

ROSEMOUNT U OF M (UMRRRC)
Record of Decision
Soil Cleanup
June 11, 1990

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO THE ATTENTION OF:
5RA-14

JUN 29 1990

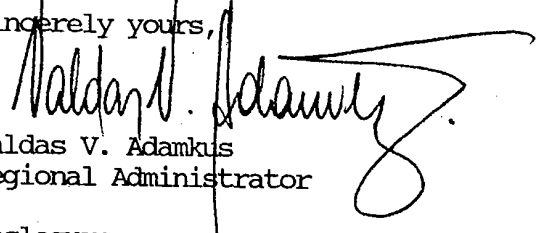
Mr. Gerald L. Willet
Commissioner
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Mr. Willet:

The U.S. Environmental Protection Agency (U.S. EPA) hereby concurs with the remedy identified in the enclosed Record of Decision (ROD) completed by the Minnesota Pollution Control Agency (MPCA) for the University of Minnesota Rosemount Research Center site. Our concurrence is in accordance with 40 CFR §300.515(e)(2)(i) and (ii) and is based upon our review of the documents contained on the first enclosure to this letter.

Our concurrence with the ROD is also based upon the understanding that off-site disposal of lead after August 8, 1990 will comply with Land Disposal Restrictions.

We look forward to our continuing involvement on the University of Minnesota Rosemount Research Center Site.

Sincerely yours,

Valdas V. Adamkus
Regional Administrator

Enclosures

RECEIVED

JUL 19 1990

MPCA, Ground Water
Solid Waste Div.

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JUL 09 1990

MINN. POLLUTION
CONTROL AGENCY

UNIVERSITY OF MINNESOTA
ROSEMOUNT RESEARCH CENTER
DOCUMENTS REVIEWED FOR ROD CONCURRENCE

1. Rosemount Research Center Hydrogeologic Investigation Rosemount, Minnesota; August 27, 1984; prepared by SEC;
2. University of Minnesota Response To Request for Information, September 4, 1984; prepared by University of Minnesota;
3. Shallow Seismic Reflection Feasibility Study, University of Minnesota, Rosemount, Minnesota; March 29, 1985; prepared by SEC and Bison Instruments, Inc;
4. Site Security and Safety Plan, June 28, 1985, SEC;
5. Quality Assurance Manual, PEI Laboratory; July 1, 1985; SEC;
6. Quality Assurance Manual, July 1, 1985, TCT;
7. Seismic Refraction Investigation, University of Minnesota Research Facility, Rosemount, Minnesota; July 1985; SEC and Bison Instruments, Inc.;
8. First Quarter Summary Report, Phase II Remedial Investigation, Rosemount Research Center, University of Minnesota; August 27, 1985; TCT;
9. Final Report, Ground Water Contamination, Remedial Investigation, Rosemount Research Center, University of Minnesota; November 27, 1985; TCT;
10. Second Quarter Summary Report, Phase II Remedial Investigation, Rosemount Research Center, University of Minnesota; December 9, 1985; TCT;
11. Remedial Investigation Final Report, George's Used Equipment Site, U.S. Transformer Site, Coates Dump Site, Oxidation Pond, Rosemount Research Center, University of Minnesota; February 25, 1986; TCT;
12. Detailed Analysis Report, Alternatives For A Permanent Drinking Water Supply - Rosemount Center Area, Rosemount, Minnesota; February 25, 1986; University of Minnesota;
13. Final Supplemental RI Report; Rosemount Research Center, Rosemount, Minnesota; August 15, 1986; IT;
14. Letter Report, Investigation of the Porter Electric Area, Rosemount Research Center; September 5, 1986; IT;
15. Endangerment Assessment, Rosemount Research Center, University of Minnesota (including Executive Summary); September 26, 1986; IT;
16. Ground Water Interim Response Action Plan, University of Minnesota, Rosemount Research Center Site; November 11, 1986; Delta Environmental Consultants, Inc. (Delta);

17. Alternatives Report, Rosemount Research Center, Rosemount, Minnesota; November 1986; (including addenda dated February 18, 1987 and July 22, 1988 and Executive Summary dated November 10, 1986); IT;
18. Evaluation of Waste Disposal Burn Pit, Alternative water Supply Sites and Existing Well Abandonment Procedures, University of Minnesota, Rosemount Research Center, Rosemount, Minnesota; September 29, 1986; TCT and Delta;
19. Final Detailed Analysis Report And Conceptual Design, Rosemount Research Center, Rosemount, Minnesota; May 12, 1987; IT;
20. Geophysical Surveys of the University of Minnesota Rosemount Research Center, May 14, 1987, Minnesota Department of Natural Resources;
21. Proposed Design and Schedule For An Alternative Treatment Method of Contaminated Water; July 8, 1987; Delta;
22. Final Report Phase II Ground Water Investigation, George's Used Equipment Site, Rosemount Research Center; April 21, 1988; IT;
23. Final Report, Soil Contamination Investigation, George's Used Equipment Site, Rosemount Research Center; June 7, 1988; IT;
24. Soil Contamination Investigation, Rosemount Research Center, Volumes 1 and 2; July 28, 1988; IT;
25. Air Quality Review and Project Schedule, July 28, 1988; IT;
26. Pilot Test Report, December 1988, IT;
27. Quality Assurance Plan and Field Sampling Procedures For: U of M - Rosemount Research Center, George's Used Equipment and Porter Electric sites; March 20, 1989; IT; and
28. Site Use Evaluation for University of Minnesota PCB Site Clean Up, Rosemount Research Center; May 5, 1989; IT;
29. Final Phase III Ground Water Sampling Report, Rosemount Research Center; July 10, 1989; IT; and
30. Final Design Specifications For: University of Minnesota PCB Site Clean Up Rosemount Research Center, September 26, 1989, IT;
31. Phase I Report, University of Minnesota, Rosemount Research Center Remedial Investigation, Rosemount, Minnesota; February 1985; prepared By Soil Exploration Company (SEC);
32. Final Report, Groundwater Contamination Remedial, Rosemount Research Center; November 27, 1985; prepared by Twin City Testing Corporation (TCT);

33. Final Design Specifications For: University of Minnesota PCB Site Clean Up, Rosemount Research Center, July 28, 1988, prepared by International Technology Corporation (IT);
34. Letter Report: Submittal of Cost Estimates to Include Excavation to 10 Ppm PCB; December 13, 1988; International Technology Corporation (IT);
35. Letter Report: Submittal of Cost Estimates to Include Excavation to Lower Levels; December 13, 1988; IT and
36. Letter Report for Excavation and Backfill of Soil with 10-25 Ppm PCBs, Rosemount Research Center; December 14, 1989; IT.

Record of Decision

University of Minnesota Rosemount Research Center

1990

Minnesota Pollution Control Agency

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- Attachment 1 Final Detailed Analysis Report and Conceptual Design Responsiveness Summary
- Attachment 2 Minnesota Enforcement Decision Document For Burn Pit Site

DECLARATION

Site Name and Location

University of Minnesota Rosemount Research Center, Rosemount,
Dakota County, Minnesota

Statement of Basis and Purpose

This decision document presents the selected remedial actions for the University of Minnesota Rosemount Research Center Site in Rosemount, Dakota County, Minnesota. The document was developed in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by Superfund Amendments Reauthorization Act (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

Description of the Selected Remedy

George's Used Equipment/Porter Electric and Machine Company/U.S. Transformer Sites

The selected remedy, thermal destruction of the polychlorinated biphenyls (PCBs), with preference for on-site thermal desorption with fume incineration, and off-site disposal of soil contaminated with lead and copper, was developed to protect public health and the environment by preventing direct contact with contaminated soils and by preventing leaching of the contaminants into the ground water by removing the sources of contamination.

The major components of the remedy are:

- ° Excavate 6,469 cubic yards of soil and concrete contaminated with greater than 25 parts per million (ppm) PCBs and 2,620 cubic yards of soil contaminated with metals (copper and lead) exceeding 1,000 ppm lead (of the 2,620 cubic yards, 1,896 cubic yards also contaminated with PCBs);
- ° Consolidate 14,809 cubic yards of soil from the three Sites contaminated with 10 to 25 ppm PCBs and at one location and limit access by man-made barriers;
- ° Thermally destroy the PCBs from the 6,469 cubic yards of soil and concrete;
- ° Transport soil exceeding 1,000 ppm of lead to an off-site RCRA-permitted landfill (transport soil exceeding 49 ppm PCBs to a RCRA-/TSCA-permitted landfill); and
- ° Backfill with clean soil, grade and establish vegetation.

This remedy addresses the principal threats of ingestion or direct contact with the contaminated soil or ingestion of PCB and lead contaminated ground water.

Burn Pit Site

The selected remedy for the second operable unit, a pump out and air stripper treatment system, was developed to protect public health and the environment by preventing ingestion of ground water contaminated with volatile organic compounds.

The major component of the remedy is:

Ground Water Pumpout

- ° Install a pump in a monitoring well downgradient of the Burn Pit Site;
- ° Treat pump out water in a packed tower aeration system; and
- ° Discharge treated water to an infiltration pond.

This remedy represents the second of two operable units within the overall site strategy and addresses the principle threat of ingestion of contaminated water.

Declaration of Consistency

The selected remedies are protective of human health and the environment, attain federal and state requirements that are applicable or relevant and appropriate to this remedial action, and are cost-effective. These remedies satisfy the statutory preference for remedies that employ treatment that reduce toxicity, mobility or volume as a principal element and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

6-11-90

Date

Gerald L. Willet

Gerald L. Willet

Commissioner

Minnesota Pollution Control Agency

Date

Valdas V. Adamkus

Regional Administrator

Region V

U.S. Environmental Protection Agency

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

University of Minnesota Rosemount Research Center

Rosemount, Minnesota

I. Site Name, Location, and Description

The University of Minnesota's Rosemount Research Center (RRC) is located within the city limits of Rosemount in Dakota County, approximately 20 miles southeast of the Minneapolis/St. Paul metropolitan area (Figure 1). The RRC covers approximately 12 square miles and is used primarily as an agricultural research station, although some light manufacturing and service companies are present. Within the confines of the RRC, the RRC Site (Site), consisting of several disposal sites, has been investigated. This Record of Decision addresses the remediation of the following disposal Sites: the George's Used Equipment (GUE) Site, the Porter Electric and Machine Company (PE) Site, the U.S. Transformer (UST) Site and the Burn Pit Site (Figure 2).

The topography of the RRC is the result of glacial and glaciofluvial deposition. The RRC is molded by glacial deposition and the RRC is generally level, except the southeast corner which is bounded by a northwest-southeast trending ridge of Iowan age till (Figure 2). The RRC is underlain by 75 to 150 feet of Pleistocene age outwash sand and gravel. These deposits constitute the upper aquifer and are recharged by precipitation. The sand and gravel is underlain by fractured dolomite of the Ordovician Prairie du Chien Group, although in places these two units are separated by clays of the Superior Lobe till. The dolomite is hydraulically connected to the underlying Cambrian Jordan Sandstone and forms the second aquifer of concern. The Jordan Sandstone is underlain by the St. Lawrence Formation, a dolomitic siltstone that acts as a regional aquitard. A third water-bearing unit, the Franconia Formation,

underlies the St. Lawrence Formation, but is not widely used as a water source in the area and is not presently at risk.

A major erosional bedrock valley is present in the northern portion of the RRC (Figure 3) and is filled with sand and gravel deposits. This valley fill modifies the regional ground water flow direction which is generally to the east-northeast. The valley divides into two branches, one to the north and one to the east, both of which ultimately discharge to the Mississippi River. The water table is present at a depth of 60 to 70 feet, within the outwash sand and gravel.

No significant surface water resources are present on the RRC. The Mississippi River is located approximately 5 miles east and northeast of the RRC and acts as a regional discharge point for ground water. The RRC Site described by this document is not part of the 100 year flood plain, according to the National Flood Plain Program map for the city of Rosemount.

Land adjacent to the RRC is used for agriculture and rural residences. According to 1980 census data, approximately 7,000 people live within a 4-mile radius of the Site; less than 75 people live within a 1-mile radius of the Site. Eleven water wells are located on RRC property and approximately 50 residential and small business wells are present north and east of the RRC (Figure 4).

II. Site History and Enforcement Activities

Site History

The RRC was originally developed as a federal ammunition manufacturing plant during the early 1940s. Operation ceased in 1945, and the facility was deeded over to the University of Minnesota (University). Since that time, the RRC has been used by the University for research. The University has also leased various sites and facilities to individuals and small businesses.

Activities and disposal practices of the University and some of its lessees resulted in the subject soil and ground water contamination.

The GUE Site (Figure 5) was used as an electrical equipment storage and salvage facility, as well as a general salvage facility between 1968 and 1985. The activities conducted at the GUE Site included reclamation of copper wire by burning off insulation, the salvage of electrical equipment, batteries, and drums; incineration of liquids, including polychlorinated biphenyl (PCB) contaminated oils; and unidentified drum handling/storage and transfer activities. Most of the PCB oils were apparently disposed of in a depressional area, although low-level contamination is widespread at the GUE Site (Figure 7). Some solvents were also released at the GUE Site. The contamination of soil by lead is believed to be associated with lead acid battery and wire reclamation activities at the GUE Site.

The Porter Electric and Machine Company leased property immediately south of the GUE Site from 1968 to 1971 (Figure 5). This property was used for storage and reconditioning of used industrial electrical equipment. PCB contaminated waste oils generated from these activities reportedly were spread on roads in the area. An area of soil contaminated by PCBs exists at the PE Site (Figure 7).

U. S. Transformer leased property approximately 2000 feet northeast of the GUE Site from 1973 to 1978 (Figure 6). The property was used for dismantling and salvaging electrical transformers. Waste oils from these activities were reportedly washed off a concrete slab onto the soil at the UST Site. An extensive area of PCB contaminated soil exists at the UST Site (Figure 8).

The Burn Pit Site, located just north of 160th Street, mid-way between Akron and Blaine Avenues, was used by the University as a disposal area for waste chemicals (Figure 2). Unconfirmed reports suggest disposal of chemicals

began in this area in the early 1960s. University records indicate that, between 1968 and 1974, approximately 90,000 gallons of laboratory chemicals, solvents, corrosives, salts, heavy metals, organics and inorganics were infiltrated and/or burned in the pit. The pit was lined with lime, backfilled with clean sand and capped with clay in 1980.

The investigation of the RRC Site began on January 31, 1984, when, during routine monitoring of the Pine Bend Landfill, the Minnesota Department of Health (MDH) detected 1.3 parts per billion (ppb) chloroform in a residential water well upgradient of the landfill. Following additional sampling, the Minnesota Pollution Control Agency (MPCA) staff met with Dakota County (County) officials on March 14, 1984, to discuss the direction of the investigation. On June 12, 1984, further sampling of wells on and off of the RRC occurred, followed by a report submitted by the County to the MPCA staff on June 18, 1984.

In July 1984, additional sampling occurred, as well as a site inspection made by MPCA, County and University officials. As a result of these investigations, the MDH issued well advisories to 27 families whose wells were contaminated with chloroform above the Recommended Allowable Limit (RAL). In 1984, the RAL for chloroform was 1.9 ppb, was raised to 5 ppb, and then to 57 ppb in early 1988.

On August 2, 1984, a formal Request for Information (RFI) was sent by the MPCA staff to the University and current RRC tenants. The University hired a consultant to conduct the Remedial Investigation (RI) to respond to the RFI; a response to the RFI was received on September 4, 1984. On October 4, 1984, the MPCA issued a Request for Response Action (RFRA) to the University. Sampling of residential and monitoring wells continued. Formal negotiations between the MPCA staff and University began on January 9, 1985 and resulted in a Response Action Agreement dated May 30, 1985. During this time, Phase I of the RI was

completed; the Phase I RI Report was submitted on March 13, 1985. This report identified the Burn Pit Site as the source of the ground water contamination.

An epidemiology study was initiated by the MPCA and MDH staff on July 9, 1985. Phase II of the RI continued, with quarterly reports being submitted to the MPCA staff. The RI Final Report was submitted in November 1985.

In late 1985, the GUE/PE/UST soil investigation became a separate investigation from the ground water solvent contamination. Because of the immediate threat to the public, the ground water contamination was given priority, and on February 25, 1986, the Detailed Analysis Report, Alternatives For A Permanent Drinking Water Supply - Rosemount Research Center Area, Rosemount, Minnesota (DAR) for an alternative water supply was submitted. The DAR recommended installation of new deeper wells to replace the private wells which had contaminated water. Following MPCA staff and public approval of the DAR, the Response Action Plan, Ground Water Contamination Project, Rosemount Research Center, was submitted on May 12, 1986, and a prototype replacement well was completed on July 17, 1986.

Work on remediation of the solvent plume and water supply plans continued through late 1986 with submission of the Ground Water Interim Response Action Plan, University of Minnesota, Rosemount Research Center Site Report, dated November 11, 1986, and the Evaluation of Waste Disposal Burn Pit, Alternate Water Supply Sites and Existing Well Abandonment Procedures, University of Minnesota, Rosemount Research Center, Rosemount, Minnesota Report submitted on February 10, 1987.

The soil investigation for the GUE/PE/UST Site was also underway during 1986. On October 26, 1986, the Endangerment Assessment, Rosemount Research Center, University of Minnesota (Endangerment Assessment) for the GUE, PE and UST Sites was submitted to the MPCA staff. The Alternatives Report, Rosemount Research Center, Rosemount, Minnesota for remediation of the PCB contaminated soil was submitted on November 10, 1986, followed by the Final Detailed Analysis

Report And Conceptual Design, Rosemount Research Center, Rosemount, Minnesota on May 12, 1987. On July 21, 1987 the MPCA staff approved the selection of Alternative 7D (on-site thermal desorption and fume incineration) and Alternative 7F (on-site thermal desorption with condensation and scrubbing of vapors followed by off-site commercial incineration) as the remedial actions. However, after further analysis, Alternative 7F was eliminated because of problems with handling and disposal/destruction associated with fume condensation. A ground water investigation at the GUE Site, began in early 1987 and advanced to Phase II in early 1988. In December 1987, the entire RRC Site was placed on the National Priority List with a score of 46.

In 1988 the following reports were submitted to the MPCA staff:

Final Report Phase II Ground Water Investigation, George's Used Equipment Site, Rosemount Research Center on April 21, 1988; Final Report, Soil Contamination Investigation, George's Used Equipment Site, Rosemount Research Center on June 7, 1988; Soil Contamination Investigation, Rosemount Research Center; Volumes 1* and 2 on July 28, 1988; Air Quality Review and Project Schedule on July 28, 1988; and Pilot Test Report in December 1988.

Early in 1988, the chloroform RAL was raised to 57 ppb. None of the residential wells exceeded this concentration; however, the University decided to install a rural water system installation anyway.

Enforcement Activities

Enforcement actions relating to the RRC Site included Requests For Information to the Potential Responsible Parties (PRPs) issuances of a Request For Response Action to the University, and negotiations and execution of a Response Action Agreement with the University as described above. The cooperative response by the University made moratorium unnecessary. Negotiations resulted in a Response Action Agreement dated May 30, 1985, between

the University and the MPCA. The only lawsuit that arose from the RI was brought before the United State Bankruptcy Court, District of Minnesota, In Re: U.S. Transformer, Inc., Debtor (Case No. 3-84-1136). Technical discussions with PRPs are summarized in the Administrative Record.

III. Community Participation

Public interest in the RRC Site has focused on the ground water contamination and the water supply remedial action alternatives for the affected residents. PCB and lead contamination in the soil on the Site received moderate public attention during the RI, but public interest in the recommended alternatives has been low to date.

Public meetings regarding the ground water contamination investigation were held on July 25, 1984; March 26, 1985; May 23, 1985; August 28, 1985; and March 10, 1986. These meetings resulted in consent among the MPCA staff, the University, the County, Rosemount officials and Rosemount residents that construction of new residential wells was the preferred drinking water remedial action. In accordance with this decision, a prototype well was installed in July 1986, but was found to be susceptible to iron bacterial growth. Because of this, in December 1986, Rosemount residents requested that the MPCA staff and the University re-evaluate the water supply remedial action alternatives. In response to this request, the University held public meetings to discuss rural water supply systems on August 3, and October 21, 1987.

On April 25, 1988, the MPCA staff received draft revisions of the MDH RALs. The chloroform RAL was raised from 5 to 57 ppb. Because this increase in the RAL meant the water from affected drinking water wells in Rosemount no longer exceeded the chloroform's RAL, and because trend analyses of ground water data showed no significant risk of contaminants over RALs reaching water supplies

from the RRC Site, the MPCA staff determined that the University no longer had a legal obligation to install a water supply system. On May 16, 1988, this information was presented to the residents at a public meeting and discussion ensued regarding the University's legal obligations. On June 13, 1988, the University's Board of Trustees met and approved completion of the independent water distribution system provided that a majority of residents sign a property damage waiver. A majority of residents agreed by September 1988, and work on the system proceeded.

The soil contamination investigation proceeded concurrently with the ground water investigation. Public meetings, held in Rosemount on March 26, 1985, August 28, 1985, and April 14, 1986, presented the results of the soil investigations conducted by the MPCA staff and the University. On August 27, 1987, a public notice was mailed to affected residents and interested parties and a news release was mailed to all County newspapers and the St. Paul and Minneapolis daily papers. The notice and news release briefly described the soil remediation alternatives at the GUE/PE/UST Sites and the water distribution and air stripping treatment process at the Burn Pit Site being considered and those being recommended by the University. The notice and news release also indicated that copies of the Final Detailed Analysis Report and Conceptual Design Report were available for public review in the Rosemount City Hall, and announced the public meeting to discuss the alternatives report. The news release was published in four County newspapers between September 7 and September 10, 1987. A paid public notice was published in the St. Paul Pioneer Press daily paper on September 18, 1987.

The public meeting was held on September 16, 1987, and 11 area residents attended. Many questions were asked about specific details of thermal desorption, incineration, soil excavation, ground water pump out, and ground

water movement; however, there were no public comments on the recommended alternative. County officials had previously provided written comments which are described in the attached responsiveness summary. The comment period ended on September 23, 1987. Except for County officials, no further communications from the public have been received about the recommended alternatives. At the community's request, subsequent documents on the site have been made available at the Rosemount City Hall for review.

As indicated previously, in early 1988, the need to implement the water supply remedy was reevaluated and it was determined that due to the change in the Minnesota Department of Health's Recommended Allowable Limit for chloroform, the University of Minnesota had no legal obligation to implement this remedy; however, the University intends to implement the water supply remedy anyway. The ground water pump out remedy has been implemented. This ROD discusses the decision making process which led to the selection of the water supply remedy even though now the University has no legal obligation to implement the water supply remedy.

IV. Scope and Role of Operable Units in the Response Action

In the overall site strategy one operable unit addresses the soil contamination at the GUE, PE and UST Sites and a second operable unit addresses the volatile organic compound (VOC) ground water contamination from the burn pit Site.

The first operable unit will address the soil contamination by PCB-bearing oils and solvents at the GUE, PE, and UST sites and from metals (lead and copper). The first operable unit involves the excavation of the contaminated soil, and thermal destruction of the PCBs (thermal desorption followed by fume incineration), backfilling of clean soil, and off-site landfilling of soil contaminated with metals. The total volume of contaminated soil to be excavated and treated, disposed of off-site, and consolidated on the GUE Site is estimated at 23,898 cubic yards. Soil (some of which will be contaminated with PCBs) with

lead concentrations greater than 1,000 parts per million (ppm) will be shipped off site for disposal at a RCRA-permitted facility. Soil with concentrations of PCBs greater than 25 ppm will be treated by thermal destruction (desorption-incineration). Also, 14,809 cubic yards of soil from the three sites with from 10 to 25 ppm PCBs will be consolidated on the GUE Site. Thus, the first operable unit addresses the principal threats of direct contact with PCB and/or metal contaminated soil or ingestion of PCB and/or metal contaminated ground water by removing and destroying the sources of contamination. The most current estimates of soil to be treated or consolidated are found in the document entitled, Letter Report For Excavation and Backfill of Soil With 10-25 PCBs, Rosemount Research Center, dated December 14, 1989.

The second operable unit, addressing the ground water contamination from the Burn Pit Site, consists of a pump out well and air stripper system and a rural water supply system is described in the Minnesota Enforcement Decision Document, University of Minnesota Rosemount Research Center (MEDD) (see Attachment 2) dated December 4, 1986, and a Proposed Design and Schedule for an Alternative Treatment Method of Contaminated Water, dated July 8, 1987. This operable unit addresses the principal threat of ingestion of ground water contaminated with VOCs by volatilizing the VOCs and by providing an alternative, clean water supply to potential receptors.

