste containers which could be in that location under any foreseeable conditions was selected as ten 55-gallon drums. The accident selected was that of a fire in this drum staging area resulting in the complete vaporization of all contents of the ten drums. This accident would result in airborne releases of both radioactive and nonradioactive contaminants. Section 4.1.5.2 provides a quantitative and qualitative estimate of those releases. The probability of occurrence for this accident is estimated at 0.00001 (Appendix D).

Table 2.1-1. Glass Melter Operational Conditions

Item	Operational Conditions
CO in Stack Gas	<100 ppm
Waste Feed Rate	$<10^6$ Btu/h
Combustion Zone Temperature	1500 - 2750 °F
Furnace Gas:	
Velocity	<50 fps
Flow Rate	600 ACFM (max)
Residence Time	>1.56 sec
HCl Removal Efficiency	>99%

Note: Fugitive emissions and radioactive releases are controlled by negative furnace pressure.

Table 2.1-2. Process Safeguard System

Parameter	Warning	Warning and Feed Shutdown
High CO	500 ppm peak	1000 ppm peak 100 ppm one hour rolling average (or equivalent)
Low furnace, chamber: room dP		0.25 in. water column
High furnace, chamber: room dP		6.00 in. water column
Low furnace, chamber temperature (offgas end TC)		1500°F
High furnace chamber temperature (offgas end TC)		2600°F
High furnace chamber temperature (feed end TC)	2650°F	2750°F
Low scrub pH	7.0	3.0
Low venturi dP		25 in. water column
High venturi dP		55 in. water column
High offgas temperature (after spray tank)	200°F	205°F
High offgas temperature (after venturi)	190°F	200°F
High liquid feed flow		0.4 gal/min
Low liquid feed flow		0.03 gal/min
Low flue gas flow rate		100 ft/min

dP differential pressure
TC thermocouple

Table 2.1-3. Typical Wastes To Be Processed Through the Glass Melter Annually

Component	Amount	Component	Amount	Component	Amount
Radioactive Mixed Wastes				**Nonradioactive Waste Solvents**	
Oils and Other Nonhazardous Organics Contaminated with Solvents		**Scintillation Vials**		Methyl isobutyl ketone	127 kg/year
				Methylene chloride	3735 kg/year
Glycol	18.6 kg/year	Xylene	38.5 kg/year	Methanol	756 kg/year
Octane	18.6 kg/year	Toluene	38.5 kg/year	Isopropanol	3447 kg/year
Hydrocarbon oil	1690.0 kg/year	Water	131.0 kg/year	Acetone	5571 kg/year
Water	108.0 kg/year	Nonhazardous organics (glycol, oils)	76.0 kg/year	Ethanol	4553 kg/year
Trichloroethane	1.9 kg/year	Alkylpolyethoxyethanol and arylhydrocarbons	44.1 kg/year	Diacetone alcohol	113 kg/year
Gasoline	1.9 kg/year	1,4-Dioxane	18.7 kg/year	Trichloroethylene	513 kg/year
Trichloroethylene	0.89 kg/year	Naphthalene	20.9 kg/year	Water	5640 kg/year
Freon	3.7 kg/year	2,5-Diphenyloxazole	0.154 kg/year	Trichloroethane	976 kg/year
Methylene chloride	1.9 kg/year	Pseudocumene	52.3 kg/year	Toluene	640 kg/year
Acetone	0.89 kg/year	Synthetic organic surfactants	34.9 kg/year	Trichlorotrifluoroethane	1335 kg/year
Ethyl alcohol	3.7 kg/year	Tritium	2.18 Ci/year	Hexane	204 kg/year
Stoddard solvent	3.7 kg/year	Plutonium-238	0.00436 Ci/year	Heptane	244 kg/year
Carbon tetrachloride	1.9 kg/year			Methyl ethyl ketone	87 kg/year
Kerosene	1.9 kg/year			Cyclohexanone	51 kg/year
Lead	0.0081 kg/year			Petroleum naphtha	11 kg/year
Tritium	9.32 Ci/year			Tetrachloroethylene	95 kg/year
Plutonium-238	0.0186 Ci/year			Tetrachloroethane	36 kg/year
				Mineral spirits, oil	221 kg/year
				Chlorobenzene	91 kg/year
				Mineral spirits	127 kg/year
				Chlorobenzene	91 kg/year
				Mineral spirits	127 kg/year
				Xylene	36 kg/year
				Acetonitrile	3491 kg/year
				Tetrahydrofuran	3491 kg/year
				Dimethylsulfoxide	1091 kg/year
				Butylacetone	327 kg/year
Total Annual Throughput	1858 kg/year		455 kg/year		37,009 kg/year
Total Activity	9.34 Ci/year		2.18 Ci/year		
Grand Totals					39,322 kg/year
					11.5 Ci/year

Table 2.1-4. Existing Waste Backlog To Be Processed Through the Glass Melter

Components	Amount
Radioactive Mixed Waste	
Oils and other Nonhazardous Organics Contaminated with Solvents	
Glycol	251 kg
Octane	251 kg
Hydrocarbon oil	22885 kg
Water	1457 kg
Trichloroethane	25 kg
Gasoline	25 kg
Trichloroethylene	12 kg
Freon	50 kg
Methylene chloride	25 kg
Acetone	12 kg
Ethyl alcohol	50 kg
Stoddard solvent	50 kg
Carbon tetrachloride	25 kg
Kerosene	25 kg
Lead	0.110 kg
Tritium	126 Ci
Plutonium-238	0.251 Ci
Totals	25,143 kg 126 Ci
Radioactive Mixed Waste	
Scintillation Vials	
Xylene	1502 kg
Toluene	1502 kg
Water	5101 kg
Nonhazardous organics (glycol, oils)	2964 kg
Alkylpolyethoxyethanol and arylhydrocarbons	1717 kg
1,4-Dioxane	727 kg
Naphthalene	815 kg
2,5-Diphenyloxazole	6 kg
Pseudocumene	2040 kg
Synthetic organic surfactants	1360 kg
Tritium	85 Ci
Plutonium-238	0.170 Ci
Totals	17,734 kg 85.2 Ci
Grand Totals	42,877 kg 211 Ci

Table 2.1-5 Source Terms

Category	Item	Melter Influent Content	Melter Discharge Content			
			Offgas to scrubber	Offgas to HEPA	Aqueous	Solid
HAZARDOUS WASTE AND COMPONENT OF MIXED WASTE	POHC	(a)		<0.1% [c]	<0.1%[c]	<0.1%[c]
	HCl	◆	◆◆	<0.01 lb/hr [d]	◆◆	NA
	NO_x	◆	◆◆	<100 ppm [e]	◆◆	NA
	CO	◆	◆◆	<1 ppm [e]	◆◆	NA
	Unsaturated hydrocarbons	◆	◆◆	<1 ppm	◆◆	NA
	Particulate	◆	◆◆	<1 mg [f]	◆◆	NA
	Aqueous Discharge	◆	◆◆	<0.0001%		NA
	Polychlorinated Dibenzodioxins	0.0	BDL	BDL	◆◆	NA
	pH	◆	◆◆		8-10	NA
		ppm	g/year [b]		µg/L [b]	ppm [b]
	Arsenic	5.0	56	◆◆	1.8	43
	Cadmium.	2.0	22	◆◆	0.034	23
	Chromium	10	110	◆◆	0.17	120
	Lead	100	1100	◆◆	1.7	1200

Notes:

NA = Not Applicable
BDL = Below Detection Limits
a = The potential organic hazardous constituent (POHC) composition of the waste feed stream is given in Tables 2.1-3 and 2.1-4.
b = The distribution of inorganic waste feed constituent in discharge is based on EA Section 2.1.2 assumptions.
c = Based on EA section 2.1.2 DRE results.
d = Based on Table 2.1-1.
e = Based on Table 2.1-6. As an upper bound, a value of <1 was assumed for ppm values.
f = Based on 99.9% HEPA efficiency.
◆ = Values will vary for each drum.
◆◆ = Insufficient data collected to characterize.

Table 2.1-5 Source Terms (Continued)

Category	Item	Melter Influent Content Ci/Kg	Melter Discharge Content		
			Gas Ci/year	Aqueous Ci/L	Solid Ci/Kg
RADIOACTIVE COMPONENT OF MIXED WASTE	Americium-241	*	**	***	****
	Cobalt-60	*	**	***	****
	Cesium-137	*	**	***	****
	Hydrogen-3	$5x10^{-3(g)}$	$3.4x10^{+1(h)}$	$7.4x10^{-3(h)}$	0
	Plutonium-238	$1x10^{-5(g)}$	$1.0x10^{-4(i)}$	$2.4x10^{-7(i)}$	$1.2x10^{-4}$
	Plutonium-239	*	**	***	****
	Plutonium-240	*	**	***	****
	Plutonium-241	*	**	***	****
	Thorium-228	*	**	***	****
	Thorium-230	*	**	***	****
	Thorium-232	*	**	***	****
	Uranium-235	*	**	***	****
	Uranium-238	*	**	***	****

Notes:

g = Based on Table 2.1-8

h = $5x10^{-3}$ Ci/Kg x $4.8x10^{-4}$ Kg burned (max)/year = 240 Ci/year.
From Table 2.1-9, 86% in liquid, 14% in gas.
^{3}H content in liquid = 86% x 240 = 206 Ci/year = $206/2.8x10^{+4}$ L/year = $7.4x10^{-3}$ Ci/L.
^{3}H content in gas = 14% x 240 = 34 Ci/year.

i = Based on Table 2.1-9 and the worst-case approach as discussed in Section 2.1.2.3, the distribution for ^{238}Pu would be 78% in glass Block, 21% in gas, and 1.4% in liquid.
$1.0x10^{-5}$ Ci/Kg x $4.8x10^{+4}$ Kg waste burned (max)/year = 0.5 Ci/year.
^{238}Pu in liquid = $1.0x10^{-5}$ x $4.8x10^{+4}$ x $0.014/2.8x10^{+4}$ = $2.4x10^{-7}$.
^{238}Pu in gas = $1.0x10^{-5}$ x $4.8x10^{+4}$ x 0.21x(1-0.999) = $1.0x10^{-4}$ Ci/year.

* = Based on Table 2.1-8, the combined radionuclide content for these nuclides will be $<3.3x10^{-6}$ Ci/Kg.

** = The combined radionuclide release for these nuclides will be $<3.3x10^{-5}$ Ci/year

*** = The combined radionuclide release for these nuclides will be $<6.0x10^{-8}$ Ci/year

**** = The combined radionuclide release for these nuclides will be $<4.0x10^{-5}$ Ci/year of glass.

Table 2.1-6. Summary of Gaseous, Pre-Scrubber Concentrations

Flue Gas	Concentration
CO_2	3% avg. (8.3% max)
CO	<100 ppm average[a]
NO_x	35 ppm avg. (0.05% lb/h)[b]
Unsaturated Hydrocarbons	zero ppm [c]
Combustibles	zero ppm [c]

Note: Normal waste feed rate was 23 kg/h and air flow rate was 12 to 415 DSm^3/h (dry standard cubic meters per hour).

a In a separate series of tests (Mound, 1987), the 4-minute averages of CO levels before the scrubber ranged between 1.4 and 16.8 ppm.

b Without dilution air, concentration could be up to 2.8 times higher, but total lb/h would be the same.

c At standard operating conditions. (Conditions which will be imposed by the Part B permit.)

Table 2.1-7. Heavy Metals That Are Expected To Be Present in Wastes Processed by the Glass Melter

Heavy Metal	Content* (ppm)
Arsenic	5
Cadmium	2
Chromium	10
Lead	100

Source: Weston Services, Inc., 1990.

* Values are based on EPA not-to-exceed limits for classifying waste oils as nonhazardous.

Table 2.1-8. Radionuclides That Are Expected To Be Present in Radioactive Wastes Processed by the Glass Melter

Radionuclide	Comments	Concentrations (Ci/kg)
Americium-241	Minor contaminant of ^{238}Pu	*
Cobalt-60	R&D, environmental samples	*
Cesium-137	R&D, environmental samples	*
Hydrogen-3	Production, environmental samples, contaminated materials	5×10^{-3}
Plutonium-238	Heat source grade-samples and contaminated materials	1×10^{-5}
Plutonium-239	Weapons-grade samples and contaminated materials; minor contaminant of ^{238}Pu	*
Plutonium-240	Minor contaminant of ^{238}Pu	*
Plutonium-241	Minor contaminant of ^{238}Pu	*
Thorium-228	Minor contaminant of ^{232}Th	*
Thorium-230	Minor contaminant of ^{232}Th	*
Thorium-232	Environmental samples, contaminated materials	*
Uranium-235	Minor contaminant of ^{238}U	*
Uranium-238	Environmental samples, contaminated materials	*

* Hydrogen-3 and heat source grade Plutonium-238 are the primary radionuclides present in Mound's radioactive mixed wastes. Quantities of other transuranic isotopes, Cobalt-60, and Cesium-137 combined will comprise less than 25% of the total nontritium radioactivity in wastes (i.e., $<3.3 \times 10^{-6}$ total Ci/kg). These levels of radioactivity are considered negligible.

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Table 2.1-9. Distribution of Radioactive Isotopes in Melter System

	% of Total Curies			
	Glass	Scrub Solution	Carryover	Refractory Uptake*
^{137}Cs	58[b]	21.1[d]	—**	20.9*
^{60}Co	78[a,b]	1.4[c]	—**	20.6*
^{54}Mn	79[b]	1.4[c]	—**	19.6*
^{3}H	—	86	14	—

Sources: Klingler and Armstrong, February 1985.
Klingler and Armstrong, first draft 1988.

* Based on difference [e.g., 100 - (58 + 21.1) = 20.9]
** By difference definition there is no value for this item

Notes:

a Spike retention data were used. Cobalt apparently absorbs rapidly onto the lower floor refractory.

b Only runs prior to the electrode replacement were used. There were obvious short-term mixing problems after installation of larger electrodes.

c The larger average resulting from Method 5 sampling was used since the insolubility of the oxide in alkaline scrub solution introduces scrubber sampling errors.

d Due to high solubility of cesium in the scrub solution, the scrub solution sample data were selected as the most accurate indicator of furnace loss. The loss is obviously one of continuing vaporization. Only runs prior to the electrode replacement were used.

2.2 ALTERNATIVES

Mound personnel have reviewed their waste disposal requirements and have consolidated several disposal options. Based on this review, alternatives to the proposed action have been considered. These include both on-site and off-site alternatives. These alternatives are briefly described in the following sections.

2.2.1 On-Site Alternatives

2.2.1.1 No-Action Alternative

The no-action alternative assumes the continuation of present practices of waste storage and disposal. With respect to wastes that would be fed to the glass melter under the proposed action, a total of 143 m^3 of hazardous waste is presently being shipped off site each year. Currently, these hazardous wastes are being shipped to disposal facilities in Pinewood and Roebuck, South Carolina; Eldorado, Arkansas; and Pecatonica, Illinois.

An additional eight 55-gal drums of mixed waste (approximately 1.6 m^3, or 56 ft^3) are currently being generated annually and stored on site in Building 23. The storage capacity of Building 23 based on spill capacity has been exhausted. Mound personnel indicate that at the rate mixed wastes are likely to be generated as a result of lab cleanouts and decontamination/decommissioning activity, physical storage capacity will also be exhausted in the near future unless some consolidation of wastes can be accomplished. Since no other storage capacity suitable for these wastes is available on site, adoption of the no-action alternative would require the construction of additional storage capacity. If 55-gal drums have a base diameter of 0.6 m and are stored four to a pallet, stacked two pallets high, then the total annual storage requirement for the mixed wastes is about 1.5 m^2. A structure the size of the existing mixed-waste storage building (approximately 23 m^2, or 247 ft^2) would provide about 15 years of storage capacity. Under normal circumstances, a minimum of six years are required to plan, obtain funding, complete safety and environmental studies, and complete such new construction. RCRA permitting activity may take additional time.

2.2.1.2 Administrative Action

The initiation of administrative actions to reduce the generation of radioactive mixed waste provides an alternative for waste control. The Mound Plant has established and formalized a waste minimization and pollution prevention awareness program (EG&G, 1990). A Waste Minimization Committee and Chairman have been selected from members of management. A waste minimization plan (*Waste Minimization and Pollution Prevention Awareness Plan,* MD-81501) has been developed and issued plant-wide. Training needs have been identified, and a training and communication program has been developed to ensure that all employees understand their obligation to minimize waste generation in all processes and operations.

A program for reviewing all plant processes to fully characterize waste generation and individual waste streams has been put into place at Mound Plant. Technical Manual

MD-81502, "Process Waste Assessment Plan," specifies activities and methods that will be employed for this program. The primary goal of the program will be to identify, screen, and analyze options to reduce the generation of waste. This program has resulted in the elimination of RCRA hazardous scintillation cocktail waste and a number of solvents, and is expected to significantly reduce all new radioactive mixed waste generation at Mound Plant.

Efforts to reduce waste generation at Mound cannot totally eliminate the generation of radioactive mixed wastes, however. Hazardous waste generating materials are already in radioactive systems, and will eventually become waste. Replacement of some hazardous materials will not be easy to accomplish under Mound's DOE mission requirements. Waste reduction will not affect waste already in storage. The need for disposal options will persist.

2.2.2 Off-Site Alternatives

All of the following off-site alternatives require transportation from the Mound facility to the designated option site. Transportation of hazardous and radioactive wastes is conducted in compliance with Department of Transportation (DOT) and state regulations regarding the shipment of such wastes. Annual off-site disposal of approximately 39,000 kg of wastes would require approximately four shipments. These shipments would include three hazardous waste shipments and one mixed-waste shipment. These materials would be shipped from Mound to one or more of the designated option sites.

The Mound Plant retains a share of the legal responsibility for any environmental problems resulting from transportation, storage, treatment, and land disposal of wastes shipped off-site.

2.2.2.1 Off-Site Hazardous Waste Disposal

Hazardous wastes not contaminated with radioactivity could be shipped off-site for treatment and disposal. Mound currently uses the services of Laidlaw Environmental Inc. which is a full service waste treatment company specializing in the disposal of hazardous wastes. This service handles the evaluation, transportation, temporary storage, and disposal (or subcontracting for disposal) of all hazardous wastes, including those not suitable for glass melter treatment. Mound currently makes three to five shipments of hazardous waste annually. Laidlaw does not handle mixed wastes, so this disposal option does not address Mound's primary concern, that of stored and newly generated mixed wastes.

Use of the Laidlaw option would involve shipment of hazardous wastes to any of several sites used by Laidlaw. Trip distance for these sites ranges from 1,240 km (771 miles) to 3,000 km (1,865 miles). The average distance traveled per trip is 1,100 km (684 miles). This results in an approximate total travel distance of 3,300 km (2,050 miles) for

the three hazardous waste shipments (of glass melter suitable waste) required to meet Mound Plant's disposal requirements.

2.2.2.2 Quadrex HPS, Inc.

Quadrex HPS, Inc., located in Gainesville, Florida, is a waste-handling and storage company that can offer the disposal of scintillation fluids and nonradioactive ignitable hazardous wastes. The facility cannot accept non-scintillation mixed wastes, and could accept only those scintillation fluid wastes containing carbon-14, tritium, and other short-lived hospital/research lab type isotopes of concentrations no greater than 0.05 microcuries per gram of medium. Quadrex contracts with waste brokers to transport the various waste components to Gainesville. The liquid scintillation vials are shredded, rinsed, and transported to a sanitary landfill. The fluids are collected, analyzed, and used for fuel in a rotary kiln incineration system. The ignitable hazardous wastes are collected, tested, and used for fuels. The following Mound waste constituents could be burned at the Quadrex facility provided they are components of scintillation fluid which meet the restrictions above, or are not radioactively contaminated:

acetone,
carbon disulfide,
chlorobenzene,
cyclohexanone,
ethanol,
1,4-dioxane,
hexane,
methanol,
methyl ethyl ketone,
methyl isobutyl ketone,
methylene chloride,
naphthalene,
tetrachloroethylene,
toluene,
1,1,1-trichloroethane,
trichloroethylene, and
xylene (m,o,p types).

While the Quadrex facility cannot accept non-scintillation mixed wastes, and could accept only a portion of Mound's tritium contaminated scintillation fluid waste, it could accept the three annual shipments of glass melter suitable waste currently being sent to the Laidlaw Environmental facilities (Section 2.2.2.1). The Quadrex facility is located approximately 1,450 km (900 miles) from Mound Plant. Transport of the three annual hazardous waste shipments to Quadrex would involve a total annual travel distance of 4,350 km (2,703 miles).

2.2.2.3 Diversified Scientific Services, Inc.

Diversified Scientific Services, Inc. (DSSI), located in Kingston, Tennessee, operates an industrial boiler and expects to accept a variety of listed and characteristic RCRA hazardous wastes as fuel for electricity generation. DSSI has a RCRA permit for storage of hazardous and radioactive mixed waste. DSSI's radioactive materials license allows it to accept most of the hazardous and radioactive mixed wastes generated and stored at Mound. Treatment of the Mound waste by DSSI, however, may be greatly restricted by DSSI air permit conditions, and by impacts of the new Boiler and Industrial Furnace (BIF) regulations. An operating permit issued by the Tennessee Air Pollution Control Board in October, 1990, specifically limits the types of fuel that may be used by DSSI for its boiler to D001 solvents, natural gas, and liquid propane, and specifically forbids the use of solvents containing halogens or heavy metals. A temporary operating permit issued August, 1991, allowed the addition of F001-F005 solvents to the fuel list, but specifies that it is not a permit to operate. New BIF rules effective August, 1991 require boiler burners to meet the destruction and removal efficiency standards for hazardous waste incinerators. The ability of the DSSI unit to meet those standards and obtain the required BIF license is unknown at this time.

In addition to the permitting unknowns, system capacities are extremely limited at the present time, and the waste acceptance priorities have not been defined. For DSSI and all other commercial facilities, the requirements of DOE Order 5820.2A restricting DOE radioactive waste disposal to DOE facilities must be considered.

2.2.2.4 Idaho National Engineering Laboratory

The Idaho National Engineering Laboratory (INEL) has a permitted incinerator facility, the Waste Experimental Reduction Facility (WERF), capable of burning low-specific-activity (LSA) radioactive material and hazardous waste. The current waste acceptance criteria (WAC) for WERF prohibit receipt of wastes containing alpha emitters at levels greater than 0.1 nanocuries per gram media, PCBs at levels greater than 50 parts per million, or any free liquids. Waste chloride content must be controlled to limit the chloride release rate to no more than four pounds per hour. These criteria would prohibit the acceptance at WERF of almost all of the waste proposed for treatment in the Glass Melter (Tables 2.1-3 and 2.1-4). The WAC for alpha emitters cannot be increased without substantial upgrades to address safety concerns. The WAC for chlorinated solvents are limited for corrosion protection and cannot be increased without the addition of further protective devices to the stack. Finally, the current liquid injection system would also require substantial upgrades to accept free liquids. WERF was shut down in February 1991 to correct potential safety problems. Operation of WERF is contingent on completion of NEPA review and approval of a Safety Analysis Report.

2.2.2.5 Los Alamos National Laboratory

The Los Alamos incinerator facility in New Mexico is in the process of being permitted. A RCRA trial burn is currently planned for 1994. The priority for this facility will be the burning of transuranic waste, although some low-level radioactive mixed wastes

generated on site may be treated. Current operational plans do not include acceptance of off-site wastes, and the current LANL RCRA permit prohibits treatment of off-site waste.

2.2.2.6 Savannah River Site

The Savannah River Site is currently constructing the Consolidated Incinerator Facility (CIF). The CIF will be capable of handling both solid and liquid wastes that are RCRA hazardous, radioactive, or radioactive mixed (including scintillation fluids). DOE is preparing an EIS on waste management at SRS, which will include further analysis of operation of the CIF and other volume reduction alternatives. Trial burns and operation of the CIF are being deferred until the completion of the EIS process. The construction permit from the State of South Carolina, however, does not allow out-of-state waste to be treated in the CIF.

2.2.2.7 Oak Ridge Gaseous Diffusion Plant

The incinerator at the Oak Ridge Gaseous Diffusion Plant (ORGDP) facility in Oak Ridge, Tennessee is currently in use for the disposal of mixed wastes. Priorities for handling waste in this facility are as follows:

1. Use the incinerator for wastes generated within the immediate ORGDP complex.

2. Accept other wastes generated in Oak Ridge.

3. Make the incinerator available for the acceptance of DOE wastes generated in the region.

The ORGDP incinerator has a substantial backlog of wastes that will take several years to destroy. Thus, this alternative would not be available to Mound Plant for several years and will not meet the Mound immediate needs.

2.2.2.8 Nevada Test Site

Disposal of mixed waste at the Nevada Test Site is considered a possible alternative to treatment in the Glass Melter. Land disposal restriction under the Resource Conservation and Recovery Act would require, however, that any mixed waste be treated before disposal. The Nevada Test Site would only, therefore, be a reasonable alternative for Mound waste already treated at another facility. DOE has not yet decided to what extent the Nevada Test Site would be used for future disposal of offsite waste; such decisions will be made after completion of the Environmental Management Programmatic Environmental Impact Statement and the Nevada Test Site Sitewide Environmental Impact Statement.

3.0 EXISTING ENVIRONMENT

This chapter describes various components of the existing environment that may be affected by the operation of the Mound glass melter. The proposed action potentially impacts air quality, surface water quality, biological resources, and human health and safety. In order to evaluate impacts to these resources, information on existing conditions is required. Section 3.1 presents information on atmospheric resources (e.g., meteorology and existing air quality). Section 3.2 presents data on water resources, and Section 3.3 provides a broad characterization of biological resources.

3.1 ATMOSPHERIC RESOURCES

Emissions from the glass melter potentially affect local and regional air quality. To evaluate impacts to these receptors, data on meteorologic conditions (particularly wind speed and direction) and existing air quality are needed. Table 3.1-1 summarizes wind speed and direction data for Mound. The distributions of wind speed and direction are significant factors in the contaminant emissions evaluations and public exposure assessments discussed in Section 4.1.1.

The Mound Plant is located in Montgomery County, within the Metropolitan Dayton Intrastate Air Quality Control Region (AQCR). In addition to Montgomery County, this AQCR includes Clark, Darke, Greene, Miami, and Preble counties. The region is under the authority of the Regional Air Pollution Control Agency (RAPCA), which conducts a program to monitor ambient levels of criteria pollutants. Recent data from the RAPCA regional monitoring program and that of the southwestern region of the Ohio Air Pollution Control Agency for sites near Mound are contained in Table 3.1-2. The location for each of these sites is shown in Figure 3.1-1. These data may be compared to the National Ambient Air Quality Standards (NAAQS) listed in Table 3.1-3. NAAQS defines the level of air quality that has been judged necessary to provide an adequate margin of safety to protect the public health (primary standards) and the public welfare (secondary standards).

In addition to the monitoring sites operated by RAPCA, Mound measures total suspended particulates (TSP) at 20 sites. Site locations (five on site near the fence line, ten within a 1-mi radius of Mound, and five sites in nearby communities) are identified in Figures 3.1-2 and 3.1-3. The results of the latest 5-year monitoring effort are provided in Table 3.1-4.

Sites located within the Mound Plant fence line (the 200 series monitoring stations listed in Table 3.1-4) are not accessible to the public and, therefore, not subject to the

Table 3.1-1. Percent Frequency of Wind Direction and Wind Speed at Mound (1981-1984)

Direction	%	Avg. Speed (meters/sec)
N	4.2	4.3
NNE	4.5	4.1
NE	4.9	4.0
ENE	4.9	4.0
E	4.5	4.1
ESE	4.1	3.9
SE	4.4	4.1
SSE	4.7	4.2
S	6.0	4.4
SSW	9.7	5.0
SW	12.4	5.6
WSW	8.7	5.2
W	5.4	5.0
WNW	5.3	5.1
NW	6.0	4.7
NNW	4.4	4.4
Calm	6.1	--
Total	100.0	4.4

Table 3.1-2. Regional Pollutant Levels

Annual Average Pollutant Levels

Site	Pollutant	1987 Mean	1986 Mean	5-year Avg.	Stnd.[a]
Kettering	TSP	42	42	41	
Moraine	($\mu g/m^3$)	69	67	64	75/60
Centerville		38	39	39	
Moraine	PM-10 ($\mu g/m^3$)	36	32		50
Dayton	SO_2 (ppm)	0.006	0.008	0.008	0.03

Maximum Short-Term Pollutant Levels

		Maximum 24-h Level		
		1987	1986	Stnd.
Kettering	TSP	114	111	260/150
Moraine	($\mu g/m^3$)	152	117	
Miamisburg		117	111	
Centerville		74[b]	103	
Moraine	PM-10 ($\mu g/m^3$)	69		50
Dayton	SO_2 (ppm)	0.031	0.031	0.14

		Maximum 8-h Level		
		1987	1986	Stnd.
Dayton	CO (ppm)	8.9	8.3	9

		Maximum 3-h Level		
		1987	1986	Stnd.
Dayton	SO_2 (ppm)	0.053	0.074	0.5

		Maximum 1-h Level		
		1987	1986	Stnd.
Dayton	CO (ppm)	14.3	12.6	35

[a] Primary and secondary standards are given as applicable. See Table 3.1-3 for an explanation of the National Ambient Air Quality Standards.

[b] Monitoring was discontinued at this site in April 1987.

