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U.S. DEPARTMENT OF ENERGY

ENVIRONMENT, SAFETY AND HEALTH
OFFICE OF ENVIRONMENTAL AUDIT

ENVIRONMENTAL SURVEY
FINAL REPORT

MOUND PLANT
MIAMISBURG, OHIO

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PREFACE TO
THE DEPARTMENT OF ENERGY
MOUND PLANT
ENVIRONMENTAL SURVEY FINAL REPORT

This Report contains the results of the U.S. Department of Energy (DOE) Environmental Survey at the Mound Plant in Miamisburg, Ohio. It includes the final findings of the on-site assessment of environmental problems and areas of environmental risk, and the final risk-based ranking of those problems. Information presented in this Report is based on data collected during the on-site assessment in August 1986.

The Mound Plant Survey is a portion of a larger, comprehensive program of Environmental Surveys conducted at 36 major DOE operating facilities. The Environmental Survey Program was one of several initiatives, announced on September 18, 1985, by then Secretary of Energy John S. Herrington, to strengthen the Environment, Safety and Health (ES&H) programs and activities within DOE. It is fundamentally an internal DOE management tool designed to facilitate long-range planning and efficient allocation of limited resources.

The purpose of the Program is to identify, via "no fault" baseline Surveys of all the Department's major operating facilities, environmental problems and areas of environmental risk, and then to rank the identified problems based on risk. Because the Survey is a "no fault" environmental assessment rather than an audit, it is not intended to identify specific instances of noncompliance or to analyze environmental management practices. Such incidents and/or management practices are used, however, as a means of identifying existing and potential environmental problems.

Another purpose of the Survey is to develop a baseline of environmental information which allows DOE to measure and validate future environmental performance at its facilities. It can also be used to establish priorities, using the background information; for ongoing and future environmental audit programs within DOE.

The Environmental Survey Program has been managed by the Office of Environmental Audit (EH-24) under the Assistant Secretary for Environment, Safety and Health (EH-1). The Program has consisted of three major aspects -- on-site assessments, sampling and analysis, and prioritization. It has been conducted in accordance with the protocols and procedures set forth in the DOE Environmental Survey Manual (DOE/EH-0053, August 1987). Areas of technical specialty covered in the Survey are related to environmental media, including air, surface water, groundwater, and soil; and non-media environmental issues, including waste management, toxic and chemical materials, radiation, environmental quality assurance, and inactive sites and releases.

The on-site assessments were implemented using five teams, each consisting of from 4 to 19 outside experts in the technical areas described above, led and managed by a Team Leader and Assistant Team Leader from EH-24. The investigations were conducted to identify environmental problems and risks, which were defined to include the following:

- pollutants or contaminants in the air, surface water, groundwater, or soil resulting from DOE operations that pose or may pose a hazard to human health or the environment; and

- conditions at DOE facilities that could potentially cause the release of pollutants or contaminants to the environment in a manner that may pose a hazard to human health or the environment.

The results of the on-site assessment for the Mound Plant were included in the Mound Plant Environmental Survey Preliminary Report (March 1987). This document included both a baseline description of the technical areas covered in the Environmental Survey as well as preliminary findings of existing or potential environmental problems.

Subsequent to on-site activities, sampling and analysis (S&A) was conducted by DOE national laboratories based on plans developed by the Survey teams. The S&A effort was designed to confirm the presence or absence of contamination rather than to fully characterize the nature and extent of contamination. Results were used to assist the Survey team in filling data gaps associated with findings, in further

defining the existence and magnitude of identified environmental problems, and in more effectively evaluating risk. The S&A data base is maintained by EG&G Idaho's Data Applications Unit at the Idaho National Engineering Laboratory.

In addition to S&A, technical review comments on the Preliminary Report were received from the sites and/or DOE Field (formerly Operations) Offices. A follow-up site visit to the Mound Plant was also conducted in June 1989, nearly 3 years after the on-site assessment, to observe the corrective actions made to date on Survey findings. The results of S&A, technical review comments, and follow-up visit observations were used to revise the Preliminary Report findings. The resulting Final Survey Findings as well as any closed Preliminary Survey Findings are presented in Section 8.0 of this Report. It should be noted that corrective actions taken by the site subsequent to the follow-up visit are not reflected in the Final Survey Findings.

The third portion of the Environmental Survey involved the risk-based ranking of environmental problems identified during the on-site assessments. This was accomplished in two major phases -- Mechanistic and Judgmental. The Mechanistic Phase included the aggregation of Survey findings into ranking units (groups of findings consisting of similar environmental problems, environmental settings, or institutional concerns); developing data associated with the ranking units, including S&A results, for input to the Multimedia Environmental Pollutant Assessment System (MEPAS) model; and running the MEPAS model. The MEPAS model is described in Supplemental Mathematical Formulas: The Multimedia Environmental Pollutant Assessment System (MEPAS) (Pacific Northwest Laboratory, PNL-7201, 1989). The Judgmental Phase involved integrating the MEPAS model results [the Hazard Potential Index (HPI)] for each ranking unit with 12 other public health and environmental degradation criteria as part of the Risk Information System (RIS) to yield an overall risk group for each ranking unit. In some cases, ranking units were not amenable to MEPAS modeling because they did not deal with public health issues. For these ranking units, evaluation was based on the environmental degradation criteria of RIS. RIS is further described in Analysis of Health Impact Inputs to the U.S. Department of Energy's Risk Information System (Pacific Northwest Laboratory, PNL-7432, 1990).

Preliminary results of the risk-based rankings for DOE's 16 weapons production facilities were published in the Environmental Survey Preliminary Summary Report

of the Defense Production Facilities (DOE/EH-0072, September 1988). That document was prepared in response to the high degree of public interest in environmental problems at DOE's defense production sites. However, the preliminary rankings in that report were represented only by the HPI, and did not incorporate S&A, site accuracy review comments, or the 12 other public health and environmental degradation criteria of the RIS. Rankings for the Mound Plant were included in the Preliminary Summary Report.

Since the publication of DOE/EH-0072, ranking units for all 36 DOE facilities in the Environmental Survey Program have been considered and, where appropriate, have been developed and modeled using MEPAS. S&A results and site comments have been incorporated into the ranking units and modeling input parameters, where applicable, and RIS has been applied to the MEPAS model outputs. The final integrated RIS risk-based ranking results for each Mound Plant ranking unit are presented in Section 2.0 of this Report; the final ranked results for individual RIS criteria, including HPI, are presented in Sections 3.0 and 4.0. These results are based on information collected during the on-site assessment and during the 1989 follow-up visit. They do not reflect corrective actions taken by the site subsequent to the follow-up visit. However, sites have provided updates of the regulatory aspects and status of each of the ranking units as of 1990, which are presented in Section 6.0.

Subsequent to the time of the on-site Environmental Survey and the 1989 follow-up visit, several DOE Headquarters programs, including the Environment, Safety and Health Tiger Team Assessments and the Environmental Restoration and Waste Management Five-Year Plan, have been initiated. These programs are further identifying environmental problems and ensuring implementation of corrective actions for those problems.

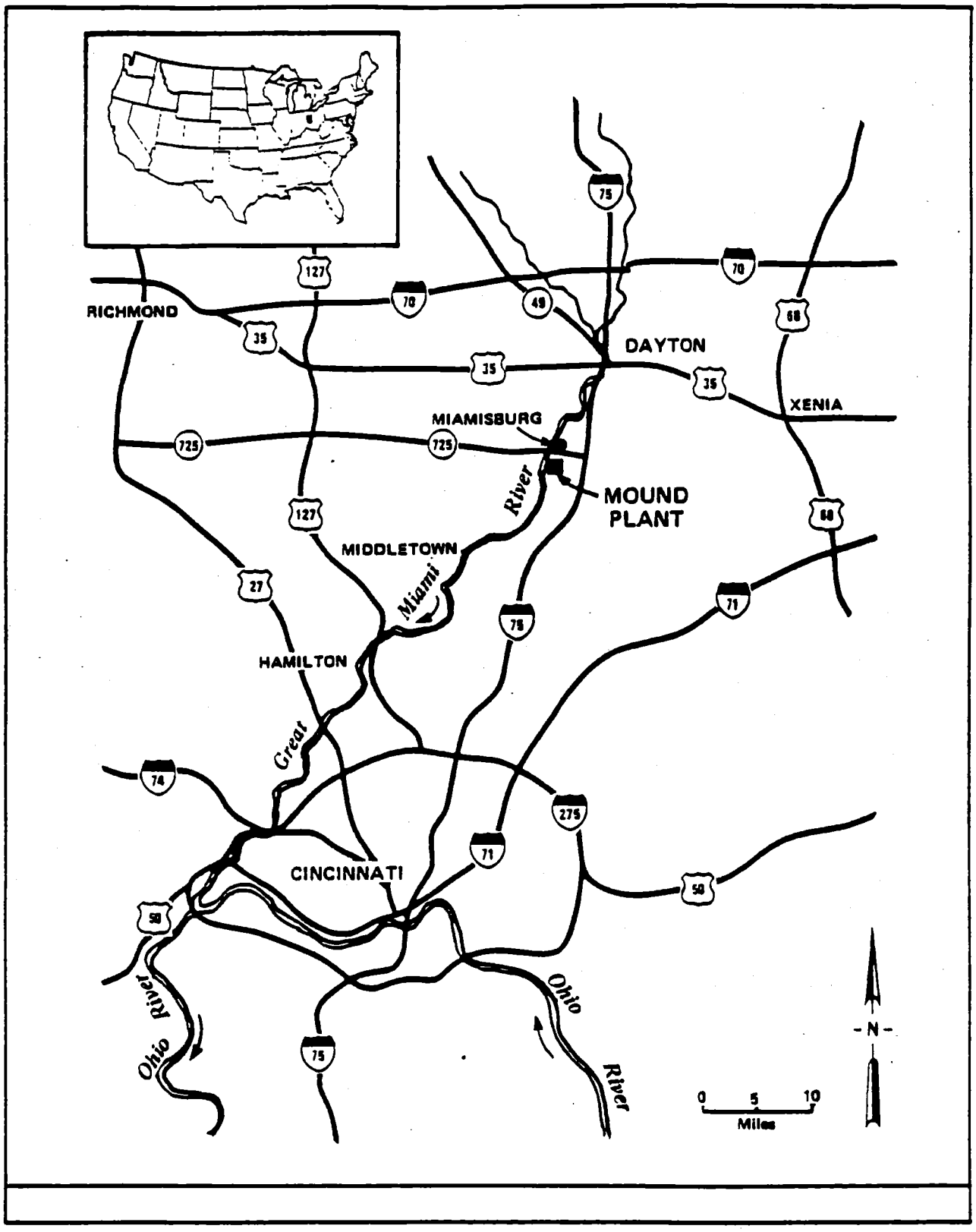
1.0 INTRODUCTION TO MOUND PLANT

1.1 Site Setting and Mission

This section describes the environmental setting and mission of the Mound Plant. It is based on information collected during the on-site Environmental Survey in August 1986. The Mound Plant is located on a 306-acre site in southwestern Ohio. The major technical work areas of the Mound Plant are within the city limits of Miamisburg, Ohio, and about 10 miles south-southwest of Dayton, Ohio (see Figure 1.1). The main mission of this facility is the manufacturing of both non-nuclear and tritium-containing components for nuclear weapons which are assembled at another site. The Mound Plant has been in continuous use since 1948.

The northern boundary of the site is approximately 0.13 mile south of Mound Avenue in Miamisburg. Mound Avenue runs south along the eastern boundary of the site. The southern boundary of the site is Benner Road. Tracks of the Penn Central Railroad roughly parallel the western boundary at distances ranging from approximately 50 to 200 feet. The Great Miami River flows 1,500 to 2,000 feet west of the site. The present land use within a 5-mile radius is mostly residential, with limited industrial development. Most residential, commercial, and industrial development is concentrated on the Great Miami River floodplain. The adjacent upland areas are used for residences and agriculture or are unused open spaces. The major water body in the vicinity of the plant site is the Great Miami River. Agricultural land within a 5-mile area around the site is used primarily for corn and soybean production and for livestock grazing.

The climate of the area is continental, with moderate ranges in temperature. Temperatures in the Dayton area range from an average daily minimum of 23.1°F in January to an average daily maximum of 86.9°F in July. The relative humidity in southwestern Ohio is moderately high, correlating with precipitation patterns; estimated average values for different times of day at the Mound site range from 50 to 85 percent. Precipitation is common in all seasons. The average annual rainfall equivalent is about 40 inches, including about 27 inches per year of snow. The maximum 24-hour rainfall recorded in Dayton is 4.56 inches. The surface wind flow at Dayton is predominantly from the southwest quadrant. Average annual wind speeds range from 7 to 10 miles per hour.



LOCATION OF MOUND PLANT

FIGURE 1.1

1.2 Summary of Survey Findings and Disposition

The Survey for the Mound Plant includes 29 Category II and III findings. An additional four preliminary findings have been closed since they were reported in the Mound Plant Environmental Survey Preliminary Report. Section 8.0 of this Report includes all Mound Plant Final Survey Findings. Complete versions of active findings are included in Section 8.1 and summaries of closed findings are included in Section 8.2.

Eleven of these findings were not ranked as they were beyond the focus of the prioritization: seven because they represent compliance or management issues and four because they dealt with data quality issues. These findings are summarized in Section 5.0 of this Report.

The remaining 18 findings are grouped into 11 ranking units (Table 1.1), all of which were evaluated using the risk-based model Multimedia Environmental Pollutant Assessment System (MEPAS) model. This model is described in Supplemental Mathematical Formulas: The Multimedia Environmental Pollutant Assessment System (MEPAS) (Pacific Northwest Laboratory, PNL-7201, 1989). All of these ranking units represent existing or suspected environmental problems and are discussed in Section 3.0 of this Report. There are no ranking units that may present potential future environmental problems (Section 4.0). The locations of the 11 ranking units are shown on Figure 1.2. The integrated summary ranking of all Mound Plant ranking units, using the U.S. Department of Energy's Risk Information System (RIS), is presented in Section 2.0. A discussion of each ranking unit, including the method and results of MEPAS modeling, where applicable, is presented in Section 6.0; qualifiers to the risk-based MEPAS modeling are presented in Section 7.0.

TABLE 1.1
MOUND PLANT RANKING UNITS

Ranking Unit Name	Location on Figure 1.2
EXISTING OR SUSPECTED ENVIRONMENTAL PROBLEMS	
• Hazardous Air Emissions - Vents	J
• Inactive Leach Pit	G
• Contamination in the Canal	F
• Contamination of Dirt Road	I
• Contamination in Area S-1	A
• Contamination in the Valley Locations	E
• Contamination on the SM/PP Hill	C
• Contamination in Area S-7	B
• Contamination in the Main Hill Groundwater	D
• SM/PP Hill Drum Storage Area	H
• Potential Leakage from Underground Tanks	D

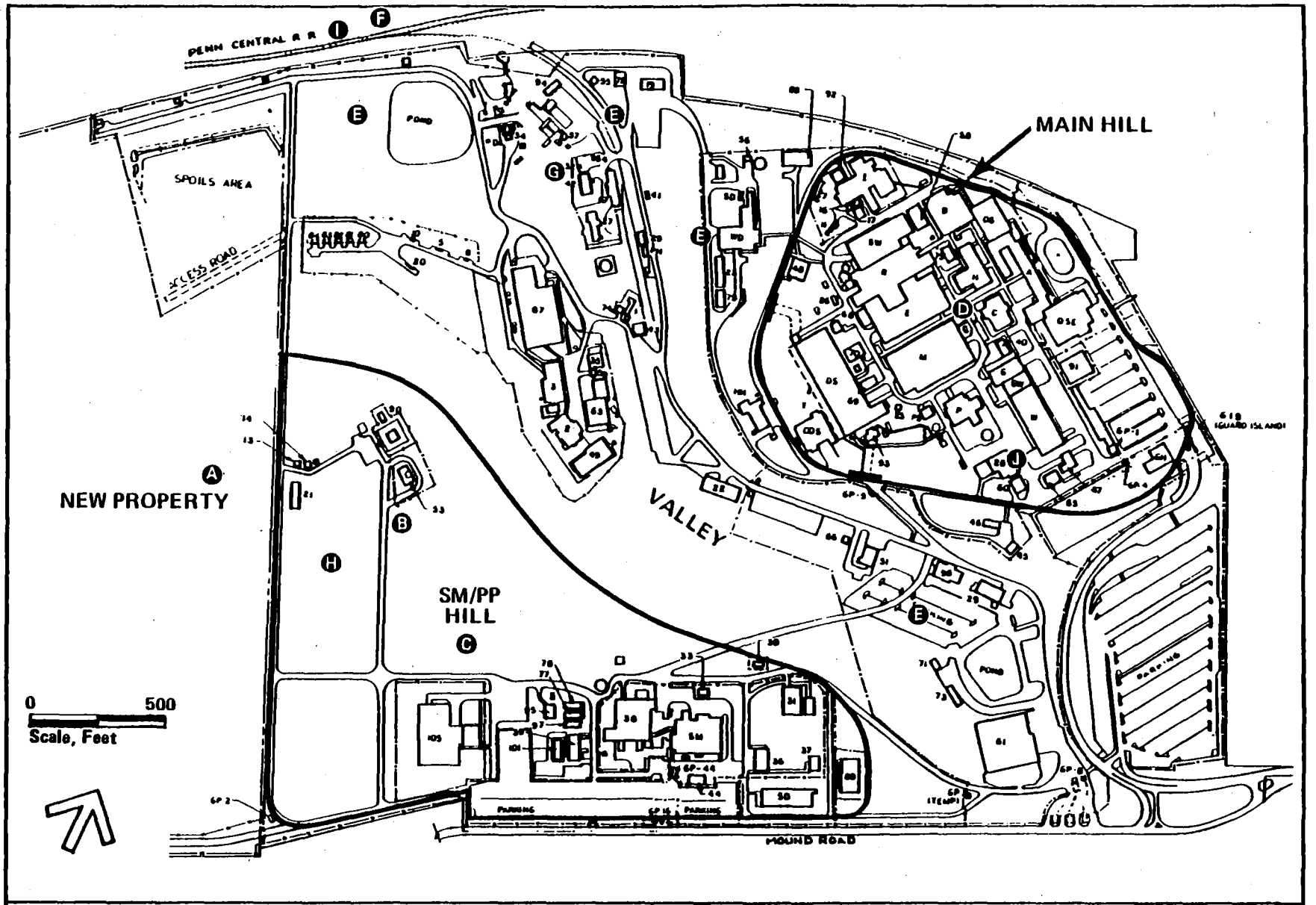


FIGURE 1.2

APPROXIMATE LOCATIONS OF
RANKING UNITS FOR MOUND PLANT

2.0 RISK INFORMATION SYSTEM RANKING RESULTS

The U.S. Department of Energy's (DOE's) Risk Information System (RIS) generates a risk-based score for each existing or potential environmental problem included in the Environmental Survey. RIS consists of 13 individual input criteria, 10 of which are measures of risk to public health and 3 of which are measures of environmental degradation. RIS is further described in Analysis of Health Impact Inputs to the U.S. Department of Energy's Risk Information System (Pacific Northwest Laboratory, PNL-7432, 1990). Each of the 13 criteria and their results for the Mound Plant are discussed in Section 3.0. These results are based on information collected during the on-site assessment and during a follow-up visit in 1989. They do not reflect corrective actions taken by the site subsequent to the follow-up visit.