V. Site Characteristics

GUE/PE/UST Sites

The GUE, PE, and UST Sites were all used as electrical equipment storage and/or reconditioning facilities. All three sites have soil contaminated with PCBs and, in the case of the GUE Site, copper and lead from the recycling and incineration process used to salvage metal wire and lead from lead acid batteries. Other contaminants have been identified in the soil at the sites, but do not represent a threat to public health or the environment at the

concentrations observed on site. These other contaminants are: acetone, phenol, 1,4-dichlorobenzene, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, naphthalene, diethyl phthalate, dibutyl phthalate, and a variety of polynuclear aromatic hydrocarbons (PAHs) at low ppm levels; antimony, arsenic, beryllium, cadmium, chromium, nickel, and zinc; and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and furan 2,3,7,8-tetrachlorodibenzofuran (TCDF). Pesticides were analyzed for, but not detected. Of the compounds present in the soil, only chromium was detected in ground water in a monitoring well (0.16 ppm - sample collected January 1986) above the maximum contaminant level (MCL) (0.05 ppm), although subsequent sampling showed it to be below the MCL (0.020 ppm - sample collected July 1986). The other compounds were below the detection limits in ground water. Although many of these compounds, particularly List 1 PAHs, dioxins, and furans, are known or suspected carcinogens, the low levels at which they occur in the soil and their absence in ground water was the basis for the determination that they do not represent a threat to public health or the environment.

PCBs have been detected in the soil at the three sites. At the GUE Site, surface soil sample concentrations range from 1.7 to 42,000 ppm. Over most of the site, PCBs are concentrated in the upper 2 to 9 feet of the soil. However, an area approximately 50 by 100 feet with high concentrations of PCBs to a depth of at least 36 feet is present in a natural depression (Figure 7). There is evidence that the PCBs may have migrated in this area to a depth of 61 feet, although the levels detected below 36 feet range from below the detection limit to 7.7 ppm and may be the result of contamination during drilling. The PCBs were identified as Aroclor 1260, with the exception of one surface sample identified as Aroclor 1254.

The situation at the PE Site is similar to the GUE Site. Surface sampling revealed an area approximately 250 by 150 feet where PCB concentrations range from 3.8 to 63,000 ppm (Figure 7). The types of PCBs identified are Aroclor

1242, 1248, 1254, and 1260. Samples from a boring drilled in the most contaminated zone indicated contamination by Aroclor 1242 PCBs to depth of 74.5 feet. The concentrations decrease dramatically with depth and are generally below 10 ppm at depths greater than 43 feet.

At the UST Site, PCB contamination is widespread but shallow, being confined to the upper 3 feet of soil over an area approximately 300 by 400 feet (Figure 8). The PCBs were identified as Aroclor 1260.

Heavy metal contamination occurs predominantly at the GUE Site, although slightly elevated levels of copper were detected at the UST Site. At the GUE Site, analysis of surface soil samples revealed a range of lead concentrations from 9.5 to 40,000 ppm and copper concentrations from 84 to 310,000 ppm. The metal contamination is largely restricted to shallow soil; soil contaminated at or above the cleanup criterion of 1,000 ppm lead is present only to a depth of two feet (Figure 9). At the UST Site, copper and lead concentrations exceed the background concentrations of the soil at the RRC, but the lead concentrations of 40 ppm fall within the common range of lead in U.S. soil (2-200 ppm) as identified by the U.S. EPA (1983) and also within the range of Midwest native soil (up to 2,500 ppm). The copper concentration of 172 ppm slightly exceeds the common range of copper in U.S. soil (2-100 ppm), but does not require response action.

Lead is relatively immobile in soil because of lead's strong sorption to soil particles and organic compounds. The low solubility of PCBs in water makes PCBs mobility relatively low. This is consistent with the widespread but shallow PCB and lead contamination observed at the GUE, PE and UST Sites. The deep PCB contamination at the GUE and PE sites may have occurred as a result of dumping large volumes of PCB oil in a small area or co-disposal of VOCs with the PCB oils. PCBs are highly soluble in organic solvents, such as tri- and

dichlorobenzene and acetone, and these may have enhanced the PCBs' ability to migrate. However, the non-polar organic solvents detected at the sites are also readily adsorbed onto organic compounds and may not readily migrate through soil. A second theory is that the sheer volume of PCB oil disposed at the sites saturated the soil with oil and caused the PCB oil to migrate.

The types of media affected at the sites are predominantly sandy soil and outwash sands, with some clayey organic soil and fill material present at the surface at the GUE Site and some PCB contaminated concrete at the UST Site. The estimated volumes of contaminated materials (> 1 ppm PCB, > 50 ppm lead) are 2,500 cubic yards of lead soil, 160 cubic yards of concrete, and 57,000 cubic yards of PCB soil. Lead and PCBs were detected in the ground water on only one occasion in different monitoring wells, but subsequent sampling did not confirm the presence of PCBs or lead which indicates that the ground water has not yet been impacted by these contaminants.

Burn Pit Site

The burn pit was constructed in the late 1960s by filling in an existing east-west drainage ditch at two locations approximately 80 feet apart. The surface dimensions of the pit were 35 feet by 80 feet by 12 feet deep. The walls of the pit were sloped and blast shields and chutes were located on two sides of the pit to protect the employees during the disposal and burning of the waste.

The burn pit was used during the late 1960s and early 1970s for disposal of waste laboratory chemicals, solvents, corrosives, salts, heavy metals, organics and inorganics by infiltration and burning. During closure, lime was applied to a depth of six inches over the entire surface of the pit. After liming, the pit was filled with clean dirt and capped with clay. The pit was closed in 1980.

Analysis of soil from borings in and around the burn pit indicate low ppb

concentrations of toluene, 1,1,1 trichloroethane, carbon tetrachloride, tetrachloroethane, and methylene chloride. The maximum concentration of these contaminants was 11 ppb toluene. Lindane and PCBs were detected at low ppb levels at depths of 14.5 to 16.5 and 22 to 24 feet in one boring. No chloroform was detected in the soil samples. The level of soil contamination at the burn pit does not necessitate any remedial action.

Ground water contamination associated with the burn pit occurs as a plume approximately four miles long that trends to the east and then northeast (Figure 10). The highest concentrations of chloroform (72 ppb) were detected in monitoring well MW-21D, approximately one mile east of the burn pit. Concentrations range from non-detect to 39 ppb in the other monitoring wells, and from non-detect to 16 ppb in the residential wells.

VI. Summary of Site Risks

Selection of Indicator Chemicals

In accordance with the Guidance on Remedial Investigations under CERCLA, dated May 1985 and the Superfund Public Health Evaluation Manual Draft, dated January 5, 1986, indicator chemicals were selected to facilitate the public health evaluation and determination of the cleanup criteria. Lead and PCB (Aroclor 1260 and 1242) were selected for the soil remediation based on their greater concentration, toxicity and areal distribution compared to the other compounds detected at the GUE, PE and UST Sites. Chloroform was selected for the ground water remediation because it occurred in the greatest number of residential wells and was the only compound found in the residential wells that occurred in significant concentration (based upon the chloroform RAL of 1.9 at that time). The other compounds have never been detected above 2 ppb.

Exposure Assessment

The Endangerment Assessment, analyzes the potential transport pathways and receptors for contamination at the GUE, PE and UST Sites. Surface water run-off is recharged directly to ground water and does not represent a potential pathway. Likewise, analysis of air transport modeling has eliminated air as a potential pathway. According to the models, a hypothetical receptor 1,000 feet downwind would receive a PCB dose between 10 to 1,000 times less than the most restrictive occupational exposure guideline of one microgram per cubic meter. Lead would be approximately 1,000 times less than the occupational exposure limit of 0.15 milligram per cubic meter.

Due to the high infiltration rates of the Rosemount outwash (17 inches per year), migration of contaminants to the ground water represents a potentially significant transport pathway. The nearest existing ground water receptors are 12 private water supply wells located 5,000 to 7,000 feet northeast of the GUE and UST Sites. Ground water modeling predicts an arrival time of 50,000 years for PCBs at the RRC property boundary and 100,000 years for the nearest receptor. Solvents which may increase the solubility of PCBs have not been found in significant quantity during testing; therefore, solvents are not expected to play a role in long-term PCB mobility. The Endangerment Assessment predicted that lead would migrate more rapidly if not intercepted by the pump out system, arriving at the property boundary in approximately 41 years. The construction of a rural water supply, already in progress, as part of the second operable unit at the RRC Site (addressing the VOC problem) will remove the receptors from the contaminated aquifer.

Direct dermal contact and/or ingestion of contaminated soil are thus the only remaining exposure pathways to seriously consider at the PCB sites. The most likely receptors for these pathways are workers at the sites. Public

access to the sites is restricted and there are fewer than 75 people living within a one-mile radius of the sites. Proper training and protective equipment should be adequate to ensure worker safety during cleanup of the sites.

The potential for direct contact with burn pit solvents was eliminated as an exposure pathway when the pit was closed in 1980. The only important pathway remaining for solvent exposure is ingestion of contaminated ground water. At present, 20 wells, serving 27 families, have detectable quantities of chloroform and 16 other wells in the study area could potentially become contaminated. However, aquifer remediation is underway and the construction of a rural water supply system, begun in October 1988, will eliminate this pathway.

Risk Assessment

PCBs

Information provided here is extracted from the Toxicological Profile for PCBs (June, 1989) published by the Agency for Toxic Substances and Disease Registry (ASTDR). PCBs exist at background levels in much of our air, water and soil.

No adequate studies have been conducted to determine if long-term exposure to PCBs causes cancer in humans. PCB exposure has resulted in an increased incidence of hepatocellular carcinoma in several animal studies. Data from the most recent study on animals were used by the U.S. EPA Carcinogen Assessment Group as the basis for carcinogenic risk assessment. The EPA classifies PCBs as a Group B2 carcinogen (Probable Human Carcinogen). The criteria for this classification is sufficient evidence of carcinogenicity from animal studies and inadequate evidence of carcinogenicity from human studies. EPA has estimated that lifetime ingestion of 0.175 ug/day would present an increased cancer risk of 1 excess cancer per population of 100,000.

An applicable health guideline is the U.S. EPA's PCB Spill Cleanup Policy,

dated July 1, 1987, at 40 CFR § 761 Subpart G of the U.S. EPA's Toxic Substances Control Act (TSCA), which establishes cleanup levels based on the potential for human contact with the PCBs. The codified policy for new spills requires the following cleanup levels:

<u>Type of Area</u>	<u>PCB Decontamination Concentration (ppm)</u>
Nonrestricted Access Area (residential/commercial and rural areas)	Decontaminate to 10
Restricted Access Area (.1 km from residential/commercial area, limited by man-made barriers)	Decontaminate to 25
Restricted Access (Electrical Substation)	Decontaminate to 25 or 50

According to the TSCA categories, the area with residual PCBs may be classified as a restricted access area if the contaminated soil were cleaned up to 25 ppm PCB and limited by a man-made barrier. The Office of Health and Environmental Assessment (OHEA) has concluded that a PCB level of 25 ppm in soil would present less than a 1×10^{-7} level of oncogenic inhalation risk to people on site who work more than 0.1 kilometers from the actual spill area (assuming that the spill area is less than 0.5 acres). The OHEA has also calculated the risk associated with ingestion of 10 ppm PCBs in soil to be 1.54×10^{-4} .

The OHEA has published a report which indicates that a 10-inch cover of clean soil reduces the risk of PCB contaminated soil by approximately an order of magnitude. The planned remedy will have a 16-inch cover over the 10-25 ppm PCB-contaminated soil. The remaining unconsolidated soil, which could have up to 10 ppm PCBs, would have an ingestion risk of 1.54×10^{-4} .

Lead

Data concerning carcinogenicity of high levels of lead in humans are inconclusive, but there is evidence that several lead salts are carcinogenic in laboratory animals, causing tumors of the kidneys. The available evidence indicates that high levels of lead exposure exerts toxic effects on pregnant

women and the fetus. Lead also causes a variety of toxic effects in the brain and nervous system, the kidneys and the blood formation system of humans and has a significant effect on developmental process in young children. Increased blood pressure is also associated with lead, which appears to be significant for middle-aged white males.

The state interim standard for lead in soil is 1,000 ppm. Currently, a waste is classified as hazardous under RCRA only if an EP toxicity leach test for lead yields a concentration of greater than 5 ppm in the leachate. Under RCRA, the total allowable concentration of lead in soil may vary, depending on the chemical form and how well the lead is bound to the soil particles.

Chloroform

The Toxicological Profile for Chloroform, published by the ASTDR (January, 1989) provides the basis for this risk assessment. Exposure to high levels of chloroform by ingestion can affect the central nervous system, liver and kidneys. Chronic exposure to low levels of chloroform has resulted in tumors in animals. However, because there is insufficient evidence of carcinogenicity in humans, chloroform is classified as a Group B2 carcinogen (Probable Human Carcinogen). The EPA originally estimated that lifetime ingestion of only 1.9 ug/l of water would present an increased cancer risk of 1 excess cancer per population of 100,000. More recent and more appropriate research has determined that chloroform is not as potent a carcinogen when administered in drinking water. The Carcinogen Assessment Group has now estimated that lifetime exposure to 57 ug/l of water would present an excess cancer risk of 1 excess cancer per population of 100,000.

Environmental Risks

As described above, the only significant contaminant transport pathways for PCBs and lead are ground water ingestion and direct dermal contact and/or soil ingestion. The environmental impact of these potential pathways is not clear. The potential of significant contaminant migration to the Mississippi River, more than four miles from the GUE, PE and UST Sites, is negligible and would take an enormous amount of time. The models indicate it will take approximately 100,000 years for PCBs and 41 years for lead to travel one mile. Fences may help to deter animals from entering the Site, but the potential remains for direct contact and uptake through the food chain by wildlife. Removal of the contaminated soil and backfill with clean soil should greatly restrict these pathways.

The potential risk associated with chloroform and other VOCs from the Burn Pit Site is that of ingestion of contaminated ground water. The potential environmental impact of this contaminated ground water is, therefore, very limited. Ultimately, the contaminated ground water, without treatment, would discharge to the Mississippi River. Ground water monitoring indicates that the contaminant concentrations decrease with distance from the burn pit, and are below method detection limits of 1 ppb before the ground water reaches the river.

The use of a packed tower aeration system to treat the ground water presents an additional potential environmental exposure pathway. However, according to air quality dispersion calculations for the treatment system in place at the RRC Site, all air quality criteria are expected to be met.

Comparison to ARARs

The federal and state chemical-specific applicable or relevant and appropriate requirements (ARARs) or criteria that are to be considered (TECs) are shown in Table 1. As described above, PCBs and lead have not been conclusively detected in the ground water, but do exceed, by as much as five orders of magnitude, the ARARs and TECs in the soil at the GUE, PE and UST Sites.

When this investigation began in 1984, chloroform was detected in 25 wells, of which only 14 exceeded the original RAL of 1.9 ppb. The present RAL of 57 ppb is not exceeded in any residential well, and is exceeded in only one monitoring well (MW-21) on the RRC.

VII. Documentation of Significant Changes

GUE/PE/UST Sites

The preferred alternative for remediation of the UST, GUE and PE Sites (with or without PCB soil contamination) is excavation of soil with greater than 25 ppm PCBs and 1,000 ppm lead. Soil contaminated with lead greater than 1,000 ppm will be disposed of at an off-site RCRA-permitted landfill without being treated for PCBs. Soil with greater than 25 ppm PCBs (with lead levels below 1,000 ppm) will undergo on-site thermal desorption-incineration to remove PCBs. Soil from the GUE, PE and UST Sites with PCB concentrations between 10 and 25 ppm PCBs would be consolidated on the GUE Site and covered.

The bid specifications will be based on performance criteria determined from the approved alternative, rather than being method specific as originally proposed. This change was made to increase the range of available technologies so that a significant number of bids would be forthcoming to encourage competitive costs.

Burn Pit Site

The preferred alternative for remediation of contaminated ground water from the Burn Pit Site is a pump out and treatment system located on the University property. This alternative was implemented as described in the MEDD, previously mentioned. Treatment of the water consists of packed tower aeration and discharge to an infiltration pond. This action represents a significant change from the initial spray irrigation treatment system, but provides more effective treatment method than the original design. Spray irrigation would not have consistently satisfied the discharge requirement of 5 ppb chloroform (or VOCs) so the packed tower aeration alternative was implemented.

The second phase of the remedial action for the Burn Pit Site is the construction of a rural water supply system to provide clean long-term drinking water to residents with wells that are now or could potentially be affected. The rural water system alternative is a change from the original selected alternative which was approved for this operable unit. However, a rural water supply system provides an equivalent of protection of public health and provides water with more pleasing aesthetic qualities. Initially, the University and the MPCA staff approved the construction of new individual residential wells screened in the Franconia aquifer, as described in the MEDD. This solution was initially accepted by the residents and Rosemount and County officials. The prototype Franconia well proved to be susceptible to taste and odor problems from bacterial growth due to high iron concentrations in the water. Therefore, the residents asked the University to reconsider a rural water supply system. Further negotiations among the residents, Rosemount officials, University officials and the MPCA staff resulted in the selection of a rural water supply system as the appropriate alternative.

VIII. Description of Alternatives

GUE/PE/UST Sites

The Alternatives Report, Rosemount Research Center, Rosemount, Minnesota, dated November 1986, identified 42 potentially relevant technologies for the remediation of the RRC Site. The acceptable technologies were then combined to create 20 alternative remedial actions (summarized in Table 2). Each alternative remedial action was analyzed for effectiveness in meeting the evaluation criteria (see Section IX.: Summary of Comparative Analysis). Alternatives 1 through 5 require at least 30 years of operation and maintenance (O&M).

Soil significantly contaminated with copper and lead which is identified for treatment will be referred to as "soil contaminated with metals." The term "RCRA landfill or vault" means a RCRA approved landfill or vault. The term "TSCA landfill or vault" means a TSCA approved landfill or vault.

Alternative 1: No Action

Alternative 1 involves only long-term ground water monitoring for at least 30 years. The potential for direct dermal contact with and/or ingestion of lead and PCBs would remain, as would the potential threat to ground water due to leaching of metals and PCBs. Implementation of this option would mean that certain areas would remain restricted for residential and commercial use for an indefinite period of time. This alternative is considered a base line scenario to which other alternatives can be compared.

Alternative 2: Limited Site Control

Alternative 2 combines site access and use restrictions and soil venting. Access to the sites would be restricted by the construction of fences around all areas where PCBs exceed 25 ppm and/or lead exceeds 1,000 ppm. In addition, the

University would revise the Comprehensive Development Plan for the RRC to ensure continued restricted site access. A notice would be filed with the Dakota County Registrar of Deeds, recording the change in status of the property. These actions would reduce the risk of direct dermal contact with the contaminated soil.

Soil venting is an accepted technology for removing VOCs from unsaturated soil above the water table. At the RRC Site, it would be used to volatilize the VOCs at the GUE and PE Sites, eliminating the potential for VOCs to mobilize PCBs. The effectiveness of this action would be verified by long-term ground water monitoring (at least 30 years). Solvent venting would have no effect on reducing the potential migration of lead to ground water.

Alternative 3: Permeable Cover

Alternative 3 involves the excavation and off-site disposal of approximately 2,620 cubic yards of soil contaminated with metals at a RCRA landfill. A permeable soil cover of 1.5 feet in thickness would then be spread over areas in excess of 25 ppm PCB to reduce the risk of direct dermal contact. The cover would be graded and then seeded with grass to minimize erosion. A soil venting system would be installed to volatilize the VOCs to reduce the potential for PCB migration to ground water. The effectiveness of the remediation would be verified by long-term ground water monitoring (at least 30 years). Because the PCB contaminated soil are not excavated or moved, this alternative would minimize exposure of workers during the remedial action.

Alternative 4: Impermeable Cap

Alternative 4 is similar to Alternative 3, except the cover on the RRC Site would be impermeable (therefore a cap) thus restricting surface water infiltration. Without the infiltration of water acting as a driving force to dislodge PCBs presently adsorbed onto the unsaturated soil, there is no need for

a venting system. The cap would consist of a clay layer overlain by seeded topsoil, the total thickness being either 2.5 or 4 feet. Excavation of 2,620 cubic yards of soil contaminated with metals for off-site disposal at a RCRA landfill would eliminate the potential for lead contamination of ground water.

This alternative also would require long-term ground water monitoring and cap maintenance.

Alternative 5A: On-Site TSCA Vault

Alternative 5A involves the excavation of 6,469 cubic yards of soil and concrete contaminated with PCBs exceeding 25 ppm and 2,620 cubic yards of soil contaminated with metals exceeding 1,000 ppm lead. The soil contaminated with metals would be disposed of off-site at a RCRA landfill. The PCB-contaminated material would be enclosed in a TSCA vault that would be located in an uncontaminated area immediately west of the GUE Site.

This alternative would require long-term ground water and leachate monitoring, as well as maintenance of the vault.

Alternative 5B: On-Site RCRA Vault

Alternative 5B is essentially the same as Alternative 5A, except the on-site vault would be RCRA permitted (instead of a TSCA vault), allowing the soil contaminated with metals to be co-disposed with the PCB contaminated soil in the vault.

Alternative 6A: On-Site Extraction and Biodegradation

Alternative 6A involves excavation and solvent (methane and petroleum ether extraction (PET)) extraction of 6,469 cubic yards of PCB-contaminated soil and concrete followed by ultraviolet (UV) dechlorination of the liquid extract and biological treatment (Aroclor 1242 only) prior to discharge to Metropolitan Waste Control Commission (MWCC) sewer system. The treated soil would then be backfilled in the excavation at the GUE Site. Two thousand six

hundred and twenty cubic yards of soil contaminated with metals would also be excavated and disposed of at an off-site RCRA landfill.

Alternative: 6B On-Site Extraction

Alternative 6B is essentially the same as Alternative 6A, except in Alternative 6B the soil from the PE Site, which contains Aroclor 1242, does not receive direct biodegradation. Instead, all of the excavated PCB-contaminated soil would undergo methanol and PET extraction separation, drying, and backfilling. The liquid phase from the solvent extraction stage would undergo UV light dechlorination, distillation, and activated sludge biological treatment. The resulting clear liquid would then be discharged to the MWCC sewer system. The soil contaminated with metals would be sent to an off-site RCRA landfill, as in Alternative 6A.

Alternative 6C: On-Site Extraction and Biodegradation/Off-Site

Incineration

Alternative 6C is similar to Alternative 6A in that the Aroclor 1260 PCB-contaminated soil from the GUE and UST Sites would undergo methanol-PET extraction and the Aroclor 1242 PCB-contaminated soil from the PE site would undergo direct biodegradation. The treated soil would then be backfilled on the GUE Site. However, the liquid phases separated from these processes would pass through activated carbon filters prior to discharge to the MWCC sewer system. The carbon filters and the concentrate formed during the distillation phase of solvent extraction would be transported to an off-site TSCA incinerator. Tankers with a 4,000 gallon capacity would be used to transport the waste, requiring the construction of on-site facilities for storage of the waste until that volume is generated. The soil contaminated with metals exceeding 1,000 ppm lead would be sent to an off-site RCRA landfill.

Alternative 6D: On-Site Extraction/Off-Site Incineration

Alternative 6D is essentially the same as Alternative 6C, except the Aroclor 1242 PCB-contaminated soil from the PE Site would not undergo direct biodegradation. All of the PCB-contaminated soil undergo methanol-PET extraction, separation, drying, and backfilling. The distilled liquid phase would pass through activated carbon filters and then be discharged to the MWCC sewer system. The carbon filters and distillation concentrate would be transported to an off-site TSCA incinerator. The soil contaminated with metals would be sent to an off-site RCRA landfill.

Alternative 7A: On-Site Incineration and Biodegradation

Alternative 7A involves excavation of 6,469 cubic yards of soil and concrete contaminated with more than 25 ppm PCBs and 2,620 cubic yards of soil contaminated with metals exceeding 1,000 ppm lead. The soil contaminated with lead greater than 1,000 ppm and PCBs greater than 49 ppm would be sent to an off-site RCRA/TSCA landfill. Shallow soil contaminated with between 10 and 25 ppm PCBs will be consolidated and covered (permeable cover) with soil and vegetated so that surface PCB concentration does not exceed 10 ppm. Each of the three disposal sites will have 10-25 ppm PCB soil covered under this alternative.

