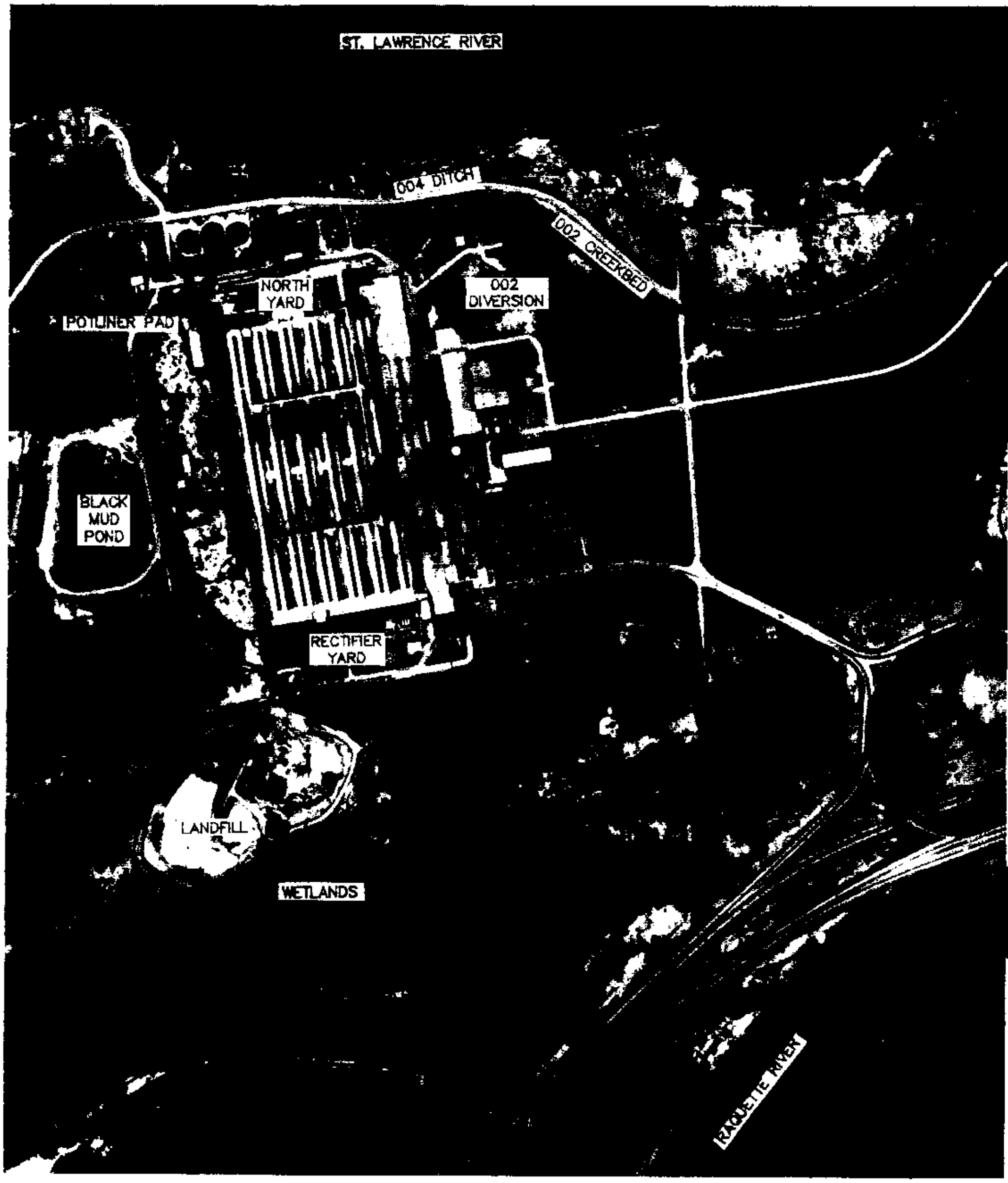
FINAL REPORT

VOLUME II

REVISED FINAL FEASIBILITY STUDY ST. LAWRENCE REDUCTION PLANT



Prepared for:

Reynolds Metals Co.
St. Lawrence Reduction Plant
P.O. Box 500
Massena, NY 13662
August 19, 1991

Woodward-Clyde

Prepared by:

Woodward-Clyde Consultants
5120 Butler Pike
Plymouth Meeting, PA 19462

Project No. 89C2515C-2

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APPENDIX A

GENERAL ASSUMPTIONS FOR COST ESTIMATING

APPENDIX A

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1.0 INTRODUCTION

The cost estimates presented in the FS were developed using the general guidelines described in this Appendix. The costing methods were maintained as consistent as possible for all areas and alternatives to enable a meaningful comparison of remediation options with regard to cost.

Estimated costs provided as part of remedial alternative development and evaluation were derived from a variety of sources. Unit costs were estimated based on a combination of information supplied by contractors, equipment suppliers, construction estimating guides, and WCCs past experience in construction and remediation related activities. Table A-1 summarizes the sources for some of the cost information used for this FS. Appendices E and G provide more detailed information for costs relative to a new on-site landfill and the North Yard remediation, respectively.

Actual costs for interim remediations at the St. Lawrence Reduction Plant, including work done in 1988, 1989, and 1990, indicate that some of the unit costs used in these estimates may be underestimated due to oversimplifications by the contractors who provided estimates. In some cases, excavation, on-site transport, stockpile management, dewatering of excavated soils, and run-on, run-off control have cost more than $100 per ton, exclusive of sampling, analysis administration, surveying, health protection, safety, or disposal costs. Detailed excavations, in heavily contaminated soils, which are close to buildings or foundations, which will obstruct free movement of workers and machines, could be even more costly than this, on a per-ton basis.

The level of detail presented for the capital costs is intended to clarify the activities involved for the implementation of each alternative. However, detailed cost estimates were not made for activities which were judged to be relatively minor with regard to the overall implementation of the remedial measures. The operation and maintenance (O&M) costs presented are those which would be required for a 30-year post-closure period for each alternative. Present worth costs for each alternative are determined based on a 4 percent interest rate to enable comparisons of the costs in light of O&M expenses. This is a rate-of-return which has been discounted for inflation.

As a starting point for the cost estimates, the quantities of contaminated soils, sediments and waste which require remediation were estimated (Table A-2). Where possible, the contaminated soil and sediment volumes used are those presented in the July 1990 Revised Preliminary FS. For areas where volume estimates were not available, estimates were made as described in the relevant sections of this report. To approximate the corresponding weight of materials, unit weights were assumed as indicated in Table A-1, based on WCC's knowledge of the materials in question.

2.0
DIRECT CAPITAL COSTS

The direct capital costs for each area are divided into the following categories:

A) Site Preparation
B) Excavation and Handling of Contaminated Soil/Sediment/Waste
C) Transport and Treatment or Disposal of Contaminated Materials
D) Collection and Treatment of Water
E) Site Restoration

The activities required for each category are area- and alternative-specific; however, many alternatives involve similar activities for which the unit costs are comparable. Unit costs were increased over standard construction costs by approximately 20 percent where appropriate to reflect the increased costs of handling contaminated materials. A more detailed description of the basis for some of the cost estimates follows.

2.1 SITE PREPARATION

Many areas require dewatering or water control during remediation activities. Other areas, such as the Wetlands may require additional activities such as clearing, grubbing, and preparing access roads for equipment and moving wastes and cover materials. The lump sum costs for dewatering include the costs for pumping of the water from a network of well points or from localized sumps with the use of temporary berms, as necessary, depending on the alternative in question. It does not include costs for water treatment. For the purposes of this FS, it was assumed that fluids generated during dewatering activities would be treated in the newly installed North Yard GAC system.

For the Wetlands, clearing and grubbing costs are based on clearing medium brush and disposing of it on-site. The cost for roads to provide access for equipment to the Wetlands Areas is based on costs to clear, grade and provide an adequate subbase to mobilize equipment in the Wetlands. It is assumed that these roads could be left in place upon completion of the remedial measures, as they would be in outer areas of Reynolds' property.

2.2 EXCAVATION AND HANDLING OF CONTAMINATED SOIL/SEDIMENT/WASTE

Excavation work was assumed to be performed using standard earthwork equipment, with workers in upgraded Personal Protection Level (PPL) D. Excavation unit costs were estimated at $5 per ton to reflect standard earthworks for all areas excluding the Wetlands where $10 per ton was estimated to accommodate operations in wet and soft soil conditions. Excavation costs in the North Yard Area are based on quotes from contractors who have recently performed excavation work there (Table A-1). Excavation costs for perimeter drains were assumed to be performed using standard practices as described in Sections 6.2.2 and 7.1.1. The unit costs presented in this section do not include costs for transport or disposal of the materials, which are addressed below.

2.3 TRANSPORT AND TREATMENT OR DISPOSAL OF CONTAMINATED MATERIALS

Many of the remedial measures being considered by this FS involve the excavation and transport of contaminated materials. Costs for on-site transport of contaminated material were estimated at $2 per ton based on a round trip transport of half a mile. This is a distance which would be applicable, for example, to the transport of low-level contaminated soils/sediments from the Potliner Pad Area, or from the Wetlands drainageways to the Former Potliner Storage Area, or to an on-site landfill in the area west of the Black Mud Pond. The costs for transport of contaminated materials to an off-site treatment or disposal facility are included in the cost for treatment or disposal as discussed below.

Various treatment technologies are considered by this FS. For the black mud, cost estimates for resource recovery were based on information supplied by Reynolds which reflects recent operating costs (T.M. Wade's Memorandum of May 15, 1990). Based on WCC's volume estimate for the black mud, and the recent annual rate of 4000 tons per year remediated, approximately 41 years would be required to completely empty the Pond. For simplicity it was assumed that remediation could be scaled up to be completed over a 30 year period; costs for the remediation were therefore included as O&M costs in Table III-2. Data from Reynolds based on recent experience indicates that unit cost for excavation, handling, and transport to the resource recovery facility are approximately $84/ton of wet black mud.

For alternatives which require off-site incineration, unit costs for both transport and treatment were estimated at $1500 per ton, based on a quote obtained from Rollins Environmental Services for treatment at their incinerator in Deer Park, Texas which could accept the material in bulk. The quote was based on the estimated volumes of materials under consideration.

For alternatives which require on-site incineration, costs were estimated based on the sources discussed below. For the North Yard, alternatives 2A and 3A, the cost of incineration by OHM's mobile infrared unit was estimated based on their quote after the treatability study (see Appendix C). For the Black Mud Pond, alternative 7, the cost of design, construction, and operation of an on-site rotary kiln incinerator, summarized on a per ton basis as $200/ton, was obtained from OH Materials. This cost is comparable with values given by other vendors (e.g., Western Services,Inc.) for mobile rotary kilns.

The cost estimate for the transport and disposal of hazardous contaminated soils/wastes at a secure landfill is $360 per ton (1991 dollars). This estimate is based on costs for transport and disposal in bulk in the Chemical Waste Management secure landfill in Model City, New York. If the soils or sediments of concern require solidification or dewatering to eliminate free liquids prior to transport for disposal, additional costs (approximately 20 percent more) would be incurred.

Cost estimates for on-site disposal are based on the design and construction requirements for the RCRA-style landfill cell and cap described in Appendix E; the cost presented in Appendix E for on-site disposal is $60 per ton, which does not include implementation, administration and contingency costs, based on a air-value of 70,000 cubic yards.

2.4 COLLECTION AND TREATMENT OF WATER

Cost estimates for hydrologic controls and collection strategies for surface water and groundwater are described below. For the alternatives which require surface water run-on and run-off controls, the cost estimates used were based on costs required for constructing berms, swales, new drainageways, and grading areas to promote adequate drainage of the areas of concern.

The surface water collection which would be required in the Black Mud Pond Area by some of the remedial alternatives would involve construction of a surface water impoundment. The cost estimate for the impoundment is based on the design conditions discussed in Section 7.1.1. The cost of pumps and piping directly associated with the impoundment is also included. The cost of piping (conveyance) of water to the North Yard GAC water treatment system is listed separately.

Groundwater recovery by a perimeter drain is proposed for the Black Mud Pond and the Landfill Area, and is described in detail in Section 6.3.2. Similarly constructed lateral drains are proposed for some of the Wetland alternatives. Implementation of the proposed perimeter drain design would conceptually involve the following steps: 1) excavation of the drain, 2) installation of the piping, manholes, pumps, utilities and backfill required for operation, and 3) transport and disposal of the excavated soils. Excavation costs per linear foot were determined based on the total volume of soils to be removed for the trench. The unit cost to install the perimeter drain varies for each area depending on the dimensions of the drain and the corresponding lengths of pipes, number of pumps, etc., and is described in more detail below. Transport and disposal costs for the excavated perimeter drain soils would be minimized by on-site disposal, either in the Former Potliner Storage Area or in a new secure on-site landfill.

For the purposes of estimating the perimeter drain installation costs, the trench excavations were assumed to be three feet wide. The trenches would be backfilled with clean crushed stone (and a segregation geotextile), with the exception of the upper foot which would be backfilled with a lower permeability fill material to minimize rainwater infiltration. Submersible pumps would be placed every 200 to 300 feet along the length of the drain in manholes. Four-inch perforated pipe would be used over the entire length of the trench to enhance collection of groundwater. In addition, a header pipe and electrical conduits and controls would be installed. Based on estimates of these component costs, perimeter drain installation for each area of concern was determined. For the purposes of cost estimating, it was assumed that the drains could be excavated with minimal obstructions. It was also assumed that installation of the drains could be performed with minimal requirements for work within the excavated trenches (and therefore minimal requirements for shoring).

For the purposes of this FS, it was assumed that the North Yard GAC system would have sufficient capacity to treat water from the following sources:

- Water generated during dewatering activities
- Surface water collection
- Groundwater recovery

For alternatives where permanent surface water collection and groundwater recovery have been included, a separate cost is included for installation of piping and pumps necessary to carry water from a particular area to the North Yard GAC system. For alternatives which involve dewatering only, the cost of transporting the water via tank truck has been included. Underground piping exists from the North Yard to the Black Mud Pond, and also to the Landfill Area. This piping could potentially be used to carry contaminated water from each area of concern to the North Yard GAC system. However, since this piping is old and little is known of its overall condition, it was assumed that new piping would be installed between each area of concern and the North Yard GAC system. Capital costs for single-walled piping installation were estimated for each area assuming no other piping would be available. Costs were included to place manholes at 300- to 500-foot intervals along the length of the pipelines to allow access for O&M. Should groundwater collection be part of the selected alternative for the Landfill and the Wetlands Areas, it would be possible to use a single larger pipe for conveyance of water between these two areas and the North Yard GAC system, thereby representing a cost savings.

2.5 SITE RESTORATION

Site restoration activities would typically involve backfilling, grading and seeding. For some alternatives a RCRA-style cap over the area is required, and for the Wetlands Area, creation of a new wetlands nearby would also be required. Costs for backfilling and compacting were estimated at $5 per ton for most areas. This cost includes excavation, hauling and placement of the material, assuming that fill from Reynolds' on-site borrow pit would be used, with minimal reworking of the material required. For the Wetlands Area, costs were increased to $10 per ton to reflect constructability constraints, as discussed in Section 13. For remedial measures which require drainageway excavation and backfill, crushed stone would be used to minimize erosion and promote good drainage; this cost was estimated at $10 per cubic yard.

For the North Yard, costs for backfilling and installation of a macadam cap and for the uniform grouted mat are based on vendor's quotes, and include preliminary activities required such as grading.

Unit costs for the installation of a RCRA-style cap were based on the criteria for cap design specified by RCRA and NYSDEC, as discussed in Appendix E, and were estimated to be $5 per square foot. In the Wetlands Area, the cost for installation of a RCRA-type cap was increased to $10 per square foot, due to anticipated subbase preparations required to ensure cap subgrade stability.

The costs for the creation of a new wetlands area are based on the development of an area on Reynolds property, as described in Section 13.1.1.

3.0
INDIRECT CAPITAL COSTS

Indirect capital costs include expenditures for detailed design, legal expenses, administration, etc. These indirect costs have been divided into three broad categories: 1) implementation, 2) administration, and 3) contingency costs. Estimates for these costs have been determined as described below.

Implementation costs were generally assumed to be 4 percent of the total capital costs and would include such items as:

- Preparation of engineering drawings, designs, and specifications
- Obtaining regulatory approvals
- Analytical confirmatory sampling
- Insurance
- Bonds
- Permitting

For the Wetlands, Potliner Pad, and Miscellaneous Areas, implementation costs were anticipated to be proportionately higher then for larger areas, and were estimated at 25 percent. Administrative costs were assumed to be the costs necessary to manage implementation of a selected remedial alternative. These costs were assumed to be 15 percent of the direct capital costs. Finally, contingency costs were generally assumed to be 20 percent of the total capital costs and represent miscellaneous costs not anticipated during cost estimating, such as the possible need for upgraded health and safety precautions during the remediation activities, or to allow for unanticipated volumes of contaminated media. For the Wetlands, contingency costs were estimated at 25 percent, as working in that area may be more difficult than in other areas.

4.0 OPERATION AND MAINTENANCE COSTS

For many of the alternatives under consideration, O&M costs include surface water and/or groundwater monitoring. Additional O&M costs would also be incurred for alternatives which require water treatment, capping, or the construction of an on-site landfill. For the Black Mud Pond, resource recovery was calculated as an on-going O&M expense over a 30-year period. For this alternative, and for the North Yard alternative 1, groundwater and surface water monitoring would continue for 30 years post-closure, yielding a total duration for these alternatives of 60 years.

4.1 MONITORING

Surface water and groundwater monitoring costs were estimated based on sampling for indicator parameters on a quarterly basis. A monitoring network for surface water would be established during remediation, and groundwater would be monitored using existing monitoring wells. (Additional wells may be required if an on-site landfill were constructed.)

4.2 WATER COLLECTION

For either groundwater recovery or surface water collection, this cost would be associated with the maintenance of pumps to pump water from each area of concern to the North Yard GAC system. It was assumed that mechanical equipment would require replacement at approximately 10 year intervals. In addition the O&M cost includes costs for the electrical supply to power the pump. For groundwater recovery, it was assumed that recovery wells would likely require replacement every 5 to 10 years over the 30-year post-closure period. Replacement of the wells could be required intermittently in the event of well failure due to clogging of the screen, or accidental damage to the well. For perimeter drains, it is assumed that the only maintenance they would require (with exception of pump maintenance, mentioned above) would be intermittent cleaning of any clogged of sumps or pipes. Surface water collection O&M costs include pump maintenance, and annual inspection of any berms, swales or new drainageways constructed. They would then be maintained as necessary to ensure continued performance of the surface water control strategy.

4.3 CONVEYANCE TO THE NORTH YARD GAC SYSTEM

The annual cost for maintenance of the pipelines to the North Yard GAC water treatment system was estimated as 4 percent of the capital cost for installation of the lines. This would include intermittent inspections or cleaning out of the pipelines as necessary to ensure a clear passageway for flow.

4.4 WATER TREATMENT

A portion of the O&M cost is also associated with treatment of contaminated surface water and groundwater by the North Yard GAC system. Woodard and Curren, Inc., designers of the North Yard GAC system, have estimated that annual O&M costs for this facility will be in the range of $80,0000 per year and would include the costs of utilities, chemicals, and supervision by part-time operations personnel. This $80,000 estimate was used as a guideline for treatment costs for contaminated water from each area of concern. Therefore, the cost of treating surface water and shallow groundwater for the North Yard Area was estimated to cost $80,000 per year, with an additional incremental amount of this $80,000 cost being associated with water treatment for other individual areas of concern. These incremental costs are included in O&M costs associated with each area of concern.

4.5 RCRA CAP

RCRA cap maintenance would be required to ensure continued performance of the cap. Maintenance would include monthly inspections, maintenance of the vegetative cover, and repair of any damage that could occur as a result of erosion or rodents. In addition, periodic surveys should be made to quantify any settlement or subsidence, and to ensure adequate run-off control from the cap. For the RCRA-type caps, O&M costs over its 30-year design life were estimated based on O&M costs developed in Appendix E.

4.6 ASPHALT - COMPOSITE CAP

O&M costs for the cap are based on costs for the following activities:

1) Semi-annual inspection for cracks

2) Application of a hot joint filler to cracks found

3) Application of a sealant about every 3 years

4) Resurfacing every 10 years with a top coat of asphalt

4.7 LANDFILL CELLS

In addition to cap maintenance groundwater monitoring, leachate collection and treatment would be required for operation of a secure landfill on-site. Operating costs for maintenance of an on-site landfill post-closure were based on costs to maintain the leachate collection pumps and were bawed on O&M costs developed in Appendix E. O&M costs for monitoring were included under the groundwater monitoring heading to indicate that O&M of an on-site landfill would require groundwater monitoring specifically for the landfill.

5.0
INDIRECT O&M COSTS

Administration and contingency costs are included as described above for capital costs. However, these costs were each estimated at 4 percent of the direct O&M costs instead of 15 and 20 percent, respectively for the capital cost estimates. Lower administration and contingency costs would be anticipated in light of the more routine nature of O&M activities relative to the initial implementation of remedial measures.