This section examines the integrated RIS ranking results for the environmental problems at the Mound Plant, which are based on the judgments of the Integration Panel, a group composed of environmental managers from throughout DOE. The ranking is discussed after a brief review of the risk criteria that the Integration Panel felt should most heavily influence the RIS score.

2.1 Summary of Integration Panel Concerns

The integrated ranking of environmental problems at each DOE facility reflects the judgments made by the Integration Panel in weighting the importance of the 13 risk criteria in the RIS. The Panel determined which risk factors should most influence the ranking unit's final score. For instance, the Panel gave greater weight to human health risks than to potential environmental degradation, reflecting a high degree of concern with protecting public health; nevertheless, the Panel sought to give sufficient emphasis to potential environmental degradation to ensure that this factor had a significant effect on the final ranking.

Within the health risk category, the Panel gave significantly greater emphasis to current and near-term risks than to long-term risks, and greater emphasis to ranking units at which critical data were based upon measured or monitored values, as opposed to conservative assumptions. In addition, the Panel weighted equally risks to maximally exposed individuals and risks to the total exposed population. This decision reflected the Panel's concern that the ranking sufficiently account for both

the severity of risks to any one individual and the extent of risks to the population as a whole. For both population and individual risk, however, the Panel drew sharp distinctions concerning the magnitude of risk, giving strong emphasis to Level 5 risks (i.e., highest assigned level) and progressively less emphasis to lower risk levels (see Sections 3.1.1 and 3.1.2).

In its evaluation of risks to maximally exposed individuals, the Panel's judgments changed depending upon the time period projected for the onset of significant exposures. For ranking units at which risks are considered current or near-term, the Panel gave greater emphasis to risks to the modeled receptor than to the hypothetical receptor at the site boundary. For ranking units at which risks are considered long-term, however, the Panel gave equal emphasis to these criteria, reflecting the belief that the hypothetical exposure scenario represents an increasingly realistic measure of risk in later years. The Panel also gave slightly greater emphasis to carcinogenic risks than to non-carcinogenic risks. Finally, in comparison to the other individual risk measures, the Panel gave relatively little emphasis to the loss of institutional control criterion, but did give this factor slightly greater emphasis for ranking units identified as long-term risks.

In its evaluation of risks to the total exposed population, the Panel chose to rely exclusively on the multiple contaminant - discounted Hazard Potential Index (HPI). This decision reflected the Panel's belief that the ranking of problems, to the extent the data allow, should take into account risks from all contaminants. The decision also reflects the Panel's belief that the ranking should give greater emphasis to health effects estimated to occur within the first 70 years, as opposed to effects that the Multimedia Environmental Pollutant Assessment System (MEPAS) projects may occur centuries from now.

The Panel's judgments concerning the criteria that describe potential environmental degradation in several ways parallel those made for the health risk criteria. The Panel again gave greater emphasis to current than to near-term risks, and greater emphasis to near-term than to long-term risks. In addition, the Panel assigned progressively greater weight to situations in which contaminants are considered more likely to reach a sensitive environment. Finally, the Panel gave greater weight to ranking units that threaten to affect sensitive environments of global or national importance (e.g., the ozone layer, national parks) than to environments of state or

regional importance, but in general made relatively moderate distinctions among the sensitive environment categories.

2.2 Integrated Ranking for Mound

2.2.1 Description of RIS Risk Groups

The RIS integrated score for each ranking unit is based on the scores for each of the 13 component criteria and the relative importance assigned to each criterion by the Integration Panel. Because these scores synthesize the Integration Panel's subjective assessment of the importance of many risk factors, they do not describe risk in an absolute sense. Instead, the scores are a unitless indicator of the priority the Panel would give each problem in establishing a risk-based ranking. As an integrated measure of relative risks, the scores provide a means of ranking environmental problems that otherwise could not be compared on a consistent basis. However, recognizing the importance of interpreting RIS scores in a way that relates them to more commonly used measures of absolute risk, DOE's Integration Panel divided the scores into five general categories. These categories represent groups of ranking units that share common attributes and, in the Panel's judgment, pose similar risks. The characteristics of each of these groups are described below.

Risk Group 5 includes the ranking units that, in the Panel's estimation, present the highest risk. All of these ranking units exhibit the following characterisitics:

- the time period projected for initial health risks is current; and
- the level of one or both of two criteria given significant weight by the Panel -- the multiple contaminant - discounted population HPI Group and the maximum exposed individual (MEI) risk to the modeled receptor -- is five.

Risk Group 4 includes all ranking units not included in Risk Group 5 that exhibit the following characteristics:

- current health risks and a level of four on the multiple contaminant - discounted population HPI Group or modeled receptor MEI risk; and

- health risks projected within 70 years and a level of five on the multiple contaminant - discounted population HPI Group or modeled receptor MEI risk; or health risks projected within 70 years and a level of four on both the multiple contaminant - discounted population HPI Group and modeled receptor MEI risk, accompanied by a relatively high subscore for potential environmental degradation.

Risk Group 3 includes:

- all remaining ranking units that combine a current time of arrival for health risks with a level of three on the multiple contaminant - discounted population HPI Group or modeled receptor MEI risk;

- other units identified as current health risks with a level of less than three on the multiple contaminant - discounted population HPI Group and modeled receptor MEI risk, but with relatively high levels on other factors (e.g., a level of four for risk to the hypothetical receptor at the site boundary, or a relatively high potential environmental degradation score);

- ranking units that are projected to pose no potentially significant health risks until 71 to 7,000 years from the present, but which receive relatively high potential environmental degradation scores; or

- several ranking units that are projected to pose health risks within 40 years and that have a level of three or more on the multiple contaminant - discounted population HPI Group, modeled receptor MEI risk, or hypothetical boundary receptor MEI risk.

Risk Group 2 encompasses:

- all remaining ranking units identified as potential current health risks. These ranking units have levels of one or two on the multiple contaminant - discounted population HPI Group and modeled receptor MEI risk; or

- other ranking units where the onset of significant health risks, if any, is projected to occur in later periods, and where scores for potential environmental degradation are relatively moderate or low.

Risk Group 1 contains the lowest-ranked environmental problems. The primary characteristics of these ranking units are as follows:

- no significant health effects are anticipated for at least 70 years. With few exceptions, the designated time of arrival for all ranking units is either 71 to 7,000 years or beyond 7,000 years;

- relatively low health risks. With some exceptions, the ranking units have levels of less than three for the multiple contaminant - discounted population HPI Group and modeled receptor MEI risk; and

- relatively low potential environmental degradation scores.

2.2.2 RIS Risk Group Results

In contrast to several other sites, RIS ranking results indicate a fair degree of homogeneity in the risks posed by the ranking units at the Mound Plant. The Survey effort characterized risks for 11 ranking units at Mound, all of which represent existing or suspected environmental problems. Table 2.1 shows that the scoring system placed nine ranking units in Risk Group 3, one in Risk Group 2, and one in Risk Group 1. It is noteworthy that the RIS classified no Mound ranking units in the two groups of highest concern (Risk Groups 4 and 5).

Of the nine ranking units in Risk Group 3, seven were classified as having a current time of arrival for health effects; all of these ranking units were estimated to have moderate health risk potential, with HPI Group Level and MEI scores of Level 2 or 3. Another ranking unit in Risk Group 3 -- Contamination in the Main Hill Groundwater -- was classified as having an 8- to 20-year time of arrival; this ranking unit was estimated to pose moderate health risk potential, with HPI Group Level 3 and MEI Level 3 risks. The final ranking unit -- Potential Leakage from Underground Tanks --

TABLE 2.1

MOUND PLANT
RIS RANKING OF EXISTING
OR SUSPECTED ENVIRONMENTAL PROBLEMS

Ranking Unit Name	Risk Group
Contamination in the Valley Locations	3
Contamination in the Canal	3
Contamination in Area S-1	3
Contamination in the Main Hill Groundwater	3
Hazardous Air Emissions - Vents	3
Potential Leakage from Underground Tanks	3
Contaminations of Dirt Road	3
Contamination on the SM/PP Hill	3
Contamination in Area S-7	3
Inactive Leach Pit	2
SM/PP Hill Drum Storage Area	1

was estimated to pose moderately high individual risk (MEI Level 4); however, due to its 21- to 40-year time of arrival for health effects, it was relegated to Risk Group 3.

The ranking unit in Risk Group 2 was classified as having a mid-term (8 to 20 years) time of arrival for health effects, but did not score higher because of limited health risk potential (HPI Group Level 2 and MEI Level 1). The ranking unit in the lowest risk group received a minor RIS score because of time of arrival beyond 70 years and because of minimal health risk potential (HPI Group Level 1 and MEI Level 1).

3.0 RISK INFORMATION SYSTEM INPUTS FOR EXISTING OR SUSPECTED ENVIRONMENTAL PROBLEMS

This section includes a description of the Risk Information System (RIS) inputs or criteria pertaining to environmental problems classified as either known or suspected to currently exist. These types of problems include current contamination resulting from either past practices or current activities.

The RIS inputs provide information on a number of aspects of risk to public health and the environment. They include ten measures of risk to public health (Section 3.1) and three measures of environmental degradation (Section 3.2). The public health criteria consist of three means of describing individual risk (Section 3.1.1), four means of describing population risk (Section 3.1.2), and two other measures that act as an adjustment to the risk to public health (Sections 3.1.3 and 3.1.4). Overlying two of the population risk measures and two of the individual risk measures is a health effects criterion. The environmental degradation criteria consist of a qualitative assessment of the potential for contaminants associated with the environmental problem to reach sensitive environments.

3.1 RIS Inputs for Public Health Measures

RIS inputs for public health measures are indicators of potential impacts to human health as a result of contaminant exposures. These measures are categorized into the following three major areas: 1) individual risk; 2) population risk; and 3) adjustment factors, which consist of uncertainty and contaminant time of arrival.

3.1.1 RIS Inputs for Individual Risk Measures

Individual risk measures presented in Table 3.1 focus on risks to an individual at three potential receptor locations. The maximum individual risk to the modeled receptor provides the maximum individual risk to current potential receptors. The maximum individual risk to the hypothetical boundary receptor provides individual risk information at the site boundary, which may be considered a worst-case location for the off-site public (assuming current site access restrictions are maintained). The loss of institutional control, consistent with the U.S. Department of Energy's (DOE's)

TABLE 3.1

MOUND PLANT
RIS PUBLIC HEALTH INPUTS
FOR EXISTING OR SUSPECTED ENVIRONMENTAL PROBLEMS
INDIVIDUAL RISK MEASURES

Ranking Unit Name	A			B			C
	Modeled Receptor			Hypothetical Boundary Receptor			Loss of Institutional Control
	Maximum Individual Risk Level	Time Period of Maximum Impact	Health Effects Type	Maximum Individual Risk Level	Time Period of Maximum Impact	Health Effects Type	Contamination Remaining
Potential Leakage from Underground Tanks	4	141-210	Carcin	4	71-140	Carcin	None
Hazardous Air Emissions - Vents	3	0-70	Carcin	3	0-70	Carcin	None
Contamination in the Valley Locations	3	2311-2380	Carcin	3	6721-6790	Carcin	Some
Contamination in the Main Hill Groundwater	3	71-140	Carcin	3	71-140	Carcin	Some
Contamination of Dirt Road	2	0-70	Rad	3	0-70	Rad	NR*
Contamination in Area S-7	2	0-70	Rad	1	0-70	Rad	NR*
Contamination in the Canal	2	0-70	Rad	3	0-70	Rad	NR*
Contamination on the SM/PP Hill	2	0-70	Carcin	2	0-70	Carcin	NR*
Contamination in Area S-1	2	0-70	Rad	3	0-70	Rad	NR*
Inactive Leach Pit	1	0-70	Non-Carcin	1	0-70	Non-Carcin	None
SM/PP Hill Drum Storage Area	1	2731-2800	Non-Carcin	1	2731-2800	Non-Carcin	NR*

*Non-Carcin = Non-Carcinogen
Rad = Radionuclide
Carcin = Carcinogen (Other Than a Radionuclide)
NR = Not Ranked
NP = Not Projected Within 7000 Years

current radioactive materials management, assumes current site access restrictions are relinquished after 100 years and an individual has access to the site at that time.

Table 3.1 provides data concerning calculated risks, the time period in which the calculated risk occurs, and the type of health effect associated with the risk. It also provides a qualitative estimate of the contamination remaining at the site under the loss of institutional control scenario.

The calculated Maximum Individual Risk Levels for both the modeled receptors and the hypothetical boundary receptors are defined in terms of levels at which regulatory actions are generally initiated.

LEVEL 5 - Individual risk level is generally above levels at which regulatory decisions are made and is equal to or greater than a 10^{-2} risk for carcinogens or a level greater than or equal to 100 times the reference dose for non-carcinogens.

LEVEL 4 - Individual risk level is generally above levels at which regulatory decisions are made and is less than a risk of 10^{-2} but greater than a risk of 10^{-4} for carcinogens or a level less than 100 but greater than or equal to 10 times the reference dose for non-carcinogens.

LEVEL 3 - Individual risk level is generally within levels requiring further study under regulatory programs and is less than or equal to a risk of 10^{-4} but greater than or equal to a risk of 10^{-6} for carcinogens or a level less than 10 times but greater than or equal to the reference dose for non-carcinogens.

LEVEL 2 - Individual risk level is generally below levels at which regulatory actions are taken and is less than a risk of 10^{-6} but greater than or equal to a risk of 10^{-9} for carcinogens or a level less than the reference dose but greater than or equal to one-tenth the reference dose for non-carcinogens.

LEVEL 1 - Individual risk level is generally below levels at which regulatory actions are taken and is less than a risk of 10^{-9} for carcinogens or a level less than one-tenth the reference dose for non-carcinogens.

The Time Period of Maximum Impact indicates the 70-year period during which the maximum risk is projected to occur. The Multimedia Environmental Pollutant Assessment System (MEPAS) was designed to evaluate chronic health impacts following the U.S. Environmental Protection Agency (EPA) guidance for both non-radioactive and radioactive constituents. Although the duration of exposure varies between problems, the effects are computed in terms of 70-year lifetimes.

The Health Effects Type indicates whether the human health risk is projected to result from a radionuclide, carcinogen (other than a radionuclide), or non-carcinogen. Radionuclides and carcinogens other than radionuclides are separated to match the historical division for considering health effects. The health effects for radionuclides were based on available National Research Council recommendations. EPA guidance (i.e., Integrated Risk Information System) was used as the primary source of toxicity values for the other carcinogens.

3.1.1.1 Maximum Individual Risk to Modeled Receptor by Health Effects Type

This criterion, as shown in Table 3.1 (column A), presents the Maximum Individual Risk Level, Time Period of Maximum Impact, and Health Effects Type projected for current potential receptors. Comparing this criterion to population risk measures presented in Table 3.2 allows decision makers to be aware of situations involving large impacts to small populations. It also identifies when high scores are due to small impacts to large populations.

With only one exception, the ranking units for Mound result in individual risks to modeled receptors at levels lower than those at which regulatory actions are generally taken. However, three of the ranking units fall in that range of scores which may require further characterization of the individual risk. The ranking unit that has the potential for individual risk to modeled receptors at levels above those at which regulatory actions are generally taken is Potential Leakage from Underground Tanks. In five ranking units the individual risk to modeled receptor scores do not mirror those of the population-based Hazard Potential Index (HPI). The Potential Leakage from Underground Tanks ranking unit's HPI score of HPI Group Level 3 would not reflect the significance of the relatively high individual risk to modeled receptors score (Level 4). In addition, the Contamination in Area S-1 and

TABLE 3.2

MOUND PLANT
RIS PUBLIC HEALTH INPUTS
FOR EXISTING OR SUSPECTED ENVIRONMENTAL PROBLEMS
POPULATION MEASURES

Ranking Unit Name	Discounted			Undiscounted			E
	A		B	C		D	
	Single		Multiple	Single		Multiple	Time Period of Maximum Impact
	HPI Group Level	Health Effects Type*	HPI Group Level	HPI Group Level	Health Effects Type*	HPI Group Level	
Hazardous Air Emissions - Vents	3	Carcin	3	3	Carcin	3	0-70
Contamination in the Main Hill Groundwater	3	Carcin	3	3	Carcin	3	71-140
Contamination in the Valley Locations	3	Carcin	3	4	Carcin	4	2311-2380
Contamination in Area S-1	3	Rad	3	3	Rad	3	0-70
Contamination in the Canal	3	Rad	3	3	Rad	3	0-70
Potential Leakage from Underground Tanks	2	Carcin	2	3	Carcin	3	141-210
Contamination of Dirt Road	2	Rad	2	2	Rad	2	0-70
Contamination on the SM/PP Hill	2	Carcin	2	2	Carcin	2	0-70
Contamination in Area S-7	2	Rad	2	2	Rad	2	0-70
Inactive Leach Pit	2	Non-Carcin	2	2	Non-Carcin	2	0-70
SM/PP Hill Drum Storage Area	1	Non-Carcin	1	1	Non-Carcin	1	2731-2800

*Non-Carcin = Non-Carcinogen
Rad = Radionuclide
Carcin = Carcinogen (Other Than a Radionuclide)
NR = Not Ranked
NP = Not Projected Within 7000 Years

Contamination in the Canal ranking units' HPI Group Level 3 does not reflect the relatively low individual risk to modeled receptors score.