Soil and concrete from the GUE and UST Sites contaminated with Aroclor 1260 would be crushed and fed into a continuous-feed rotary kiln or circulating fluidized bed combustion incinerator to thermally destroy the PCBs at 1,800°F. An afterburner attaining temperatures of 2,200°F and/or scrubbing and filtering systems may be necessary to completely destroy the PCBs in the off-gases prior to release to the environment. The destruction rates achieved would approach 100 percent, with residual PCB concentration in the soil of less than 2 ppm.

The Aroclor 1242 PCB soil from the PE Site would undergo direct biodegradation as described in Alternative 6A, prior to incineration.

Alternative 7B: On-Site Incineration

Alternative 7B is essentially the same as Alternative 7A except the Aroclor 1242 PCB-contaminated soil from the PE Site would be incinerated without first undergoing biodegradation.

Alternative 7C: On-Site Thermal Desorption, Biodegradation and Fume Incineration

Alternative 7C involves the excavation of 6,469 cubic yards of soil and concrete contaminated with 25 ppm or more PCBs, and 2,620 cubic yards of soil contaminated with metals. The soil contaminated with lead greater than 1,000 ppm and PCBs greater than 49 ppm would be sent to an off-site RCRA/TSCA landfill. Surface soil with between 10 and 25 ppm PCBs would be consolidated and covered. Each of the three disposal sites will have soil with between 10 and 25 ppm PCBs covered under this alternative.

Soil and crushed concrete from the GUE and UST Sites would be crushed and fed into a thermal desorber. The Aroclor 1242 PCB soil from the PE Site would undergo biodegradation as described in Alternative 6A, prior to thermal desorption. There the soil would be heated indirectly through a gas fired, electric or infrared light system to volatilize the PCBs. The fumes from the desorber would pass into a fume incineration chamber where the PCBs will be oxidized at temperatures of 2200°F. The off-gases would then be scrubbed in a wet alkaline scrubber prior to release to the atmosphere. These emissions would be monitored to ensure compliance with air quality rules. The scrubber brine would be disposed to the MWCC sewer system. The removal rates would approach 100 percent, with residual PCB concentrations of less than 2 ppm.

The soil would exit the thermal desorber and enter a hopper for cooling and backfilling.

Alternative 7D: On-Site Thermal Desorption and Fume Incineration

Alternative 7D is essentially the same as Alternative 7C, except that the Aroclor 1242 PCB soil from the PE Site would undergo direct thermal desorption and fume incineration and not undergo biodegradation. This results in residual soil PCB concentrations of less than 2 ppm after treatment.

Alternative 7E: On-Site Thermal Desorption, Biodegradation, and Fume Condensation

Alternative 7E involves the excavation of 6,469 cubic yards of soil contaminated with greater than 25 ppm PCBs, and 2,620 cubic yards of soil contaminated with metals with greater than 1,000 ppm lead. The soil contaminated with lead greater than 1,000 ppm and PCBs greater than 49 ppm would be sent to an off-site RCRA/TSCA landfill. Surface soil with PCB concentrations between 10 and 25 ppm will be consolidated and covered. Each of the three disposal sites will have 10-25 ppm PCB soil covered under this alternative.

The Aroclor 1242 PCB soil from the PE Site would first undergo biodegradation, as described in Alternative 6A, prior to thermal desorption. The Aroclor 1260 PCB soil from the GUE and UST Sites would be combined with contaminated concrete, crushed and fed into a thermal desorber. There the soil will be heated to volatilize the PCBs. The soil would then exit to a hopper for cooling and backfilling. The PCB destruction rate would approach 100%, with residual concentrations of less than 2 ppm.

The off-gases from the thermal desorber then pass through a condenser system where the gases would be cooled and condensed, producing essentially four major products: non-condensable gases, water, organics (PCBs), and dust. The gases would pass through an emissions control system such as carbon absorption

before release to the atmosphere. These emissions would be monitored for compliance with air quality rules. The water would pass through activated carbon filters and then be disposed on-site by spray irrigation. The organics and dust would be containerized and transported, with the spent carbon filters, to an off-site TSCA incinerator.

Alternative 7F: On-Site Thermal Desorption and Fume Condensation

Alternative 7F is essentially the same as Alternative 7E except that the Aroclor 1242 PCB soil would undergo direct thermal desorption without first undergoing biodegradation. The residual PCB concentrations would be less than 2 ppm.

Alternative 7G: On-Site Thermal Desorption and Fume Incineration, Consolidation of Soil with 10 to 25 ppm PCBs and 50 to 1,000 ppm Lead in GUE Depression

Alternative 7G is the same as Alternative 7D except at the surface soil contaminated with between 10 and 25 ppm PCBs and soil contaminated with between 50 and 1,000 ppm lead would be consolidated and covered at the GUE Site. Approximately 22,793 additional cubic yard of soil would have to be excavated and consolidated at the GUE Site. Cost estimates for this remedy were described in a letter report entitled Submittal of Cost Estimates To Include Excavation to 10ppm PCB, dated December 13, 1988.

Alternative 7H: On-Site Thermal Desorption and Fume Incineration, Consolidation of 1 to 25 ppm PCBs and 50 to 1,000 ppm Lead in GUE Depression

Alternative 7H is the same as Alternative 7D except that PCB contaminated soil between 1 and 25 ppm would be consolidated and covered at the GUE Site. Approximately 60,458 additional cubic yards of soil would have to be excavated and consolidated at the GUE Site. Cost estimates for this remedy were described in a letter report entitled Submittal of Cost Estimates to Include Excavation to Lower Levels, dated December 13, 1988.

Alternative 7I: On-Site Thermal Desorption and Fume Incineration and Consolidation of Soil With 10 to 25 ppm PCBs in GUE Depression

Alternative 7I is the same as Alternative 7D except that soils contaminated with between 10 and 25 ppm PCBs would be excavated and consolidated at the GUE Site. Estimates of excavation volumes and costs were detailed in a document entitled Letter Report for Excavation and Backfill of Soil with 10-25 ppm PCBs, Rosemount Research Center, dated December 14, 1989. The most current excavation volume estimates are found in this report.

Alternative 7I leaves on the site soils contaminated with up to 25 ppm PCBs and up to 640 ppm lead. Access to this consolidation area will be restricted by man-made barriers as required by TSCA. Because additional remediation for lead and PCBs may be required if cleanup criteria become more restrictive in the future, and because remedial actions at all NPL sites are required to undergo periodic review "... no less often than each 5 years after the initialization of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented..." (Section 121 (c) of SARA), Alternative 7I includes a Section 121(c) review of this remedial action, due within three years of the effective date of the ROD to address changes in mandatory cleanup levels. In addition the review shall evaluate other remedial action alternatives not previously reviewed which would further remediate the lead and PCBs in the contaminated soil.

PCBs

The University may satisfy the PCB review by funding original research (possibly a masters thesis) consisting of a literature search and a pilot study evaluating one or more PCB remedial alternatives for the treatment of the contaminated soil. The literature search and pilot study shall be conducted by

University of Minnesota staff in one or more of the University's academic departments.

If expertise does not exist in any University academic department to conduct a literature search and a pilot study, the University shall indicate the unavailability of such expertise and pursue such expertise elsewhere. For each evaluated PCB (and for each evaluated lead remedial action alternative - see next paragraph) remedial action alternative, the following shall be addressed and presented in the review:

1. Cost. A preliminary estimate of the capital, operation and maintenance costs associated with installing or implementing each evaluated alternative.
2. Environmental Effects. A general discussion of the expected adverse effects which each evaluated alternative may have on the environment.
3. Effectiveness. A preliminary analysis as to whether each evaluated alternative is likely to effectively abate or minimize the release and/or minimize the release or threatened release and/or minimize the threat of harm to the public health, welfare, and the environment.

Lead

The review shall also report on the results of original research being conducted at the University into innovative methods to remove lead from soils such as the research presently being conducted by Rodney L. Bleifuss, Program Director of the Metallurgy Minerals Division of the National Resources Research Institute or any other similar University research projects.

Compliance with Land Disposal Restrictions

The Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) - P.L. 98-616, signed on November 8, 1984 - include specific provisions restricting the land disposal of RCRA hazardous wastes (land

disposal restrictions (LDRs)). The purpose of these HSWA provisions is to minimize the potential of future risk to human health and the environment by requiring the treatment of hazardous wastes prior to their land disposal.

HSWA directed EPA to establish treatment standards for each of seven groups of RCRA hazardous wastes by specific dates. These dates are referred to as statutory deadlines. The effective date for LDRs for "third third wastes" (which includes the lead found on site) has been extended from May 8, 1990 to August 8, 1990 under present EPA regulations.

Even though the alternatives cited in this ROD were studied prior to the EPA regulations for "third third wastes," LDRs must now be considered as ARARs for this Site. This means that Alternative 7I must comply with the LDRs for lead.

This ROD, however, allows the University to landfill the lead contaminated soil (as described in Alternative 7C) if the landfilling occurs before the statutory deadline for "third third wastes" (i.e. August 8, 1990, or any subsequent extension deadline). Should landfilling of these soils occur before the statutory deadline, LDRs will not be considered ARARs; however, for soil contaminated by lead disposed of in a landfill after August 8, 1990 (or any subsequent extension deadline), LDRs shall be considered as ARARs.

Alternative 8A: Off-Site Landfill

Alternative 8A would involve excavation of contaminated soil (soil greater than 25 ppm PCBs and greater than 1,000 ppm lead) and disposal in an existing RCRA and TSCA approved facility licensed to accept both the lead and PCBs. The landfill alternative is capable of accepting the materials at the same rate as excavation and transport with no time delay. This alternative involves some potential hazards to the public health and environment during transport. Cost estimates for this alternative were detailed in a letter report entitled Addendum to the Alternatives Report, dated February 18, 1987.

Alternative 8B: Off-Site Incineration

Alternative 8B is similar to Alternative 8A except that the PCB contaminated soil would be incinerated at an off-site facility rather than disposed of off-site in a RCRA and TSCA approved facility. Lead contaminated soil would not be incinerated. Cost estimates for this alternative were detailed in a letter report entitled Addendum to the Alternatives Report, dated February 18, 1987.

The Burn Pit Area Site

Five basic alternative remedial actions were proposed in the Detailed Analysis Report Alternatives For A Permanent Drinking Water Supply - Rosemount Research Center, Rosemount, Minnesota dated February 25, 1986 and the Ground Water Interim Response Action Plan, University of Minnesota, Rosemount Research Center Site dated November 11, 1986. These alternatives are summarized in Table 3. Each alternative was analyzed for effectiveness in meeting the nine evaluation criteria (see Section IX: Summary of Comparative Analysis). All of the alternatives, except the No-Action Alternative, require at least 30 years of O&M.

Alternative 1: No Action

Alternative 1 would neither reduce the exposure to VOCs via ingestion of contaminated ground water nor prevent further migration of the contaminant plume and was not considered further.

Alternative 2: Activated Carbon Filtration System

Alternative 2 would involve the installation of two activated carbon filters in series at the point of entry of each house with a contaminated well having MDH drinking water well advisory. The filters would remove the VOCs from the water prior to its entering the distribution lines within the house.

In combination with the carbon filtration system, this alternative calls for a ground water pump out system to prevent further migration of the contaminated

plume. This system would consist of a well screened in the Prairie du Chien aquifer hydraulically downgradient of the Burn Pit Site. This well must be capable of creating a capture zone at least as wide as the contaminant plume. The well must also be capable of inducing flow upward from the Jordan Formation toward the Prairie du Chien Aquifer, as pump test data indicate these aquifers are hydraulically connected by fractures. The well is located where the plume is 2,000 feet wide. Pump test results indicate that monitoring well, MW-28, is capable of capturing the plume if it is pumped at 155 to 200 gallons per minute.

The treatment system would provide VOC reduction approaching 100 percent. Regular monitoring of the water would be necessary to ensure compliance with the cleanup goal of 57 ppb chloroform.

Alternative 3: New Residential Wells

Alternative 3 involves the construction of 20 wells finished in the Franconia Formation to serve the 27 families receiving bottled water. The Franconia Formation, at a depth of approximately 500 feet below the surface, is separated from the contaminated upper aquifers by the St. Lawrence Formation which functions as a regional aquitard. The original residential wells would be abandoned according to MDH codes.

This alternative includes a ground water pump out system as described in Alternative 2.

Alternative 4: Extending the RRC Water Distribution System

Alternative 4 involves the extension of the existing University water distribution system at the RRC to supply water to the 27 families receiving bottled water. The existing distribution system would have to be upgraded with additional chemical treatment facilities and improved supply and storage facilities.

In addition to a water supply system, this alternative includes a pump out system as described in Alternative 2.

Alternative 5: Extending Rosemount Water Distribution System

Alternative 5 is essentially the same as Alternative 4, except it would involve the extension of the city of Rosemount's existing water system located 2.8 miles to the west, rather than that of the RRC. Three subalternatives would be for a complete city system, a partial system sized for future development, or a system sized for only the 27 families receiving bottled water.

In addition to a water supply system, this alternative includes a pump out system as described in Alternative 2.

Alternative 6: Independent Water Distribution System

Alternative 6 involves construction of a completely independent water distribution system. This system would have two wells and two pump houses with hydro-pneumatic tanks to maintain pressure. One well will act as back up if the other is shut down for maintenance. Because the wells would be constructed north and upgradient of the contaminated plume, they can be finished in the Jordan Sandstone Aquifer.

The subalternatives for this system are a complete system, a partial system sized for future development, or a system sized for only the 27 families receiving bottled water. In addition to the water supply system, Alternative 6 includes a pump out system as described in Alternative 2.

IX. Summary of Comparative Analysis

The alternative actions proposed for the GUE/PE/UST Sites and Burn Pit Site remediations were evaluated according to the rules outlined in the National Contingency Plan and Section 121 of the Superfund Amendment and Reauthorization Act (SARA). Section 121 (b) (1) states that: "Remedial actions in which

treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element, are to be preferred over remedial actions not involving such treatment. The off site transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored remedial action where practicable treatment technologies are available."

Section 121 (b) (1) also states the following be addressed during the remedy selection process:

- the long-term uncertainties associated with land disposal;
- the goals, objectives and requirements of the Solid Waste Disposal Act;
- the persistence, toxicity, mobility, and propensity to bioaccumulate of the contaminants and their constituents;
- the short and long-term potential adverse health effects from human exposure;
- the long-term maintenance costs;
- the potential for future remedial action costs if the remedial action in question were to fail; and
- the potential threat to human health and the environment associated with excavation, transportation, and redisposal or containment.

The selected remedy also must be protective of human health and the environment, cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery to the maximum extent possible.

In addition to the factors detailed in SARA, nine other criteria were considered during the remedy selection. These nine criteria, established by the U.S. EPA and detailed in the Interim Guidance on Superfund Selection of Remedy, dated December 24, 1986, and Additional Interim Guidance for FY 1987 Records of Decision, dated July 24, 1987, are as follows:

1. Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection, and describes how risks are eliminated, reduced, or controlled.
2. Compliance with ARARs addresses whether or not a remedy will satisfy all of the ARARs and TBCs, or provide grounds for invoking a waiver.
3. Long-term effectiveness and permanence refers to the ability of a remedy to continue to provide protection of human health and the environment over time after the action is completed.
4. Reduction of toxicity, mobility and/or volume is the anticipated level of performance of the technologies employed.
5. Short-term effectiveness refers to the protection of human health and the environment during construction and implementation of the remedy, and the length of time until the cleanup goals are achieved.
6. Implementability is the technical and administrative feasibility of a remedy, including the availability of goods and services.
7. Cost Criteria refers to capital, administrative, and operation and maintenance O & M costs.
8. State acceptance indicates whether, based on its review of the RI/FS and Proposed Plan, the MPCA staff concurs on the preferred alternative.
9. Community acceptance indicates the public support of a given remedy.

The comparative evaluation of the remedial action alternatives for the GUE/PE/UST and Burn Pit Sites is summarized in this section. Tables 6 and 7 at the end of this section provide a summarized comparison of the alternatives and the evaluation criteria.

Overall Protection of Human Health

GUE/PE/UST Sites

The No-Action and Limited Site Control Alternatives are not protective of human health or the environment because soil with high concentrations of PCBs and lead would continue to be exposed at the ground surface. Even if access were restricted the potential would remain for direct dermal contact. Also, the potential for ground water contamination would persist.

The alternatives involving a permeable cover or an impermeable cover (cap), in conjunction with soil venting and removal of soil contaminated by metals exceeding 1,000 ppm lead, would eliminate the potential for direct dermal contact with the contaminated soil and slow or halt the migration of contaminants to the ground water. These alternatives also involve the least handling of the contaminated soil during the remedial action, thus posing the least exposure risk to site workers. However, the potential remains for the cover or cap to be breached, re-exposing the contaminants.

Vaulting of the contaminated soil further isolates soil from human contact and the environment, under a more controlled setting than a permeable cover or an impermeable cover (cap). This option, however, involves excavation and movement of the soil, creating a higher potential for site worker exposure.

The on-site solvent extraction alternatives are less protective than the vaulting options. All of the variations of the solvent extraction process result in residual values of between 10 and 50 ppm PCBs, so that in some cases the cleanup goal of 25 ppm would not be met. This soil would then be backfilled in the excavation pits, resulting in movement during two phases of contaminated soil treatment (before and after treatment). Despite significant reductions in PCB concentration, these alternatives are not as protective of human health and the environment as others available.

Thermal treatment, by either incineration or thermal desorption, provides the greatest long-term protection of human health and the environment. The residual concentrations following treatment are expected to be less than 2 ppm PCB, and the surficial concentrations of unexcavated soil will be less than 25 ppm. This soil can be backfilled without representing a further threat to the environment or the site workers. However, during the remedial action, worker exposure may occur during the excavation and stockpiling phase. Potential for the formation and release of dioxins and furans during thermal treatment can be minimized by careful monitoring and appropriate operation of system controls. Monitoring of air emissions and sampling of the treated soil for these and other undesirable compounds will help to reduce this risk.

All of the alternatives, except No-Action and Limited Site Control, provide varying degrees of protection. The protection afforded by the permeable cover, impermeable cover and vault alternatives is dependent on the quality of long-term O & M and monitoring. The soil treatment remedies result in significant reductions of PCBs. The potential for short-term exposure is higher with these alternatives, but the potential exposure over the long term for humans and the environment are significantly reduced.

Burn Pit Site

The No-Action Alternative is not protective of human health or the environment since the contaminant plume would be allowed to continue to migrate toward the river. This would cause additional residential wells to become contaminated.

Point-of-entry carbon filters have been demonstrated to purify water to drinking water standards. There is, however, a potential for human health risks

if the carbon filters are not properly maintained and periodically replaced and chemical breakthrough occurs. The pump out well and air stripper system would control contaminant migration.

The alternative water supply and new residential well options are both highly protective of human health as they provide residents with clean water from outside the contaminant plume. The pump out well and air stripper system will control plume migration and provide an additional measure of protection. Air modeling has shown that air stripping treatment of pump out water will not represent a human health or environmental threat.

The pump out system is now in operation. Air emissions from the air stripper system will be evaluated by the MPCA staff. The Division of Air Quality of the MPCA is currently developing criteria to be used to evaluate air emissions from air strippers.

All of the alternatives, except for No-Action, are protective of human health. No threat to the environment is anticipated by either the contaminants in the ground water or the remedial actions. The most protective options are the alternate water supply systems. Independent carbon treatment units are dependent on proper O & M and may result in chemical break through if not properly maintained.

Compliance with ARARs

The chemical-specific ARARs and TBCs are identified on Table 1. Location-specific ARARs or TBCs are relevant to the RRC Site in that a "restricted access area" must be 0.1 kilometers from residential/commercial areas, limited by a man-made barrier. Action-specific requirements, which indicate how the selected alternatives must be achieved, are described in Part XI, Statutory Determinations.

GUE/PE/UST Sites

All protective alternatives are designed to attain the applicable or relevant and appropriate requirements (ARARs) of federal and state environmental laws. The following alternatives or portions of alternatives will not meet the ARARs:

The No-Action and Limited Site Control Alternatives will not meet the ARARs as high concentrations of PCBs and lead will continue to be exposed at the ground surface. Also, these alternatives do not satisfy the requirements of the state's ground water protection strategy as the contaminants may potentially migrate toward the water table.

The solvent extraction alternatives may not achieve the proposed TSCA clean up goal of 25 ppm. These alternatives, at best, will attain only a 1.54×10^{-4} cancer risk.

The final criteria to be considered is that of the preference for permanent treatment as promulgated in Section 121 of the SARA. Only the solvent extraction and thermal treatment alternatives satisfy this requirement.

Burn Pit Site

All the protective alternatives are designed to attain the ARARs of federal and state environmental laws with the exception of the No-Action Alternative. All of the other alternatives proposed for the ground water remediation meet the ARARs. Implementation of the No-Action Alternative would permit contaminated ground water to continue to migrate, in conflict with the state's ground water protection strategy.

Short-Term Effectiveness

GUE/PE/UST Sites

The No-Action and Limited Site Control Alternatives, while not creating additional short-term threats, are insufficient to prevent direct contact with PCBs and lead.

The permeable cover and impermeable cap alternatives provide the greatest short-term effectiveness because the PCB-contaminated soil is not disturbed.

All of the other remedies involve short-term risks to worker human health and the environment inherent in the excavation and transport of contaminated soil. The threats could be minimized with dermal and respiratory protection. In the case of the vaulting options, the term of potential exposure would be approximately three months. The solvent extraction and thermal treatment alternatives would span a longer time period, probably two to three years, and would have additional exposure risks associated with stockpiling of contaminated soil. Again, these risks would be primarily limited to, and be greatest for, site workers.

Thermal treatment poses the greatest potential short-term threat to site workers. Modeling of estimated emissions and dispersal patterns, described in the Final Detailed Analysis Report And Conceptual Design, Rosemount Research Center, Rosemount Research Center, Rosemount, Minnesota, dated May 12, 1987, indicates the primary receptors of concern are the site workers. In a worst case scenario of thermal treatment with emission control failure, RRC tenants and University staff to the north and southeast of the GUE, PE, and UST Sites might receive doses of PCBs between 1,700 and 10,000 times less than the NIOSH standard of 1 ug/m^3 over an eight hour exposure. These estimates do not take into account the air pollution control system that will reduce the emission concentration to $1 \times 10^{-4} \text{ ug/m}^3$. Frequent monitoring of air quality from soil

handling and the stack emissions, and the use of respiratory protection during excavation should address the threat to site workers.

Alternatives 7E and 7F pose the additional risk of exposure to highly concentrated contaminants in the condensate. This material would require particularly careful handling and transport by site workers. However, Alternatives 7E and 7F would produce 90 percent fewer gas emissions than would Alternative 7C and 7D.

Burn Pit Site

With the exception of the No-Action Alternative, none of the remedial actions for this operable unit present short-term threats to the population. The No-Action Alternative exposes residents to contaminated ground water in both the short and long term. Implementation of the other alternatives will take one month for carbon filters, six months for new residential wells, or two to three years for water supply systems. During this time, residents will continue to receive bottled water and ground water monitoring will continue to determine if additional wells become contaminated.

The pump out well and air stripper system, whether packed tower aeration or spray irrigation, will not significantly impact air quality at the RRC. This remedy will not pose a threat to residents or site workers.

Long-term Effectiveness

GUE/PE/UST Sites

The No-Action Alternative provides no degree of long-term effectiveness. Surface concentrations of PCBs and lead would remain dangerously high and the potential for ground water contamination would persist.

Although site access would be restricted for the Limited Site Control Alternative, the potential for direct dermal contact remains. Soil venting may remove a potential vehicle for PCB migration, but lead could continue to have

the potential to migrate to the ground water. There are no guarantees that over a very long period of time the PCBs would not migrate.

The Permeable Cover and the Impermeable Cap Alternatives provide a moderate degree of long-term effectiveness. In both remedies the metal contaminated soil is physically removed from the site, eliminating it as a source. PCB migration to ground water would be slowed or halted by the removal of the driving force. If the driving force was solvents, the driving force would be removed by soil venting; if the driving force was infiltration, it would be removed by an impermeable cap. As noted above, there is no guarantee that the PCBs will not ultimately migrate to the ground water. Additionally, any breach of the cover or cap would re-expose the contaminated soil.

Vaulting, by fully encapsulating the contaminated soil, provides an extra degree of long-term effectiveness. Again, the key to continued protection is proper O & M.