TABLE A-1

SOURCES USED TO ESTIMATE COSTS

Type of Cost	Contact	Date of Contact
Excavation and dewatering	Sevenson Environmental Services	9/12/90
Resource recovery	Reynolds Metals Company Memorandum by T.M. Wade	5/15/90
Off-site incineration	Rollins Environmental Services	8/31/90
Mobile infrared thermal destruction	OH Materials	2/11/91
Mobile rotary kiln incineration	Weston	5/21/91
North Yard excavation	Perras excavating	5/15/91
North Yard rail replacement	Fiacco & Riley	5/17/91
On-site rotary kiln design, construction and operation	OH Materials	5/13/91
Off-site landfilling at Chemical Waste Management in Model City, New York	Reynolds Metals Company	5/1/91
North Yard GAC System construction and O&M	Woodard and Curren, Inc.	1/4/91
Landfill construction	Gundle Lining Systems	5/7/91
Landfill construction leachate piping	M & T Plastics	5/17/91
Landfill construction earthwork	Perras Excavating	5/7 - 5/8/91
Various construction/process costs	Means, 1991	See "References"
Various construction/process costs	Richardson, 1988	See "References"

TABLE A-2

COST ESTIMATING ASSUMPTIONS
QUANTITY AND AREA ESTIMATES

Area of Concern	Quantity (cu yd)	Unit Weight (ton/ cu yd)	Quantity (ton)	Area (acre)	Source
Black Mud Pond	**187,928**		**204,629**	**6.0**	
Black Mud	165,660	1.0	165,660		Preliminary FS
Soil	22,090	1.75	38,658		Preliminary FS
Buried Soil S.W. of BMP	178	1.75	312		Final RI
Landfill Area	**246,630**		**352,732**	**11.4**	
Landfill:					
Waste	134,055	1.25	167,568		Preliminary FS
Soil	20,740	1.75	36,295		Preliminary FS
Former Potliner Storage Area:					
Waste	23,685	1.25	29,606		Preliminary FS
Soil	68,150	1.75	119,263		Preliminary FS
Wetlands	**16,295**		**24,424**	**10.1**	See Section 13.0
Drainageway Sediment	5,163	1.5	7,745	3.2	
Open Water Area Sediment	11,132	1.5	16,679	6.9	

TABLE A-2
(continued)

Area of Concern	Quantity (cu yd)	Unit Weight (ton/ cu yd)	Quantity (ton)	Area (acre)	Source
Potliner Pad Area	**3,436**		**5,939**	**1.2**	See Section 16.0
Soil	3,141	1.75	5,496	1.0	Assuming contamination to depth of till
Sediment	295	1.5	443	0.2	Preliminary FS
North Yard					
Soil >10 ppm PCBs	28,600	1.75	50,000	4.6	Phase II PCDF/PCDD Sampling Report
Soil >500 ppm PCBs	4,975	1.75	8,700	0.8	Phase II PCDF/PCDD Sampling Report
Rectifier Yard	**4,330**		**6,495**	**1.3**	
Drainageway Sediment	3,000	1.5	4,500	1.3	Final RI; Additional Sediment Sampling Report, 1990
Pond Water Area Sediment	1,330	1.5	1,995		
Area North of Haverstock Road	**1,700**	**1.75**	**2,980**	**1.0**	See Section 24.0
Soil Stockpile	**2,700**	**1.5**	**4,050**	**0.4**	See Section 25.0

APPENDIX B

GRC TREATABILITY STUDY REPORT

February 11, 1991

R00011

GALSON REMEDIATION CORPORATION'S
Final Report
Treatability Study on Soils at the Reynolds Metals Plant, Massena, New York

Presented to
Woodward-Clyde Consultants
Plymouth Meeting, Pennsylvania

Galson
Remediation Corp.

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Executive Summary

Two samples of North Yard Soil, one low PCB concentration and one a mixture of high concentration soil and low PCB concentration soil, were treated with Galson Remediation Corporation's (GRC) patented APEG-PLUS™ treatment system in laboratory scale equipment. Treatment resulted in reduction of the PCB concentration in a low PCB concentration soil sample from 40 ppm to less than 2 ppm. Treatment of the mixed soil resulted in reduction of the PCB concentration in a high PCB concentration soil sample from 5000 ppm to 30 ppm. Analysis for dioxins and dibenzofurans was completed by a third-party laboratory. The reduction in PCB concentrations was less pronounced than GRC has experienced with soils from other sites. The problem seems related to interferences unique to the North Yard soil.

Analysis of the exit fractions for reagent components and other data on the site was used to generate cost estimates. The cost for treating the 37,200 cubic yards (assuming roughly 56,000 tons) of contaminated soil in the North Yard is estimated to be approximately $450 per ton (within a ±50% range of accuracy, based on the treatability study results). A cost estimate has been provided as Appendix 4.

The APEG-PLUS™ treatment system is mobile, and full-scale treatment would take place at the site. Because the site is large, GRC recommends treating it with an 8- to 10-reactor system, which can treat approximately 160-200 tons per day. A pilot study would be necessary in order to verify performance and to optimize treatment conditions.

Introduction

GRC is pleased to present the draft final report with results from the laboratory-scale treatability study, using GRC's patented APEG-PLUS™ chemical dechlorination treatment technology to destroy the PCB and dioxin/furan contaminants in samples of soils from the Reynolds/St. Lawrence Reduction Plant (Reynolds) site. The objective of the laboratory treatability study was to determine the effectiveness of the APEG-PLUS™ treatment system on composite samples (as described in Woodward-Clyde Consultants' [WCC] "Treatability Study Work Plan for North Yard Soils," p. 4) from the Reynolds site.

The Reynolds site is contaminated with PCBs and some dioxin/furans. GRC's treatability study was targeted to reduce the concentration of PCBs to less than two (2) parts per million (ppm). GRC also assumed that the dioxins/furans would require decontamination to 5 part per billion (ppb), based on conversations with Mr. Peter Jacobson of Woodward-Clyde Consultants.

The treatability study was originally divided into six phases.

- Phase 1: Preliminary testing, selecting initial conditions
- Phase 2: Initial reactions
- Phase 3: Optimization reactions
- Phase 4: Analysis by outside laboratories
- Phase 5: Reagent recovery analysis, full-scale cost estimate
- Phase 6: Waste disposal and project report

The phases are discussed in detail in the remainder of this report.

Phase 1: Preliminary Testing, Selecting Initial Conditions

WCC delivered two samples of PCB-contaminated soil from the North Yard of the Reynolds site to the GRC mobile laboratory at the site. The first sample was low PCB concentration soil, the second was from a high PCB concentration area. GRC personnel passed the soil through a screen with 0.25" openings to remove pebbles and sticks and collected the soil in a metal pan. The soil was mixed manually to make the batch homogeneous. All work with this soil was conducted under a fume hood by personnel wearing appropriate gloves.

The soil samples were analyzed for PCBs using GRC's usual method (attached). The samples were also analyzed for percent moisture, crude particle size distribution, and KOH absorption capacity. The data generated in this portion of the lab study are summarized in Table 1. The dioxin/furan analyses were provided by outside laboratories, through WCC (correspondence dated 1/29/91 WCC to GRC).

Table 1. Preliminary Analysis of North Yard Soils

	Low PCB Concent.	High PCB Concent.
PCB Concentration, ppm (μg/g)	44	17,000
Dioxins (ppb)	0.001	0.992
Furans (ppb)	0.278	67
Per cent Moisture	16%	13%
KOH Absorption Capacity, mg/g	150	

Particle Size Distribution

	Sieve	#300	#140	#60	#0.5	#1	% Oversize
Mesh Size	μm	50	100	250	500	1000	0.25 inch
Low PCB Concent.	% passing	3%	17%	42%	54%	69%	16%
High PCB Concent.	% passing	0.6%	4%	12%	20%	37%	23%

Reagent formulation and loading were selected for the initial reactions of each sample type (soil) based on the analytical results and on previous experience with other soils. The KACs for these samples are above average for soils. GRC's usual procedure is to double the usual amount of KOH when the KAC is over 100 mg/g to assure there will be enough KOH available to complete the reaction. PCB dechlorination reactions usually require 6-8 hours to reduce PCB concentrations from a few hundred ppm to the 2 ppm clean level. In the case of the low PCB concentration soil, however, the PCB concentration was fairly low and the dechlorination was expected to take less time. Based on previous experience, it was thought that the mixed (high PCB concentration) soil would require about 10 hours to be treated to less than 2 ppm. For the first reaction, GRC selected its standard reagent (1:1:2:2 PEG:TMH:DMSO:45% KOH) at 60 % loading (60 g reagent per 100 g soil) as a starting point and doubled the amount KOH used.

Phases 2 & 3: Soil Treatment Reactions

GRC conducted the first four reactions at 150°C according to its standard protocol (attached). Monitoring samples were collected from the reactor hourly. The monitoring samples were analyzed for PCBs by GRC's rapid analytical method (attached). Throughout this project, the reactor and GC were in separate cities, and it was not possible to analyze the monitoring samples in "real time." For that reason, reaction times were arbitrarily set at 10 hours, based on scheduling concerns and on the project manager's experience with similar materials. After the reactions were complete, the reagents were recovered and the soil was washed according to the standard protocol (see Appendix 1).

Since this project was done on an accelerated schedule, GRC decided to alternate reactions of low PCB concentration soil and high PCB concentration soil so that there would be time to analyze samples and evaluate the results before doing the next reaction with the same type of material.

Two additional reactions, one with each type of sample (low PCB concentration and high PCB concentration) were added to the project. These reactions were run at 150°C for a few hours, then heated to 170°C in an attempt to improve reaction effectiveness.

Treatment Reactions for Low PCB Concentration Soil

Three reactions (Reactions 1, 3, and 5) were conducted for the low PCB concentration soil sample according to GRC's standard protocol (see Appendix 1). All three reactions treated 500 grams (g) of soil and were run for 10 hours starting when heat was first applied. Reactions 1 and 3 were held at 150°C for the entire time (after heatup). Reaction 5 was heated to 170°C after the eighth hour. Because of the rather high potassium absorption capacity (KAC) for this soil, the amount of potassium hydroxide (KOH) used was twice the usual amount. Because the soil slurried well and had a fairly low PCB concentration, the first reaction was done with only 400 g of reagent for 500 g of soil.

Early analytical results indicated that the Reactions 1 and 3 had reduced the PCB concentration substantially, but not to the 2 ppm "clean" level. The most common cause of sluggish reaction performance is lack of KOH. Reaction 3 was supposed to be conducted using three times the normal amount of KOH. However, as s a result of a lab error, the KOH addition was accomplished in two stages rather than one. The initial reagent in Reaction 3 contained only the normal amount of KOH. The additional KOH was added after the sixth hour. Unfortunately, the additional KOH did not revive the sluggish reaction.

Reaction 5 was completed with 66% more of the polyethylene glycol (PEG), tetra ethylene glycol methyl ether (TMH, a Dowanol), and dimethyl sulfoxide (DMSO), as well as additional KOH. Reaction 5 brought the PCB concentrations to less than 2 ppm in less than 2 hours of reaction. As an additional test for boosting reaction efficiency, Reaction 5 was heated to 170°C during the last two hours. (Keep in mind that analyses were being run at the GRC laboratory in Syracuse, and the lab staff at the Reynolds site were not aware that Reaction 5 had already been successful without the temperature boost.) As the reactor temperature increased from 150°C to 170°C, oil was distilled from the reactor and collected in the condensate flask. During the ninth hour, Reaction 5 showed a 10 ppm result, probably due to unreacted material from the side of the reactor collecting during sampling.

Reaction Conditions for Low PCB Concentration Soil Reactions

Reaction	# 1	# 3	# 5
Grams of soil treated	500	500	507
Grams of PEG used	50	56	85
Grams of TMH used	52	60	79
Grams of DMSO used	103	158	178
Grams of 45% KOH used	202	107+*	337
Temperature	150°C	150°C	150/170

80 g of flake KOH were added to Reaction 3 at the sixth hour.

Monitoring Data for Low PCB Concentration Soil Reactions

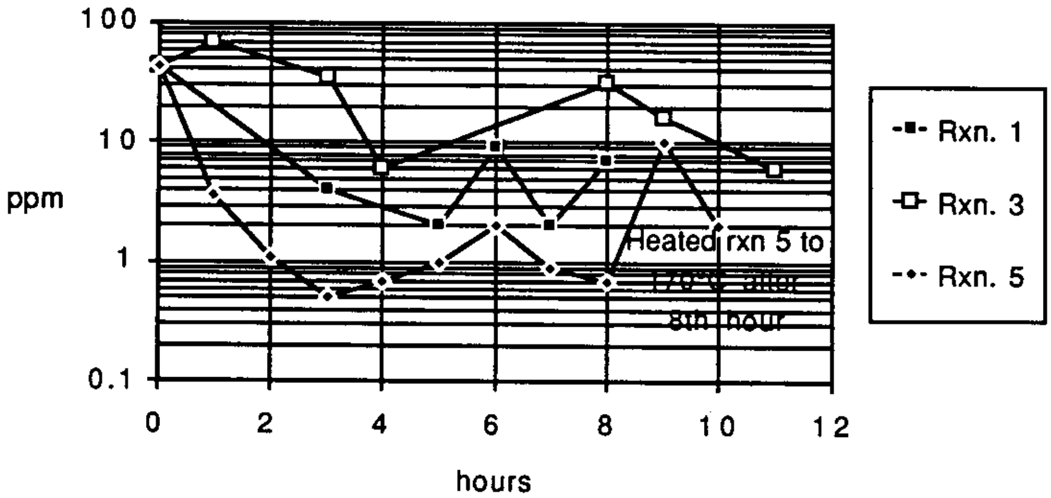
Reaction (Time, Hours)	# 1 ppm PCB	# 3 ppm PCB	# 5 ppm PCB
1	QA	68	4
2	IP	IP	1
3	4	35	<0.5
4	IP	6	1
5	2	IP	1
6	9	QA	2
7	2	QA	1
8	7	31	1

9	IP	16	10
10	QA	IP	2
11	N/A	6	N/A
Treated, Washed Soil	3	N/A	<0.5

[QA = Analysis failed to pass QA criteria. IP = In Progress. N/A = Not Analyzed or Not Applicable. < means below detection limit given.]

Reaction curves (PCB concentration vs. time) for the Low PCB Concentration soil reactions are shown in the following graph.

Reynolds, Representative Soil, PCB vs. Time



Treatment Simulations for High PCB Concentration Soil

The high PCB concentration soil contained 17,000 ppm of PCBs. GRC's TSCA R&D permit allows us to conduct reactions with soil contaminated with concentrations of PCBs up to 5000 ppm. During full- scale operations, the high PCB concentration soil would be blended with other soil so that the input stream would have a more consistent PCB concentration. GRC elected to simulate the blending process and thereby simulate the most probable treatment scenario for the high PCB concentration soil.

A 450 g portion of high PCB concentration soil was blended with 1550 g of low PCB concentration soil. The objective was to produce a blend that contained about 4000 ppm.

Samples of the blended soil were analyzed and found to contain 5000 ppm PCB by GRC's analytical method.

Three reactions (simulations) were conducted for the blended soil according to GRC's standard protocol (attached). All three reactions treated 500 g of soil and were run for 10 hours starting when heat was first applied. Reactions 2 and 4 were held at 150°C for the entire time (after heatup). Reaction 6 was heated to 170°C after the fifth hour. Because of the rather high KAC for this soil, the amount of KOH used in Reaction 2 was twice the usual amount. Because the soil slurried well, the initial reaction was completed using only 400 g of reagent for 500 g of soil. Early analytical results indicated that the reaction had reduced the PCB concentration substantially, but not to the 2 ppm "clean" level.

The most common cause of sluggish reaction performance is lack of KOH. Reaction 4 was therefore completed with three times the normal amount of KOH; however, increasing the KOH did not improve the reaction effectiveness noticeably. The final reaction (Reaction 6) was completed with more of all the reagent components. Increasing the reagent loading improved the reaction effectiveness. In addition, Reaction 6 was heated from 150°C to 170°C after the fifth hour. Again, this caused some oil to be distilled out of the reactor and collected in the condensate flask.

Reaction Conditions for Mixed Soil Reactions

Reaction	# 2	# 4	# 6
Grams of soil Treated	501	494	500
Grams of PEG used	50	47	86
Grams of TMH used	53	50	85
Grams of DMSO used	104	101	167
Grams of 45% KOH used	201	300*	508
Temperature	150°C	150°C	150/170

41 g of flake KOH were also added to Reaction 4.

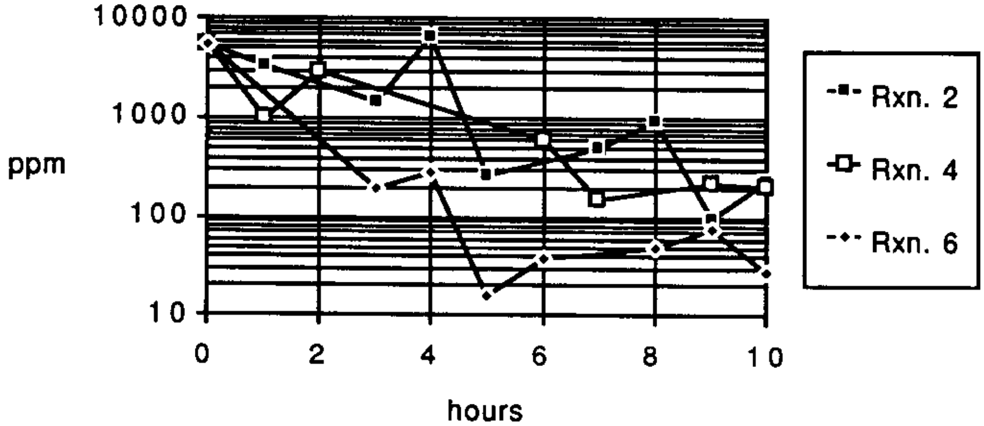
Monitoring Data for Mixed Soil Reactions

Reaction (Time, Hours)	# 2 (ppm PCB)	# 4 (ppm PCB)	# 6 (ppm PCB)
1	3300	1000	QA

2	QA	3000	QA
3	1500	87	199
4	6500	1200	282
5	264	730	16
6	QA	620	37
7	510	150	QA
8	940	48	50
9	100	220	74
10	240	210	27
Treated, Washed Soil	17	5	*34

QA = Analysis failed to pass QA criteria. N/A = Not Analyzed or Not Applicable
*Incorrectly reported in Preliminary report due to typographical error

Reynolds, MIxed Soil, PCB vs. Time



The final washed soil from Reactions 2 and 4 contained markedly lower PCB concentrations than the final monitoring samples. The most likely cause is removal of fine soil particles, rich in PCBs, during the washing process. PCBs and/or particulates in the washwater are considered to be a substantial interference for the evaporator in full-scale processing. Therefore, Reactions 2 and 4 were not considered the "best" in terms of full-scale treatment, even though they produced the lowest PCB in soil results from the high PCB concentration sample. Since the PCBs in Reaction 6 were actually reacted rather than simply removed, Reaction 6 was chosen as the "best" reaction for subsequent analysis.

GRC analyzed the exit fractions of the "best" reactions for PCB. The condensate from Reaction 6 contained enough oil so that it was possible to collect a sample of it to analyze for PCBs. The oil was heavier than water, and was pipetted from the bottom of the condensate flask. The total mass of the oil was 0.274 g. The condensate from Reaction 5 did not contain enough oil to enable GRC to analyze the oil separately from the aqueous condensate.

PCB Analysis of Exit Fractions

	Reaction 5, Low PCB Concent.		Reaction 6, Mixed Soil	
	(ppm PCB)	(DCB% R)	(ppm PCB)	(DCB% R)
Reagent	*<0.2*	*204*	4.4	102
Wash 1	*<0.2*	*184*	<0.2	106
Wash 2	*<0.2*	*169*	<0.2	124
Wash 3	<0.2	135	*<0.2*	*197*
Wash 4	<0.2	139	<0.2	140
Wash 5	<0.2	112	<0.2	98
Condensate	*12.40*	*333*	*4.8*	*45*
Condensate oil	N/A	N/A	*4,500,000.*	N/A
Treated soil	<0.5	113	34	56
Treated soil duplicate	<0.5	110	20	66

N/A = Not Analyzed or Not Applicable. Data in italics fail to meet QA criteria and are reported as approximate.

The reagent from Reaction 6 contained a small amount of PCB (4.4 ppm). This is to be expected since the soil concentration was not brought down to the "clean" level. Condensates from Reactions 5 and 6 were also PCB contaminated, probably due to co-distillation of PCBs with the oil that was removed from the soil when the temperature was increased to 170°C. The PCB result from the condensed oil was "4,500,000 ppm." It is not possible for a sample to contain more than one million parts per million of anything. The extremely high result indicates that the oil contains compounds that interfere with PCB analysis and cause false high results to be reported. Even if the PCB concentration in the condensates were all "real," the amount of PCB removed from the soil by distillation was less than the amount present before the temperature was elevated.

Discussion

The final samples for all six reactions produced chromatograms with one or two large peaks in the dichlorobiphenyl area of the chromatogram and little else. These peaks are suspicious in themselves. They also seem to "tail" and thereby elevate the reported areas of subsequent small PCB peaks. Although preliminary GC/MS analysis indicates that dichlorobiphenyl is present in at least one of the peaks, there is some question whether all of the peak area is produced by dichlorobiphenyl. It is possible that a significant part of the peak area being reported as PCB is actually produced by interfering compounds. More GC/MS work on the Reynolds samples is needed to investigate the true nature of the two remaining peaks and to accurately quantify the PCB remaining in the treated soil.