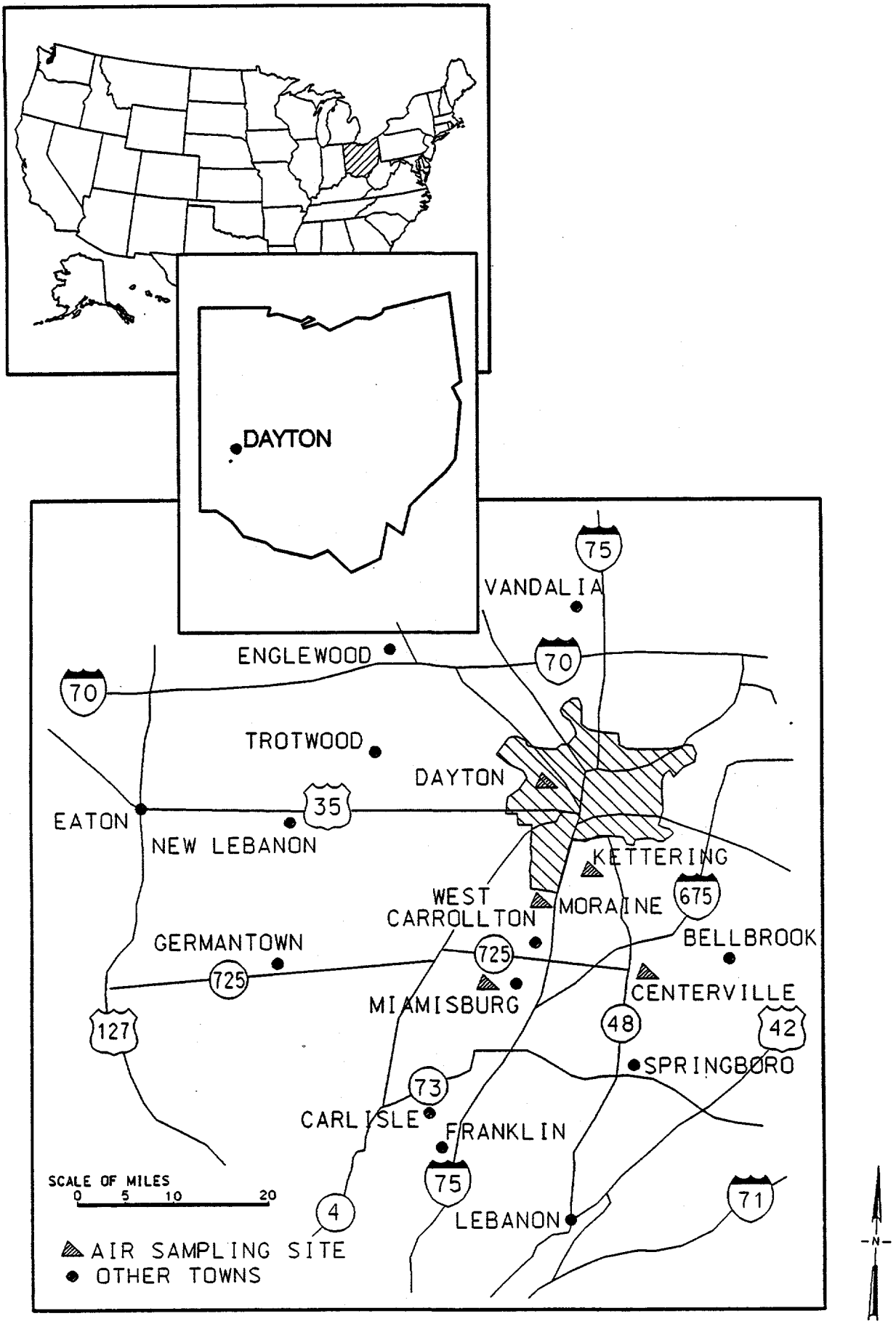


Figure 3.1-1. RAPCA Air Sampling Locations

Table 3.1-3. National Ambient Air Quality Standards

Pollutant	Concentration[a,b]	Remarks[c]
*Inhalable particulates (PM-10)	50 $\mu g/m^3$ primary/ secondary	Maximum annual arithmetic mean
	150 $\mu g/m^3$ primary/ secondary	Maximum 24-h concentration not to be exceeded more than once per year
*Suspended particulates (TSP)	75 $\mu g/m^3$ primary 60 $\mu g/m^3$ secondary	Maximum annual geometric mean
	260 $\mu g/m^3$ primary 150 $\mu g/m^3$ secondary	Maximum 24-h concentration not to be exceeded more than once per year
Sulfur dioxide	0.03 ppm primary	Maximum annual arithmetic mean
	0.14 ppm primary	Maximum 24-h/average concentration not to be exceeded more than once per year
	0.5 ppm secondary	Maximum 3-h/average concentration not to be exceeded more than once per year
Lead	1.5 $\mu g/m^3$ primary	Maximum concentration averaged over a calendar quarter
Carbon monoxide	9 ppm primary	Maximum 8-h average not to be exceeded more than once per year
	35 ppm primary	Maximum 1-h/average concentration not to be exceeded more than once per year
Nitrogen dioxide	0.05 ppm primary/ secondary	Annual arithmetic mean
Ozone[d,e]	0.12 ppm primary/secondary	Maximum 1-h average not to be exceeded on more than one day per year, averaged over the three most recent years
Hydrocarbons Nonmethane (guideline only)	0.24 ppm	Maximum 3-h average concentration between the hours of 6 to 9 a.m., not to be exceeded more than one day per year

* NAAQS for inhalable particulates were promulgated on 7/31/87. The state of Ohio retains standards for suspended particulates as well as for inhalable particulates.

Table 3.1-3. National Ambient Air Quality Standards (continued)

[a] Primary standards define the level of an air pollutant above which human health is endangered. Secondary standards define the level of a pollutant above which the welfare of citizens is endangered due to damage to crops, animals, vegetation, and materials.

The federal standards can be found in the 40 CFR, Part 50.4 - 50.11. The state standards are listed in the Ohio Administrative Code, Chapter 374.5.

[b] Micrograms per cubic meter ($\mu g/m^3$): a standard method of expressing the concentration of a pollutant on a weight basis. One microgram = .000001 gram.

[c] Depending on the pollutant, either the geometric or arithmetic mean is employed.

[d] To calculate the number of violations of the ozone standard averaged over three years, one must account for missing data (due to equipment malfunction, etc.). The U.S. EPA formula for calculating the "expected exceedences" for the period a monitor did not operate is listed in Appendix H of the Federal Register, Vol. 44, No. 28, pp. 8220-8221.

[e] In calculating exceedances of the ozone standard, a maximum 1-hour average ozone reading of greater than 0.12 but less than 0.125 is not considered an exceedance of the standard.

Conversion Factors
ppm SO_2 x 2620 = $\mu g/m^3$ SO_2
ppm CO x 1150 = $\mu g/m^3$ CO
ppm NO_2 x 1880 = $\mu g/m^3$ NO_2
ppm O_3 x 1960 = $\mu g/m^3$ O_3

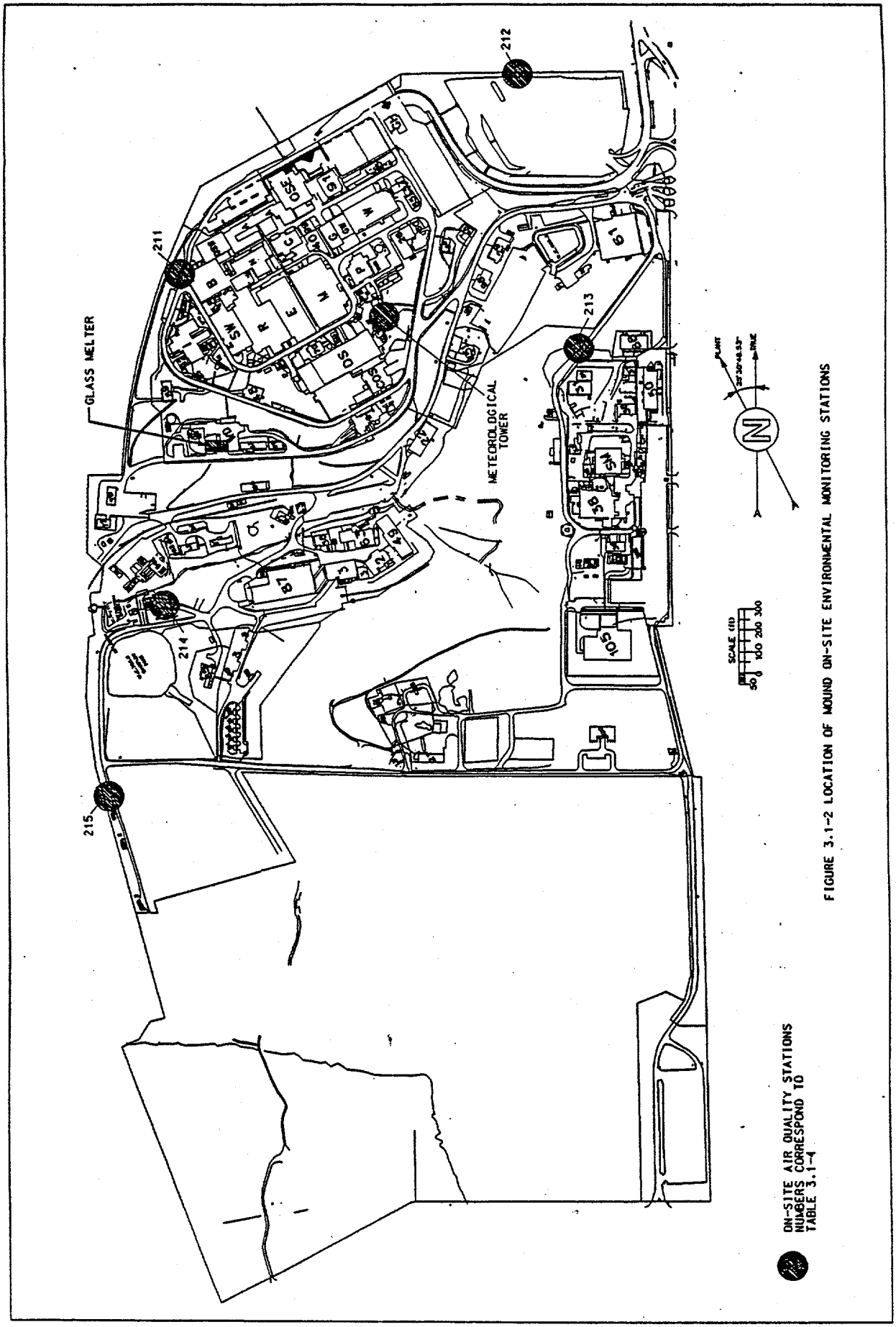


Figure 3.1-2. Location of Mound On-Site Environmental Monitoring Stations

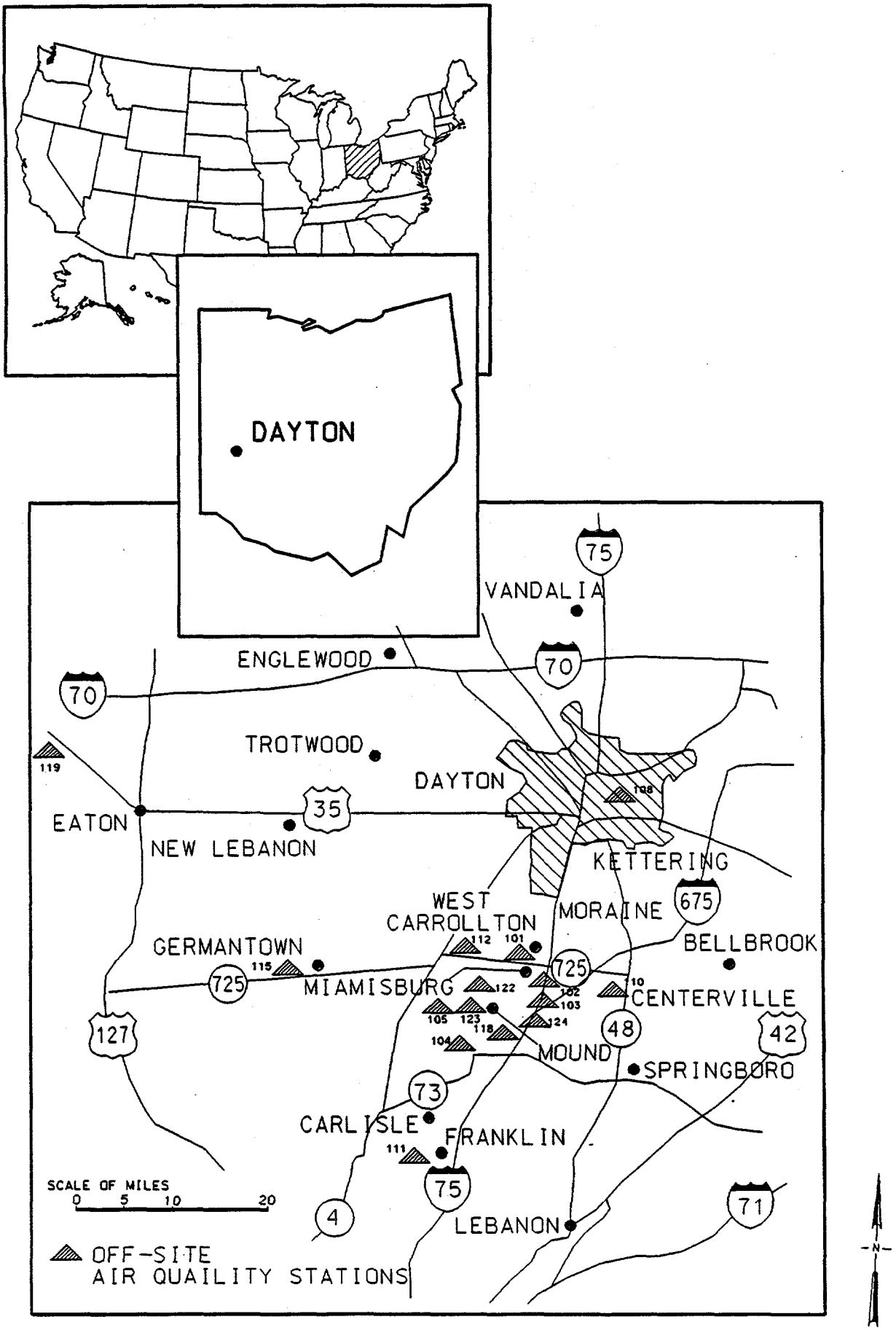


Figure 3.1-3. Location of Off-Site Environmental Monitoring Stations Near Mound

Table 3.1-4. Ambient Air Concentration of Total Suspended Particulates, 1981–1985

Monitoring Station	Ambient TSP Concentration: ($\mu g/m^3$) Calendar Year 1981	1982	1983	1984	1985
101	103(P)	97(P)	105(P)	54	50[a]
	174(S)	202(S)	216(S)	142	98[b]
102	95(P)	76(P)	78(P)	38	40
	307(P)	234(P)	165(P)	64	133
103	75(P)	67(P)	63(S)	34	32
	227(S)	161(S)	115	95	61
104	95(P)	91(P)	86(P)	40	42
	220(S)	212(S)	174(S)	105	286(P)
105	82(P)	66(S)	62(S)	33	37
	275(S)	153(S)	116	65	47
108	111(P)	109(P)	98(P)	53	50
	195(S)	239(S)	154(S)	95	86
110	70(S)	63(S)	74(S)	34	31
	139	170(S)	234(S)	62	51
111	106(P)	103(P)	104(P)	43	39
	191(S)	476(P)	394(P)	88	72
112	88(P)	73(S)	73(S)	38	31
	172(S)	212(S)	180(S)	63	49
115	89(P)	65(S)	80(P)	38	36
	267(P)	152(S)	229(S)	82	106
118	89(P)	80(P)	84(P)	40	39
	194(S)	203(S)	145	82	96
119	79(P)	64(S)	57	30	26
	472(P)	209(S)	202(S)	64	56
122	67(S)	60(S)	51	28	32
	271(P)	183(S)	93	66	69
123	90(P)	76(P)	81(P)	39	36
	155(S)	185(S)	296(P)	77	65
124	85(P)	78(P)	75(P)	38	34
	319(P)	228(S)	139	74	58
211	81(P)	73(S)	73(S)	54	50
	133	169(S)	339(P)	163(S)	127
212	72(S)	72(S)	67(S)	39	29
	147	168	305	74	57
213	81	86	117(P)	84(P)	62(S)
	153(S)	346(P)	265(P)	295(P)	108
214	59	60(S)	57	36	45
	124	204(S)	136	129	122
215	67(S)	70(S)	53	32	30
	146	231(S)	95	52	63

Source: MRC, 1982-1984, (1985, 1986)

Notes: Stations with serial numbers above 200 are located within the Mound Plant fence line.

a Upper value for a monitoring station is the annual arithmetic average.

b Lower value of a monitoring station is the maximum 24-h average.

(P) Denotes an exceedance of a primary NAAQS.

(S) Denotes an exceedance of secondary NAAQS.

NAAQS. Thus, exceedances of the NAAQS at sites within the fence line of the Mound Plant are irrelevant to this discussion. While Mound Plant is not subject to either the TSP or the new PM-10 standard, DOE recognizes that the Mound facility could contribute to regional air quality and strives to comply with both the TSP and PM-10 standards.

Based on maintenance of pollutant levels below the NAAQS, the region has been classified as attainment of the NAAQS for nitrogen dioxide (NO_2), sulfur dioxide(SO_2), and lead (Pb). However, several counties within the AQCR, including Montgomery County, have been classified as nonattainment for ozone (O_3). Montgomery County is also designated as nonattainment for TSP; however, application for redesignation has been submitted for consideration by EPA.

RAPCA has recently initiated programs to characterize ambient levels of toxic chemicals and heavy metals in the Dayton area. A program to inventory emission levels of toxics based on Ohio EPA's 1986 list of 39 toxic chemicals (Table 3.1-5) was conducted during 1986. Xylene and toluene accounted for more than 70% by mass of all toxics emitted by industrial sources under the jurisdiction of RAPCA. Chloroform and methylene chloride accounted for approximately 12% for each of the remaining emissions. A summary of point source toxic emissions is provided in Table 3.1-6.

A study to determine ambient levels of heavy metals was conducted in Dayton during the years 1980 through 1986. The program revealed measurable levels of arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, manganese, molybdenum, nickel, lead, vanadium, and zinc; however, levels were often less than background levels. Therefore, accurate estimates cannot be made. Analyses did, however, show levels of lead and copper to be declining and those of iron and manganese to be increasing. RAPCA assigned an upper bound to the risk associated with the measured concentrations of some metals. Chromium was found to have the highest upper bound of individual lifetime cancer risk, 98 cancers per million persons (RAPCA, 1988).

Ohio EPA has recently compiled a list of 29 toxics that, based on their usage within the state, are of maximum concern to the citizens of Ohio. For each of these toxics, the state has assigned a maximum acceptable ground level concentration (MAGLC), which is currently one-tenth of the Threshold Limit Value (TLV) assigned by the American Conference of Governmental Industrial Hygienists (ACGIH). For carcinogens, the state considers a risk-based assessment that does not allow a maximum individual risk to exceed 9.9×10^{-6} acceptable. Regulatory policy is currently under review, and revisions are expected in the near future (Koval, 1988).

Mound Laboratory uses a number of chemicals in various processes. Quantities of selected materials used annually are listed in Table 3.1-7. Chemical compounds proposed to be processed in the glass melter are listed in Tables 2.1-3, 2.1-4, and 2.1-5.

Table 3.1-5. Toxic Air Pollutants, State of Ohio

Pollutant	Pollutant
Acetaldehyde	Ethylene
Acetonitrile	Ethylene dibromide
Acrylonitrile	Ethylene dichloride
Ammonia	Ethylene oxide
Arsenic and compounds	Fluorine
Benzene	Formaldehyde
Benzo (a) pyrene	Hydrogen cyanide
Beryllium and compounds	Maleic anhydride
Bromine	Methyl chloride
Butadiene	Methyl methacrylate
Cadmium and compounds	Methylene chloride
Carbon disulfide	Perchloroethylene
Carbon tetrachloride	Phosgene
Chlorine	Styrene
Chlorabenzene	Titanium tetrachloride
Chloroform	Toluene
Chromium (VI) compounds	Toluene diisocyanate
Cyanide and compounds	Vinyl chloride
Dioxin	Xylene
Ethylbenzene	

Table 3.1-6. Summary of Point Source Toxic Emissions in the Dayton Area for 1986

	No. of Facilities	Tons/year Emitted	Percentage of Total
Xylene	34	818	47
Toluene	32	411	23
Chloroform	1	219	12
Methylene chloride	14	207	13
Tetrachloroethylene	7	76	4
Styrene	5	15	1
Formaldehyde	7	3	0.2
Methyl methacrylate	1	1	<0.1
Toluene diisocyanate	1	0.2	<0.1
Benzene	3	0.2	<0.1
Ethylbenzene	3	0.1	<0.1
Ammonia	1	1	<0.1
		Total = 1,751.5 tons	

Source: RAPCA , 1988.

Table 3.1-7. Estimated Annual Usage of Chemicals at Mound

Inventory Materials Purchased

Material	Estimated Annual Usage (lb/year)
Organics	
Acetone	8,705
Acetonitrile	42
Butylacetone	213[a]
Benzene	42
Cyclohexane	63
Diacetone alcohol	3
Dichlorobenzene	2[a]
Ethanol	30,358
Isopropanol	14,612
Methanol	1,152
Methylene chloride	6,403
Refrigerant	7,425
Toluene	1,192
Trichloroethane	2,560
Trichloroethylene	6,121
Xylene	11
Inorganics	
Asbestos	could not be estimated
Cyanides	could not be estimated
Hydrofluoric acid	2
Hydrochloric acid	2,532
Lead	60[a]
Mercury	233[a]
Mercury chloride	1[a]
Nitric acid	2,532
Sulfuric acid	6,507

Sources: MRC, 1986
MRC, 1985

[a] Estimate based on Mound Industrial Hygiene Inventory.

Present operations at Mound result in releases of plutonium (Pu) and tritium. The site is also a source of radon due to past practices, as well as uranium (U), thorium (Th), cesium (Cs), and cobalt (Co) via resuspension of contaminated soils related to past practices. Mound operates a network of twenty ambient air monitoring stations (refer to Figures 3.1-2 and 3.1-3) for plutonium and tritiated water vapor. Measured background concentrations are plotted in Figures 3.1-4 and 3.1-5. The population distribution around Mound is shown in Figure 3.1-6. Ambient concentrations from the various sites are provided in Tables 3.1-8 and 3.1-9. Recorded levels are well below the DOE off-site derived concentration guidelines (DCGs). The DCGs for these nuclides are as follows:

Nuclide	DCG ($\mu Ci/mL^3$)
^{238}Pu	3.0×10^{-14}
^{239}Pu	2.0×10^{-14}
^{3}H (oxide)	1.0×10^{-7}

Source: DOE Order 5400.5

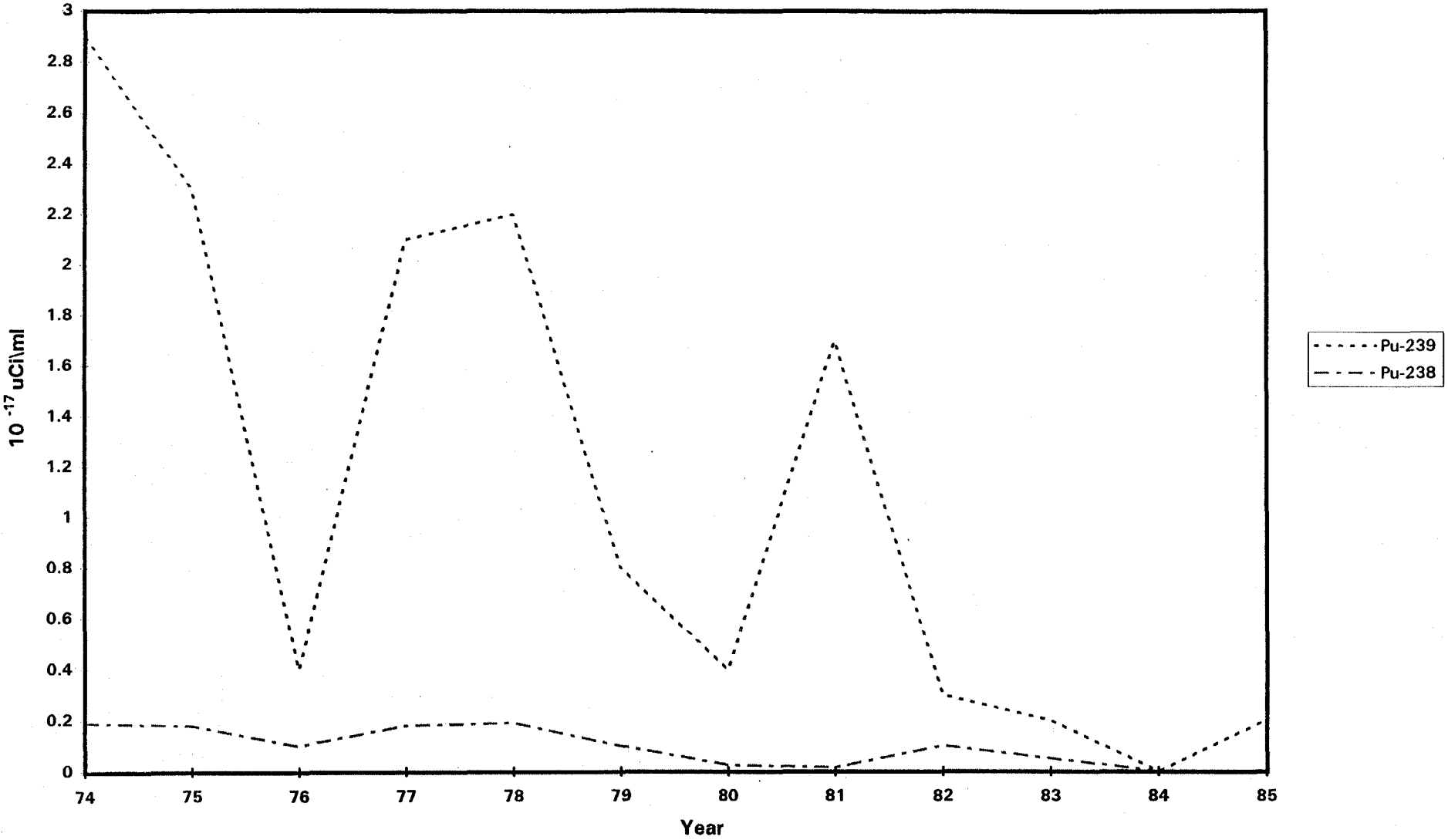
3.2 WATER RESOURCES

There are no perennial streams on the Mound site. Runoff from the site is directed to a northeast-southwest trending drainage that transects the site. This drainage basin is small with steep slopes. Two man-made ponds and a series of interconnected concrete, retention basins control storm runoff. An asphalt-lined pond collects runoff from the Special Metallurgical Hill in the upper reach of the watershed. Retention basins on the western edge of the site collect runoff before discharging off site to the Miami-Erie canal. During periods of heavy rainfall, these basins overflow to a nearby clay-lined pond.

Major surface water features of the area are shown in Figure 3.2-1. The surface water closest to the Mound Plant is the Great Miami River. The total area of the Great Miami River drainage basin at Miamisburg is 7,018 km^2 (2,710 $miles^2$) and consists of several minor subdrainages and three major subdrainages: Stillwater River, with an area of 1,750 km^2 (676 $miles^2$); Great Miami above Stillwater, draining 3,042 km^2 (1,175 $miles^2$); and Mad River, that drains 1,700 km^2 (656 $miles^2$).

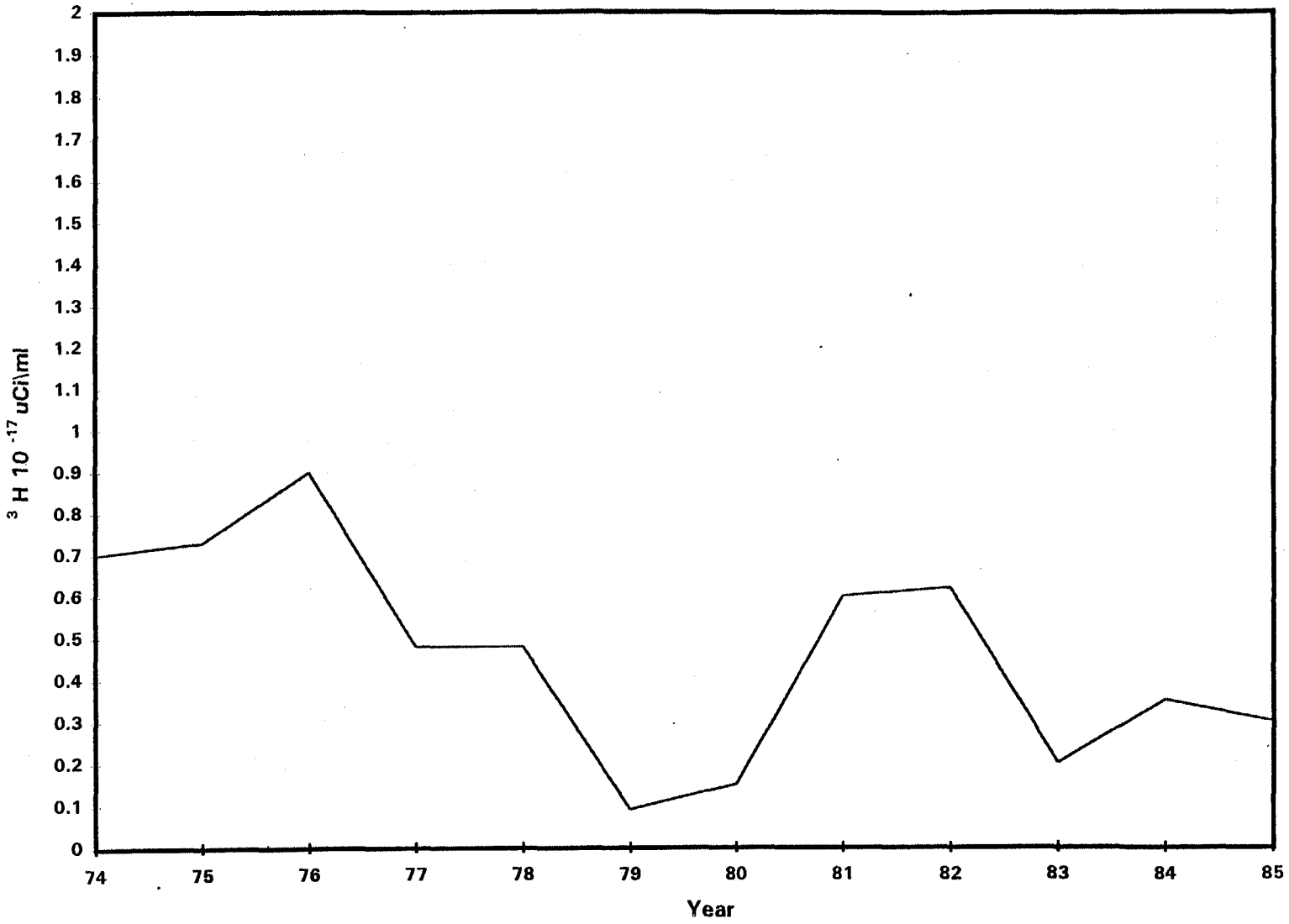
Flow in the Great Miami River in the vicinity of the site is regulated by the Hutchings Station Dam, which is located approximately 2.4 km (1.5 miles) downstream of Mound. The normal pool elevation near the site is maintained at 208 m (682 ft); river bottom elevation is at 204 m (669 ft). Elevations within the Mound facility range between 216 to 268 m (709 to 879 ft). The WD building containing the glass melter is located at approximately 242 m (794 ft) elevation.