Solvent extraction and thermal treatment provide long-term effectiveness in the form of significant reduction in PCB concentration and removal of metal contaminated soil from the Site. It is unclear whether solvent extraction can achieve the cleanup goal of 25 ppm PCBs. Thermal treatment will meet less than 2 ppm PCB, providing the greatest long-term effectiveness of all the alternatives.

Burn Pit Site

The No-Action Alternative does not provide any degree of long-term effectiveness. The residential wells will continue to be contaminated and other wells may become so.

Point-of-entry carbon filters, given proper maintenance, provide long-term protection.

The highest degree of long-term protection is provided by the water supply system alternatives. The New Residential Well Alternative offers long-term effectiveness dependent on proper siting and construction of the wells.

The pump out well and air stripper system provides additional long-term effectiveness to each of the alternatives because it will control contaminant migration. Ultimately it will prevent any contamination from migrating away from the RRC Site, although those VOCs already downgradient of the well will continue to migrate toward the river.

Reduction of Mobility, Toxicity or Volume

GUE/PE/UST Sites

The effectiveness of the alternatives in reducing the mobility, toxicity or volume (MTV) of hazardous material on the RRC Site is summarized in Table 4. The No-Action Alternative does nothing to reduce the MTV of the contaminants. The Limited Site Control Alternative does little better to reduce the MTV, but attempts to address mobility by removing VOCs.

The Permeable Cover and Impermeable Cap Alternatives do not alter the toxicity of the contaminants. These alternatives may reduce PCB mobility. The volume of soil contaminated with metals will be reduced by excavation and off-site disposal. However, there is no reduction in PCB volume in these soils.

Vaulting, like covering, will not change the toxicity of the contaminated soil. However, both vault types will reduce mobility by isolating the soil from the environment. The RCRA vault will not result in a volume reduction, as all materials will be vaulted on site. The TSCA vault option will result in a slight volume reduction because of off-site disposal of the soil contaminated with metal; however the volume of PCB soil will not be reduced.

The solvent extraction and thermal treatment options are the only alternatives that reduce toxicity, as well as mobility, and volume. Solvent extraction will reduce PCB concentrations to between 10 and 50 ppm; thermal treatment will reduce PCBs to less than 2 ppm.

Burn Pit Site

The No-Action Alternative does nothing to reduce contaminant MTV. In all of the other alternatives, it is the pump out and air stripper system that affects the contaminant MTV by dispersing the VOCs in the atmosphere. The Actuated Carbon Filtration System Alternative would result in further reduction of toxicity at each residence. However, none of the proposed alternatives actually destroy the contaminants.

Implementability

GUE/PE/UST Sites

The implementability of each alternative is based on technical feasibility, administrative feasibility, and the availability of services and materials for the alternative.

All of the alternatives are technically feasible, involving proven treatment technologies. However, alternatives such as 6A, 6C, 7A, 7C and 7E, which utilize different technologies based on Aroclor type, are more complicated than is necessary. In particular, for Alternatives 7A, 7C and 7E the biodegradation phase of these alternatives is redundant because all the Aroclor types are destroyed during thermal treatment.

Regarding administrative implementability, Alternative 5B, the On-Site RCRA vault, is slightly less favorable compared to Alternative 5A, the On-Site TSCA vault, due to the additional engineering and regulatory restrictions involved in RCRA vault construction. This may be somewhat off set by eliminating the need to transport and dispose of the soil contaminated with metals.

The solvent extraction alternatives also include additional administrative costs due to extra design requirements and the time involved in obtaining National Pollutant Discharge Elimination System (NPDES) and Metropolitan Waste Control Commission (MWCC) permits to discharge treated waters into the municipal sewer system. Also, pilot tests will be necessary for these alternatives.

Thermal treatment is the most administratively difficult alternative, as state and federal regulation of this technology is the most stringent. A test burn may be required. Also, the bid process for these alternatives can be quite involved. Incineration (Alternatives 7A and 7B) would be the most costly and time consuming to obtain approval.

The services and materials for all of the options, except solvent extraction and thermal treatment, are locally available. The component equipment for solvent extraction is commercially available, but would require assembly and fabrication. Mobile thermal treatment systems are available, but not abundant and must be carefully screened to ensure suitability to the destruction of the particular wastes on the Site.

Burn Pit Site

All of the alternatives proposed for the Burn Pit Site remediation are technically feasible. The water supply alternatives (4, 5, and 6) compare unfavorably with the other alternatives in terms of administrative costs, due to the much greater engineering and permitting demands. The services and materials for all of the alternatives are readily available locally.

Cost Criteria

GUE/PE/UST Sites

The estimated present worth values of the remedial alternatives are compiled in Table 5. The No-Action and Limited Site Control Alternatives are

the least expensive. However, these options are not cost effective as they will not satisfy the cleanup criteria.

The cost range for Alternative 4 reflects the cost difference between a 2.5 and four-foot thick cap. The additional protection afforded by the four foot thick cap is debatable, and not likely to merit \$250,000 in extra expenses.

The on-site vault alternatives (5A and 5B) provide greater protection than the Permeable Cover and Impermeable Cap Alternatives (3 and 4), but are less expensive. The on-site vault alternatives represent cost effective solutions.

The solvent extraction alternatives are some of the most expensive remedies proposed. Given the uncertainty that these alternatives can even satisfy the remediation objectives, solvent extraction is the least cost effective solution.

Thermal treatment is slightly less expensive than solvent extraction and does satisfy the remediation objectives. The alternatives that incorporate biodegradation (7A, 7C and 7E) are not cost effective because the biodegradation is unnecessary to achieve the cleanup goals, yet biodegradation costs an additional \$100,000 to \$200,000. The most cost effective thermal treatment is Alternative 7D, On-Site Thermal Desorption and Fume Incineration.

Burn Pit Site

The Independent Water Distribution System Alternative is slightly more costly than other available alternatives. However, it was more desirable for a number of political and socioeconomic reasons. The reasons have been covered in previous sections.

Community Acceptance

Community response to the alternatives is presented in the Responsiveness Summary (See Attachment 1.)

The emission levels from the tower are well below air quality standards.

The Independent Water Distribution System Alternative is also consistent with Section 121 of SARA. This part of the remedy addresses the short- and long-term potential adverse health effects of human exposure by providing clean drinking water.

XI. Statutory Determinations

Protection of Human Health and the Environment

GUE/PE/UST Sites

The selected remedy provides protection of human health and the environment by removing and/or destroying the contaminated media. Elimination of the contaminant source alleviates the risk from direct soil contact and ground water contamination. This will be accomplished without creating unacceptable short-term risks or cross-media impacts.

By consolidating and covering soil contaminated with between 10 ppm to 25 ppm PCBs into an excavation at the GUE Site, the GUE/PE/UST Sites will have a cancer risk of approximately 1.54×10^{-4} . The risk of 1.54×10^{-4} is based on the ingestion of 10 ppm PCBs per day for 70 years. Given the remoteness of the Sites, it is unlikely that this level of exposure would occur and thus the remedy will be adequately protective of human health.

Burn Pit Site

The selected remedy provides protection of human health and the environment by extracting and treating the contaminated ground water using an air stripper. This will prevent the continued migration of contamination and the treated water will represent a unit cancer risk of less than 1×10^{-6} . The Independent Water Distribution System Alternative will provide clean water to residents with impacted wells, eliminating any risk associated with ingestion of contaminated water.

State Acceptance

The MPCA is the lead agency for the RRC Site. The MPCA staff has selected the remedies presented in Section X of this document.

X. Selected Alternative

GUE/PE/UST Sites

Based on current information, the MPCA staff has selected Alternative 7I, On-Site Thermal Desorption and Fume Incineration, Consolidation of Soil with 10 to 25 ppm PCBs in the GUE Depression, as the most appropriate final remedy for the GUE, PE and UST Sites. The significant features of this remedy are as follows:

- ° Excavate 2,620 cubic yards of soil contaminated with metals exceeding 1,000 ppm lead (of which 1,896 cubic yards are also contaminated with PCBs) and transport to an off-site RCRA landfill for disposal (soil exceeding 49 ppm PCBs transported to an off-site RCRA-/TSCA-landfill);
- ° Excavate 6,469 cubic yards of PCB-contaminated soil and concrete with concentrations greater than 25 ppm;
- ° Consolidate 14,809 cubic yards of soil with 10 to 25 ppm PCBs and in the GUE depression and limit access by man-made barriers;
- ° Thermally desorb the PCBs from the excavated soil containing greater than 25 ppm PCBs and incinerate the fumes on-site; and
- ° Backfill excavations with the treated soil, grade, and vegetate.

Target Cleanup Levels

For carcinogens, the U.S. EPA generally considers risks of 10^{-4} to 10^{-7} unit cancer risk as acceptable and generally protective of human health and the environment. Since the RRC Site is considered a "restricted access location" as

defined by the U.S. EPA's TSCA PCB Spill Cleanup Policy, dated July 1, 1987, the cleanup criteria of 25 ppm PCBs has been applied. This will achieve the risk level as stated in 40 CFR 761.

There are no clearly defined cleanup criteria for lead in soil. Currently, a lead waste is classified as hazardous under RCRA only if it leaches lead at a concentration of greater than 5 ppm in the leachate using the EP Toxicity Leach Test. A leach test on the contaminated soil at the GUE Site indicated that a cleanup criteria of 1,000 ppm lead satisfies the RCRA requirements. (A lead contaminated soil sample measuring 1,420 ppm lead had an EP Toxicity Leach Test concentration of 3 ppm lead).

Rationale for Decision

Alternative 7I was selected as the preferred remedy because it represents a permanent solution to the PCB contamination at the GUE, PE, and UST Sites. Solvent extraction also represents a permanent solution, but it is not clear that it could satisfy the cleanup criteria.

Although Alternative 7D, On-Site Thermal Desorption and Fume Incineration, and Alternative 7F, On-Site Thermal Desorption with Condensation Scrubbing Vapors with Off-Site Commercial Incineration, were approved by the MPCA staff on July 27, 1987, after further analysis, Alternative 7F was eliminated because of problems with handling and disposal/destruction associated with fume condensation. Alternatives 7D and 7G represented less of a short-term threat to potential receptors during handling and transport. Alternatives 7D, 7G, and 7I are three of the least expensive of the permanent solution alternatives, in comparison to solvent extraction and biodegradation.

In response to concerns from officials of Dakota County and the city of Rosemount regarding Alternative 7D, which leaves in place soils which contain up to 25 ppm PCBs, the MPCA staff chose Alternative 7I to further reduce health risks and risks to the environment.

Points of Compliance

Alternative 7I is consistent with the objectives of Section 121 of SARA, which establishes a preference for permanent solutions that significantly reduce the volume, toxicity, or mobility of hazardous substances. The remedy deviates from SARA by employing the off-site transport of soil contaminated with metals. However, this was determined to be more protective of human health and the environment than other alternatives available for lead contaminated soil.

Alternative 7I exceeds the requirements of the cleanup criteria and ARARs. It is expected that the treated soil will contain less than 2 ppm PCBs, the surface soil after backfilling will contain less than 10 ppm PCBs, and the unexcavated soil and treated soil at the GUE Site will be less than the EP Toxicity criterion of 5 ppm lead.

Burn Pit Site

Based on current information, Alternative 6, Independent Water Distribution System, is the most appropriate final remedy for the Burn Pit Site ground water contamination problem. The significant features of this remedy are as follows:

1. Water Supply

- ° Construct two supply wells completed in the Jordan Sandstone Formation; and
- ° Construct two pump houses and distribution lines to the 27 residences with contaminated drinking water.

2. Ground Water Pump Out

- ° Pump and treat contaminated ground water by packed tower aeration; and
- ° Continued monitoring of ground water quality in the study area.

Target Cleanup Levels

The cleanup criteria established for chloroform is 57 ppb. This value was derived from the MDH RAL. The RAL was officially revised to 57 ppb for a 10^{-5} unit cancer risk in December 1988, after the U.S. EPA Carcinogen Assessment Group determined chloroform to be a less potent carcinogen than was previously believed. Although the RAL chloroform have not been exceeded in residential areas, the University has agreed to implement the independent water distribution system. The ground water pump out system will continue until the ground water meets the RAL for chloroform. In addition, the MDH has proposed a residential drinking water well advisory criterion such that four or more contaminants, at any measureable level, is sufficient for a residential drinking water well advisory. This criterion will also be considered in evaluating whether the pump out system is protective of human health and the environment.

Rationale for Decision

With the exception of the No-Action Alternative and the Actuated Carbon Filtration System Alternative, the proposed remedies for the contaminated ground water provided essentially the same level of protection. The Independent Water Distribution System Alternative with pump out well and packed tower aeration treatment was the alternative most acceptable to the public.

This alternative is more expensive than Alternative 3, New Residential Wells; however, the prototype Franconia well was susceptible to iron-bacteria growth. As a result, the residents found this option unacceptable. The cost of the selected remedy is comparable to that of the other water distribution alternatives.

Points of Compliance

The pump out well and packed tower aeration part of this remedy is, in part, consistent with the objectives of Section 121 of SARA, which establishes a preference for permanent solutions that significantly reduce the volume, toxicity, or mobility of hazardous substances. This remedy certainly reduces the volume, toxicity, and mobility of chloroform in the contaminated ground water, but accomplishes this by transferring the contaminants to the atmosphere.

Attainment of Applicable or Relevant and Appropriate Requirements

GUE/PE/UST Sites

Implementation of Alternative 7I will meet the chemical, location, and action-specific ARARs of the following federal and state laws, regulations, and guidelines:

1. Toxic Substances Control Act (TSCA), 40 CFR Part 761;
2. Minnesota Statutes 115, 116 and Minnesota Rules Chapters 7001, 7045, which reflect the ARARs of Resource Conservation and Recovery Act (RCRA), 40 CFR Parts 260-264;
3. Safe Drinking Water Act (SDWA), 40 CFR Parts 141-143;
4. Minnesota Department of Health Recommended Allowable Limits (RALs);
5. Minnesota Environmental Response and Liability Act (MERLA);
6. Superfund Amendment and Reauthorization Act (SARA), Section 121, and National Oil and Hazardous Substances Pollution Contingency Plan (NCP);
and
7. Minnesota Statutes 116 and Minnesota Rules Chapters 7001, 7005 which reflect the ARARs of Clean Air Act (CAA);

Burn Pit Site

Implementation of Alternative 6 will meet the chemical and action-specific ARARs of the following federal and state laws, regulations, and guideline:

1. Minnesota Statutes 115, 116 and Minnesota Rules Chapters 7001, 7045 which reflect the ARARs of RCRA, 40 CFR Parts 260-264;
2. SDWA; 40 CFR Parts 141-143;
3. MERLA, CERCLA, SARA, Section 121, and NCP;
4. Minnesota Department of Health RALs;

5. Minnesota Rules Chapter 7050; and
6. Minnesota Statutes 116 and Minnesota Rules Chapters 7001, 7005 which reflect the ARARs of CAA.

Cost Effectiveness

GUE/PE/UST Sites

The selected remedy will effectively remediate the contaminated soil at the GUE, PE, and UST Sites. The high cost of this alternative is justified because it represents a permanent solution. Alternative 7I was determined to be cost effective because it is the most protective, permanent solution.

Burn Pit Site

The selected remedy will effectively remediate the ground water at the RRC Site and provide clean drinking water to residents. This alternative is equally as protective as the other water distribution alternatives (4 and 5) is more protective than the No-Action Alternative and the Activated Carbon Filtration Alternative, and is more acceptable to the residents than the New Residential Well Alternative. The remedy is judged to be cost effective because it is a protective, permanent solution that is comparable in price to the other alternatives which achieve the same level of protection.

Utilization of Permanent Solutions and Alternative Treatment (or Response Recovery) Technologies to the Maximum Extent Practicable

GUE/PE/UST Sites

The selected remedy, Alternative 7I, was determined to best meet the nine evaluation criteria. Of particular importance was that the remedy be a permanent solution which is protective of human health and the environment in both the short and long term, and that the remedy be cost effective. Alternative 7I meets these criteria and also utilizes alternative treatment

technologies (thermal desorption, incineration) to the maximum extent practicable.

Alternative technologies could not be used to address the lead contamination in soil. Lead is not "treatable" in the practical sense and is best removed to a secure landfill.

Burn Pit Site

The selected remedy, Alternative 6, was determined to best meet nine evaluation criteria. In this case, the particularly important criteria were that the remedy be a permanent solution which is protective of human health and the environment, be cost effective, and be acceptable to the public. The Independent Water Distribution System, Alternative 6, coupled with a pump out well and packed tower aeration system, meets these criteria and utilizes alternative technologies (air stripping) to the maximum extent practicable.

Preference for Treatment as a Principal Element

GUE/PE/UST Sites

The statutory preference for remedies that employ permanent solutions and which significantly reduce the toxicity, mobility or volume of hazardous substances is satisfied by the selected remedy. Alternative 7I, represents a permanent treatment of the soil, lowering its PCB concentration and so reducing the toxicity, mobility and volume of the contaminants.

Landfilling of the soil contaminated with metals does not permanently treat the contaminants, but it does reduce their mobility. This is consistent with Section 121 of SARA because no practical treatment technologies exist for lead. Pursuant to Minn. Stat. Chapter 115B.02 subd. 16, the off-site transport of soil contaminated with metals (lead and copper) is determined to be a remedial action because the action is necessary to protect the public health, welfare,

and environment from a present and potential risk which may be created by further exposure to the continued presence of the hazardous substance (lead).

Burn Pit Site

The Independent Water Distribution System, Alternative 6, satisfies the statutory preference for remedies that employ permanent solutions and which significantly reduce the toxicity, mobility or volume of hazardous substances. The packed tower aeration system will effect permanent restoration of the ground water quality at the RRC Site, and will significantly reduce the toxicity, mobility and volume of the contaminated ground water to the maximum extent practical.

Schedule

GUE/PE/UST Sites

The following are key milestones for implementation of the remedial action:

Contract Bidding	May 1990
Initiation of Remedial Action	July 1990
Completion of Remedial Action	July 1991

Burn Pit Sites

The pump out well and packed tower aeration system is in place and functioning at the time of this writing. Construction of the independent water distribution system was begun in 1988 and should be completed during 1990.

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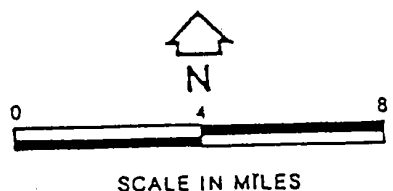
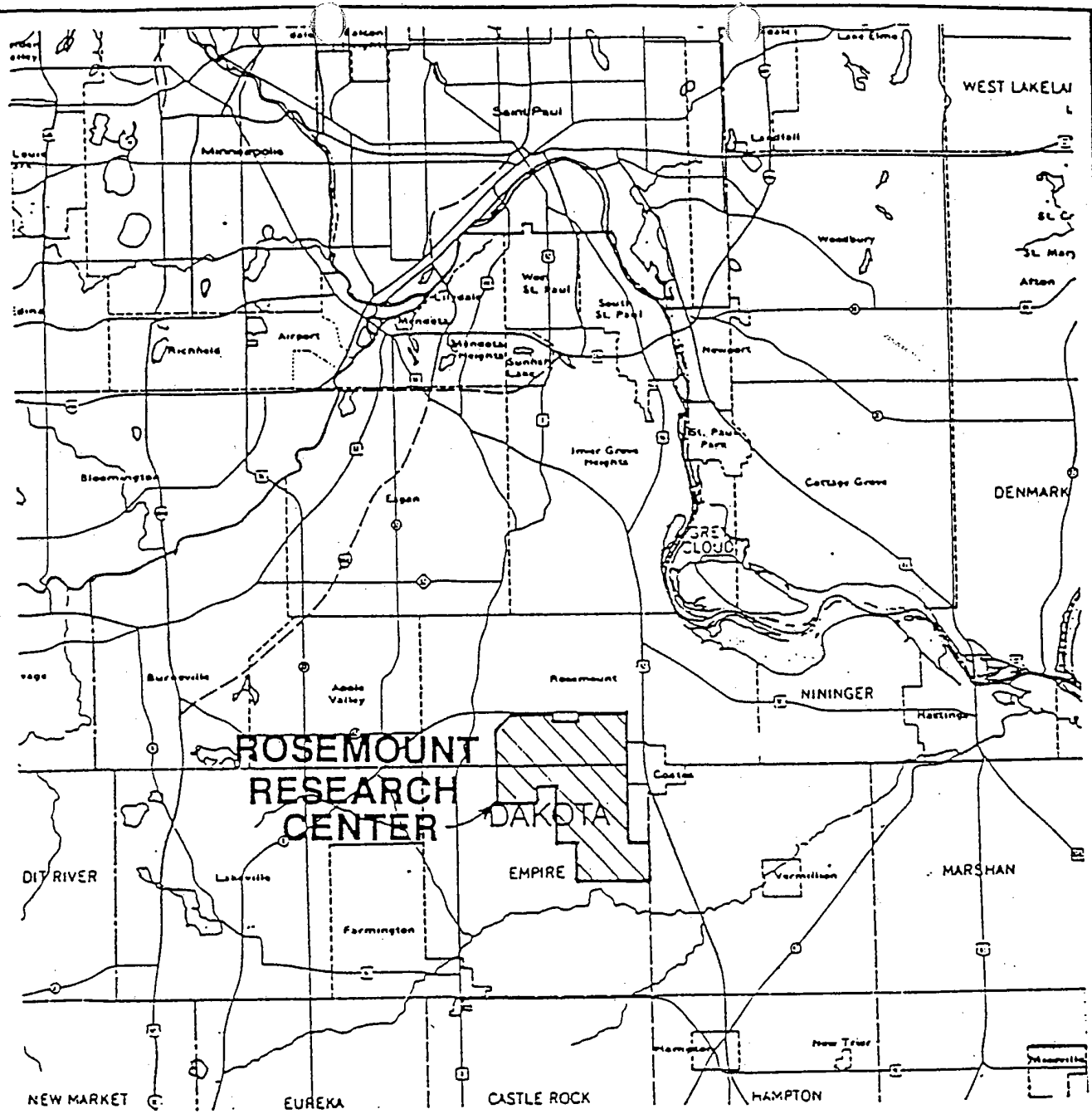