Distillation of oil in the two reactions (Reactions 5 and 6) that were heated to 170°C indicates that some of the soil particles may be coated with oil even at the normal reaction temperature (150°C). An oily layer could prevent contact between the reagent and PCBs in the deep soil pores. DMSO is ordinarily able to extract PCBs from the soil pores, but it is possible that the oil is slowing that process down. It is usually not desirable to operate at temperatures over 150°C because the breakdown of DMSO is accelerated at higher temperatures, leading to odor problems as well as slightly increased reagent costs. The effect of the oil on the PCB reaction rate was unanticipated.

Early use of APEG-PLUS™ treatment (early 1980s) was applied successfully in removing PCBs from transformer oil. The oil from the Reynolds site probably originated as a fraction of the coal tar pitch used at the site. Some of the compounds in the pitch may have broken down into smaller molecules with lower boiling points since they first came into contact with the soil. Coal tar contains more aromatic compounds than transformer oil and extracting PCBs (also aromatic) from coal tar liquids will be more difficult than extracting them form transformer oil. Removal of the oil by use of a slight vacuum at 150°C might be a desirable alternative.

If the final two peaks in the soil are totally composed of PCBs rather than interfering compounds, the next logical step would be to increase the reagent loading further and/or treat the high concentration soil in a two-stage process. GRC has conducted successful lab reactions for transformer oil containing 70,000 ppm PCB (for a confidential client in Canada) by using two batches of reagent for a single batch of oil. However, using two batches of reagent would be more costly than doubling the reagent loading and treating the soil only once because of the extra centrifugation step that would be necessary.

GRC would like to conduct treatment simulations on blended high PCB concentration soil from the Reynolds site. These simulations would test mild vacuum oil removal, increased reagent loading, and/or two-stage treatment as soon as these reactions can be conducted in our Joy Road laboratory. GRC would expect to absorb the costs of these additional studies. Efficient decision making requires real-time PCB analysis, which is not possible when reactions are done in the mobile lab. GRC anticipates receiving regulatory status for conducting PCB reactions at Joy Road at some time during the first quarter of 1991. GRC has discussed with Mr. Peter Jacobson the possibility of obtaining samples from the Reynolds North Yard site when GRC's Commercial Storer Permit is in place (in the near future), so that the GRC lab can determine how best to treat the high PCB concentration soil to the clean level. This additional analysis would be at GRC's cost.

Phase 4: Results of Analysis by Outside Labs.

GRC evaluated the data from the six reactions and selected the best reaction for each material. The following samples were submitted to Enseco and California Analytics, independent commercial labs selected by Woodward-Clyde.

- Untreated low PCB concentration soil
- Untreated high PCB concentration soil
- Untreated mixed soil
- Treated low PCB concentration soil from Reaction 5
- Treated high PCB concentration soil from Reaction 6

The samples were to be analyzed for:

- PCBs using a standard analytical method (EPA method 8080 of SW-846)
- Polycyclic aromatic hydrocarbons (PAHs)
- Metals on the TCLP leachate
- Moisture
- Chlorinated dioxins and furans.

The table below is the information provided by WCC to GRC in a correspondence dated January 29, 1991, and contains the data provided to WCC by the laboratories. In addition, the other analyses listed above were provided to WCC from the third-party laboratories. The table shows that APEG-PLUS™ was successful in reducing the dioxins and furans to well below the clean level required by the NYSDEC.

Soil Sample	Untreated Dioxins (ppb)	Untreated Furans (ppb)	APEG-PLUS Treated Dioxins (ppb)	APEG-PLUS Treated Furans (ppb)
Low PCB Concentration	0.001	0.278	<0.001	<0.001
High PCB Concentration	0.992	67	NA	NA
Mixed	0.153	15	<0.001	0.0063

Phase 5: Reagent Recovery Analysis

GRC analyzed the exit fractions from the best reaction of each material for the reagent components. These analyses enabled GRC to calculate the rate of reagent consumption during full-scale cleanup operations. The results of these analyses and mass balance calculations can be found in the mass balance sheets in Appendix 2. The reagent recovery results are summarized in Table 4.

Table 4. Reagent Recovery from Reynolds Soil Reactions

	Reaction 5, Low PCB Concentration Soil				Reaction 6, Mixed Soil			
component	PEG	TMH	DMSO	KOH	PEG	TMH	DMSO	KOH
g dry mass used	84.80	78.70	177.8	151.5	85.70	85.00	166.5	228.4
g found in Condensate	0.00	0.00	5.03	0.00	0.00	0.00	5.27	0.00
g found in Reagent	76.24	66.67	100.5	17.95	100.0	87.28	113.0	19.65
g found in Wash 1	23.80	19.89	28.62	46.24	20.93	15.04	19.81	82.19
g found in Wash 2	10.33	6.99	12.34	23.79	7.42	7.32	7.39	34.88
g found in Wash 3	0.00	2.50	3.02	0.00	0.00	1.11	1.22	0.00
g found in Wash 4	0.00	0.92	1.47	0.00	0.00	1.16	1.60	0.00
g found in Wash 5	0.00	0.46	0.63	0.00	0.00	0.57	0.75	0.00
g found in Final Soil	0.00	0.68	0.63	0.00	0.00	0.00	0.51	0.00
Total g Recovered	110.4	98.11	152.2	87.98	128.4	112.5	149.5	136.7

Percent Recovery	130%	125%	86%	58%	150%	132%	90%	60%
KOH Consumption*				13%				18%

* KOH consumption = g KOH consumed per 100 g soil treated, expressed as percent.

Recovery of reagents from soil treatment reactions was good except for KOH, which was consumed in side reactions with the soil. In addition, residual KOH in both soils was neutralized during the third wash. Recoveries of the glycols (PEG and TMH) were greater than 100%. The unrealistically high values for the glycols were probably caused by interfering compounds present in the soil from the site. Performance evaluation samples for the reagent analysis were within acceptable recovery ranges. Very little reagent was recovered in washes 4 and 5. If soil washing is as efficient in full scale as it was in the lab, as we expect, adequate reagent removal from the soil could be achieved in three washes. Since eliminating the last two washes could provide a cost savings, full-scale cost estimates were based on three washes rather than five. Soil reagent residuals should be checked after the pilot-scale reactions to verify that the concentrations are acceptable.

Based on all of the lab data, GRC has prepared cost estimates for full scale cleanup of the North Yard soil by APEG-PLUS™ treatment for the PCBs and dioxins. The cost estimate document is provided as Appendix 4. It is important to note all of the assumptions made in preparing the estimates.

Phase 6: Waste Disposal

Before moving the mobile lab from the Reynolds facility, GRC personnel packed up most of the residues from this treatability study for disposal and turned the containers over to Reynolds for final disposal. Only those samples requiring further analysis were shipped to GRC's laboratory.

After the final report has been accepted by Woodward-Clyde and Reynolds, GRC will pack and return the analytical samples and related materials to the Reynolds facility. Ultimate disposal of these materials will be the responsibility of Reynolds.

Summary and Conclusions

APEG-PLUS™ treatment has been proven effective in removing PCBs from the low concentration North Yard soil. Treatment resulted in reduction of PCB concentrations from 44 ppm to less than 2 ppm. APEG-PLUS™ treatment also reduced PCBs in the high PCB concentration soil from 5000 ppm to 34 ppm. Since the "clean" level for this site is 2 ppm, GRC proposes to run additional reactions (at GRC's expense) using higher reagent loadings and/or vacuum removal of the "oil" which seems to retard the treatment reactions for the mixed soils.

Analysis of the exit fractions for reagent components and other data on the site were used to generate cost estimates for full scale remediation of the site.

The presence of coal tar pitch makes remediation of this site unusually difficult for two reasons. First, the oily material in the soil interferes with PCB analysis and makes accurate quantitation of PCB concentrations difficult. Second, the oily material seems to slow down the APEG-PLUS™ reactions.

Two adjustments to the treatment system could solve the second problem. If lab reactions show that a vacuum can remove the oily material and that such removal enables the treatment system to reduce high concentration soil to the the clean level, vacuum equipment could be added to the full-scale treatment system. If lab reactions show that increasing the reagent loading enables the APEG-PLUS™ system to decontaminate the high concentration soil, GRC will increase the reagent loading used for the high concentration soil.

During full-scale treatment, GRC will have an occasional batch of soil that contains more PCB than expected. To increase the reagent loading during processing, GRC will pump half of that reactor load into the next available reactor, then add additional reagents to both reactors and continue treatment until the clean level is reached. This is expected to happen with 5-10% of the soil to be treated. Costs associated with these adjustments are included in the full scale cost estimate.

GALSON REMEDIATION CORPORATION
Appendix 1: Methods Used

February 11, 1991

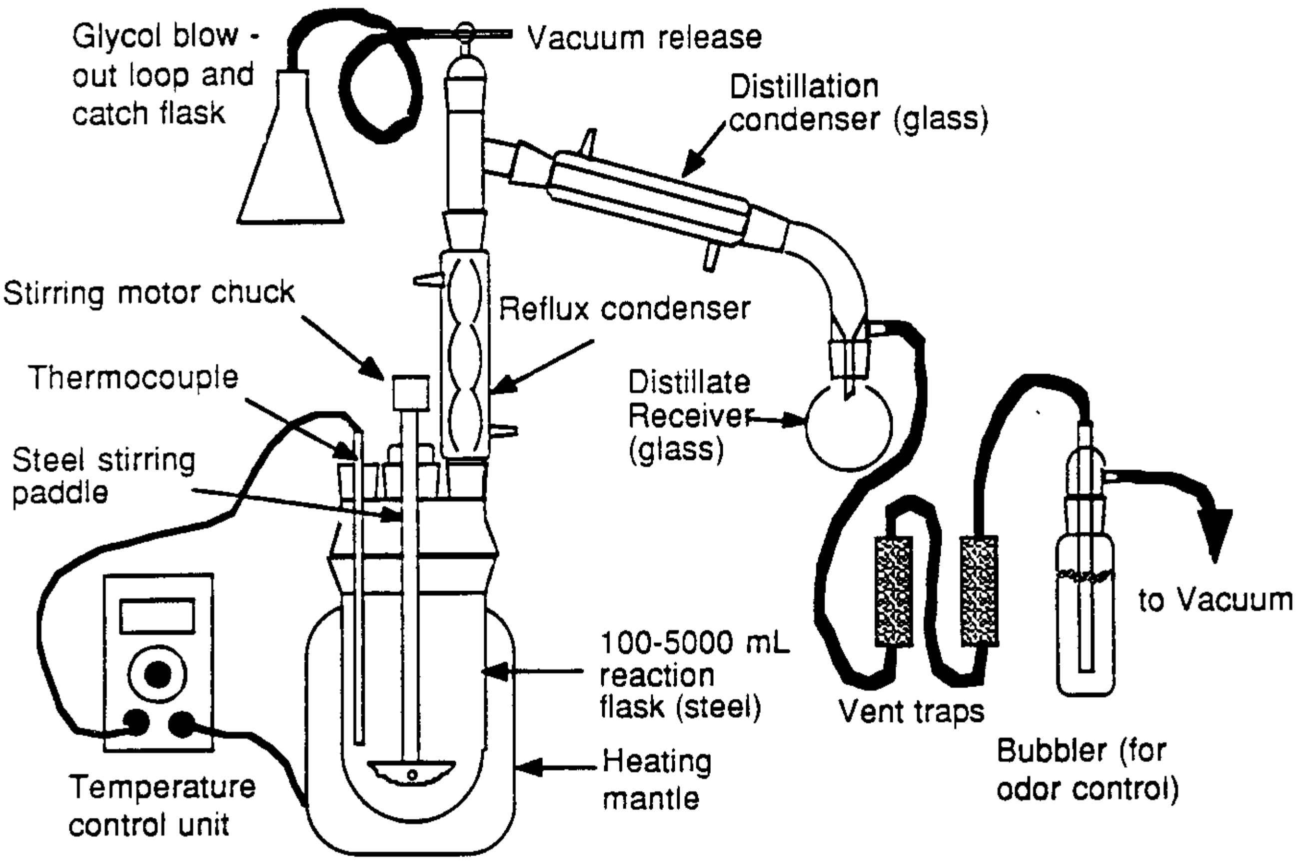
Galson
Remediation Corp.

6627 Joy Road • East Syracuse, NY 13057 • Tel: (800) 722-7123

Protocol for Laboratory Soil and Sludge Reactions

Galson Remediation's APEG-PLUS™ treatment system can be used to treat soil contaminated with aromatic halides -- for example: PCBs, dioxins and hexa-chlorobenzene. Before full-scale treatment is begun, it is prudent to verify that the treatment system can indeed decontaminate the soil. Lab reactions are conducted to imitate full-scale soil treatment so that critical reaction parameters, such as reagent composition, can be established and tested. Laboratory data can also be used to estimate full-scale reagent consumption and reaction time, which affect treatment costs.

Before any reactions are done, soil samples are analyzed for the contaminant(s) of interest, percent moisture, particle size distribution (crude), and KOH absorption capacity. These analyses help the lab personnel decide on the reagent formulation and loading for the initial reaction, and set up a schedule for the reaction time that will be required. The GRC laboratory soil reactor is illustrated below.



Laboratory Soils Reactor

The reactor bottom, distillate receiver, and jars for reagent, soil, and washes are tared before starting the reaction. Soil is weighed into the reactor bottom. The reactor is clamped together and set up in a fume hood. The thermocouple, condenser system, and condensate receiver are attached and a thermostatically controlled heating mantle is positioned on the bottom of the reactor as shown. Reagents are weighed and added through the neck that usually holds the thermocouple. Soil and reagents are mixed into a slurry.

Reactions are timed from the start of heating. During heating, slight vacuum (<1" Hg) is applied at the exit from the vent trap. The vacuum imitates the negative pressure maintained on the full scale reactor. The vent trap assures that no vapors escape from the system. Water distills between 110 and 130°C (due to boiling point elevation). Samples are taken throughout the reaction, usually about one per hour, and analyzed according to GRC's rapid analytical method for the contaminant(s) in soil. Results are usually available in 1-2 hours. When the contaminant concentration in the soil has reached the desired "clean" level the reactor is cooled to 90-100°C and a small quantity of water is added to prevent solidification of the KOH. The reactor is then cooled to room temperature.

Reagent recovery and soil washing are carried out using centrifugation as the separation method. The reactor is emptied into one or more centrifuge bottles. The bottles are centrifuged at a known RPM, usually 1500, for a known time, usually one to five minutes. The centrifuge speed and time are selected to imitate the G force and dwell time of the centrifuges to be used in full scale soil treatment. The reagent is poured or pipetted off the soil into its tared jar. The soil is returned to the reactor and the reactor is re-assembled so that the stirrer can be used. Wash water is weighed into the reactor and mixed with the soil. The reactor contents are heated to the desired washing temperature (usually 90°C) and held at that temperature for 20 minutes with constant agitation. The reactor is cooled to a comfortable working temperature and the contents are emptied into the same centrifuge bottles as before. The washing procedure is repeated for the desired number of washes, usually three to five. Residual KOH may be neutralized with acid at any point during the reagent removal process. The choice of neutralization point is based on soil handling characteristics.

The contaminant data from the monitoring samples are used to generate a concentration vs. time graph for the soil. This graph can be used to estimate the difference in reaction time for various "clean" levels that may be requested. Reaction time affects treatment cost. The reagent, washes, distillate, and vent traps are also analyzed for the contaminant(s) to verify that the contaminant(s) are reacted and not just removed.

When all the liquids are in their tared jars, the jars (and the distillate receiver) are re-weighed and mass recoveries are calculated. The reagent, washes, and distillate may be analyzed for the various reagent components. Mass balances for each reagent component could then be calculated. The reagent mass balance data would be used to generate an estimate of reagent consumption and cost for full scale treatment.

GRC Analytical Method for PCB in Soil

Soil samples generated during APEG treatment require unusual treatment because the KPEG reagent is somewhat destructive to standard gas chromatography (GC) equipment. Care must be taken so that reagent is not included in the extract that is injected into the GC. This method has been developed to provide accurate results in the shortest time possible.

1. Soil Wash Step (not required for final treated soil or untreated soil)

A sample of the reaction slurry is collected directly in (or transferred from a a large sample jar into) a tared 8 mL vial. The usual sample size is 4-5 mL of slurry. The vials are re-weighed to obtain the weight of slurry used. Water is added to the vials to fill them up to the "shoulders" and the vials are capped with solid, teflon lined caps and shaken vigorously using a vortex mixer to suspend the soil. The vial is then centrifuged at 1500 rpm for two minutes. The supernatant is transferred into a 24 mL collection vial. Two additional aliquots of deionized water (4-5 mL each) are used to wash the soil by the same method. The vial containing the wet soil is re-weighed to obtain a wet soil weight.

2. Extraction Step

After the final water wash is carefully decanted, a recovery surrogate (usually decachlorobiphenyl) is added to the sample and mixed in well. Then 1 mL of methanol and 3 mL of hexane are added to the 8 mL vial containing the soil sample. (Dry, untreated soil is weighed in a tared vial and saturated with 1:4 water:methanol. Hexane is then added as for a treated sample). The vial is shaken vigorously on the vortex mixer to suspend the soil from the bottom of the vial. Shaking is continued for an additional minute. The vial is then centrifuged for two minutes as described above. The hexane layer is carefully transferred into a 10 mL volumetric flask using a disposable Pasteur pipette. Two additional aliquots of hexane, 3 mL each, are used to extract the soil+water +methanol slurry by the same method. Each hexane layer is transferred into the volumetric flask. After the third extraction, the volume in the volumetric flask is adjusted to 10 mL with fresh hexane. The volumetric flask is mixed gently on the vortex mixer and 2-3 mL of the extract are transferred to a 4 mL vial containing 0.5 mL copper dust (measured with a powder measure). The 4 mL vial sealed is with a teflon lined screw cap and is shaken for about 30 seconds on the vortex mixer. The vial is opened, 1 mL of concentrated sulfuric acid is added and it is shaken again. The vial is then centrifuged to separate the phases. This procedure usually produces a colorless, dry extract above the acid/copper layer. The sulfuric acid wash may be repeated if necessary. The clean extract is transferred to a 1.5 mL vial used for GC analysis. The remainder of the unwashed extract is transferred into an 12 mL storage vial and retained until a satisfactory analytical result is obtained for that sample. The level of extract in the 12 mL vial is marked as a precaution against solvent evaporation.

The vial containing the extracted soil is left uncapped in a hood or over a steam bath to dry. The vial and soil are then re-weighed to obtain the dry soil weight.

3. Chromatography

The acid/copper washed sample extracts are diluted as required and used for GC analysis. PCB standards and blanks are injected on the same day as samples to provide instrument response data for calculations and adequate quality control for the analysis. Samples, standards and blanks are injected into one of two chromatographic systems. Conditions for each instrument are as follows.

<u>Hewlett Packard 5890A</u>
Injector temp.: 250°C. Manual injections with solvent flush
Column: 30 m x 0.543 mm ID fused silica coated with 1.5 µm DB-1
Carrier gas: nitrogen at 25 mL/min through column, makeup to 60 ml/min.
Temperature Program: 170°C, 25°C/min. to 270°C, hold 6 min.
Detector: Ni-63 ECD, base: 300°C
Integrator: Hewlett Packard 59970C Chemstation with GC software.
Threshold: 0, atten 2^6 (adjust as needed), Report mode: Area%

<u>Shimadzu GC9A</u>
Injector/detector block: 300°C. Manual injections with solvent flush
Column: 30 m x 0.543 mm ID fused silica coated with 1.5 µm DB-1
Carrier gas: nitrogen at 30 mL/min.
Temperature Program: 170°C, 5°C/min. to 230°C, hold 7 min.
Detector: Ni-63 ECD, saturation current : 1 nA, range: 10^1
Integrator:Shimadzu C-R5A Chromatopac, width: 10, slope: 320 (adjust as needed) min. area: 1000, speed: 10, atten: 2^4

4. Data Reduction

The APEG process causes unique problems in the area of data reduction because in many cases some PCB congeners react more rapidly than others. The differences in reaction rate result in a disruption of the usual aroclor peak pattern. Since the samples do not have the usual peak pattern, the normal methods of quantitation by comparison to standard aroclors are not appropriate.

The concentration of PCB in samples is calculated according to the procedure of Webb and McCall as described in the EPA method for PCB analysis (EPA 600/4-81-045). Each PCB peak is treated as a separate compound and is quantified individually. The total PCB concentration in a sample is the sum of the concentrations represented by the various peaks. This method provides a much more accurate estimate of the PCB concentrations in treated samples. It also provides accurate results for aroclors and mixtures of aroclors.

Chromatograms of samples and standards are studied and peak names, based on the relative retention times (RRT's) given in the EPA method, are assigned. Peaks 11 and 14 represent monochlorobiphenyls, peaks 16 and 21 represent dichlorobiphenyls and so on.