Figure 3.1-4 Measured Background $^{238, 239}$ Pu Air Concentrations In Southwestern Ohio, 1974-1985



Source: Mound Environmental Monitoring Reports (MRC, 1975-1984, 1985b, 1986b)

Figure 3.1-5 Measured Background ^{3}H Air Concentrations In Southwestern Ohio, 1974-1985



Source: Mound Environmental Monitoring Reports (MRC, 1975-1984, 1985b, 1986b)

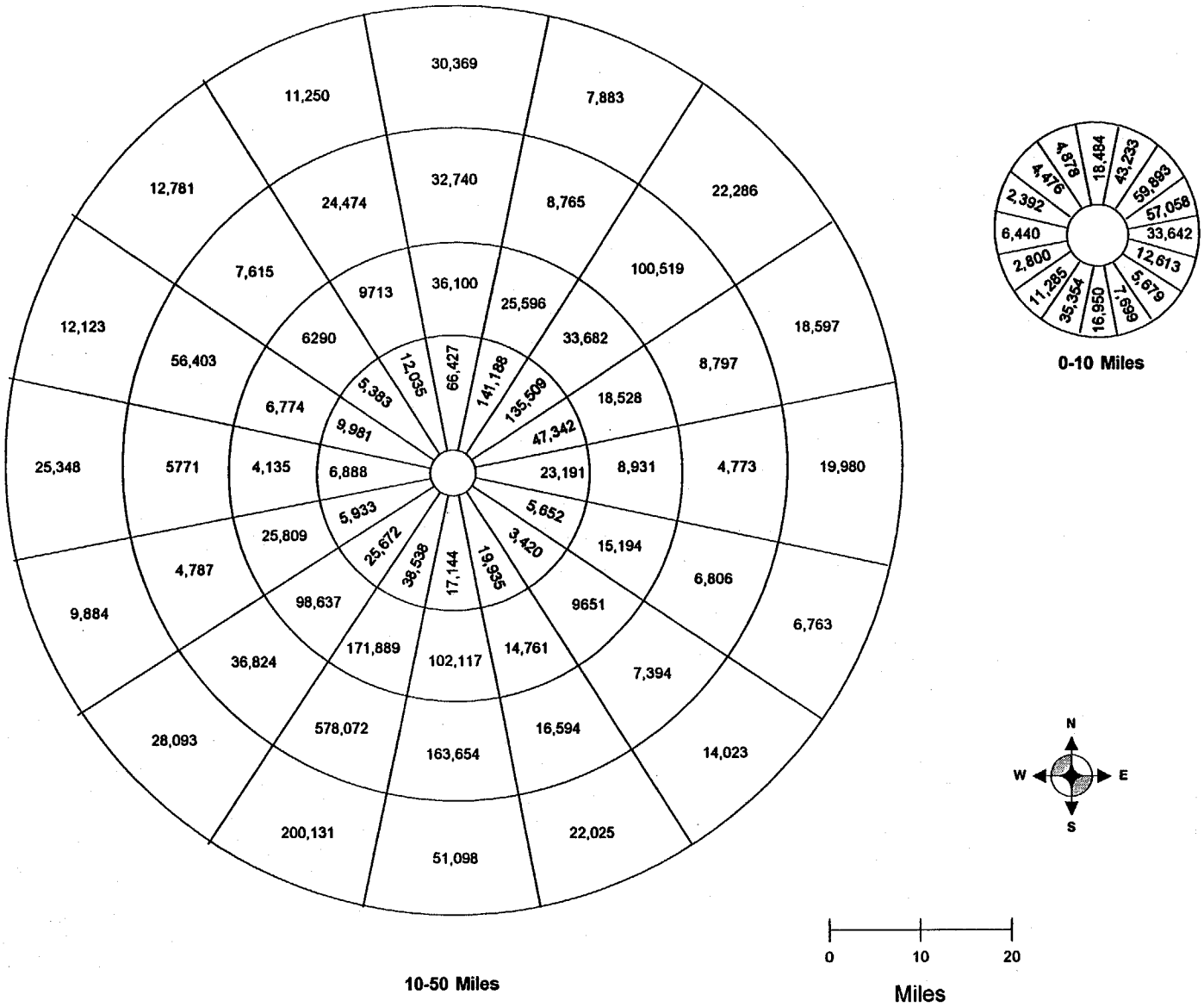


Figure 3.1-6 Distribution of Population within 50 mi (80 km) of Mound

Table 3.1-8. Ambient Annual Average Plutonium Concentrations, 1974 - 1985

(10^{-17} μ Ci/mL)

Year		Monitoring Station									
		101	102	103	104	105	108	110	111	112	115
1974	^{238}Pu	10.00 max	6.00	6.40	1.30	1.20	3.20	1.30	0.78	2.00	1.00
	^{239}Pu [a]	3.10	2.80	3.20	3.30	3.40 max	3.40 max	1.30	3.00	2.70	3.40 max
1975	^{238}Pu	2.30 max	1.40	1.30	1.40	0.94	0.75	<0.23	<0.33	0.35	<0.17
	^{239}Pu	2.90 max	2.90 max	2.30	2.20	1.90	1.90	1.90	2.20	3.10	2.60
1976	^{238}Pu	3.90	2.60	2.90	<0.79	<0.21	0.39	<0.17	<0.17	0.26	0.21
	^{239}Pu	0.67	0.52	0.86	0.52	0.48	0.44	0.46	.046	0.51	0.55
1977	^{238}Pu	1.00	0.81	0.62	0.37	<0.15	<0.15	<0.09	<0.21	<0.16	<0.13
	^{239}Pu	2.40	2.20	2.10	2.20	2.20	2.70	2.30'	2.50	2.10	2.50
1978	^{238}Pu	0.31	0.66	3.00 max	0.27	0.15	0.14	0.11	0.26	0.12	<0.08
	^{239}Pu	2.80	3.20 max	2.70	2.60	2.70	3.90 max	2.90	3.30	3.00	2.70
1979	^{238}Pu	0.34	0.67	0.42	0.40	0.14	0.11	0.10	0.16	0.09	0.07
	^{239}Pu	0.87	0.87	0.85	1.00	0.81	1.10	0.95	0.95	0.88	0.92
1980	^{238}Pu	0.22	0.69	0.56	0.25	0.09	0.04	0.07	0.12	0.06	0.06
	^{239}Pu	0.55	0.48	0.49	0.47	0.49	0.51 max	0.51 max	0.51 max	0.42	0.42
1981	^{238}Pu	0.12	0.47	0.71	0.26	0.10	0.02	0.05	0.02	0.04	0.04
	^{239}Pu	1.86	1.83	1.77	1.71	1.57	2.32 max	1.84	1.77	1.74	1.93
1982	^{238}Pu	0.21	0.45	0.40	0.17	0.09	0.03	0.03	0.06	0.04	0.04
	^{239}Pu	0.26	0.26	0.23	0.22	0.21	0.27 max	0.20	0.26	0.25	0.20
1983	^{238}Pu	0.10	0.28	0.65	0.43	0.07	0.02	0.06	0.07	0.04	0.07
	^{239}Pu	0.29	0.24	0.25	0.23	0.25	0.19	0.21	0.19	0.25	0.22
1984	^{238}Pu	0.29	1.12	0.46	0.23	0.08	0.07	0.02	0.02	0.02	0.03
	^{239}Pu	0.06	0.06	0.05	0.04	0.03	0.05	0.03	0.05	0.05	0.04
1985	^{238}Pu	0.26	0.819	0.65	0.188	0.262	0.02	0.018	0.035	0.099	0.008
	^{239}Pu	0.025	0.027	0.039	0.017	0.017	0.033	0.016	0.021	0.022	0.023

Table 3.1-8. Ambient Annual Average Plutonium Concentrations, 1974 - 1985 (continued)

(10^{-17} μ Ci/mL)

Year		Monitoring Station									
		118	119	122	123	124	211[b]	212[b]	213[b]	214[b]	215[b]
1974	^{238}Pu	1.40	0.19	—	—	—	81.00	19.00	57.00	17.00	8.20
	^{239}Pu [a]	3.00	2.90	—	—	—	—	—	—	—	—
1975	^{238}Pu	0.44	<0.14	1.70	—	—	21.20	5.20	103.3 max	6.70	3.80
	^{239}Pu	1.80	1.90	1.60	—	—	2.20	2.10	4.10 max	2.50	2.20
1976	^{238}Pu	0.65	<0.05	3.80	16.00 max	—	8.70	3.50	26.70 max	9.10	3.30
	^{239}Pu	0.56	0.38	0.60	0.51	—	0.59	0.54	1.30 max	0.81	2.20
1977	^{238}Pu	0.75	<0.10	2.10	2.90 max	1.70	5.10	2.50	8.10 max	3.10	1.30
	^{239}Pu	2.50	2.10	1.60	2.10	2.40	2.00	1.90	3.10 max	1.90	<1.70
1978	^{238}Pu	0.95	0.16	0.94	3.00	1.40	2.70	1.50	12.00	3.30	1.30
	^{239}Pu	3.60	2.20	2.20	3.00	3.00	2.60	2.70	2.70	2.60	2.50
1979	^{238}Pu	0.41	0.05	0.42	3.60 max	1.30	2.20	1.70	19.00 max	1.40	0.68
	^{239}Pu	0.99	0.78	0.74	0.96	0.98	0.84	0.83	1.10 max	0.81	0.79
1980	^{238}Pu	0.12	0.02	0.28	1.40 max	0.66	3.80	0.91	5.90 max	0.69	0.57
	^{239}Pu	0.48	0.34	0.33	0.44	0.45	0.43	0.40	0.49 max	0.31	0.37
1981	^{238}Pu	0.23	0.01	0.17	1.66 max	1.59	36.40 max	1.04	6.62	2.08	0.61
	^{239}Pu	2.04	1.63	1.30	1.71	1.70	1.86 max	1.26	1.36	1.38	1.48
1982	^{238}Pu	0.11	0.03	0.28	1.74 max	0.46	8.83 max	0.88	3.86	2.42	0.55
	^{239}Pu	0.27 max	0.26	0.23	0.26	0.25	0.29 max	0.25	0.24	0.28	0.24
1983	^{238}Pu	0.06	0.02	0.20	1.24 max	0.60	2.96	0.62	7.44 max	1.34	0.29
	^{239}Pu	0.31 max	0.1	0.15	0.27	0.28	0.23	0.23	0.30 max	0.22	0.19
1984	^{238}Pu	0.50	0.0002	0.21	1.50	2.20 max	4.19	1.71	12.60 max	2.32	0.50
	^{239}Pu	0.05	0.04	0.05	0.07 max	0.06	0.10	0.06	0.11 max	0.07	0.06
1985	^{238}Pu	1.10	0.015	0.858	4.03 max	1.38	18.20 max	1.69	15.30	12.60	1.66
	^{239}Pu	0.029	0.013	0.033	0.084 max	0.02	2.21 max	0.31	0.99	0.74	0.37

Source: MRC, 1975-1984, 1985, 1986

a Concentration of $^{239}Pu + ^{240}Pu$

b On Site

max Maximum annual average off-site and on-site concentrations

— Not reported

Table 3.1-9 Ambient Annual Average Tritium Concentrations, 1974 - 1985

(10^{-17} µCi/mL)

Year	Monitoring Station									
	101	102	103	104	105	108	110	111	112	115
1974	<11.00	<14.00	<14.80	<4.90	<5.40	<1.60	<1.70	<1.10	<4.00	<1.20
1975	<1.30	<1.60 max	<1.40	<0.90	<0.78	<0.78	<0.74	<0.74	<1.00	<0.75
1976	<1.30	<1.50 max	<1.10	<0.94	<0.90	<0.89	<0.90	<0.81	<0.92	>0.85
1977	<0.64	<1.24 max	<0.72	<0.44	<0.40	<0.37	<0.40	<0.62	<0.59	<0.56
1978	0.44	0.86 max	0.52	0.34	0.14	0.17	0.14	0.30	0.29	0.07
1979a	0.53	1.04	0.65	0.39	0.05	0.10	0.05	0.05	0.22	0.03
1980	4.96	13.70 max	5.55	1.40	0.18	0.60	0.18	0.01	0.71	EL
1981	7.02 max	6.10	5.17	2.92	1.19	1.10	1.19	0.72	1.29	0.16
1982	4.70 max	3.57	3.13	1.09	0.63	0.73	0.63	0.57	0.81	0.11
1983	2.53	2.60	1.97	0.78	0.24	0.45	0.24	0.46	0.73	0.02
1984	1.88 max	1.72	1.14	0.87	0.09	0.26	0.09	EL	0.11	EL
1985	1.74	2.92 max	1.09	0.939	0.099	0.23	0.099	EL	0.245	EL

Year	Monitoring Station									
	118	119	122	123	124	211	212	213	214	215
1974	<8.70	<0.70	—	—	—	<8.60	<11.00	<32.00 max	<17.00	<16.00
1975	<0.89	<0.74	—	—	—	<3.10	<3.30	<3.10	<3.40 max	<2.00
1976	<0.90	<0.88	—	<1.10	—	<1.80	<2.00	<2.80 max	<2.20	<2.40
1977	<0.57	<0.44	—	<0.88	<0.94	<1.80	<3.00 max	<2.00	<1.60	<1.60
1978	0.19	0.56	—	0.73	0.60	0.94	0.62	0.90 max	0.87	0.45
1979[a]	0.29	0.06	0.62	0.76	1.10 max	0.83	0.99	1.35 max	0.86	0.74
1980	0.86	0.20	4.21	4.53	7.60	8.88	41.30 max	21.50	8.58	3.90
1981	3.12	0.65	3.19	5.26	5.94	7.18	6.76	7.85 max	4.45	3.04
1982	0.66	0.73	1.70	2.80	2.00	5.26	3.93	5.65 max	3.02	2.07
1983	0.75	0.14	2.15	3.07	3.26 max	3.53	3.21	4.25 max	3.43	2.12
1984	0.19	0.41	1.44	1.58	1.61	2.21	2.11	2.83 max	2.67	2.15
1985	0.649	0.254	1.17	2.02	1.82	3.27 max	2.97	2.73	2.48	1.98

Source: Mound Environmental Monitoring Reports (MRC, 1975-1984, 1985, 1986)

[a] Concentrations after 1978 are incremental relative to the concentration measured at Station 119

EL Less than background levels

max Maximum on-site and off-site concentrations

— Not reported

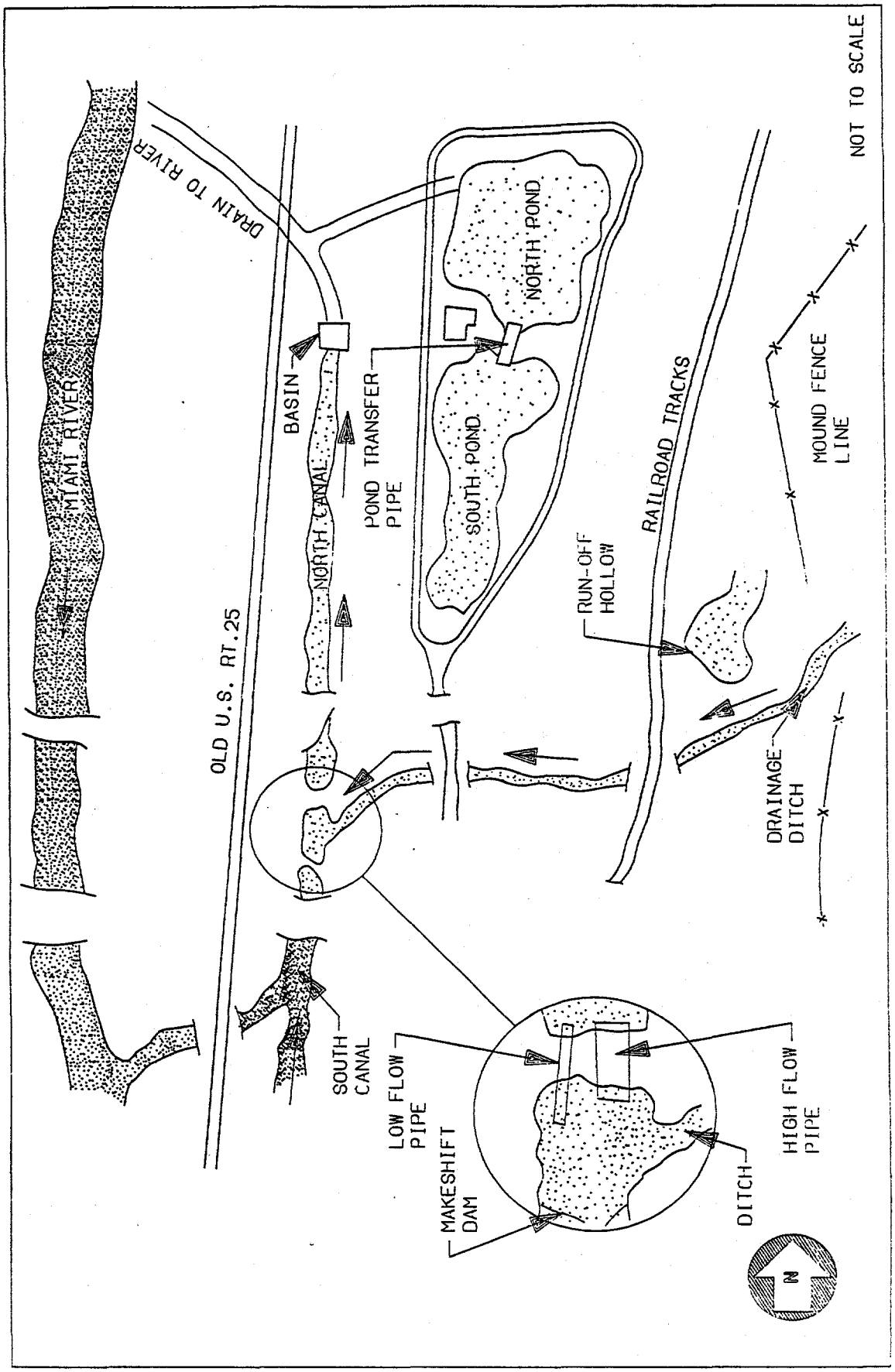


Figure 3.2-1. Surface Water Features

Flow data are available from a gauging station operated since 1916, located 1.6 km (1 mi) upstream from Mound. According to the flow duration data (DOE, 1979), the discharge equals or exceeds 310 cubic feet per second (cfs) (low-flow conditions) 90% of the time and 1,050 cfs (mean-flow conditions) 50% of the time; the 7-day, 20-year low flow is 180 cfs. The greatest historic discharge at Miamisburg was estimated at 257,000 cfs during a flood in 1913. The Miami Conservancy District constructed retarding basins on reaches of the river in 1921. Since that time, a maximum discharge of 61,800 cfs was recorded in 1959 at Miamisburg.

3.3 BIOLOGICAL RESOURCES

This section provides a general description of terrestrial and aquatic biota found in the vicinity of Mound. A list of terrestrial and aquatic species is provided in DOE, 1979.

3.3.1 Terrestrial Biota

Because much of the land near Mound is farmed, the most noticeable animals are domesticated animals grown for food, breeding, or recreational purposes. Many feral species, however, are supported by the abundant wooded areas nearby. Mammals commonly found in the Miami Valley include opossum, mole, shrew, bat, rabbit, squirrel, woodchuck, chipmunk, rat, mouse, raccoon, weasel, mink, skunk, fox, and deer. Some of the smaller mammals are sometimes seen in the wooded areas on the Mound site, as are lizards, land turtles, and several varieties of snakes. Many bird species are commonly found in the vicinity of Mound, and numerous others are present frequently or migrate through the area. The order Passeriformes is represented by the most species, i.e., more than 100. Sparrows, wrens, swallows, robins, pigeons, and many crows are regularly seen on or near the Mound site, along with an occasional owl or hawk.

The cultivated land near Mound is used principally to grow soybeans and corn. The heavily wooded areas on and near the Mound site support an abundance of native flora. Most species of trees are included in the beech, willow, walnut, birch, maple, olive, and dogwood families. Additionally, many conifer and ornamental species have been introduced into the area. The hilly areas are commonly covered with small trees and shrubs, whereas scrub growth and grasses are the dominant vegetation on the flatter areas.

3.3.2 Aquatic Biota

The Great Miami River, located 0.93 km (0.58 miles) west of Mound, supports several species of fish, including species of black bass, carp, catfish, crappie, darter, herring, perch, sculpin, sucker, sunfish, trout-perch, and walleye. Beaver and otter, semiaquatic animals, are also present as well as numerous species of salamanders, frogs, and turtles. Perennial streams do not exist on the Mound site, but there are several privately-owned fishing ponds in the vicinity of Mound. Aquatic species present in local waterways (exclusive of fish stocked in ponds) are presented in DOE, 1979.

3.3.3 Endangered and Threatened Species

According to the Fish and Wildlife Service, the only endangered species that may be present in the area of concern is the Indiana bat, *Myotis sodalis*. This bat lives in caves and riparian habitats in several Ohio counties, including Montgomery County. These habitats do not exist on the Mound site. There are no threatened species in the vicinity of Mound (see Appendix A).

4.0 IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter evaluates the environmental consequences of the proposed action (Section 4.1) and of the alternatives (Section 4.2). The analysis focuses primarily on impacts associated with routine operation of the glass melter. In some instances (such as human health), additional analysis is provided for accident conditions.

4.1 THE PROPOSED ACTION

The proposed action was evaluated to determine the potential impacts of a number of environmental components, including air quality, surface water quality, and biological resources, as well as the potential effects to human health and safety. The potential impacts to these receptors are evaluated in the following subsections. No impact pathways were identified for land use, socioeconomics, or groundwater resources.

4.1.1 Air Quality

Operation of the glass melter will require approval of the Ohio EPA and/or the U.S. EPA Region V. The Mound facility is in Montgomery County, within the Metropolitan Dayton Intrastate Air Quality Control Region (AQCR). The region is under authority of the Regional Air Pollution Control Agency (RAPCA), which monitors ambient levels of criteria pollutants. Monitoring data are compared to the National Ambient Air Quality Standards (NAAQS), (Clean Air Act, as amended) and the state of Ohio air standards (listed in the Ohio Administrative Code, Title 3745). Montgomery County is currently classified as nonattainment for ozone and total suspended particulates.

Glass melter emissions are also regulated by the National Emission Standards for Hazardous Air Pollutants (NESHAP). The EPA regulations on NESHAP were promulgated under authority of the Clean Air Act, as amended. NESHAP regulations (40 CFR Part 61) cover a wide variety of toxic air pollutants, including beryllium, mercury, vinyl chloride, asbestos, and arsenic. They also cover certain radioactive emission sources from underground uranium mines, elemental phosphorus plants, and radioactive emissions from facilities licensed by the Nuclear Regulatory Commission. In addition, Subpart H establishes a national emission standard for radioactive emissions from facilities owned or operated by the DOE. The emission standard is 10 mrem/year effective dose equivalent.

Air quality will be impacted by emissions of particles and gaseous compounds generated by the combustion of waste materials in the glass melter. The waste feedstocks anticipated are listed in Table 2.1-3, and include volatiles, semi-volatiles, and nonvolatile materials, some of which are contaminated with radionuclides. Approximately one-sixth of the annual waste processed through the glass melter will be existing "backlog" waste, listed in Table 2.1-4. The average waste profile will therefore consist of:

Waste type	Table	kg/year	% of total
Nonrad hazardous	2.1-3	37,009	77
Mixed waste	2.1-3	1,858	4
Scintillation vials	2.1-3	455	1
Backlog mixed waste	2.1-4	8,678	18
Total		48,000	100

4.1.1.1 Impact of Nonradioactive Emissions

During normal operation of the glass melter, the impact of emissions from combustion of volatiles and semivolatiles will be negligible due to the high DRE demonstrated during tests of the glass melter (Section 2.1.2.1). Emission rates of nonvolatile hazardous materials, including metals and criteria pollutants, are listed in Table 2.1-5. Worst-case short-term ambient concentrations of these materials were projected by the PTPLU-2.0 dispersion model.

PTPLU-2.0 is an EPA guideline model for estimating the maximum short-term concentration in ambient air during each of the 49 combinations of wind speed and atmospheric stability customarily used for screening purposes. It was assumed that the glass melter will operate 40 hours per week, 52 weeks per year, and that the discharge rate for each pollutant will be relatively constant during operation. In Table 2.1-5, for example, the emission rate of arsenic, 56 g/year, was assumed to be 7.5E-06 g/sec for 2,080 hours. Other input data were: stack height = 57 ft, stack diameter = 6 in., gas temperature = 200°F, and stack velocity = 50 ft/sec.

Table 4.1-1 lists the emission rate and maximum predicted concentration of each nonradioactive pollutant. Each of the predicted concentrations represents the highest of the 49 concentrations calculated by PTPLU-2.0 and is therefore the maximum short-term concentration to be expected under worst-case meteorological conditions. In all cases, the maximum concentration occurred 220-m downwind, a location that can be either on site or off site, depending on wind direction.

Table 4.1-1. Maximum Short-Term, Ground-Level Concentrations of Pollutants Emitted by the Glass Melter

Nonradiological Pollutants

Pollutant	Emission Rate (g/sec)[a]	Predicted Conc. (g/m^3)	Applicable Standards: MAGLC (g/m^3)	Applicable Standards: Predicted Conc. minus MAGLC
Arsenic	7.50E-06	2.03E-09	2.00E-05	-2.00E-05
Cadmium	2.90E-06	7.86E-10	5.00E-06	-5.00E-06
Chromium	1.47E-05	3.98E-09	5.00E-05	-5.00E-05
Lead	1.47E-04	3.98E-08	1.50E-05	-1.50E-05
Carbon monoxide	2.64E-02	7.15E-06	5.50E-03	-5.49E-03
Hydrogen chloride	1.30E-03	3.52E-07	7.00E-04	-7.00E-04
Nitrogen oxides	1.30E-03	3.52E-07	6.00E-04	-6.00E-04
Particulates	3.00E-04	8.13E-08	3.00E-05	-2.99E-05

Radiological Pollutants

Pollutant	Emission Rate (Ci/sec)[a]	Predicted Conc. (Ci/m^3)	Standards[b]
Tritium	3.40E+01	9.21E-03	
Plutonium-238	1.00E-04	2.71E-08	
All others	3.33E-05	9.02E-09	

Note: To project maximum annual concentrations (g/m^3) at the property line, multiply emission rate (g/sec) by 2.72E-06.

[a] Based on data in Table 2.1-5.

[b] Short-term standards for these radionuclides do not exist. See Section 3.1.

Table 4.1-1 also compares predicted concentrations to MAGLCs for nonradioactive pollutants. MAGLCs were calculated according to the methodology employed by Ohio EPA, Division of Air Pollution Control (DAPC), which divides the time weighted average (TLV-TWA) for each pollutant by 10 to adjust the occupational standard to a short-term standard applicable to the general public. As shown in Table 4.1-1, the maximum predicted concentrations are lower than corresponding MAGLCs.

Glass melter stack emissions requirements have been determined based on criteria found in the EPA report "Guidance on Metals and Hydrogen Chloride Controls for Hazardous Waste Incinerators" (Draft final report 9/88). Permissible levels of metals emitted can be set in one of the following ways:

- Limits set on feed rates - "Tier I Limits"
- Limits set on emissions - "Tier II Limits"

Tier I limits assume all metals are emitted, and take no credit for partitioning of metals into the glass structure, or removal of metals from stackgases by air pollution control devices. Reasonable worst case dispersions are assumed. Tier II limits take into account metals partitioning and removal, by using actual stack emission rates. Worst case dispersion is assumed.

Limits for concentration of metals that could be present in trace quantities in waste feed streams for the glass melter have been determined based on Tier I limits in Table 4.1-2. For noncarcinogenic metals for which Tier I limits are too restrictive, and for carcinogenic metals, Tier II limits based on stack emissions have been estimated (see Table 4.1-2). In making these calculations, assumptions have been made relative to pollution control device efficiency and metals partitioning occurring in the system. These assumptions will be evaluated during the glass melter trial burn, and Tier II feed metal concentration limits will be revised in accordance with the data collected.

NO_2 and particulates are criteria pollutants for which there are NAAQS expressed as annual averages. The standards, 100 and 60 mg/m^3, respectively, are applicable to off-site locations. Accordingly, maximum annual average concentrations at the property line were estimated, using the Industrial Source Complex (ISC) dispersion model running in the long-term mode.

The ISC model is an EPA guideline model that accepts actual meteorological data and estimates ambient concentrations of pollutants at user-specified receptor locations. In this instance, the annual average of eight years of meteorological data recorded at the National Weather Service station at Dayton was used. A receptor was placed at the intersection of the property boundary with each of 36 radials, spaced 10° apart, emanating from the glass melter stack.

Table 4.1-2 Limits for Metals Concentrations in Waste Feed Streams

Table 4.1-2A		Table 4.1-2b	
Tier I		Tier II	
Metals	Feed Concentration [a] (ppm)	Metals	Feed Concentration [a] (ppm)
Non-carcinogenic		Non-carcinogenic	
Antimony	4,286	Antimony	14,286
Barium	71,429		
Lead	129	Lead	2,857
Mercury	2,857		
Selenium	1,000		
Silver	429		
Thallium	425	Thallium	14,286
Carcinogenic		Carcinogenic	
Arsenic	2.8	Arsenic	95
Cadmium	8	Cadmium	266
Chromium	11.4	Chromium	57
Beryllium	5.7	Beryllium	285

[a] Concentration determined based on 70 lb/hr. waste feed

The 36 radial distances from the stack to the property line ranged from 108 to 808 m. Using an assumed emission rate of 1 g/sec, the model calculated the annual average concentration at each of the 36 receptor locations. The highest concentration at the property boundary was 2.72 mg/m^3, which occurred 320 m due north of the glass melter stack. Since receptor concentrations are directly proportional to the source strength, the maximum annual average concentration (mg/m^3) of any pollutant listed in Table 4.1-1 can be obtained by multiplying the "emission rate (g/sec)" by 2.72. Accordingly, the maximum annual average concentrations of NO_2 and particulates are 0.0035 and 0.0008 mg/m^3, respectively. Both concentrations are negligible compared to NAAQS and will not adversely affect ambient air quality.

The release of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) from incinerators is an area of concern. The concern originated during testing of municipal waste incinerators (MWIs). These tests showed that PCDDs (up to 4.4 mg/m^3) and PCDFs were coming from the stacks of these incinerators in levels exceeding the assumed input levels of these compounds. PCDDs are considered to be carcinogens by EPA and promoters of carcinogenicity by Canada and some European countries. The potency factor for the worst PCDD is 1.56×10^5, which is the highest among all listed carcinogens (EPA, 1986b). The potential for release of these compounds from the glass melter is discussed in Appendix B and summarized in the following paragraphs.

PCDDs are not known to be formed by any biological activity, and all known sources of PCDDs involve oxidation and/or chlorination of organic compounds that are precursors or building blocks for PCDDs. Therefore, the source of dioxins from the glass melter will be either dioxins introduced into the furnace, either intentionally or as a contaminant (eg., trace contaminant of paper), or dioxins formed in the furnace and ancillary equipment from precursor chemicals. The high destruction and removal efficiency of the melter, up to 99.9999%, (Table 4.1-3) ensures that in the unlikely event that PCDDs are formed in the glass melter, their destruction will also be nearly complete. The high combustion efficiency will destroy most precursor chemicals before they are able to form PCDDs. Dioxins are formed in the temperature range of 200 to 730°C (approximately 390 to 1,350°F) and are destroyed at temperatures exceeding 750°C (1,380°F). The formation of dioxins is virtually impossible due to operating temperatures in the combustion zone of 1,400 to 2,750°F and the very rapid cooling below the formation temperature by the quench water in the wet scrubber. The rapid quenching below formation temperature is the method recommended by EPA for minimizing PCDD emissions from municipal waste incinerators.

The conclusion drawn in Appendix B is that the high system combustion efficiency will ensure the destruction of virtually all trace dioxins and dioxin precursors, and rapid quenching below dioxin-formation temperatures will prevent the creation of PCDDs and PCDFs. Release of any PCDDs or PCDFs will not be in excess of acceptable standards.