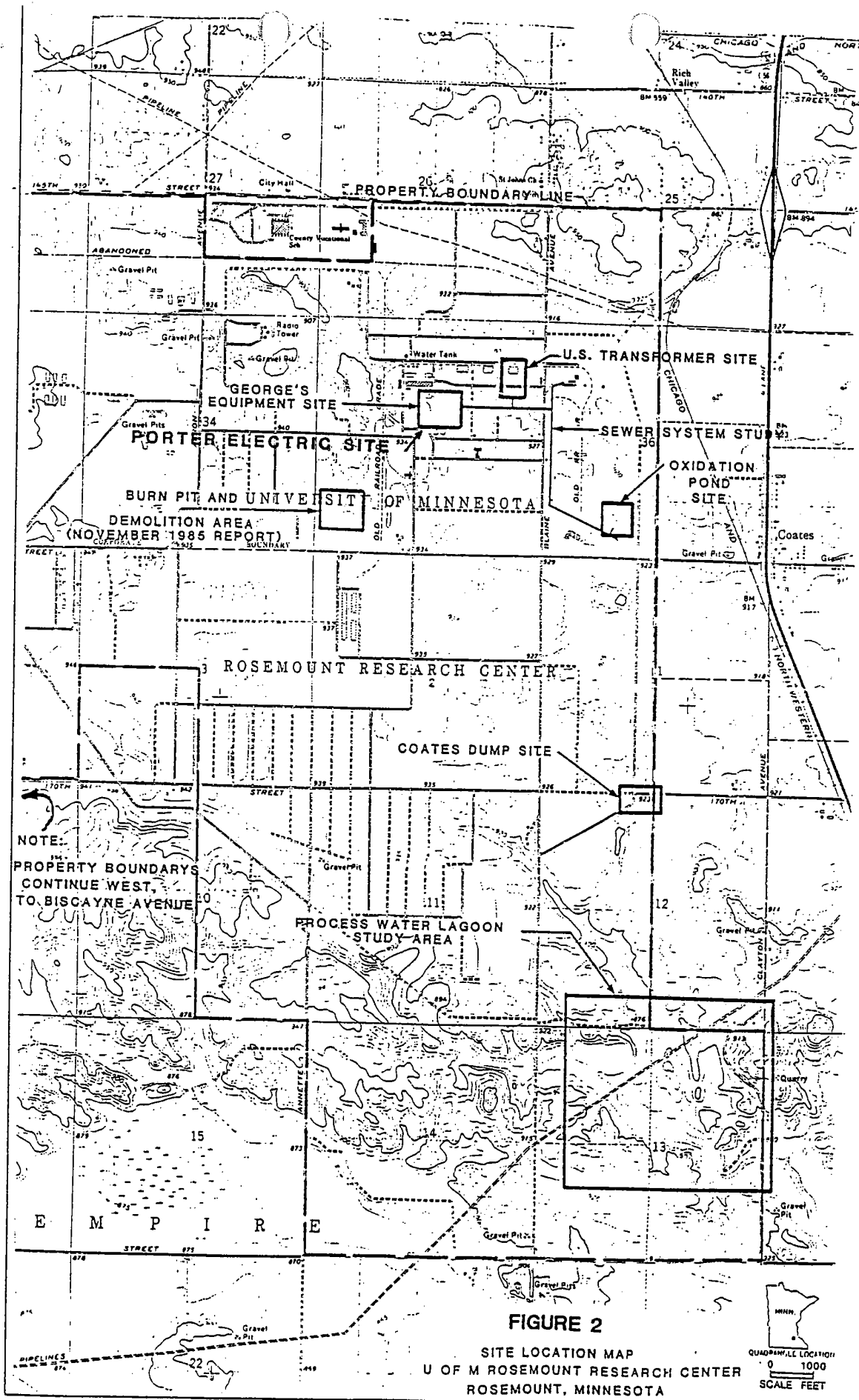
FIGURE 1
REGIONAL LOCATION OF THE
ROSEMOUNT RESEARCH CENTER
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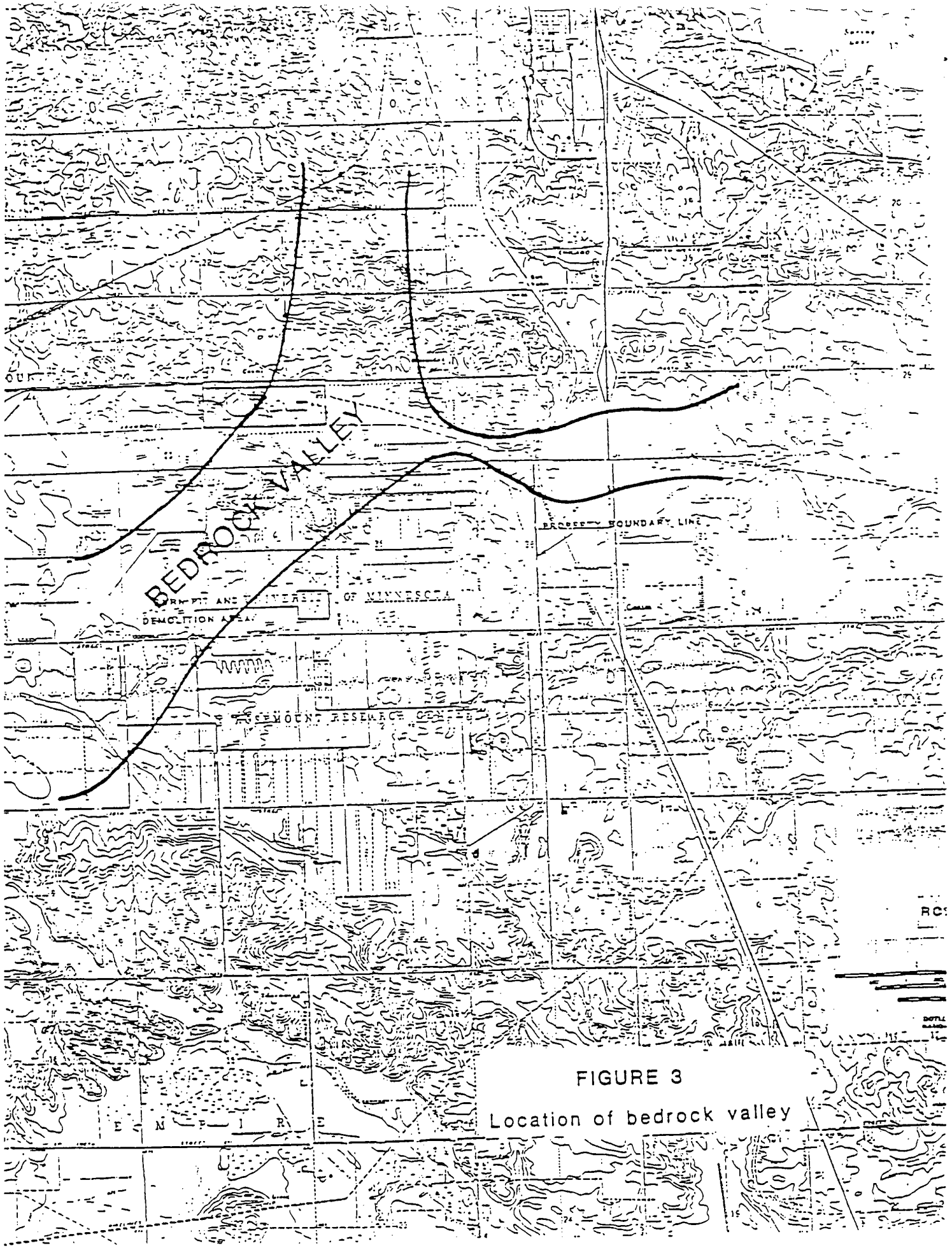


FIGURE 3

Location of bedrock valley

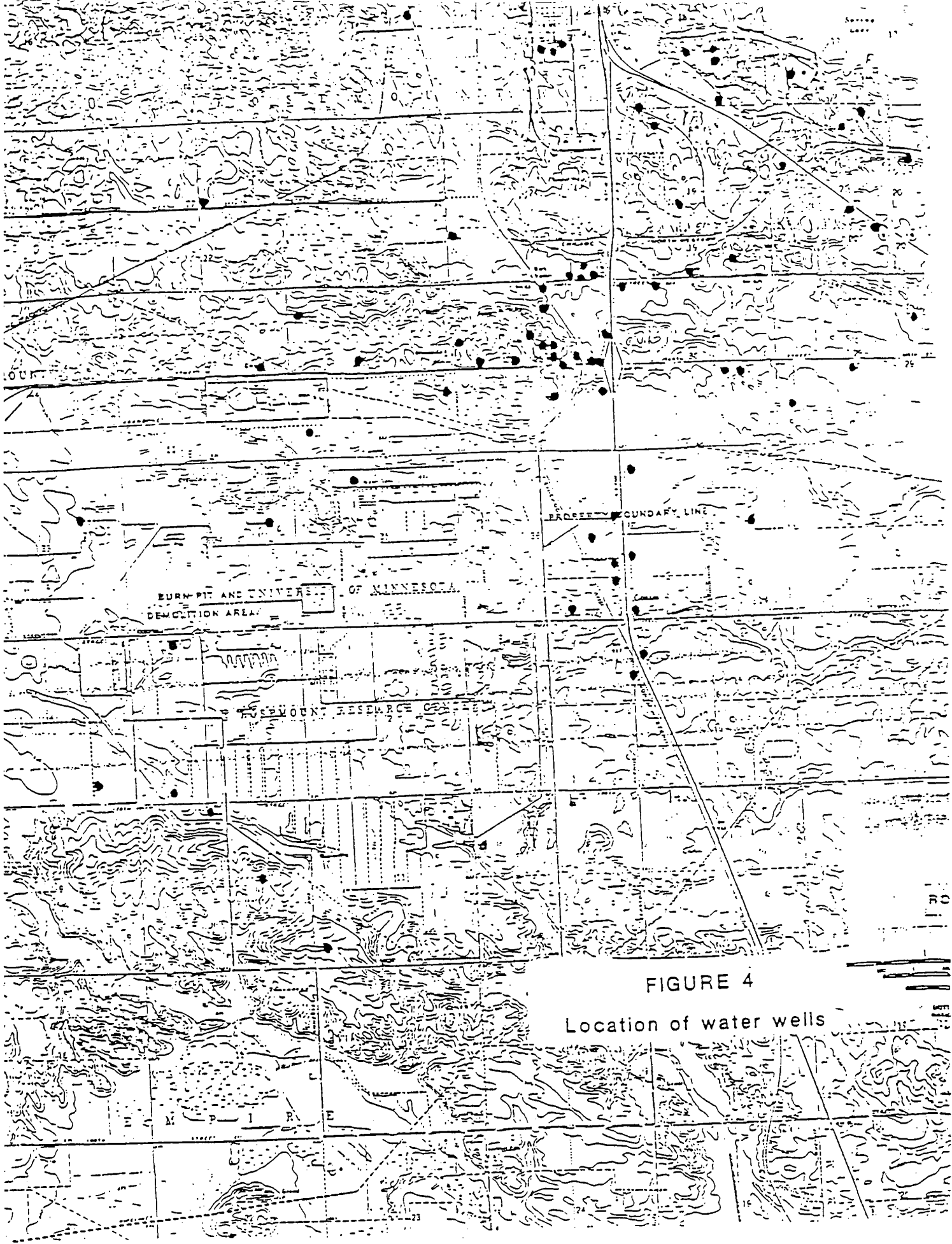
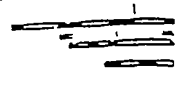


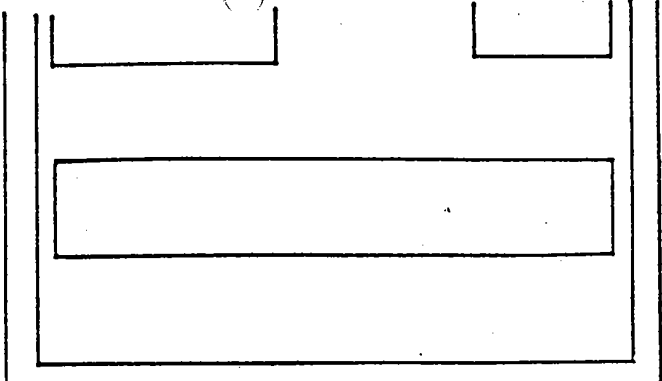
FIGURE 4

Location of water wells



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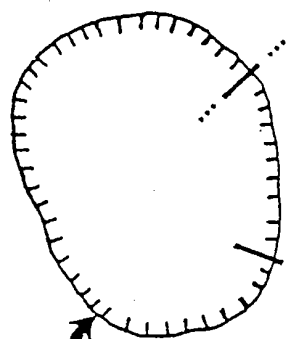


GEORGE'S USED EQUIPMENT

CONCRETE SLAB

SHALLOW DEPRESSION

EXISTING STORAGE BUILDING



DEPRESSION

RUNOFF DRAINAGE ROUTES

PORTER ELECTRIC

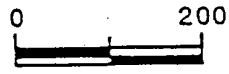


FIGURE 5.

LOCATION OF GEORGE'S USED EQUIPMENT AND PORTER ELECTRIC SITES

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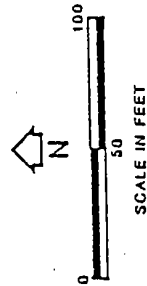
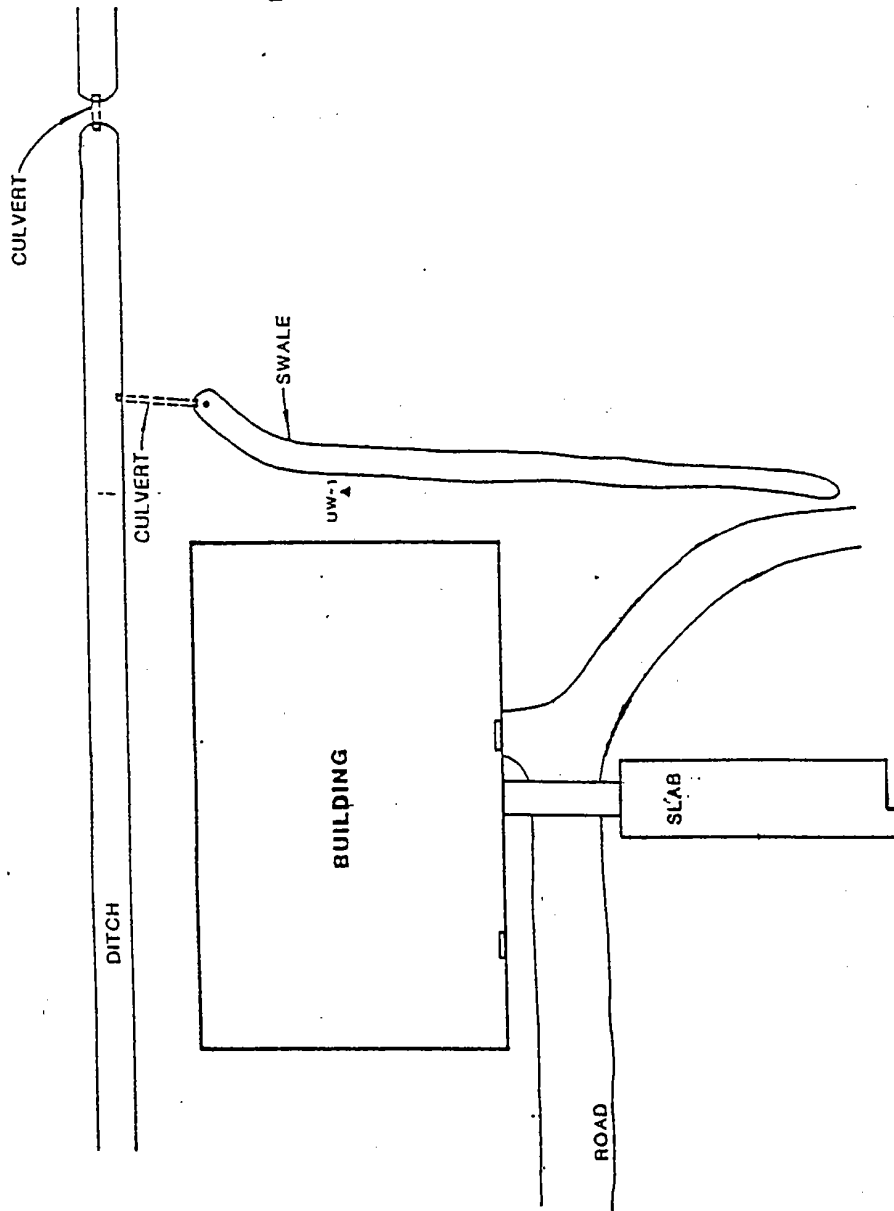


FIGURE 6

U.S. TRANSFORMER SITE
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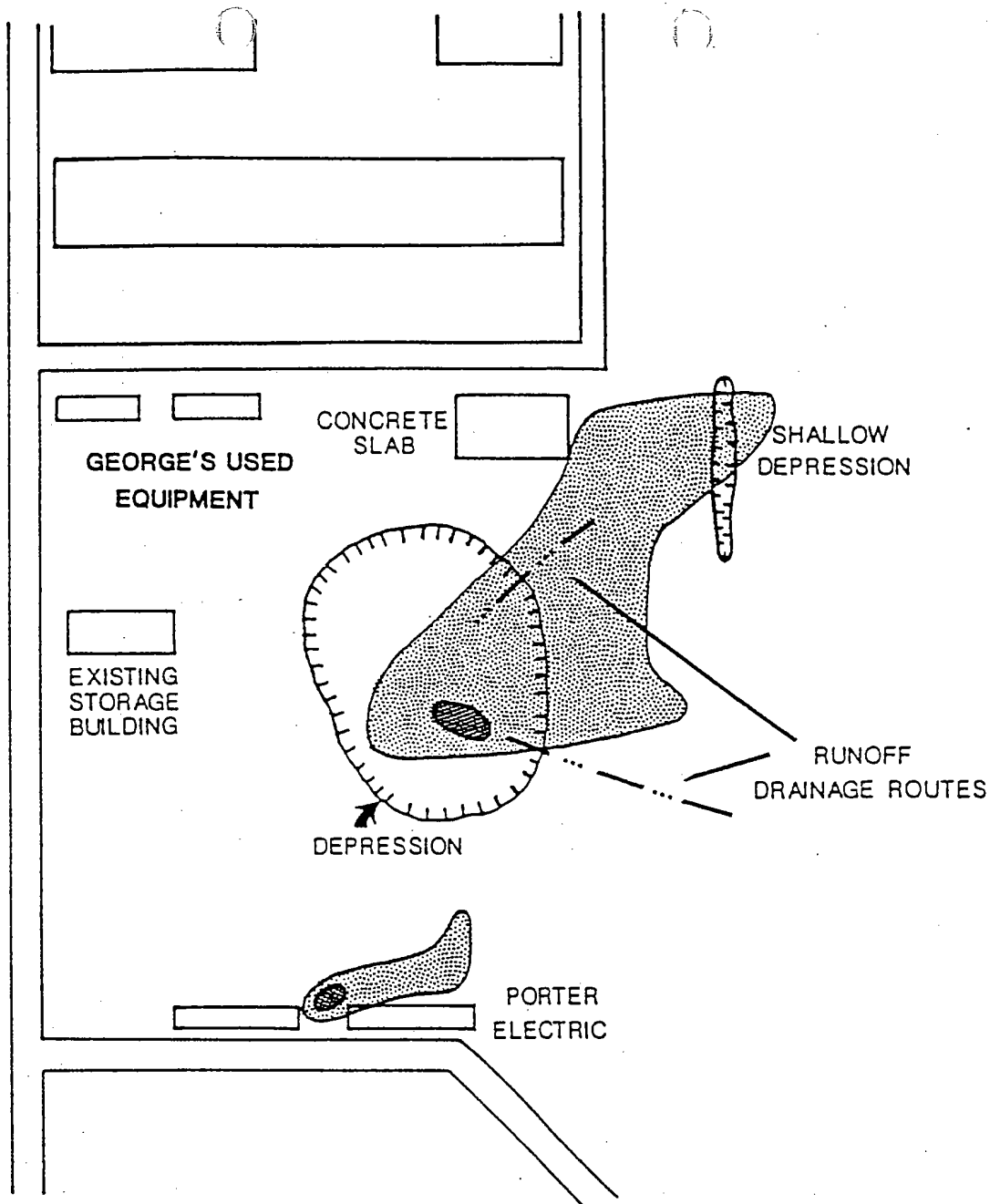




FIGURE 7

INFERRED EXTENT OF SHALLOW AND DEEP PCB CONTAMINATION

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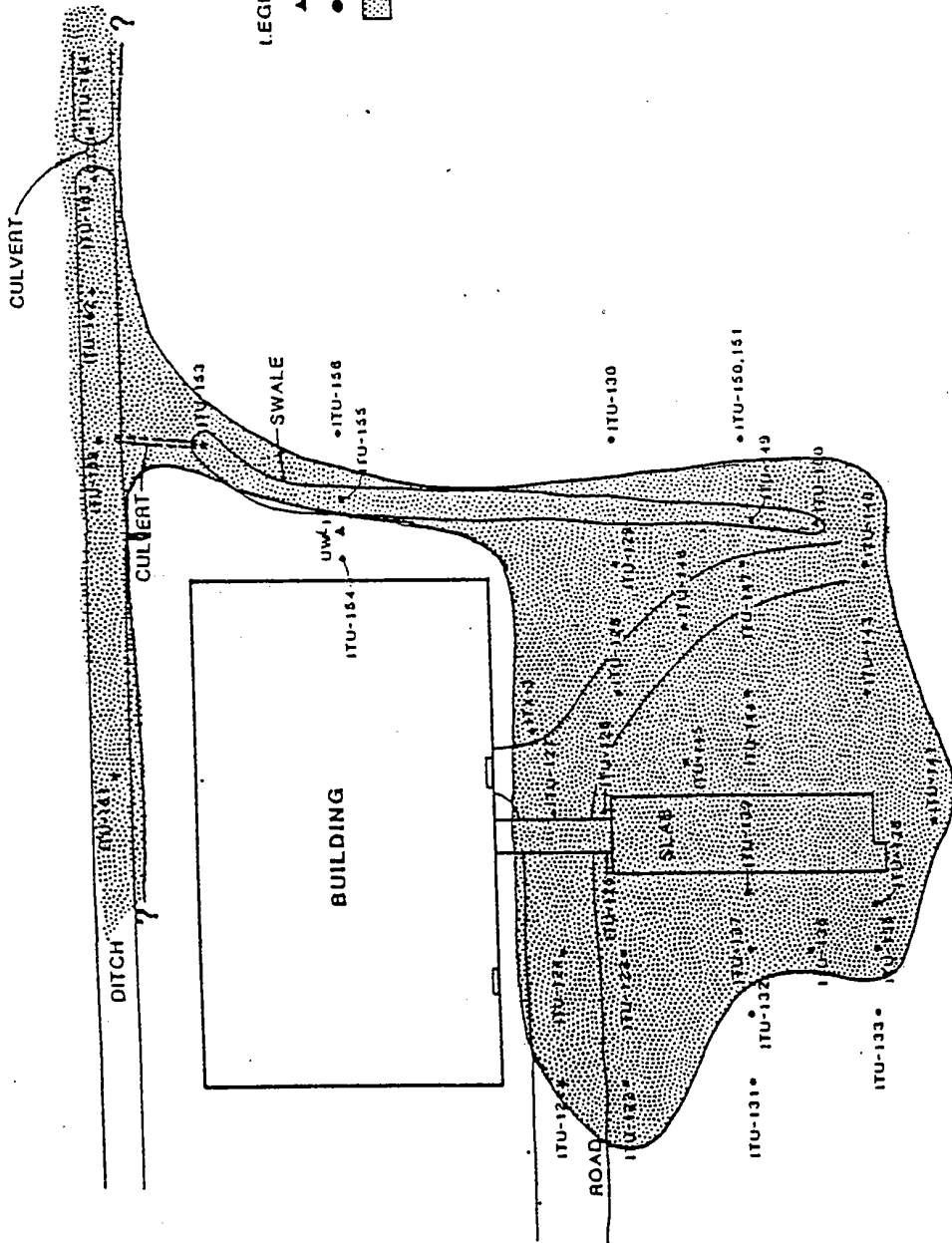
-  SHALLOW CONTAMINATION
-  DEEP CONTAMINATION



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LEGEND

- ▲ MONITORING WELL
- SOIL SAMPLING POINT
- ▨ PCB CONTAMINATION

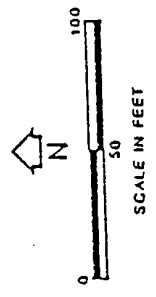


FIGURE 8

INFERRED EXTENT OF SHALLOW PCB CONTAMINATION

U.S. TRANSFORMER SITE

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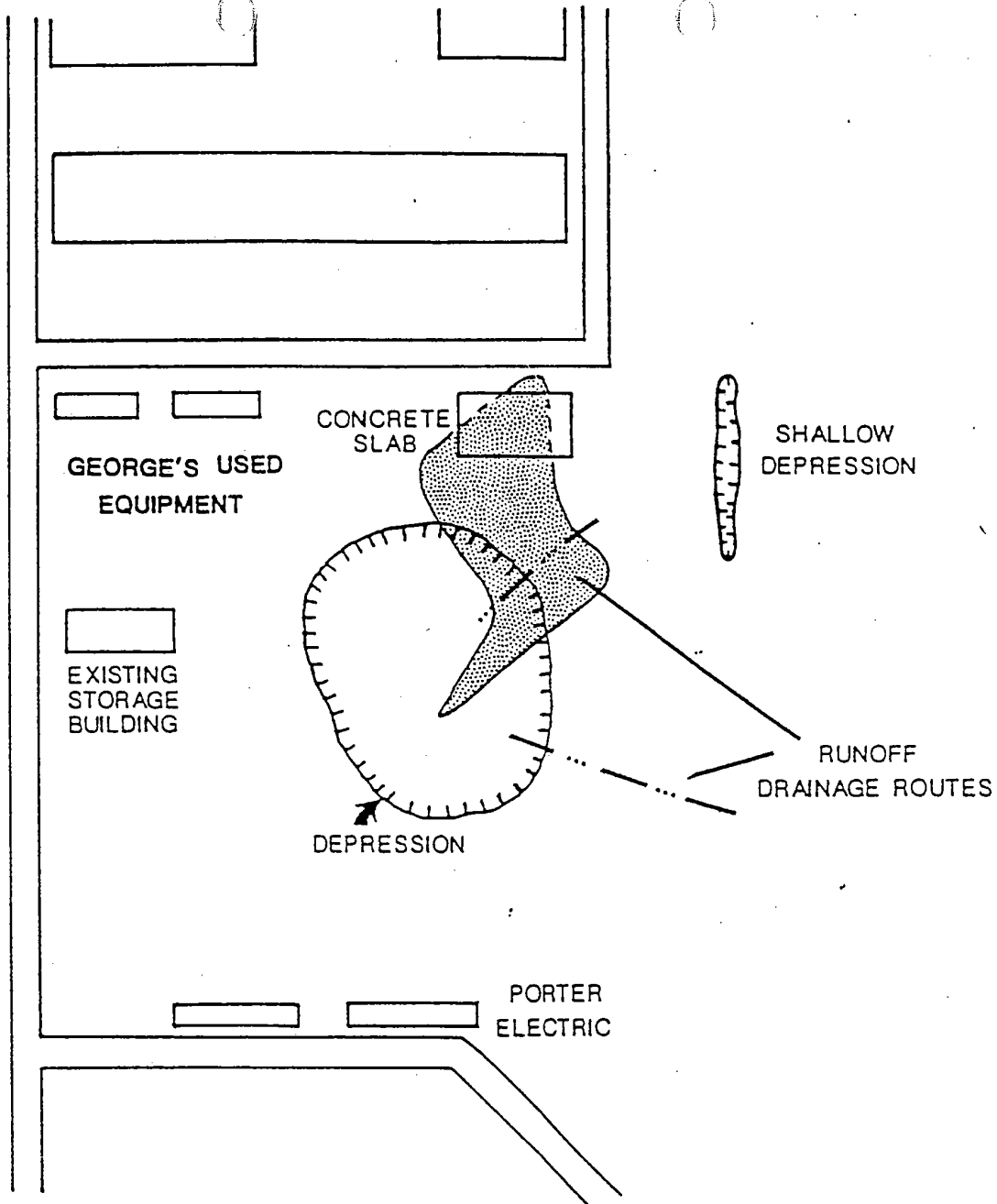