The standards used for calculations are hexane solutions of a 1:1 mixture of aroclors 1242 and 1260 at various concentrations. The nanograms of PCB represented by a given peak ($ngix$) within a standard is calculated as follows.

$$ngix = Cx * Vl * (Mia + Mib)/200$$

where Cx = the total PCB concentration of standard x in ng/µL,
Vl = the injection volume of the standard in µL, and
Mia = the mean weight percent of peak i in Aroclor 1242, taken from Table 3 of the EPA method.
Mib = the mean weight percent of peak i in Aroclor 1260, taken from Table 6 of the EPA method

The nanograms of PCB represented by each peak in a sample is calculated by linear interpolation between two standards having the same peak at higher and lower concentrations. The equation for this calculation is:

$$ng_{is} = ng_{ih} - [(A_{ih}-A_{il})(ng_{ih}-ng_{il})/(A_{ih}-A_{is})]$$

where i refers to a peak name,
s refers to the sample,
h refers to the higher standard,
l refers to the lower standard, and
A is a peak area.

The total nanograms of PCB in a sample injection, (ng_t) is the sum of the nanograms of the individual PCBs (ng_{is}).

$$ng_t = \sum ng_{is}.$$

The PCB concentration in the soil is calculated from the nanograms in the sample injection as follows:

$$C = ng_t * V * D/(VJ * W)$$

where C = the concentration of PCB in soil in mg/kg (ppm)
V = the total sample extract volume
W = the weight of soil, in grams and
D = any additional dilution factor required, e.g. if a 1/100 dilution of the extract is injected, D=100

In order to speed up calculations without requiring a large computer, a spreadsheet program was developed for doing the Webb McCall calculations on a Macintosh microcomputer using a spreadsheet. After peak identities are assigned by trained personnel, peak areas and concentrations of standards and dilution information for each sample are typed into the spreadsheet. The spreadsheet is programmed to calculate ng injected for each PCB peak by linear interpolation, to add up the total ng of PCB injected, to correct for the injection volume, sample dilution, extract volume and sample weight, and to report concentrations in ppm by weight in the soil. The instructions used for training analysts to identify peaks and use the spreadsheet are attached.

When rapid sample turn around is critical, as in process monitoring, it is not possible to obtain dry soil weights for the individual samples in the required time. In order to supply useful data as quickly as possible, half of the wet soil weight (after washing) is used to approximate the dry soil weight, and the data are reported verbally as approximate. GRC's experience has shown that half of the wet soil weight is a good apporoximation of the dry soil weight in this analysis. The soil samples are dried after extraction and re-weighed to obtain the dry soil weight before final data are reported.

Analytical Procedures for PCB in Reagent

GRC's method for analyzing reagent for PCB is similar to the method used for soil. A sample of reagent is weighed accurately, diluted with enough 1:4 aqueous methanol to reduce the viscosity roughly to that of water. The reagent solution is extracted three times with a volume of hexane roughly equal to the volume of the reagent solution. After each extraction, the hexane layer is transferred to a volumetric flask or graduated receiver. After the third extraction, the hexane extract is brought up to a known volume. The sample is cleaned up by shaking 2 mL of the hexane extract briefly with 0.5 mL of copper dust and 1 mL of concentrated sulfuric acid as described for soil extracts. The extract is then injected into a GC with ECD.

The chromatographic technique for the hexane solution was the same as for the hexane extract from a soil sample. PCB concentration is calculated as described for soil samples.

Analytical Procedure for PCB in Wash Water

Wash water from the APEG process is difficult to extract with organic solvents because residual PEG and TMH in the wash water act as surfactants and cause formation of emulsions. For that reason, it is necessary to use centrifuge glassware rather than separatory funnels for the extraction.

An initial "screening" of the wash water for PCB may be done according to the procedure for reagent. If the PCB concentration is below the detection limit for that procedure, it is necessary to extract a larger sample and/or concentrate the extract.

About 20 g of wash water is accurately weighed into a 40 mL glass disposable centrifuge tube with a teflon lined screw cap. Recovery surrogate (usually DCB) is added to the sample and mixed in well using the vortex mixer. The sample is extracted with three 5 mL portions of hexane. Each portion of hexane is shaken with the sample for one minute using the vortex mixer and centrifuged at 1500 rpm for three minutes to separate the phases. The hexane layer is pipetted off the top and collected in a 15 mL centrifuge tube. After the third extraction, the hexane volume may be reduced as desired under a gentle stream of purified air and/or brought up to a known volume with fresh hexane. The hexane extract is mixed well, cleaned up with copper and acid, and analyzed for PCB as described for soil extracts.

Soil Source:						
Stack Section	bottom	#230	#120	#60	#35 + cap	Total
Mesh size (um)	NA	63	125	250	500	NA
Empty weights (g)						0
Weights with soil						0
Net soil	0	0	0	0	0	0
g passing		0	0	0	0	
%passing		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
Soil Source:						
Stack Section	bottom	#230	#120	#60	#35 + cap	Total
Mesh size (um)	NA	63	125	250	500	NA
Empty weights (g)						0
Weights with soil						0
Net soil	0	0	0	0	0	0
g passing		0	0	0	0	
%passing		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
Soil Source:						
Stack Section	bottom	#230	#120	#60	#35 + cap	Total
Mesh size (um)	NA	63	125	250	500	NA
Empty weights (g)						0
Weights with soil						0
Net soil	0	0	0	0	0	0
g passing		0	0	0	0	
%passing		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
Soil Source:						
Stack Section	bottom	#230	#120	#60	#35 + cap	Total
Mesh size (um)	NA	63	125	250	500	NA
Empty weights (g)						0
Weights with soil						0
Net soil	0	0	0	0	0	0
g passing		0	0	0	0	
%passing		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	

Procedure for Percent Moisture

Percent moisture data are important for calculating soil recoveries and for setting all analytical data to a fixed base.

Weigh an empty container (beaker or dish) on the lab balance. Add 10 - 100 g of soil "as received" (depending on how much dry soil you will need). Re-weigh and subtract the weight of the empty container to obtain the wet weight of the soil. Record all weights in the lab notebook.

> **If the soil contains flammable organic liquids (such as gasoline or methanol), these must be removed using the vacuum desiccator before oven drying.** Place the container in the desiccator and connect the side tube to a cold trap connected to the vacuum pump. Set the needle valves of the pump for minimum vacuum. Turn the pump on and increase the vacuum slowly to avoid boiling the sample. Leave the sample in the dessicator with the pump on maximum for at least two hours.

Place the container in the drying oven (set at 95-100°C) until the soil appears dry. Transfer the container to a desiccator, allow it to cool to room temperature and re-weigh it. Return the container to the oven for another hour, cool and weigh again. When two consecutive weights agree, then the soil is dry. Subtract the weight of the empty container to obtain the dry weight of the soil.

Calculate percent moisture as follows and record it in the notebook:

$$\%\text{Moisture} = \frac{100 \times (\text{wet weight} - \text{dry weight})}{\text{wet weight}}$$

NOTE: wet weight = soil as received

Procedure for Checking KOH Absorption Capacity

The objective of this test is to determine whether a soil will absorb KOH from the KPEG reagent and to quantify the amount absorbed. If KOH is absorbed by the soil, additional KOH will be needed to drive the dechlorination reaction.

Accurately weigh about 10 g of dry, untreated soil into a 24 mL vial. (Weigh the vial with its cap, record the weight, add soil, re-weigh, record, subtract and record the soil weight.) Add 10 mL of 45 % KOH to the vial using a measuring pipette. Shake vigorously to mix and place the vial in GRC's ultrasonic bath. Prepare a blank by pipetting 10 mL of 45 % KOH into an empty vial. Because reactions between soil and KOH are very slow, it is necessary to agitate the soil samples overnight.

The next morning, shake the samples one more time and centrifuge the vials at about 1500 rpm for 3 minutes to settle the soil particles. Pipette 0.5 mL of the liquid into a beaker or conical flask containing about 50 mL of deionized water. Add three drops of phenolphthalein indicator to the solution and titrate with 0.1 N hydrochloric acid until the pink color is discharged.

The KOH absorption capacity (KAC) is calculated as follows:

$$\text{KAC (mg/g)} = \frac{0.1 \times (\text{blank mL} - \text{sample mL}) \times 56 \times 10 \text{ mL}_{\text{equilibrated}}}{\text{g sample} \times 0.5 \text{ mL}_{\text{titrated}}}$$

Record the soil weight, the volume and concentration of KOH solution, the volume taken for titration, the volume and concentration of the acid used, and the result of the KAC calculation in the lab notebook or use the KAC spreadsheet.

Procedure for Rough Particle Size Distribution Analysis

Particle size distribution affects the mixing characteristics of soils as well as their filtering or centrifuging needs.

Weigh each section of the sieve stack and the entire assembled stack on the lab balance. Spoon 30 - 50 g of dry untreated soil into the top of the stack and re-weigh the stack to obtain the soil weight. Shake the stack in a circular motion with slapping of the side for 15 minutes. Dis-assemble the stack carefully to avoid spilling soil and re-weigh each section, recording the weights. Calculate data points for a distribution curve using a table like the one below. Make such a table in the lab notebook. Artificial data are used in the table below to illustrate the calculations.

Stack Section	bottom	#230	#120	#60	#35 + cap	Total
Mesh size (μm)	NA	63	125	250	500	NA
Empty weights (g)	20	40	40	40	50	190
Weights with soil	25	46	47	52	60	230
Net soil	5	6	7	12	10	40
g passing		5	11	18	30	
%passing		13%	28%	45%	75%	

The spreadsheet program "PSDcalc" has been created to speed up these calculations and provide a permanent record suitable for pasting into the lab notebook. A copy of a blank page of "PSDcalc" is attached.

Analytical Method for KOH Titrations

Between .5 - 5 grams of sample is weighed into an erlenmeyer flask. If the sample is opaque, it may be diluted with distilled or deionized water. A few drops of phenolphthalein indicator are added. The sample is titrated with acid solution (usually .1N Hydrochloric) until the pink color is discharged. If the sample is highly colored, a pH meter may be used to monitor the titration and the sample is titrated to a pH of 8.2. For a soil sample, 10 grams of soil is allowed to sonicate with 10 grams of water over night. About 1 gram of the aqueous solution is titrated (as detailed above). The concentration of KOH in the sample is calculated as follows.

mg KOH/g sample = mL titrant x titrant normality x 56 / sample weight (g).

Analytical Method for PEG, TMH, and DMSO

HPLC Set-up

Any HPLC system equivalent to the following may be used, provided that its performance is checked.

Mainframe: Hewlett Packard 1050
Mobile Phase: 10% methanol in HPLC grade water (isocratic)
Flow rate: 2 mL/min, Max Pressure set at 400 bar
Guard Column: 7 cm x 2 mm ID stainless steel packed with 37-53 µm silica gel (Whatman 4390-411 or equivalent) frits and packing changed when pressure exceeds 300 bar.
Analytical column: 25 cm x 4.6 mm ID stainless steel packed with 10 µm silica gel (Whatman 4216-001 or equivalent)
Detector: Hewlett Packard 1047A refractive index detector, set at 30°C
Integrator: Hewlett Packard 3396A, atten: 2^6, area reject: 10000, peak width: 0.10, Threshold 3, chart speed: 1 cm/min, zero at 10% of full scale, Mode: peak height, Events: baseline hold 0.5 min, baseline next valley after PEG A peak, baseline all valleys after PEG B peak, stop at 20 min.

Turn the detector power on and allow it to warm up for two hours (total) before injecting samples. During this time, purge the mobile phase with helium for 15 minutes to remove traces of air, turn on mainframe power, allow the instrument to go through its self test program and pump mobile phase through the columns for 30 minutes to assure good equilibration. During column equilibration, the switching valve on the RI detector should be in the "flush" position. Deactivate "flush", wait at least one minute, then press "INT" to check the balance between the sample detector and the blank (mobil phase) detector. If the reading is not zero, press "balance".

Sample Preparation for Liquid Samples

Mix the samples well. Weigh 1-2 g of reagent or 5-6 g of wash water into a 15 mL graduated centrifuge tube with a teflon lined screw cap. Record the sample weight in your notebook. Add deionized water to the reagent samples so that the volume is 5-6 mL and mix on the vortex mixer. Bring the pH to <8 by dropwise addition of 25% sulfuric acid, using Hydrion paper to check the pH. Bring the sample volume up to 10 mL with deionized water. Mix on the vortex mixer. Record the solution volume (10 mL) in your notebook. The pH adjustment may produce copious quantities of precipitate. Use the centrifuge to settle the precipitate and filter about 1.5 mL of the liquid using a filter syringe (Lid-X/AQOR .45 or equivalent).

Sample Preparation for Soil or Other Solid Samples

Mix the samples well. Weigh 2-3 g of sample into an 8 mL vial with a teflon lined screw cap. Record the sample weight in your notebook. Add 2 mL of deionized water to the sample and mix on the vortex mixer. Bring the pH to

<7 by dropwise addition of concentrated sulfuric acid, using Hydrion paper to check the pH. Cap and vortex for 5-10 seconds and loosen cap with caution in case of pressure buildup or effervescence. Let stand for 10-15 minutes to allow solids to react with the acid and re-check the pH. Extract the sample three times with methanol. For each extraction, add 3 mL of methanol to the 8 mL vial from a Repipet®, mix on the vortex mixer for two minutes (make sure all sediment is stirred up from the bottom of the vial), centrifuge for two minutes or until the liquid layer is clear, and transfer the liquid layer to a 15 mL centrifuge tube.

After the third portion of methanol has been added to the centrifuge tube, reduce the volume to less than 2 mL under a gentle stream of air or nitrogen. The volume reduction can be speeded up by placing the centrifuge tube in warm (about 60°C) water. Cap and vortex the centrifuge tube occasionally during volume reduction to assure that all the methanol is exposed to evaporation. It is very important that all of the methanol be removed during the volume reduction. Verify that the pH is still <7 and adjust the final volume to 3-5 mL with deionized water. Record the solution volume in your notebook. Vortex for 5-10 seconds and centrifuge for 1-2 minutes to remove any sediment. Filter about 1.5 mL of the liquid using a filter syringe (Lid-X/AQOR .45 or equivalent).

Standard Preparation

Use disposable pipettes to measure the desired quantities of the analytes you need into 10 mL volumetric flasks and bring them up to the mark with deionized water. The following table lists volumes of analytes and the concentrations they will produce in the volumetric flasks. It is recommended that the mixed standard be kept in the 1:1:2 PEG:TMH:DMSO ratio anticipated for the samples. That way any cross interference will be cancelled out. Filter about 1.5 mL of the each standard using a filter syringe (Lid-X/AQOR .45 or equivalent).

Table of Concentrations for Standards in 10 mL Flasks

	Standard #0		Standard #1		Standard #2		#3
Analyte[1]	µL used	mg/mL	µL used	mg/mL	µL used	mg/mL	mg/mL
PEG	200	22.5	100	11.25	50	5.625	1.13
TMH	200	21.08	100	10.54	50	5.27	1.05
DMSO	400	44.04	200	22.02	100	11.01	2.20

*listed in reverse order of elution from HPLC
**standard #3 is a 1/10 dilution of standard #1
This table assumes that analytes are at room temp (25°C)

Inject samples and standards into the HPLC. Adjust the injection volume as desired. Standard #0 is concentrated enough for the DMSO peak to exceed the working range of the detector if 10 µL are injected. Inject only 5 µL of standard #0. Write the injection volume and the sample identification number or standard identification number on the chromatogram. If a sample produces a peak area higher than that of the most concentrated standard, it is necessary to use a smaller injection volume. If that doesn't bring the peak area low enough, dilute the sample. Use a 1 mL disposable pipette to measure 0.5 or 1 mL of sample solution into a 10 mL test tube and bring the volume up to 3-10 mL as desired. Record all dilution volumes in your notebook.

Data Reduction

A copy of a standard chromatogram with peaks marked is attached to this method. DMSO produce only one peak each. TMH produces 2 peaks, but only the largest one is used for quantitation. PEG produces a series of peaks. The heights of the four largest peaks are summed and used for quantitation. These four peaks are marked in the chromatogram attached to this method.

The number of micrograms of analyte "i" in an injection is calculated from the concentration of that analyte in the standard and the injection volume as follows. (Remember that mg/mL = ug/uL)

$$ug_{is} = C_{is} \cdot V_{js}$$

where ug_{is} = the micrograms of analyte "i" in standard injection
C_{is} = the concentration of "i" in the standard (in mg/mL)
V_{is} = the injection volume for the standard.

The micrograms of analyte "i" in a sample injection is calculated by linear interpolation between standards of higher and lower concentration. The equation for this calculation

$$ug_{ix} = ug_{ih} - [(H_{ih}-H_{il})(ug_{ih}-ug_{il})/(H_{ih}-H_{ix})]$$

where i refers to a peak name,
x refers to the sample,
h refers to the higher standard,
l refers to the lower standard, and
H is a peak height.

The peaks generated in this method are broad and the integrator baseline correction is not consistent. Therefore integrated peak areas vary randomly and produce inconsistent results. Peak height was found to produce more reliable results. Therefore peak height is used instead of peak area for this analysis. Since peak height is a function of the voltage difference between the "zero" voltage and the voltage at the tip of the peak, it is very important that the detector "zero" be checked frequently throughout the day and adjusted as required.

The concentration of analyte "i" in the reagent is calculated from the micrograms in the injection, the sample injection volume, the sample solution volume (usually 10 mL), and the sample weight. It is most useful to report concentrations in mg analyte per gram of reagent or wash water. The equation for that is given below.

$$\text{"i"} \ (mg/g) = (ug_{ix} * V)/(V_{jx} * W)$$

where V is the sample solution volume in mL (usually 10 mL)
V_{jx} is the sample injection volume and
W is the sample weight in grams.

A spreadsheet program which does these calculations automatically has been developed using Microsoft Excel. The program is quite similar to the Webb McCall spreadsheet used to calculate PCB concentrations in soil samples. A copy of the first page of a blank calculation file is attached.

GALSON REMEDIATION CORPORATION
Appendix 2: Mass Balance Sheets

February 11, 1991

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	A	B	C	D	E	F
1	**MASS BALANCE: LABORATORY DECHLORINATION REACTION FOR Reynolds soil**					
2	Reaction 5, 100% Loading, 2x KOH					
3	**Inputs**	grams	**Outputs**	grams		
4	Untreated Soil	506.80	Treated Soil	540.91		
5	PEG	84.80	Reagent	372.20		
6	TMH	78.70				
7	DMSO	177.80	Slurry samps	43.44		
8	45% KOH	336.70				
9	Wash 1	485.60	Wash 1	464.50		
10	Wash 2	485.10	Wash 2	533.10		
11	Wash 3	379.07	Wash 3	375.70		
12	Wash 4	485.40	Wash 4	468.90		
13	Wash 5	485.10	Wash 5	453.30		
14	20% H2SO4 added	106.33				
15	replace cond.	220.00	condensate	214.40		
16	Total Inputs	3831.40	Total Outputs	3466.45		
17					% recovery =	90.47
18	SOIL	INPUT	FINAL			
19	total mass	506.80	540.91			
20	% moisture	16.00	36.00			
21	dry mass	425.71	346.18			
22	% Recovery, dry basis		81.32			
23						
24	REAGENT INPUT					
25	component	PEG	TMH	DMSO	KOH	
26	Dry mass used	84.80	78.70	177.80	151.52	
27						
28	CONDENSATE OUTPUT		SAMPLE # 901030082512			
29	total mass	214.40				
30	mg/g	0.00	0.00	23.46		
31	mass found	0.00	0.00	5.03	0.00	
32	% recovery	0.00	0.00	2.83	0.00	
33						
34	REAGENT OUTPUT		SAMPLE # 901030091017			
35	total mass	372.20				
36	mg/g	204.84	179.12	269.90	48.22	
37	mass found	76.24	66.67	100.46	17.95	
38	% recovery	89.91	84.71	56.50	11.85	
39						
40	WASH 1 OUTPUT		SAMPLE # 901030111017			
41	total mass	464.50				
42	mg/g	51.23	42.81	61.62	99.55	
43	mass found	23.80	19.89	28.62	46.24	
44	% recovery	28.06	25.27	16.10	30.52	
45						
46	WASH 2 OUTPUT		SAMPLE # 901030140517			
47	total mass	533.10				
48	mg/g	19.37	13.12	23.15	44.62	
49	mass found	10.33	6.99	12.34	23.79	
50	% recovery	12.18	8.89	6.94	15.70	
51						
52	WASH 3 OUTPUT		SAMPLE # 901030163017			
53	total mass	375.70				
54	mg/g	0.00	6.66	8.03		
55	mass found	0.00	2.50	3.02	0.00	
56	% recovery	0.00	3.18	1.70	0.00	
57						
58	WASH 4 OUTPUT		SAMPLE # 901030181017			
59	total mass	468.90				

	A	B	C	D	E	F
60	mg/g	0.00	1.97	3.13		
61	mass found	0.00	0.92	1.47	0.00	
62	% recovery	0.00	1.17	0.83	0.00	
63						
64	WASH 5 OUTPUT		SAMPLE # 901031084517			
65	total mass	453.30				
66	mg/g	0.00	1.02	1.38		
67	mass found	0.00	0.46	0.63	0.00	
68	% recovery	0.00	0.59	0.35	0.00	
69						
70	FINAL SOIL OUTPUT		SAMPLE # 901031085017			
71	total mass	540.91				
72	mg/g	0.00	1.25	1.17		
73	mass found	0.00	0.68	0.63	0.00	
74	% recovery	0.00	0.86	0.36	0.00	
75						
76	**Total %R**	**130.15**	**124.67**	**85.60**	**58.06**	