In addition, dioxin formation in the ash is not expected because the ash constituents are incorporated into the glass and maintained at high temperatures for

Table 4.1-3. DRE Test Burns Conducted with the Glass Melter System January 14-31, 1985

Waste Name	Physical State	Components	%	POHC?	Minimum Chamber Temperature (°F)	DREs			
Sludge-Wastewater Treatment Waste A Run 7	Sludge	Acrylonitrile	1.4	Y	1,906	99.99998	99.99999	99.99998	
		Carbon Tetrachloride	1.5	Y		99.99998	99.99999	99.99998	
		Chlorobenzene	1.0	Y		99.99972	99.99990	99.99993	
		Phenol	1.2	Y		99.99978	99.99998	99.99998	
		Water	60	N					
		Waste Treatment Solids	Bal	N					
Sludge-Wastewater Treatment Water A Run 8	Sludge	Acrylonitrile	2.8	Y	1,974	99.99998	99.99999		
		Carbon Tetrachloride	3.0	Y		99.99998	99.99999		
		Chlorobenzene	2.1	Y		99.99993	99.99976		
		Phenol	2.4	Y		99.99998	99.99999		
		Water	47	N					
		Waste Treatment Solids	Bal	N					
Sludge-Wastewater Treatment Waste A Run 9	Sludge	Acrylonitrile	2.8	Y	1,745	99.99994			
		Carbon Tetrachloride	3.0	Y		99.99998			
		Chlorobenzene	2.1	Y		99.99966			
		Phenol	2.4	Y		99.99997			
		Water	47	N					
		Waste Treatment Solids	Bal	N					
Acetonitrile Waste Waste C Run 1	Clear Liquid	Acetonitrile	77	Y	1,769	99.99995	99.99999		
		Acrylonitrile	3	Y		99.99988	99.99994		
		Water	20	N					
Acetonitrile Waste Waste C Run 2	Clear Liquid	Acetonitrile	75	Y	2,135	99.99999	99.99999		
		Acrylonitrile	5	Y		99.99997	99.99998		
		Water	20	N					
Acetonitrile Waste C Run 3	Clear Liquid	Acetonitrile	75	Y	1,759	99.99998			
		Acrylonitrile	5	Y		99.99995			
		Water	20	N					
"Cocktail" Waste Waste D Run 4	Liquid	Kerosene	91	N	1,781				
		Carbon Tetrachloride	2.0	Y		99.99986	99.99998	99.99992	99.99983
						99.99990	99.99992	99.99993	
		Chlorobenzene	2.2	Y		99.99987	99.99989	99.99993	99.99984
						99.99992	99.99989	99.99994	

Table 4.1-3. DRE Test Burns Conducted with the Glass Melter System January 14-31, 1985 (continued)

Waste Name	Physical State	Components	%	POHC?	Minimum Chamber Temperature (°F)	DREs			
		Phenol	2.3	Y		99.99987	99.99989	99.99993	99.99985
						99.99990	99.99992	99.99992	
		Xylene	ppm	Y		99.99841	99.99843	99.99906	99.99764
						99.99929	99.97484	99.99954	
"Cocktail" Waste Waste D Run 5	Liquid	Kerosene	88	N	1,799				
		Carbon Tetrachloride	2.9	Y		99.99990			
		Chlorobenzene	3.6	Y		99.99992			
		Phenol	2.7	Y		99.99990			
		Xylene	ppm	Y		99.99929			
"Cocktail" Waste Waste D Run 6	Liquid	Kerosene	88	N	1,714				
		Carbon Tetrachloride	2.9	Y		99.99992	99.99993		
		Chlorobenzene	3.6	Y		99.99989	99.99994		
		Phenol	2.7	Y		99.99992	99.99992		
		Xylene	ppm	Y		99.97484	99.99954		

Source: Mound, 1987.

Bal = balance

extended periods of time, which should destroy precursors; available formation sites will be minimized because of the liquid nature of the melted glass.

4.1.1.2 Impact of Radioactive Emissions

During normal operation of the glass melter, radionuclides will be released during the combustion of mixed wastes. The portion released from the waste but not captured by the glass, the scrubber system, or the HEPA filters will be discharged from the glass melter stack. Maximum anticipated stack emission rates of the two principal radionuclides, ^{3}H and ^{238}Pu, are 34.0 and 0.0001 Ci/year, respectively, as shown in Table 2.1-5. The combined emission rate of all other radionuclides listed is estimated to be 0.000033 Ci/year, which was modeled as ^{230}Th (for purposes of analysis). ^{230}Th was chosen because of the relatively high dose-conversion factors associated with inhalation and ingestion, the two predominant pathways for human uptake of the radionuclides listed in Table 2.1-5. The population dose[3] was estimated by the MICROAIRDOS™ model (Moore et al., 1989), which is a microcomputer version of AIRDOS designed and written by the author of the original AIRDOS Radionuclide Dispersion and Dose Assessment Code. For purposes of evaluating compliance with 40 CFR Part 61 NESHAPS, the dose to the maximally exposed individual was estimated using the AIRDOS-PC computer code (USEPA,1989).

As with AIRDOS-EPA, MICROAIRDOS™ couples the output of the atmospheric transport models with the terrestrial food-chain models of the U.S. Nuclear Regulatory Commission's (NRC's) Regulatory Guide 1.109 to estimate the radionuclide concentrations in produce, leafy vegetables, milk, and meat for human consumption. Dose conversion factors are input to the code, and doses to humans at each distance and direction specified are estimated for total body and individual organs through the following exposure modes: 1) immersion in air containing radionuclides, 2) exposure to contaminated ground surface, 3) inhalation of radionuclides in air, 4) ingestion of food produced in the area, and 5) ingestion of water containing ^{3}H. The code will accept up to 12 radionuclides and will estimate the highest sector-averaged or centerline dose to an individual, or the annual population dose. Similarly, AIRDOS-PC is a microcomputer adaptation of AIRDOS-EPA, developed by EPA specifically for evaluating NESHAPS compliance.

Using EPA dose conversion factors, the source terms above, and the meteorological and stack data previously cited, the highest effective dose equivalent

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[3] When ionizing radiation passes through matter, some of its energy is imparted to the matter. The amount absorbed per unit mass of irradiated material is called the dose and is measured in rems and rads. Effective dose equivalent means the sum of the products of absorbed dose and appropriate factors to account for differences in biological effectiveness due to the quality of radiation and its distribution in the body of reference man. The unit of the effective dose equivalent is the rem. The method for calculating effective dose equivalent and the definition of reference man are outlined in the International Commission on Radiological Protection's Publication No. 26 (ICRP).

(based on standard man) to a hypothetical individual located at the property boundary was estimated to be 0.073 millirem/year (mrem/year). The location of the individual was 470 m north-northeast from the glass melter stack. Contributions to the total dose by ^{3}H, ^{238}Pu, and ^{230}Th were approximately 40%, 50%, and 10%, respectively. Contributions by inhalation and ingestion pathways were 60% and 40%, respectively.

The estimated dose and the associated risks are very low. Recently promulgated National Emission Standards for Hazardous Pollutants (NESHAPS) limit the effective dose equivalent to 10 mrem/year for an individual. (The previous limit for a person living near an NRC-licensed facility was 10% of the occupational limit of 5,000 mrem/year, or 500 mrem/year.) Under NESHAPS, an operating permit and emission monitoring are required for any new source projected to result in more than 0.10 mrem/year effective dose equivalent to any individual.

Based on the 1990 population distribution surrounding the Mound facility, the collective effective dose equivalent (CEDE) to the total population residing within 80 km of the facility (approximately 3,035,000) was estimated to be 2.6 person-rem/year. The collective dose equivalent projected for operation of the glass melter facility is very small; no somatic or genetic effects are anticipated.

4.1.2 Surface Water Quality

Operation of the glass melter would not result in the direct discharge of effluents to surface or ground water sources. Discharge of scrubber liquid, if any, would be a minor stream to a wastewater treatment facility which discharges at an NPDES permitted outfall. This liquid would be characterized for waste feed RCRA hazardous components prior to release to ensure that pretreatment standards were met, and that toxic materials were not released to the treatment facility. Based on the control systems which would be in place, impacts on surface and ground water quality from glass melter operation would be predicted to be negligible.

4.1.3 Biological Resources

Air emissions from melter operation and resulting changes in air quality are considered to be the pathways by which biological resources could be potentially impacted. The air quality analysis indicates no measurable change in air quality with respect to priority pollutants; hence, no adverse impact is projected from this source. Radioactive emissions are predicted to result in a maximum fence line dose of 0.18 mrem/year. This is considered sufficiently low to be indicative of negligible impact to biological resources.

4.1.4 Human Health and Safety During Routine Operations

Use of the glass melter for treatment of mixed wastes could impact the health and/or safety of on-site personnel and the general public during routine operations. The following sections provide information on the potential impacts and their magnitudes.

4.1.4.1 On-Site Population

Routine operation of the glass melter could impact the on-site population in a variety of ways. These effects are grouped into three major areas:

- radiation exposure,
- industrial safety, and
- industrial hygiene.

Potential impacts to worker health and safety in each of these areas are summarized in the following subsections. Further discussion of the impacts is provided in Appendix D. Consideration was given to established procedures designed to minimize adverse effects.

Radiation Exposure. Radiological hazards to employees associated with the operation of the glass melter are expected to be minimal, based on the limited concentrations of the radionuclides in the waste and on facility design features which reduce direct employee contact with radioactive materials. The primary radionuclides treated at the glass melter include ^{3}H and Pu. Information on potential exposures to the general public during routine operations is given in Section 4.1.4.2.

Mound has an active program to keep employee exposures as low as reasonably achievable (ALARA). Extensive radiation protection procedures have been developed and implemented at the facility. Technical Manual MD-10019, *Mound Radiological Protection Program,* describes the program, including the methods used for monitoring employee exposures, applicable standards, training, personnel protection measures, and emergency procedures.

Glovebox and stack alpha radiation detectors and alarms are in place downstream of the HEPA filters, in addition to the personnel monitoring program. For any operation of the glass melter involving tritium, a room ^{3}H monitor will be employed. Special surveys made during a test run in 1985 indicated that some contaminants are present on the interior surfaces of the glass melter. Radioactive contamination levels on external surfaces of equipment to which personnel are exposed will be maintained <20 disintegrations per minute (d/min)/100 cm^2 alpha transferable or <100 d/min/100 cm^2 transferable ^{3}H, which are lower levels than the DOE guidelines.

Industrial Safety. The operation and design of the glass melter thermal unit present a number of industrial safety hazards. These hazards are grouped into the following categories: materials handling, hazardous materials spills, falls from heights, contact with heated surfaces, and contact with energized circuits.

The hazards identified in Table 4.1-3 present the greatest probability of serious injuries to personnel.

- *Materials Handling.* There are three strenuous manual materials-handling tasks performed during the glass melter operations. These include:

  — the transferring of 5-gal metal buckets filled with molten glass (100 lb) extracted from the furnace to an adjacent storage area,

  — the movement of 55-gal drums of waste liquids to the feed system hood, and

  — the loading of buckets of glass frit into the unit glovebox.

  The weight and forces combined with bending, twisting, and reaching motions make the performance of these manual tasks difficult and could lead to strain-type injuries. Appropriate mechanical aids would be provided to assist in the movement of the drums containing waste liquids.

- *Hazardous Materials Spills.* Employees could be exposed to minor spills of hazardous and radioactive liquid wastes from the movement of drums inside and outside of the glass melter building. The chemical compositions of these mixed-wastes are given in Table 2.1-3.

  Impairments to the respiratory, nervous, cardiovascular, lymphatic, integumentary, and other functional systems which could result from acute exposure to these waste solvents are not expected during routine operation.

  Site policy, as contained in the *Mound Safety and Hygiene Manual*, requires employees to wear appropriate protective clothing and respiratory equipment. Employee awareness of the hazards associated with exposures to solvents is also addressed in this manual. The Mound Toxic Material Advisory Committee and the Chemical Spill Committee provide health and safety guidance in relation to hazardous chemicals and outline appropriate actions in the event of an emergency situation.

- *Falls from Heights.* Employees operating the glass melter furnace may be exposed to potential falls from heights during the loading of the solid waste feed system. The solid waste feed system is located at a height of approximately 3 m (approximately 10 ft) above the floor. Access to the system currently requires climbing around obstructions which could cause employees to lose their balance and fall. The *Mound Safety and Hygiene Manual* addresses inspection for and correction of fall hazards.

- *Contact with Heated Surfaces.* The operation of the glass melter unit presents the potential for employees to receive burns from bodily contact with the heated furnace skin while manually transferring the 5-gal metal buckets containing molten glass extract to the adjacent storage area. Burns

may also result from contact with molten glass escaping the furnace through a break in the refractory. This potential is low since the glass normally hardens to seal the exposed surfaces.

The potential for contact with the furnace skin exists during access to the gloveboxes for the loading of glass frit and shredded solid waste. An exposure also exists when removing the buckets containing molten glass extract.

The *Mound Safety and Hygiene Manual* outlines the policy and procedures that require employees to wear the appropriate personal protective equipment. Glass melter employees are provided with welder gloves for protection from burns.

- *Contact with Energized Circuits and Energized Components.* Contact with energized circuits does not present a major risk during furnace operation. Contact with energized components is possible during water lance application to refractory breeches if electrodes are not de-energized as a preliminary precaution.

Industrial Hygiene. Employee health risks from the operation of the glass melter are divided into four categories: noise exposure, heat exposure, toxic contaminant exposure, and heavy-metal exposure.

- *Noise Exposures.* Glass melter employees are exposed to noise levels in excess of the established Mound guidelines as indicated by noise exposure readings performed during 1988 by the industrial hygiene staff. The primary noise sources are the offgas handling equipment and the propane burner on the furnace. The Site Hearing Conservation Policy, found in Technical Manual MD-10286, *Mound Safety and Hygiene Manual*, outlines the present hearing protection program. This policy is more conservative, and thus more protective, than current Occupational Safety and Health Administration (OSHA) policy for general industry found in 29 CFR Part 1910.95, Occupational Noise Exposure. The Mound Industrial Hygiene Department has identified the offgas scrubbing system area as a high noise area requiring hearing protection for all employees while engineering controls are evaluated and installed.

- *Heat Exposure.* It is expected that employees operating the glass melter furnace will be exposed to relatively high room temperatures while in the immediate vicinity of the unit and while at the glovebox located above the furnace near the room ceiling. No heat exposure data are available. Given the high furnace temperature and projected operating time, it is reasonable to conclude that a heat stress potential could exist. Heat stress guidelines are being developed for this facility.

- *Toxic Contaminant Exposure.* Personnel operating the glass melter may receive exposures to toxic contaminants when hazardous waste and mixed-waste vapors escape to the work area atmosphere during routine activities.

  During furnace tests in January 1985, personal sampling conducted by Mound industrial hygienists indicated that the exposures exceeded established standards, as shown in Table 4.1-4. The toxic substances of concern in the January 1985 sample were acrylonitrile and carbon tetrachloride. Both are considered by ACGIH to be known human carcinogens.

  Technical Manual MD-10161, *Mound Respiratory Protection Program*, provides that process hazards be evaluated and appropriate respiratory protection be provided.

  Exposure of personnel in the adjacent facility to toxic contaminants from this unit are not expected. Exposures which exceed established limits outside the glass melter and offgas equipment rooms should be precluded by the lack of direct contact with contaminants and the negative pressure maintained in the furnace offgas rooms.

  Skin contact with toxic substances is another source of exposure which should not occur. The selection and use of appropriate personal equipment minimizes the risk of direct skin contact.

- *Heavy-Metal Exposures.* Table 2.1-7 provides a list of heavy metals that could be present in the wastes. The metals of primary concern are arsenic and cadmium, which have low TLVs and are known carcinogens. These metals pose a risk to employee health if ingested or inhaled as metal oxide fumes. Table 4.1-5 indicates extremely high temperatures are necessary to vaporize all of the oxides except As_2O_3. Therefore, Cd, Cr, and Pb heavy-metal exposures are not considered an employee health risk under normal or accidental conditions.

  Arsenic and other heavy metals are readily soluble in the molten glass, and also subject to effective removal in the offgas system. Source term quantities shown in Table 2.1-5 are not sufficient to cause worker health risk if extrapolated over a year of operation, even if the total daily quantities were re-entrained into the workplace.

Table 4.1-4. Glass Melter Facility Hazard Identification

Hazard	Source/Risk Exposure	Consequences	Controls
Noise	Propane burner on the furnace and the offgas handling equipment	Potential hearing loss, noise levels in excess of standards	Evaluation of noise levels — dosimetry and sound level readings. Implementation of engineering controls, i.e., barriers, ear protection — annual hearing tests
Exposure to hazardous air contaminants	Spills of drums containing hazardous wastes to be burned—vaporization release from offgas system	Adverse health effects—narcosis irritation and other impairments exposure to carcinogens	Use of appropriate respiratory protection
Contact with hazardous materials	Unloading/feeding of solid and liquid wastes, spills	Potential of severe skin irritation and other health effects	Use of appropriate respiratory protection, gloves, goggles, protective clothing
Fire/explosion	Propane leak, flammable liquids, combustibles in feeder	Injuries to personnel, damage to property	Furnace equipment inspection and maintenance, housekeeping efforts to minimize combustible loading
Strains	Mound materials handling tasks — loading of glass frit, movement of molten glass-end product	Low back strains and other strain related injuries	Task evaluations, ergonomic redesign and weight limitations
Burns/heat exposure	Contact with furnace skin, offgas pipe, and molten glass. High room temperature and at the glovebox above the furnace	Severe burns, heat stress	Evaluation of exposure levels. Development of heat stress guidelines. Use of heat resistant gloves and clothing
Electrical shock	Contact with electrodes, unprotected contact points	Shock, death	Maintenance of present controls
Steam flash	Water in screw shaft, water lance contacting molten glass or furnace shell	Steam burns	Use of protective clothing, development of proper procedure
Falls from heights	Unprotected or inadequately protected elevated walkways and platforms	Injury to employee	Adequate means of access/egress and appropriate railings

Table 4.1-5. Heavy Metal Vapor Pressures

Element	Metal Oxide	Metal Oxide	
		Vapor Pressure (atm)	At Temp (°C)
Arsenic	As_2O_3	1.0	855
Cadmium	CdO	1.0	2838
Chromium	Cr_2O_3	1.0	7232
Lead	PbO	1.0	2682

Source: CRC, 1988.

4.1.4.2 General Public

Routine operation of the glass melter will release small quantities of airborne radioactive and hazardous materials. A summarization of the potential impacts to the health of the general public as a result of these sources is addressed in Section 4.1.1.

Radiological Effects. Routine operations at the glass melter will involve the thermal treatment of mixed wastes containing the isotopes ^{3}H and ^{238}Pu. A conservative evaluation of the off-site radiological hazards presented by the release of ^{238}Pu and ^{3}H was performed with meteorological data from the Dayton, Ohio, area. Other input parameters and analysis details are provided in Section 4.1.1. The results indicate that the dose to the nearest resident will be less than 0.10 mrem/year.

Nonradiological Effects. Routine operation of the glass melter has been evaluated for nonradiological hazards that might affect the general public. A distance of 108 m was used as the nearest point to the site boundary. The nearest resident is 427 m from the facility. Any releases that could be measured above the levels known to impact human health were addressed. Two potential hazards were considered: (1) toxic vapor releases and (2) noise generated from equipment operation.

- Toxic vapor releases from the drum-storage area are not anticipated to exceed the TLV in the vicinity of closed drums. In addition, air mixing between the drum storage area and the closest property line (108 m) would render any routine evaporating vapors below regulatory limits. No hazardous releases of toxic vapors off site are predicted during routine operations.

- Noise levels inside the glass melter facility are primarily due to fan noise from the offgas handling equipment. Recorded noise levels exceed the Mound guidelines inside the facility. Attenuation by the building walls and loss of sound pressure energy at 108 m are predicted to reduce the noise levels below levels that are considered harmful to human hearing. Noise generated during the operation of the melter should not be harmful to any persons outside the melter facility and will not exceed the OSHA standard (90 db) on site or any applicable ambient noise limits of state or local jurisdictions off site.

4.1.5 Human Health and Safety During Nonroutine Operations

Potential accidents that could occur during operation of the glass melter are summarized in this section. The postulated accident initiating events pertinent to the glass melter operations are further discussed in Section 4.1.5.2 where the maximum credible accident is fully evaluated.

Initiating events were systematically determined following:

- a review of the Preliminary Hazard Analysis (Review Report #77-12, 1986),
- a review of the glass melter facility process descriptions,
- "what if" discussions with technical personnel responsible for operation of the glass melter, and
- a visual inspection of the glass melter facility.

This systematic evaluation identified potential initiators and resulted in the classification of the initiators into three categories: natural phenomena, external events, and process-related events.

- *Natural Phenomena.* Wind and earthquake extremes may adversely affect glass melter operations resulting in the release of radioactive and hazardous materials.
- *Externally Induced Events.* Most safety-related occurrences are the result of failures within the system or the result of some actions intentionally directed toward the system. It is possible, however, for damage to be inflicted on a system as a result of some occurrence originating outside the system. An aircraft crash into the WD building and an explosion or fire from external sources are two externally induced events that were evaluated.
- *Process-Related Initiators.* Process-related initiators are those accident initiators that are a direct result of the glass melter operation. The process-related initiators are grouped according to the energetics involved: high-energetic events, medium-energetic events, and low-energetic events. Adverse impacts to the glass melter operations were evaluated independently at these levels.

4.1.5.1 Response and Prevention of Accident Conditions

In addition to the programs discussed in Section 4.1.4.1, the following programs are in effect to properly manage accident conditions at the Mound facility:

- fire protection,
- criticality safety, and
- emergency preparedness.
- emergency response/contingency

The following subsections provide a summary of these programs; additional information can be found in Appendix D.

Fire Protection. A fire at the glass melter facility, which could include the associated storage and offgas handling/equipment areas, represents an accident with a potentially large release of toxic and radioactive materials. This could result in exposures to employees, emergency response personnel, employees in adjacent facilities, and the public. For this reason, fire protection is an important consideration with regard to the safe operation of this facility.

- *Fire Hazards (Fuel & Ignition Sources).* The normal fire load for the glass melter is low since the administrative controls restrict the quantities of combustibles in the facility. No more than ten drums of waste liquids are allowed at any given time on the outdoor loading dock. This is consistent with the requirements of 29 CFR Part 1910.106 for flammable and combustible liquids. The drum containing the wastes being destroyed is located in the offgas handling room away from the furnace during the waste-liquid pumping operation. Solid wastes in shredded form are transferred by hand to the furnace glovebox. The dry solid constitutes a transient fire load if stored in the furnace area.

  The primary ignition source for combustibles is the furnace, which operates at ~871° C (~1600° F). Under normal operating conditions, the negative pressure of the furnace prevents flash fires from occurring. Molten glass breaching the unit and contacting combustibles is considered a low probability event, as is an electrical failure in the vicinity of a flammable vapor mixture. Ignition sources at the loading dock include spontaneous combustion and external sources.

- *Fire Protection Program.* The *Mound Fire Protection Program Manual* (MRC, 1987d) describes the fire protection program for the entire Mound facility. This program provides detailed descriptions of facility provisions for inspection, testing, and maintenance of fixed and portable equipment and for fire and emergency response training.

- *Fire Protection Equipment.* The indoor areas of the glass melter facility are protected from fire by a wet pipe sprinkler system, and portable equipment including a Halon 1211 Unit rated for Class B (flammable/combustible liquids) and Class C (electrical) fires. Additional fire protection is provided for this facility per NFPA-10 (National Fire Protection Association), Portable Fire Extinguishers.

- *Effects of a Fire.* The anticipated effects of a fire in or near the glass melter will vary widely with the quantity of materials involved, the components of the waste stream, and the location of the fire with respect to any permanent fire protection system.

  The maximum credible accident scenario would be a drum fire in the outside storage area that fully involves all wastes present on the dock. Such

a fire could expose unprotected individuals in the glass melter and adjacent facilities to a variety of toxic, carcinogenic, and/or radioactive combustion products.

Fire fighting and recovery personnel operate under the *Mound Fire Protection Program Manual*, which requires self-contained breathing apparatus (SCBA), appropriate fire fighting apparel, as well as personal protective equipment and respiratory protection for cleanup operations.

- *Emergency Response and Cleanup.* Emergency response and cleanup crews operate under directives of the OSHA/RCRA HAZWOPER regulations, which define affected areas and set up control areas and decontamination operations. Protective clothing and respiratory protection requirements are established to be conservative until monitoring and analysis results can justify reductions in the level of protection. No impact on clean up crews is anticipated as a result of any credible Glass Melter accident.

Criticality Safety. The prevention of an uncontrolled nuclear chain reaction is the purpose of the criticality safety program. The glass melter will not be processing ~~significant~~ quantities (<0.24 kg ^{238}Pu per year) of fissile material and will not require an assessment from the Criticality Safety Committee. The WD building is currently not a Criticality Control Area (CCA). Critical quantities of fissile material are controlled in accordance with Mound Technical Manual MD-10038, *Nuclear Criticality Precautions*.

Emergency Preparedness. Emergency conditions at the glass melter facility that could impact the health and safety of personnel, normal operations, adjacent facilities, or the environment include:

- hazardous substance spills,
- fire/explosion,
- personal injury, and
- acts of nature.

Emergency conditions presented as a single incident source or in combination could result in catastrophic conditions, causing injury to personnel or extensive damage to the glass melter building and adjacent buildings.

Emergency Preparedness System Contingency Plans have been developed to reduce the impacts of an emergency event and to ensure effective response by appropriately trained personnel and off-site response agencies. These plans are consolidated in Mound Systems Manual 721. Individual plans are reviewed and updated annually.

- *Hazardous Substance Spills.* Hazardous substance spills could result in emergency conditions from toxic air contaminant releases, fires, or explosions. The mixed-waste liquid chemical components are listed in Table 2.1-3. The percentages of each component can vary depending on production waste streams. The properties of the mixed waste (i.e., flash point, explosive limits, and toxicity) are variable since they are influenced by the component percentages found in each drum.

  Guidelines for effective response to toxic chemical spills involving nonradioactive materials are provided for in Response Plan-9, *Contingency Plan* (EG&G, 1991). This plan is initiated upon the release of any hazardous substance and assures response by a spill management team. The plan also addresses notification of off-site agencies, team responsibilities, and available cleanup resources. Response procedures to spills of radioactive materials, including low-level mixed wastes, are provided for in Response Plan-2, *Health Physics Nuclear Emergency Procedure* (EG&G, 1991), and Response Plan-7, *DOE/Mound Radiological Assistance Team Plan* (EG&G, 1991).

- *Fire/Explosion.* Emergency situations involving fires or explosions could result from these identified sources:

  — leakage and ignition of propane gas supplied to the glass melter burners,
  — electrical deficiencies,
  — ignition of hazardous waste liquids spills, or
  — externally induced ignition of wastes.

  Appropriate response actions are described in the *Mound Safety and Hygiene Manual*, the *Fire Protection Program Manual*, and in various emergency preparedness system contingency plans. The *Fire Protection Program Manual* establishes the framework for organization, detection of causative factors, and effective response to fires. The *Emergency Brigade Plan* is addressed in Response Plan-142 (EG&G, 1991). Procedures for outside assistance from Miamisburg Fire Department have been established and implemented.

- *Personal Injury.* Emergency conditions resulting from fires, explosions, hazardous materials spills, acts of nature, or other causes could result in injuries to personnel in the glass melter building and adjacent facilities. Contingency plans to address appropriate responses to emergencies involving injuries to personnel are presented in the *Emergency Preparedness System: Master Plan*, Response Plan-1 (EG&G, 1991), and in Response Plan-3, *Emergency Medical Plan* (EG&G, 1991). These plans ensure on-site emergency medical capabilities, an accurate medical records system, and medical consultation to crisis management teams.

- *Acts of Nature*. Lightning, tornadoes, earthquakes, and other acts of nature could present emergencies involving fire, explosions, release of hazardous materials, and injuries to personnel. Emergency response actions to these potentially catastrophic events are provided in the *Fire Protection Plan* and the *Emergency Preparedness System Contingency Plan*, Response Plan-9 (EG&G, 1991).

4.1.5.2 Impacts Under Maximum Credible Accident Conditions

Possible accident scenarios were developed to identify the accidental occurrence that would result in the greatest harmful release to the environment. From the analysis of potential events (Appendix D), a fire in the drum storage area of the loading dock, resulting in complete vaporization of the contents of ten waste storage drums, was selected as the maximum credible accident. The probability of this event was estimated to be 0.00001. Such an accident would cause airborne releases of both radioactive and nonradioactive contaminants. These releases would take place during the burn time of the fire.

Assuming that the specific gravity of the drummed waste is 1.0, the total content of the ten drums would be 2,080 kg. The burn time of the waste can be estimated by applying a burn rate of 40 grams/square meter-second (g/m^2sec), the approximate burn rate for acetonitrile, a typical solvent. Assuming a burn area approximately 2 ft in diameter per drum (a total burn area of 2.7 m^2), the burn time would be approximately 5.4 h, (although emergency response measures would likely reduce the burn time substantially).

Typical amounts of radioactive and nonradioactive constituents of the drummed waste are shown in Tables 2.1-3, 2.1-4, and 2.1-5. Assuming a uniform release rate during a 5.4-h period, emission rates were calculated, and downwind concentrations of nonradioactive pollutants were projected by the SCREEN dispersion model.

Impact of Nonradioactive Emissions. SCREEN is a personal computer model that performs all the calculations in EPA-450/4-88-010 (EPA, 1988), *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources*. At each user-specified downwind distance, the model will calculate the maximum concentration to be expected during worst-case meteorological conditions. In addition to calculating impacts from a stack source or area source, the model will calculate downwind concentrations from a flare.

For the drum fire application, the model was run as a flare, 1 m above ground. Five toxic compounds were chosen for modeling, based on their abundance in the drummed waste and their relatively low TLV-TWAs. Downwind concentrations of each of the five compounds were projected by the SCREEN model at selected distances between 25 and 1,000 meters. These concentrations are presented in Table 4.1-6, along with the emission rate and TLV/10 for each toxic compound. The concentrations listed are the highest that can be expected under worst-case meteorological conditions. Maximum concentrations

occurred 69 m downwind and were well below the TLV/10 guideline exposure limit for employees and the general public.

Impact of Radioactive Emissions. Assuming that the entire 2,080 kg of wastes is consumed during the drum fire scenario, radioactivity released to the atmosphere can be estimated by referring to the waste composition data (Ci/kg of waste) in Table 2.1-5. Accordingly, the radioactivity released to ambient air by the two principal radionuclides, ^{3}H and ^{238}Pu, is 10.5 and 0.00021 Ci, respectively. (Laboratory tests of organic solvent fires containing dissolved uranium indicate that less than 1% of the uranium becomes airborne. Assuming similar results from a plutonium/solvent mixture, the radioactivity released to ambient air by ^{238}Pu would not exceed 0.00021 Ci). The combined release from all other radionuclides listed in Table 2.1-5 is estimated to be one-third of that from ^{238}Pu, or 0.00007 Ci, which will be modeled as Thorium-230 (^{230}Th) (for purposes of analysis). (^{230}Th was chosen for the same reasons cited in Section 4.1.1.2). The three source terms above were modeled to determine the dose to the maximally exposed individual.

The AIRDOS model is designed for continuous releases of radionuclides during a 1-year period and is best suited for instances where the release rate is relatively constant throughout the year. The dose from a short-term event can be estimated, however, by using artificial meteorological data in the model. A conservative estimate can be made by assuming worst-case meteorological conditions, namely:

- low wind speed (1 m/sec),
- worst-case atmospheric stability ("A" stability class, in this instance),
- constant wind direction (blowing from the fire directly toward the maximally exposed individual).

Using these assumptions and source terms, the dose to the maximally exposed individual was estimated by the MICROAIRDOS™ model, which is described in Section 4.1.1.2. The fire was modeled as a source 1 m above ground, releasing 200,000 calories of heat per second.[4] Human receptors were assumed to be located at the following downwind distances: 108, 150, 200, 500, 1,000, 2,000, and 5,000 m.

The effective dose equivalent to the maximally exposed individual was estimated by the model to be 0.20 mrem. The location of the maximally exposed individual was approximately 200 m downwind, which could be either on site or off site, depending on wind direction at the time of the fire. The contributions to the effective dose equivalent to

[4] Heat causes plume buoyancy, which promotes dispersion. Two hundred thousand calories/second is a conservative estimate of heat released during combustion of the waste materials.