3.1.1.2 Hypothetical Maximum Exposed Individual Risk at Site Boundary by Health Effects Type

This criterion, as shown in Table 3.1 (column B), presents the Maximum Individual Risk Level, Time Period of Maximum Impact, and Health Effects Type posed by projected contamination at the site boundary. This component is designed to simulate DOE's current radiation management approach concerning responsibility for off-site impacts. It also provides useful information concerning situations where off-site contamination may exist with no current potential receptors.

To score this criterion, the potential maximum individual ingestion and inhalation risks were summed. The potential exposure from drinking water was determined at a location at the site boundary hydrologically downgradient from the ranking unit. The inhalation risk was determined at a boundary location which approximates the location where, considering prevailing winds and proximity to the boundary, the maximum risk would occur.

In general, the Mound ranking units result in maximum exposed individual scores at the Mound boundary that fall within those levels that generally require further study. Three ranking units score higher for maximum individual risk at the Mound boundary than for the maximum individual risk to modeled receptors described in Section 3.1.1.1. These ranking units, Contamination in the Canal, Contamination in Area S-1, and Contamination of Dirt Road, involve the resuspension of contaminants, and the proximity of the individual to the boundary would account for this.

3.1.1.3 Loss of Institutional Control

This criterion, as shown in Table 3.1 (column C), provides qualitative information concerning the impact of potential contamination assuming the future loss of institutional control over the site. This criterion is patterned after current DOE guidelines for radiation management and thus assumes institutional control is lost after 100 years, at which time an individual would have access to the site.

This criterion is described in terms of the fraction of the initial contamination projected to remain in the soil 100 years from now as follows:

MOST - At least half of the contamination remains.

SOME - Less than half of the contamination remains.

NONE - None of the contamination remains.

NOT RANKED - Due to difficulties in modeling, such projections cannot be made for surface soil currently available for resuspension or volatilization. Thus, ranking units whose scores are based on resuspension or volatilization are not calculated for this criterion.

Two of the ranking units for Mound involve problems where some contamination is projected to be remaining 100 years in the future assuming no remedial action. These ranking units involve groundwater transport of contaminants. For the three remaining ranking units applicable to institutional control, none of the contamination would remain.

3.1.2 RIS Inputs for Population Measures

Population measures, presented in Table 3.2, focus on risks to the population surrounding the site. Two policy issues are assessed in addressing this measure -- time weighting and single (indicator) parameter versus multiple (characterization) parameters.

The population measures are given in terms of the HPI Group Level. The HPI Group Level is a composite score that reflects the receptor population risk combined over one hundred 70-year periods. The 70-year periods simulate the approximate lifetimes of individuals. This combination is presented as both discounted (time weighted) and undiscounted. In discounting, the health effects associated with each 70-year period are weighted half as much as the preceding 70-year period to account for the greater concern of health risks that may occur in nearer-term time frames. In addition, the HPI Group Level is presented for both the highest risk for a single

contaminant (as an indicator of the significance of the problem) and the combined risk for multiple contaminants (representative of a characterization perspective). The multiple contaminants measure assumes health effects across chemicals are additive. All four combinations of the population measures (Discounted Single Contaminant, Discounted Multiple Contaminants, Undiscounted Single Contaminant, and Undiscounted Multiple Contaminants) are presented in Table 3.2.

There are five HPI Group Levels describing population measures. HPI Group Level 5 includes those ranking units of most concern from the perspective of potential public health hazard. HPI Group Level 4 includes those ranking units of secondary concern from the perspective of potential public health hazard. HPI Group Level 3 includes those ranking units of tertiary concern from the perspective of potential public health hazard. HPI Group Level 2 includes those ranking units characterized as generally reaching receptors at levels well below those used in regulatory decisions. HPI Group Level 1 includes those ranking units that are not expected to reach receptors.

Given the level of precision associated with the Environmental Survey's data, MEPAS model results are represented logarithmically, as HPI Groups, on a scale of 0 to 10. This provides for relative rankings between orders of magnitude. However, for the population measures of the RIS, these HPI Groups are further aggregated into HPI Group Levels to represent the level of significance associated with each as described in the preceding paragraph.

For each of the population measures, the corresponding HPI Groups included within the HPI Group Levels are:

HPI Group Level 5	HPI Groups 8, 9, 10
HPI Group Level 4	HPI Groups 6, 7
HPI Group Level 3	HPI Groups 4, 5
HPI Group Level 2	HPI Groups 1, 2, 3
HPI Group Level 1	HPI Group 0

The Time Period of Maximum Impact indicates the 70-year period during which the maximum risk is projected to occur. MEPAS is focused on chronic health impacts and

thus, consistent with most EPA assumptions on chemical effects, calculates all impacts on the basis of a 70-year lifetime.

The Health Effects Type indicates whether the human health risk is projected to result from a radionuclide, carcinogen (other than a radionuclide), or non-carcinogen. Radionuclides are considered separately to allow the decision maker to identify which problems may be impacted by recent National Research Council studies on the health effects of low-level radiation. This criterion allows the decision makers to weight the various types of health effects as they see appropriate.

3.1.2.1 Single Contaminant Population Risk by Health Effects Type - Discounted

This criterion, as shown in Table 3.2 (column A), is represented by the HPI Group Level and Health Effects Type. By comparing this criterion to that presented in column C (as discussed in Section 3.1.2.2), the effect of discounting risks associated with future 70-year periods is evident.

The five highest scoring ranking units at Mound ranked in HPI Group Level 3. The Hazardous Air Emissions - Vents ranking unit involves atmospheric releases of organic contaminants from 570 ventilation hoods in 34 buildings at the facility. The contaminants include acetone, methylene chloride, trichloroethylene, and toluene. The Contamination in the Canal ranking unit involves plutonium-238 resulting from an accidental discharge during 1969. The Contamination in Area S-1 ranking unit involves surface soil contamination in an undeveloped portion of the site. The Contamination in the Main Hill Groundwater ranking unit includes contamination identified in the shallow perched zones on-site. And the Contamination in the Valley Locations ranking unit includes radioactive and chemical contamination of areas in the valley.

The lowest scoring ranking unit at Mound resulted in HPI Group Level 1. This low score can be attributed to small inventories and low soil concentrations.

Air transport pathways dominate the ranking for the site due to the potential for resuspension of contaminated soils. The potential for contaminant migration from surface soils to groundwater exists for most of the ranking units. In a few instances, due to the persistence of the contaminants potentially emitted, the overland runoff

of potentially contaminated surface soils to surface water transport pathway is a potential concern.

3.1.2.2 Single Contaminant Population Risk by Health Effects Type - Undiscounted

This criterion, as shown in Table 3.2 (column C), presents the HPI Group Level and Health Effects Type. By comparing this criterion to that presented in column A, the effect of discounting risks associated with future 70-year periods is evident.

The Mound ranking units for this criterion generally score in HPI Group Levels that are considered a tertiary level of concern or lower. This is consistent with the scores presented for the discounted criterion (column A). Two ranking units in this criterion had scores which increased, Contamination in the Valley Locations and Potential Leakage from Underground Tanks. These two ranking units involve exposures through the groundwater pathway that would occur in the distant future. Thus, eliminating the discounting factors that are included in column A accounts for the higher scores for these ranking units.

3.1.2.3 Multiple Contaminant Population Risk - Discounted

This criterion, as shown in Table 3.2 (column B), is similar to the criterion in column A, except that the time-weighted population risks for all contaminants are added. The Multiple Contaminant HPI Group Level assumes health effects across chemicals are additive. This information allows consideration of multiple contaminants at a site. By comparing this criterion to that presented in column A, the effect of adding contaminant risks can be assessed.

There are no changes from the single contaminant - discounted criterion when multiple contaminants are considered.

3.1.2.4 Multiple Contaminant Population Risk - Undiscounted

This criterion, as shown in Table 3.2 (column D), is similar to the criterion in column C, except that the undiscounted population risks for all constituents are added. The Multiple Contaminant HPI Group Level - Undiscounted is similar to the Multiple

Contaminant - Discounted, in that health effects across chemicals are assumed to be additive. This information allows consideration of multiple contaminants at a site without discounting the health risk to future generations. By comparing this criterion to that presented in column C, the effect of adding contaminant risks can be assessed.

There are no changes from the single contaminant - undiscounted criterion when multiple contaminants are considered.

3.1.3 RIS Inputs for Uncertainty Measures

Uncertainty measures provide a perspective on the potential variability of the scores that are influenced by the sensitivity of the MEPAS model and the quality of the MEPAS model input data. These criteria, as shown in Table 3.3, include a qualitative assessment of the overall uncertainty associated with the resultant scoring. The uncertainty associated with the scores is a combination of uncertainty associated with the MEPAS model sensitivity, represented as Model Variability, and uncertainty associated with the data, represented as the Critical Data Category.

Model Variability represents the total variation in the range of HPI Groups (the logarithmic 0 to 10 scale). The Model Variability values are based on Multimedia Environmental Pollutant Assessment System (MEPAS) Sensitivity Analysis of Computer Codes (Pacific Northwest Laboratory, PNL-7296, 1990). The variability source tables are documented in the previously referenced Pacific Northwest Laboratory publication, PNL-7432. The sensitivity analysis was based on a well-characterized site and identifies variation in scoring ranging from 0 to 3 HPI Groups, depending on the applicable constituent/pathway.

The Critical Data Category is an assessment by the modelers of the values assigned to those parameters which are most critical in driving the HPI score. The assessment is based on the source of the critical data and ranges from Critical Data Category A, representing those ranking units with the lowest uncertainty in the data, to Critical Data Category C, representing those with the highest uncertainty. The critical data categories are defined below based upon the source of the critical data.

TABLE 3.3

MOUND PLANT
RIS PUBLIC HEALTH INPUTS
FOR EXISTING OR SUSPECTED ENVIRONMENTAL PROBLEMS
UNCERTAINTY MEASURES

Ranking Unit Name	Qualitative Uncertainty Score	Critical Data Category	Model Variability	HPI Group
Hazardous Air Emissions - Vents	High	C	0	5
Contamination in the Valley Locations	Moderate	B	3	4
Potential Leakage from Underground Tanks	Moderate	B	2	3
Contamination in the Main Hill Groundwater	Moderate	B	0	4
Inactive Leach Pit	Moderate	B	0	1
SM/PP Hill Drum Storage Area	Low	A	2	0
Contamination in Area S-1	Low	A	0	4
Contamination in the Canal	Low	A	0	4
Contamination of Dirt Road	Low	A	0	3
Contamination on the SM/PP Hill	Low	A	0	3
Contamination in Area S-7	Low	A	0	2

CRITICAL DATA CATEGORY A - The values used for the critical data were based on measured or monitored data.

CRITICAL DATA CATEGORY B - The values used for the critical data were based on a combination of measured or monitored data and a moderate amount of assumptions.

CRITICAL DATA CATEGORY C - The values used for the critical data were derived mainly from assumptions.

The overall qualitative uncertainty score, which combines the two areas of uncertainty, is presented as either high, moderate, or low. Since few of the ranking units can be described as well characterized, it appears that the uncertainty in the scores is generally more a function of the Critical Data Category than of the Model Variability. Thus, in describing overall uncertainty more weight is given to the uncertainty associated with the data than that associated with the model. Therefore, uncertainty characterized as low includes ranking units with Critical Data Category A; moderate includes ranking units with Critical Data Category B; and high includes ranking units with Critical Data Category C.

In general, a moderate to low amount of uncertainty is associated with the ranking units included within this site. Most of the uncertainty is associated with data used in the modeling. The highest scoring ranking unit has a large amount of uncertainty.

3.1.4 RIS Inputs for Time of Arrival

This criterion, as shown in Table 3.4, is designed to describe the urgency associated with the environmental problem. Thus it separates impacts projected to arrive at potential receptors within the next few years from those projected to arrive in time periods farther in the future. The time of arrival indicates the time at which either the individual risk to the modeled receptor first exceeds 10^{-7} for carcinogens or the dose exceeds one-tenth of the reference dose for non-carcinogens. If impacts are not projected to reach these levels, then the time at which the maximum individual risk or dose to the modeled receptor occurs is indicated in parentheses. These levels were chosen since EPA generally requires cleanup actions at the 10^{-6} or reference

TABLE 3.4

MOUND PLANT
RIS PUBLIC HEALTH INPUTS
FOR EXISTING OR SUSPECTED ENVIRONMENTAL PROBLEMS
TIME OF ARRIVAL

Ranking Unit Name	Time of Arrival	HPI Group Level
Contamination in the Valley Locations	Present	3
Contamination in Area S-1	Present	3
Contamination in the Canal	Present	3
Hazardous Air Emissions - Vents	Present	3
Contamination in Area S-7	(Present)*	2
Contamination of Dirt Road	(Present)*	2
Contamination on the SM/PP Hill	(Present)*	2
Contamination in the Main Hill Groundwater	8-20 Years	3
Inactive Leach Pit	(8-20 Years)*	2
Potential Leakage from Underground Tanks	21-40 Years	2
SM/PP Hill Drum Storage Area	(71-7000 Years)*	1

*Impacts are not projected to reach a risk to an individual at the modeled receptor in excess of 10^{-7} for carcinogens or a dose in excess of one-tenth of the reference dose for non-carcinogens.

dose levels. The time of arrival is defined below in terms of the period in which the above-described exposures occur.

PRESENT - The above-defined exposure is calculated or measured currently.

WITHIN THE CURRENT 5-YEAR PLANNING TIME HORIZON - The above-defined exposure is calculated to occur between 1 and 7 years from 1990 (i.e., until the end of the 5-year planning period of 1992 to 1997).

8 TO 20 YEARS - The above-defined exposure is calculated to occur during the 8- to 20-year time period.

21 TO 40 YEARS - The above-defined exposure is calculated to occur during the 21- to 40-year time period.

41 TO 70 YEARS - The above-defined exposure is calculated to occur during the 41- to 70-year time period.

71 TO 7,000 YEARS - The above-defined exposure is calculated to occur during the 71- to 7,000-year time period.

NOT WITHIN 7,000 YEARS - No contaminants are calculated to reach modeled receptors within 7,000 years.

The HPI Group Level for the single contaminant population risk - discounted, as presented in Table 3.2, column A, is also given to provide perspective on time of arrival relative to the significance of the associated ranking unit.

Since many of the ranking units for Mound include resuspension or volatilization of contaminants or overland runoff to surface water, contaminants are projected to reach receptors relatively quickly. Three ranking units involving groundwater transport of contaminants are projected to reach receptors in the near term. One ranking unit is projected to reach receptors in future generations.

3.2 RIS Inputs for Environmental Degradation Measures

RIS inputs for environmental degradation are indicators of the presence of contaminants at sensitive environments located within or near the site. Sensitive environments were identified through a screening procedure that took into account evidence of existing contamination, output from fate and transport modeling, and/or distance of the sensitive environment from the site. This procedure makes it possible to have one ranking unit affecting multiple sensitive environments. As presented in Table 3.5, the risk of contamination for each sensitive environment/ranking unit pair is characterized by three criteria. First, the sensitive environment is classified in one of seven categories that describe the type of environment potentially affected. Table 3.6 lists the sensitive environments included in categories A, B, C, D, E, F, and X. Categories A through D are drawn from EPA's Hazard Ranking System (40 Code of Federal Regulations 300, Appendix A), while categories E, F, and X are included to address specific DOE concerns. Second, the likelihood of contamination criterion assesses the probability that contaminants will reach the receptor. The three categories used to indicate likelihood are probable (exposure has already occurred or there is a greater than 90 percent likelihood that it will occur), possible (there is a realistic likelihood of exposure, between 10 and 90 percent, depending on uncertain circumstances), and negligible (exposure is highly unlikely to occur, less than 10 percent). Third, the time of arrival criterion reflects the expected period of time before the contaminant in question reaches the sensitive environment (current, within 10 years, more than 10 years).

Two sensitive environments of concern -- wetlands along the Great Miami River (Environment Type B) and the aquifer underlying the site (Environment Type F) -- were identified at Mound. As Table 3.5 indicates, two ranking units (Contamination of Dirt Road and Contamination in the Canal) were identified as a concern to both environments. In addition, two ranking units were identified as potential concerns to the wetlands alone; four others were of concern to the aquifer.

The likelihood that contaminants may reach the wetlands in detectable concentrations was deemed negligible for all four ranking units associated with this sensitive environment, primarily because the quantity of contaminants that may enter the river is likely to be extremely small relative to the river's flow. In contrast, the likelihood that contaminants would reach the aquifer was deemed probable for

TABLE 3.5

MOUND PLANT
RIS ENVIRONMENTAL DEGRADATION INPUTS
FOR EXISTING OR SUSPECTED ENVIRONMENTAL PROBLEMS

Ranking Unit Name	Sensitive Environment Type	Likelihood of Contamination	Time of Arrival
Contamination in Area S-1	B	Negligible	Within 10 Years
Contamination in Area S-7 *	Not Applicable	Not Applicable	Not Applicable
Contamination in the Canal	B	Negligible	Beyond 10 Years
	F	Possible	Within 10 Years
Contamination in the Main Hill Groundwater	F	Probable	Current
Contamination in the Valley Locations	F	Probable	Current
Contamination of Dirt Road	B	Negligible	Within 10 Years
	F	Possible	Within 10 Years
Contamination on the SM/PP Hill *	Not Applicable	Not Applicable	Not Applicable
Hazardous Air Emissions - Vents	B	Negligible	Within 10 Years
Inactive Leach Pit	F	Possible	Within 10 Years
Potential Leakage from Underground Tanks	F	Possible	Beyond 10 Years
SM/PP Hill Drum Storage Area *	Not Applicable	Not Applicable	Not Applicable

* Sensitive environments were not identified for this ranking unit and therefore environmental degradation is not an applicable criterion.