	A	B	C	D	E	F
1	MASS BALANCE: LABORATORY DECHLORINATION REACTION FOR Reynolds Soil					
2	Reaction 6, 100% Loading, 3X KOH					
3	Inputs	grams	Outputs	grams		
4	Untreated Soil	500.40	Treated Soil	509.60		
5	PEG	85.70	Reagent	407.30		
6	TMH	35.00				
7	DMSO	166.50	Slurry samps	46.51		
8	45% KOH	507.60				
9	Wash 1	482.80	Wash 1	543.70		
10	Wash 2	479.70	Wash 2	497.00		
11	Wash 3 -water					
12	Wash 3 -acid	161.16	Wash 3	186.20		
13	Wash 4	485.89	Wash 4	542.50		
14	Wash 5	488.10	Wash 5	492.20		
15	replace cond.	208.00	condensate	209.61		
16	Total Inputs	3650.85	Total Outputs	3434.62		
17					% recovery =	94.08
18	SOIL	INPUT	FINAL			
19	total mass	500.40	509.60			
20	% moisture	14.50	17.10			
21	dry mass	427.84	422.46			
22	% Recovery, dry basis		98.74			
23						
24	REAGENT INPUT					
25	component	PEG	TMH	DMSO	KOH	
26	Dry mass used	85.70	85.00	166.50	228.42	
27						
28	CONDENSATE OUTPUT		SAMPLE # 901101090012			
29	total mass	209.61				
30	mg/g	0.00	0.00	25.14		
31	mass found	0.00	0.00	5.27	0.00	
32	% recovery	0.00	0.00	3.16	0.00	
33						
34	REAGENT OUTPUT		SAMPLE # 901101091512			
35	total mass	407.30				
36	mg/g	245.62	214.29	277.32	48.25	
37	mass found	100.04	87.28	112.95	19.65	
38	% recovery	116.73	102.68	67.84	8.60	
39						
40	WASH 1 OUTPUT		SAMPLE # 901101110017			
41	total mass	543.70				
42	mg/g	38.50	27.67	36.44	151.16	
43	mass found	20.93	15.04	19.81	82.19	
44	% recovery	24.43	17.70	11.90	35.98	
45						
46	WASH 2 OUTPUT		SAMPLE # 901101123012			
47	total mass	497.00				
48	mg/g	14.92	14.73	14.86	70.18	
49	mass found	7.42	7.32	7.39	34.88	
50	% recovery	8.65	8.61	4.44	15.27	
51						
52	WASH 3 OUTPUT		SAMPLE # 901101162012			
53	total mass	186.20				
54	mg/g	0.00	5.97	6.53		
55	mass found	0.00	1.11	1.22	0.00	
56	% recovery	0.00	1.31	0.73	0.00	
57						
58	WASH 4 OUTPUT		SAMPLE # 901101185012			
59	total mass	542.50				

	A	B	C	D	E	F
60	mg/g	0.00	2.14	2.95		
61	mass found	0.00	1.16	1.60	0.00	
62	% recovery	0.00	1.37	0.96	0.00	
63						
64	WASH 5 OUTPUT		SAMPLE # 901102091512			
65	total mass	492.20				
66	mg/g	0.00	1.16	1.52		
67	mass found	0.00	0.57	0.75	0.00	
68	% recovery	0.00	0.67	0.45	0.00	
69						
70	FINAL SOIL OUTPUT		SAMPLE # 901102092017			
71	total mass	509.60				
72	mg/g	0.00	0.00	1.00		
73	mass found	0.00	0.00	0.51	0.00	
74	% recovery	0.00	0.00	0.31	0.00	
75						
76	**Total %R**	**149.81**	**132.34**	**89.79**	**59.85**	

GALSON REMEDIATION CORPORATION
Appendix 3: Outside Laboratory Results

NOTE: See text page 12.

February 11, 1991

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GALSON REMEDIATION CORPORATION
Appendix 4: Cost Estimate

February 11, 1991

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Treatment of the Reynolds Site: Cost Estimates for Galson's APEG-PLUS™ Treatment System

Galson Remediation Corporation (GRC) has completed a treatability study on soil from the Reynolds Metals site (Reynolds) in Massena, New York. Based on the results of that treatability study and GRC's site visit, GRC is pleased to submit the following cost proposal to remediate this site according to the terms set out in this estimate.

Woodward-Clyde Consultants (WCC) asked GRC to provide a cost estimate of full-scale site cleanup. Primary assumptions include:

1) site waste and cleanup standards as shown in Table 1;

2) an average soil moisture of 15 to 25 per cent;

3) a total volume of 37,200 cubic yards. Of that total, an estimated 2100 cubic yards are "high PCB concentration" soils from the site. Costs estimated here may vary if the percentage of oversized material (currently estimated at 25 per cent of the total site) changes substantially.

4) a soil density of approximately 1.5 (or 3,000 pounds per cubic yard of soil). At this density, the total quantity of wet tons for the project was estimated at approximately 56,000.

This cost estimate assumes that GRC would provide fuel and electricity required to conduct the clean up. The cost is based on a minimum 10-hour cycle time, a minimum 100 per cent loading of reagent materials, and replacement with 100 per cent potassium hydroxide (KOH) on a wet basis.

Table 1. Reynolds Site Contaminants

Constituent	Concentration Before APEG-PLUS	Concentration After APEG-PLUS	Clean Levels
PCBs			
-- Low PCB Concent.	44 ppm	<2 ppm	<2 ppm
-- High PCB Concent.	17,000 ppm	30 ppm	<2 ppm

As noted in the treatability study itself, the failure to achieve the <2 ppm clean level for the high PCB concentration soil proved to be the most challenging for the GRC laboratory. Given the timing of the study and the deadlines the staff was under, we were not able to pursue destruction of the PCBs in this sample to the extent we would have liked. We do request, and have discussed with Mr. Peter Jacobson from Woodward-Clyde Consultants, that GRC receive a sample of the high PCB concentration soil from the Reynolds site when GRC's TSCA Commercial Storer Permit is in place so that we may continue our efforts to reduce the samples to the clean level. This additional effort would, of course, be at the expense of GRC. We hope that our Commercial Storer Permit is in place very soon.

Based on the successful portion of the treatability study -- the low PCB concentration soils -- GRC was able to develop the costs in Table 1. As with any remediation technology, cleanup costs would be refined during the pilot study phase, when a much larger body of data is gathered. In addition, since the initial treatability study was completed, GRC has completed its development of a pilot unit, which is beginning operation at our facility in Syracuse. This new pilot unit, planned to be moved to a fixed-base facility (TSD facility) in the next year, would have the capability of reviewing options for cleanup steps not available during the treatability study phase. For example, we are evaluating the pretreatment option of soil washing or solvent extraction (using reagent) in order to reduce the quantity of materials to be treated for another client, and we would expect to develop pertinent data for other pilots from the data generated.

Based on the results of the treatability study alone, the cost for destroying the contaminants at the Reynolds site, noted in Table 1, is estimated to be $450 per wet ton in full scale. This cost is estimated to be accurate only within ±50 per cent, based solely on the results of the treatability study conducted at the site. This cost includes:

- mobilization and demobilization;
- full cost for on-site operations, including items such as utilities, reagent costs, labor, overhead;
- an approximate 12- to 18-month project time;
- equipment set up (excluding site development such as a building or a concrete pad);

A rough breakdown of what some of these costs include is shown below:

ITEM	UNIT	COST/UNIT
Chemicals		
dimethyl sulfoxide	lbs.	$1.25
polyethylene glycol (400)	lbs.	$0.95
TMH (a Dowanol product)	lbs.	$0.95
potassium hydroxide	lbs.	$0.16
Fuel Oil	gal.	$1.25
Utilities		
Electrical service	kwh	$0.10
Water	gal.	$0.001

These unit costs will also vary according to quantity used; there is an understandly large incremental discrepancy between pilot- and full-scale jobs. The client is sometimes able to realize a cost savings by buying these materials at a lower (wholesale) cost.

Aside from full-scale costs, costs for pilot-scale units would depend on the type of pilot -- that is, the extent of precision -- required by the project, and on the size of the actual pilot chosen. These options will be outlined for you in the pilot proposal.

Site Preparation

The cost includes reasonable site preparation costs based on GRC's current knowledge of the site conditions. In the event that extraordinary costs, such as the need to build a concrete pad, are required, GRC will develop proposals for the least-cost solution for the client.

The equipment used in the APEG-PLUS™ treatment system for a site of this size will consist of a pretreatment (preslurry) system for materials handling, four or five reactor tank trailers (each transported on two trailers and assembled at the site), at least two centrifuge trailers, one boiler trailer, one wash tank trailer, one reagent recovery trailer (transported on three trailers and assembled at the site), a field operations control/electrical trailer, one personnel decontamination/change trailer, and the mobile laboratory. Auxiliary equipment (spare parts, piping, etc.) will be hauled on separate trailers.

Staffing

GRC staff at the site will consist of a site manager, shift managers, field technicians, laboratory chemists, a health and safety officer, and a preslurry system operator, at a minimum. The treatment system will run 24 hours a day, 7 days a week; estimated shut-down time for maintenance is 30 per cent.

GRC management staff will oversee all operation of the APEG-PLUS™ treatment system. Supervision of staff for other vendors at the site (excavators, construction workers, etc.) is the responsibility of the prime contractor or client at the site.

Operations at the job in both pilot and full-scale cleanup will follow the procedures outlined in the Responses to Comments, submitted to Woodward-Clyde Consultants on December 12, 1990, as the response to Items 1 and 6.

The disposal of the spent reagent costs about $1 per pound, which is figured into the overall cost for the project. The spent reagent is incinerated as "hazardous waste."

Potential Cost Reductions through Field Demonstration (Pilot) Analysis

As noted above, $450/wet ton is estimated to be accurate within a roughly 50 per cent margin of error allowed, based on laboratory analyses and results. It has been the experience of GRC that, as the size of the project scales up from laboratory to pilot and finally to full scale, the costs will be reduced. To evaluate these potential cost reductions, GRC recommends pilot field demonstration at the site. Listed below are some areas where costs may be reduced.

- Using a mixture of KOH and NaOH (instead of KOH alone), which reduces the reagent costs overall;
- reducing the KOH consumption through other methods of washing; and
- increasing the amount of soil put into each reactor.

Other factors that could affect the prices include:

- cost of electricity,
- cost of fuel oil, and
- costs of chemicals.

For example, the cost for maintenance of equipment at the site has been estimated conservatively and is likely to be reduced. The cost estimate given in this report does not include obtaining, preparing, or submitting permits that may be required before the cleanup could take place, nor negotiating for solid waste disposal with vendors. Further details of operation and maintenance of the APEG-PLUS™ treatment system will be offered when a proposal for the full-scale cleanup is prepared, or sooner on request by the client.

December 12, 1990 R00011

GALSON REMEDIATION CORPORATION'S
Response to Comments
Treatability Study on Soils at the
Reynolds Plant, Massena, New York

Presented to
Woodward-Clyde Consultants
Plymouth Meeting, Pennsylvania

Galson
Remediation Corp.

Galson
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Galson Remediation Corporation
6627 Joy Road
E Syracuse, NY 13057
Tel (315) 463-5160
1-800-PCBS-123
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December 12, 1990

Mr. Peter Jacobson
Woodward-Clyde Consultants
5120 Butler Pike
Plymouth Meeting, PA 19462

SUBJECT: Response to WCC Comments Dated 12/4/90
APEG-PLUS™ Treatability Study--Reynolds Massena
GRC Job #R00011

Dear Peter:

Thank you again for hosting Edwina and me in your offices. The meeting we shared was productive, and allowed us a chance to finally meet face to face rather than over the phone. We've worked diligently toward responding to the questions presented to us by your group. We were impressed by the obvious quality in your staff, and the questions and concerns raised in the meeting and in your letter reflect that quality.

I hope that the attached responses will provide you with the information needed to continue investigation of GRC's APEG-PLUS™ system. We anticipate FAXing a copy of the final report to you tomorrow (followed by a hard copy to you in overnight FedEx). The cost estimate for full scale will be forwarded to you as a part of that final report. As always, don't hesitate to call and discuss points as you deem necessary. I will await your call to determine if a meeting with Dale DeLisle is warranted.

Best wishes,

Sharleen Pendergrass

A. Sharleen Pendergrass
Client Services Manager

c: E. Milicic, Laboratory Director, GRC
R. Tavelli, President, GRC
R. Dionne, Field Operations Manager, GRC

RESPONSE TO COMMENTS, WOODWARD-CLYDE CONSULTANTS' SUBMITTAL DATED DECEMBER 4, 1990

1) Provide conceptual process flow diagrams, complete with major equipment descriptions and material balance for all the system components.

Please see the attached drawing and material balance. These data are presented based on actual work GRC is conducting for a confidential client. Obviously, aspects of the material balance would change from site to site. A process flow, layout, capacity, and time-to-complete schedule specific to the Reynolds site will all depend on the outcome of the pilot-scale study, which should be conducted at the site.

Process Description

GRC's process uses a mobile, modular decontamination unit capable of processing approximately 20-200 tons of material per day.

Soil Preparation

Contaminated soil is removed from a stockpile (generally supplied by the prime contractor), screened to less than six inches, and sent through a shredder. After this initial screening, it is loaded onto a covered weighing conveyor, and is conveyed into a mobile west slurry mixer. A quantity of reagent appropriate to the site is added to the mixer, and the soil and reagents are mixed into a workable slurry. Once mixed, the slurry is passed through a series of screens. Material greater than one-quarter inch is separated out for rock washing. The slurry, screened to less than one-quarter inch, is pumped to the reactors, and the reactor is closed.

Reaction

Once loaded into the reactors, the soil/reagent mixture is heated and agitated until contamination has been reduced to required levels. A slight vacuum is maintained on the vessel to prevent contaminants from escaping the reactor. Slurry samples for analysis are taken by a remote automatic auger device directly from the reactor vessel during the reaction to determine when the clean level has been reached. The samples are analyzed for contamination at the on-site laboratory.

Steam emitting from the reactor is condensed and any "light ends" or "heavy ends" are separated out of the condensate. Recovered water is cycled back into the system to be used as wash water. Any condensable materials or volatiles are removed and treated.

Major pieces of equipment used in the reaction process include:

- Two ASME-code reactor vessels with an approximate capacity of 3,030 gallons each. Both are rated for full vacuum and 40 psig. Both vessels have hot oil jackets for heating.
- Agitators, one in each reactor vessel.
- A vacuum pump to maintain a slight vacuum on the reactor and the condenser. Tube and shell heat exchangers to condense steam from each reactor.
- Hot well tank and condensate transfer pump for each condenser.
- One condensate treatment tank for both condenser systems. This tank is located off the trailer.
- Electrical and PLC control panels containing breakers and PLC interface specific to the reactor trailer.

Separation/Reagent Removal

When the reaction is complete and it has been verified that contamination has been reduced to the acceptable "clean level" for a particular site, the reagent must be separated from the soil. The soil/slurry is pumped out of the reactor into the centrifuge where liquids (reagent and water) are removed from the soil.

The chemicals used in the reaction process are water soluble. Further removal of these reagents from the soil is accomplished by washing the soil with water. After initial separation of the liquids, the soil is reslurried with wash water and sent to a slurry tank for holding and mixing. The slurry is then re-centrifuged to remove the dilute reagents. This process is repeated until reagent concentration in the soil is reduced to acceptable levels. During one of the wash passes, the soil is neutralized to a prescribed pH by adding an appropriate quantity of acid to the wash water.

Major pieces of equipment utilized in the centrifugation process include:

- Two Bird 39 x 96 horizontal solid bowl decanter centrifuges with a G force of approximately 400 Gs. Each centrifuge is trailer mounted.
- A slurry tank with an appropriately sized mixer.
- Conveyors to remove soil from the solids end of the centrifuges and to discharge clean soil from the process.
- Electrical and PLC control panels containing breakers and PLC interface specific to the centrifuge trailers.

Reagent Recovery

The reagents used in the process are recycled for use in subsequent batches. For the reagent to be effective, water added during treatment must be removed. Dilute reagent removed in the separation process is sent to the reagent recovery system. An evaporator system is used to concentrate the reagent to concentration levels based on project specifications. Refortification of the reagent will be necessary when reagent (especially KOH) is absorbed by soil components or neutralized. Makeup reagent is added to restore the reagent to appropriate concentrations.

Steam generated from the evaporation process is condensed and recycled as wash water. Any volatiles are pulled off and treated by appropriate means -- perhaps off-site disposal, bioremediation, or solidification.

Major pieces of equipment utilized in the reagent recovery process include:

- A triple effect evaporator.
- Associated heat exchangers, distillation columns and pumps.

- Tanks for dilute reagent storage and condensate storage.
- Electrical and PLC control panels containing breakers and PLC interface specific to the reagent recovery trailer.

Volatiles and Condensate Treatment

Site-specific design of this system is currently under development. One possibility is to treat the emissions with dry carbon and treat oils and heavy materials by a standard separation process.

Clean Soil

Decontaminated soil is discharged from the centrifuge onto a conveyor and stockpiled according to specifications of the site. In all cases processed soil will be stored separately from contaminated material.

Support Equipment

Heating

Reaction and reagent separation both require a heat supply. Heat is generated by a fuel oil-fired hot oil boiler located on the boiler trailer. The boiler is rated at 10 million British thermal unit (Btu) output and heats a special heat transfer fluid (HTF). The HTF is pumped through a distribution system to the jackets of the reactors and the primary heat exchanger in the reagent recovery system. When the HTF is not being used for heating, it is recirculated from the main supply valve back to an expansion tank. The boiler unit temperature controller monitors and maintains a constant HTF temperature.

Cooling

The reagent recovery process requires a cooling system for condensing steam and cooling the condensate. The glycol cooling system circulates a mixture of water and ethylene glycol through a series of heat exchangers and air coolers. Appropriate temperature is maintained by controlling the flow of coolant through air coolers.

The "cooling" system is designed to fill a dual purpose. Since normal operating temperature of the coolant is higher than the freezing points of water and the reagents, the waste heat in the "coolant" can be used to keep these liquids from freezing during winter operations. The tanks on the tank trailer are jacketed for this purpose.

Electrical/Control

Electrical supply is distributed through a mobile electrical substation. The substation has a capacity of 6000 amps at 480 volt, three-phase power. It is capable of distributing variable voltage and amperage levels to supply various equipment power requirements.

The same trailer contains the control room. This room is the center of operations and contains the programmable logic controller (PLC) controls, communications controls, and video surveillance equipment. Through the PLC, the control room operator can regulate the process equipment, monitor the status of the process, and respond to alarm situations. From this station the operator can also communicate with field personnel via two-way radio and visually monitor operations through the video surveillance equipment. The control room contains the video display unit and controls for this system.

2) Provide a detailed cost estimate for the conceptual full scale system. In addition to the per-ton cost for soil treatment, the cost estimate should include:

- equipment costs
- reagent costs
- labor costs
- operation and maintenance costs
- residual disposal costs
- utility costs

The cost to conduct full-scale treatment at the Reynolds site will vary, depending on the results of two phases of work yet to be completed: 1) further analyses must be conducted on an additional sample of soil from the site, and 2) a pilot-scale study must be completed. With these two phases complete, GRC will be able to offer to Reynolds and WCC a relatively accurate cost estimate for full-scale treatment.

GRC will assume that a eight- to ten-reactor (12- to 18-month treatment time) system, using a slurry feed preparation system with multiple centrifuges, will be appropriate for the full-scale cleanup of the Reynolds site, based on data provided during the treatability study. A final detailed description of the process can be developed after the application of treatability study parameters to pilot scale work. At pilot scale, GRC will be able to determine what changes in the system are appropriate for further "scale up."

Please refer to the Draft Final Report for the Treatability Study, submitted to Woodward-Clyde Consultants on December 12, 1990.

3) Provide a thorough description of the oversize material treatment system. Cite similar applications which can demonstrate the effectiveness of this system.

Oversize Treatment System Description

Shredder. A commercially available shredder with sloped grate mounted above the shredder will be used to size material to 6 inches and less. The shredder will break up the soil as much as possible. An enclosed conveyor belt including an electronic scale will weigh and deliver the soil to the mixer.

Mixer. The mixer will be a large capacity (20-25 cubic yard) commercially available, trailer mounted, sludge mixer. The mixer will be the rotary drum type with flights inside for auguring the material into and out of the drum. GRC has completed full-scale testing with two commercial concrete mixer trucks of 11 cubic yards nominal capacity. The slurry is much thinner than concrete so these mixers could hold only about three- fourths of the nominal batch capacity.

The full-scale tests were done using a 60% loading of water by weight to GRC's "typical" test soil. This test soil is quite similar to EPA's test soil matrix. GRC's "typical" soil material broke up into small clay balls that represented about 1% by weight larger than 1/4 inch for the total 10-ton batch. The rest of the material mixed and slurried very well and passed through the 1/4-inch screen. A larger capacity mixer will be purchased to hold a full 16- to 20-ton batch of soil and reagent.

The following advantages were determined based on the field tests discussed above:

- as-received soil with clumps measuring as much as 24 inches was effectively broken down except for 1% by weight that formed clay balls;

- material up to the size of a full concrete block was mixed and discharged without any material feed jams;

- a higher quantity of rock in the soil was more effective in breaking up the clay balls; and

- further modifications are available to improve effectiveness based on particular soil matrix.