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LEAD CONTAMINATION

FIGURE 9

INFERRED EXTENT OF LEAD
CONTAMINATION

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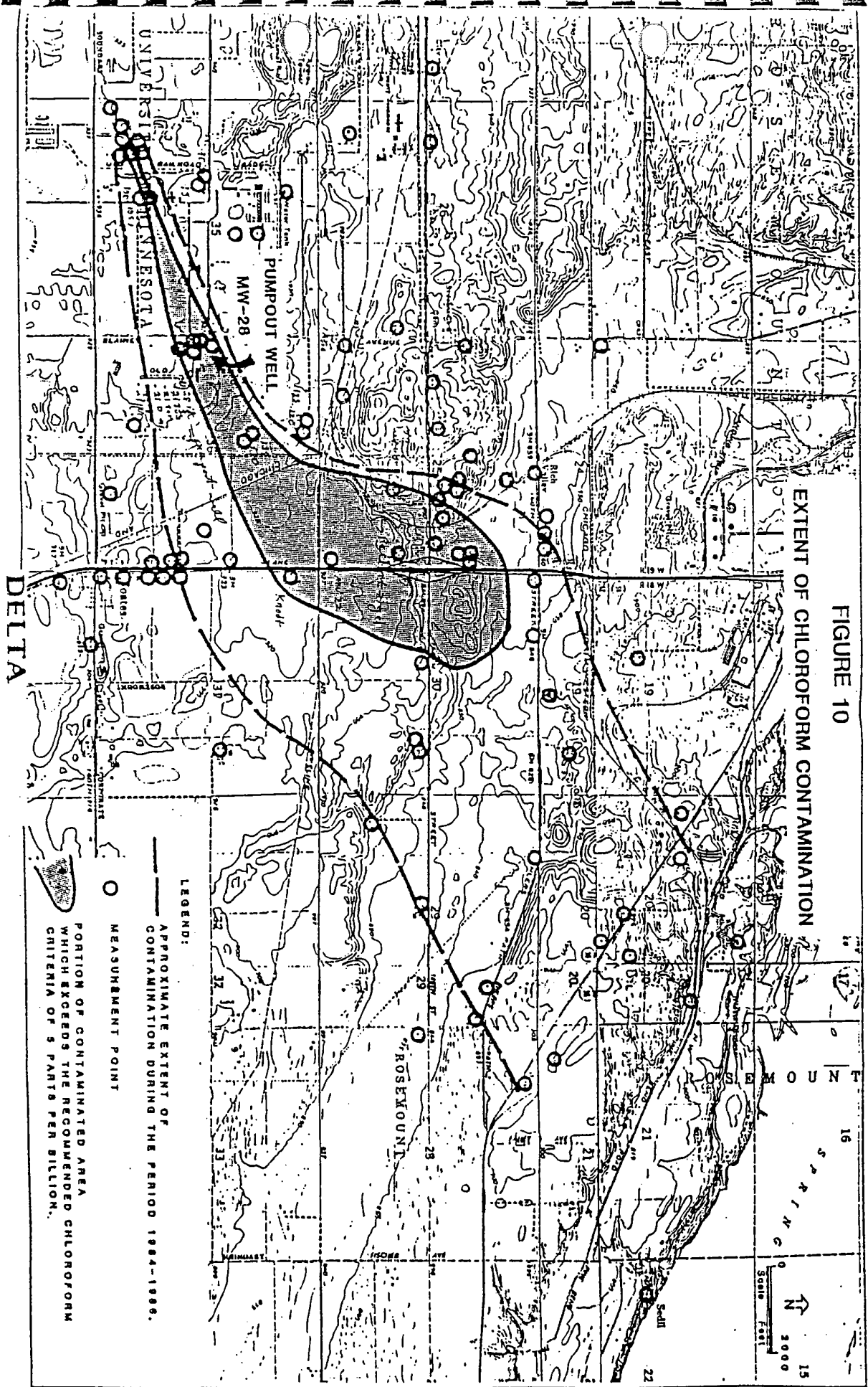


Table 1

Rosemount Research Center, Rosemount, Minnesota

Applicable or Relevant and Appropriate Requirements (ARAs) and other Criteria to be Considered (CBCs)

Chemical-Specific

Applicable or Relevant and Appropriate Requirements

Pathway	Contaminant	SDWA	OSHA	TECA	(RCRA)	MN Rules 7015	SDWA	CIA	MN Rules	Other Criteria to be Considered
										MDEQ SDWA MCLG/1 MCL/1
Ground Water	PCB					7060: Nondegradation			7060: Nondegradation	RAL: .05 ug/l MCLG: 0 MCL: 0 ug/l
Ground Water	Lead	MCL: 50 ug/l				7050.0220: 50 ug/l 7060: Nondegradation			7050.0220: 50 ug/l 7060: Nondegradation	RAL: 20 ug/l MCLG: 20 ug/l MCL: 0 ug/l
Ground Water	Chloroform	MCL: as trihalomethanes 100 ug/l				7060: Nondegradation			7060: Nondegradation	RAL: 57 ug/l MCLG: 1300 ug/l
Soil	PCB				Residential: 10 ppm, restricted access: 25 ppm					RAL: 100 ug/l MCLG: 100 ug/l MCL: 100 ug/l
Soil	Lead				guidelines: 1,000 ppm EPEC: 5 ppm	Interim Std: 1,000 ppm				RAL: 10 ⁻⁵ risk: 60 ug/l 10 ⁻⁶ risk: 10 ⁻⁶ risk: 6 ug/l
Air	PCB	PEL: 1,000 ug/m ³								ALIP: 2 ppm PCBP: 17 ppm Air.1: 7700 ppm
Air	Lead	PEL: 50 ug/m ³			AQS: 1.5 ug/m ³					ADI
Air	Chloroform	PEL: 240,000 ug/m ³								ADI

Table 1 continued

MCL	Maximum Contaminant Level
SDWA	Safe Drinking Water Act
TSCA	Toxic Substances Control Act Cleanup Policy
RCRA	Resource Conservation and Recovery Act
EPTC	Extraction Procedure Toxicity
Sec	Secondary
PEL	Permissible Exposure Level
OSHA	Occupational Safety and Health Act
CAA	Clean Air Act
AQS	National Primary and Secondary Air Quality Standard
MN	Minnesota
MNDH	Minnesota Department of Health
RAL	Recommended Allowable Limit
NIOSH	National Institute for Occupational Safety and Health
Std	Standard
CAG	Carcinogen Assessment Group
EPA	U.S. Environmental Protection Agency
WQC	Ambient Water Quality Criterion, drinking water plus fish
TEL	Toxicity Exposure Level
10^{-5} , 10^{-6}	risk Concentration corresponding to a lifetime incremental cancer risk of 10^{-5} or 10^{-6}
ALIP	Advisory level upper bound for direct inhalation and ingestion by children with pica, 10^{-5} risk at 0.175 ug/day dose
ALI.1	Advisory level lower bound for inhalation .1 km from site, 10^{-5} risk at 0.175 ug/day dose
PCAP	ALIP with 10 inches of clean soil
ACGIH	American Conference of Governmental Industrial Hygienists
AWQC	Ambient Water Quality Criterion in navigable waters
DWQ	Drinking Water Criteria

Table 2
 Rosemount Research Center, Rosemount, Minnesota
Summary of Remedial Alternatives: GUE/PE/UST Sites

<u>Alternative</u>	<u>Features</u>	<u>Goals</u>	<u>Present Worth Cost</u>
1: No Action	Long-term monitoring	No action	\$24,000
2: Limited Site Controls	Fence areas where PCBs > 25ppm, lead > 1000 ppm; adjust deed to reflect contamination; soil venting	Restrict access to contaminated soil; inhibit PCB migration	\$130,650
3: Permeable Cover	1.5 foot thick soil cover over areas where PCBs > 25 ppm; soil venting to remove solvents; soil with metals disposed off-site.	Prevent direct contact with contaminated soil; reduce PCB mobility	\$600,000
4: Impermeable Cap	2.5 or 4 foot thick clay and topsoil cap; soil with metals disposed off-site	Prevent direct contact and reduce PCB mobility; remove soil >1,000 ppm lead	\$570,300 for 2.5 ft. cap \$897,000 for 4.0 ft. cap
5A: On-Site TSCA Vault	On-site disposal of PCB soil in vault lined with clay, membrane, and geotextile; soil with metals disposal off-site	Isolate PCBs from environment; remove soil > 1,000 ppm lead	\$3,006,550
5B: On-Site RCRA Vault	On-site disposal of both PCB and metal contaminated soil	Isolate PCBs and lead from environment; remove soil > 1,000 ppm lead	\$3,128,050
6A: On-Site Extraction and Biodegradation	Excavation; direct biodegradation or solvent extraction followed by UV light dechlorination and biodegradation; backfilling; soil with metals disposed off-site	Treat soils > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$13,112,650
6B: On-Site Extraction	Excavation; all soil undergoes solvent extraction UV light dechlorination and biodegradation; backfilling; soil with metals disposed of off-site	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$12,974,950

<u>Alternative</u>	<u>Features</u>	<u>Goals</u>	<u>Present Worth Cost</u>
6C: On-Site Extraction and Biodegradation; Off-Site Incineration	Excavation; direct bio-degradation or solvent extraction; backfilling; fluid phase incinerated off-site; soil with metals disposed off-site	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$11,287,450
6D: On-Site Extraction; Off-Site Incineration	Excavation; solvent extraction; backfilling; fluid phase incinerated off-site; soil with metals disposed off-site.	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$11,086,300
7A: On-Site Incineration and Biodegradation	Excavation; direct bio-degradation or incineration; backfilling; soil with metals disposed off-site	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$12,686,250
7B: On-Site Incineration	Excavation; incineration; backfilling; soil with metals disposed off-site	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$12,578,250
7C: On-Site Thermal Desorption, Bio-degradation and Fume Incineration	Excavation; direct bio-degradation or thermal desorption; backfilling; fumes incinerated; soil with metals disposed off-site	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$ 7,581,900
7D: On-Site Thermal Desorption and Fume Incineration	Excavation; thermal desorption with fumes incinerated; backfilling; soil with metals disposed off-site	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$ 7,372,650
7E: On-Site Thermal Desorption, Bio-degradation and Fume Condensation	Excavation; direct bio-degradation or thermal desorption with fumes condensed and incinerated; backfilling; soil metals disposed off-site	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$ 8,083,900
7F: On-Site Thermal Desorption and Fume Condensation	Excavation; thermal desorption fumes condensed, incinerated off-site; backfilling; soil with metals disposed off-site	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$ 7,934,050

<u>Alternative</u>	<u>Features</u>	<u>Goals</u>	<u>Present Worth Cost</u>
7G: On-Site Thermal Desorption and Fume Incineration	Same as 7D except excavation and consolidation of soil with 10 to 25 ppm PCBs and 50 to 1,000 ppm lead and covered at GUE	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$ 8,075,200
7H: On-Site Thermal Desorption and Fume Incineration	Same as 7D except excavation and consolidation of soil with 1 to 25 ppm PCBs and 50 to 1,000 ppm lead and covered at GUE	Treat soil to > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$ 9,527,200
7I: On-Site Thermal Desorption and Fume Incineration	Same as 7D except excavation and consolidation of soil with 10-25 ppm PCBs and covered at GUE	Treat soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$ 7,511,448*
8A: Off-Site Landfill	Off-site disposal of PCB and lead contaminated soil in RCRA and TSCA facility	Remove soil > 25 ppm PCBs; remove soil > 1,000 ppm lead	\$16,744,050
8B: Off-Site Incineration	Off-site incineration of PCB contaminated soil; soil with metals disposed off-site; requires staged excavation	Treat soil > 25 ppm PCBs; remove soil 1,000 ppm lead	\$54,234,900

*Includes 7D's present worth value (\$7,372,650) + \$138,798.

Table 3
 Rosemount Research Center, Rosemount, Minnesota
Summary of Remedial Alternatives: Burn Pit Site

<u>Alternative</u>	<u>Features</u>	<u>Goals</u>
1: No action	None	No action
2: Carbon Filters Pump Out System	Point-of entry activated carbon filters in homes with contaminated wells; pump out well and air stripper	Treat ground water to 57 ppm chloroform*; provide clean drinking water to residents
3: New Residential Wells; Pump Out System	New wells screened in the Franconia for residents with contaminated wells; pump out well and air stripper	Treat ground water to 57 ppm chloroform; provide clean drinking water to residents
4: Extending RRC Water Supply; Pump Out System	Extend existing RRC water distribution lines to residents with/without option for further expansion; pump out well and air stripper	Treat ground water to 57 ppm chloroform; provide clean drinking water to residents
5: Extending Rosemount's Water Supply; Pump Out System	Extend existing Rosemount water distribution lines to residents with contaminated wells with/without option for further expansion; pump out well and air stripper	Treat ground water to 57 ppm chloroform; provide clean drinking water to residents
6: New Water Supply; Pump Out System	Construct an independant water distribution system to residents with contaminated wells with/without option for further expansion; pump out well and air stripper	Treat ground water to 57 ppm chloroform; provide clean drinking water to residents

*Carbon filters are capable of treating to below chloroform's detection limit.

Table 4

Rosemount Research Center, Rosemount, Minnesota

Comparison of Remedial Alternatives: Reduction of Toxicity, Mobility, and Volume

<u>Alternative</u> <u>GUE/PE/UST Sites</u>	<u>Toxicity (T)</u>	<u>Mobility (M)</u>	<u>Volume (V)</u>	<u>Overall</u> <u>MTV</u>
1: No Action	NE	NE	NE	-
2: Limited Site Control	NE	L	NE	-
3: Permeable Cover	NE	L-M	NE	-
4: Impermeable Cap	NE	L-M	NE	-
5A: TSCA Vault	NE	M-H	NE	-
5B: RCRA Vault	NE	M-H	NE	-
6A: Extraction/Biodegradation	M-H	M-H	M	+
6B: Extraction	M-H	M-H	M	+
6C: Extraction/Biodegradation/ Incineration	M-H	M-H	M	+
6D: Extraction/Incineration	M-H	M-H	M	+
7A: Incineration/Biodegradation	M-H	M-H	M	+
7B: Incineration	M-H	M-H	M	+
7C: Thermal Desorption/ Biodegradation/Fume Incineration	M-H	M-H	M	+
7D: Thermal Desorption/Fume Incineration	M-H	M-H	M	+
7E: Thermal Desorption/ Biodegradation/Condensation	M-H	M-H	M	+
7F: Thermal Desorption/ Condensation	M-H	M-H	M	+
7G: Thermal Desorption/Fume Incineration	M-H	M-H	M	+
7H: Thermal Desorption/Fume Incineration	M-H	M-H	M	+
7I: Thermal Desorption/Fume Incineration	M-H	M-H	M	+
8A: Off-Site Landfill	NE	M-H	NE	-
8B: Off-Site Incineration	M-H	M-H	M	+

Table 4 (continued)

Rosemount Research Center, Rosemount, Minnesota

Comparison of Remedial Alternatives: Reduction of Toxicity, Mobility, and Volume

<u>Alternative</u> <u>Burn Pit Sites</u>	<u>Toxicity (T)</u>	<u>Mobility (M)</u>	<u>Volume (V)</u>	<u>Overall</u> <u>MTV</u>
1: No Action	NE	NE	NE	-
2: Carbon Filters; Pump Out System	H	H	M-H	+
3: New Residential Wells; Pump Out System	H	H	M-H	+
4: Extend RRC Water Supply; Pump Out System	H	H	M-H	+
5: Extend Rosemount Water Supply; Pump Out System	H	H	M-H	+
6: New Water Supply; Pump Out System	H	H	M-H	+

"NE" means not effective

"L" means little effect

"M" means moderately effective

"H" means highly effective

"+" means generally favorable in comparison to other alternatives

"-" means generally unfavorable in comparison to other alternatives

Table 5
Rosemount Research Center, Rosemount, Minnesota

Comparison of Remedial Alternatives: Cost Analysis^a

<u>Alternative</u>	<u>Capital Cost</u>	<u>Annual O & M Cost</u>	<u>Period</u>	<u>Total Present Worth</u>
<u>GUE/PE/UST Sites:</u>				
1: No Action	\$ -0-	\$ 800	30 yrs.	\$ 24,000
2: Limited Site Control	106,650	800	30 yrs.	130,650
3: Permeable Cover	486,000	3,800	30 yrs.	600,000
4: Impermeable Cap: 2.5ft.	456,300	3,800	30 yrs.	570,300
4: Impermeable Cap: 4.0ft.	783,000	3,800	30 yrs.	897,000
5A: TSCA Vault	2,873,560	4,433	30 yrs.	3,006,550
5B: RCRA Vault	2,995,060	4,433	30 yrs.	3,128,050
6A: Extraction and Biodegradation	13,112,650	-0-	1 yr.	13,112,650
6B: Extraction	12,974,950	-0-	1 yr.	12,974,950
6C: Extraction, Biodegradation, and Off-Site Incineration	11,287,450	-0-	1 yr.	11,287,450
6D: Extraction, Off-Site Incineration	11,086,300	-0-	1 yr.	11,086,300
7A: Incineration and Biodegradation	12,686,250	-0-	1 yr.	12,686,250
7B: Incineration	12,578,250	-0-	1 yr.	12,578,250
7C: Thermal Desorption, Biodegradation, and Fume Incineration	7,581,900	-0-	1 yr.	7,581,900

^aCost analysis from Alternatives Report, November 1986

Table 5 (continued)
 Rosemount Research Center, Rosemount, Minnesota

Comparison of Remedial Alternatives: Cost Analysis

<u>Alternative</u>	<u>Capital Cost</u>	<u>Annual O & M Cost</u>	<u>Period</u>	<u>Total Present Worth</u>
7D: Thermal Desorption, Fume Incineration	7,372,650	-0-	1 yr.	7,372,650
7E: Thermal Desorption, Biodegradation, Condensation	8,083,900	-0-	1 yr.	8,083,900
7F: Thermal Desorption, Condensation	7,934,050	-0-	1 yr.	7,934,050
7G: ^b Thermal Desorption, Fume Incinerator (Excavation, consolidation of soil with 10-25 ppm PCBs and 50-1,000 ppm lead)	8,075,200	-0-	1 yr.	8,075,200
7H: ^c Thermal Desorption, Fume Incineration, (Excavation, consolidation of soil with 1-25 ppb PCBs and 50-1,000 ppm lead)	9,527,200	-0-	1 yr.	9,527,200
7I: Thermal Desorption, Fume Incineration, (Excavation, consolidation of soil with 10-25 ppm PCBs)	7,511,448	-0-	1 yr.	7,511,448

^b Additional volume to be consolidated is estimated to be 22,793 cubic yards (See International Technology Corporation (IT) letter dated December 13, 1988).

^c Additional volume to be consolidated is estimated to be 60,458 cubic yards (See IT letter dated December 13, 1988).

Table 5 (continued)
 Rosemount Research Center, Rosemount, Minnesota

Comparison of Remedial Alternatives: Cost Analysis

<u>Alternative</u>	<u>Capital Cost</u>	<u>Annual O & M Cost</u>	<u>Period</u>	<u>Total Present Worth</u>
8A: Off-Site Landfill	16,744,050	-0-	1 yr.	16,744,050
8B: Off-Site Incineration	54,234,900	-0-	1 yr.	54,234,900
<u>Burn Pit Site^a:</u>				
1: No Action	-0-	-0-	-0-	
2: Carbon Filters; Pump Out System ^b ,	101,038	32,995	20	
3: New Wells; Pump Out System	283,328	8,695	20	
4: RRC Water Supply; Pump Out System	690,238	8,695	20	
5: Rosemount Water Supply; Pump Out System	876,238	8,695	20	
6: New Water Supply; Pump Out System	797,238	8,695	20	

^a Total Present Worth calculations were not required at the time these estimates were developed and are not included.

^b Capital costs for the pump out system are \$63,238; Annual O & M costs for the pump out system are \$8,695.