TABLE 3.6

SENSITIVE ENVIRONMENT CATEGORIES

Category A

Critical habitat for federally designated endangered or threatened species
Marine Sanctuary
National Park
Designated Federal Wilderness Area
Areas identified under the Coastal Zone Management Act
Sensitive areas identified under the National Estuary Program or Near Coastal Waters Program
Critical areas identified under the Clean Lakes Program
National Monument (air pathway only)
National Seashore Recreational Area
National Lakeshore Recreational Area

Category B

Habitat known to be used by federally designated or proposed endangered or threatened species
Wetlands (freshwater, estuarine or coastal -- five-acre minimum)
National Preserve
National or State Wildlife Refuge
Unit of the Coastal Barrier Resources System
Coastal Barrier (undeveloped)
Federal land designated for protection of natural ecosystems
Administratively Proposed Federal Wilderness Area
Spawning areas critical for the maintenance of a fish species within a river system, coastal embayment, or estuary (e.g., anadromous salmon, alewives, shad)
Migratory pathways critical for the maintenance of a fish species within a river system, coastal embayment, or estuary
Feeding areas critical for the maintenance of a fish species within a river system, coastal embayment, or estuary
National river reach designated as recreational

Category C

Habitat known to be used by State-designated endangered or threatened species
Habitat known to be used by a species under review as to its Federal endangered or threatened status
State-designated areas for the protection or maintenance of aquatic life (coastal, estuarine, or freshwater area)
Coastal Barrier (partially developed)
Federally designated Scenic or Wild River

TABLE 3.6

SENSITIVE ENVIRONMENT CATEGORIES (Continued)

Category D

State land designated for wildlife or game management
State-designated Scenic or Wild River
State-designated Natural Areas
Particular areas, relatively small in size, important to the maintenance of unique biotic communities (e.g., prairie pot holes, buffalo wallows, alligator holes, desert springs)

Category E

Other environmental resources (applied only to ranking units that pose no threat to human heatlh)

Category F

Important aquifers (e.g., sole-source aquifers)

Category X

Stratospheric ozone layer

Source: Categories A through D are taken directly from the proposed HRS (Federal Register, Vol. 53, No. 247, Dec. 23, 1988, pp. 52019-20). Categories E, F and X have been added to reflect additional concerns at DOE sites.

two ranking units (Contamination in the Main Hill Groundwater and Contamination in the Valley Locations), since contaminants are already present in the aquifer at measurable levels. For four other ranking units, the likelihood that contaminants would reach the aquifer in measurable amounts was deemed possible; while contamination from these ranking units has not been detected in groundwater, the presence of contaminants in the soil suggests that groundwater contamination may occur in the future.

As noted above, the chance that contaminants from Mound might reach the Great Miami River wetlands in detectable amounts was deemed negligible. Based on the absence of detectable concentrations of contaminants at this sensitive environment, none of the four ranking units of concern were classified as current. For three ranking units, however, the transport pathways of concern suggest that any contaminants that might reach the wetlands would do so within 10 years. This is the case for two ranking units where overland runoff is the most likely transport pathway (Contamination in Area S-1 and Contamination of Dirt Road), and for one ranking unit where airborne contaminants are of primary concern (Hazardous Air Emissions - Vents). For the fourth ranking unit associated with the wetlands (Contamination in the Canal), the only pathway of concern is transport of contaminants to the wetlands via groundwater; any contaminants that might reach the wetlands via this route would not be expected to do so within 10 years.

Two ranking units were classified as current relative to the aquifer underlying Mound. As indicated above, contaminants from these ranking units (Contamination in the Main Hill Groundwater and Contamination in the Valley Locations) have been detected in the aquifer. Due to the proximity of contaminants to the aquifer, three other ranking units were classified as near-term. The remaining ranking unit of concern, Potential Leakage from Underground Tanks, was classified as long-term.

4.0 RISK INFORMATION SYSTEM INPUTS FOR SITUATIONS THAT MAY REPRESENT POTENTIAL FUTURE ENVIRONMENTAL PROBLEMS

There are no ranking units that represent potential future environmental problems for the Mound Plant.

5.0 SUMMARY OF FINDINGS NOT INCLUDED WITHIN THE SUMMARY RANKINGS

Eleven of the findings were not ranked as they were beyond the focus of the prioritization; seven because they represent compliance or management issues and four because they dealt with data quality issues.

The compliance/management issues focused on potential environmental releases, improper storage of hazardous waste, and improper management of dose assessment evaluations (see Final Survey Findings: Toxic and Chemical Materials II-1; Waste Management III-1, III-2, III-3, III-4; Air II-3 and III-1). The data quality findings included insufficient laboratory quality assurance, inadequate characterization of the hydrogeologic regime, and deficiencies in the dose assessment procedures (see Final Survey Findings: Quality Assurance/Quality Control III-1; Groundwater III-3; Air II-1 and II-2).

6.0 RANKING UNIT NARRATIVES

This section includes a short narrative on each ranking unit in the order that they are presented in Section 1.0 of this Report. Each narrative is formatted to provide a concise discussion of specific information pertaining to the ranking unit. The specific information in these narratives includes a short discussion of the following:

- description of ranking unit;
- supporting Final Survey Findings (see explanation below);
- how the ranking unit was modeled;
- results of the risk-based ranking;
- qualifiers to the risk-based ranking;
- qualitative uncertainty analysis;
- regulatory aspects of the ranking unit; and
- status of the ranking unit in 1990.

The supporting Final Survey Findings are organized by the following technical areas: air, soil, surface water, groundwater, waste management, toxic and chemical materials, radiation, quality assurance/quality control, and inactive sites and releases.

Roman numerals refer to the category in which the finding has been placed. Thus, Category II findings have a Roman numeral II, while a Roman numeral III represents a Category III finding. The second number refers to the specific finding in the category. Thus, an Air III-4 refers to the fourth Category III air finding in the Environmental Survey Preliminary Report for that site.

Section 8.0 of this Report should be reviewed for a more detailed discussion of each finding. Many of the Final Survey Findings have multiple aspects. To reflect this,

some findings are included in more than one ranking unit, while others are grouped together with related findings into a single unit. In addition, for some findings, only a part of the finding was ranked. The remainder may have centered on an aspect that was beyond the focus of this ranking.

The ranking units, Final Survey Findings, and results of the risk-based ranking are based on information collected during the on-site assessment and during a 1989 follow-up visit. They do not reflect corrective actions taken by the site subsequent to the follow-up visit. However, sites have provided updates of the regulatory aspects and status of each of the ranking units as of 1990, which are presented in this Section.

6.1 Existing or Suspected Environmental Problems

6.1.1 Hazardous Air Emissions - Vents

Description of Ranking Unit

There is a potential for atmospheric releases of organic contaminants from 570 ventilation hoods from production buildings at the facility. These organic compounds include acetone and methylene chloride.

Supporting Final Survey Finding

Air II-4

How the Ranking Unit was Modeled

The transport pathway that was modeled is a release to air.

The exposure pathways that were modeled include: 1) the potential for inhalation of contaminants; and 2) the potential for consumption of potentially contaminated crops and crop-fed livestock within a 50-mile radius of the site.

The transport pathways and associated exposure pathways that were not modeled include groundwater, overland runoff, and surface water. Since the release is to air,

the likelihood of groundwater or surface water contamination is negligible. Surface water bodies which could absorb volatiles would dilute these contaminants to undetectable concentrations. In addition, since the contaminants are volatiles, they are unlikely to deposit in any detectable concentrations on the soil and subsequently contaminate the groundwater.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report. Constituents modeled included the five most heavily used and most toxic volatile organics on the site, as reported in the above-mentioned document. Since the contaminants of concern were volatile organics, there are no major gaps in the type of contaminants modeled.

As part of the Survey Sampling and Analysis (S&A) Program, air samples from Building 28 vents were collected and analyzed for organics. The analysis confirmed the presence of contaminants such as acetone and methylene chloride. These data were used to determine the source term.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in a Hazard Potential Index (HPI) Group 5, which would place the ranking unit with those environmental problems that represent a tertiary level of concern from the potential hazard perspective. Scores for this group are generally a result of either small receptor populations, low doses, or low-toxicity contaminants. The driving contaminant was 1,1,1-trichloroethane, which potentially could be transported through the air to the receptors where it could potentially be inhaled. The contaminant and pathway scored in an HPI Group 5 because of the volume of contaminant assumed to volatilize and the speed of transport through the air, which results in a near-term impact at the receptor. The area surrounding the Mound Plant was modeled as supporting a large population.

Qualifiers to the Risk-Based Ranking

None of the standard qualifiers apply to this ranking unit.

Qualitative Uncertainty Analysis

This ranking unit scores for 1,1,1-trichloroethane in air. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range within the same HPI Group. Based on an evaluation of the modeling for this ranking unit, the critical data are the volumes of volatiles which evaporated and the velocity of the releases from the vents, which were derived from assumptions. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is a "C", implying a high level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a large amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that the Regional Air Pollution Control Agency is aware of air sources. The air sources are being characterized to determine if permits are required.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that characterization has been initiated and is scheduled for completion by September 30, 1990.

6.1.2 Inactive Leach Pit

Description of Ranking Unit

There is a potential for groundwater releases of organic contaminants from the subsurface soil in a 25-ft by 25-ft pit on the western portion of the facility. This pit received acetone for 18 years until 1985. This potential release of acetone to the groundwater from leachate migration could result in groundwater contamination.

Supporting Final Survey Findings

Inactive Sites and Releases III-3; Groundwater III-1 (portion)

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration to groundwater; and 2) potential contaminant migration to groundwater, which recharges nearby surface water from groundwater seeps.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion and inhalation of bathwater derived from potentially contaminated groundwater; 3) the potential for ingestion of potentially contaminated surface water; 4) the potential for ingestion of fish dependent on potentially contaminated surface water; 5) the potential for ingestion of bathwater derived from potentially contaminated surface water; and 6) the potential for accidental ingestion of potentially contaminated surface water while swimming in the river.

The transport pathways that were not modeled include: 1) potential contaminant releases to the air and overland runoff because this is an underground release of contaminants; and 2) direct discharge from the stormwater system because the ranking unit initially contaminates the groundwater. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater or surface water because there is no reported usage of groundwater or surface water for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and recent on-site well data supplied by Mound personnel. The constituent modeled was acetone, which was the only constituent of concern. As a result there are no major data gaps in the contaminants modeled.

As part of the Survey S&A Program, soil core samples at the leach pit near Building 42 were collected and analyzed for volatiles and semivolatiles. In addition, groundwater samples were collected in downgradient wells. The results of the soil analyses were inconclusive. The groundwater data were used to calibrate the modeling.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 1, which would place the ranking unit with those environmental problems that are characterized as generally reaching receptors at levels well below those used in regulatory decisions. The driving contaminant was acetone, which potentially could travel through the groundwater to the receptor well where it could potentially be used for drinking. The contaminant and pathway scored in an HPI Group 1 because of the small amount of acetone determined to be released to the groundwater. The high mobility of acetone results in a potential mid-term impact at the receptor. The well was modeled with a small-size drinking population.

Qualifiers to the Risk-Based Ranking

This ranking unit scores for potential contamination of groundwater or surface water by organics. The qualifiers discussed in Section 7.0 apply.

Qualitative Uncertainty Analysis

This ranking unit scores for acetone in groundwater. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range within the same HPI Group. Based on an evaluation of the modeling for this ranking unit, the critical datum is the release rate of acetone, which was derived in part from measured data and in part from assumptions. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is a "B", implying a moderate level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a moderate amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that this ranking unit is included as an operable unit in an Interagency Agreement. A complete Remedial

Investigation/Feasibility Study (RI/FS) will be performed and appropriate action will be taken.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that additional data needs have been identified and a sampling plan is being written.

6.1.3 Contamination in the Canal

Description of Ranking Unit

There is a potential for groundwater releases of plutonium-238 from the subsurface soil in a 4,000-ft by 20-ft portion of the abandoned Miami-Erie Canal that is about 500 feet west of Areas V-1 and V-5. This site received accidental discharge of plutonium-238 during 1969.

Supporting Final Survey Finding

Inactive Sites and Releases III-1

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration from surface soils to groundwater; 2) potential resuspension of potentially contaminated soils; and 3) potential overland runoff of potentially contaminated surface soils to surface water.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion of bathwater derived from potentially contaminated groundwater; 3) the potential for ingestion of fish dependent on potentially contaminated surface water; 4) the potential for ingestion of potentially contaminated surface water; 5) the potential for inhalation of contaminants; 6) the potential for consumption of potentially contaminated crops and crop-fed livestock by airborne resuspension within a 50-mile radius of the site; 7) the potential for external exposure to radionuclides during surface water-

related recreational activities; 8) the potential for ingestion of bathwater derived from potentially contaminated surface water; and 9) the potential for accidental ingestion of potentially contaminated surface water while swimming in the river.

The transport pathways that were not modeled include: 1) direct discharge from the stormwater system to surface water because this is a release of contaminants to the soil; 2) potential contaminant migration to groundwater that recharges surface water because the river recharges the groundwater in this area; and 3) volatilization because the contaminant of concern does not volatilize. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater or surface water because there is no reported usage of groundwater or surface water for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and the Environmental Survey Sampling and Analysis Data Document for Mound. The constituent modeled was plutonium-238 and its daughter products, which were the only constituents of concern. As a result there are no major data gaps in the contaminants modeled.

As part of the Survey S&A Program, soil core samples were collected from within the canal and analyzed for the presence of radionuclides. The results of the analysis confirmed the presence of plutonium-238. The results were used to calculate the source term.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 4, which would place the ranking unit with those environmental problems that represent a tertiary level of concern from the potential hazard perspective. Scores for this group are generally a result of either small receptor populations, low doses, or low-toxicity contaminants. The driving contaminant was plutonium-238, which potentially could be transported through the air to the receptors where it could potentially be inhaled. The contaminant and pathway scored in an HPI Group 4 because of the concentration of contaminant in the soil and the percent and type of vegetation. The speed of

transport through the air results in a near-term impact at the receptor. The area surrounding the Mound Plant was modeled as supporting a large population.

Qualifiers to the Risk-Based Ranking

This ranking unit includes potential for contaminated soil runoff. The qualifiers discussed in Section 7.0 apply.

Qualitative Uncertainty Analysis

This ranking unit scores for plutonium-238 in air. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range within the same HPI Group. Based on an evaluation of the modeling for this ranking unit, the critical data are the concentration of plutonium-238 and the percent and type of vegetation present at the site, which were derived from measured data. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is an "A", implying a low level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a relatively low amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that this ranking unit is included as an operable unit in an Interagency Agreement. Any action taken will depend on risk assessment studies.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that an RI/FS is in preparation.

6.1.4 Contamination of Dirt Road

Description of Ranking Unit

Elevated beta/gamma radiation readings were detected off-site on a dirt road east of the Miami-Erie Canal. The road is approximately one-half mile long and extends southward from a recreation parking lot. The dirt road appeared to be partially constructed of an ash material that may be fly ash from a coal-fired boiler. Coal fly-ash typically contains a radioactive component due to the natural radioactivity in the native coal.

Supporting Final Survey Finding

Inactive Sites and Releases III-7

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration from surface soils to groundwater; 2) potential resuspension of potentially contaminated soils; and 3) potential overland runoff of potentially contaminated surface soils to surface water.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion of bathwater derived from potentially contaminated groundwater; 3) the potential for ingestion of fish dependent on potentially contaminated surface water; 4) the potential for ingestion of potentially contaminated surface water; 5) the potential for inhalation of contaminants; 6) the potential for consumption of potentially contaminated crops and crop-fed livestock by airborne resuspension within a 50-mile radius of the site; 7) the potential for external exposure to radionuclides during surface water-related recreational activities; 8) the potential for ingestion of bathwater derived from potentially contaminated surface water; and 9) the potential for accidental ingestion of potentially contaminated surface water while swimming in the river.

The transport pathways that were not modeled include: 1) direct discharge from the stormwater system to surface water because this is a release of contaminants to the

soil; 2) potential contaminant migration to groundwater that recharges surface water because the river recharges the groundwater in this area; and 3) volatilization because the contaminant of concern does not volatilize. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater or surface water because there is no reported usage of groundwater or surface water for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and the Environmental Survey Sampling and Analysis Data Document for Mound. The constituent modeled was plutonium-238 and its daughter products, which were the only constituents of concern. As a result there are no major data gaps in the contaminants modeled.

As part of the Survey S&A Program, soil samples were collected from the dirt road and analyzed for radionuclides. The results confirmed the presence of plutonium-238. These data were used to determine the source term.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 3, which would place the ranking unit with those environmental problems that are characterized as generally reaching receptors at levels well below those used in regulatory decisions. The driving contaminant was plutonium-238, which potentially could be transported through the air to the receptors where it could potentially be inhaled. The contaminant and pathway scored in an HPI Group 3 because of the concentration of contaminant in the soil and the percent of non-erodible material present on the site. The speed of transport through the air results in a near-term impact at the receptor. The area surrounding the Mound Plant was modeled as supporting a large population.

Qualifiers to the Risk-Based Ranking

This ranking unit includes potential for contaminated soil runoff. The qualifiers discussed in Section 7.0 apply.

Qualitative Uncertainty Analysis

This ranking unit scores for plutonium-238 in air. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range within the same HPI Group. Based on an evaluation of the modeling for this ranking unit, the critical data are the concentration of plutonium-238 and the percent of non-erodible material present on the site, which were derived from measured data. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is an "A", implying a low level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a relatively low amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that there is no regulatory action pending.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that no further action is anticipated.

6.1.5 Contamination in Area S-1

Description of Ranking Unit

There is a potential for groundwater, surface water, and atmospheric releases of radioactive contamination from the soil in a 500-ft by 1,300-ft portion of the facility. This site received discharges of plutonium-238 and thorium-232 during 1964.