Vibratory Screen

This unit is commercially available from at least three manufacturers as a standard piece of equipment. This unit will take the material 6 inches and less in size from the mixer and separate it to three streams; 6 to 2 inch, 2 to 1/4 inch, and less than 1/4 inch. The material greater than 1/4 inch will go to the pebble/rock basin and the material less than 1/4 inch will be pumped to the reactor for treatment.

The unit GRC is considering purchasing has 36 inches by 24 inches of surface and can handle a flow rate of 100 gallons per minute of the slurry. This unit will probably include a scraper for cutting vegetative matter off the lower surface of the screen.

Although this unit has not been tested, all three manufacturers have no reservations that this unit will provide excellent performance for this application based on experience for similar applications. This unit is totally enclosed for emissions control and safety reasons.

Pebble/Rock Basin

This piece of equipment will be used to catch all of the material rejected from the vibratory screen. This unit will have spray bars on each side so that the reagent and the fines can be washed off of the rocks and other debris that is rejected from the vibratory screen. The fine material contains most of the contamination; therefore, the rocks and other hard surface debris will be clean once the reagent is removed with the wash water. Based on GRC's prior experience on other hazardous waste sites, we are confident that this technique will work.

If there is a large carry-over of clay balls, the material with the rocks and the clay will be recycled through the mixer to breakup all of the clay material. This recycle may be done with water and/or reagent depending on the material being processed. This will be tested during our full scale testing in early 1991. This unit is currently being designed with the assistance of our material handling consultant. It will be designed to allow maximum enclosure, efficient washing to minimize water quantities, and ease to unload clean material. The last wash water will be analyzed for PCBs or other appropriate contaminants before the oversized material is consider clean.

4) It appears the oil phase inhibited PCB degradation during the lab tests. Cite similar applications to verify the performance of the negative pressure reactor vessel that you suggest may be effective in removing the oil.

Use of vacuum for the specific purpose of removing oil from an APEG-PLUS™ reactor has not been attempted in the past. We have, however, used vacuum (25" Hg) to assist in removal of DMSO from treated soil at 150° C. (The boiling point of DMSO at normal atmospheric pressure is 180°C.) The vacuum distillation experiment was a part of an in-house research project designed to reduce the residual concentrations of reagents in treated soil. (See memo/report dated June 22, 1990, attached.) According to the design engineers for the full-scale APEG-PLUS™ equipment, it will be possible to pull a vacuum of at least 15" Hg on the full-scale reactor once the water has all been removed and the reactor has reached 150°C.

5) Provide a qualitative assessment to describe the final fate of the organics after dechlorination. Also, provide chlorine/chloride balances.

When PCBs are dechlorinated in APEG-PLUS™ treatment, the chlorine is replaced with glycol groups as shown in the reactions below.

$$ROH + KOH \xrightarrow{DMSO} ROK + HOH\uparrow \quad (1)$$

ROH	KOH	DMSO	ROK	HOH
Polyethylene glycol	Potassium Hydroxide	Dimethyl sulfoxide	Potassium polyethylene glycolate	water (distilled out)

(2)

4,4'-dichlorobiphenyl — Potassium polyethlyene glycolate — APEG/PCB Reaction Product (after first substitution) — Potassium chloride

The reactions may be repeated until all of the chlorines are replaced with glycol groups. For the North Yard soils, which have an average PCB concentration of 1100 ppm, treatment of an average ton of soil will produce approximately 11.2 lb of substituted biphenyl reaction product and 1.7 lb of KCl assuming that (a) the dechlorination reaction is 100% efficient, (b) the PCB is in the form of Aroclor 1248, and (c) the glycol groups have an average molecular weight of 336 daltons resulting from a 1:1 mixture of PEG 400 and TMH. The reaction products, both substituted biphenyl and KCL, are expected to leave the treatment system as "salt blowdown" from the reagent recovery system. They will not be removed "dry" but will leave the system as a slurry with the reagent liquids, so that the total weight will be double the weight of products and KCl alone.

Calculating a chlorine/chloride balance on soil is considered impractical because of the relatively high concentrations of salt (sodium chloride) naturally occurring in soil and living systems in general. The statistical variation in the background chloride concentration often exceeds the concentration of organic chlorine in the PCBs contaminating the soil. The results of a chlorine/chloride mass balance would therefore be of questionable validity.

The chlorine/chloride mass balance was quite successful for APEG-PLUS™ treatment of transformer oil (see Table 1). It is important to note that transformer oil does not contain inorganic chlorides. Chloride salts are not soluble in transformer oil. Therefore, it was very easy to find the KCl formed during APEG-PLUS™ treatment in the reagent. Table 1 presents data from a chlorine/chloride mass balance for three batches of transformer oil contaminated with Askarels and treated with a single batch of reagent.

Table 1. Chlorine Mass Balance for a Series of Transformer Oil Reactions

	Average Composition of Askarel	Chlorine in Compound
60%	Aroclor 1260	60%
30%	Trichlorobenzene	59%
10%	Tetrachlorobenzene	66%

Other Useful Information

Oil Specific Gravity	0.88
Liters in a gallon	3.8
kg of Reagent used to treat oil	48.7

Overall Chlorine Input

	BATCH 1	BATCH 2	BATCH 3
Run	70	71	71
Oil (gallons)	40	40	40
ppm total PCB at start of reaction	1080	1080	838
ppm total PCB at end of reaction	5	9	22
g Cl removed from PCB by reaction	86	86	65
g Cl from Trichlorobenzenes*	42	42	32
g cl from Tetrachlorobenzenes*	16	16	12
Total g Cl in run	144	144	109
Total g Cl in all three runs	397		

Overall Chlorine Outputs

Cl in reagent, by titrimetric analysis	0.88%
Total g Cl in reagent used to treat oil	430
Percent of original chlorine found as chloride	108%**

[*Note: We had no analytical data on chlorobenzenes for these samples; therefore, we assumed that PCBs and chlorinated benzenes remain in their original proportions.
**These calculations have an estimated accuracy of ±15 percentage points.]

As we discussed at the meeting, structural analysis of the reaction products from APEG-PLUS™ treatment has been attempted by various analytical methods (GC/MS, HPLC.MS, SCFC/MS) without success. GRC is in the process of obtaining the equipment for total organic chlorine analysis which can be used to determine the concentration of partially dechlorinated PCBs in soil in terms of organic chlorine. As a condition of our TSCA R&D permit, GRC is required to determine the solubility of PCB reaction products so that a suitable extraction solvent can be selected for organic chlorine analysis. Total organic chlorine analysis will be done on the treated soil from the Reynolds lab study as soon as the analytical procedures are developed and checked. We are required to do this analysis on all treated soils from lab studies as a condition of our TSCA R&D permit. PCB reaction products have been subjected to toxicity testing by the EPA and have been found non-toxic, non-mutagenic, and non-bioaccumulative. (See Chemosphere articles in the GRC Information Package.)

6) Provide a thorough description of the reagent recovery system. There is concern that the soluble salts will inhibit the distillation operation.

GRC is also concerned about the build up of soluble salts with continued recovery and refortification of the reagent. However, GRC's concern is focsued on the destruction reaction that occurs in the reactor vessel. GRC is planning to conduct pilot testing in January and February of 1991 and full-scale testing in February and March 1991. Part of the protocol for these tests will be the recycle of reagents using the reactor for pilot scale and the reagent recovery system for full scale.

For the full-scale process, we are planning to remove a slipstream of the recovered reagent. This will occur after the dilute reagent has been concentrated by the reagent recovery system. The quantity of this slipstream will depend on the soil matrix and other soil contaminants being processed by the APEG-PLUS™ system. Based upon the expertise of GRC staff and consultants, we do not believe that the soluble salts will inhibit the distillation process. This opinion will be tested as soon as possible and will be confirmed during our full-scale remediation project for PCBs in 1991. For the Reynolds site, pilot testing will determine the quality and quantity of salt build up specific to the soil matrix.

OVERVIEW

The reagent recovery system is used to separate the reagent and the water that are present in the discharge stream from the centrifuging operation. Typically, the feed stream to this recovery system consists of 6,560 lb/hr of reagent and 23,000 lb/hr of water. A total of 21,000 lb/hr of water is evaporated, collected as condensate, and reused as wash water in the centrifuges. The concentrated reagent stream, consisting of 6,560 lb/hr of reagent and 2,000 lb/hr of water, is also reused in the reactors.

DESIGN PARAMETERS

Primary Heat Source: Hot Oil at 575°F • Heat Rejection: Ambient Air at 85°F

Heat rejection for the entire soils treatment process is accomplished through several air-cooled exchangers and a water/glycol coolant recirculation loop. Design temperature for the water/glycol mixture is 125°F. A coolant loop arrangement, rather than condensing steam directly in the air-cooled exchangers, was chosen to eliminate a number of potential winter freeze-up problems. As a result, the sink temperature for the evaporator and for the reactors should be taken as 125°F.

SYSTEM DESCRIPTION

- triple-effect evaporation;
- forced recirculation in the first effect;
- once-through flow in the second and third effects;
- reflux streams on all three columns;
- reagent flow is from first to second to third effect;
- boiling takes place in all three exchangers;
- condensate is trapped and flashed to the next lower effect;
- all noncondensables are passed through vent condenser HX-15 to reduce the temperature and the saturation component as low as possible before passing the gasses through a carbon filter;
- the discharge streams, both reagent and condensate, are cooled to prevent flashing in the atmospheric storage tanks.

SAFETY CONSIDERATIONS

The process is designed to fail-safe. Loss of power, or loss of control signal, will automatically fail to a "shutdown" condition.

- all high-temperature vessels and piping are insulated for personnel protection.
- all pressure-containing components are designed and built to the ASME Code.
- all normal emissions are controlled, filtered, and monitored.
- retaining dikes are employed around all process equipment to prevent any liquid from escaping to the environment.

ENERGY CONSIDERATIONS

As much as possible, the system stands alone, with minimum dependence on local services. Water will be trucked to the site, and water is recycled 100 percent wherever possible. Recycling also reduces the need to tie in to local sewers. Fuel oil, delivered by truck, is the only source of fuel for the boilers.

An effort has been made to minimize energy consumption, both fuel oil and electricity.

7) Cite similar applications to verify the treatment effectiveness on the levels of PCB contamination listed in Table 1.

GRC has conducted treatability studies and/or pilot studies at several sites in the United States where PCB contamination warranted clean up efforts. Please see the attached table titled "PCB Summary Table." Note that four of the sites mentioned in the table treated PCB concentrations from a high of over 1,000 ppm to a low of 1 to 25 ppm (where 25 ppm was the clean level for the site).

As noted in Table 1 of WCC's December 4 correspondence, 95 percent of the soils in the North Yard are estimated to be at <1000 ppm concentration of PCBs, translated to a quantity of 35,065 cubic yards (or an estimated 52,600 tons). With only 5 percent of the remaining soil above 1000 ppm, we would assume that blending of the hot spot soil would be feasible, considering the 20:1 ratio of relatively low concentration to hot spot soil.

8) Provide chemical characterization data on all treatment residuals along with estimated volumes and management options.

At the end of soil treatment at the Reynolds Site, we would expect the residuals listed in the following table. This table assumes that we will treat 37,200 cubic yards (approxi-mately 56,000 tons) of North Yard soil, using an 8- or 10-reactor system.

Residual	Characterization	Estimated Volume	Management Option
Reagent	10-15% PEG 400, 10-15% Dowanol TMH, 20-30% DMSO, 10-30% potassium salts (neutralized KOH), and water	30,000 gallons (approximately 225 tons), one time, at the end of the project	a. off-site incineration as "PCB material" b. delist and dispose of as a combustible liquid[1]
Distilled Water (distilled from washwater in reagent recovery system)	Water, may be contaminated with traces of volatile organic compounds such as coal tar pitch volatiles, PCBs (<1 ppm), DMSO, and other solvents present at the site.	approximately 675 tons, one time, at the end of the project[2]	carbon treat, verify removal of organic contaminants, then discharge. (This will require a discharge permit.)
Salt blowdown (solids/sludge from reagent recovery system)	approximately 50% reagent (see reagent characterization above), 5-10% KCl, and 30-45% glycol substituted biphenyl	approximately 840 tons (30 lb/ton of soil treated)	a. off-site incineration as "PCB material" b. delist and dispose of as a combustible sludge/solid[1]
Non-aqueous condensate (separated from aqueous condensate before reagent recovery treatment and recycling of the water)	"Oil" (heavier than water) consisting primarily of coal tar pitch volatiles and over 5000 ppm PCBs.	30-60 tons (1-2 lb per ton of soil treated)	off-site incineration as "PCB material"
Carbon from water treatment	Carbon contaminated with whatever was in the distilled water before treatment, but more concentrated	Approximately 7 tons	off-site incineration as hazardous waste/PCB material[1]

[1]GRC does not recommend landfilling as a disposal option because of the continuing potential for liability to the client. If the client wishes to use landfilling as a disposal method for residuals, they must first be "delisted" from PCB status.

[2]The APEG-PLUS™ system is a net consumer of water. Soil enters the system at its ambient moisture content and leaves the system saturated with water. The water is recycled throughout the course of site remediation, but the final batch of water must be disposed of at the end of site operations.

SON REMEDIATION CORPORATION
SITE
TERIAL BALANCE

UNT OF SOIL	7 TONS
NDS OF SOIL	14000 POUNDS
S =	350 PPM

REVIEW DRAFT

	GIVEN	CORRECTED
WATER	25.00%	18.72%
ROCKS	5.00%	3.74%
WOOD	2.00%	1.50%
SILT	58.00%	43.43%
SAND	11.00%	8.24%
CLAY	31.00%	23.21%
VEG	1.00%	0.75%
OIL	0.50%	0.37%
PCB	0.04%	0.03%
TOTAL	133.54%	100.00%

COST OF REAGENT FRESH WATER WASH
GRC - SUMMARY OF CHEMICAL COST FOR THE ITS SITE

REAGENT	COST/ #	INITIAL COST($)	% LOSS PER BATCH	POUND LOSS PER BATCH	POUND LOSS (286 BATCHES)	TOTAL CHEMICAL LOSS (#)	TOTAL COST LOSS ($)	COST PER TON OF SOIL ($/TON)
PEG	$0.95	$2,217	8%	190	54313	54503	$51,778	$26
DMSO	$1.25	$5,833	7%	318	90977	91295	$114,118	$57
TMH	$0.90	$2,100	8%	190	54423	54614	$49,152	$25
KOH @ 45%	$0.16	$747	81%	3773	1079107	1082880	$173,261	$87
TOTAL							$388,310	$194

COST OF REAGENT WITH RECYCLE
GRC - SUMMARY OF CHEMICAL COST FOR THE ITS SITE

REAGENT	COST/ #	INITIAL COST($)	% LOSS PER BATCH	POUND LOSS PER BATCH	POUND LOSS (286 BATCHES)	TOTAL CHEMICAL LOSS (#)	TOTAL COST LOSS ($)	COST PER TON OF SOIL ($/TON)
PEG	$0.95	$2,217	5%	116	33256	35590	$33,811	$17
DMSO	$1.25	$5,833	4%	195	55705	60371	$75,464	$38
TMH	$0.90	$2,100	5%	117	33323	35657	$32,092	$16
KOH @ 45%	$0.16	$747	81%	3758	1073631	1077388	$172,382	$86
TOTAL							$313,748	$157

BASIS: SOIL (TONS): 2000
@7 TON PER BATCH 286 BATCHES

REVIEW DRAFT

WASHING WITH FRESH WATER
FIVE CENTRIFUGES
UNITS ARE # /BATCH

PCB 0.04% 0.03%
TOTAL 133.54% 100.00%

ROCK WASHING SEQUENCE (#2, #2A, #2B); MIXER BALANCE (#3, #4); BALANCE AROUND THE REACTOR (#5–#7A)

STREAM	#1	#2	#2A W.WATER	#2B W.W/CORN	#3	#4	#5	#6	#7	#7A	#8
COMP.											
WATER	2621	52	3984	3984	2569	2566	9119	8571.4	414.8	11923.1	11290.9
ROCKS	524	524	0	0	0	0	0	0.0	0.0	0.0	0.0
WOOD	210	210	0	0	0	0	0	0.0	0.0	0.0	0.0
SILT	6081	122	0	122	5959	0	6081	0.0	6080.8	6080.8	0.0
SAND	1153	23	0	23	1130	0	1153	0.0	1153.3	1153.3	0.0
CLAY	3250	65	0	65	3185	0	3250	0.0	3250.1	3250.1	0.0
VEG	105	105	0	0	0	0	0	0.0	0.0	0.0	0.0
OIL	52	0	0	0	52	0	52	52.4	0.0	0.0	0.0
KOH	0	0	0	0	0	2100	2100	0.0	1890.0	1890.0	0.0
PEG-400	0	0	0	0	0	2334	2334	23.3	2228.4	2228.4	0.0
TMH	0	0	0	0	0	2334	2334	0.0	2232.1	2232.1	0.0
DMSO	0	0	0	0	0	4666	4666	924.8	3733.0	3733.0	0.0
PCB	3.7	0	0	0	3.7	0	3.7	0.0	0.4	0.4	0.0
DMS	0	0	0	0	0	0	0	1.9	0.0	0.0	0.0
DMDS	0	0	0	0	0	0	0	1.9	0.0	0.0	0.0
BMMM	0	0	0	0	0	0	0	2.3	0.0	0.0	0.0
FORM	0	0	0	0	0	0	0	2.3	0.0	0.0	0.0
DECHLOR ORG.	0	0	0	0	0	0	0	0.0	185.9	185.9	0.0
KCl	0	0	0	0	0	0	0	0.0	113.3	113.3	0.0
TOTAL POUNDS	14000	1101	3984	4194	12899	14000	31093	9588.4	21285.1	32803.3	11290.9
% SOLIDS							34		49	38	
PEG PPM							75089		104702		
PCB PPM							118		17		
% PEG LOSS								1%			
% DMSO LOSS								20%			
% TMH LOSS								0%			
% KOH LOSS								0%			

CENTRIFUGE #1 (#9, #10); CENTRIFUGE #2 (#13, #14); CENTRIFUGE #3 (#17, #18)

STREAM	#9 LIQUID TO	#10 SOLID	#11 CENTRATE W.	#12 WATER	#13 LIQUID TO	#14 SOLID	#15 CENTRATE W.	#16 WATER	#17 LIQUID TO	#18 SOLID	#19 CENTRATE W.
WATER	11923	7305	4728	7800	15006	9197	5808	7800	16997	10417	6579
ROCKS	0	0	0	0	0	0	0	0	0	0	0
WOOD	0	0	0	0	0	0	0	0	0	0	0
SILT	6081	6081	0	0	6081	6081	0	0	6081	6081	0
SAND	1153	1153	0	0	1153	1153	0	0	1153	1153	0
CLAY	3250	3250	0	0	3250	3250	0	0	3250	3250	0
VEG	0	0	0	0	0	0	0	0	0	0	0
OIL	0	0	0	0	0	0	0	0	0	0	0
KOH	1890	1807	63	0	1807	1758	49	0	1758	1728	30
PEG-400	2229	1346	883	0	1344	825	521	0	825	506	319
TMH	2233	1348	885	0	1348	826	522	0	826	507	320
DMSO	3733	2254	1479	0	2254	1382	873	0	1382	847	535
PCB	0.4	0.4	0	0	0.4	0.4	0.0	0.0	0.4	0.4	0
DMS	0	0	0	0	0	0	0	0	0	0	0
DMDS	0	0	0	0	0	0	0	0	0	0	0
BMMM	0	0	0	0	0	0	0	0	0	0	0
FORM	0	0	0	0	0	0	0	0	0	0	0
DECHLOR ORG.	185.9	185.9	0	0	185.9	185.9	0.0	0.0	185.9	185.9	0
KCl	113.3	70	46	0	69.6	43	26.9	0.0	42.7	26	16.5
TOTAL POUNDS	[illegible]	24700	8100	7800	32500.0	24700	7800	7800	32500	24700	7800
% SOLIDS	38	50			38	50			38	50	
PEG PPM		54480				33392				20446	
PCB PPM		15				15				15	
% PEG LOSS		50%				35%				22%	
% DMSO LOSS		48%				30%				19%	
% TMH LOSS		50%				35%				22%	
% KOH LOSS		84%				84%				82%	

CENTRIFUGE #4 (#21, #22); CENTRIFUGE #5 (#25, #26); CENTRIFUGE #6 (#29, #30)