Table 4.1-6. Downwind Concentrations of Toxic Compounds from Drum Fire

Compound	Emission Rate (g/sec)	TLV/10 (mg/m^3)	Concentrations (mg/m^3) at Downwind Distances (m)								
			25m	50m	69m[a]	100m	108m[b]	150m	200m	500m	1000m
Methylene chloride	8.33	17.5	0.1	2.0	2.4	2.0	2.0	1.7	1.4	0.7	0.4
Acetone	12.42	178	0.2	2.9	3.6	3.1	2.9	2.5	2.1	1.1	0.6
1, 1, 2 Trichloroethane	2.18	4.5	<0.1	0.5	0.6	0.5	0.5	0.4	0.4	0.2	0.1
Tetrahydrofuran	7.79	59	0.1	1.8	2.2	1.9	1.8	1.6	1.3	0.7	0.4
Acetonitrile	7.79	7.0	0.1	1.8	2.2	1.9	1.8	1.6	1.3	0.7	0.4

a Maximum concentrations occur 69 m downwind.

b Distance to nearest property line is approximately 108 m.

the maximally exposed individual by ^{3}H, ^{238}Pu, and ^{230}TH were approximately 10, 74, and 16%, respectively. Contributions by inhalation and ingestion pathways were 73 and 22%, respectively.

Even with the conservative assumptions about meteorology during the accidental fire, the calculated dose is very small, far below the EPA Protective Action Guides (PAGs). No measurable somatic or genetic effects for the downwind population (employees or the general public) are anticipated.

4.1.5.3 Co-Location Considerations

The glass melter and associated equipment are located in an annex to the WD building in the northwest portion of the Mound facility. This location is approximately 108 m from the nearest property line. Predominant winds from the south and west put the majority of the Mound facility downwind of the glass melter (Figure 2.1-1).

The location of the glass melter in close proximity to other buildings initiated a review to determine whether the maximum credible accident (a drum fire on the loading dock) could adversely impact the health or safety of personnel, cause significant property damage, cause a loss of production capability, or initiate an accident at another building.

Physical damages that could be experienced from the maximum credible accident include fire damages, principally to the exterior of the glass melter, WD building, and shower/change facility. Fire ratings of the exterior walls preclude damage to the functional areas of these buildings, and fire loading at the loading dock is within limits established under OSHA (29 CFR Part 1910.106).

Fires such as that postulated as the maximum credible accident are known to produce missiles. The unpredictable nature of drum fires precludes quantifiable risk calculations. Fire-incident command training provided by Professional Loss Control, Inc., of Oak Ridge, Tennessee, instructs responders to drum fires to withdraw all personnel within a 1,000-ft radius (304.8 m) and observe conditions prior to initiating fire fighting efforts.

Information obtained from Tennessee Emergency Management Agency (TEMA) personnel regarding actual drum fires indicates projectiles are not known to travel in excess of 100 m. If an additional 50 m is added to the predicted maximum travel distance of missiles to account for the facilities to the south being downgrade, structures within a 150-m radius of the glass melter loading docks could be within range of the missiles. The glass melter building and WD building provide an intervening barrier which would prevent solvent drums from reaching structures to the north and east; however, buildings 19, 24, 27, 42, 43, 52, 64, and 67, as shown in Figure 2.1-1, fall within the 150-m radius.

Building	No.
Storage warehouse	19
Water treatment building	24
Explosives processing building	27
Pyrotechnic Component Fabrication Facility	42
Explosives preparation building	43
Magazines	52, 64
Office	67

These buildings are considered vulnerable because of a lack of missile protection in the roofs. Missiles from a maximum credible fire might also serve as an initiator of an accident at these facilities.

Emergency procedures for the various facilities at Mound allow for safe shut-down of operations in the event of an emergency.

4.1.6 Conservation

The primary energy source for the glass melter is electricity. Electricity is used (resistance heating) to maintain the glass in a molten state. The initial melt (startup) is accomplished by means of a propane burner. There are additional energy requirements associated with normal operation (air conditioning, lighting, etc.) and maintenance of the glass melter building. The annual propane requirements will be approximately 440 m (15,527 ft^3), assuming three 3-day startup cycles each year. Approximately 310,500 kW of electricity will be required to operate the glass melter, assuming one 2,000-h operational cycle per year. Waste preparation and incidental building operation (air conditioning, hot water, etc.) energy requirements were not determined.

Operational byproducts (wastes) will be placed in steel containers and shipped to a disposal site. This will result in consumption of fuel and lubricants by the truck(s). There are no estimates of consumptive water use. However, some water may be lost if system sludges are immobilized in concrete (an operational option).

The proposed action will result in an irreversible and irretrievable commitment of electricity, propane, fuel (transportation), steel, glass, water, and concrete. The quantities involved represent a negligible loss of these resources.

4.1.7 Solid Waste

The Resource Conservation and Recovery Act (RCRA) of 1976 (Pub. L. 94-580) and the Hazardous and Solid Waste Amendments of 1984 (Pub. L. 98-616) set forth basic objectives to protect human health and the environment and conserve valuable material and energy resources. The core of RCRA is the hazardous waste program

mandated by Subtitle C (Sections 3001 through 3013); the intent is a "cradle-to-grave" regulatory control program for hazardous wastes.

RCRA requires every owner or operator of a treatment, storage, or disposal (T/S/D) facility to obtain a permit. The Mound facility is currently operating on a RCRA Interim Status Permit while the RCRA Part B Permit Application undergoes review and revision. The glass melter was operated in an experimental test mode in 1985 under RCRA Interim Status and was put in cold shutdown mode once the testing had been completed.

Although classified as a thermal treatment unit, the glass melter will be required to meet the performance standards in 40 CFR Part 264, "Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities," specifically, standards for incineration of hazardous waste. No major problems are anticipated since the melter met incineration regulatory requirements during a set of test burns.

Current and future steps to permitting the glass melter for routine operation include: 1) approval of a Part B permit application by the State of Ohio; 2) approval of a Trial Burn Plan which defines conditions under which the unit will be operated, and details the methodology to be used to demonstrate that the unit can meet hazardous waste incinerator standards; 3) conduct of a Trial Burn, under conditions established in the Trail Burn plan; 4) securing of the Part B permit, which allows operation of the unit under strictly controlled conditions.

4.1.8 Ecological Resources

Endangered Species Act. The Endangered Species Act of 1973, as amended, requires each federal agency to ensure that any action it authorizes, funds, or performs does not jeopardize the continued existence of endangered or threatened species, and does not result in the destruction or adverse modification of their critical habitat. Section 7 of the act specifies procedures to be followed in the consultation process. These steps are outlined in the *Environmental Guidance Program Book* (DOE, 1988).

To date the U.S. Fish and Wildlife Service (FWS), Reynoldsburg Field Office, has been contacted and a letter received (Appendix A) identifying the Indiana bat (*Myotis sodalis*) as the only federally listed endangered species which may be found in the Miamisburg, Montgomery County, Ohio, vicinity. The proposed action is not anticipated to adversely affect this species; there are no known critical habitats of this species near the Mound site. DOE is in compliance with the provisions of the Endangered Species Act regarding this proposed action.

Floodplain Management Executive Order. Executive Order 11988, Floodplain Management, requires each federal agency to take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Specifically, the order

requires each agency to determine whether the proposed action will occur in a floodplain and, if it does, to consider alternatives to avoid adverse effects and incompatible development.

The proposed use of the glass melter as described in this EA involves no property located in a floodplain. The 100-year flood level is at an elevation of 701 feet above sea level. The 500-year flood plain is at an elevation of 704 feet above sea level (McCann, 1988). Most of the Mound site is above 800 feet, with elevations in the developed area ranging from 710 to 870 feet (Mound, 1987). One small area in the southwestern corner of the property is located within the 100-year floodplain; however, in cognizance of Executive Order 11988, no structures are scheduled for construction here (Mound, 1987). The proposed action will not involve use of this property.

The Federal Emergency Management Agency (FEMA) flood insurance rate map (FIRM) for the city of Miamisburg, Ohio, was used in determining the 100-year floodplain boundaries and the DOE study referred to above was used in determining the 500-year floodplain.

Protection of Wetlands Executive Order. Executive Order 11990, Protection of Wetlands, requires each federal agency to take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Specifically, each agency, to the extent permitted by law, shall avoid undertaking or providing assistance for new construction located in wetlands unless there are no practicable alternatives and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use.

The only wetland of any appreciable size is the Great Miami River, which is at least 1/2 mile from the glass melter. Since the proposed action involves no new construction in wetlands, DOE is fully compliant with Executive Order 11990.

4.1.9 Transportation

At least six laws impact the transportation of hazardous wastes and substances: RCRA, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Superfund Amendments and Reauthorization Act (SARA), SARA Title III, Occupational Safety and Health (OSH) Act and the Hazardous Materials Transportation Act (HMTA) (SAIC, 1988).

The preparation of hazardous materials and their transport from the glass melter to an off-site disposal area will involve the hazardous materials transportation regulations promulgated under HMTA (Pub. L. 93-633) as well as RCRA (for RCRA wastes). It is assumed that CERCLA, SARA, and SARA Title III will not be involved. The OSH Act prohibits OSHA from exercising regulatory authority over working conditions of employees where another federal agency has already exercised its regulatory authority. However, DOE and DOE contractors are subject to OSHA's Hazard Communication Standard (29

CFR Part 1910.1200) by virtue of DOE Order 5480.4, which adopts 29 CFR Part 1910 as mandatory as a matter of policy (SAIC, 1988).

The key to compliance in this complex regulatory environment is properly identifying exactly what wastes are involved. These compliance issues can be adequately addressed when the exact engineering options for waste stream generation are selected. It is assumed that compliance issues will be a composite of those faced in shipments of radioactive and hazardous waste currently taking place at the facility.

4.1.10 Archaeological and Historical Resources

National Historic Preservation Act. The National Historic Preservation Act of 1966, Section 106, specifies that federal agencies must evaluate the effect of any federal, federally assisted, or federally licensed undertaking on historic resources. Federal agencies are required to afford the Advisory Council on Historic Preservation an opportunity to review and comment on the effects of proposed actions on historic resources (DOE, 1988). Specifically, DOE must request a list of resources potentially affected by the proposed project from the State Historic Preservation Office (SHPO) and, depending on the status of known resources, proceed in accordance with basic compliance steps spelled out in the DOE *Environmental Guidance Program Book*, (DOE, 1988).

Information received from the Ohio Historic Preservation Office, indicates that there will be no impacts on historical resources or archaeological remains resulting from normal operation or maximum credible accident conditions. (See letter from the Ohio Historical Society in Appendix A)

4.2 EVALUATION OF ALTERNATIVES

This section provides a qualitative evaluation of the ramifications for each of the alternatives to the proposed action.

4.2.1 No-Action Alternative

Under the no-action alternative, existing waste disposal practices at Mound would continue. Selection of this alternative would entail the continued shipment of 143 m^3 of hazardous wastes and the on-site storage of current inventory and eight drums of newly generated mixed waste per year. The environmental effects associated with the transportation of the hazardous wastes would remain unchanged from those currently experienced. Since existing authorized storage capacity has been exhausted, additional storage capacity is required. Therefore, construction-related impacts are entailed under the no-action alternative. The major impact will be the disturbance of approximately 23 m^2 (247 ft^2) of land associated with the storage building, plus an equivalent area associated with construction laydown. Minor, short-term impacts include changes in air

quality due to the operation of machinery and equipment and to land-disturbance activities. Increased runoff may also have minor, short-term impacts on water quality. The only direct source of impact from this alternative is the possible effects on archaeological resources during land-disturbance activities. The magnitude of these effects cannot be evaluated until a specific site is selected for the storage facility. The Mound site has known archaeological resources; and, while much of the site has been previously disturbed, selection of this alternative will require that this issue be evaluated in detail.

4.2.2 On-Site Alternative

Adoption of new administrative actions that reduce wastes produced at Mound would have minor positive effects on the environment. Such actions have, in fact, been adopted by EG&G at Mound Plant (EG&G, 1992) as part of a waste minimization program. While these actions will significantly reduce the amount of mixed waste generated at Mound Plant, they will not totally eliminate the generation of such wastes, and will have no impact on backlog wastes. As a result, it is expected that additional mixed-waste treatment and disposal capabilities will continue to be required.

4.2.3 Off-Site Alternatives

Impacts associated with each off-site alternative would arise primarily from transportation, and treatment or disposal activities at the off-site location. Each facility considered for off-site treatment or disposal presently exists, but the precise physical and regulation capabilities of the facilities to accept Mound waste vary and in all cases are not completely known. Analysis of impacts associated with disposal at these facilities should be subsumed within the independent and site-specific environmental compliance requirements for those facilities. No site-specific analyses of these facilities are presented in this section.

Transportation associated with the off-site alternatives could potentially affect traffic load, air quality (through engine exhaust), and socioeconomics (through labor requirements). These sources of impact are considered trivial, given the relatively few (4) shipments per year. Table 4.2-1 summarizes the requirements for off-site treatment or disposal, and Table 4.2-2 summarizes the transportation requirements for the proposed action. These requirements are even lower than those for the off-site alternatives. In either case, the associated impacts are independent of the type of waste transported. Since the distances involved for any of the off-site options are similar (refer to Table 4.2-1), the resulting impacts are dependent only on the number of trips involved. Since fewer trips are involved in the proposed action, fewer impacts would be expected.

Off-site treatment or disposal is currently being used for hazardous and other nonradioactive waste. No off-site options are available at the present time for radioactive mixed wastes.

Table 4.2-1. Transportation Requirements* for Off-Site Alternatives

Alternative Facility or Company	Location	Waste(s) Accepted	Trip Distance km (Approximate)	Maximum Number of Shipments Annually	Annual Total km
GSX	Various	Hazardous	1,100 avg. (684 miles)	3	3,300 (2,050 miles)
Quadrex	Florida	Scintillation fluids and ignitable hazardous	1,450 (900 miles)	3	4,350 (2,703 miles)
INEL	Idaho	LSA radioactive and hazardous	2,970 (1,846 miles)	3	8,910 (5,536 miles)
Los Alamos	New Mexico	Low-level radioactive (current priority)	2,500 (1,554 miles)	1	2,500 (1,554 miles)

*Note: Annual disposal of approximately 39,000 kg of waste requires 4 shipments to an appropriate combination of the above options.

Table 4.2-2. Transportation Requirements* for Proposed Action

Assumed Disposal Site	Waste Involved	Trip Distance in km (Approximate)	Maximum Number of Shipments	Annual Total km
Southeast	LSA radioactive	1,350 (839 miles)	3	4,050 (2,517 miles)
Southwest	LSA radioactive	2,750 (1,709 miles)	3	8,250 (5,126 miles)
Northwest	LSA radioactive	2,900 (1,802 miles)	3	8,700 (5,406 miles)

*Note: Annual disposal of approximately 30 LSA Boxes (4 ft x 4 ft x 8 ft) to an appropriate combination of the above options, for a total of 3 shipments to the same combinations of sites.

REFERENCES

29 CFR (Code of Federal Regulations) Part 1910.1200.

40 CFR (Code of Federal Regulations) Part 61.

40 CFR (Code of Federal Regulations) Part 264.

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5.0 SUMMARY

This environmental assessment provides an analysis of several approaches to the handling of hazardous and mixed wastes at DOE's Mound Plant in Miamisburg, Ohio. The first approach considered, the proposed action, involves the operation of an existing glass melter (also known as a Penberthy Pyro-Converter joule-heated glass furnace) for the treatment of hazardous and mixed wastes. The analysis also considers the no-action alternative, involving the continuance of existing practices at Mound for the handling of hazardous and mixed wastes, as well as various on-site and off-site treatment, storage, or disposal alternatives.

Under the proposed action, the primary potential sources of environmental impact are air emissions and effluent discharges. Potential changes in air and water quality may result in impact to biotic resources and human health. This assessment considers the potential effects of routine operation as well as the potential effects of a maximum credible accident scenario on human/worker health and safety. (This maximum credible accident scenario involves a drum fire/explosion on the loading dock outside the building housing the glass melter.)

Air emissions from the glass melter during routine operation include both criteria and noncriteria pollutants, heavy metals, and radionuclides. The EPA-approved screening level model PTPLU-2.0 was used to predict ground-level concentration and downwind distance to the maximum concentration. Results of the analysis indicate that the distance from the source to the predicted point of maximum impact is 220 m. Predicted concentrations met applicable short-term standards, the NAAQS for criteria pollutants and the MAGLCs for all other nonradiological pollutants.

Potential effect of the proposed action on the biota arise through changes in water and air quality. With respect to water resources, no measurable impacts to water quality were projected; as a result, no measurable impact to biological resources was predicted for this pathway.

With respect to radiological concentration parameters, radioactive air emissions were calculated based on typical waste content of radionuclides. Using the AIRDOS-PC model, the effective dose equivalent to the maximally exposed individual was determined to be 0.07 mrem/year from all pathways during routine operations. This estimated dose level is far below the limit of 10 mrem/year (40 CFR Part 61, Subpart H).

Under maximum credible accident conditions, the effective dose equivalent predicted by the model was 0.20 mrem/year. Since human health standards are not

exceeded for either case, no impacts to human health are projected as a result of radioactive releases. Likewise, no impacts to biotic resources are projected from this source. Model results for toxic chemical releases under very conservative assumptions indicate that under maximum credible accident conditions, TLV/10 guidelines are not exceeded. Because of the emergency capabilities on site and the low probability of having all the criteria met that are assumed for the maximum credible scenario, it is even less likely that a major fire would result in adverse health effects.

With respect to worker safety, on-site personnel are not exposed to unique hazards. In addition, they are adequately protected from potential exposure to radionuclides or other hazards by the existing health and safety programs.

Two on-site alternatives to the use of the glass melter were briefly considered. Under the no-action alternative, primary impact would arise from additional construction of approximately 23 m^2 (247 ft^2) of storage space. Potential impacts to air and water quality caused by construction-related land disturbance would be minimal and short lived. Some potential for impact to archaeological resources exists for this alternative. The magnitude of such impacts cannot be evaluated until a specific site is selected for the storage facility.

Administrative efforts to reduce the amount of waste generated at Mound would result in minor positive benefits to the environment (air quality and traffic) by reduction of transportation requirements for off-site disposal. With respect to off-site alternatives, distances to be traveled to each potential disposal site were similar. As a result, no substantive differences between the alternatives would be expected with respect to transportation-related impacts.

6.0 REFERENCES

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40 CFR (Code of Federal Regulations) Part 61, Subpart H.

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EG&G Mound Applied Technologies, Nuclear Radiation Safety: Technical Manual MD-10019, Issue 6.

EG&G Mound Applied Technologies, Systems Manual 721.

Response Plan-1 Master Plan

Response Plan-2 Health Physics Nuclear Emergency Procedures

Response Plan-3 Emergency Medical Plan

Response Plan-7 DAO/Mound Radiological Assistance Team Plan

Response Plan-9 Contingency Plan.

Response Plan-14 Emergency Brigade Plan.

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[6450-01-P]

DEPARTMENT OF ENERGY
Proposed Finding of No Significant Impact
for Operation of the Glass Melter Thermal Treatment Unit at the
U.S. Department of Energy's Mound Plant, Miamisburg, Ohio

AGENCY: Department of Energy

ACTION: Proposed Finding of No Significant Impact

SUMMARY: The U.S. Department of Energy (DOE) has prepared an environmental assessment (DOE/EA-0821) for the proposed operation of the Glass Melter thermal treatment unit ("Glass Melter") at DOE's Mound Plant in Miamisburg, Ohio. The Glass Melter would thermally treat mixed waste (hazardous waste contaminated with radioactive constituents, largely tritium, plutonium-238, and/or thorium-230) that was generated at the Mound Plant and is now in storage by stabilizing the waste in glass blocks. Depending upon the radiation level of the waste, the Glass Melter may operate for as short a time as one year, but not longer than six years. DOE considered two onsite alternatives to the proposed action and seven offsite alternatives.

Based on the analysis presented in the environmental assessment, DOE believes that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq. Therefore, DOE proposes to issue a finding of no significant impact. This proposed finding of no significant impact is being made available for public review. DOE will consider any comments received in making a final determination on whether to issue a finding of no

significant impact or to prepare an environmental impact statement for the proposed operation of the Mound Plant glass melter thermal treatment unit.

DATES: Comments on the proposed finding of no significant impact should be postmarked by [insert date 30 days after] to assure consideration. Comments postmarked after that date will be considered to the extent practicable.

ADDRESS: This proposed finding of no significant impact is being distributed to those persons and agencies known to be interested in or affected by the proposed action or alternatives. Comments or requests for copies of the environmental assessment should be addressed to:

James Johnson
Miamisburg Area Office
U.S. Department of Energy
Mound Plant
Box 66
Miamisburg, OH 45342
(513) 847-5234 FAX: (513) 865-4489

FOR FURTHER INFORMATION: For further information on the Glass Melter project, contact James Johnson at the above address. For further information on the DOE National Environmental Policy Act process, contact:

Carol M. Borgstrom, Director
Office of NEPA Oversight (EH-25)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
(202) 586-4600 or (800) 472-2756

SUPPLEMENTARY INFORMATION: The proposed action would bring the Mound Plant Glass Melter out of cold shutdown mode and use it for treating mixed waste that was generated at the Mound Plant and is now in storage. The Glass Melter, housed in an annex of the Liquid Waste Disposal Building, consists of a burn chamber of stainless steel (lined with refractory material) with an exhaust (offgas) system connected to a system of pipes and scrubbers ending in a stack. (Scrubbers are devices that remove small particles, gasses, and airborne radionuclides generated during thermal treatment.) Waste in sealed drums would be transported by truck from the Mound Hazardous Waste Storage Building or Radioactive Mixed-Waste Storage Building to the annex, staged on a concrete loading dock adjacent to the annex, and then moved individually to a fume hood in the annex where the contents would be transferred into a feed system for processing in the melter. The waste would be added to molten soda-lime silica glass in the burn chamber of the Glass Melter. Ash from the combustion process would fall to the glass surface, where it would be incorporated into the melt. When the molten glass would reach a prescribed chemical mix (or a prescribed level of radioactivity), it would be discharged from the melter into 19 liter (five gallon) containers. The containers would then be transferred to a storage area in the building using mechanical aids (e.g., hoists and a roller conveyor system) to cool and to await transport by truck to existing onsite storage facilities.

The Glass Melter would have an estimated annual capacity of approximately 48,000 kg (106,000 lb) of wastes, based on an average throughput of 23 kg/hour (51 lb/hr) and a 2,080-hour work year. As originally proposed by the Department, and as analyzed in the environmental assessment, operating at this capacity would have enabled DOE to eliminate the existing backlog of approximately 43,000 kg (95,000 lb)

of mixed waste in approximately six years, while processing hazardous and mixed wastes approximately 39,000 kg (86,000 lb) annually of nonradioactive solvents and mixed wastes] as generated.

Since the environmental assessment was written, DOE has decided to close the Mound Plant. DOE proposes, therefore, to use the Glass Melter only for the mixed waste backlog. DOE has not yet fully characterized this waste for radioactive contamination levels. The radiation level of the waste feed would be limited by the need to comply with the Environmental Protection Agency's National Emissions Standards for Hazardous Air Pollutants and by internal Mound limitations. If, after characterization, the radiation level of the waste is determined to be low enough that the capacity of the Glass Melter would be the factor controlling the processing rate, then the schedule for treatment of the backlog waste could be as short as one year.

The environmental impacts of the proposed treatment of only the mixed waste backlog are adequately covered, and are bounded by, the analysis in this environmental assessment, because calculations of radiological exposures and impacts were based on assumptions of waste radioactivity content that would exceed the actual content under the current proposed action. (According to the environmental assessment, the mixed waste backlog is estimated to have a total activity of 211 curies of tritium and 0.42 curies of plutonium-238; the calculations for Glass Melter operations, however, are based on a total waste activity content of 240 curies/yr of tritium and 0.48 curies/yr of plutonium-238.) The discussion below, which is based on the environmental assessment, therefore, would apply equally to the new proposed action. If the Department later proposes to use the Glass Melter to treat other than

mixed waste backlog, it will undertake appropriate further review under the National Environmental Policy Act.

Routine operation of the Glass Melter would generate treated offgas, scrubber sludge, scrubber liquid effluent, and several solid waste streams. The sludge generated by the scrubbing operations [approximately 770 kg (170 lb) per year] would be transferred by pipeline (1) back to a Glass Melter feed port for reprocessing, (2) to an existing cementation process for immobilization in concrete, or (3) to container storage for any subsequent additional treatment required under the Resource Conservation and Recovery Act (RCRA) land disposal restrictions. Filtered liquid scrubber effluent [approximately 36,000 kg (79,000 lb) per year], depending on its composition, would be (1) pumped to an existing wastewater treatment facility, (2) pumped to the cementation process for immobilization as concrete (if the waste processed involved significant tritium concentrations), or (3) packaged for any subsequent additional treatment required under RCRA land disposal restrictions. Most liquid effluent would be treated at Mound's existing radioactive wastewater treatment facility and released via an existing outfall permitted under the National Pollutant Discharge Elimination System.

The Glass Melter would generate, per year, approximately 3,200 kg (TOW lit) of glass block (mixed waste); 8,900 kg (20,000 lb) of cementized scrubber effluent and sludge (also mixed waste); and 1,900 kg (4,200 lb) of maintenance wastes (filters, replacement parts, etc.). (The maintenance wastes will generally be considered mixed waste, although certain of the replacement parts may have only surface radioactive contamination or may not be hazardous waste.) The mixed wastes would be stored onsite until a mixed waste disposal facility is available.

The immediate result of Glass Melter treatment would be the conversion of waste that is primarily liquid and combustible to a stable, inorganic form that would present very little environmental concern in storage. Most of the waste would eventually require transport to a radioactive mixed waste land disposal facility. (Any waste that is not mixed waste would be disposed of with other, similar Mound wastes, e.g., hazardous waste is shipped offsite for disposal.)

Environmental Impacts: in a series of test burns conducted in January 1985, the Glass Melter demonstrated the capability to thermally treat hazardous wastes in compliance with regulatory requirements. In June 1987, the Glass Melter was further tested and demonstrated effective treatment of low-level radioactive waste while meeting applicable regulatory requirements. Proposed future treatment of wastes using the Glass Melter would also meet all applicable environmental requirements. The Glass Melter is considered a "thermal treatment unit," not an "incinerator" under the Environmental Protection Agency regulations (40 CFR 260.10). Under the regulations for miscellaneous treatment, storage, and disposal units (40 CFR Part 264, Subpart X), any permit for the glass melter may include appropriate conditions from the incinerator regulations (Subpart O). Thermal treatment is one of the limited options DOE currently has to meet the requirement for site treatment plans under the Federal Facility Compliance Act.

The Environmental Protection Agency issued a Draft Strategy for Combustion of Hazardous Waste in Incinerators and Boilers on May 18, 1993, initiating a reexamination of its existing regulations and policies on waste combustion. In the draft strategy the Environmental Protection Agency indicates that, "if conducted in

compliance with regulatory standards and guidance, combustion can be a safe and effective means of disposing [of] hazardous wastes." To the extent that the Glass Melter would destroy hazardous wastes it would effectively "dispose" of that portion of the mixed waste backlog. Nevertheless, the thermal treatment of mixed wastes would necessitate the disposal of treatment residues as a mixed waste, which would be stored pending final disposal in an approved location.

Emissions of nonradiological pollutants to the air during routine operations of the Glass Melter would include arsenic, cadmium, chromium, lead, carbon monoxide, hydrogen chloride, nitrogen oxides, and particulates. Predicted concentrations of nonradiological pollutants would meet applicable National Ambient Air Quality Standards and the maximum acceptable ground-level concentrations established by the Ohio Environmental Protection Agency. During routine operations of the Glass Melter the effective dose equivalent of radiation to the maximally exposed individual at the Mound Plant boundary [approximately 470 meters (510 yd) north-northeast ,rom the Glass Melter stack] would be 0.07 mrem/year (tritium, plutonium-238, and thorium-230) from inhalation and ingestion pathways. These emissions would not cause the Mound Plant to exceed the individual effective dose equivalent limit of 10 mrem/year in the Environmental Protection Agency's National Emission Standards for Hazardous Air Pollutants. Based on the 1990 population distribution surrounding the Mound Plant, the collective effective dose equivalent to the total population residing within 80 km (50 mi) of the facility would be 2.6 person-rem/year. The environmental assessment shows that the health risk from such exposures would be very small.

Onsite personnel would not be exposed to unique hazards and would be adequately protected from potential exposure to radionuclides or other hazards by the existing health and safety programs. Existing facility design features would reduce direct worker contact with radioactive materials.

The formation of dioxins from Glass Melter operation would be virtually precluded due to specific technological design features of the equipment. For instance,temperatures

destruction and removal efficiency (99.9999% in test burns). In addition, the rapid cooling of the offgases below dioxin-forming temperatures, as recommended by the Environmental Protection Agency for municipal waste incinerators, would also be used to preclude dioxin formation.

The worst reasonably foreseeable accident involving the Glass Melter would be a fire on the loading dock that would result in the complete vaporization of the contents of ten mixed waste storage drums. The estimated frequency of such an accident is once every 100,000 years. The effective dose equivalent to the maximally exposed individual [approximately 200 m (220 yd) downwind] would be 0.2 mrem, well below Environmental Protection Agency standards. The environmental assessment shows that the health risk from such exposures would be very small. Predicted concentrations of nonradiological pollutants would meet the Ohio Environmental Protection Agency's maximum acceptable ground-level concentrations. Taking account of the low probability of such an event and the small magnitude of the consequences, the health risk posed by the accident is insignificant.

No endangered species, critical habitats, floodplains, wetlands, or historical or archaeological resources would be affected by the proposed action.

Alternatives Considered: in the environmental assessment, DOE considered two onsite alternatives to the proposed action and seven offsite alternatives in the context of the original proposed action (i.e., assuming the continuing operation of the Mound Plant). The discussion below, however, while being based on the environmental assessment, reflects the current proposed use of the Glass Melter following DOE's decision to close the Plant, which is to treat only mixed waste backlog.

- No Action. The present practices of waste storage and disposal would continue and the Glass Melter would not be used. Most of the mixed waste backlog is liquid, and much of it is Combustible. Storage of the untreated waste, therefore, could adversely impact human health and the environment, especially in the case of a fire in the storage facility.
- Administrative Action. Another alternative would be to rely upon the established Mound Waste Minimization and Pollution Prevention program to identify, screen, and analyze options to reduce the generation of waste. Waste that is in storage would not be affected by this program. The need for treatment options would persist.
- Offsite Treatment and Disposal. These alternatives would involve the transportation of mixed wastes to designated sites. DOE considered seven options for offsite treatment. All of the offsite treatment alternatives (i.e., all offsite alternatives except the Nevada Test Site) would involve thermal treatment.
    - Quadrex HPS, Inc. (Gainesville FL). This commercial facility cannot accept certain of the Mound mixed wastes, so this alternative would not, by itself, address the need to treat such wastes.

- Diversified Scientific Services, Inc. (Kingston. TN). This commercial facility could accept most of the mixed waste from Mound. Treatment, however, may be restricted by air permit conditions limiting the type of waste used for fuel and by Environmental Protection Agency regulations for boilers and industrial furnaces (40 CFR 266.100-112 and Appendices I-IX).
- Idaho National Engineering Laboratory (INEL). INEL has a permitted incinerator facility, the Waste Experimental Reduction Facility (WERF), capable of burning radioactive material and hazardous waste. WERF is currently shut down, and its operation is contingent upon completion of National Environmental Policy Act review and DOE approval of a Safety Analysis Report. The current waste acceptance criteria for WERF limit the radioactive and chloride content of wastes and prohibit receipt of any free liquids. These criteria would prohibit the acceptance at WERF of almost all of the waste proposed for treatment in the Glass Melter. The criteria could not be changed without substantial upgrades to WERF.
- Los Alamos National Laboratory The proposed Controlled Air Incinerator is currently being permitted and undergoing National Environmental Policy Act review for operation at production capacity. Current operational plans do not include acceptance of offsite wastes, and the draft RCRA permit proposes to prohibit treatment of offsite waste.