Supporting Final Survey Finding

Soil III-1

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration from surface soils to groundwater; 2) potential resuspension of potentially contaminated soils; and 3) potential overland runoff of potentially contaminated surface soils to surface water.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion of bathwater derived from potentially contaminated groundwater; 3) the potential for ingestion of fish dependent on potentially contaminated surface water; 4) the potential for ingestion of potentially contaminated surface water; 5) the potential for inhalation of contaminants; 6) the potential for consumption of potentially contaminated crops and crop-fed livestock by airborne resuspension within a 50-mile radius of the site; 7) the potential for external exposure to radionuclides during surface water-related recreational activities; 8) the potential for ingestion of bathwater derived from potentially contaminated surface water; and 9) the potential for accidental ingestion of potentially contaminated surface water while swimming in the river.

The transport pathways that were not modeled include: 1) direct discharge from the stormwater system to surface water because this is a release of contaminants to the soil; 2) potential contaminant migration to groundwater that recharges surface water because the river recharges the groundwater in this area; and 3) volatilization because the contaminants of concern either do not volatilize or were disposed of in the past so that volatilization would have already occurred. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater or surface water because there is no reported usage of groundwater or surface water for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and the Environmental Survey Sampling and Analysis Data Document for Mound. The constituents modeled were plutonium-238 and its daughter products, and thorium-232, which were the only constituents of concern. As a result there are no major data gaps in the contaminants modeled.

As part of the Survey S&A Program, soil samples were collected from the drainage swale on the new property near Building 21. The samples were analyzed for radionuclides. The analysis confirmed the presence of plutonium-238 and thorium-232. These data were used to determine the source term.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 4, which would place the ranking unit with those environmental problems that represent a tertiary level of concern from the potential hazard perspective. Scores for this group are generally a result of either small receptor populations, low doses, or low-toxicity contaminants. The driving contaminant was plutonium-238, which potentially could be transported through the air to the receptors where it could potentially be inhaled. The contaminant and pathway scored in an HPI Group 4 because of the concentration of contaminant in the soil. The speed of transport through the air results in a potential near-term impact at the receptor. The area surrounding the Mound Plant was modeled as supporting a large population.

Qualifiers to the Risk-Based Ranking

This ranking unit includes potential for contaminated soil runoff. The qualifiers discussed in Section 7.0 apply.

Qualitative Uncertainty Analysis

This ranking unit scores for plutonium-238 in air. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range within the same HPI Group. Based on an evaluation of the modeling for this ranking unit, the critical datum is the concentration of plutonium-238, which was derived from measured data. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is an "A", implying a low level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a relatively low amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that this site is in Mound's decontamination and decommissioning (D&D) program and as such will be made part of the Interagency Agreement.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that an RI/FS will be prepared.

6.1.6 Contamination in the Valley Locations

Description of Ranking Unit

There is a potential for groundwater contamination and atmospheric releases due to radioactive and chemical contamination of areas in the valley. These areas include M-1, M-2, M-3, M-5, V-1, V-2, the Diversion Basin, and the Lower Retention Pond; they have received radiologically and chemically contaminated discharges over the last 18 years.

Supporting Final Survey Findings

Soil III-2 (portion), III-3 (portion); Groundwater III-2; Surface Water III-1; Inactive Sites and Releases III-2, III-4, and III-6

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration from surface soils to groundwater; and 2) potential resuspension and volatilization of potentially contaminated soils.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion and inhalation of bathwater derived from potentially contaminated groundwater; 3) the potential for inhalation of contaminants; and 4) the potential for consumption of

potentially contaminated crops and crop-fed livestock within a 50-mile radius of the site.

The transport pathways that were not modeled include: 1) direct discharge from the stormwater system to surface water because this is a release of contaminants to the soil; 2) potential contaminant migration to groundwater that recharges surface water because the river recharges the groundwater in this area; and 3) overland transport of contaminants to the surface water because retention basins intercept and retain all surface erosion. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater because there is no reported usage of groundwater for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and the Environmental Survey Sampling and Analysis Data Document for Mound. The constituents modeled were organics, inorganics, and radionuclides encountered in the S&A effort. As a result, there are no data gaps in the contaminants modeled.

As part of the Survey S&A Program, soil, sediment, surface water, and groundwater samples were collected from valley locations. The samples were analyzed for organics, inorganics, and radionuclides. The results confirmed the presence of contaminants such as lead and trichloroethylene. These data were used to develop the source term.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 4, which would place the ranking unit with those environmental problems that represent a tertiary level of concern from the potential hazard perspective. Scores for this group are generally a result of either small receptor populations, low doses, or low-toxicity contaminants. The driving contaminant was benzo(b)fluoranthene, which potentially could travel through the groundwater to the receptor well where it could potentially be used for drinking. The contaminant and pathway scored in an HPI Group 4 because of the inventory of the contaminant and the proximity to the receptor well. The low

mobility of the contaminant results in a potential future generational impact at the receptor. The well was modeled with a small-size drinking population.

Qualifiers to the Risk-Based Ranking

This ranking unit scores for potential contamination of groundwater or surface water by organics. The qualifiers discussed in Section 7.0 apply.

Qualitative Uncertainty Analysis

This ranking unit scores for benzo(b)fluoranthene in groundwater. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range of three HPI Groups. Based on an evaluation of the modeling for this ranking unit, the critical data are the inventory of benzo(b)fluoranthene and the receptor population, which were derived in part from measured data and in part from assumptions. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is a "B", implying a moderate level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a moderate amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that all contaminated soil areas are included as an operable unit in an Interagency Agreement. Action taken will be consistent with RI/FS guidelines.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that a draft RI/FS is in internal review.

6.1.7 Contamination on the SM/PP Hill

Description of Ranking Unit

There is a potential for groundwater, surface water, and atmospheric releases of radioactive contamination from the soil in a 205-ft by 800-ft area of the facility. This site received discharges of plutonium-238, thorium-232, and actinium-227 during the past 25 years.

Supporting Final Survey Findings

Soil III-2 (portion), III-3 (portion); Inactive Sites and Releases III-5

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration from surface soils to groundwater; and 2) potential resuspension and volatilization of potentially contaminated soils.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion and inhalation of bathwater derived from potentially contaminated groundwater; 3) the potential for inhalation of contaminants; and 4) the potential for consumption of potentially contaminated crops and crop-fed livestock within a 50-mile radius of the site.

The transport pathways that were not modeled include: 1) direct discharge from the stormwater system to surface water because this is a release of contaminants to the soil; 2) potential contaminant migration to groundwater that recharges surface water because the river recharges the groundwater in this area; and 3) overland transport of contaminants to the surface water because retention basins intercept and retain all surface erosion. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater because there is no reported usage of groundwater for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and the Environmental Survey Sampling and Analysis Data Document for Mound. The constituents modeled were radionuclides, organics, and inorganics, which were the constituents of concern. As a result there are no major data gaps in the contaminants modeled.

As part of the Survey S&A Program, sediment and water samples were collected from the ponds at the base of the SM/PP Hill. The samples were analyzed for volatiles, semivolatiles, and inorganics. The results indicated the presence of contaminants including pyrene, fluoranthene, and beryllium. These data were used to determine the source term for modeling.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 3, which would place the ranking unit with those environmental problems that are characterized as generally reaching receptors at levels well below those used in regulatory decisions. The driving contaminant was chromium VI, which potentially could be transported through the air to the receptors where it could potentially be inhaled. The contaminant and pathway scored in an HPI Group 3 because of the concentration of chromium VI in the soil and the percent and type of vegetation present on the site. The speed of transport through the air results in a near-term impact at the receptor. The area surrounding the Mound Plant was modeled as supporting a large population.

Qualifiers to the Risk-Based Ranking

None of the standard qualifiers apply to this ranking unit.

Qualitative Uncertainty Analysis

This ranking unit scores for chromium VI in air. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range within the same HPI Group. Based on an evaluation of the modeling for this ranking unit, the critical data are the concentration of chromium VI and the percent and type of vegetation present at the

site, which were derived from measured data. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is an "A", implying a low level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a relatively low amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that this ranking unit is a composite of several areas which are parts of several operable units in an Interagency Agreement. One or more RI/FS documents will cover this general area.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that one or more RI/FS documents will be prepared.

6.1.8 Contamination in Area S-7

Description of Ranking Unit

There is a potential for groundwater, surface water, and atmospheric releases of radioactive contamination from the soil in a 100-ft by 100-ft area of the facility. This site received discharges of cobalt-60 during 1985.

Supporting Final Survey Finding

Soil III-2 (portion)

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration from surface soils to groundwater; and 2) potential resuspension of potentially contaminated soils.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion of bathwater derived from potentially contaminated groundwater; 3) the potential for inhalation of contaminants; and 4) the potential for consumption of potentially contaminated crops and crop-fed livestock by airborne resuspension within a 50-mile radius of the site.

The transport pathways that were not modeled include: 1) direct discharge from the stormwater system to surface water because this is a release of contaminants to the soil; 2) potential contaminant migration to groundwater that recharges surface water because the river recharges the groundwater in this area; 3) volatilization because the contaminants of concern do not volatilize; and 4) overland transport of contaminants to the surface water because retention basins intercept and retain all surface erosion. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater or surface water because there is no reported usage of groundwater or surface water for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and the "Mound Site Survey Project for the Characterization of Radioactive Materials in Site Soils" Draft, MLM-ML-86. The constituent modeled was cobalt-60, which was the only constituent of concern. As a result there are no major data gaps in the contaminants modeled.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 2, which would place the ranking unit with those environmental problems that are characterized as generally reaching receptors at levels well below those used in regulatory decisions. The driving contaminant was cobalt-60, which potentially could be transported through the air to the receptors where it could potentially be inhaled. The contaminant and pathway scored in an HPI Group 2 because of the concentration of the contaminant in the soil and the percent and type of vegetation present on the site. The speed of transport through the air results in a near-term impact at the receptor. The area surrounding the Mound Plant was modeled as supporting a large population.

Qualifiers to the Risk-Based Ranking

None of the standard qualifiers apply to this ranking unit.

Qualitative Uncertainty Analysis

This ranking unit scores for cobalt-60 in air. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range within the same HPI Group. Based on an evaluation of the modeling for this ranking unit, the critical data are the concentration of cobalt-60 and the percent and type of vegetation present at the site, which were derived from measured data. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is an "A", implying a low level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a relatively low amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that this area is included as an operable unit in an Interagency Agreement. Action will be taken consistent with RI/FS guidelines.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that a draft RI/FS is in internal review.

6.1.9 Contamination in the Main Hill Groundwater

Description of Ranking Unit

Past on-site releases have resulted in tritium contamination of groundwater on the Main Hill. Site sampling has confirmed tritium contamination and has found elevated tritium concentrations in shallow groundwater.

Supporting Final Survey Findings

Groundwater II-1 and III-1 (portion)

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration from surface soils to groundwater; 2) potential contaminant migration to groundwater that recharges nearby surface water from groundwater seeps; and 3) potential volatilization of contaminated seepwater.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion and inhalation of bathwater derived from potentially contaminated groundwater; 3) the potential for ingestion of potentially contaminated surface water; 4) the potential for ingestion of fish dependent on potentially contaminated surface water; 5) the potential for ingestion of bathwater derived from potentially contaminated surface water; 6) the potential for external exposure to radionuclides during surface water-related recreational activities; 7) the potential for accidental ingestion of potentially contaminated surface water while swimming in the river; and 8) the potential for consumption of potentially contaminated crops and crop-fed livestock within a 50-mile radius of the site.

The transport pathways that were not modeled include: 1) direct discharge from the stormwater system to surface water because the ranking unit initially contaminates the groundwater; and 2) overland transport of contaminants to the surface water because retention basins intercept and retain all surface erosion. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater or surface water because there is no reported usage of groundwater or surface water for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report, the Environmental Survey Sampling and Analysis Data Document, and recent on-site well data presented in the Mound Environmental Monitoring Report for 1988. The constituents modeled were tritium

and three organics encountered in the Survey S&A Program. As these are the only constituents encountered in sampling, they are the only constituents of concern. As a result there are no major data gaps in the contaminants modeled.

As part of the Survey S&A Program, water samples from seeps and groundwater monitoring wells were collected and analyzed for volatiles, semivolatiles, inorganics, and radionuclides. The results confirmed the presence of contaminants such as tritium and tetrachloroethylene. These data were used to determine the source term and to calibrate the model.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 4, which would place the ranking unit with those environmental problems that represent a tertiary level of concern from the potential hazard perspective. Scores for this group are generally a result of either small receptor populations, low doses, or low-toxicity contaminants. The driving contaminant was tetrachloroethylene, which potentially could travel through the groundwater to the receptor well where it could potentially be used for drinking. The contaminant and pathway scored in an HPI Group 4 because of the amount of tetrachloroethylene determined to be released to the groundwater. The high mobility of tetrachloroethylene results in a potential mid-term impact at the receptor. The well was modeled with a small-size drinking population.

Qualifiers to the Risk-Based Ranking

This ranking unit scores for potential contamination of groundwater or surface water by organics. The qualifiers discussed in Section 7.0 apply.

Qualitative Uncertainty Analysis

This ranking unit scores for tetrachloroethylene in groundwater. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range within the same HPI Group. Based on an evaluation of the modeling for this ranking unit, the critical data are the release rates of tetrachloroethylene, which were derived in part from measured data and in part from assumptions. Therefore, the Critical Data

Category, which represents the uncertainty associated with the data, for this ranking unit is a "B", implying a moderate level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a moderate amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that this ranking unit is included as an operable unit in an Interagency Agreement. Actions taken will be consistent with RI/FS guidelines.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that a draft RI/FS is in internal review.

6.1.10 SM/PP Hill Drum Storage Area

Description of Ranking Unit

There is a potential for groundwater releases of organic and inorganic contaminants from the subsurface soil in a 50-ft by 50-ft area of the facility that was previously used for storage of drums in 1985. Contents of the drums include organics and inorganics.

Supporting Final Survey Finding

Inactive Sites and Releases III-8

How the Ranking Unit was Modeled

The transport pathways that were modeled include: 1) potential contaminant migration from surface soils to groundwater; and 2) potential resuspension and volatilization of potentially contaminated soils.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion and

inhalation of bathwater derived from potentially contaminated groundwater; 3) the potential for inhalation of contaminants; and 4) the potential for consumption of potentially contaminated crops and crop-fed livestock within a 50-mile radius of the site.

The transport pathways that were not modeled include: 1) potential contaminant migration to groundwater that recharges surface water because the river recharges the groundwater in this area; 2) direct discharge from the stormwater system to surface water because there is no stormwater system servicing this storage area; and 3) overland transport of contaminants to the surface water because retention basins intercept and retain all surface erosion. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on potentially contaminated groundwater or surface water because there is no reported usage of groundwater or surface water for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and the Environmental Survey Sampling and Analysis Data Document for Mound. The constituents modeled were inorganics and organics, which were the only constituents of concern. As a result there are no major data gaps in the contaminants modeled.

As part of the Survey S&A Program, soil samples were collected and analyzed for the presence of volatiles, semivolatiles, radionuclides, and inorganics. The results of the analysis confirmed the presence of contaminants such as cadmium, methyl ethyl ketone, and pyrene. These data were used to determine the source term for modeling.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 0, which would place the ranking unit with those environmental problems that are not projected to reach receptors. A wide variety of organic and inorganic constituents were modeled, and none of them scored. This ranking unit did not score because of the low concentration of contaminants and the high percentage of non-erodible material and vegetation at the site.

Qualifiers to the Risk-Based Ranking

None of the standard qualifiers apply to this ranking unit.

Qualitative Uncertainty Analysis

This ranking unit ranks in HPI Group 0. For a well-characterized problem, the Model Variability associated with the combination of the modeled transport scenario and constituent will typically exhibit a range of three HPI Groups. Based on an evaluation of the modeling for this ranking unit, the critical data are the concentration of contaminants and the percent of non-erodible material on the site, which were derived from measured data. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is an "A", implying a low level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a relatively low amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that this ranking unit is included as an operable unit in an Interagency Agreement. Actions taken will be consistent with RI/FS guidelines.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that an RI/FS will be prepared.

6.1.11 Potential Leakage from Underground Tanks

Description of Ranking Unit

There is a potential for groundwater releases of organic contaminants from the subsurface soil behind Building 51 from an underground solvent storage tank. The tanks have not been leak tested.

Supporting Final Survey Findings

Toxic and Chemical Materials III-1 and III-2

How the Ranking Unit was Modeled

The standard release scenario for leaking underground storage tanks (USTs) was used in modeling this ranking unit. The tanks were placed into one of five age groups: 0-5, 6-10, 11-15, 16-20, and greater than 20 years old. A fixed percentage of each tank age group was assumed to leak. The percentages of each tank in the age groups discussed above that are assumed to leak at a site are 1.6, 10.8, 22.5, 25.9, and 40, respectively. The leak rate for all tanks that leak was held at one percent of the tank contents per week. Inactive tanks were assumed to leak until the total tank inventory was depleted. Active tanks were assumed to leak until 1994 when regulations for USTs will require leak testing, corrosion protection, leak detection, or tank removal. No tanks were assumed to be removed, replaced or repaired until 1994.

The transport pathways that were modeled include: 1) potential contaminant migration to groundwater; and 2) potential contaminant migration to groundwater that recharges nearby surface water from groundwater seeps.

The exposure pathways that were modeled include: 1) the potential for ingestion of potentially contaminated groundwater; 2) the potential for ingestion and inhalation of bathwater derived from potentially contaminated groundwater; 3) the potential for ingestion of potentially contaminated surface water; 4) the potential for ingestion of fish dependent on potentially contaminated surface water; 5) the potential for ingestion of bathwater derived from potentially contaminated surface water; and 6) the potential for accidental ingestion of potentially contaminated surface water while swimming in the river.