STREAM	#20 WATER	#21 LIQUID TO	#22 SOLID	#23 CENTRATE W	#24 WATER	#25 LIQUID TO	#26 SOLID	#27 CENTRATE W	#28 WATER	#29 LIQUID TO	#30 SOLID	#31 CENTRATE
WATER	7800	18217	11165	7052	7800	18965	11624	7341	7800	19424	11905	7519
ROCKS	0	0	0	0	0	0	0	0	0	0	0	0
WOOD	0	0	0	0	0	0	0	0	0	0	0	0
SILT	0	6081	6081	0	0	6081	6081	0	0	6081	6081	0
SAND	0	1153	1153	0	0	1153	1153	0	0	1153	1153	0
CLAY	0	3250	3250	0	0	3250	3250	0	0	3250	3250	0
VEG	0	0	0	0	0	0	0	0	0	0	0	0
OIL	0	0	0	0	0	0	0	0	0	0	0	0
KOH	0	1728	1709	18	0	1709	1698	11	0	1698	1691	7
PEG-400	0	506	310	196	0	310	190	120	0	190	116	74
TMH	0	507	310	196	0	310	190	120	0	190	117	74
DMSO	0	847	519	328	0	519	318	201	0	318	195	123
PCB	0	0.4	0.4	0	0	0.4	0	0	0	0	0	0
DMS	0	0	0	0	0	0	0	0	0	0	0	0
DMDS	0	0	0	0	0	0	0	0	0	0	0	0
BMMM	0	0	0	0	0	0	0	0	0	0	0	0
FORM	0	0	0	0	0	0	0	0	0	0	0	0
DECHLOR ORG.	0	185.9	185.9	0	0	185.9	186	0	0	186	185.9	0
KCl	0	26.1	16	10.1	0	16.0	10	6	0	10	6	4
TOTAL POUNDS	7800	32500	24700	7800	7800	32500	24700	7800	7800	32500	24700	7800
% SOLIDS		38	50			38	50			0	0	
PEG PPM			12544				7688				4712	
PCB PPM			15				15				15	
% PEG LOSS			13%				8%				5%	
% DMSO LOSS			11%				7%				4%	
% TMH LOSS			13%				8%				5%	
% KOH LOSS			81%				81%				81%	

RECYCLE WASHING
2nd CENTRIFUGE WASHES
UNITS ARE # /BATCH SOIL

ROCK WASHING SEQUENCE (#2, #2A, #2B); MIXER BALANCE (#3, #4); BALANCE AROUND THE REACTOR (#5–#7A)

STREAM	#1	#2	#2A W.WATER	#2B W.W/CORN	#3	#4	#5	#6	#7	#7A	#8
COMP.											
WATER	2621	52	3564	3984	2569	2566	9119	8571	415	9479	8921.8
ROCKS	524	524	0	0	0	0	0	0	0	0	0.0
WOOD	210	210	0	0	0	0	0	0	0	0	0.0
SILT	6081	122	0	122	5959	0	6081	0	6081	6081	0.0
SAND	1153	23	0	23	1130	0	1153	0	1153	1153	0.0
CLAY	3250	65	0	68	3185	0	3250	0	3250	3250	0.0
VEG	105	105	0	0	0	0	0	0	0	0	0.0
OIL	52	0	22	0	52	0	52	52	0	19	19.1
KOH	0	0	0	0	0	2100	2100	0	1890	2149	49.1
PEG-400	0	0	10	0	0	2334	2334	23	2229	2840	529.4
TMH	0	0	0	0	0	2334	2334	0	2233	2856	521.9
DMSO	0	0	385	0	0	4666	4666	925	3733	4951	1209.5
PCB	4	0	0	0	4	0	4	0	0.4	0.4	0.0
DMS	0	0	1	0	0	0	0	2	0.0	0.0	1
DMDS	0	0	1	0	0	0	0	2	0.0	0.0	1
BMMM	0	0	1	0	0	0	0	2	0.0	0.0	1
FORM	0	0	1	0	0	0	0	2	0.0	0.0	1
DECHLOR ORG.	0	0	0	0	0	0	0	0	185.9	185.9	0
KCl	0	0	0	0	0	0	0	0	113.3	27	26.9
TOTAL POUNDS	14000	1101	3984	4194	12899	14000	31093	9580	21285	33252.7	11291
% SOLIDS	81%	95%	0%	5%	80%	0%	39%	0	58%	37%	
PEG PPM	0	0			0	0	75089	0	104702		
PCB PPM	0	0			0	0	118	0	17		
% PEG LOSS	0%	0%			0%	0%	0%	1%			
% DMSO LOSS	[illegible]	[illegible]			0%	0%	0%	20%			

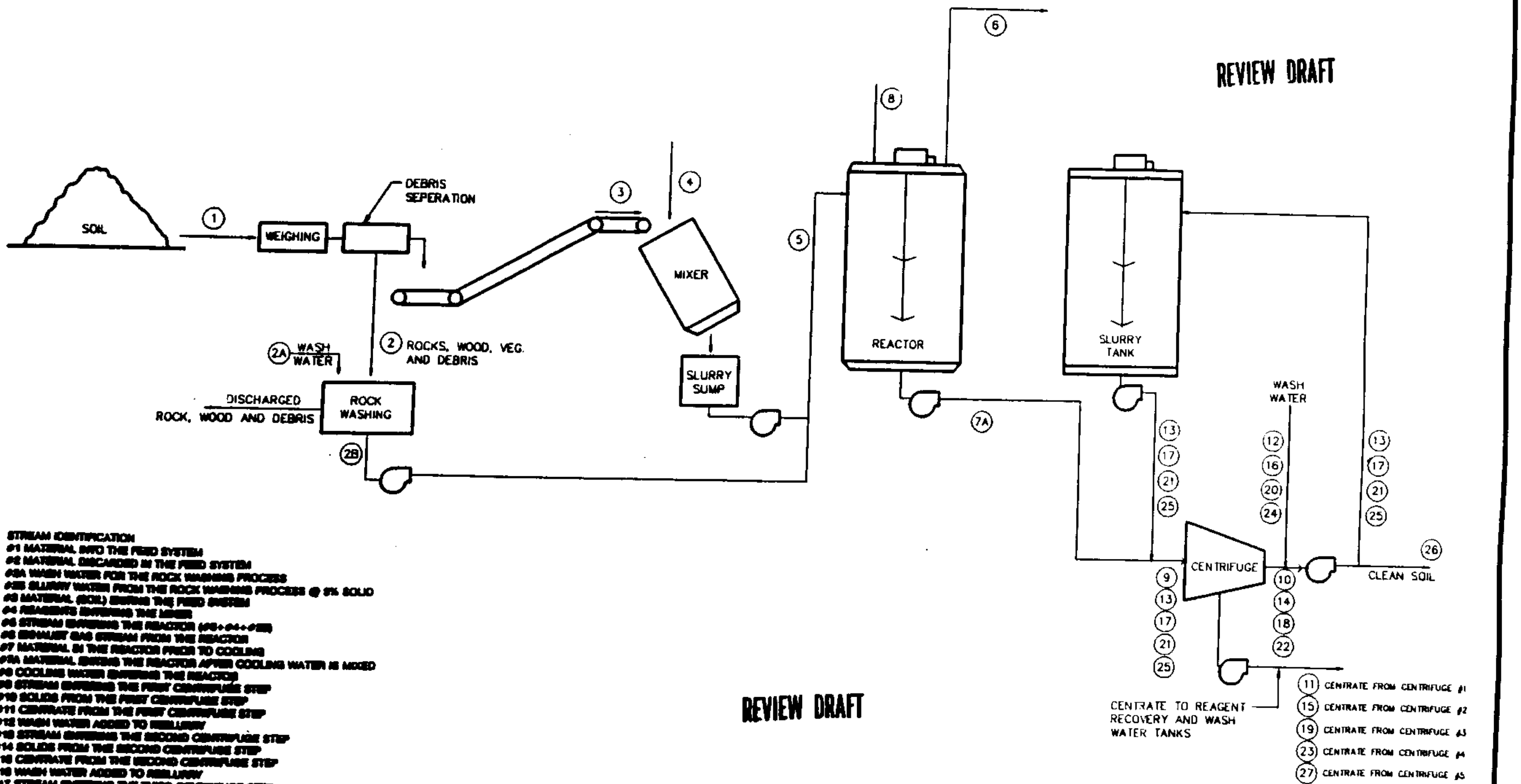
CENTRIFUGE #1 (#9, #10); TO #8 (#11); CENTRIFUGE #2 (#13, #14); CENTRIFUGE #3 (#17, #18)

STREAM	#9 LIQUID TO	#10 SOLID	#11 CENTRATE W.	#12 WATER	#13 LIQUID TO	#14 SOLID	#15 CENTRATE W.	#16 WATER	#17 LIQUID TO	#18 SOLID	#19 CENTRATE W.
WATER	9479	5677	3802	6579	12302	7486	4716	7052	14537	8910	6579
ROCKS	0	0	0	0	0	0	0	0	0	0	0
WOOD	0	0	0	0	0	0	0	0	0	0	0
SILT	6081	6081	0	0	6081	6081	0	0	6081	6081	0
SAND	1153	1153	0	0	1153	1153	0	0	1153	1153	0
CLAY	3250	3250	0	0	3250	3250	0	0	3250	3250	0
VEG	0	0	0	0	0	0	0	0	0	0	0
OIL	19	19	0	0	19	0	19	0	0	0	0
KOH	2149	1961	188	30	1991	1871	120	18	1809	1800	30
PEG-400	2840	1701	1139	319	2020	1239	781	196	1435	880	319
TMH	2856	1710	1145	320	2030	1245	785	196	1442	884	320
DMSO	4951	2909	1961	535	3524	2162	1362	328	2490	1528	535
PCB	0.4	0.4	0	0	0.4	0	0	0	0	0	0
DMS	0	0.0	0	0	0	0	0	0	0	0	0
DMDS	0	0.0	0	0	0	0	0	0	0	0	0
BMMM	0	0.0	0	0	0	0	0	0	0	0	0
FORM	0	0.0	0	0	0	0	0	0	0	0	0
DECHLOR ORG.	186	185.9	0	0	185.9	185.9	0	0	186	185.9	0.0
KCl	26.9	26.9	0	17	43.4	27	17	10	37	23	16.5
TOTAL POUNDS	32991	24755	8236	7800	32500.0	24700	7800	7800	32500	24704	7800
% SOLIDS	37%	50%			38	50			38	50	
PEG PPM		54480				33392				35636	
PCB PPM		15				15				15	
% PEG LOSS		73%				53%				38%	
% DMSO LOSS		64%				46%				33%	
% TMH LOSS						[illegible]				18%	

CENTRIFUGE #4 (#21, #22); CENTRIFUGE #5 (#25, #26); CENTRIFUGE #6 (#29, #30)

STREAM	#20 WATER	#21 LIQUID TO	#22 SOLID	#23 CENTRATE W	#24 WATER	#25 LIQUID TO	#26 SOLID	#27 CENTRATE W	#28 WATER	#29 LIQUID TO	#30 SOLID	#31 CENTRATE
WATER	7341	16251	9959	6292	7519	17476	10711	7341	7800	18511	11905	6606
ROCKS	0	0	0	0	0	0	0	0	0	0	0	0
WOOD	0	0	0	0	0	0	0	0	0	0	0	0
SILT	0	6081	6081	0	0	6081	6081	0	0	6081	6081	0
SAND	0	1153	1153	0	0	1153	1153	0	0	1153	1153	0
CLAY	0	3250	3250	0	0	3250	3250	0	0	3250	3250	0
VEG	0	0	0	0	0	0	0	0	0	0	0	0
OIL	0	0	0	0	0	0	0	0	0	0	0	0
KOH	11	1820	1766	54	7	1772	1737	11	0	1737	1691	46
PEG-400	120	1000	614	387	74	687	421	120	0	421	116	305
TMH	120	1005	616	388	74	690	423	120	0	423	117	306
DMSO	201	1728	1060	668	123	1184	725	201	0	725	195	530
PCB	0	0	0	0	0	0	0	0	0	0	0	0
DMS	0	0	0	0	0	0	0	0	0	0	0	0
DMDS	0	0	0	0	0	0	0	0	0	0	0	0
BMMM	0	0	0	0	0	0	0	0	0	0	0	0
FORM	0	0	0	0	0	0	0	0	0	0	0	0
DECHLOR ORG.	0	186	185.9	0	0	186	185.9	0.0	0	186	186	0
KCl	6	29	18	11	4	21	13	6.2	0	13	6	7
TOTAL POUNDS	7800	32503	24703	7800	7800	32503	24700	7800	7800	32500	24700	7800
% SOLIDS		38	50			38	50			32500	24700	
PEG PPM			24642				17049				4712	
PCB PPM			15				15				15	
% PEG LOSS			26%				18%				5%	
% DMSO LOSS			23%				16%				4%	
% TMH LOSS			26%				18%				5%	

GALSON\PFD2



STREAM IDENTIFICATION
#1 MATERIAL INTO THE FEED SYSTEM
#2 MATERIAL DISCARDED IN THE FEED SYSTEM
#2A WASH WATER FOR THE ROCK WASHING PROCESS
#2B SLURRY WATER FROM THE ROCK WASHING PROCESS @ 5% SOLID
#3 MATERIAL (SOIL) EXITING THE FEED SYSTEM
#4 REAGENTS ENTERING THE MIXER
#5 STREAM ENTERING THE REACTOR (#3+#4+#2B)
#6 EXHAUST GAS STREAM FROM THE REACTOR
#7 MATERIAL IN THE REACTOR PRIOR TO COOLING
#7A MATERIAL EXITING THE REACTOR AFTER COOLING WATER IS MIXED
#8 COOLING WATER ENTERING THE REACTOR
#9 STREAM ENTERING THE FIRST CENTRIFUGE STEP
#10 SOLIDS FROM THE FIRST CENTRIFUGE STEP
#11 CENTRATE FROM THE FIRST CENTRIFUGE STEP
#12 WASH WATER ADDED TO RESLURRY
#13 STREAM ENTERING THE SECOND CENTRIFUGE STEP
#14 SOLIDS FROM THE SECOND CENTRIFUGE STEP
#15 CENTRATE FROM THE SECOND CENTRIFUGE STEP
#16 WASH WATER ADDED TO RESLURRY
#17 STREAM ENTERING THE THIRD CENTRIFUGE STEP
#18 SOLIDS FROM THE THIRD CENTRIFUGE STEP
#19 CENTRATE FROM THE THIRD CENTRIFUGE STEP
#20 WASH WATER ADDED TO RESLURRY
#21 STREAM ENTERING THE FOURTH CENTRIFUGE STEP
#22 SOLIDS FROM THE FOURTH CENTRIFUGE STEP
#23 CENTRATE FROM THE FOURTH CENTRIFUGE
#24 WASH WATER ADDED TO RESLURRY
#25 STREAM ENTERING THE FIFTH CENTRIFUGE STEP
#26 CLEAN SOIL
#27 CENTRATE FROM THE FIFTH CENTRIFUGE STEP

GALSON REMEDIATION	LAW ENVIRONMENTAL, INC.	PROCESS FLOW DIAGRAM FOR MATERIAL BALANCE

Memorandum

To: Sharleen Pendergrass, Client Services Associate
From: Edwina Milicic, Lab Manager
Date: 6/22/90

Subject: Recent Research on Reagent Residuals Reduction

As I discussed in my memo of June 18, GRC's laboratory group has conducted some additional studies in response to client concerns about the concentrations of reagent components in soil treated by the APEG-PLUS™ system.

As you know, the original laboratory procedure for reagent recovery and soil washing did not duplicate the stage efficiencies achievable in larger equipment, and the reagent residuals left in the soil during the lab treatability studies have been quite high. The first step in reducing the reagent residuals was to change the procedure for washing soils during lab treatability studies.

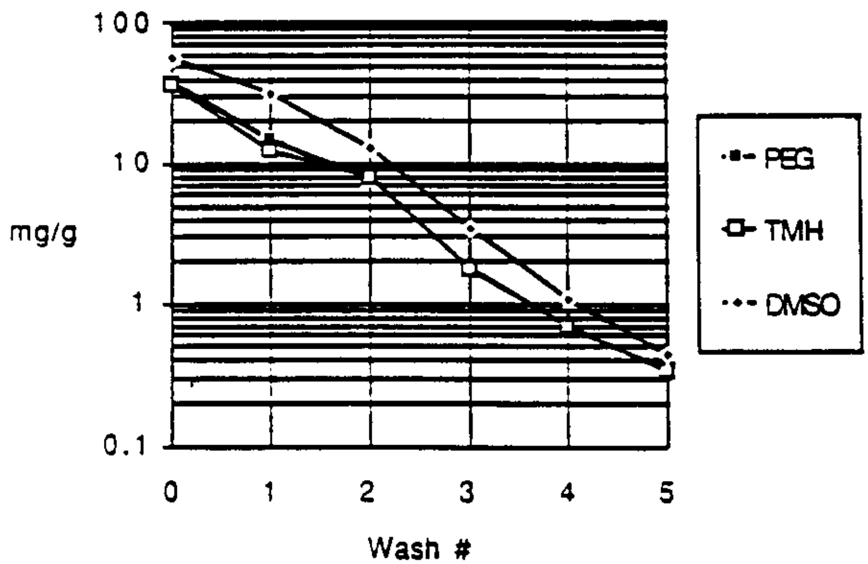
The old procedure was to transfer the reactor contents (soil and reagent) into centrifuge bottles, centrifuge, decant the reagent, and wash the soil three times with room temperature water all in the same bottles. Since each bottle could hold only about 250 mL, a one liter reactor was divided into four bottles, and the soil was not re-mixed until after all the washing was done.

The new procedure is to transfer the reactor contents (soil and reagent) into centrifuge bottles, centrifuge, decant the reagent, then return the soil to the reactor. Water is added to the reactor and the soil and water are mixed, heated to 90°C and held at that temperature for 20 minutes with constant agitation. The reactor contents (soil and washwater) are cooled slightly, transferred back to the centrifuge bottles and centrifuged. The washwater is decanted and the soil is returned to the reactor for the second wash. The entire procedure is repeated for each wash. Although it greatly increases the time and labor for soil washing in the lab, the new procedure is more like what will happen in full scale - the soil will be returned to the agitated reactor and the water will be hot. The new procedure has brought the lab stage efficiencies to approximately 80% for the reagent removal step and 60 % for each washing step. These efficiencies are closer to what we expect for full scale work than the efficiencies we obtained with the old washing procedure.

Since DMSO was the compound of greatest concern, we tested a new reagent recovery protocol which removed DMSO preferentially. We ran a standard reaction with the usual reagent. The soil and reagent were separated as usual, the soil was returned to the reactor and reslurried with PEG alone. The reactor was heated to 150°C under strong vacuum (25" Hg) to distill out the remaining DMSO. The soil was washed four times with water as described previously. Interference from PEG makes it difficult to determine the final DMSO concentration, but the soil definitely contained less than 100 ppm of DMSO after washing. Unfortunately, the soil still contained 4000 ppm of PEG, and our recent conversation indicated that the client does not want PEG left in the soil either. Also, there is some disagreement between Bob and Roger about whether we can achieve the same vacuum (25" Hg) in full scale equipment.

We ran another reaction and washed the soil four times with the improved washing procedure (without the DMSO distillation step). We then treated the soil with a fifth wash containing 1% hydrogen peroxide (a 1/3 dilution of what you can buy at the drugstore for cuts etc.) The peroxide did not improve the stage efficiency, nor did it reduce the residuals below 100 ppm. The final concentration of DMSO in that soil was 440 ppm, the concentration of TMH was 350 ppm and the final concentration of PEG was non-detectable, which means it was below 3000 ppm, but we don't know by how much. If it's any help, the concentrations of PEG and TMH stayed pretty close together until the PEG dropped below it's detection limit.

The graph below shows the concentrations as they drop through the washing series.



The concentrations reported for the non-vacuum reaction are averages for two analyses of each sample. Agreement between duplicates was good, and recovery from the performance evaluation sample was 80% for DMSO, 110% for TMH, and 240% for PEG, probably because the PEG concentration in the PE sample was too close to the detection limit.

We also had an outside lab determine the toxicity of DMSO to earthworms. The NOAEL (No Observable Adverse Effect Level) for DMSO in soil is 7000 ppm (7 mg/g). We were below that concentration after the third wash.

PCB SUMMARY TABLE

Site, State	Client	Contaminant and Matrix	Original Concentration (ppm)	Final Concentration (ppm)	Date
Southern Texas	Confidential	PCBs (clay soil)	100	<25	1990
Northern NY	Confidential	PCB (soil)	145	<2	1990
Confidential, OH	Confidential	PCB (soil)	125	<2	1990
Confidential, Canada	Confidential	PCB (oil) PCB (soil)	69,000 160	<2 <2	1990
not specified	CEOOS	PCB (soil)	300	<1	1988
Wide Beach, NY	Ebasco, Inc.	PCB (soil pilot) PCB (soil lab)	260-30 690-490	<2 6.5-3.8	1988 1987
New Bedford, MA	E. C. Jordan	PCB (sediment)	7,500-6,000	<1	1987
Cloverdale, CA	Kennedy, Jenks, Chilton	PCB (soil)	790	6	1987
Resolve, MA	Camp, Dresser & McKee	PCB (sand)	2,900	<1	1987
GE Moreau, NY	USEPA PEI	PCB (soil lab) PCB (soil pilot)	7,000 245	<10 2.7	1986 1987
Bengart & Memel, NY	USEPA	PCB (soil drums)	116	8.8	1986
Niagara Mohawk Power Corp.	Niagara Mohawk Power Corp.	PCB (oil)	1,000-100	<2	1984-85

APPENDIX C

OHM TREATABILITY STUDY REPORT

THERMAL TREATMENT
FEASIBILITY STUDY

FINAL REPORT

SUBMITTED TO

WOODWARD-CLYDE CONSULTANTS
PLYMOUTH MEETING, PENNSYLVANIA

OHM REMEDIATION SERVICES CORP. (OHM)
FINDLAY, OHIO

PAUL JAYKO
Project Engineer

OHM Corporation

February 11, 1991

Peter R. Jacobson
Woodward-Clyde Consultants
5120 Butler Pike
Plymouth Meeting, PA 19462

Dear Mr. Jacobson:

Enclosed is the final report for the treatability study and analysis performed by OHM Remediation Services Corp. (OHM). As indicated in the draft report, dated January 7, 1991, results of the analysis indicate that the polychlorinated biphenyl (PCB) contaminated soils at the Reynolds Metals Company site in Massena, New York, are applicable to treatment utilizing OHM's Thermal Destruction Unit (TDU).