Table 6
Rosemount Research Center, Rosemount, Minnesota
Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 1 Evaluation

Description: No Action

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Not effective. No reduction of threat to ground water or direct contact.
2. Long-Term Effectiveness and Permanence	Not effective. Lead and PCBs may potentially enter ground water and will persist at hazardous levels in soil; 30 year monitoring period.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Not effective.
4. Implementability	Implementable.
5. Cost Criteria	Capital: 0 Annual O&M Cost: \$800 per year for 30 years Present Worth Value: \$24,000
6. Compliance with ARARs	Noncompliant with soil and ground water ARARs.
7. Overall Protection of Human Health and the Environment	Not protective. Persistence of contaminants pose threat to human health and the environment.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 2 Evaluation

Description: Limited Site Control - fencing of areas where PCBs exceed 25 ppm and lead exceeds 1,000 ppm; soil venting; adjustment of deed.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Not effective. Potential for direct contact with PCBs and lead persists; lead may migrate to ground water.
2. Long-Term Effectiveness and Permanence	Not effective. Contaminants remain at hazardous levels at surface and lead and PCB will continue to have the potential to enter ground water; 30 year monitoring period.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Low - soil venting may inhibit mobility of PCBs; toxicity and volume unchanged.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital: \$106,650 Annual O&M Cost: \$800 per year for 30 years Present Worth Value: \$130,650
6. Compliance with ARARs	Noncompliant with soil and ground water ARARs.
7. Overall Protection of Human Health and the Environment	Not protective. Persistence of contaminants pose threat to human health and the environment.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 3 Evaluation

Description: Permeable Cover - excavation and off-site disposal of soil contaminated with metals; emplacement of permeable cover over areas where PCBs exceed 25 ppm; soil venting.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - requires only minimal handling and movement of contaminated soil.
2. Long-Term Effectiveness and Permanence	Moderately effective - the combination of a cover and soil venting should reduce the threat of direct contact and ground water contamination; dependent on long-term maintenance; 30 year monitoring period.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Low - removal of soil contaminated with metals reduces its on-site TMV; PCB mobility may be inhibited, volume and toxicity unchanged.
4. Implementability	Technically and administratively feasible.
5. Cost	Capital Cost: \$486,000 Annual O&M Cost: \$3,800 per year for 30 years Present Worth Value: \$600,000
6. Compliance with ARARs	Noncompliant with U.S. EPA PCB cleanup goals and Section 121 of SARA.
7. Overall Protection of Health Health and the Environment	Moderately protective - threat of ground water contamination and direct contact reduced. PCBs remain on site at hazardous levels.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 4 Evaluation

Description: Impermeable Cap - excavation and off-site disposal of soil contaminated with metals; emplacement of impermeable clay cap over areas where PCBs exceed 25 ppm.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - requires minimal handling and movement of contaminated soil.
2. Long-Term Effectiveness and Permanence	Moderately effective - the cap should both inhibit PCB migration and remove threat of direct contact; dependent on long-term maintenance; 30 year monitoring period.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Low - cap may inhibit PCB mobility, not reduce toxicity or volume.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$456,000 - \$783,000 Annual O&M Cost: \$3,800 per year for 30 years Present Worth Value: \$570,400 - \$897,000
6. Compliance with ARARs	Noncompliant with U.S. EPA proposed PCB cleanup goals and Section 121 of SARA.
7. Overall Protection of Human Health and the Environment	Moderately protective - threat of direct contact and ground water contamination reduced; PCBs remain on site at hazardous levels.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
Rosemount Research Center, Rosemount, Minnesota
Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 5A Evaluation

Description: On-Site TSCA Vault - excavation and off-site disposal of soil contaminated with metals; excavation of soil with 25 ppm or more PCBs and disposal in TSCA - permitted vault constructed on site.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - involves only a short period of handling and movement of contaminated soil.
2. Long-Term Effectiveness and Permanence	Effective - isolates contaminants from the environment; dependent on long-term maintenance; 30 year monitoring period.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Low - isolation of PCBs reduces their mobility; toxicity and volume unchanged.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$2,873,560 Annual O&M: \$4,433 per year for 30 years Present Worth Value: \$3,006,550
6. Compliance with ARARs	Noncompliant with Section 121 of SARA.
7. Overall Protection of Human Health and the Environment	Moderately protective - significantly reduces threat of direct contact and ground water contamination; PCBs remain on site at hazardous levels.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 5B Evaluation

Description: On-Site RCRA Vault - excavation of soil and ash containing greater than 25 ppm PCBs and/or greater than 1000 ppm lead; disposal in a RCRA - permitted vault constructed on site.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - requires only a short period of handling and movement of contaminated soil.
2. Long-Term Effectiveness and Permanence	Effective - isolates contaminated soil from environment; dependent on long-term maintenance; 30 year monitoring period.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Low - upgrading to RCRA permit adds extra safeguards against mobility; volume and toxicity unchanged.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$2,996,060 Annual O&M Cost: \$4,433 per year for 30 years Present Worth Value: \$3,128,050
6. Compliance with ARARs	Noncompliant with Section 121 of SARA.
7. Overall Protection of Human Health and the Environment	Moderately protective - threat of direct contact and ground water contamination significantly reduced. PCBs remain on site at hazardous levels.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 6A Evaluation

Description: Solvent Extraction and Biodegradation - excavation and off-site disposal of soil contaminated with metals; solvent extraction, UV light dechlorination, and activated sludge treatment of Aroclor 1260 soil; direct biodegradation of Aroclor 1242 soil; backfilling of soil; sewerage of wastewater.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of handling, movement and stockpiling of contaminated soil.
2. Long-Term Effectiveness and Permanence	Moderately effective - represents a permanent reduction in contaminant levels, but may not meet ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by biological destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically feasible, administratively complex.
5. Cost Criteria	Capital Cost: \$13,112,650 Annual O&M Cost: 0 Present Worth Value: \$13,112,650
6. Compliance with ARARs	May not attain U.S. EPA proposed PCB cleanup goal.
7. Overall Protection of Human Health and the Environment	Moderately to highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 6B Evaluation

Description: Solvent Extraction - excavation and off-site disposal of soil contaminated with metals; excavation, solvent extraction; UV light dechlorination, and activated sludge treatment of all soil greater than 25 ppm PCBs; sewerage of wastewater; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of handling, moving and stockpiling contaminated soil
2. Long-Term Effectiveness and Permanence	Moderately effective - permanently reduces contaminant levels, but may not meet ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by biological destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$12,974,950 Annual O&M Cost: 0 Present Worth Value: \$12,974,950
6. Compliance with ARARs	May not attain U.S. EPA proposed PCB cleanup goal.
7. Overall Protection of Human Health and the Environment	Moderately to highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 6C Evaluation

Description: Solvent Extraction and Biodegradation, Off-Site Incineration - excavation and solvent extraction of Aroclor 1260 soil; direct biodegradation of Aroclor 1242 soil; carbon filtration and off-site incineration of liquid phase; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of handling, moving and stockpiling contaminated soil.
2. Long-Term Effectiveness and Permanence	Moderately effective - permanently reduces contaminant levels, but may not meet ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by biological and/or thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically feasible; administratively complex.
5. Cost Criteria	Capital Cost: \$11,287,450 Annual O&M Cost: 0 Present Worth Value: \$11,287,450
6. Compliance with ARARs	May not attain U.S. EPA PCB cleanup policy.
7. Overall Protection of Human Health and the Environment	Moderately to highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 6D Evaluation

Description: Solvent Extraction and Off-Site Incineration - excavation and off-site disposal of soil contaminated with metals; excavation and solvent extraction of all soil with greater than 25 ppm or more PCBs; carbon filtration and off-site incineration of liquid phase; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of handling, moving and stockpiling contaminated soil.
2. Long-Term Effectiveness and Permanence	Moderately effective - permanently reduces contaminant levels, but may not meet ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soils reduced.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$11,086,300 Annual O&M Cost: 0 Present Worth Value: \$11,086,300
6. Compliance with ARARs	May not attain U.S. EPA PCB cleanup policy
7. Overall Protection of Human Health and the Environment	Moderately to highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
Rosemount Research Center, Rosemount, Minnesota
Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7A Evaluation

Description: On-Site Incineration and Biodegradation - excavation and off-site disposal of soil contaminated with metals; excavation and incineration of Aroclor 1260 soil; excavation, biodegradation and incineration of Aroclor 1242 soil; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of handling, moving and stockpiling of contaminated soil; potential for emission of air pollutants.
2. Long-Term Effectiveness and Permanence	Highly effective - permanently reduces contaminants to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically feasible, administratively complex.
5. Cost Criteria	Capital Cost: \$12,686,250 Annual O&M Cost: 0 Present Worth Value: \$12,686,250
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7B Evaluation

Description: On-Site Incineration - excavation and off-site disposal of lead-bearing ash; excavation and incineration of all soil with greater than 25 ppm PCBs; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of handling, moving and stockpiling contaminated soil; potential for emission of air pollutants.
2. Long-Term Effectiveness and Permanence	Highly effective - permanently reduces contaminant levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soils reduced.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$12,578,250 Annual O&M Cost: 0 Present Worth Value: \$12,578,250
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7C Evaluation

Description: On-Site Thermal Desorption Biodegradation and Fume Incineration,
 - excavation and off-site disposal of soil contaminated with
 metals; excavation and thermal desorption of Aroclor 1260 soil;
 excavation, biodegradation and thermal desorption of Aroclor 1242
 soil; incineration of off-gases; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of handling, moving and stockpiling contaminated soil; potential for emission of air pollutants.
2. Long-Term Effectiveness and Permanence	Highly effective - permanently reduces contaminant levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically feasible, administratively complex.
5. Cost Criteria	Capital Cost: \$7,581,000 Annual O&M Cost: 0 Present Worth Value: \$7,581,000
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7D Evaluation

Description: On-Site Thermal Desorption with Fume Incineration - excavation and off-site disposal of soil contaminated with metals; excavation and thermal desorption of all soil with greater than 25 ppm PCBs; incineration of off-gases; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of moving, handling and stockpiling contaminated soil; potential for air pollutant emissions.
2. Long-Term Effectiveness	Highly effective - permanently reduces contaminant and Permanence levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$7,372,650 Annual O&M Cost: 0 Present Worth Value: \$7,372,650
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human	Highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7E Evaluation

Description: On-Site Thermal Desorption and Biodegradation, Fume Condensation - excavation and off-site disposal of soil contaminated with metals; excavation and thermal desorption of Aroclor 1260 soil; excavation, biodegradation and thermal desorption of Aroclor 1242 soil; fume condensation; backfilling of soil; off-site incineration of condensate.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of moving, handling, and stockpiling contaminated soil; some handling of condensate; potential for air pollutants emissions.
2. Long-Term Effectiveness and Permanence	Highly effective - permanently reduces contaminant levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically feasible, administratively complex.
5. Cost Criteria	Capital Cost: \$8,083,900 Annual O&M Cost: 0 Present Worth Value: \$8,083,900
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7F Evaluation

Description: On-Site Thermal Desorption and Fume Condensation - excavation and off-site disposal of soil contaminated with metals; excavation and thermal desorption of all soil with greater than 25 ppm PCBs; fume condensation and off-site incineration; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of moving, handling and stockpiling contaminated soil; some handling of condensate; potential for air pollutant emissions.
2. Long-Term Effectiveness and Permanence	Highly effective - permanently reduces contaminant levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$7,934,050 Annual O&M Cost: 0 Present Worth Value: \$7,934,050
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly effective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7G Evaluation

Description: On-Site Thermal Desorption and Fume Condensation - excavation and off-site disposal of soil contaminated with metals; excavation and consolidation of soil with from 10 to 25 ppm PCBs and 50 to 1,000 ppm lead on GUE Site; and thermal desorption of all soil with greater than 25 ppm PCBs; fume condensation and off-site incineration; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of moving, handling and stockpiling contaminated soil; some handling of condensate; potential for air pollutant emissions.
2. Long-Term Effectiveness and Permanence	Highly effective - permanently reduces contaminant levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$8,075,200 Annual O&M Cost: 0 Present Worth Value: \$8,075,200
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly effective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7H Evaluation

Description: On-Site Thermal Desorption and Fume Condensation - excavation and off-site disposal of soil contaminated with metals; excavation and consolidation of soil with from 1 to 25 ppm PCBs and from 50 to 1,000 ppm lead on GUE Site; excavation and thermal desorption of all soil with greater than 25 ppm PCBs; fume condensation and off-site incineration; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness.	Low - requires long periods of moving, handling and stockpiling contaminated soil; some handling of condensate; potential for air pollutant emissions.
2. Long-Term Effectiveness and Permanence	Highly effective - permanently reduces contaminant levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically difficult but administratively feasible.
5. Cost Criteria	Capital Cost: \$9,527,200 Annual O&M Cost: 0 Present Worth Value: \$9,527,200
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly effective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 7I Evaluation

Description: On-Site Thermal Desorption with Fume Incineration - excavation and off-site disposal of soil contaminated with metals; excavation and thermal desorption of all soil with greater than 25 ppm PCBs; incineration of off-gases; backfilling of soil; excavation and consolidation of soil with from 10 to 25 ppm PCBs.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires long periods of moving, handling and stockpiling contaminated soil; potential for air pollutant emissions.
2. Long-Term Effectiveness	Highly effective - permanently reduces contaminant and Permanence levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV reduced by thermal destruction of PCBs; mobility of metals in soil reduced.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$7,511,448 Annual O&M Cost: 0 Present Worth Value: \$7,551,448
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human	Highly protective - significantly reduces contaminant levels, decreasing threat of direct contact and ground water contamination.
8. Support Agency Acceptance	Acceptable.
9. Community Acceptance	Acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 8A Evaluation

Description: Off-Site Landfill - excavation of soil contaminated with metals with lead in excess of 1,000 ppm and/or soil in excess of 25 ppm PCBs; off-site disposal of these soils in a RCRA and TSCA approved landfill licensed to accept both PCBs and lead; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - requires only a short period of handling and movement of contaminated soil.
2. Long-Term Effectiveness and Permanence	Not effective - merely moves from one site to another.
3. Reduction and Toxicity, Mobility and Volume (TMV)	Low - PCB mobility may be reduced; toxicity or volume unchanged.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capitol Cost: \$16,744,050 Annual O&M: 0 Present Worth Value: \$16,744,050
6. Compliance with ARARS	Noncompliant with U.S. EPA proposed PCB cleanup goals and Section 121 of SARA.
7. Overall Protection of Human	Moderately protective - threat of direct contact and ground water contamination reduced.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 6
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: GUE/PE/UST Sites

Alternative 8B Evaluation

Description: Off-Site Incineration - excavation of soil contaminated with metals with lead in excess of 1,000 ppm and/or soil in excess of 25 ppm PCBs; off-site incineration of soil in a RCRA and TSCA approved facility licensed to accept both PCBs and lead; backfilling of soil.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Low - requires staged excavation and/or storage of soil.
2. Long-Term Effectiveness and Permanence	Highly effective - permanently reduces contaminant levels to below ARARs.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly - TMV reduced by thermal destruction of metals and PCBs; mobility of metals in soil reduced.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capitol Cost: \$54,234,900 Annual O&M: 0 Present Worth Value: 54,234,900
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human	Moderately protective - threat of direct contact and ground water contamination reduced. Some potential risks during transport.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 7
Rosemount Research Center, Rosemount, Minnesota
Nine Criteria Evaluation: Burn Pit Site

Alternative 1 Evaluation

Description: No Action

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Not effective - contaminated ground water will continue to migrate.
2. Long-Term Effectiveness and Permanence	Not effective - contaminated ground water will migrate to additional residential wells.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Not effective.
4. Implementability	Implementable.
5. Cost Criteria	Capital Cost: 0 Annual O&M Cost: 0 Present Worth Value: 0
6. Compliance with ARARs	Noncompliant with ground water ARARs.
7. Overall Protection of Human Health and the Environment	Not protective of human health or the environment as contaminants will persist and migrate.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 7
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: Burn Pit Site

Alternative 2 Evaluation

Description: Activated Carbon Filtration - installation of two point-of-entry carbon filters in series in houses with contaminated wells; pump out well with air stripper system.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - filters will remove volatiles to below detection limits; pump out well will inhibit further migration of contaminants.
2. Long-Term Effectiveness and Permanence	Effective - filters, if properly maintained, will continue to remove contaminants from residential water, pump out well and air stripper will control contaminant migration.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - the TMV of contaminants in the ground water will be significantly reduced, but the contaminants are simply shifted to another media.
4. Implementability	Technically feasible; administratively complex.
5. Cost Criteria	Capital Cost: \$ 37,800 Annual O&M Cost: \$486,000 Present Worth Value: \$523,800
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Moderately protective - removal of contaminants from the ground water by the filters and air stripper reduces threat to human health and the environment, but requires O & M to avoid chemical break through and human exposure.
8. Support Agency Acceptance	Not acceptable.
9. Community Acceptance	Not acceptable.

Table 7
Rosemount Research Center, Rosemount, Minnesota
Nine Criteria Evaluation: Burn Pit Site

Alternative 3 Evaluation

Description: New Residential Wells - construction of 20 new wells serving 27 families finished in the Franconia Formation; pump out well and air stripper system.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - provides a potable water supply to residents while controlling contaminant migration.
2. Long-Term Effectiveness and Permanence	Effective - provides a permanent potable water supply and the air stripper will ultimately remove the contaminants from the ground water.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV will be reduced in the ground water, but contaminants are simply shifted to another media.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$220,000 Annual O&M Cost: 0 Present Worth Value \$220,000
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly protective - clean water supply protects human health, pump out well and air stripper control contaminant migration.
8. Support Agency Acceptance	Acceptable.
9. Community Acceptance	Not acceptable.

Table 7
Rosemount Research Center, Rosemount, Minnesota
Nine Criteria Evaluation: Burn Pit Site

Alternative 4 Evaluation

Description: Extension of RRC Water Distribution System - existing RRC water supply system expanded to service all or part of study area; pump out well and air stripper system.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - provides a clean potable supply while controlling contaminant migration.
2. Long-Term Effectiveness and Permanence	Effective - provides a permanent potable water supply and the air stripper will ultimately remove the contaminants from the ground water.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - the air stripper will reduce the TMV of the ground water, but the contaminants are simply shifted to another media.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$469,000 or more Annual O&M Cost: Present Worth Values:
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly protective - clean water supply protects human health, pump out well and air stripper controls contaminant migration.
8. Support Agency Acceptance	Acceptable.
9. Community Acceptance	Not acceptable.

Table 7
Rosemount Research Center, Rosemount, Minnesota
Nine Criteria Evaluation: Burn Pit Site

Alternative 5 Evaluation

Description: Extending Rosemount Water Distribution System - existing Rosemount water supply system expanded to service all or part of study area; pump out well and air stripper system.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - provides potable water supply to residents while controlling contaminant migration.
2. Long-Term Effectiveness and Permanence	Effective - provides a permanent potable water supply and the air stripper will ultimately remove the contaminants from the ground water.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV will be reduced in the ground water, but contaminants are simply shifted to another media.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$569,000 or more Annual O&M Cost: Present Worth Value:
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly protective - clean water supply protects human health; pump out well and air stripper controls contaminant migration.
8. Support Agency Acceptance	Acceptable.
9. Community Acceptance	Not acceptable.

Table 7
 Rosemount Research Center, Rosemount, Minnesota
 Nine Criteria Evaluation: Burn Pit Site

Alternative 6 Evaluation

Description: Independent Water Distribution System - construction of two wells finished in the Franconia Formation, construction of two pump houses and distribution lines to all or part of the study area; pump out well and air stripper system.

<u>Criteria</u>	<u>Evaluation</u>
1. Short-Term Effectiveness	Effective - provides a potable water supply to residents while controlling contaminant migration.
2. Long-Term Effectiveness and Permanence	Effective - provides a permanent potable water supply and the air stripper will ultimately remove the contaminants from the ground water.
3. Reduction of Toxicity, Mobility and Volume (TMV)	Moderately to highly effective - TMV will be reduced in the ground water, but contaminants are simply shifted to another media.
4. Implementability	Technically and administratively feasible.
5. Cost Criteria	Capital Cost: \$560,000 or more Annual O&M Cost: Present Worth Value:
6. Compliance with ARARs	Complies with all ARARs.
7. Overall Protection of Human Health and the Environment	Highly protective - clean water supply protects human health, air stripper and pump out well controls contaminant migration.
8. Support Agency Acceptance	Acceptable.
9. Community Acceptance	Acceptable.

Table 8

GUE/PE/UST Sites

COMPARISON AMONG REMEDIAL ALTERNATIVES

GUE/PE/UST Sites

Evaluation Criteria	1	2	3	4	5A	5B	6A	6B	6C	6D	7A	7B	7C	7D	7E	7F	7G	7H	7I	8A	8B	
1. Short-Term Effectiveness	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
2. Long-Term Effectiveness and Permanence	-	-	-	-	+	+	-	-	-	-	+	+	+	+	+	+	+	+	+	+	-	+
3. Reduction of Toxicity, Mobility and Volume (TMV)	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
4. Implementability Technical Feasibility Administrative Feasibility Availability of Services and Materials	+	+	+	+	+	+	+	+	-	+	-	+	-	+	-	+	+	-	+	+	+	+
5. Cost ^a	+	+	+	+	+	+	-	-	-	-	-	-	+	+	+	-	+	-	+	-	-	-
6. Compliance with ARARs	-	-	-	-	-	-	-	+	-	-	+	+	+	+	+	+	+	+	+	+	-	+
7. Overall Protection of Human Health and the Environment	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	-	+
8. Support Agency Acceptance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
9. Community Acceptance	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-
TOTAL	-5	-5	-3	-3	-3	-3	-7	-3	-7	-5	-1	+1	+1	+5	+1	+1	+3	-1	+7	-5	+1	

Notes: "+" means generally favorable in comparison to other alternatives

"-" means generally unfavorable in comparison to other alternatives

^a "-" means cost greater than Alternative 7G (approximately \$8.1 million); "+" oposite of "-"

Table 9

Burn Pit Site

COMPARISON AMONG REMEDIAL ALTERNATIVES

Burn Pit Site

Evaluation Criteria	1	2	3	4	5	6
1. Short-Term Effectiveness	-	+	+	+	+	+
2. Long-Term Effectiveness and Permanence	-	+	+	+	+	+
3. Reduction of Toxicity, Mobility and Volume (TMV)	-	+	+	+	+	+
4. Implementability Technical Feasibility Administrative Feasibility Availability of Services and Materials	+	+	+	+	+	+
5. Cost ^a	NA ^a	NA	NA	NA	NA	NA
6. Compliance with ARARs						
7. Overall Protection of Human Health and the Environment	-	+	+	+	+	+
8. Support Agency Acceptance	-	-	+	+	+	+
9. Community Acceptance	-	-	-	-	-	+
TOTAL	-5	+3	+5	+5	+6	+7

Notes: "+" means generally favorable in comparison to other alternatives

"-" means generally unfavorable in comparison to other alternatives

^a Total Present Worth calculations were not required at the time this remedy was evaluated and are not included.

ATTACHMENT #1

UNIVERSITY OF MINNESOTA ROSEMOUNT RESEARCH CENTER
ROSEMOUNT, MINNESOTA

FINAL DETAILED ANALYSIS REPORT AND CONCEPT DESIGN
RESPONSIVENESS SUMMARY

This community responsiveness summary has been developed to document responses to community comments received during the comment period on the proposed remedy for soil and ground water contamination at the University of Minnesota Rosemount Research Center.

Descriptions of the recommended alternative and the community involvement during the Remedial Investigation and the Detailed Analysis Report discussions are included in the Community Relations segment of the Record of Decision.

SUMMARY OF COMMUNITY COMMENT

Comment: Dakota County (County), in a June 19, 1987 letter detailed specific comments on the analysis and design of the remedial alternatives. The County expressed a preference for on-site thermal desorption and condensation with off-site incineration. Other comments expressed were that:

1. Lead cleanup criteria needed to be based on background soil lead concentrations in the Rosemount area;
2. Disposal methods for treated soils be determined based on soil lead testing after treatment;
3. Cleanup criteria be established for PCDDs, PCDFs, chlorobenzenes, and heavy metal;
4. Testing and monitoring be done to ensure the efficiency of the

- thermal desorption process for PCB soils;
5. Land disposal sites be identified for all appropriate wastes from cleanup activities;
 6. County and city of Rosemount licenses and permits be obtained when needed for cleanup efforts;
 7. Ground water monitoring plan be included for all contaminants that might be released from the site;
 8. The construction site be investigated prior to any construction site plan development for cleanup activities;
 9. A Health and Safety Plan provide additional information to ensure that proper safeguards are in place to protect on-site and off-site personnel; and
 10. All known or alleged PCB sites be investigated.

Response: MPCA staff met with County officials on September 8, 1987, to discuss the comments in the County's letter. The MPCA and County staff discussed the advantages and disadvantages of on-site versus off-site incineration, recognizing that the pilot test data will enable a more informed decision. The MPCA addressed each of the County's comments as follows:

1. The lead criteria selected is sufficient to protect the public health, welfare, and environment. To clean up to more restrictive criteria would have a significant impact on the cost of the excavation, shipment, and disposal at a RCRA landfill.
2. The MPCA staff intends to require soil testing of the treated soils. Subsequent submittals by the University will include

proposed details for MPCA staff approval. Treated soils remaining on the site must meet the selected criteria of 1,000 ppm total lead and 5 ppm lead by the E.P. Toxicity Test. These tests will provide sufficient information for decision making.

3. Available and planned data correlations will allow for the selection of indicator parameters. If soil is cleaned up to PCB and lead criteria, other contaminants will also have been addressed.
4. Since the site is listed on the National Priority List, the proposed treatment facility is governed by CERCLA and the Response Action Agreement. Applicable rules and regulations under other laws, including RCRA will be enforced. The items listed will be addressed in subsequent submittals by the University.
5. The MPCA agrees and requires identification of all waste streams and appropriate disposals including the RCRA landfill facility. Use of solid waste facilities is not anticipated.
6. CERCLA on-site remedial action are exempted from federal, state, and local permits. The state will use its discretion in requiring the University to obtain such permits; however, compliance with the substantial and applicable provisions will be required.
7. The County will be provided opportunity to comment on the monitoring plan when it is submitted with the Response Action Plan. The Response Action Agreement does not require the Detailed Analysis Report to include this detail. The MPCA agreed

that ground water should be monitored for filtered lead in the monitoring plan.

8. The MPCA agrees that the proposed site should be tested prior to finalizing the construction plan.
9. The Response Action Agreement requires a Site Safety Plan to be submitted with the Response Action Plan.
10. All of the known or alleged PCB sites on the list provided by the County with their comments were included in information provided by the County prior to the Remedial Investigation approval. MPCA staff evaluated the information at that time and required the University to do further Remedial Investigation work. The subsequent Remedial Investigation Report was approved.

During the discussions, the County agreed with the MPCA that the PCB criteria selected was adequate to protect the public health under current security arrangements, although they preferred a lower criteria to enable future unrestricted development planning. A letter to County summarized the meeting and asked for the County to notify the MPCA if they had questions about the MPCA's summary. No response was received; however, about six months later the County sent a letter to the MPCA that reiterated all of the County's original comments.