The transport pathways that were not modeled include: 1) potential contaminant releases to the air and overland runoff because this is an underground release of contaminants; and 2) direct discharge from the stormwater system to surface water because the ranking unit initially contaminates the groundwater. The exposure pathway that was not modeled is ingestion of crops and livestock dependent on

potentially contaminated groundwater or surface water because there is no reported usage of groundwater or surface water for irrigation of crops or as feedwater for animals that may be consumed.

Data used in modeling this ranking unit were derived primarily from the Environmental Survey Preliminary Report and the Environmental Survey Sampling and Analysis Data Document. The constituents modeled were organics and inorganics encountered in the Survey S&A Program. As these are the only constituents encountered in sampling, they are the only constituents of concern. As a result there are no major data gaps in the contaminants modeled.

As part of the Survey S&A Program, sludge samples from the tank and soil gas samples from near the tank were collected. The samples were analyzed for volatiles, semivolatiles, inorganics, and polychlorinated biphenyls (PCBs). The samples confirmed the presence of contaminants such as PCBs, methyl ethyl ketone, and trichloroethylene. These data were used to determine the source term for modeling.

Results of the Risk-Based Ranking

This ranking unit at the Mound Plant ranks in an HPI Group 3, which would place the ranking unit with those environmental problems that are characterized as generally reaching receptors at levels well below those used in regulatory decisions. The driving contaminant was PCBs, which potentially could travel through the groundwater to the receptor well where it could potentially be used for drinking. The contaminant and pathway scored in an HPI Group 3 because of the small amount of PCBs released to the groundwater and the low mobility of PCBs, which results in a potential future generational impact at the receptor. The well was modeled with a small-size drinking population.

Qualifiers to the Risk-Based Ranking

This ranking unit scores for potential contamination of groundwater or surface water by organics. The qualifiers discussed in Section 7.0 apply.

Qualitative Uncertainty Analysis

This ranking unit scores for PCBs in groundwater. For a well-characterized problem, the Model Variability associated with this combination of scoring transport scenario and constituent will typically exhibit a range of two HPI Groups. Based on an evaluation of the modeling for this ranking unit, the critical data are the release rates of the PCBs, which were derived in part from measured data and in part from assumptions. Therefore, the Critical Data Category, which represents the uncertainty associated with the data, for this ranking unit is a "B", implying a moderate level of uncertainty is associated with the data. The combined Model Variability and Critical Data Category result in a moderate amount of uncertainty associated with this ranking unit.

Regulatory Aspects of the Ranking Unit

In June 1990, the site informed the Survey that all USTs are in a program to assure compliance with UST regulations. The UST program is being tracked by the United States and Ohio Environmental Protection Agencies through the Interagency Agreement.

Status of the Ranking Unit in 1990

In June 1990, the site informed the Survey that UST guidelines are being followed and six tanks were leak-tested in 1989 and appropriate action taken.

7.0 LIST OF QUALIFIERS TO THE RISK-BASED RANKINGS

Potential Contamination of Groundwater or Surface Water by Organics

Modeling of organics in surface water or groundwater in this report assumes no reduction due to decay or volatilization. Including these factors in the analysis would have the effect of reducing the impacts and thus the scores of these ranking units. The amount of reduction generally would be in the range of one Hazard Potential Index (HPI) Group or less. These factors were not included since this information is generally not available at the stage of investigation associated with many of the ranking units. To have applied these factors at the few sites where they exist would have resulted in inconsistent application of the ranking.

Potential for Contaminated Soil Runoff

The complex nature of sediment transport makes using simplified modeling techniques difficult for contaminated soil runoff as a potential transport pathway. Thus, a significant, but unquantified, amount of uncertainty is associated with ranking unit scores that encompass contaminated soil runoff as a transport pathway. Such pathways consistently score low in this report. Therefore, it is possible that this aspect of the environmental problem is not sufficiently represented in the scoring.

8.0 FINDINGS AND OBSERVATIONS

This section contains all Category I, II, and III Final Survey Findings. Category IV findings from the Environmental Survey Preliminary Report are not included because they represent instances of administrative noncompliance and of management practices that are not directly related to environmental risk. Citations and references provided in this section can be found in the Environmental Survey Preliminary Report for this site.

The Final Survey Findings include modifications in response to the Technical Accuracy Review Comments on the Environmental Survey Preliminary Report that were received from the site and/or DOE Operations (now Field) Office. The Final Survey Findings also include the results of Survey Sampling and Analysis (S&A), as appropriate, and reflect the status of the finding as reported by the site at the time of the Data Accuracy Review (DAR) meeting in June 1989. It should be noted that corrective actions taken by the site since the DAR meeting are not reflected in the Final Survey Findings.

8.1 Active Findings and Observations

8.1.1 Air

The following constitute the Final Survey Findings for Air at the Mound Plant. There are no Category I Final Survey Findings for Air. The Category II and III Final Survey Findings are provided below.

Final Survey Finding: Air II-1 (Preliminary Survey Finding: Air II-1)

Accuracy of Dose Estimates. The total dose estimates reported by Mound are considered questionable. Mound estimates total dose of radionuclides based on ambient air monitoring data. However, the Survey team found inadequacies in the monitoring system that bring into question the accuracy of the reported dose. These inadequacies include monitoring station siting and calibration and unmonitored radionuclides.

One-third of the air monitoring stations examined during the Survey were found not to meet accepted siting criteria. The Survey team was able to inspect only 12 of the 20 ambient air monitoring stations because of time constraints. The following three stations were considered poorly sited.

Station 102: The station is atop the locker facility and covered by a tree growing between the buildings. The tree could block airborne particulates from reaching the monitor.

Station 122: The monitor is on the ground in a fenced enclosure. Decorative wooden slats mounted on the fence block the air flow to the monitoring train intakes.

Station 214: Located on the ground near the discharge canal in tall vegetation and near a tree.

The other stations visited (Stations 101, 103, 118, 123, 124, 211, 212, and 213) were found to be in well-exposed locations.

In addition, monitoring stations are not regularly calibrated. The high-volume air sample flow rates at the on-site monitoring stations were last calibrated in July 1986. Prior to this, there had been no calibration of any on-site high-volume air sampler since 1977. The 15 off-site high-volume air samplers maintained by RAPCA have not been calibrated since 1977. While the most recent calibrations did not indicate any significant change in the characteristics of the critical flow orifice at five of the on-site stations, there can be no assurances that the air sample flow rates remained stable over the 10-year period between calibrations.

Radon and other unmonitored radionuclides are emitted from Mound. The unmonitored emissions result in a potential for underestimating the annual dose impact. There are two known sources of radon: SW Building and Building 21. The radon emission rates from these facilities have not been quantified by Mound. Consequently, it cannot be determined if the contribution from these sources to the radon concentration at the nearest residence conforms to the recently issued U.S. Environmental Protection Agency (EPA) action guideline of 4 pCi/l. As part of the Survey S&A Program, air samples were collected at Building 21 and the SW Building

and analyzed for radon and other radionuclides. The analysis confirmed the presence of radon.

Thorium, uranium, and, to a lesser extent, cesium and cobalt are unmonitored contributions to the off-site doses, since they can become airborne by wind erosion and earth-moving activities involving soils contaminated with these radionuclides. As part of the Survey S&A Program, air samples from the air monitoring stations at SM/PP Hill, Well #2, and the Williamsburg swimming pool were collected and analyzed for radionuclides, uranium, and total suspended particulates. The results of the analysis indicated the presence of total suspended particulates and several radionuclides, including bismuth, radium, and lead.

Final Survey Finding: Air II-2 (Preliminary Survey Finding: Air II-2)

Accuracy of Radionuclide Emission Measurements. The reported stack emissions of plutonium-238 and tritium from Mound are considered to be questionable and possibly understated. The sampling probes installed in the various effluent streams do not have a consistent design, and they are generally too close to disturbed flow regions in the duct or stack to obtain a representative sample of particulate emissions.

At the request of the Survey team, seven sampling probes were pulled for inspection; an eighth sampling probe was pulled by the Mound staff and their observations were communicated to the Survey team. The R Building probe was of an entirely different design than any of the others. The holes in it spiraled along the length of the tube and had decreasing hole sizes toward the effluent end. This design appeared to be an attempt to draw an isokinetic sample from along the length of the probe. The second probe pulled was the SM Building B-probe. This probe had a series of about 20 holes of equal size drilled in it, with each set of holes offset 45 degrees. An inspection of this probe found that about 40 percent of the holes were either completely or partially blocked by metal burrs. Mound personnel had difficulty removing the SM Building A-probe but later found that it was nothing more than a straight tube projecting about 6 inches into the large duct.

On the basis of these initial observations, all the probes were pulled in the WD Building stacks. There are two probes each in the WDAHR and WDALR stacks. The

primary probes in each stack consisted of a row of holes of equal size along the length of the probe. The alignment of the holes relative to the flow would be important for the sample collected. The primary sample probe in WDALR was found to be rotated about 45 degrees from the flow. The secondary probes in WDAHR and WDALR were of a different design from the primary probes and also from each other. The secondary WDAHR probe had three groups of equal-size holes along one side of the probe, while the secondary WDALR probe had three groups of different-size holes in what appeared to be a random pattern around the circumference for each group. Again, it is considered unlikely that any of these probes draws an isokinetic sample along its length or, for that matter, at any location on the probe. The WDSS stack probe was observed to consist of a 6-inch stub tube oriented perpendicular to the flow in a 15-inch-diameter stack.

There are plans to install an isokinetic probe at the 100-foot level of the SM/PP stack. However, there is a need to determine the possible inaccuracies in the reported annual emissions. The Survey collected air samples at the SM/PP stack and WDALR Stack and analyzed them for radionuclides. The results indicated the presence of radionuclides such as elemental tritium, plutonium, and radium.

Final Survey Finding: Air II-3 (Preliminary Survey Finding: Air II-3)

Unapproved Method Used to Calculate Off-Site Dose Impacts. The Mound procedures used to determine the reported off-site dose impacts may not be in conformance with regulatory requirements under the National Emission Standards for Hazardous Air Pollutants (NESHAP).

The ambient air monitoring data rather than atmospheric dispersion modeling of emissions are used to calculate the dose to the general public for comparison with the NESHAP standards (40 CFR 61, Subpart H). Measurements from air monitoring data can be used to demonstrate acceptable levels of environmental impact from the operation, provided EPA gives its approval. Although this resulted from a policy decision by the Albuquerque Operations (now Field) Office, EPA approval of this approach could not be demonstrated. While the problems identified with the ambient monitoring program are not likely to cause a dramatic change in the reported doses, quality control and quality assurance procedures to support the data are lacking. In addition, it is difficult to demonstrate that the existing monitoring

network actually detects the maximum plutonium-238 and tritium concentrations, given the siting and calibration problems discussed in the previous finding and the inability to correlate emissions and monitoring data.

The 1985 reported dosimetric impacts from Mound operations (MRC, 1986b) are quite small, being about 1.2 percent of the NESHAP allowable values from all pathways. Of the 0.88 mrem dose calculated for calendar year 1985, the air pathway contributed 0.61 mrem or 69 percent to the total internal organic dose.

Final Survey Finding: Air II-4 (Preliminary Survey Finding: Air II-4)

Lack of Organic and Toxic Emissions Inventory. The nonradioactive air emissions from Mound cannot be determined because there is no air emissions inventory. Nonradioactive air emissions occur throughout the Mound site as a result of the use of volatile organic and other chemicals in the ventilation hoods of production buildings. The emission points for the ventilation hoods and the type of emission control equipment installed on the effluent gas stream are known. The quantities of selected chemical materials purchased at Mound for a 7-month period and extrapolated to estimated annual usage are also known. However, it was impossible to reconstruct a building-by-building air emissions inventory solely from this information. In general, Mound personnel have installed control equipment on many of the air emission sources. However, this is not the rule for most ventilation hoods that emit organic substances to the atmosphere. It must be stressed that individual ventilation hoods are likely to be small sources, and unless the material is particularly toxic or hazardous there may not be a compelling reason to install such devices. However, the lack of a comprehensive emissions inventory of organic and toxic air pollutant emissions is a potential problem, because these substances are unmonitored and the cumulative amounts emitted over the entire site may be of concern. Based on the ventilation hood inventory and the chemical usage information referenced above, there is a potential concern about the level of toxic air pollutant emissions from solvent usage and plating operations. For example, the solvents acetone, trichloroethylene, and methylene chloride are used in large quantities. The plating shop contains a vapor degreaser which uses perchloroethylene to clean components. Laboratories at Mound often evaporate small quantities of solvents in fume hoods. As part of the Survey S&A Program, air samples from Building 28 vents were collected and analyzed for organics. The

analysis confirmed the presence of contaminants such as acetone and methylene chloride. These data were used in modeling the Hazardous Air Emissions - Vents ranking unit.

Final Survey Finding: Air III-1 (Preliminary Survey Finding: Air III-1)

Tritium Emissions from the WD Building. The tritium air emissions from the WD Building stacks are not measured by Mound; this results in an underestimation of the total emissions from Mound. There is evidence that tritiated water is infiltrating the abandoned alpha waste pipeline and entering the alpha waste treatment facility. This could lead to unmonitored air emissions of tritium for the WDALR and WDSS stacks and also from the building ventilation system by evaporative losses from the flocculator tanks. These potential unmonitored tritium air emissions are likely to be small, compared with the monitored tritium emission points at Mound. The Survey collected air samples from the flocculators at the WD Building and analyzed the samples for total tritium. The analysis confirmed the presence of tritium.

8.1.2 Soil

The following constitute the Final Survey Findings for Soil at the Mound Plant. There are no Category I or II Final Survey Findings for Soil. The Category III Final Survey Findings are provided below.

Final Survey Finding: Soil III-1 (Preliminary Survey Finding: Soil III-1)

Potential Movement of Plutonium and Thorium Contamination on the New Property. Plutonium and thorium have contaminated a drainage path on the new property, and the contamination may be moving toward Mound property boundaries. This is the area referred to in this report as Area S-1. The source of the plutonium was an incident involving the storage of plutonium-contaminated materials in wooden boxes north of Building 21.

Bulk transfer of thorium drums to and from the storage basin (Building 21) resulted in spillage of thorium. The area (approximately 136,000 ft^2) was cleaned up and backfilled with clean soil. Mound has found that an area on the new property is

contaminated with thorium-232. Plutonium-238 contamination, which was caused by exposed storage of wooden containers and resultant surface runoff, has been found in the vicinity. Preliminary data indicate that peak plutonium-238 contamination is 34,000 pCi/g. Peak thorium-232 contamination is greater than 100 pCi/g (the average is 10 to 100 pCl/g). The peak plutonium-238 soil contamination of 34,000 pCl/g is over 340 times the decommissioning and decontamination (D&D) levels for the site. The peak thorium-232 concentration is over 50 times the background level at Mound.

Plutonium and thorium contamination has been found on the new property, and the Survey team believes that physical conditions exist which could cause plume movement. A site survey (MRC, 1986d) indicates that the plutonium-238 and thorium-232 have been scoured from the center line of the drainage basin. The data indicate that contamination is still present along the sides of the drainage basin. This implies that the contamination was deposited by high-volume runoff which more completely flooded the basin while smaller runoff volumes have subsequently removed soil contamination deposited along the center line farther downstream and farther along the drainage center line.

In addition to the potential for the plutonium and thorium contamination to have moved by waterborne transport of material, there is a potential for movement and dispersion due to earth-moving activities nearby. During the U.S. Department of Energy (DOE) Environmental Survey, it was noticed that earth-moving operations had occurred on the new property near the end of Area S-1. If the soil surface contamination has indeed moved since the 1982 survey (MRC, 1986d), the earth-moving operations may have disrupted the plume and moved contaminated soil closer to the site boundary. Movement closer to the site boundary increases the potential for exposure to the general public. As part of the Survey S&A Program, soil samples from along the drainage swale on the new property near Building 21 were collected and analyzed for radionuclides. The analysis confirmed the presence of plutonium-238 and thorium-232. These data were used in modeling the Contamination in Area S-1 ranking unit.

Final Survey Finding: Soil III-2 (Preliminary Survey Finding: Soil III-2)

Potential for Radionuclide Contamination of Surface Water from Runoff. Areas M-1, M-2, V-1, V-2, S-2, and S-7 have been contaminated with radionuclides. The contamination is on the surface and has the potential for movement off-site into surface waters. Each area is discussed below:

- Area M-1 is located near WD Building. The area around the building was contaminated with polonium-210 and cobalt-60 when the building's influent tanks overflowed in 1965 (polonium has decayed out, leaving residual cobalt-60). Contamination also resulted from the rupture in 1969 of the WTS line, which released plutonium-238. Preliminary data indicate that the average soil plutonium-238 concentration ranges from 100 to 1000 pCi/g (MRC, 1986d). No estimates are available for cobalt-60 concentrations.

- Area M-2 is near WD Building. Area M-2 is the sewage sludge disposal drying pits which were contaminated with polonium-210 and cobalt-60 from the accident noted in M-1 above. The drying pits are part of the old SD Building located immediately adjacent to the WD Building. Plutonium-238 contamination also resulted from the WTS line rupture mentioned in M-1 above. No estimates are available for plutonium-238 and cobalt-60 concentrations.

- Area V-1, which surrounds Buildings 72, 55, 94, and 57, was a storage and redrumming area covering approximately 15,000 ft^2. The area was cleaned and backfilled with clean soil in 1965. Previous studies found no thorium; however, plutonium-238 contamination was discovered which was probably the result of contamination from the WTS line rupture noted in M-1 above. Preliminary data indicate that the average plutonium-238 concentration is 10 to 100 pCi/g (MRC, 1986d).

- Area V-2 is an open drainage ditch which contained plutonium. Part of this ditch is being decontaminated along with Area M-4. The plutonium spill may not have been accurately identified in current D&D plans, resulting in the potential for less than total remediation of the area. This

area was previously reported to have involved the spill of a plutonium-containing solution shown to be at the east end of WD Building. Review of interview records and conversations with a former employee revealed that this was incorrect. The spill involved leakage from one or more plutonium liquid waste drums stored at the southwestern corner loading area of WD Building, near where the liquid tank trucks from SM/PP area are now unloaded. This spill ran into the catch basin south of this loading dock area and flowed down a stone-lined open drainage culvert southwest across the buried pipeline from Building 41 to WD Building. More accurate location information is important, because present plans to remediate the spill do not encompass all areas contaminated by the release.