- Savannah River Site. DOE is currently constructing the Consolidated Incinerator Facility under a construction permit from the State of South Carolina that does not allow out-of-state waste to be treated in the facility. DOE is preparing an environmental impact statement on waste management at the Savannah River Site, which will include further analysis of operation of the Consolidated Incinerator Facility and other volume reduction alternatives. Trial burns and operation of the facility are being deferred until the completion of the environmental impact statement process.

- Oak Ridge Gaseous Diffusion Plant. The incinerator at the Oak Ridge Gaseous Diffusion Plant currently treats mixed waste. The primary sources of waste treated at this incinerator are the Paducah Gaseous Diffusion Plant, the Portsmouth Gaseous Diffusion Plant, and the Oak Ridge Reservation. A substantial backlog of waste exists that will take several years to treat. Thus, this alternative would not be available to Mound for several years and would not meet Mound's immediate needs.

- Nevada Test Site. Disposal of mixed waste at the Nevada Test site is considered a possible alternative to treatment in the Glass Melter. Land disposal restrictions under the Resource Conservation and Recovery Act would require, however, that any mixed waste be treated before disposal. The Nevada Test Site would only, therefore, be a reasonable alternative for Mound waste already treated at another facility. DOE has not yet decided

to what extent the Nevada Test Site would be used for future disposal of offsite waste; such decisions will be made after completion of the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement and the Nevada Test Site Sitewide Environmental Impact Statement.

Proposed Determination: Based on the information and the analysis in the environmental assessment, DOE believes the proposed action (operation of the Glass Melter for treatment of backlog mixed waste only) does not constitute a major Federal action that would significantly affect the quality of the human environment within the meaning of the National Environmental Policy Act. Therefore, DOE proposes to issue a finding of no significant impact and not require the preparation of an environmental impact statement. DOE will make a final determination after considering the comments received during a 30-day public comment period.

Issued at Washington D.C., this 27th day of October 1994.

Peter Brush
Principal Deputy Assistant Secretary
Environment, Safety and Health

APPENDIX A: AGENCY CONSULTATIONS

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

Reynoldsburg Field Office
6950-H Americana Parkway
Reynoldsburg, Ohio 43068-4115
(614/469-6923)

September 2, 1988

Ms. Anna S. Hammons
SAIC
P. O. Box 2501
Oak Ridge, Tennessee 37831

Re: Glass Melter Thermal Treatment Unit at Monsanto Research Corporation, Miamisburg, Ohio.

Dear Ms. Hammons:

This responds to your August 26, 1988 request for Federally listed endangered or threatened species which may be found in the Miamisburg, Montgomery County, Ohio vicinity.

This information is provided in accordance with provisions of the Endangered Species Act, of 1973, as amended.

ENDANGERED SPECIES COMMENTS: To facilitate compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies are required to obtain from the Fish and Wildlife Service information concerning any species, listed or proposed to be listed, which may be present in the area of a proposed action. Therefore, we are providing you the following list of endangered (E) or threatened (T) species which may be present in the concerned area:

Name/Status	Habitat	Distribution
Indiana bat (E) *Myotis sodalis*	Caves and riparian	Statewide, except Athens, Belmont, Carroll, Coshocton, Gallia, Guernsey, Harrison, Jackson, Jefferson, Lawrence, Meigs, Monroe, Morgan, Muskingum, Noble, Tuscarawas, Vinton, and Washington Counties

We appreciate this opportunity to comment on your proposed project.

Sincerely yours,

Kent E. Kroonemeyer

Kent E. Kroonemeyer
Supervisor

cc: Chief, Ohio Division of Wildlife, Columbus, OH
ODNR, Outdoor Recreation Service, Attn: M. Colvin, Columbus, OH
Ohio EPA, Water Quality Monitoring & Assessment, Columbus, OH
U.S.EPA, Office of Environmental Review, Chicago, IL

Ohio Historic Preservation Office

Ohio Historical Center
1982 Velma Avenue
Columbus, Ohio 43211-2497
(614) 297-2470

OHIO HISTORICAL SOCIETY
SINCE 1885

March 15, 1991

Mark D. Gilliat
EG&G Mound Applied Technologies
P.O. Box 3000
Miamisburg, Ohio 45343-0987

Dear Mr. Gilliat:

Re: Mound Facility, Miamisburg, Ohio

This is in response to your letter dated February 21, 1991 concerning the Miamisburg facility. Based on the field survey and examination of the Mound Facility undertaken by Dr. Robert Riordan, Wright State University, in 1987 it appears that there are no significant archaeological remains on the Mound Facility due to previous disturbance. No archaeological sites eligible for the National Register will be affected. Please note that the buildings comprising the facility have not been evaluated in regard to National Register criteria. In order to do this we must have photographs of the buildings, their ages, and a brief history of the facility.

Any questions concerning this matter should be addressed to Julie Quinlan at (614) 297-2470. Her hours are from 5-11 a.m. Thank you for your cooperation.

Sincerely,

Judith Kitchen

Judith Kitchen, Department Head
Technical and Review Services

JLK/JAQ:jq

APPENDIX B: HEALTH AND ENVIRONMENTAL RISK OF POLYCHLORINATED DIBENZO-P-DIOXINS

APPENDIX B
HEALTH AND ENVIRONMENTAL RISK OF POLYCHLORINATED DIBENZO-P-DIOXINS

PCDDs and PCDFs form a group of trace environmental pollutants related to the potent carcinogen 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). An assessment of comparative toxicity and biologic activity of the various chlorinated dibenzo-p-dioxins and furans indicates a range of potency extending from approximately 10^{-1} to $<10^{-6}$ relative to TCDD (Kociba and Cabey, 1985). This assessment is summarized below:

> Of all the chlorinated dibenzo-p-dioxins and furans, 2,3,7,8-TCDD has been evaluated most extensively in regard to its biologic activity and toxicologic properties. Thus, TCDD has been used as the reference for comparative evaluation of the other dioxins and furans.
>
> Comparative studies with as many as seven different animal species provided single-dose oral LD_{50} data for sixteen different dioxins and five furans. Results indicate marked differences in acute toxicity when evaluated on the basis of interspecies differential response (same isomer, different animal species) or on the basis of intraspecies differential response (same animal species, different isomers).
>
> Marked differences in response have also been noted for those chlorinated dibenzo-p-dioxins and furans that have been comparatively evaluated in studies of the potential for teratogenesis or carcinogenesis.
>
> When evaluated for comparative biologic activity (as measured by various *in vitro* tests for enzyme induction or epithelial keratinization), a similar wide range of differential response has been noted for the various chlorinated dibenzo-p-dioxins and furans.

TCDD is one of the most potent carcinogens; its carcinogenicity to humans is strongly supported by animal evidence. EPA (1986a) ranked 2,3,7,8-TCDD as a probable human carcinogen (B2) in its weight of evidence scheme (EPA, 1986b). The ranking scheme, based on animal and human evidence, consists of five categories:

Group A	Known human carcinogen
Group B (B1 and B2):	Probable human carcinogen
Group C:	Possible human carcinogen
Group D:	Not classifiable as to human carcinogenicity
Group E:	Evidence of noncarcinogenicity to human

The animal evidence for human carcinogenicity of TCDD is rated as "sufficient," which is the highest evidence in a rating scale consisting of: 1) sufficient, 2) limited, 3) inadequate, 4) no data, and 5) no evidence. However, human evidence for its carcinogenicity in humans is "inadequate," which is lower on the rating scale.

The potency factor (q_1*), also known as the unit cancer risk (UCR), assigned to 2,3,7,8-TCDD was 156,000 mg/kg/d. This is the most potent carcinogen listed in the *Superfund Public Health Evaluation Manual* (EPA, 1986a). From the q_1* value, the dose level associated with acceptable risk (e.g., 10^{-6}) can be derived.

The acceptable intake levels of 2,3,7,8-TCDD, estimated by extrapolation from high to low concentrations, differ substantially (Table B-1). The province of Ontario has a maximum allowable daily intake of 10 pg/kg/d for humans (Paustenbach et al., 1986). in contrast, EPA has a value of 0.0064 pg/kg/d. The U.S. Food and Drug Administration (FDA) accepted risks associated with the ingestion of up to 13 pg/kg/d. The fundamental difference between the EPA and Canadian analyses is in the mechanism of action. Canada and Western Europe regard TCDD as a tumor promoter in animals; however, EPA regards TCDD as a tumor initiator. Recently, EPA has moved to lower the risk assessment for TCDD by 16 times based on the possibility that dioxin might be a promoter of tumors in humans (Pereva, 1988).

PCDDs have been found in the stack emissions of MWIs. They have also been found to undergo decomposition under high temperatures or sunlight. This section explains why PCDDs/PCDFs are not expected to be a health or environmental problem in the operation of the glass melter. There are no known PCDDs/PCDFs in the feed wastes, and any trace amount of PCDD/PCDF formed in the incinerator is expected to be destroyed by the high efficiency incinerator.

EVALUATION

PCDDs have been found in emissions of MWIs. The glass melter is different from MWIs in temperature, residence time, waste composition and incinerator design. The emission data from MWIs are not appropriate for the risk assessment of the glass melter. As stated in Hutzinger et al. (1985), the PCDDs/PCDFs that may form during combustion of organic substances can be effectively destroyed under adequate incineration conditions. Since PCDDs decompose in air at temperatures above 750°C (1,382°F), they are likely to decompose in the melter chamber, which operates at temperatures between 760°C and 1,510°C (1,400° to 2,750°F).

There are no known PCDDs present in feed wastes to the melter. Instead, the question of potential PCDD emissions focuses on formation of PCDDs in the glass melter and on glass melter performance. A surrogate POHC approach has been used to determine the DRE of a system for organic compounds, including PCDDs. Use of low-concentration feed quantities of PCDD is not practiced because the expected low emission concentrations are very difficult, if not impossible, to detect (EPA, 1985).

Spiking high levels of PCDDs in feed wastes to measure the DRE is prohibitive because of their potential health problems. Thus a surrogate POHC is used.

Table B-1. TCDD Cancer Risk Estimates by Different Agencies

Agency	Daily Intake Dose at Acceptable Risk Level (pg/kg/d)	Model
Ontario	10	Safety factor (100)
U.S. EPA[a]	0.0064	Linear multistage
CDC[b]	0.028 - 1.428 0.63	Linear multistage (Best estimate)
FDA	13	Safety factor (77) Linear multistage (10^{-5} risk)

[a] Acceptable defined as 10^{-6} risk (upper bound).
[b] Based on mouse and rat bioassay (10^{-6} risk).

Source: Paustenbach et al., 1986

According to the heat of combustion hierarchy, hexachlorodibenzo-p-dioxin (H_xCDD) is more difficult to incinerate than other listed PCDDs/PCDFs because it has the lowest heat of combustion (2.81 kcal/g). Therefore, the selected surrogate should have a heat of combustion value lower than 2.81 kcal/g (Table B-2).

With a heat of combustion value of 1.99, 1,1,1-trichloroethane would be a suitable surrogate for all PCDDs/PCDFs in the DRE tests (EPA, 1985). Carbon tetrachloride (tetrachloromethane) is an even better surrogate because it has a lower value, 0.24 kcal/g, and is very difficult to incinerate (Table B-2). In the six performance tests on the glass melter at temperatures between 934°C and 1,079°C (1,714°F to 1,974°F), the six 9s DRE was achieved using carbon tetrachloride as a surrogate (see Table 4.1-2). The six 9s DRE is a conservative measure of melter performance because of the use of carbon tetrachloride as a surrogate.

Excessive water content in liquid feed waste appeared to have some effect on melter performance. Fluctuation in the DRE of methylene chloride was noted during the incineration of liquid feed wastes containing extremely high percentages of water (Table B-3). The melter achieves a five 9s DRE for methylene chloride in liquid feed wastes containing 44 to 83% of water. In comparison, the melter reached a six 9s DRE for carbon tetrachloride in liquid feed waste free of water (see Table 4.1-2). Note that carbon tetrachloride is harder to burn than methylene chloride, according to their heats of combustion. When the water content increased to 99.27%, the DRE of methylene chloride fluctuated somewhat and fell to the four 9s level in several cases. This apparent effect of extremely high water content on the DRE is evident also in the parameters which will result in feed shutdown (Table 2.1-2), ensuring that waste streams which effect DRE are avoided, or introduced to the melter in a manner which will not upset combustion parameters.

The stack tests establish that even the most difficult organic compounds will be effectively destroyed by the glass melter furnace. Therefore, if any trace PCDDs are present in the furnace feed, it is expected that undetectable quantities will be emitted.

Many studies have shown that dioxins can be formed in the post-flame environment of an incinerator. These studies have shown that in air PCDDs are destroyed at temperatures over 1,380°F and can be formed in the temperature range 390 to 1,350°F. Studies have shown that dioxins can be formed either in the combustion airstream or on ash particles in both the fly ash and grate ash. Dioxins are formed from precursor chemicals such as chlorophenol, chlorinated benzene, and lignin that resemble parts of the dioxin molecule. Elimination of the precursor chemicals effectively prevents any possibility of dioxin formation. For example, Shaub (1983) reported that dioxin formation was proportional to the square of the unburned chlorophenol concentration; thus, a municipal incinerator with a DRE of 99.9% will emit one million times the quantity of PCDDs that an incinerator with a DRE of 99.9999% emits. The glass melter has a very high DRE that effectively eliminates precursor chemicals.

Table B-2. Heats of Combustion for PCDDs, PCDFs, and POHCs

Compound	Heat of Combustion (kcal/g)
Chlorinated Dibenzo-p-dioxins	
Tetra - CDD	3.46
Penta - CDD	3.10
Hexa - CDD	2.81
Chlorinated Dibenzofuran	
Tetra - CDF	3.66
Penta- CDF	3.40
Hexa - CDF	3.07
Typical POHCs	
Tetrachloromethane	0.24
Tetrachloroethane	1.39
Methylene chloride	1.70
1,1,1 -Trichloroethane	1.99

Source: EPA, 1985.

Table B-3. Test Burns Conducted with the Glass Melter System June 2-5, 1987

Waste Name (Mound #)	Physical State	Components	%	POHC?	Minimum Melter Temperature (°F)	DREs
27 Solvent Waste C Run 1	Liquid	Acetone	11.0	N	1,648	
		Ethanol	23.9	N		
		Water	64.4	N		
		Methylene Chloride	0.73	Y		99.99968 99.99989 9999925 -------- 99.99966
27 Solvent Waste B Run 2	Liquid	Acetone	3.7	N	1,325	
		Ethanol	12.9	N		
		Water	82.7	N		
		Methylene Chloride	0.73	Y		99.99983 99.99968 9999968 99.99911 99.99958
27 Solvent Waste D Run 3	Liquid	Acetone	16.5	N	1,880	
		Ethanol	38.6	N		
		Water	44.1	N		
		Methylene Chloride	0.73	Y		99.99932 99.99980 9999966 99.99986 99.99987
27 Solvent Waste A Run 4	Liquid	Acetone	0	N	1,825	
		Ethanol	0	N		
		Water	99.27	N		
		Methylene Chloride	0.73	Y		99.99480 99.99615 9999826 99.99979 99.99972

Source: Mound, 1987

The glass melter's combustion gases are very quickly cooled by a wet scrubber system to around 200°F. This rapid cooling effectively eliminates sufficient time for any precursors to react and form dioxins. EPA recommends use of this approach to prevent formation of dioxins in municipal incinerators. Prior to entering the wet scrubber and a few seconds after leaving the combustion chamber, glass melter exhaust gases are approximately 300°F lower than the combustion chamber temperature. Thus, only rarely is it possible for any PCDDs to form, and the time is exceedingly short.

PCDD formation is thought to occur on the surface of ash particles. The limiting factor in this formation scenario is the available surface area on ash at temperatures low enough for dioxin formation to occur. The glass melter has a liquid surface instead of an ash grate and thus will have a much smaller surface area for dioxin formation than the ash surface. The glass surface will also be very close to the bulk glass temperature due to conduction and convection and to its high specific heat. Airborne particulates will encounter the same rapid cooling experienced by the gases and will not encounter favorable temperature regimes for PCDD formation.

The conclusion is that any PCDDs or precursors will be eliminated effectively by the incinerator. The rapid quenching of the combustion gases effectively eliminates the possibility of formation of PCDDs in the gas phase, while the nature of the surface of the glass and the rapid cooling of any particulate matter minimize the possibility of PCDD formation on ash surfaces. Therefore, there is no perceived risk due to PCDDs in the glass melter.

REFERENCES

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APPENDIX C: HUMAN HEALTH AND SAFETY

APPENDIX C
HUMAN HEALTH AND SAFETY

C.1 ON-SITE PERSONNEL EXPOSURES DURING ROUTINE OPERATIONS

Radiation Exposure

The principal hazard associated with ^{3}H and Pu, the primary radionuclides processed at the glass melter facility, is internal radiation exposure. Strict precautionary measures have been implemented to prevent the inhalation, ingestion, or absorption of the substances into the body. Engineered controls such as gloveboxes and negative pressure systems have been incorporated into the building design to prevent employee exposure to radioactive contaminants in the glass melter and WD building. Protective clothing and respirators are provided for employees working in these facilities.

The *Mound Nuclear Radiation Protection Program* is designed to maintain employee exposures ALARA. As a part of the program, a health physics surveyor has been assigned to the WD building. The health physics surveyor performs routine area surveys for surface contamination on a weekly basis, collects daily air samples at fixed locations, and monitors specific jobs when necessary. Glass melter and WD building employees are required to leave urine samples on a regular basis; thermoluminescent dosimeters (TLDs) are changed every two weeks; and nose wipe samples are taken at least twice daily. Radiation survey instruments are located near the exits of the WD building to ensure that contaminants are not removed from the facility on hands, shoes, or clothing.

Nonradiological Exposures

Nonradiological hazards were identified during a visit to the glass melter facility and through a review of facility documents. The traditional major industrial safety hazards have been identified and eliminated by design or have been adequately guarded. The remaining risks to operating personnel are primarily related to ergonomics and industrial hygiene. The ergonomic-related risks are associated with material handling. The handling of solid and liquid feed materials and the handling of solidified glass are considered sources of potential employee injury for which there are neither specific regulatory requirements nor site-specific policies.

Risks related to industrial hygiene are controlled to a large extent by the same engineering controls and procedures which maintain radiological exposures ALARA. Additional site programs adequately address all potential industrial hygiene risks with the exception of heat stress. A heat-stress program was being drafted at the time of this report.

Materials Handling The manual materials-handling task, identified as the most difficult to perform during the glass melter operations, requires the moving of 5-gal

buckets of high temperature glass from the drain area. Under current practice, containers for draining glass are placed on carts prior to use. These carts are then used to move the containers under the drain, and then to transport the glass away from the drain area for cooling. Moving the carts from the drain fume hood requires awkward body motions, however, to avoid the heated skin of the furnace, the high temperature glass, and glass melter appendages. The buckets filled with the glass weigh approximately 45 kg (99 lb). Bending, twisting, and reaching motions and excessive object weight are undesirable job characteristics that increase the risk of strain-related injuries. No object weight/force evaluation has been performed to determine appropriate application of ergonomics in the redesign of this manual materials-handling task. Employees performing tasks in the immediate vicinity of the furnace also face some risk of burns resulting from contact with heated surfaces and high temperature glass.

Prior to startup of the glass melter for waste processing, an improved mechanical system will be designed and installed to eliminate manual effort, and operator proximity to the high temperature glass containers during the glass draining and the container cooling processes. As currently envisioned, this system will make use of a high temperature resistant, roller conveyor system to transport containers from the glass melter drain fume hood to a separate storage hood at the rear of the room. The conveyor will be either power driven, or placed on a slight incline to allow for gravitational assisted transport of the containers. A hoist system will be used to place cooled glass containers into secondary containment drums or boxes, and standard hand or power driven equipment will be used to load these containers onto a truck for transport to storage facilities.

Two other strenuous materials-handling tasks performed in this operation are: 1) the receiving and movement of 55-gal drums of waste liquids to the feed system hood, and 2) the loading of buckets of glass frit into the glovebox. Both tasks involve weights typically in excess of 32 kg (71 lb). Mechanical aids are available to assist in the movements of the waste drums to the feed line fumehood. Conveyor rollers are used for movement of the waste drum inside the fumehood. Glass frit are presently transferred to the feed hopper by means of a pulley and bucket system. A track system allows the pulley and bucket to be maneuvered into place for filling of the frit feed hopper.

Hazardous Materials Spills. Of the numerous liquid waste mixtures and pure form solvents, a variety of solvents present in the waste inventory and radioactive mixed oils and solvents can cause adverse health effects from acute exposure during a spill. The severity of the impact to human health is dependent upon a multitude of variables including:

chemical composition of the mixture,
duration of exposure,
route of exposure (inhalation, ingestion, skin absorption),
rate of evaporation, and
weather conditions.

Acute exposures to these waste solvents can cause impairments to many of the body's functional systems. Hazardous thermal decomposition byproducts are presented in Table C-1. The quantities of these byproducts from a spill are expected to be very small compared to those of the prime wastes. Thus, detailed analysis showing possible effects of these is not considered necessary.

Noise Exposure. Exposures to noise generated from the offgas handling equipment and the propane burner on the furnace are intermittent as employees enter their areas from the control room located between the offgas treatment area and the furnace area. Propane-burner noise levels are an exposure factor for approximately three days while the glass is converted to a molten state. Once the glass is molten, the propane burner is turned off, and heat is maintained by the joule heaters. The major noise source during routine waste processing operations is the off-gas handling equipment. Measurements taken during operations have determined that sound levels do not exceed 104 dB within the building. Sound levels outside the building are not significant since building walls are constructed of thick concrete blocks filled with insulation, providing an effective sound dampening barrier.

Toxic Contaminant Exposure. Personnel exposures to toxic contaminants may occur during routine operations if volatile solvent vapors escape into the work area.

Personal sampling conducted by Mound industrial hygienists during furnace tests in January 1985 indicated the exposures shown in Table 4.1-4, Occupational Exposures to Airborne Contaminants During Glass Melter Trial Runs. Sampling was conducted for the following materials:

cadmium dust,
phenol,
acrylonitrile,
carbon tetrachloride,
and chlorobenzene.

A comparison of these exposures with the ACGIH TLVs (ACGIH, 1988) and OSHA Permissible Exposure Limits (PELs) suggests the TLV-TWA for the mixture of contaminants was exceeded. The relatively high sample weights in this 42-min sample suggest the work practices and engineering controls in use would not be sufficient to protect employees for an 8-h exposure without the aid of appropriate respiratory protection.

The *Mound Respiratory Protection Program* provides for Health Physics and Industrial Hygiene to jointly evaluate the respiratory hazards associated with this process and to provide appropriate respiratory protection. The respiratory protection program by design protects workers from airborne hazards that are not otherwise controlled.

Table C-1. Thermal Decomposition Byproducts

Solvent	Byproducts
Acetonitrile	Oxides of Nitrogen (NO_x)
Acrylonitrile	Hydrogen Cyanide (HCN)
Benzyl Chloride	Chloride (Cl)
Carbon Disulfide	Sulfur Dioxide ($S0_2$), Carbon Monoxide (CO)
Carbon Tetrachloride	Phosgene ($COCl_2$)
Chlorobenzene	Phosgene
Chloroform	Phosgene
Cresols	Carbon Monoxide
Dichlorobenzene	Phosgene
Dichloroethane	Phosgene
Dichloroethylene	Phosgene
1,4-Dioxane	Explosive Peroxide Formation
Isobutyl Alcohol	Carbon Monoxide
Methylene Chloride	Phosgene, Hydrogen Chloride (HCl)
Methyl Ethyl Ketone	Carbon Monoxide, Oxides of Nitrogen
Nitrobenzene	Oxides of Nitrogen
Nitrophenol	Oxides of Nitrogen
Nitropropane	Oxides of Nitrogen
Pyridine	Oxides of Nitrogen
Tetrachloroethane	Phosgene
Tetrachloroethylene	Phosgene
Trichlorobenzene	Phosgene
Trichloroethane	Phosgene
Trichloroethylene	Phosgene
Trichloromonofluoromethane	Phosgene
Xylene	Carbon Monoxides, Oxides of Nitrogen

Acrylonitrile is not listed in Table 2.1-3 as a typical waste to be processed through the glass melter. Carbon tetrachloride, a toxic substance of concern in the 1985 sample, is listed in Table 2.1-3. Other substances included in Table 2.1-3 that are listed by the ACGIH as potential carcinogenic agents include:

methylene chloride,
trichloroethylene,
1,4-dioxane,
tetrachloroethane

It is assumed that the recorded exposures to glass melter workers occurred principally from their working directly over open waste drums. It is also assumed the dilution of airborne contaminants combined with the negative pressure maintained in the rooms will prevent any exposures outside the glass melter or offgas equipment rooms.

A secondary source of exposure to toxic substances is by direct skin contact. Materials such as 1,4-dioxane, carbon disulfide, and tetrachloroethane provide employees with potential exposures through the subcutaneous route. The use of appropriate personal protective equipment minimizes the risks of such exposures. The *Mound Safety and Hygiene Manual,* section C-1, "Personal Protective Equipment Approval" (EG&G, 1997), specifies the health physics organization for approval of personal protective equipment in radiation areas such as the glass melter facility. Section D-3, "Carcinogen Control Program," provides for the industrial hygiene staff to determine the controls necessary to maintain employee exposures below the established limits. Direct skin contact with glass melter feed materials is a potential exposure for the glass melter employees only.

C.2 EXPOSURE TO THE GENERAL PUBLIC DURING ROUTINE OPERATIONS

Radiological Effects

In the evaluation of off-site radiological hazards, the assumption was made that the radioactive wastes processed will contain the concentrations shown in Table 2. 15. It was also assumed that the unit will operate 8 hours/day, 5 days/week, 52 weeks/year. The resulting quantities of radioactive materials released to the atmosphere are described Section 4.1.1.2.

Nonradiological Effects

The possibility of off-site personnel being affected by the routine operation of the glass melter was evaluated. From a human health perspective, two possible sources of concern were identified: toxic vapor releases and noise. Potential toxic vapor releases are evaluated in Section 4.1.1.1. Potential vapor releases from drum storage or minor spills are not predicted to be above regulatory ceilings at the property line. Noise exposures inside the facility exceed regulatory limits. This condition has been identified and addressed according to site procedures. Noise levels outside the building are not

available. Since the source of the noise is equipment located inside the facility, and the building walls and distance to the nearest point off site are expected to attenuate the noise, no perceptible increase in noise is expected off site from the operation of this facility.

C.3 ACCIDENT ANALYSIS

Natural Phenomena

The following paragraphs discuss the potential impacts to glass melter operations from wind and earthquake extremes.

Winds. Two types of winds are considered in this section: straight winds and whirling-type winds (including tornadoes).

Straight Winds. High velocity straight winds in the Miamisburg vicinity are usually associated with severe summer thunderstorms. Straight winds as a result of thunderstorms have been known to reach 60 to 70 mph. Based on 43 years of data, the "fastest mile" straight wind recorded in Dayton was 78 mph (Freeman and Hauenstein, 1983).

The WD building, which houses the glass melter, has exterior walls constructed of concrete block. This type construction is expected to withstand the impact of a 78-mph straight wind without significant damage. It is unlikely that the glass melter or stored waste in the vicinity of the glass melter will be breached by the high wind.

The probability of occurrence of a straight-line wind event that could damage the glass melter building was estimated using force balances and wind frequency data. The effect of wind on a structure is to produce stresses and bending moments which may cause the materials of construction to fail. The balances of force and moment established that tensile stress in the mortar caused by the presence of a bending moment would be the limiting load for a concrete block building such as the WD building,. Using a conservatively selected tensile strength for the material, an allowable overpressure (0.38 psi) was calculated from the moment balance. This overpressure was then related to the steady wind velocity through use of an energy balance and external pressure coefficients. Using a theoretically based empirical correlation (B1evins, 1984), a wind velocity of 155 mph was estimated for the WD building. Hazard curves, which relate return period for natural events to event severity, have been cataloged for DOE facilities. For straight-line winds at the Mound facility, the return period for a 155 mph wind is greater than a million years (Coats and Murray, 1985). Therefore, the probability of exceeding the estimated threshold in one year is less than 1 .Oe-6.

Tornadoes. Of the tornadoes that occurred in Ohio during the period 1953 to 1972, 31 occurred in a 1° square centered near Mound Plant (DOE, 1979). Therefore,

tornadoes of sufficient magnitude to damage the WD building and release radioactive and hazardous material from the glass melter cannot be ruled out. Tornado winds exceeding 112 mph (Fujita Class 2) are assumed to directly cause sufficient damage to the WD building and the glass melter that an airborne release would result. Stored waste in the vicinity of the glass melter would also be susceptible to release from a tornado event. Tornadoes are estimated to occur at the Mound site with a frequency of 1.2 x 103/year (Freeman and Hauenstein, 1983).

The estimation of frequency of occurrence of tornado wind forces which might damage the glass melter building is the same as that described above for straight-line winds, with the exception that return period/severity relation is replaced. Using the derived relationship for the Mound site (Coats and Murray, 1985), a return period in excess of ten thousand years is estimated for a 155-mph tornado. Therefore, the probability of exceeding this threshold in one year is 1.0e-4.

Earthquakes. The Mound facility is located in an area where damage might occur from earthquakes. Since the WD building was not designed as a seismic-resistant structure, it is assumed that an earthquake exceeding one-tenth of gravity will directly result in the airborne release of hazardous and/or radioactive waste.

The methodology applied for estimation of probability of occurrence of an earthquake is parallel to that used for wind phenomena. An allowable load is estimated and related to probability of occurrence using hazard curves established for DOE facilities. The allowable load is a peak ground acceleration of one-tenth of gravity and the related return period is 320 years (Coats and Murray, 1984). The probability of exceeding the threshold in one year is 0.003.

Externally Induced Events

Occurrences originating outside the glass melter facility which may adversely impact operations are discussed in the following paragraphs.

Aircraft Crash. A large airplane crashing into the waste disposal building will cause significant damage to the building and the glass melter. This accident assumes a direct hit of the WD building by a large aircraft having a 10,000-lb fuel load. The aircraft is assumed to penetrate the building before the fuel tank ignites and destroys the facility.

Studies related to nuclear power reactors, based on U.S. civil aviation accident data, indicate that the expected frequency of aircraft overflight becomes constant at distances greater than 5 miles from an airport runway. The expected annual frequency is about 3×10^{-9}/flight-miles^2 for commercial aviation and about 7×10^{-9}/flight-miles for general aviation (du Pont, 1981).

Based on a conservatively estimated frequency of 4,000 flights over the Mound facility per year, the expected frequency of an aircraft crash anywhere within the Mound

facility boundary is 2.8×10^{-5}/y-mi^2. The WD building in which the glass melter is housed represents a "target" area of 1.0×10^{-3} mi^2. Therefore, the expected frequency of an aircraft crash into the WD building is 2.8×10^{-8}/y. Because of the low frequency of this event, Elder et al. (1986) consider an aircraft crash to be incredible. The consequence and risk of this event were not evaluated.

Adjacent Explosion/Fire. The potential for an explosion or fire from an external source causing damage to the glass melter was evaluated during the course of the analysis. Buildings in the vicinity of the WD building were evaluated to determine their ability to impact the glass melter. The Pyrotechnic Component Fabrication Facility (Building 42) was assumed to represent the greatest hazard potential for the WD building. This building is located approximately 400 ft south of and 50 ft lower in elevation than the WD building. It is conservatively estimated that it would take a blast equivalent to more than 43 lb of TNT outside Building 42 to damage the concrete block walls of the WD building. A blast of this magnitude was not considered a credible event. Therefore, the probability, consequence, and risk of an adjacent explosion were not evaluated. Adjacent fires are unlikely to impact the glass melter operation.