Minnesota Enforcement Decision Document

Name: University of Minnesota Rosemount Research Center

Location: The Site is located in all or part of Sections 25-28 and 33-36, T115N, R19W, and Sections 1-4 and 10-14, T114N, R19W, Rosemount, Dakota County, Minnesota

DOCUMENTS REVIEWED

I am basing my decision primarily on the following documents describing the analysis of the cost and effectiveness of the response action alternatives for the University of Minnesota Rosemount Research Center.

- Remedial Investigation Final Report dated November 26, 1985.
- Feasibility Study Detailed Analysis Report dated February 25, 1986.
- Response Action Agreement dated May 30, 1985.

DESCRIPTION OF APPROVED RESPONSE ACTION(S)

The Minnesota Enforcement Decision Document is limited to remedies which address only the ground water contamination by chloroform. Any additional response actions that may be necessary as a result of on-going investigations, will be the subject of a separate Minnesota Enforcement Decision Document when appropriate.

The major components of the remedy for the ground water contamination problems are: (1) new individual residential wells drilled into the Franconia aquifer and (2) a ground water pump-out system to be located on the University property.

Wells will be sampled on a yearly basis for a minimum of five years by mutual agreement between the University and the MPCA. Operation and maintenance of the wells will be the responsibility of the owner of the individual wells.


DECLARATIONS

Consistent with the Environmental Response and Liability Act of 1983 (ERLA), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that the response action(s) at the University of Minnesota Rosemount Research Center are cost-effective response actions that provides adequate protection of public health, welfare, and the environment. In addition, the approved response actions will require future operation and maintenance (O & M) activities to ensure the continued effectiveness of the response actions. These O & M activities will be considered part of the approved response actions.

I have also determined that the approved response actions are cost-effective alternatives when compared to the other response actions alternatives reviewed.

In accordance with Task H of Exhibit C to the Response Action Agreement between the Minnesota Pollution Control Agency and University of Minnesota dated May 29, 1985, University of Minnesota shall implement the approved response actions at University of Minnesota Rosemount Research Center.

12/4/86
Date


for Executive Director
Minnesota Pollution Control Agency

Attachments:

Minnesota Enforcement Decision Document
Response Order by Consent

MINNESOTA ENFORCEMENT DECISION DOCUMENT

This Minnesota Enforcement Decision Document (MEDD) summarizes the facts and determinations made by the Minnesota Pollution Control Agency (MPCA) staff in approving the recommended ground water response action alternative for protecting the public health, welfare or the environment from the releases or threatened releases of hazardous substances from the University of Minnesota Rosemount Research Center (UMRRC) Hazardous Waste Site (Site). Detailed information regarding these facts and determinations is located in the MPCA files.

SITE LOCATION

The Site is located in all or part of Sections 25-28 and 33-36, T115N, R19W, and Section 1-4 and 10-14, T114N, R19W, Rosemount, Dakota County, Minnesota (see attachment 1).

SITE DESCRIPTION AND HISTORY

From 1967 to about 1974 the University of Minnesota (University) operated a waste disposal/burn pit at the UMRRC. According to University records, approximately 90,000 gallons or more of liquid hazardous wastes were disposed of in the waste disposal/burn pit. Some of this pooled liquid has infiltrated into the underlying soil and has migrated to the ground water.

In June 1984, MPCA staff sampled numerous residential wells in the area of the site and found 16 residential wells to the northeast of the Site to be contaminated with chloroform above the U.S. Environmental Protection Agency (EPA) recommended level of 1.9 parts per billion. As a result of the levels of chloroform found in the residential wells, the Minnesota Department of Health (MDH) issued a Health Risk Advisory to twenty-seven families in July of 1984. The University is providing bottled drinking water to those families affected by the advisory. A remedial investigation of the ground water contamination confirms that the former University waste disposal/burn pit is the source of the

ground water contamination. This MEDD covers only the on-site and off-site ground water contamination by chloroform. It does not cover other necessary on-site response actions which are the subject of a feasibility study, which is due in November 1986.

In October 1984, MPCA staff submitted a recommendation to the EPA that the Site be included on the National Priority List (NPL). The Site has a Hazardous Ranking System Score of 46.

ENFORCEMENT

In October, 1984, a Request for Response Action (RFRA) was issued by the MPCA Board to the University with respect to the Site.

In May, 1985, a Response Action Agreement (Agreement) between the University and the MPCA was executed. The Agreement required the University to conduct a Remedial Investigation/Feasibility Study (RI/FS), submit a Response Action Plan (RAP), and Implement Response Actions at the Site.

REMEDIAL INVESTIGATION

The University began sampling on-site monitoring wells and off-site residential wells in June of 1984 under direction of the MPCA staff. In August, 1984, the University submitted to the MPCA a RI Work Plan which outlined the procedures which the University proposed for investigation of the Site.

In November, 1985, the University transmitted to the MPCA a Remedial Investigation Final Report, for the ground water contamination portion of the Site, verifying that the waste disposal/burn pit located on the UMRRC was the source of the chloroform ground water contamination to the northeast of the UMRRC.

The MPCA approved the RI Final Report on December 26, 1985.

FEASIBILITY STUDY

ALTERNATIVES EVALUATION

Based upon the RI, the MPCA staff has determined that response actions are necessary at and around the Site to reasonably protect the public health, welfare or the environment from the continuing release or threatened release of hazardous substances from the Site. The release and threatened releases (releases) from the Site threaten the public health, welfare or the environment as described below:

1) The releases from the Site have caused an exceedence of the drinking water guidelines in the ground water beneath and in the area of the Site. These releases generally preclude use of these public ground water resources as a drinking water supply and thereby threaten the public health and welfare.

2) The releases from the Site pose a present and potential contamination threat to private wells in the vicinity of the Site. These releases present a health risk to the users of private wells and thereby threaten the public health and welfare.

RESPONSE GOALS AND OBJECTIVES

The response objective for this portion of the Site is to:

- Adequately protect the public against exposure to chloroform and other volatile organic compounds through direct contact or ingestion of ground water from private water supply system.

RESPONSE ALTERNATIVES

Only applicable and feasible technologies were evaluated for specific engineering, cost, environmental, and institutional criteria consistent with the National Contingency Plan (NCP). The following are brief description of each alternative considered.

ALTERNATIVE 1: ACTIVATED CARBON FILTER SYSTEM

This proposed treatment system would be installed in each home and would consist of installing activated carbon filters, capable of removing volatile organic chemicals including chloroform, in a series with the incoming water line.

There are some disadvantages to this type of systems. First, replacement of the filters may be required every six months depending upon the amount of water usage by each individual family. Second, activated carbon filters have no disinfectant capability, as such, bacterial contamination could be added to the water. Third, the Minnesota Health Department does not have any rules or regulations concerning these systems, and has indicated that approval for such a system could be difficult to obtain. Fourth, under this scenario continued ground water monitoring and possibly increased monitoring of individual wells to determine filter failure, would be necessary. Lastly, the lateral and vertical extent of the contaminated plume would continue to expand. The estimated cost per house is \$1,400.00 with additional annual maintenance and monitoring cost of \$900.00 per house. Based on the 27 families affected the estimated cost is \$37,800 with replacement and monitoring costs of \$24,300 per year.

ALTERNATIVE 2: NEW INDIVIDUAL RESIDENTIAL WELLS

Alternative 2 proposes the construction of new wells to replace existing contaminated wells serving the families receiving bottled water. These wells would be finished in the Franconia Sandstone Formation which is below, but which is not hydraulically connected to the contaminated Prairie du Chien Formation.

This proposed alternative would provide a water supply that is nearly the same as what existed before the contamination problem occurred.

The only concern is that of proper construction of the wells. Little information is known about the Franconia Formation in this area and there are no

existing wells in the Franconia at present. Therefore, a test well has been completed to insure that the proposed well design and construction is adequate to: (1) prevent downward migration of contaminants and (2) to insure that the Formation will not collapse as it is being penetrated by the drill.

Original estimated costs for 20 wells to serve the 27 families affected was \$220,000.00. Revised costs, which include iron filtration and water softening units are \$500,000.

ALTERNATIVE 3: RURAL COMMUNITY WATER SYSTEM

Under this alternative, three systems, and for each system three designs, were considered. The three designs within each system are:

1. Construction of a complete water system to cover present and future needs for the entire water study area.
2. Construction of only that portion of the system that is necessary to serve the 27 families receiving bottled water with proper sizing to allow for expansion to meet future needs within the study area.
3. Construction of a system adequate for only the needs of the 27 families now on bottled water.

The three major systems considered are:

1. Extension of the UMRRC water distribution system.
2. Extension of the City of Rosemount's water distribution system.
3. An independent water distribution system.

Estimated costs for each of the systems range from; \$1,069,000 to \$1,283,000 for design a; \$627,000 to \$813,000 for design b; and \$469,000 to \$569,000 for design c respectively.

ADDITIONAL PROPOSED ACTIONS

In addition, the University has elected to install a ground water gradient control system, in conjunction with Alternative 2, on-site as a secondary measure to prevent further off-site migration of contaminants. This system will also serve to expedite aquifer restoration. The gradient control system is scheduled to be implemented during the Fall of 1986.

SUMMARY OF THE REMEDIAL ACTION ALTERNATIVES

Alternative 1 - the activated carbon filter system has a high maintenance and monitoring cost. If those systems were installed, they would have to be monitored and maintained until the contaminated water has migrated from the area. There is potentially a health risk from bacteria growing on the filters and approval from the Minnesota Department of Health is uncertain. These systems could be installed this year and added to easily if additional wells become contaminated.

Alternative 2 - a prototype well is necessary before additional replacement wells are constructed. The new wells could be constructed during this construction season and new wells could be installed easily if necessary. Once new wells are in operation, the maintenance and operation costs should be the same as it was for the existing wells. This alternative has the least environmental impact on the study area.

Alternative 3 - it is unlikely that any of the systems could be constructed during this construction season. Construction costs for any of the systems is high. Operation and maintenance costs would be extremely high. The systems are not designed to provide fire protection.

ALTERNATIVE MONITORING

Ground water and water supply systems must be monitored as part of all alternatives considered for the Site. Monitoring would serve to document the performance of the implemented response, direct corrective actions as contingencies in case of response failure, and confirm the quality of drinking water supplies.

CONSISTENCY WITH OTHER ENVIRONMENTAL LAWS

Technical aspects of the response action alternatives implemented at the Site will be consistent with other applicable environmental laws. Other environmental laws which appear to be applicable to the response action alternatives evaluated in the Feasibility Study are the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, the Safe Drinking Water Act, the Minnesota Environmental Response and Liability Act (MERLA), the Rules and Regulations of the MPCA, the MDH and Department of Natural Resources, and the Statutes of the State of Minnesota. The ground water protection standards under RCRA Part 264 may apply to the level of ground water cleanup achieved by the proposed ground water gradient control system. An alternate concentration limit (ACL) may be established at the waste management unit boundary, and may consider the factors outlined under 40 CFR 264.94, including impacts on nearby surface water bodies. It is recommended, however, that the ACL demonstration at the Site be deferred until the conclusion of the response action program outlined in the Consent Order. Deferring the ACL demonstration will allow the State and the University to collect additional information during the course of response actions, and define fate and transport models which may be used to determine the effects on potential receptors of any remaining contamination within the plume at the conclusion of the response action program.

COST ANALYSIS

Estimated costs for each alternative are presented in Table 1.

SELECTION OF ALTERNATIVE

This presents the rationale used to approve a single recommended alternative for the Site. The NCP [Section 300.68(i)] requires the U.S. EPA to select the "Lowest cost alternative that is technologically feasible and reliable, and which effectively mitigates and minimizes damage and provides adequate protection of the public health, welfare, or the environment."

MPCA staff chose to parallel the NCP requirements in its selection. Similarly, the Agreement requires that the MPCA use environmental effects, effectiveness, technical feasibility and implementability and cost as criteria for approving a recommended alternative for the Site.

SELECTED ALTERNATIVE

Alternative 2 in the Detailed Analysis Report was recommended by the University as the response action alternative for the Site. The discussion below summarizes the reasons for MPCA approval of Alternative 2 as the selected response alternative to be implemented pursuant to Exhibit C of the Agreement for the Site.

Alternative 2, New Residential Wells, when completed, would provide a very high quality water supply and eliminates the health risk to area residents now under a Health Risk Advisory.

Alternative 2 has the lowest estimated cost for system installation and in terms of operation and maintenance.

Alternative 2 can also be completed during the 1986/1987 construction season.

In summary, Alternative 2 is the lowest cost alternative which is technologically feasible and reliable, and which effectively mitigates and minimizes damage to and provides adequate protection of public health, welfare and the environment and complies with applicable and relevant environmental laws, guidances and standards.

In addition, the University has proposed installation of a ground water gradient control system on-site as a secondary measure to prevent off-site migration of contaminants and expedite aquifer clean-up. The gradient control system is scheduled to be implemented during the Fall of 1986. The gradient control system is hereby approved as proposed. A State disposal system permit is not required for the gradient control system because all water pumped out and spray irrigated will infiltrate back into the soil within the pump-out system capture zone. In addition, monitoring of the system will not be required as, off site well analysis will be an indicator of system performance.

COMMUNITY RELATIONS

The Ground Water Remedial Investigation (RI) Final Report was submitted to the MPCA on November 26, 1985. Copies of this report were provided to the Cities of Rosemount and Coates and to Dakota County officials. In addition, a copy of the report was placed at the UMRRC for public viewing. The residents affected by the off-site contamination received a letter in December 1985 summarizing the RI findings and identifying the location of documents available for their review.

On January 30, 1986 a letter was sent to each of the affected residents. This letter outlined each of the alternatives under consideration by the University and requested public comment and input. No comments were received by the University.

The Alternative Report was received by the MPCA on February 25, 1986. A letter outlining the report and recommended alternative was sent to area residents on February 27, 1986.

A public meeting regarding the proposed alternative was held on March 10, 1986 at the Rosemount City Hall. At that meeting, approximately one hundred people, including local officials, members of the press and officials from the University were present. The RI/FS, as well as the alternative response actions, including the selected alternative were also discussed at that meeting.

IMPLEMENTATION SCHEDULE

This Site response action will be implemented in the Fall/Winter of 1986.

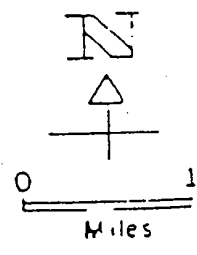
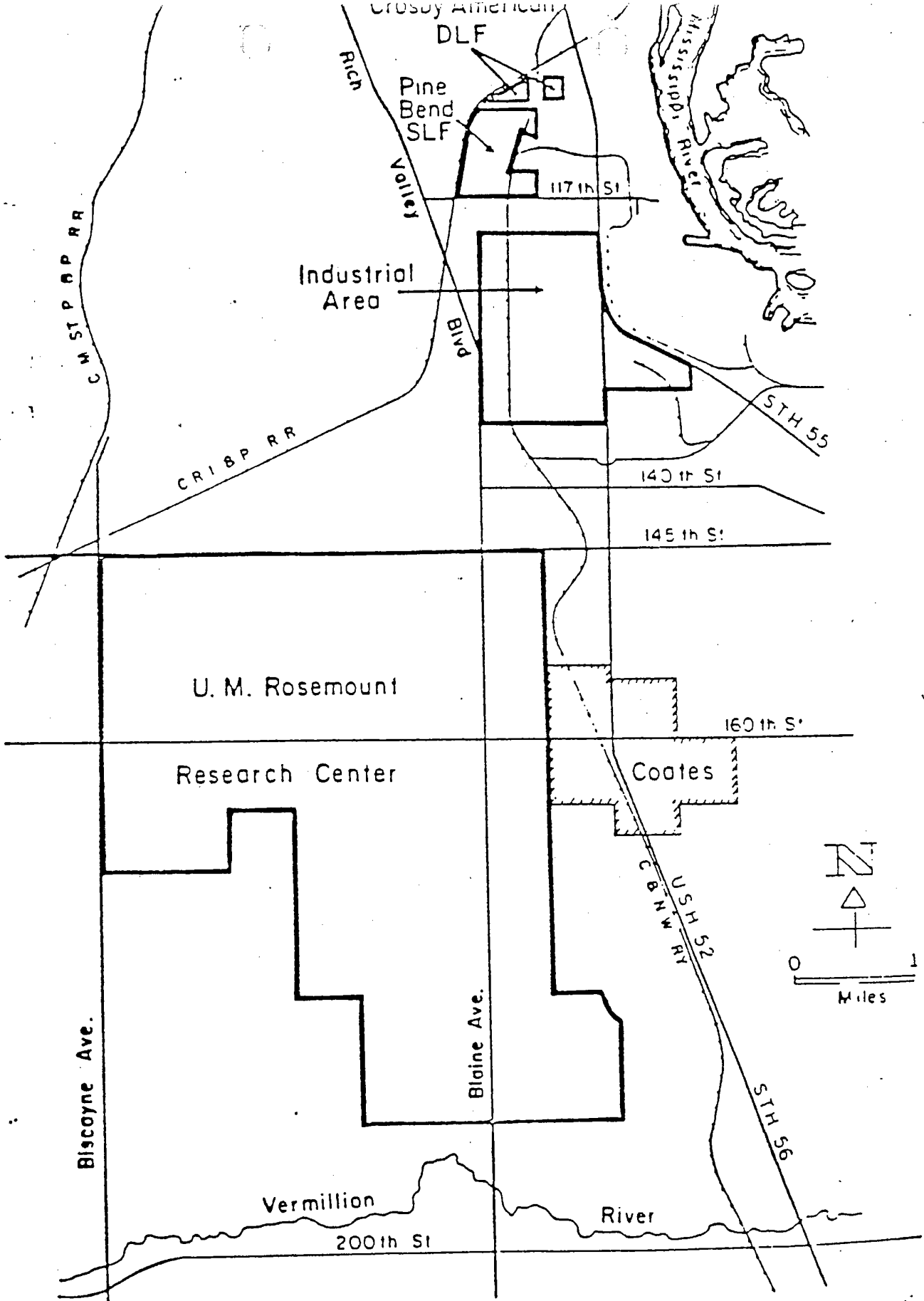
FUTURE ACTIONS

The additional actions required to complete ground water response actions associated with the Site include a Response Action Plan (RAP) and response action implementation.

Other hazardous waste sites within the UMRRC are the subject of future reports.

V. TABULATION OF ESTIMATED COSTS FOR ALTERNATE WATER SYSTEM

<u>ALTERNATES</u>	<u>DESCRIPTION</u>	<u>TOTAL</u>
1 -	Activated Carbon Filters and Installation (\$1,400/House x 27 Bottled Water - Families Maintenance, Replacement and Monitoring (\$900/House/Year x 20 years at present rate x 27 houses)	\$ 37,800 \$ 486,000 \$ 523,800
2 -	New Residential Wells (\$11,000/Well x 20 wells)	\$ 220,000
3 -	Extend Rosemount Research Center Water Distribution System A. Complete system for all future growth B. Partial system to serve 20 wells but sized for future C. Small system sized for 20 wells only (no future growth)	\$ 1,069,000 \$ 627,000 \$ 469,000
4 -	Extend City of Rosemount Water Distribution System A. Complete system for all future growth B. Partial system to serve 20 wells but sized for future C. Small system sized for 20 wells only (no future growth)	\$ 1,283,000 \$ 813,000 \$ 569,000
5 -	Independent Water Distribution System A. Complete system for all future growth B. Partial system to serve 20 wells but sized for future C. Small system sized for 20 wells only (no future growth)	\$ 1,198,000 \$ 734,000 \$ 560,000



Administrative Record Index

Chronology File

Effects of Landfill Disposal of Chemical Wastes

on Groundwater Quality - Final Report of the Investigation of the University of Minnesota's Chemical Waste Disposal Facilities at the Rosemount Research Center by Prem K. Saint (PhD thesis), July 1973

Hydrogeological Implications of Chemical Waste Disposal in a Glaciated Terrain, Rosemount, Minnesota, by Bruce Allan Labno (MS Thesis), December 1973

Hydrologic Reconnaissance of Groundwater Pollution in the Pine Bend Area, Dakota County, Minnesota, by Harold O. Reeder and Ralph F. Norvitch, U.S. Department of the Interior, Geological Survey Administrative Report to Minnesota Pollution Control Agency, 1974

Correspondence, 1977-1981, on hazardous waste issues.

Gopher Ordinance Works

Final Report to the Rosemount Groundwater Protection Task Force (2 Vols.), Metropolitan Waste Control Commission, February 1987

Odd-sized documents

New Articles

Requests for Information, August 1984 - November 1985

Responses to Requests for Information, August 1984 - January 1985

Response to RFI - Metro Mosquito Control

Response to RFI - University of Minnesota, September 4, 1989

Proposal for Rosemount Research Center Hydrogeological Investigation, Soil Exploration, August 27, 1984

Board Items:

1. Request for Response Action, October 4, 1984
2. Response Action Agreement, May 30, 1985

Dakota County Real Estate Computer Printout October 19, 1984

Miscellaneous Notes File

General Correspondence June - August 1984

General Correspondence September - December 1984

General Correspondence January - June 1985

General Correspondence July - December 1985

General Correspondence January - May 1986

General Correspondence June - December 1986

General Correspondence January - June 1987

General Correspondence July - December 1987

General Correspondence January - June 1988

General Correspondence June - December 1988

General Correspondence January - 1989

Hazard Ranking System Score File

Chemical Analysis of Water

Chemical Analysis of Soil
Well and Soil Boring Logs
George's Used Equipment Correspondence and Reports
George Moe Deposition
George's Used Equipment Activities and Notes
U.S. Transformer
Response Action Agreement Negotiations
Minnesota Enforcement Decision Document addressing groundwater
water contamination by chloroform through 1. new individual
residential wells and, 2. groundwater pumpout system
December 4, 1986

Reports

08-27-84 Rosemount Research Center Hydrogeologic Investigation (Soil Ex)
09-04-84 Response to Request for Information
02-28-85 Phase I Report U of M RRC (Soil Ex)
03-29-85 Shallow Seismic Reflection Feasibility Study (Bison)
06-28-85 Site Security and Safety Plans
07-01-85 QA Manual (TCT)
07-01-85 QA Manual (PEI)
07-31-85 Seismic Refraction Investigation (Bison)
08-27-85 First Quarter Summary Report Phase II
11-27-85 Final Report Groundwater Contamination Remedial Investigation (TCT)
12-09-85 Second Quarter Summary Report Phase II Remedial Investigation (TCT)
02-25-86 Remedial Investigation Final Report, GUE, UST, Coates Dump,
Oxidation Pond, Lagoon (TCT)
02-25-86 Detailed Analysis Report - Alternatives for a Permanent Drinking
Water Supply
05-12-86 Response Action Plan Groundwater Contamination project (Alternate
Water Supply Prototype Well, Gradient Control/Contaminant Pumpout
Well, RA Monitoring Plan (plan has no details)
05-30-86 Specifications for a Water Well Installation (TCT)
08-08-86 Specifications for Installation of Contaminant Pumpout,
Monitoring and Alternate Water Supply Wells (Delta)
08-15-86 Final Supplemental RI Report (IT)
09-05-86 Letter Report Investigation of the PE Area (IT)
09-17-86 Prototype Water Well Installation (Delta)
09-26-86 Endangerment Assessment (IT)
11-11-86 Groundwater Interim Response Action Plan (Delta)
11-30-86 Alternatives Report (IT)
02-10-86 (09-29-86) Evaluation of Waste Disposal Burn Pit Alternate Water
Supply Sites and Existing Well Abandonment Procedures (Delta)
02-28-87 Final Report to the Rosemount Groundwater Protection Task Force (2
Vols)
05-12-87 Final Detailed Analysis Report and Conceptual Design (IT)
05-14-87 Geophysical Surveys of the U of M RRC (MDNR)
07-08-87 Proposed Design and Schedule for an Alternate Treatment Method
of Contaminated Water (Delta)
04-21-88 Final Report Phase II Groundwater Investigation GUE (IT)
06-07-88 Final Report Soil Contamination Investigation GUE (IT)
07-28-88 Soil Contamination Investigation (2 vols) (IT)
07-28-88 Final Design Specifications for U of M RRC PCB Site Cleanup (IT)
07-28-88 Air Quality Review and Project Schedule (IT)

12-21-88 Response Action Plan U of M RRC PCB and Lead Soils Contamination
(IT)

12-31-88 Pilot Plant Test Report