- Area S-2, located near Building 31, was a storage and redrumming area which was contaminated with thorium-232. The area, approximately 40,000 ft^2, was cleaned and backfilled with clean soil in 1965. Thorium-contaminated soil was removed to another area on-site. Preliminary data indicate that the area still has an average soil thorium-232 concentration ranging from 1 to 10 pCi/g (MRC, 1986d).

- Area S-7 contamination resulted from the transfer in 1985 of contaminated soil from Area M-5, near HH Building. The area of contamination has not been calculated. Preliminary data indicate that the average concentration of cobalt-60 in the soil ranges from 10 to 100 pCi/g (MRC, 1986d).

As part of the Survey S&A Program, sediment and water samples were collected from three ponds at the base of the SM/PP Hill and from National Pollutant Discharge Elimination System (NPDES) outfalls 002 and 003. The samples were analyzed for volatiles, semivolatiles, and inorganics. The results of the analysis confirmed the presence of contaminants including pyrene, fluoranthene, and beryllium in the ponds. The sampling results from the outfalls were inconclusive. The S&A data from the ponds were used in modeling the Contamination on the SM/PP Hill ranking unit. Site-generated soil data were used in modeling the Contamination in Area S-7 ranking unit and the Contamination in the Valley Locations ranking unit.

Final Survey Finding: Soil III-3 (Preliminary Survey Finding: Soil III-3)

Potential for Radionuclide Contamination of Groundwater. Areas M-3, V-5, V-6, S-4, S-6, S-8, and S-9 all have subsurface contamination only. This contamination poses some degree of threat to the groundwater exclusively. The degree of threat posed in many instances is low, due to mobility characteristics of the radionuclide. The areas are described below:

- Area M-3 is located north of Building 48. A radioactive waste line containing cobalt-60 and polonium-210 from HH Building to WD Building ruptured in 1969. Polonium has decayed out, leaving residual cobalt-60. The area covers approximately 6,800 ft^2. Preliminary data indicate that average soil concentrations of cobalt-60 range from 10 to 100 pCi/g (MRC, 1986d).

- Area V-5 is located south of Overflow Pond. The silt and dredgings from an on-site drainage ditch were used from 1971 to 1974 as cover for certain sections of landfill. Approximately 3,200 ft^3 of silt and dredgings were spread over an area of 60,000 ft^2. A site survey (MRC, 1986d) did not find any surface soil plutonium-238 contamination (0.1 to 1.0 pCi/g) either at the surface or in two boreholes drilled atop the new landfill. However, the study recommended further sampling.

- Area V-6, located southeast of Buildings 51 and 29, was thought to contain empty corroded thorium drums buried from 1954 to 1965. The area, which is approximately 22,000 feet, is suspected to be contaminated with radium-226, actinium-227, and thorium-228. A previous study (MRC, 1986d) found no radium-226, and actinium-227 was located in only one part of the area. In addition, a septic tank used during construction later may have been used for the burial of radioactive waste products from SW Building. This area is now a paved parking lot. Preliminary data indicate that the peak soil actinium-227 concentration is 1,400 pCi/g. The average soil thorium-228 concentration is 1 to 10 pCi/g (MRC, 1986d).

- Area S-4 is west of Building 30. This area in 1965 received subsurface contaminated dirt from the decontamination operations near Building 21

and Building 31. The area is approximately 25,000 ft^2. Preliminary data indicate that the average concentration of thorium-232 in the soil is 10 to 100 pCi/g (MRC, 1986d).

- Area S-6 is west of SM Building. Area S-6 contains buried contaminated dirt from decontamination of thorium near Building 21 (Area S-1) in 1965. The area covers approximately 19,000 ft^2. A site survey (MRC, 1986d) also found plutonium-238 contamination, which is probably the result of SM operations. Since the WTS line traversed this area, much of the contaminated soil was removed as part of that decontamination work. Preliminary data indicate that the average soil plutonium-238 concentration is 10 to 100 pCi/g. Preliminary data indicate that the average soil thorium-232 concentration is 1 to 10 pCi/g (MRC, 1986d).

- Area S-8 is west of SM Building. Prior to 1965, Area S-8 was contaminated by SM Building operations. The area is approximately 2,600 ft^2. Preliminary data indicate that average soil plutonium-238 concentration is 10 to 100 pCi/g (MRC, 1986d).

- Area S-9, west of Building 30, contained a sanitary sewage septic tank and leach basin for SM Building used from 1960 to 1965. The area is approximately 15,500 ft^2. Preliminary data indicate that the average soil plutonium-238 concentration is 10 to 100 pCi/g (MRC, 1986d).

As part of the Survey S&A Program, groundwater samples were collected from several groundwater monitoring wells and sludge and water samples from the lower retention pond and the diversion basin. The samples were analyzed for volatiles, semivolatiles, radionuclides, and inorganics. The results of the analysis confirmed the presence of contaminants such as trichloroethylene in the wells and lead in the pond and basin. These data were used in modeling the Contamination on the SM/PP Hill and the Contamination in the Valley Locations ranking units.

8.1.3 Surface Water

The following constitute the Final Survey Findings for Surface Water at the Mound Plant. There are no Category I or II Final Survey Findings for Surface Water. The Category III Final Survey Finding is provided below.

Final Survey Finding: Surface Water III-1 (Preliminary Survey Finding: Surface Water III-1)

Potential Contamination of Sediment. The sediment in the lower and upper stormwater retention ponds (and the smaller basins at NPDES Outfall 5002) may be contaminated with hazardous waste and radionuclides as a result of plant processes and runoff from contaminated areas. This could represent an environmental problem because any contamination that is in the sediment may be resuspended and released or may be transported into the soil and groundwater beneath the overflow pond.

The sediment in the lower stormwater retention pond may have received hazardous wastes which have drained from piping inside the landfill adjacent to the pond. The drain pipes inside the landfill, which were designed to drain the wastes after they were encased in clay, were installed approximately 8 feet above the clay bottom of the inside of the landfill. The wastes were wet when placed in the landfill. This 8-foot elevation is believed to be as low as the pipes could be placed and still drain by gravity into the overflow pond. It is assumed that the lower 8 feet of wastes are still saturated. Further, when the water level of the overflow pond rises 1 or 2 feet above its normally maintained depth (which it frequently does after storms, since it is used as an equalization basin), the liquid from the pond is believed to be able to flow back into the landfill wastes. This creates a constantly saturated condition in the lower 8 feet of the wastes and a percolator-type condition in the 8-foot to 10-foot layer. The trapped water in the lower 8 feet of the landfill may be quite concentrated in contaminants after leaching for 10 years. Eventually, it may escape through the bottom of the landfill. The percolator condition remains a potential problem although removal or permanent blockage of the drain pipes from inside the landfill would eliminate the problem. The existing condition has the potential to be constantly adding to the contamination of both the overflow pond sediment and the stormwater discharged through the overflow pond. Moreover, the

overflow/retention (lower) pond has not been cleaned of sediment since its construction in 1978. When last measured in February 1982, the sediment was 20.5 inches deep at the entrance channel in the north side, 14 inches deep at the midpoint of the south side adjacent to the hazardous waste landfill, 5 inches deep in the northwest corner at the outlet pipe, and from 5 to 8 inches deep at other points. The total volume of silt accumulated up to that time was estimated at 28,122 ft^3, with a total plutonium-238 activity of 53,711 microcuries.

The upper pond, near Building 61, functions as a settling lagoon similar to the lower pond. The storm sewers from the SM/PP Hill feed into it. There is also a controlled outlet and an emergency overflow spillway (which has never been utilized). Flows for both would go to the previously described basins and lower retention pond. The upper pond is paved with asphalt on the sides and bottom. The sediment depth is measured from time to time, and its gross activity is also measured. The sediment was cleaned out once, beginning in 1982. It was dewatered on-site on portable filter screens/beds and packaged for off-site disposal as low specific activity (LSA) radioactive waste. Prior to the cleanout operation, the sediment had an estimated average depth of 2 inches, and the 3,933 ft^3 of silt removed had an average plutonium-238 activity of 678.5 pCi/gram or a total of 136,867 microcuries. Much smaller concentrations of the following nuclides were also present: thorium-228, radium-226, radium-228, uranium-238, uranium-234, and lead-210. Another cleanout operation is planned for the near future.

The upper pond sediment has the potential to act as a sink for radioactive and chemical contaminants. Plutonium, thorium, and other radionuclides may adhere to particles in the sediment.

As part of the Survey S&A Program, sludge and water samples were collected from the lower retention pond and the diversion basin. The samples were analyzed for volatiles, semivolatiles, radionuclides, and inorganics. The results of the analysis confirmed the presence of contaminants such as lead and silver. These data were used to model the Contamination in the Valley Locations ranking unit.

8.1.4 Groundwater

The following constitute the Final Survey Findings for Groundwater at the Mound Plant. There are no Category I Final Survey Findings for Groundwater. The Category II and III Final Survey Findings are provided below.

Final Survey Finding: Groundwater II-1 (Preliminary Survey Finding: Groundwater II-1)

Tritium Contamination of Groundwater. Although remedial efforts at the Mound Plant have reduced tritium levels in the Buried Valley aquifer at the wells to within drinking water standards, the existence of tritium contamination in the groundwater on and in the adjacent aquifer constitutes an existing environmental problem.

While historical disposal practices were the major source of contamination of the aquifer in the past, current contamination of the groundwater both on- and off-site is likely derived from past accidental releases on-site. Past on-site releases have resulted in a reservoir of contamination that is continuing to enter the groundwater. The evidence that supports this conclusion includes analyses of core samples from inside site buildings, samples of liquids in utility trenches on-site, and samples of seeps and springs both on- and off-site.

As part of the Potable Water Standards Project, Dames & Moore (1976b) analyzed several core samples from beneath SW Building. Based on the sample results, they provided a worst-case estimate of almost 1,300 curies of tritium beneath the SW Building. A file memo (Meyer, 1963) expressed concern about contamination of the soil beneath SW Building as early as 1963, although it did not specifically mention tritium. This contamination could slowly migrate from beneath the building within the perched water zone or with water movement through utility trenches. Recent sampling efforts have confirmed that the utility trenches and gravel packs around buried pipes are acting as pathways for the migration of tritium. Samples collected from the sewer chase between Buildings SW and I indicated tritium levels in excess of 7,000 nCi/l. Analyses of samples from seeps and springs on the west and north slopes of the Main Hill indicate that elevated levels of tritium exist in the shallow groundwater. Of particular concern are those springs which are off-site and have

flowing water. One such spring on the north slope has tritium levels in excess of 100 nCi/l. Although it is unlikely that anyone will drink from this spring, it is on public property, is not marked as undrinkable, and contains tritium at five times the level allowed by the Safe Drinking Water Act.

The problem of continued migration of tritiated water in the shallow zones is compounded by a lack of understanding of flow mechanisms in these zones. The flow mechanisms could reasonably be expected to be complex and highly variable, and achieving a better understanding will be difficult.

Category II environmental problems are intended to identify environmental problems that require the immediate attention of management. To date, the management of the Mound Plant and the Albuquerque Operations (now Field) Office have devoted considerable attention, manpower, and resources to this problem. Substantial effort has been expended and is continuing to reduce all emissions to "as low as reasonably achievable." To locate the source of the contaminated seepage, a committee was formed with representatives of several divisions within the facility. This committee meets weekly to determine the course of action for the week. In addition, the Albuquerque Operations (now Field) Office is conducting an investigation of the shallow groundwater system as part of the Comprehensive Environmental Assessment and Response Program (CEARP) (DOE, 1986b).

As part of the Survey S&A Program, water samples from seeps and groundwater monitoring wells were collected and analyzed for volatiles, semivolatiles, inorganics, and radionuclides. The results confirmed the presence of contaminants such as tritium and trichloroethylene. These data were used to model the Contamination in the Valley Locations and Contamination in the Main Hill Groundwater ranking units.

Final Survey Finding: Groundwater III-1 (Preliminary Survey Finding: Groundwater III-1)

Areas With the Potential to Affect Groundwater Quality Adversely. Several areas at the Mound Plant represent potential sources of contamination to the groundwater. These areas include the old landfill, the evaporation pond behind Building 42, and the lithium carbonate and solvent disposal area. At each of these areas, historical

records indicate disposal or storage or organic chemicals. Records also indicate disposal in the landfill of drums used to store thorium. Monitor well data in the vicinity of the old landfill indicate low levels of various organic compounds in the aquifer. The Survey collected samples from groundwater monitoring wells and analyzed them for volatiles, semivolatiles, inorganics, and radionuclides. The results confirmed the presence of contaminants such as trichloroethylene and tetrachloroethylene. These data were used in modeling the Contamination in the Valley Locations ranking unit.

Final Survey Finding: Groundwater III-2 (Preliminary Survey Finding: Groundwater III-2)

Broken Pipes in Wastewater Treatment Systems. The poor condition of the three sewer systems results in a potential environmental problem for groundwater. Many sections of the three sewer systems (sanitary, storm, and abandoned radioactive waste) are in very poor condition, structurally and hydraulically. This allows both infiltration and exfiltration at various points, with the attendant possibility of the exchange of conventional, hazardous, and/or radioactive contaminants between sewer systems or between any one of them and the groundwater or soil. These exchanges are both uncontrollable and unquantifiable as the sewer systems now exist.

Recent investigations of the storm and sanitary sewer systems have shown them to have numerous pipe and joint cracks, breaks, misalignments, sags, and obstructions. The abandoned underground radioactive waste sewer system was not directly investigated, but it is likely to be in similar condition because of its similar age and condition of service. These defects are conducive to both infiltration into the pipe and exfiltration out of it, depending on the external groundwater levels at the various points along the pipe. It is likely that there is a net additional flow into the three systems. This has been demonstrated for the abandoned radioactive waste sewer system, which has no acknowledged input but has a substantial output at its terminus in WD Building. It is possible that there are losses of contaminated wastewater from these systems to the groundwater. Because there are some areas of contaminated soil on-site, it is also possible that groundwater infiltrating into these sewer systems is contaminated. Neither the amounts nor contaminant

contents of this infiltration and exfiltration have been quantified. Mound submitted a Fiscal Year 1987-1988 budget request to repair the piping systems.

Final Survey Finding: Groundwater III-3 (Preliminary Survey Finding: Groundwater III-3)

Perched Aquifer Flow Regime Poorly Understood. At the present time, there is an incomplete understanding of the hydrogeologic transport mechanisms that affect the Mound Plant, making it difficult to identify specific sources of contamination that can be seen in springs and seeps. In addition, future groundwater quality problems may be difficult to trace to a source because of the lack of information. This is particularly true of the perched water that occurs in the vadose zone on-site. The management of the Mound Plant and the Albuquerque Operations (now Field) Office recognize this problem and will be addressing it as part of the CEARP Phase 2 program.

8.1.5 Waste Management

The following constitute the Final Survey Findings for Waste Management at the Mound Plant. There are no Category I or II Final Survey Findings for Waste Management. The Category III Final Survey Findings are provided below.

Final Survey Finding: Waste Management III-1 (Preliminary Survey Finding: Waste Management III-2)

Leakage Within Building 23. Radioactive waste drums at Building 23 are stored too close together to allow visual inspection of the drums in order to identify potential leakers. The Survey team encountered a leak of a tar-like substance among radioactive waste drums in Building 23. The substance covered the floor in an area of the building, but the drums were stacked too tightly to determine the location of the leaking drum. Building 23 has a sump to collect waste, but the spilled liquid material did not reach it. The drums are not arranged so as to provide sufficient inspection space, and drums can come in contact with liquids on the floor. Drums that are in contact with liquids may result in accelerated deterioration and a higher potential for leakage.

Final Survey Finding: Waste Management III-2 (Preliminary Survey Finding: Waste Management III-3)

Temporary Waste Solvent Staging Areas. Waste solvents are stored in locations that could result in unmonitored releases to soils or the stormwater system. The Environmental Survey team noticed that a number of these waste storage locations had nearby storm drains or floor drains that could provide an avenue for liquid release in the event of a spill. For example, the waste solvent staging pad for Building 28 (one of the largest hazardous waste generators on-site) is near a large storm drain, and the B Building and the DS Building storage sheds have floor drains adjacent to the waste drums. None of these temporary storage facilities was equipped with curbing or barriers to contain the flow of spills.

Final Survey Finding: Waste Management III-3 (Preliminary Survey Finding: Waste Management III-4)

Wastewater Treatment Plant Sludge Sent to NTS May Be a Hazardous Waste. The wastewater treatment plant sludge which is removed, deposited in drying beds, and packaged for shipment as low-level waste to the Nevada Test Site (NTS) may contain heavy metals (e.g., silver and cadmium) and organic solvents (e.g., acetone, methylene chloride), thus constituting a mixed waste. The Survey team found examples of laboratory sinks (other than those connected to radioactive waste or chemical waste storage systems) or drains in Buildings M, R, 3, 49 and others that received small quantities of solvent, photographic solution (with silver), acid or bases that would enter the sanitary treatment plant. The sludge from the treatment plant is dried on drying beds adjacent to the treatment plant and packaged in boxes for shipment to NTS. The boxes and their contents are subjected to a radiological analysis but are not routinely sampled for the presence of hazardous constituents. The chemical constituents of the sludge can be expected to vary due to the changing nature of research and development (R&D) activities at Mound and the use of different solvents and chemicals on various R&D projects.

The NTS does not have approval to dispose of radioactive mixed waste and has requested that shipment of such waste to NTS end. Mound does not have a regular sewage treatment plant sludge testing program (although a one-time test was

performed) that could identify whether the sludge may be a radioactive mixed waste.

The Survey collected sludge samples from the wastewater treatment plant drying beds and analyzed them for volatiles, semivolatiles, and inorganics. The results confirmed the presence of contaminants such as chloromethane and 4-methylphenol.