Process-Related Initiators

The process-related accident initiators are grouped according to the energetics involved: high-energetic events, medium-energetic events, and low-energetic events.

High-Energetic Event Initiators. A high-energetic event is defined as one that releases sufficient energy to destroy the primary confinement barrier (glass melter and waste storage drum). The energetics involved from this type event will likely result in the circumvention of the building HEPA filtration system. Therefore, releases from these events will be expected to be unfiltered.

This analysis identified explosion as a potential high-energetic initiator. The preliminary hazards analysis (PHA) identified six explosion scenarios that can result in an unfiltered release to the environment. One of the scenarios identified by the PHA will more likely result in a glass melter pressurization, which is categorized in this analysis as a low-energetic event. The explosion scenarios are described later in this section.

Propane Explosion. The natural gas burner is used to melt the glass before the waste feed is added to the glass melter. After the glass has melted, the energy requirements for raising and then maintaining the bed temperature can gradually be assumed by electrical current. The propane burner is not normally used when waste is fed to the burner. However, in the event of a prolonged loss of electric power, the gas burner would be used to remelt the glass after it contained waste.

If a failure of the burner management system resulted in the continued addition of natural gas to the burner following flameout, reignition will result in a significant natural gas explosion. A propane explosion prior to the introduction of waste can cause serious damage to the building and critical injury to the operator, but no radioactive dose to

anyone. This accident is considered a normal industrial hazard in this analysis. In addition to building damage and operator injury, a natural gas explosion following the introduction of waste can result in a radioactive dose to the plant personnel and the public. An event tree that illustrates this accident scenario is shown in Figure C-1.

Evaluation of the probability of occurrence of a propane explosion related to the melter auxiliary heater was based on construction of a simplified fault tree at a conceptual design level of detail. The system was modeled as composed of four subsystems: 1) a storage tank, dual feed valve supply arrangement, 2) an automatic ignition component, 3) a flame detection/feed shutdown circuit, and 4) an air supply subsystem. System failure modes included leakage while not in use, failure to ignite, and loss of flame during operation. Overall event probability was dominated by the failure-while-operating scenario, which included loss of power for more than one-half hour and failure to respond to loss of flame. Base event frequencies were taken from a DOE database (Dexter and Perkins, 1982) and loss of power interval/frequency from a power plant-study (NRC). Overall annual event probability was estimated to be 0.001.

Explosion Resulting from Improper Feed Combustion. Failure in the feeding mechanisms can result in excessive feed reaching the glass melter. Under certain conditions of temperature and pressure, the accumulated, unburned waste can react, causing an explosion. Wastes such as acetonitrile will significantly contribute to this explosion potential. Acetonitrile, under certain conditions of temperature and pressure, is susceptible to deflagration. Because the quantity of acetonitrile to be stored and treated in the WD building is expected to be small, the potential for an acetonitrile explosion is expected to be minimal.

The feed liquid system includes a metering pump, a flow meter, and a shutoff valve. Combustion air is supplied through a combination of supply and exhaust fans. The condition of excess fuel in the melter may occur as a result of feed oversupply coupled with failure to shut down in response to excess flow or through failure to supply adequate combustion air. A simplified fault tree was constructed and solved to derive an estimate of annual probability of occurrence for this event of 0.031. The probability of detonation of the fuel-rich mixture is expected to be low, but no basis was available for quantification; consequently, the derived estimate of annual probability of explosion is equal to the probability of obtaining a fuel-rich mixture.

Offgas Explosion. An explosion in the offgas system was identified as a potential initiator in the PHA. An explosion in the offgas results from ignition of flammable vapors. Incomplete combustion of wastes in the glass melter may result in the release of organic vapors to the offgas system. The circulation of water in the offgas vessels is assumed to preclude an ignition source from contacting the flammable vapors.

Explosion in the offgas system requires incomplete combustion in the melter, failure of the quench system, and presence of an ignition source in the system. As data are not available on potential for incomplete combustion, and ignition may occur spontaneously at the elevated temperature experienced without quench, a conservative upper bound on the probability of this event is provided by the failure probability of the

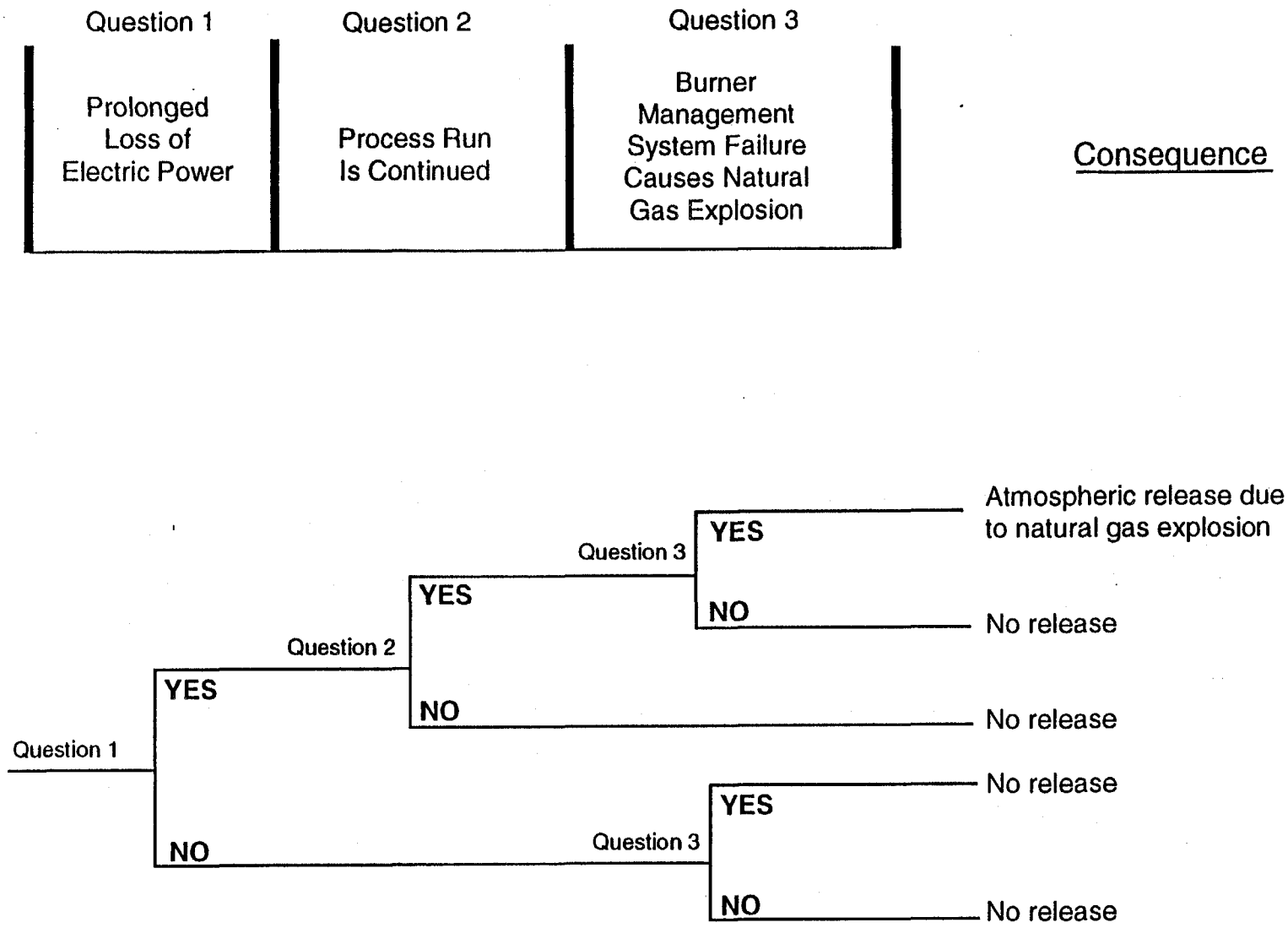

Figure C-1. Natural Gas Explosion Event Tree

loss of offgas cooling/failure to stop waste feed event. As described later in this section, this annual probability is estimated to be 0.003.

Steam Explosion. An accident scenario identified during the course of this analysis involved introduction of a water slurry onto the high temperature molten surface of a glass melter. While the molten glass/water system generally satisfies the necessary requirements for the initiation of a steam explosion, the premixing requirement for a large-scale event is limited to about 0.1 kg of water for a glass melter comparable to that at the Mound Plant (Hutcherson et al., 1984). Detailed stress analysis of the comparable glass melter showed that the design is capable of accommodating an energetic steam explosion well in excess of that involving 0.1 kg of water. This analysis assumes that while a steam explosion is a credible event, pressures developed by the explosion will be insufficient to breach the glass melter. A steam explosion will result in pressurization of the glass melter. The pressure relief device (dip-leg) will relieve the pressure into the building ventilation system. The minimal release of airborne material will be deposited on the HEPA filter.

The steam explosion event requires uncontrolled aqueous waste feed to the glass melter, leading to the accumulation of large quantities of water in the chamber, near instantaneous evaporation of the liquid, and restricted gas flow through the system to produce an over-pressure which might produce a material release. Because of the nature of the feeder, the Mound melter would not be expected to develop these conditions even in the event of operator negligence and feed shutdown system failure (Burkholder and Minor, 1986).

The feed of a large quantity of water scenario was analyzed by formulation of lumped parameter mass, momentum, and energy balances around the melter. In order to facilitate solution of the set of equations, it was assumed that the melter was capable of instantaneously evaporating the largest possible water feed. This eliminated the energy balance and set melter temperature at the operating temperature. This is a conservative approach. A simplified momentum balance was applied to represent the resistance of the offgas system to flow. The resistance coefficient for the system was estimated from the maximum flow and pressure drop conditions specified for the melter offgas system. The volumetric capacitance of the offgas system was neglected in the equations. Again, this is a conservative approach. The equations were solved using a finite difference technique, and input flow rate and effluent resistance were set at ten times the expected values. Even under these conservative conditions, the calculated overpressure was less than 0.1 psi. Consequently, it is concluded that the event, release due to steam explosion, does not occur. The consequences of the event are equivalent to the melter overpressurization event described below. The annual probability of feed-system malfunction leading to high flow without automatic feed shutdown was estimated to be 0.018.

Criticality. The potential for a criticality event in the glass melter was assumed not to be credible based on the following factors:

Most of the plutonium treated in the glass melter is ^{238}Pu.

Gamma scan of the waste is used to detect significant quantities of fissile materials.

The quantity of fissile material permitted in the building is controlled by administrative procedure which holds it to less than the quantity needed to cause criticality.

Concentration of the normally expected waste via the glass melter process is insufficient to cause criticality.

The glass matrix will inhibit any fissile material from forming a critical geometry.

An event tree that illustrates the criticality accident scenario is shown in Figure C-2. Criticality in the recycle tank was identified in the PHA as a potential hazard in the glass melter. A criticality is less likely in the recycle than in the glass melter, since most of the combusted fissile material will be deposited in the glass matrix. Only a small fraction (<10%) of the fissile material in the glass melter is likely to reach the recycle tank. Any fissile material carryover to the recycle tank will be removed by the leaf solution filters in the offgas cooling system.

Criticality events have occurred very infrequently at DOE facilities. The overall frequency for all types of criticality for all facilities is approximately 1.Oe-4/year. For the Mound Plant glass melter, the expected frequency would be lower since the waste handled at Mound has a lower concentration of fissionable material than waste handled at other DOE facilities and the total quantity of contaminated waste is small. For example, at the expected average waste-feed concentration, the material could be concentrated continuously for the life of the melter and not reach a critical mass.

Medium-Energetic Event Initiators. A medium-energetic event is defined as one that will breach the confinement barrier (glass melter, glovebox, and storage drum). Initiating factors that can lead to medium-energetic events are discussed later in this section. The release sequence for a medium-energetic event initiator assumes that the building exhaust system and its HEPA filter will continue to filter the airborne release. Fire was identified as the only medium-energetic event in this analysis.

Fire was identified in the PHA as a potential initiating event for the Mound glass melter. Fire sources include the combustible waste (paper, special case, etc.) and propane. Waste drums, screw feeders, and waste feed hoppers are likely places where a fire can occur.

Waste Drum fire. Waste storage drums containing flammable materials are susceptible to ignition from sparks or hot surfaces. Storage of drums inside the room that houses the glass melter also represents a hazard from spontaneous ignition if the building ventilation is off. During glass melter operation, the building ventilation will be operating, minimizing the potential for spontaneous combustion. Assuming operating personnel are present, fire in a drum will be confined to the contents of a single drum. Fire extinguishers are present near the glass melter to facilitate fire suppression. The room that houses the

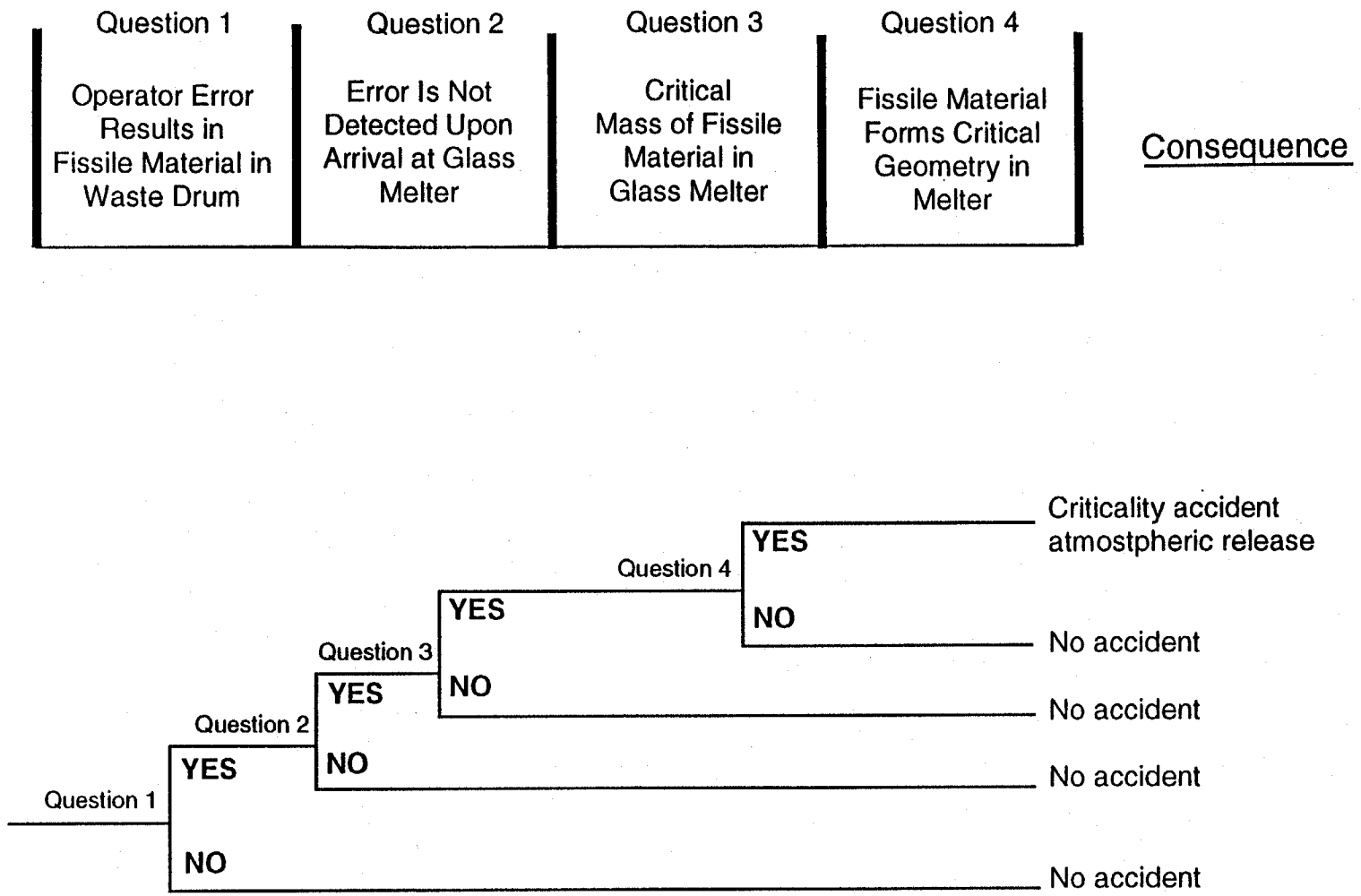

Figure C-2. Glass Melter Criticality Event Tree

glass melter is equipped with a fusible-link sprinkler system that is activated by temperatures above 100°C (212°F).

DOE has considerable experience in the handling and storage of drums containing material with physical and chemical properties similar to the waste to be processed in the glass melter. At DOE facilities, in excess of one million drum-years storage has transpired with only a single drum fire (DOE). Unusual circumstances which contributed to this fire have since been corrected at DOE facilities. At the Savannah River Site (SRS), drums similar to those stored at the Mound facility have accumulated 14,547 drum-years without occurrence of a fire (Hurrel et al., 1988). Since less than two drums are expected to be stored continuously, the predicted annual probability of fire is approximately 0.000001.

Screw feeder fire. Four separate feed systems transport waste to the glass melter. Two feed systems are screw feeders (solid waste) and two are feed tank-type systems (liquid waste). Both screw feeders are enclosed in controlled-air fume hoods. One of the screw feeders is water cooled. Since the other screw feeder is not water cooled, it is assumed to be more susceptible to fires. Sparks caused by operation of the feeder can ignite the wastes. Fires involving this screw feeder are expected to be confined to the fume hood. The event tree for a screw feeder fire is illustrated in Figure C-3.

Fire in the solid-waste screw feeder may occur through generation of a spark in the presence of air. Therefore, occurrence of this fire requires improper operation of the feeder and failure of the nitrogen purge system. A simplified fault tree estimate of the annual probability of occurrence is 0.038 if the screw feeder is used continuously and 0.002 if the feeder is used 5% of the time.

Waste feed Hopper fire. The sludge feeding system consists of a 55-gal hopper and an "open-throat" sludge pump. The pump delivers waste to the glass melter through a nominal 2-in. pipe. The PHA identified hopper fire as a potential hazard for the glass melter. Flashback from the glass melter combustion chamber can result in ignition of the waste in the hopper. This scenario requires failure of the nitrogen purge system that maintains the waste in an inert atmosphere.

The liquid feed system consists of a 55-gal feed tank, metering solvent pump, and control valves. The pump delivers the waste to the glass melter through stainless steel tubing. Flashback from the glass melter combustion chamber can also result in ignition of the solvent in the feed tank. This scenario would also require failure of the nitrogen purge system. The event tree for a waste feed hopper fire is illustrated in Figure C-4.

Fire at the liquid-waste feed hopper requires flashback through the feed system. This is possible on loss-of-flow and requires ignition at the melter, failure of the feed pump, failure to close the shutoff valve on loss-of-flow, and failure of a check valve. A simplified fault tree was constructed for this system, and annual probability of occurrence of fire in the hopper was estimated to be 0.001.

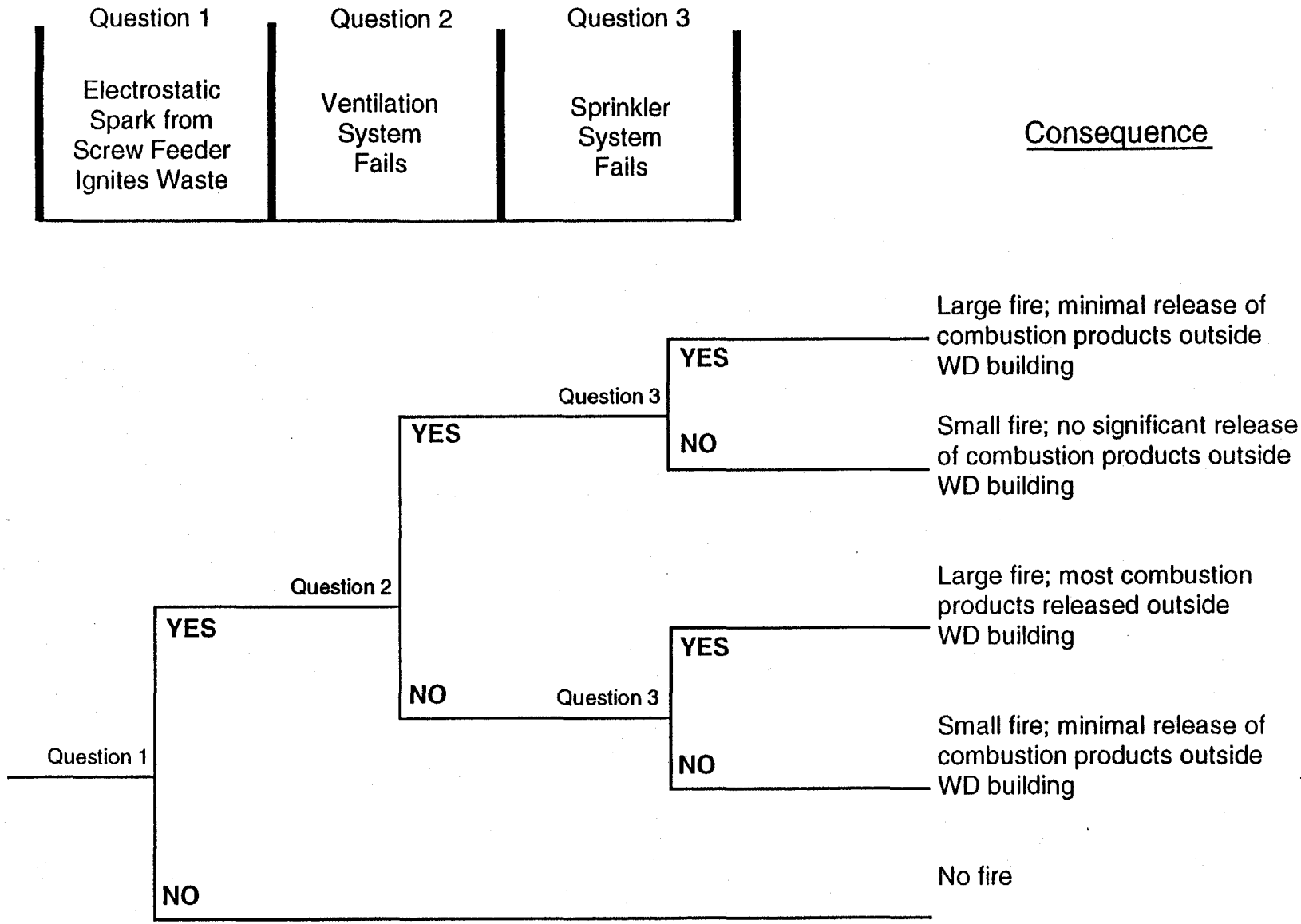

Figure C-3. Screw Feeder Fire Event Tree

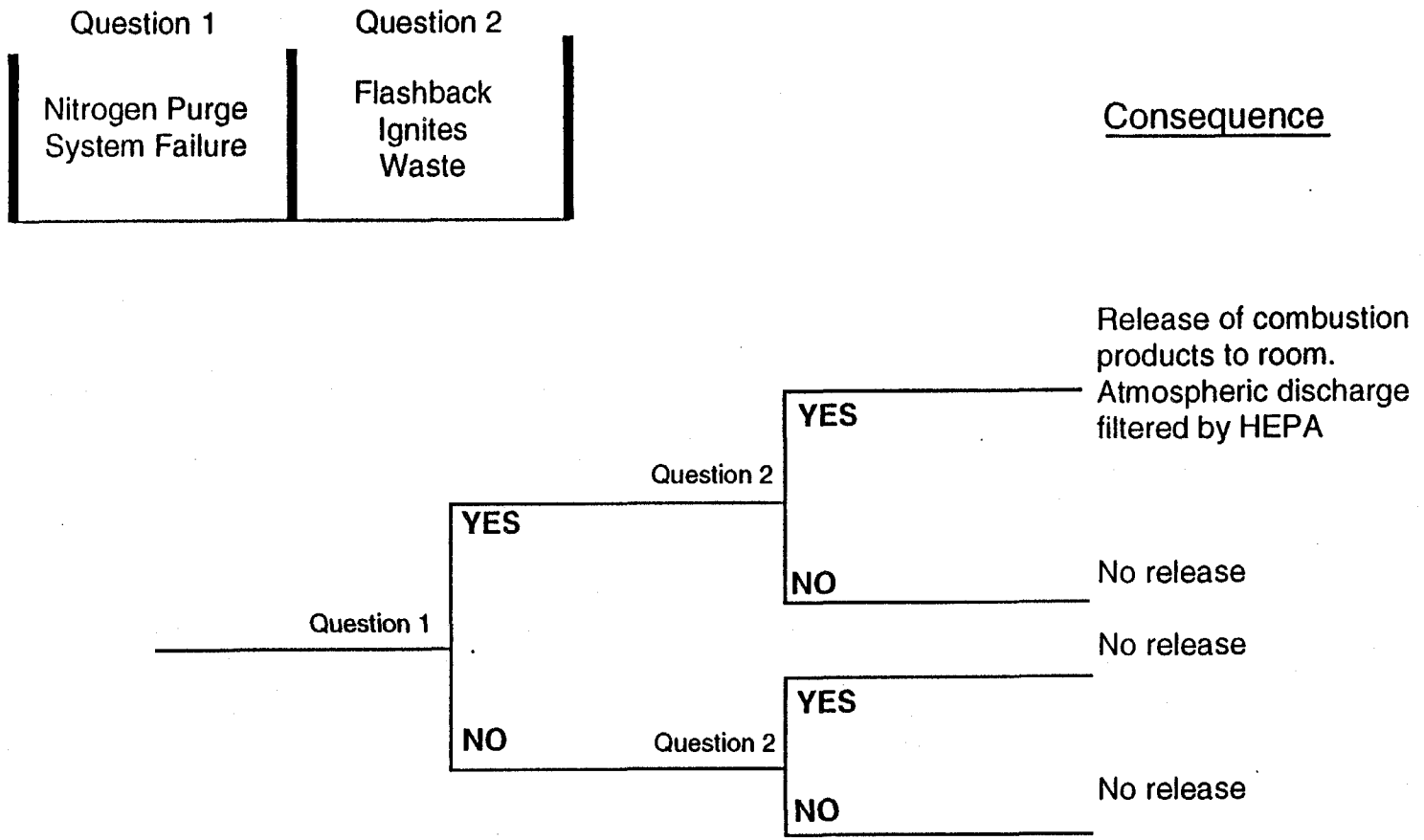

Figure C-4. Waste Feed Hopper Event Tree

Low-Energetic Events. A low-energetic event will not destroy the confinement barrier, but activity may be released from it for a short period. Examples of low-energetic events are pressurization events, glass leaks, refractory breach and loss of offgas cooling.

Melter Pressurization. Pressurization of the glass melter may result in the release of combustion products to the building exhaust. The glass melter is equipped with a pressure-relief system that discharges to the building ventilation system. The pressure-relief system is a water-filled dip-leg. The glass melter can become overpressurized as a result of loss of fan flow or sudden ignition of accumulated unburned waste. A pressurization event could result in the release of combustion products to the HEPA filter. Except under extremely abnormal conditions, the release will be contained in the building by the HEPA filters. Melter pressurization could occur through loss of the exhaust fans. Possible consequences of this event are release through leakage pathways most likely associated with the melter. The estimated annual probability of occurrence of the event is 0.1.

Glass Leak. Abnormal operation of the glass melter may result in a glass leak. The glass is assumed to solidify upon contact with a cooler surface such as the floor. The atmospheric release from such an event is expected to be negligible.

Refractory Breach. Breaching the refractory was identified as a potential hazard for the glass melter. Causes of this event include overfeeding high-Btu waste and electrode failure. The airborne release from this event should be minimal. Most of the airborne release will be contained inside the building by the HEPA filter.

Estimation of the likelihood of breaching the refractory is based upon DOE experience in the operation of joule-heated melters for waste processing. In addition to the Mound experience, refractory corrosion-rate data generated at SRS (du Pont, 1984) and operating histories for the West Valley melter (Barnes et al., 1986) have been reported. Measured corrosion rates project 20-year life for the Mound melter, and no breaches have been reported with typical operating lifetimes of greater than 5 years. Therefore, the annual probability of breech is conservatively estimated at less than 0.2 for the Mound melter.

Loss of Offgas Cooling. Because of extremely high temperatures in the glass melter (>1000°C), considerable offgas cooling is required to maintain the integrity of the exhaust system. Failure of the offgas cooling system was identified as a low-energetic event initiator. Failure of the offgas cooling system coupled with failure of the exhaust fans to maintain forced ventilation may result in damage to the HEPA filter, although natural draft and distance from the HEPA filter make this unlikely. This damage will inhibit the ability of the filters to contain the airborne release. Failure of the offgas cooling system will also increase the atmospheric releases from the glass melter process. An event tree that illustrates a loss-of-offgas cooling event is shown in Figure C-5.

Loss of offgas cooling leading to a release of contaminated material requires failure of the quench recirculation pump and failure to shut down the melter feed system. The

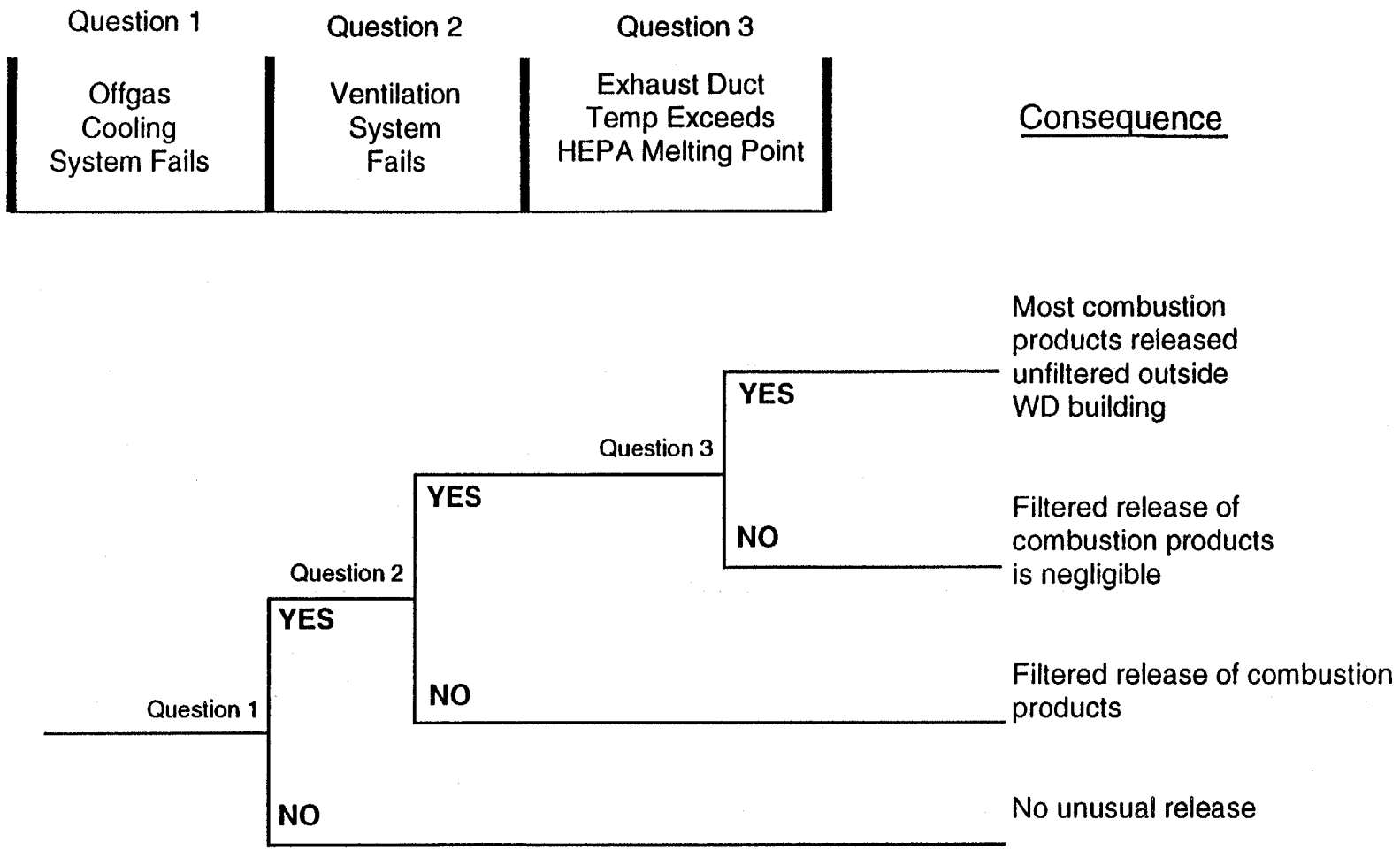

Figure C-5. Loss of Offgas Cooling Event Tree

primary shutdown system is based on flow measurement with a backup temperature measurement system providing redundancy. Exposure of the HEPA filters to hot offgas is assumed to result in complete failure. A simplified fault tree was constructed for this system, and the derived annual probability of the event was estimated to be 0.003.