Final Survey Finding: Waste Management III-4 (Preliminary Survey Finding: Waste Management III-5)

Potential for Hazardous Materials to Contaminate Burn Cubicle Ash. There is a potential for ash generated during the use of the burn cubicle (i.e., the facility at the burn area) to be contaminated with hazardous materials. If the ash is hazardous, it apparently is not being handled in a manner consistent with proper hazardous waste management.

The burn cubicle contains one 55-gallon drum which has been fitted with an air blower device to provide excess combustion air to wastes which are combusted in the drum. The area immediately surrounding the drum is used to burn waste designated as HE-contaminated. The waste includes paper, plastic, cloth products and other HE-contaminated trash. The material is generated in laboratories throughout the Mound Plant (e.g., Building DS), is brought to the burn area, and is stored until there is a sufficient quantity to initiate a burn. The material is potentially contaminated with quantities of high explosives (HE) such as PETN and HMX but also contains organic solvents. The organic solvents (such as acetone and freon) are contained on tissue paper used in laboratory operations to clean equipment, parts and components. The area around the 55-gallon drum contains a concrete floor approximately 12 feet square with walls approximately 10 feet high. The area is covered by an overhead chainlink fence. HE-contaminated trash is placed on the concrete floor of the cubicle and fitted with a remote igniter to initiate combustion. The operator activates the igniter from outside the cubicle and monitors the burn. The cubicle can be used to burn up to 40 pounds of HE-contaminated trash per event. Typically, only 5-6 pounds of such waste is burned at one time. In addition, the cubicle has occasionally been used to flash various pieces

of metal equipment to remove HE contamination prior to the metal equipment's being considered for off-site salvage.

The ash that results from burning the trash is collected from the floor and placed in a 55-gallon drum located directly outside the cubicle. The ash may contain small amounts of organic solvent or metals which remain in the ash if there is incomplete combustion.

The Survey collected samples of the ash and analyzed it for volatiles, semivolatiles, and inorganics. The results of the analysis indicate the presence of contaminants such as trichloroethylene and lead.

8.1.6 Toxic and Chemical Materials

The following constitute the Final Survey Findings for Toxic and Chemical Materials at the Mound Plant. There are no Category I Final Survey Findings for Toxic and Chemical Materials. The Category II and III Final Survey Findings are provided below.

Final Survey Finding: Toxic and Chemical Materials II-1 (Preliminary Survey Finding: Toxic and Chemical Materials II-1)

Potential for Release of Hazardous Substances to Soil and Surface Water. The placement and condition of certain chemical drums outside production area buildings warrant immediate attention to ensure that these drums do not release their contents. The responsibility for checking such drums has been delegated to the maintenance people of the buildings involved. Mound waste management in the past has conducted campaigns to identify and collect such drums before they become a problem. Current surveillance procedures for such drums have not resulted in the removal of deteriorating drums with the potential to release their contents. Drums of caustic, waste solvent and other chemical substances were found in many locations throughout the plant site.

Final Survey Finding: Toxic and Chemical Materials III-1 (Preliminary Survey Finding: Toxic and Chemical Materials III-1)

Potential for Past Release from Underground Storage Tank. An underground storage tank (UST) which is believed to contain 500 gallons of aviation fuel may have leaked over 200 gallons. The tank is located immediately north of the overflow pond and southwest of Building 34. The tank was formerly used for flame-testing containers at the Building 34 area but has not been used since 1978. The tank received 500 gallons of fuel in 1979, and 280 gallons were removed in 1988, which leaves more than 200 gallons unaccounted for. It is 16 years old, made of steel, unlined, and has no cathodic or external protection. The tank has been included on the report of USTs to the State of Ohio.

The combination of tank age, material of construction, lack of protection, fuel substance type, and location increases the potential that the unaccounted-for fuel was released to the environment.

Final Survey Finding: Toxic and Chemical Materials III-2 (Preliminary Survey Finding: Toxic and Chemical Materials III-2)

Potential for Release of Waste Solvents from Underground Storage Tank. A 1,000-gallon UST may contain waste solvents and has the potential to be a source of subsurface soil or groundwater contamination. The tank is located behind Building 51 and was used from 1968 to 1972 to store waste solvents prior to their being burned in the Building 51 incinerator. Use of the incinerator was discontinued in 1972, however, and the remaining contents of the tank were never inventoried. Also, no records were kept of what quantities or types of waste passed through this tank. The tank is currently locked and the key has been lost. The tank is 15 years old and constructed of steel. It is unlined and has no cathodic or external protection. The tank was included on a 1986 notification of USTs to Ohio officials. Mound personnel stated that the tank was to be removed in the near future. The age, material of construction, lack of protection and potential substance contained increase the potential for an environmentally damaging release.

The Survey collected sludge samples from the tank and soil gas samples from around it. The samples were analyzed for the presence of volatiles, semivolatiles, inorganics, and polychlorinated biphenyls (PCBs). The soil gas samples were analyzed for volatiles. The results of the sludge samples confirmed the presence of contaminants such as PCBs, methyl ethyl ketone, and trichloroethylene. The soil gas sample

analysis confirmed the presence of methyl ethyl ketone. The results were used in modeling the Potential Leakage from Underground Tanks ranking unit.

8.1.7 Radiation

There are no Category I, II, or III Final Survey Findings for Radiation at the Mound Plant.

8.1.8 Quality Assurance/Quality Control

The following constitute the Final Survey Findings for Quality Assurance/Quality Control at the Mound Plant. There are no Category I or II Final Survey Findings for Quality Assurance/Quality Control. The Category III Final Survey Finding is provided below.

Final Survey Finding: Quality Assurance/Quality Control III-1 (Preliminary Survey Finding: Quality Assurance/Quality Control III-1)

Insufficient Laboratory QA Protocols. The Mound Plant is not following accepted quality assurance (QA) procedures. The reliability of each measurement is not fully documented on a routine basis, and there is a potential for major errors in environmental monitoring data.

The Environmental Survey team found no confirmed evidence of invalid data, but the protocols presently used for QA are not sufficient to defend the validity of the data. Mound participates in both DOE and Monsanto QA programs, but there is no consistent, day-to-day verification that the data are of acceptable quality. The S&A phase of the Survey will split samples with Mound at the NPDES monitoring points, and an independent analysis will be performed. The analytical data will be compared to gain information pertaining to the overall quality of Mound data.

Specific aspects of the finding are discussed below:

- Bacteriological procedures for the determination of fecal coliform were modified significantly from the referenced protocol. The procedure used at Mound determines total coliform by presumptive tests. The incubation

medium differs from that specified by the approved method, and the incubation temperature was 35°C, not 44.5°C. No confirmations are made. NPDES regulations are specific as to the method used for this determination.

- Performance samples received from Environmental Measurement Laboratory (EML) and the Monsanto programs are distributed to the laboratories as received. The sample containers are easily distinguished from routine Mound environmental samples. This practice alerts the analyst that this is a performance check and obviates the purpose of the check.

- Chain-of-custody is not complete. Sample personnel deliver environmental samples to the laboratory, but no collector signature is recorded. This is a problem, because there is no documentation of sample handling and it would be difficult to substantiate sample routing.

- Minimum acceptance criteria for the internal standard in radiochemical determinations are not specified in the analytical procedures. This results in the acceptance of low recovery rate data (about 20 percent) not normally allowable by QA procedures.

- Daily maintenance and calibration records of equipment, such as balances and thermometers, are not recorded in a permanent record book. Documentation of the performance of the equipment is necessary to substantiate the analytical data.

- Analytical protocols are not available to the analyst in the laboratory. A method manual was prepared, but it merely references the publication where the method can be found. It is important that the details of analytical procedures be readily available to the analyst to help ensure proper methodology.

- Specific sampling methods for each type of sample medium were not available to the sample collector. As discussed above, formal procedures should be available to help verify proper sample collection in the field.

- QA measurements of duplicates and spikes are not determined with each radiochemical and inorganic sample batch analyzed. Accepted QA practice specifies that quality control (QC) measures of blank, duplicate, and spike be related to each result reported. As a minimum, these measures are run with every batch of 10 samples or fewer. Mound is not analyzing these QC measures this frequently.

8.1.9 Inactive Sites and Releases

The following constitute the Final Survey Findings for Inactive Sites and Releases at the Mound Plant. There are no Category I or II Final Survey Findings for Inactive Sites and Releases. The Category III Final Survey Findings are provided below.

Final Survey Finding: Inactive Sites and Releases III-1 (Preliminary Survey Finding: Inactive Sites and Releases III-1)

Potential for Undetected Movement of Plutonium. The environmental monitoring program for the off-site plutonium contamination (Site 7) would not detect low-probability releases.

Most Mound-specific and other scientific information indicates that plutonium adheres strongly to soil particles and therefore does not pose a threat to groundwater. However, some scientific literature from laboratory studies suggests that plutonium may become soluble and, therefore, mobile under certain complex conditions. Mound does not now sample media other than air in the vicinity of the canal for plutonium. The 1976 ad hoc committee report pertaining to the plutonium contamination of the canal included monitoring recommendations to detect the translocation of plutonium as well as studies regarding the adsorption of plutonium to clay. These recommendations are not presently being implemented. One of the concerns raised by the State of Ohio at a meeting with the Survey team was the potential for mobility of plutonium in the soils of the canal.

The Survey collected soil core samples within the canal and analyzed them for radionuclides. The results of the analysis confirmed the presence of plutonium-238. The results were used in modeling the Contamination in the Canal ranking unit.

Final Survey Finding: Inactive Sites and Releases III-2 (Preliminary Survey Finding: Inactive Sites and Releases III-2)

Leachate Discharge From the New Landfill. The concentrated leachate in the lower 8 feet of the new landfill (Site 1) may discharge into the stormwater retention pond due to the design of the drain pipes inside the landfill and, therefore, potentially result in an uncontrolled discharge off-site. In addition, the concentrated leachate inside the landfill may eventually escape the bottom of the landfill.

The drain pipes inside the landfill, which were designed to drain the wastes after they were encased in clay, were installed approximately 8 feet above the clay bottom of the inside of the landfill. The wastes were wet when placed in the landfill. This elevation is believed to be as low as the pipes could be placed and still drain by gravity into the overflow pond. It is assumed that the lower 8 feet of wastes are still saturated. Further, when the water level of the overflow pond rises about 1-2 feet over its normally maintained depth (which it frequently does after storms, since it is used as an equalization basin), the liquid from the pond is believed to be able to flow back into the landfill wastes. This creates a constantly saturated condition in the lower 8 feet of the wastes and a percolator-type condition in the 8-foot to 10-foot layer. The trapped water in the lower 8 feet of the landfill may be quite concentrated in contaminants after leaching for 10 years. Eventually it may escape through the bottom of the landfill. The percolator condition remains a potential problem, whereas removal or permanent blockage of the drain pipes from inside the landfill would eliminate the problem. The existing condition has the potential to be constantly adding to the contamination of both the overflow pond sediment and the stormwater discharged through the overflow pond.

Final Survey Finding: Inactive Sites and Releases III-3 (Preliminary Survey Finding: Inactive Sites and Releases III-3)

Potential Contamination from Solvent Leach Pit. Soils and groundwater in the vicinity of Building 42 may have been contaminated through the operation of a solvent leach bed (Site 2). The waste entering the leach pit contained approximately 80 percent water, 10 percent ethanol, and 10 percent acetone, with trace amounts of high explosive. The wastewaters were discharged to a basin 25 feet square by 5

feet deep. No records of the quantity discharged were kept, but it is estimated that a few thousand gallons per year were disposed of in this manner. The discharges occurred for a period of 15 to 18 years and were halted in mid-1985.

A disposal pit of similar size was operated at Building 1. Similar waste material was disposed of, but the quantity was an order of magnitude less than that at the Building 27 pit. The Building 1 waste pit operated from the late 1960s until discharge was ended in 1985.

The Survey collected soil core samples at the leach pit near Building 42 and analyzed them for volatiles and semivolatiles. In addition, groundwater samples were collected in downgradient wells. The results of the soil samples were inconclusive. The groundwater data were used in modeling the Inactive Leach Pit ranking unit.

Final Survey Finding: Inactive Sites and Releases III-4 (Preliminary Survey Finding: Inactive Sites and Releases III-4)

Potential Contamination from Construction Spoil Site. A historic construction spoil site (Site 3) may be a source of small quantities of radiological and chemical contamination of surface water. The area was formed by dumping loads of construction rubble over the east side of SM/PP Hill near the elevated water tank. The dumping occurred over a 30-year period. Approximately a dozen empty barrels are visible in the face of the debris. It is estimated that the area contains in excess of 100,000 cubic yards of material. The dumping of construction rubble in this area was stopped in the early 1980s. The available information did not identify the source of the debris. There was no information pertaining to controls which may have existed in the early years of dumping to prevent wastes other than construction rubble from being disposed of at this location. In addition, no records were available concerning asbestos disposal practices prior to 1980. It does not appear that asbestos was segregated from other construction debris. Therefore, it is possible that this area contains asbestos among the rubble.

The Survey collected soil samples from the construction spoil site and analyzed them for radionuclides. The results were inconclusive; however, other Survey sampling results were used in modeling the Construction in the Valley Locations ranking unit.

Final Survey Finding: Inactive Sites and Releases III-5 (Preliminary Survey Finding: Inactive Sites and Releases III-5)

Potential Surface Contamination at an Old Solvent Storage Area. Waste solvents may have been released to the soil from drums stored at an old solvent storage area in the southern portion of the site (Site 4). The area was located on the west side of the now-existing road between SM/PP Hill and the Building 21 area, just before the road bends to the west when going south from SM/PP. The site appears on a number of old aerial photographs of Mound and shows between 100 and 500 drums located north of the old firing range. Construction plans dated 1976 from the landfill label the area as a waste spoil site. New construction in the vicinity has removed features previously visible from the aerial photographs, and a visual inspection of the site did not reveal any drums or debris. There are no records to indicate the length of time in which solvents were stored or staged in the area, but the site appears on aerial photographs over a period of several years. The site had an estimated areal extent of 80 by 180 feet.

The Survey collected sludge samples from runoff areas near the old solvent storage area. Samples were analyzed for volatiles, semivolatiles, inorganics, and radionuclides. Results of analysis confirmed the presence of contaminants such as pyrene, fluoranthene, and beryllium. These data were used in modeling the Contamination on the SM/PP Hill ranking unit.

Final Survey Finding: Inactive Sites and Releases III-6 (Preliminary Survey Finding: Inactive Sites and Releases III-6)

Disposal of Organic Solvents to Soils. Organic solvents and lithium carbonate were disposed of in an area that is now partially covered by Building 34 (Site 5) and may pose a threat to groundwater. The waste was dumped into a pool of stagnant water approximately 150 feet in diameter. It is not known if the waste was radioactively contaminated or if the material was disposed of.

The Survey collected samples from groundwater monitoring wells and analyzed them for volatiles, semivolatiles, inorganics, and radionuclides. The results confirmed the presence of contaminants such as trichloroethylene and

tetrachloroethylene. These data were used in modeling the Contamination in the Valley Locations ranking unit.

Final Survey Finding: Inactive Sites and Releases III-7 (Preliminary Survey Finding: Inactive Sites and Releases III-7)

Elevated Radiation Readings at Off-Site Dirt Road. Elevated beta/gamma radiation readings were detected by Survey personnel off-site on a dirt road east of the Miami-Erie Canal. A walkover detected radiation readings of 10-12 counts per minute in an area where typical background is 3-4 counts per minute. The road is approximately 1/2-mile long and extends southward from the recreation parking lot. Activity readings were encountered along the entire span of road walked. The Survey team was not able to determine the source of the radioactive contamination. The dirt road appeared to be partially constructed of an ash material which may be fly ash from a coal-fired boiler. Coal fly ash typically contains a radioactive component due to the natural radioactivity in the native coal. It is not an uncommon practice to use fly ash as a part of roadbed material.

The Survey collected soil samples from the dirt road and analyzed them for radionuclides. The results confirmed the presence of plutonium-238. This datum was used in modeling the Contamination of Dirt Road ranking unit.

Final Survey Finding: Inactive Sites and Releases III-8 (Preliminary Survey Finding: Waste Management II-1)

Release of Hazardous Waste to Soils from SM/PP Hill Drum Storage Area. The previous storage of hazardous waste and waste oil drums at the field east of the burn area resulted in releases for hazardous waste to the soil. The storage area contained 193 waste drums and was located on SM/PP Hill approximately 250 yards southeast of the burn area. The area measured approximately 50 by 100 feet. The drums contained plating shop waste, solvent waste, explosive/solvent waste, batteries, kitchen grease, herbicides, photographic solution, epoxy preforms, laboratory chemicals, scintillation vials (<50 μCi/l), waste oil and other chemical wastes.

The Survey collected soil samples at the previous drum storage area on SM/PP Hill and analyzed the samples for volatiles, semivolatiles, radionuclides, and inorganics. The results of the analysis confirmed the presence of contaminants such as cadmium, methyl ethyl ketone, and pyrene. These data were used in modeling the SM/PP Hill Drum Storage Area ranking unit.

8.2 Closed Findings and Observations

- Unpermitted Hazardous Waste Storage Unit (Preliminary Survey Finding: Waste Management II-2). Based on documentation from the State of Ohio approving the closure relocation plan for the hazardous waste drum storage facility, the finding was closed.

- Potential for Release of Plutonium Wastewater (Preliminary Survey Finding: Waste Management II-3). New procedures have been developed and reviewed by the DOE Team Leader that close the drain valve of a stormwater drain adjacent to the WD Building during unloading of liquid radioactive waste from tanker trucks and open the drain valve after the off-loading is complete.

- Leak Detection System Operation (Preliminary Survey Finding: Waste Management III-1). Based on observations made at the DAR meeting, the reconfiguration of the C and D waste tanks, including the drain lines and drip lines, has rectified the need for leak detection system of WD influent waste.

- Potential for Release of Plutonium Wastewater If Pipeline Breached (Preliminary Survey Finding: Surface Water III-2). Based on observations made at the DAR meeting, the radioactive wastewater piping between SW and WD Buildings is now protected by double fencing.