Maximum Credible Accident Scenario

Several factors in combination were considered in the development of the maximum credible accident scenario. Foremost, an unconfined fire of mixed wastes is assumed to be the greatest potential source of toxic contamination spread. The location at which the greatest quantity of mixed wastes is assembled is the loading dock/storage area outside the glass melter building. At this location there is no fixed fire suppression; therefore, control of such an event will rely entirely upon employee response for detection, reporting, and suppression. This area is not normally occupied. Ignition sources can include direct sunlight on sealed drums, lightning, or nonrelated activities (smoking, cutting, welding, grinding, etc.). No obvious ignition sources are present in this area. The total possible release is bounded by the quantity of materials available. To provide a truly "maximum credible" fire, it was postulated that the 10 drums of mixed wastes allowed in the area will contain the toxic solvents listed in Table 2.1-3.

The unpredictable nature of a drum fire precludes development of a scenario which will account for the action of possible missiles from such an event. Drum failures in fires and the projectile nature of drums are more dependent upon drum strength than content volatility.

Actual drum fire reports from TEMA indicate that drums have been projected up to 150 ft vertically. Horizontal projection distance depends upon trajectory. No reports indicate that projections over 100 m occur. While a drum fire that results in the projection of drums from the storage area toward the nearest inhabited area is more spectacular, it will not endanger the public and will result in a smaller point source in terms of toxic contaminants.

The loading dock/storage area scenario is consistent with other DOE operations for storage of waste drums. In addition, the mode of operation at Mound results in limited opportunity for ignition in the exterior area, and sprinklers are provided inside the building. Therefore, the frequency of occurrence of a drum fire is expected to be approximately one per million drum-years (DOE; Hurrel et al., 1988). Since no more than 10 drums are to be stored outside the glass melter building, the annual probability of occurrence of fire in this area is estimated to be 0.00001.

C.4 RESPONSE AND PREVENTION OF ACCIDENT CONDITIONS

The *Emergency Preparedness Master Plan* and the supporting plans establish the framework for ensuring appropriate response to emergency conditions at Mound. The Mound *Fire Protection Program Manual* provides detailed guidelines for inspection,

testing, and maintenance of fire fighting equipment and emergency response training. These and other programs were developed specifically for Mound prior to the glass melter. Their implementation addresses many of the anticipated emergency contingencies that can be presented by the operation of the glass melter thermal treatment facility.

The wet pipe sprinkler system provides fire protection to the indoor areas of the glass melter facility. This system is capable of delivering approximately 40 gpm to each sprinkler head. The sprinkler heads in the furnace room are spaced on a 10 ft x 10 ft pattern designed with a fusible link rated at 100°C (212°F).

The supply of propane for the glass melter is available from a source located outside the WD building. The introduction of hazardous or mixed wastes is made only when the glass can be maintained in its molten state electrically. Table 2. 1-3 identifies the suite of solvents likely to be present in the wastes in their maximum expected concentration. These materials constitute a transient fire load in the rooms where they are stored. Table C-2 identifies the flammable liquids in the waste streams, their flashpoints, exposure limits, and target organs.

Table C-2. Chemical Components/Exposure Data

Material	Flashpoint	TLV ppm (mg/m^3)	Target Organs
Acetone	1.4°F	750 (1780)	Resp. Sys., Skin Kidneys,
Acetonitrile	42°F	40 (70)	liver, CVS, CNS, lungs, skin, eyes
Benzyl Chloride	140°F	1 (5)	Eyes, resp. sys., skin
Butylacetone	NA	NA	NA
Carbon Disulfide	-22°F	10 (30)	CNS, PNS, CVS, eyes, kidneys, liver, skin
Chlorobenzene	84°F	75 (350)	Resp. sys., eyes, skin, CNS, liver
Chloroform	Not combustible	10 (50)	Liver, kidneys, heart, eyes, skin
Cresols	178-187°F	5 (22)	CNS, resp. sys., liver, kidneys, skin, eyes
Cyclohexanone	111°F	25 (100)	Resp. sys., eyes, skin, CNS
Diacetone Alcohol	136°F	50 (240)	Eyes, skin, resp. sys.
Dichlorobenzene	151°F	75 (450)	Liver, kidneys, skin, eyes
Dichloroethane	17°F	200 (810)	Skin, liver, kidneys Resp.
Dichloroethylene	36-39°F	200 (790)	sys., eyes, CNS
Dimethylsulfoxide	192°F	NA	Skin, eyes, GI tract
1,4-Dioxane[a]	54°F	25 (90)	Liver, kidneys, skin, eyes
Ethanol	55°F	1000 (1900)	Eyes, skin, CNS, GI tract
Heptane	25°F	400 (1600)	Skin, resp. sys., PNS Skin,
Hexane	-7°F	40 (180)	eyes, resp. sys. Eyes, skin,
Isobutyl Alcohol	82°F	50 (150)	resp. sys. Eyes, skin, resp.
Isopropanol	53°F	400 (980)	sys. Eyes, resp. sys., skin
Maleic Anhydride	215°F	0.25 (1)	Eyes, skin, CNS, GI tract
Methanol	52°F	200 (260)	Skin, CVS, eyes, CNS
Methylene Chloride	None	50 (175)	CNS, resp. sys.
Methyl Ethyl Ketone	22°F	200 (590)	Eyes, resp. sys., CNS,
Methyl Isobutyl Ketone	73°F	50 (205)	GI tract, blood
Mineral Spirits	104°F	100	Skin, eyes, resp. sys., CNS
Naphthalene	174°F	10 (50)	Eyes, blood, liver, Kidneys, skin, RBC, CNS
Nitrobenzene	190°F	1 (5)	Blood, liver, kidneys, CVS, skin
Nitrophenol	NA	NA	NA
Nitropropane[a]	82°F	10 (35)	Resp. sys., CNS
Petroleum Naptha	100-109°F	100	Resp. sys., eyes, sin
Phenol	174°F	5 (19)	Liver, kidneys, skin

Table C-2. Chemical Components/Exposure Data (continued)

Material	Flashpoint	TLV ppm (mg/m^3)	Target Organs
Pyridine	68°F	5 (15)	CNS, liver, kidneys, skin, GI tract
Tetrachloroethane	Not Combustible	1 (7)	Liver, kidneys, CNS
Tetrachloroethylene	Not Combustible	50 (335)	Liver, kidneys, eyes, resp. sys., CNS
Tetrahydrofuran	6°F	200 (590)	Eyes, skin, resp. sys., CNS
Trichlorobenzene	230°F	5 (40)	Liver, skin, eyes
1,1,1-Trichloroethane	None	350 (1900)	Skin, CNS, CVS, eyes
Trichloroethylene	None	50 (270)	Resp. sys., heart, liver kidneys, CNS, skin
Trichlorotrifluoroethane	Not Combustible	1000 (7600)	Skin, heart
Toluene	40°F	100 (350)	CNS, liver, kidneys, skin
Xylene	81°F	100 (435)	CNS, eyes, GI tract, blood, liver, kidneys, skin

[a] Identifies suspect or confirmed human carcinogen.
NA - Not Available

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APPENDIX D: PERMITTING FOR THE GLASS MELTER THERMAL TREATMENT UNIT

APPENDIX D
PERMITTING FOR THE GLASS MELTER THERMAL TREATMENT UNIT

D.1 RCRA PERMIT

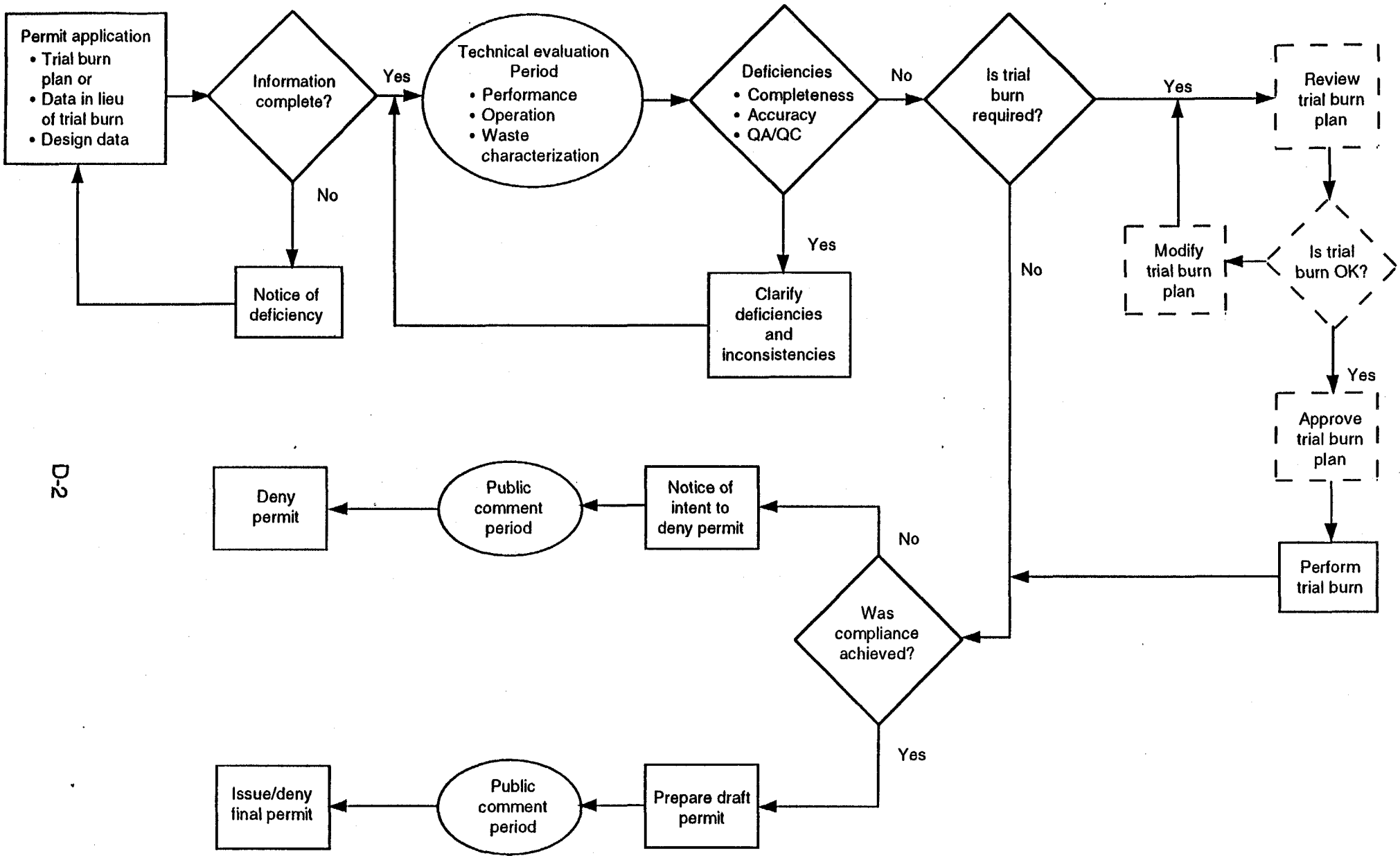
The Resource Conservation and Recovery Act (RCRA) requires the EPA to establish regulations governing the handling of hazardous wastes. Regulations governing incineration of hazardous waste were first promulgated on January 23, 1981, and numerous amendments have been made to date. The regulations that prescribe the permit program and requirements can be found in 40 CFR Part 264, Subpart 0, and Part 265, Subpart 0. The RCRA regulations cover all facilities and set standards for generators and transporters of hazardous wastes including owners and operators of treatment and disposal facilities. The general permit requirements for all treatment, storage, and disposal (TIS/D) facilities are described in Standards For Owners of Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 CFR 264.

The RCRA regulations require all owners and operators of T/S/D facilities to obtain an operating permit from the appropriate regulatory agency. The permit application is submitted to either the EPA Regional Office or a state agency if authority has been transferred. A permit application contains the following information:

description of facility,
description of the waste,
description of maintenance (preventive) procedures,
contingency plan,
inspection schedule and security procedures,
personnel training plan,
closure plan with cost estimate,
and financial statement of owner/operator.

The permitting process for an incinerator usually includes a "trial burn" that determines whether the unit can meet the performance requirements specified by the regulations. It is possible to satisfy this requirement by submitting the current "trial burn" information. The permitting procedure for existing incinerators (operating under interim status permit) is shown in Figure D-1.

40 CFR Part 270 and Part 284, Subpart 0, provide the regulatory requirements for completing the permitting process.



Source: EPA 1989

Figure D-1. Incinerator Permitting Process – Existing Facilities (Interim Status)

D.2 AIR PERMITS

An operating permit for the glass melter is required. A permit application can be obtained from the Ohio EPA (615/644-2270). The completed application will be reviewed by the agency to determine if operation of the glass melter will:

result in emission of more than 250 tons per year of any criteria pollutant, or

cause or contribute to a violation of an NAAQS, or cause excessive ambient concentrations of toxic or hazardous compounds.

National Ambient Air Quality Standards

NAAQS are based on a relationship between exposure to pollutants and the resulting effects on human health and welfare. The primary standards are intended to provide protection to public health. The secondary standards are to protect the public welfare from known or anticipated adverse effects.

Air Toxics Standards

Air toxics standards apply to pollutants which are emitted in addition to the listed criteria pollutants. The state of Ohio has issued a policy on MAGLCs, which cannot exceed the ACGIH TLV divided by 10.

National Emission Standards for Hazardous Air Pollutants

A NESHAP permit pertaining to emissions of radionuclides is required for a facility if the effective dose equivalent from the facility is greater than 0.10 mrem/y. If the glass melter causes an effective dose equivalent greater than 0.1 mrem/y by all radionuclides and all pathways, then a NESHAP permit is required.

D.3 SOLID WASTE PERMITS

The preparation and transport of solid wastes (hazardous materials) produced by the glass melter to an off-site disposal area will involve the hazardous materials transportation regulations promulgated under the HMTA (Pub. L. 93-633) as well as RCRA (for RCRA wastes). It is assumed that CERCLA, SARA, and SARA Title III will not be involved. The OSH Act prohibits OSHA from exercising regulatory authority over working conditions of employees where another federal agency has already exercised its regulatory authority. However, DOE and DOE contractors are subject to OSHA's Hazard Communication Standard (29 CFR 1910.1200) by virtue of DOE Order 5480.4. which adopts 29 CFR 1910 as mandatory as a matter of policy (SAIC, 1988).

REFERENCES

29 CFR (Code of Federal Regulations) Part 1910.1200.

40 CFR (Code of Federal Regulations) Parts 264 and 265.

40 CFR (Code of Federal Regulations) Part 270.

40 CFR (Code of Federal Regulations) Part 284.

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[Billing Code 6450-01-P]

DEPARTMENT OF ENERGY

**Finding of No Significant Impact
for Operation of the Glass Melter Thermal Treatment Unit at the
U.S. Department of Energy's Mound Plant, Miamisburg, Ohio**

AGENCY: Department of Energy

ACTION: Finding of No Significant Impact

SUMMARY: The U.S. Department of Energy (DOE) has prepared an environmental assessment (DOE/EA-0821) for the proposed operation of the Glass Melter thermal treatment unit ("Glass Melter") at DOE's Mound Plant in Miamisburg, Ohio. The Glass Melter would thermally treat mixed waste (hazardous waste contaminated with radioactive constituents, largely tritium, plutonium-238, and/or thorium-230), that was generated at the Mound Plant and is now in storage, by stabilizing the waste in glass blocks. Depending upon the radiation level of the waste, the Glass Melter may operate for as short a time as one year, but not longer than six years. DOE considered two onsite alternatives to the proposed action and seven offsite alternatives.

Based on the analysis presented in the environmental assessment, DOE believes that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq. Therefore, the preparation of an environmental impact statement is not required and the DOE is issuing this finding of no significant impact.

DATES: Proposed operation of the Mound Plant Glass Melter thermal treatment unit was the subject of a public meeting in Miamisburg, Ohio, on March 10, 1994. No unfavorable written comments from stakeholders were received by the DOE as a result of this meeting. The environmental assessment for the proposed operation of the Glass Melter was approved by DOE on October 27, 1994. A proposed finding of no significant impact (FONSI) was published in the *Federal Register* (FR) on November 3, 1994 (FR 59 55085) for public review and comment. No comments on the proposed FONSI were received, although a small number of individuals requested, and were provided, copies of the environmental assessment (EA).

ADDRESS: Mail any requests for further information on the Glass Melter project, or the associated EA and FONSI, to:

Ms. Sue Smiley
NEPA Compliance Officer
U.S. Department of Energy
Ohio Field Office
P.O. Box 3020
Miamisburg, Ohio 45343-3020

Phone: (513) 865-3987
Facsimile: (513) 865-4402

FOR FURTHER INFORMATION: For further information on the DOE National Environmental Policy Act process, contact:

Ms. Carol M. Borgstrom, Director
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Phone: (202) 586-4600 **or** 1-800-472-2756

SUPPLEMENTARY INFORMATION: The proposed action would bring the Mound Plant Glass Melter out of cold shutdown mode and use it for treating mixed waste that was generated at the Mound Plant and is now in storage. The Glass Melter, housed in an annex of the Liquid Waste Disposal Building, consists of a burn chamber of stainless steel (lined with refractory material) with an exhaust (offgas) system connected to a system of pipes and scrubbers ending in a stack (scrubbers are devices that remove small particles, gasses, and airborne radionuclides generated during thermal treatment). Waste in sealed drums would be transported by truck from the Mound Hazardous Waste Storage Building or Radioactive Mixed-Waste Storage Building to the annex, staged on a concrete loading dock adjacent to the annex, and then moved individually to a fume hood in the annex where the contents would be transferred into a feed system for processing in the melter. The waste would be added to molten soda-lime silica glass in the burn chamber of the Glass Melter. Ash from the combustion process would fall to the glass surface, where it would be incorporated into the melt. When the molten glass would reach a prescribed chemical mix (or a prescribed level of radioactivity), it would be discharged from the melter into 19 liter (five gallon) containers. The containers would then be transferred to a storage area in the building using mechanical aids (e.g., hoists and a roller conveyor system) to cool and to await transport by truck to existing onsite storage facilities.

The Glass Melter would have an estimated annual capacity of approximately 48,000 kg (106,000 lb) of wastes, based on an average throughput of 23 kg/hour (51 lb/hr) and a 2,080-hour work year. As originally proposed by the DOE, and as analyzed in the environmental assessment, operating at this capacity would have enabled DOE to eliminate the existing backlog of approximately 43,000 kg (95,000 lb) of mixed waste in approximately six years, while processing hazardous and mixed wastes [approximately 39,000 kg (86,000 lb) annually of nonradioactive solvents and mixed wastes] as generated.

Since the environmental assessment was written, DOE has decided to close the Mound Plant. DOE proposes, therefore, to use the Glass Melter only for the mixed waste backlog. DOE has not yet fully characterized this waste for radioactive contamination levels. The radiation level of the waste feed would be limited by the need to comply with the Environmental Protection Agency's National Emissions Standards for Hazardous Air Pollutants and by internal Mound limitations. If, after characterization, the radiation level of the waste is determined to be low enough that the capacity of the Glass Melter would be the factor controlling the processing rate, then the schedule for treatment of the backlog waste could be as short as one year.

The environmental impacts of the proposed treatment of only the mixed waste backlog are adequately covered, and are bounded by, the analysis in the environmental assessment, because calculations of radiological exposures and impacts were based on assumptions of waste radioactivity content that would exceed the actual content under the current proposed action (according to the environmental assessment, the mixed waste backlog is estimated to have a total activity of 211 curies of tritium and 0.42 curies of plutonium-238; the calculations for Glass Melter operations, however, are based on a total waste activity content of 240 curies/yr of tritium and 0.48 curies/yr of plutonium-238). The discussion below, which is based on the environmental assessment, therefore, would apply equally to the new proposed action. If the DOE later proposes to use the Glass Melter to treat other than mixed waste backlog, it will undertake appropriate further review under the National Environmental Policy Act.

Routine operation of the Glass Melter would generate treated offgas, scrubber sludge, scrubber liquid effluent, and several solid waste streams. The sludge generated by the scrubbing operations [approximately 770 kg (170 lb) per year] would be transferred by pipeline: (1) back to a Glass Melter feed port for reprocessing, (2) to an existing cementation process for immobilization in concrete, or (3) to container storage for any subsequent additional treatment required under the Resource Conservation and Recovery Act (RCRA) land

disposal restrictions. Filtered liquid scrubber effluent [approximately 36,000 kg (79,000 lb) per year], depending on its composition, would be: (1) pumped to an existing wastewater treatment facility, (2) pumped to the cementation process for immobilization as concrete (if the waste processed involved significant tritium concentrations), or (3) packaged for any subsequent additional treatment required under RCRA land disposal restrictions. Most liquid effluent would be treated at Mound's existing radioactive wastewater treatment facility and released via an existing outfall permitted under the National Pollutant Discharge Elimination System (NPDES).

The Glass Melter would generate, per year, approximately 3,200 kg (7,000 lb) of glass block (mixed waste); 8,900 kg (20,000 lb) of cementized scrubber effluent and sludge (also mixed waste); and 1,900 kg (4,200 lb) of maintenance wastes (filters, replacement parts, etc.). The maintenance wastes would generally be considered mixed waste, although certain of the replacement parts may have only surface radioactive contamination or may not be hazardous waste. The mixed wastes would be stored onsite until a mixed waste disposal facility is available.

The immediate result of Glass Melter treatment would be the conversion of waste that is primarily liquid and combustible, to a stable, inorganic form that would present very little environmental concern in storage. Most of the waste would eventually require transport to a radioactive mixed waste land disposal facility. Any waste that is not mixed waste would be disposed of with other, similar Mound wastes (e.g., hazardous waste is shipped offsite for disposal).

Environmental Impacts: In a series of test burns conducted in January 1985, the Glass Melter demonstrated the capability to thermally treat hazardous wastes in compliance with regulatory requirements. In June 1987, the Glass Melter was further tested and demonstrated effective treatment of low-level radioactive waste while meeting applicable regulatory requirements. Proposed future treatment of wastes using the Glass Melter would also meet all applicable environmental requirements. The Glass Melter is considered a "thermal treatment unit," not an "incinerator," under the Environmental Protection Agency regulations (40 CFR 260.10). Under the regulations for miscellaneous treatment, storage, and disposal units (40 CFR Part 264, Subpart X), any permit for the glass melter may include appropriate conditions from the incinerator regulations (Subpart O). Thermal treatment is one of the limited options DOE currently has to meet the requirement for site treatment plans under the Federal Facility Compliance Act.

The Environmental Protection Agency issued a Draft Strategy for Combustion of Hazardous Waste in Incinerators and Boilers on May 18, 1993, initiating a reexamination of its existing regulations and policies on waste combustion. In the draft strategy, the Environmental Protection Agency indicates that, "if conducted in compliance with regulatory standards and guidance, combustion can be a safe and effective means of disposing [of] hazardous wastes." To the extent that the Glass Melter would destroy hazardous wastes it would effectively "dispose" of that portion of the mixed waste backlog. Nevertheless, the thermal treatment of mixed wastes would necessitate the disposal of treatment residues as a mixed waste. These residues would be stored, pending final disposal in an approved location.

Emissions of nonradiological pollutants to the air during routine operation of the Glass Melter would include arsenic, cadmium, chromium, lead, carbon monoxide, hydrogen chloride, nitrogen oxides, and particulates. Predicted concentrations of nonradiological pollutants would meet applicable National Ambient Air Quality Standards and the maximum acceptable ground-level concentrations established by the Ohio Environmental

Protection Agency. During routine operation of the Glass Melter, the effective dose equivalent of radiation to the maximally exposed individual at the Mound Plant boundary [approximately 470 meters (510 yd) north-northeast from the Glass Melter stack] would be 0.07 mrem/year (tritium, plutonium-238, and thorium-230) from inhalation and ingestion pathways. These emissions would not cause the Mound Plant to exceed the individual effective dose equivalent limit of 10 mrem/year in the Environmental Protection Agency's National Emission Standards for Hazardous Air Pollutants. Based on the 1990 population distribution surrounding the Mound Plant, the collective effective dose equivalent to the total population residing within 80 km (50 mi) of the facility would be 2.6 person-rem/year. The environmental assessment shows that the health risk from such exposures would be very small.

Onsite personnel would not be exposed to unique hazards and would be adequately protected from potential exposure to radionuclides or other hazards by the existing health and safety programs. Existing facility design features would reduce direct worker contact with radioactive materials.

The formation of dioxins from Glass Melter operation would be virtually precluded due to specific technological design features of the equipment. For instance, the elevated operating temperatures of the Glass Melter would result in a high destruction and removal efficiency (99.9999% in test burns). In addition, the rapid cooling of the offgases below dioxin-forming temperatures, as recommended by the Environmental Protection Agency for municipal waste incinerators, would also be used to preclude dioxin formation.

The worst reasonably foreseeable accident involving the Glass Melter would be a fire on the loading dock that would result in the complete vaporization of the contents of ten mixed waste storage drums. The estimated frequency of such an accident is once every 100,000 years. The effective dose equivalent to the maximally exposed individual [approximately 200 m (220 yd) downwind] would be 0.2 mrem, well below

Environmental Protection Agency standards. The environmental assessment shows that the health risk from such exposures would be very small. Predicted concentrations of nonradiological pollutants would meet the Ohio Environmental Protection Agency's maximum acceptable ground-level concentrations. Taking into account the low probability of such an event, and the small magnitude of the consequences, the health risk posed by the accident would be very small.

No endangered species, critical habitats, floodplains, wetlands, or historical or archaeological resources would be affected by the proposed action.

Alternatives Considered: In the environmental assessment, DOE considered two onsite alternatives to the proposed action and seven offsite alternatives in the context of the original proposed action (i.e., assuming the continuing operation of the Mound Plant). The discussion below, however, while being based on the environmental assessment, reflects the current proposed use of the Glass Melter (based on DOE's decision to close the Mound Plant), which is to treat only mixed waste backlog.

- No Action: The present practice of waste storage and disposal would continue and the Glass Melter would not be used. Most of the mixed waste backlog is liquid, and much of it is combustible. Storage of the untreated waste, therefore, could adversely impact human health and the environment, especially in the case of a fire in the storage facility.

- Administrative Action: Another alternative would be to rely upon the established Mound Waste Minimization and Pollution Prevention Program to identify, screen, and analyze options to reduce the generation of waste. Waste that is in storage would not be affected by this program. The need for treatment options would persist.

- Offsite Treatment and Disposal: These alternatives would involve the transportation of mixed wastes to designated sites. DOE considered seven options for offsite treatment. All of the offsite treatment alternatives, with the exception of the Nevada Test Site, would involve thermal treatment.

  - Quadrex HPS, Inc. (Gainesville, FL): This commercial facility cannot accept certain of the Mound mixed wastes, so this alternative would not, by itself, address the need to treat such wastes.

  - Diversified Scientific Services, Inc. (Kingston, TN): This commercial facility could accept most of the mixed waste from Mound. Treatment, however, may be restricted by air permit conditions limiting the type of waste used for fuel and by Environmental Protection Agency regulations for boilers and industrial furnaces (40 CFR 266.100-112 and Appendices I-IX).

  - Idaho National Engineering Laboratory (INEL): INEL has a permitted incinerator facility, the Waste Experimental Reduction Facility (WERF), capable of burning radioactive material and hazardous waste. WERF is currently shut down, and its operation is contingent upon completion of National Environmental Policy Act review and DOE approval of a Safety Analysis Report. The current waste acceptance criteria for WERF limit the radioactive and chloride content of wastes and prohibit receipt of any free liquids. These criteria would prohibit the acceptance at WERF of almost all of the Mound waste proposed for treatment in the Glass Melter. The criteria could not be changed without substantial upgrades to WERF.

- Los Alamos National Laboratory: The proposed Controlled Air Incinerator is currently being permitted and undergoing National Environmental Policy Act review for operation at production capacity. Current operational plans do not include acceptance of offsite wastes, and the draft RCRA permit proposes to prohibit treatment of offsite waste.

- Savannah River Site: DOE is currently constructing the Consolidated Incinerator Facility under a construction permit from the State of South Carolina. This facility will not allow out-of-state waste to be treated. DOE is preparing an environmental impact statement on waste management at the Savannah River Site, which will include further analysis of operation of the Consolidated Incinerator Facility and other volume reduction alternatives. Trial burns and operation of the facility are being deferred until the completion of the environmental impact statement process.

- Oak Ridge Gaseous Diffusion Plant: The incinerator at the Oak Ridge Gaseous Diffusion Plant currently treats mixed waste. The primary sources of waste treated at this incinerator are the Paducah Gaseous Diffusion Plant, the Portsmouth Gaseous Diffusion Plant, and the Oak Ridge Reservation. A substantial backlog of waste exists that will take several years to treat. Thus, this alternative would not be available to Mound for several years and would not meet Mound's immediate needs.

- Nevada Test Site: Disposal of mixed waste at the Nevada Test site is considered a possible alternative to treatment in the Glass Melter. Land disposal restrictions under the Resource Conservation and Recovery Act would require, however, that any mixed waste be treated before disposal. The Nevada Test Site would only,

therefore, be a reasonable alternative for Mound waste already treated at another facility. DOE has not yet decided to what extent the Nevada Test Site would be used for future disposal of offsite waste; such decisions will be made after completion of the Environmental Restoration and Waste Management Programmatic Environmental Impact Statement and the Nevada Test Site Sitewide Environmental Impact Statement.

Proposed Determination: Based on the information and the analysis in the environmental assessment, DOE believes the proposed action (i.e., operation of the Glass Melter for treatment of backlog mixed waste only) does not constitute a major Federal action that would significantly affect the quality of the human environment within the meaning of the National Environmental Policy Act. Therefore, the preparation of an environmental impact statement is not required and the DOE is issuing this finding of no significant impact.

Issued in Miamisburg, Ohio, on July 26, 1995.

Robert D. Folker

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