Waste feed characterization and laboratory analysis were mandatory in order to define the waste feed matrix and its impact on the TDU's pre-treatment and waste-feed preparation requirements, metallurgical requirements and/or limitations, potential design limitations and operating conditions.

Pilot scale remediation is not considered a necessary step toward full remediation of the site. Benchscale testing has demonstrated that the relevant parameters, such as soil matrix and contamination, are within the scope of full-scale remediation.

OHM has a vast amount of hazardous waste cleanup experience with over 10,000 remediation projects completed. These projects include facility decontamination, water treatment, emergency response, and thermal treatment. Management and coordination of resources allows OHM to assemble project teams to conceive, design, fabricate and field implement specialized solutions to meet specific client needs. This turnkey project management approach is one of the reasons for our history of successful on-site remediation projects. OHM professionally manages each and every phase of the project, from remedial action planning, technology selection and design, to implementation of the actual cleanup.

16406 U.S. Route 224 East ■ P.O. Box 551 ■ Findlay, Ohio 45839-0551 ■ 419-423-3526

OHM has in-depth experience in all required federal, state, and local permitting functions, and takes an active part in community relation activities. OHM has a strong background in the design and implementation of trial burn plans for various waste streams.

The TDU is presently contracted for work through late winter of 1991. The unit is available after this time but is subject to prior commitment.

If you have any questions, please contact Greg McCartney or me at (419) 423-3526.

Sincerely,

Paul M. Jayko
Project Engineer

Encl: Final Treatability Report
Analytical Reports

1.0 INTRODUCTION

Soil from the North Yard of the Reynolds Metals Company plant in Massena, New York was evaluated for the application of thermal destruction. The tests were designed to determine the feasibility of utilizing infrared thermal treatment to remediate soil contaminated with polychlorinated biphenyls (PCB), polychlorinated dibenzo-p-dioxins (PCDD), and polychlorinated dibenzofurans (PCDF).

Specific objectives of the treatability study to be addressed were:

- o Technical feasibility of the thermal process for site-specific media and contaminants.
- o Ability of the thermal process to handle the expected variations in feed parameters.
- o Cost estimates for pilot and/or full-scale remediation.

Final test results indicate that the OHM Thermal Destruction Unit (TDU) is applicable for the thermal destruction of the contaminated soil at the Reynolds Metals Company plant.

Four incineration conditions were tested during the benchscale simulations. The resultant muffle furnace data demonstrated that under all four conditions, the OHM Thermal Destruction Unit (TDU) will reduce PCB concentrations to levels below 0.249 ppm for all aroclor groups.

Soil density averaged one ton per cubic yard, and an average mass reduction of 26% occurred during the benchscale simulation for each sample.

The TCLP analysis for chlordane used an elevated detection limit due to the difficulty in recovering chlordane in the soil matrix. Due to the elevated detection limit, analytical results are inconclusive as to whether chlordane meets the regulatory limit. However, historical operations at the site, along with generator knowledge of the waste, should be sufficient to allow permitting of incineration operations without additional TCLP analysis. The TCLP analyses for all other herbicides, metals, volatiles, and semi-volatiles indicates that these compounds are within regulatory limits.

2.0 SUMMARY

OHM received two distinct representative samples of PCB contaminated soil from Woodward-Clyde Consultants (WCC). The samples were collected on 10/15/90 and received by OHM on 12/5/90. The samples were labeled "NY-COMP1 SOIL" and "NY-COMP2 SOIL." The soil was sand-like to silty in consistency and contained noticeable debris in the form of small rocks and organic matter.

Tests were conducted to evaluate the feasibility of utilizing the TDU to attain the soil clean-up criteria required by regulation and the Reynolds Metals Company. The results are discussed in Section 4, and the complete analytical reports are contained as an enclosure.

2.1 SAMPLE NY-COMP1 SOIL

Three individual sample lots were taken from the first Reynolds Metals Company sample, and were designated as Sample 9990-1, Sample 9990-2, and Sample 9990-3.

Sample 9990-1 was soil in its original state (feed sample). A portion of Sample 9990-1 was subjected to low temperature drying to verify the moisture content of the soil. The remainder of Sample 9990-1 was submitted to the laboratory and analyzed for total solids, heat content, ash, chloride, total RCRA metals, density, flash point, and PCBs.

Sample 9990-2 was soil subjected to thermal energy, at a temperature of 1,600 degrees Fahrenheit for a 15 minute residence time. The resultant ash sample was submitted to the laboratory for analysis.

Sample 9990-3 was soil subjected to thermal energy, at a temperature of 1,600 degrees Fahrenheit for a 25 minute residence time. The resultant ash sample was submitted to the laboratory for analysis.

2.2 SAMPLE NY-COMP2 SOIL

Three individual sample lots were taken from the second Reynolds Metals Company sample, and were designated as Sample 9990-4, Sample 9990-5, and Sample 9990-6.

Sample 9990-4 was soil in its original state (feed sample). A portion of Sample 9990-4 was subjected to low temperature drying to verify the moisture content of the soil. The remainder of Sample 9990-4 was submitted to the laboratory and analyzed for total solids, heat content, ash, chloride, total RCRA metals, density, flash point, and PCBs.

Sample 9990-5 was soil subjected to thermal energy, at a temperature of 1,600 degrees Fahrenheit for a 15 minute residence time. The resultant ash sample was submitted to the laboratory for analysis.

Sample 9990-6 was soil subjected to thermal energy, at a temperature of 1,600 degrees Fahrenheit for a 25 minute residence time. The resultant ash sample was submitted to the laboratory for analysis.

2.3 ADDITIONAL SAMPLES

Additional ash samples were generated from the original Reynolds Metals samples, following an identical procedure for both long and short residence times. These sample were submitted to Enseco-Erco Laboratories in Cambridge, Massachusetts for additional analysis.

3.0 BENCH SCALE THERMAL PROCEDURE

Tests were conducted to evaluate the feasibility of utilizing the TDU to attain the soil clean-up criteria required by TSCA, RCRA, the state of New York, and Reynolds Metals Company. Test results are used to estimate production rates, disposal characteristics of treated ash, and as a basis for determining cost estimates for full scale remediation.

3.1 COMPOSITING

Soil samples were delivered as a homogenous mixture and did not require compositing. No excess moisture was observable.

3.2 DRYING

Aluminum weighing dishes were used to conduct moisture-loss analysis. This low temperature drying is used to confirm the moisture content of the soil presented in the analytical results. A total of six dishes were used (3 dishes for Sample 9990-1 and 3 dishes for Sample 9990-4). The dishes were weighed empty, and then portions of sample 9990-1 and sample 9990-4 were placed into the dishes. The dishes containing the contaminated soil were weighed again. The six samples were placed into a desiccator for three hours. At the end of the three hour drying period, the six samples were removed and weighed again. The percentage of moisture-loss was recorded and compared to the analytical results derived from the laboratory analysis.

The average moisture content indicated by low temperature drying of Sample 9990-1 and Sample 9990-4 confirm the validity of the laboratory analysis.

3.3 FEED SAMPLES

Approximately 150 grams of contaminated soil from sample NY-COMP1 SOIL was placed into a clean sample jar, labeled Sample 9990-1, and submitted to the laboratory for analysis of:

- Total Solids
- Heat Content
- Ash
- Chloride
- Total RCRA Metals
- Density
- PCB
- Flash point

Approximately 150 grams of contaminated soil was also taken from sample NY-COMP2 SOIL, placed into a clean sample jar, labeled Sample 9990-4, and submitted to the laboratory for an identical analysis.

3.4 SIMULATION PROCEDURE

A programmable electric muffle furnace was used to simulate the conditions of the TDU. An activated carbon filtration system was installed to trap fugitive emissions from the furnace. All benchscale testing was conducted beneath a vented exhaust hood.

In order to more accurately simulate the internal conditions of the TDU primary chamber, the stainless steel crucibles used to contain the soil were preheated in a second muffle furnace prior to the addition of soil. The empty weight of each stainless steel crucible was recorded prior to placing the crucible into the preheat furnace. Each empty crucible was subjected to ambient furnace temperature for a minimum of ten minutes, in order to simulate the feed belt temperatures.

The muffle furnace was brought to an operating temperature of 1,600 degrees Fahrenheit prior to adding any samples to the unit.

Four glass beakers were each filled with approximately 100 grams of contaminated soil. For each simulation procedure, the hot crucibles were removed from the preheat furnace and the soil was transferred from each of the glass beakers to the stainless steel crucibles. The crucibles and soil were then placed into the simulation muffle furnace.

The empty glass beaker used for each soil transfer was weighed again to determine the amount of soil that had adhered to the beaker and therefore not been introduced to the furnace. This measurement was later used in the determination of mass reduction.

The soil in each crucible was stirred intermittently (5 minute intervals) to simulate the internal action of the primary chamber. Each crucible was removed from the furnace at the end of its predetermined residence time.

The samples were tested as follows:

3.5 PROCEDURE 1: Sample 9990-2.
Temperature, 1,600 degrees Fahrenheit.
Residence time, 15 minutes.

The crucible was removed from the preheat furnace and filled with a pre-weighed volume of PCB contaminated soil from a glass beaker. The sample was then introduced to a muffle furnace temperature of 1,600 degrees Fahrenheit for a total residence time of 15 minutes. The crucible was removed from the furnace at 5 minute intervals, and the soil was turned to allow for uniform thermal treatment of the contaminant.

Once the sample had been subjected to a full 15 minute residence period, the crucible was removed from the furnace and cooled in a water bath. The crucible and ash were weighed again, and then the ash was placed into a clean sample jar.

3.5.1 Observations:

The soil was dark gray in color and appeared to be thoroughly dry. No excessive particulate emissions were noted.

3.6 PROCEDURE 2: Sample 9990-3.
Temperature, 1,600 degrees Fahrenheit.
Residence time, 25 minutes.

The crucible was removed from the preheat furnace and filled with a pre-weighed volume of PCB contaminated soil from a glass beaker. The sample was then introduced to a muffle furnace temperature of 1,600 degrees Fahrenheit for a total residence time of 25 minutes. The crucible was removed from the furnace at 5 minute intervals, and the soil was turned to allow for uniform thermal treatment of the contaminant.

Once the sample had been subjected to a full 25 minute residence period, the crucible was removed from the furnace and cooled in a water bath. The crucible and ash were weighed again, and then the ash was placed into a clean sample jar.

3.6.1 Observations:

The soil was dark gray in color and appeared to be thoroughly dry. No excessive particulate emissions were noted.

3.7 PROCEDURE 3: Sample 9990-5.
Temperature, 1,600 degrees Fahrenheit.
Residence time, 15 minutes.

The crucible was removed from the preheat furnace and filled with a pre-weighed volume of PCB contaminated soil from a glass beaker. The sample was then introduced to a muffle furnace temperature of 1,600 degrees Fahrenheit for a total residence time of 15 minutes. The crucible was removed from the furnace at 5 minute intervals, and the soil was turned to allow for uniform thermal treatment of the contaminant.

Once the sample had been subjected to a full 15 minute residence period, the crucible was removed from the furnace and cooled in a water bath. The crucible and ash were weighed again, and then the ash was placed into a clean sample jar.

3.7.1 Observations:

The soil was dark gray in color and appeared to be thoroughly dry. A large volume of yellow gaseous emissions was noted.

3.8 PROCEDURE 4: Sample 9990-6.
Temperature, 1,600 degrees Fahrenheit.
Residence time, 25 minutes.

The crucible was removed from the preheat furnace and filled with a pre-weighed volume of PCB contaminated soil from a glass beaker. The sample was then introduced to a muffle furnace temperature of 1,600 degrees Fahrenheit for a total residence time of 25 minutes. The crucible was removed from the furnace at 5 minute intervals, and the soil was turned to allow for uniform thermal treatment of the contaminant.

Once the sample had been subjected to a full 25 minute residence period, the crucible was removed from the furnace and cooled in a water bath. The crucible and ash were weighed again, and then the ash was placed into a clean sample jar.

3.8.1 Observations:

The soil was medium gray in color and appeared to be thoroughly dry. A large volume of yellow gaseous emissions was noted.

4.0 ANALYTICAL RESULTS SUMMARY

Six samples, 9990-1 through 9990-6, were submitted to the laboratory for various analyses which included: ash content, BTU content, total solids, chloride, full TCLP, total RCRA metals, density, and flash point.

4.1 LABORATORY PROCEDURES

The following approved test procedures were used to analyze the samples:

- Density - ASTM D1298-85, Standard Test Methods for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method, or Standard Methods for the Examination of Water and Wastewater, Method 213E.

- Ash Content - ASTM E830-81, Test Method for Ash or ASTM D482-80, Ash from Petroleum Products.

- BTU Content - ASTM E711-81, Test Method by Bomb Calorimeter, or ASTM D240-76 Test Method by Bomb Calorimeter.

- Total Solids - Standard Methods for the Examination of Water and Wastewater, Method 209F.

- RCRA/TCLP Herbicides - Method 8150, "Chlorinated Herbicides."

- Total Halogens - Method D808-81, Chlorine in New and Used Petroleum Products and Method 407C, Potentiometric Method.

- Total RCRA Metals - Samples are prepared and analyzed according to USEPA's Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846. Method 3010, 3030, 3050, or 1310 as appropriate for the following metals: arsenic, barium, cadmium, chromium, copper, lead, selenium, and silver. Mercury is prepared and analyzed by Method 7470 or Method 7471.

- Polychlorinated Biphenyls (PCB) - Solid samples are prepared and analyzed according to USEPA's Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846. Method 3550, "Sonication," or Method 3540, "Soxhelet Extraction" and Method 8080, "Organochlorine Pesticides and PCBs."

4.2 ANALYTICAL RESULTS TABLE

A summary of significant results from the laboratory analyses are shown in the following tables.

	Units	Sample 9990-1	Sample 9990-4
Conventionals			
Density	gm/cc	1.09	1.27
Halogens, Total as Cl	%	<0.1	.480
Ash	%	67.1	77.1
Solids, Total	%	84.3	88.1
BTU/lb.	BTU/lb.	469	745
Flash Point	Deg. C	>93	>93
Moisture	%	15.7	11.9

The data that was generated for ash samples appeared suspect in the first analytical run. The samples were retested for ash percentage, resulting in data points that were in line with other conventional parameters. The second set of data points is presented in the above chart.

Priority Pollutant PCB Analysis

Aroclor 1016	ppm	<24.8	<2460
Aroclor 1221	ppm	<24.8	<2460
Aroclor 1232	ppm	<24.8	<2460
Aroclor 1242	ppm	<24.8	<2460
Aroclor 1248	ppm	57.8	21,700
Aroclor 1254	ppm	<24.8	<2460
Aroclor 1260	ppm	<24.8	<2460

RCRA Total Metals Analysis

Arsenic	ppm	<10.0	<10.0
Barium	ppm	19.9	43.6
Cadmium	ppm	<1.25	<1.25
Chromium	ppm	11.9	11.4
Lead	ppm	23.3	25.6
Mercury	ppm	<0.1	<0.1
Selenium	ppm	<5.0	<5.0
Silver	ppm	<2.0	<2.0

	Units	Sample 9990-2	Sample 9990-3	Sample 9990-5	Sample 9990-6
Priority Pollutant PCB Analysis					
Aroclor 1016	ppm	<.249	<.249	<.207	<.249
Aroclor 1221	ppm	<.249	<.249	<.207	<.249
Aroclor 1232	ppm	<.249	<.249	<.207	<.249
Aroclor 1242	ppm	<.249	<.249	<.207	<.249
Aroclor 1248	ppm	<.249	<.249	.207	<.249
Aroclor 1254	ppm	<.249	<.249	<.207	<.249
Aroclor 1260	ppm	<.249	<.249	<.207	<.249
RCRA TCLP Leachate Herbicide Analysis					
2,4-D	ppm	<.250	<.250	<.250	<.250
2,4,5-TP (Silvex)	ppm	<.250	<.250	<.250	<.250
RCRA TCLP Leachate Metals Analysis					
Arsenic	ppm	<.100	<.100	<.100	<.100
Barium	ppm	.448	.402	.339	.315
Cadmium	ppm	<.005	<.005	<.005	<.005
Chromium	ppm	.0270	.0206	<.020	.0580
Lead	ppm	<.100	<.100	<.100	<.100
Mercury	ppm	<.001	<.001	<.001	<.001
Selenium	ppm	<.100	<.100	<.100	<.100
Silver	ppm	<.020	<.020	<.020	<.020
RCRA TCLP Leachate Semi-Volatile Analysis					
Chlordane	ppm	<.1	<.1	<.1	<.1
2,4-Dinitrotoluene	ppm	<.010	<.010	<.010	<.010
Endrin	ppm	<.003	<.003	<.003	<.003
Heptachlor	ppm	<.001	<.001	<.001	<.001
Heptachlor epoxide	ppm	<.001	<.001	<.001	<.001
Hexachlorobenzene	ppm	<.010	<.010	<.010	<.010
Hexachloroethane	ppm	<.010	<.010	<.010	<.010
Hexachlorobutadiene	ppm	<.010	<.010	<.010	<.010
Lindane	ppm	<.010	<.010	<.010	<.010
Methoxychlor	ppm	<.010	<.010	<.010	<.010
2-Methylphenol	ppm	<.010	<.010	<.010	<.010
4-Methylphenol	ppm	<.010	<.010	<.010	<.010

RCRA TCLP Leachate Semi-Volatile Analysis

Nitrobenzene	ppm	<.010	<.010	<.010	<.010
Pentachlorophenol	ppm	<.010	<.010	<.010	<.010
Pyridine	ppm	<.010	<.010	<.010	<.010
Toxaphene	ppm	<.100	<.100	<.100	<.100
2,4,5-Trichlorophenol	ppm	<.010	<.010	<.010	<.010
2,4,6-Trichlorophenol	ppm	<.010	<.010	<.010	<.010

RCRA TCLP Leachate Volatile Analysis

Benzene	ppm	<.013	<.013	<.013	<.013
Carbon tetrachloride	ppm	<.013	<.013	<.013	<.013
Chlorobenzene	ppm	<.013	<.013	<.013	<.013
Chloroform	ppm	<.013	<.013	<.013	<.013
1,4-Dichlorobenzene	ppm	<.013	<.013	<.013	<.013
1,2-Dichloroethane	ppm	<.013	<.013	<.013	<.013
1,1-Dichloroethylene	ppm	<.013	<.013	<.013	<.013
Methyl ethyl ketone	ppm	<.013	<.013	<.013	<.013
Tetrachloroethylene	ppm	<.013	<.013	<.013	<.013
Trichloroethylene	ppm	<.013	<.013	<.013	<.013
Vinyl chloride	ppm	<.013	<.013	<.013	<.013

4.3 DENSITY

The densities reported for Samples 9990-1 and 9990-4 were determined by Method 213E. In consideration of the soil matrix and moisture content, these densities are believed to be representative of both excavated and in place soils.

4.4 TCLP LEVELS

Analyses were conducted to determine the RCRA Total Metals in the feed samples (Samples 9990-1 and 9990-4) and the TCLP levels for ash samples (Samples 9990-2, 9990-3, 9990-5, and 9990-6).

When reporting the RCRA Total Metals in the feed samples, a standard laboratory heading of "RCRA TCLP TOTAL METALS ANALYSIS" is used. This standard heading often causes confusion in interpreting the results. The analysis conducted for WCC analyzed for eight RCRA metals in the feed samples: Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, and Silver. This analysis did not investigate leachate characteristics. The results are given in units per kilogram, rather than units per liter, indicating a soil testing procedure.

The heading in the treatability report has been changed from "RCRA/TCLP Total Metals Analysis" to "RCRA Total Metals Analysis" to aid in clarification.

Analytical tests were conducted to determine the TCLP levels for ash samples (Samples 9990-2, 9990-3, 9990-5, and 9990-6). When reporting the TCLP levels in the ash samples, a standard laboratory heading of "RCRA TCLP LEACHATE ANALYSIS" is used. The results are given in units per liter, rather than units per kilogram, indicating a leachate testing procedure. All TCLP levels in the ash samples are below regulatory limits.

4.5 DISPOSAL OPTIONS

OHM will compare model predicted concentrations to the New York acceptable ambient levels. OHM will model emissions for POCs and PICs of most concern, as well as for metals and hydrogen chloride.

The ash generated from the system will be disposed of as required by all federal and state regulations. Several options exist for management of the ash as follows:

- o Disposal as a hazardous waste
- o Formal delisting petition
- o De minimus exemption

Each form of disposal would require a different site-specific waste characterization plan.

4.5.1 Disposal as a Hazardous Waste

Disposal of the ash as a hazardous waste will require the least amount of regulatory involvement. The ash would be shipped by licensed haulers to a permitted facility. The degree and type of waste characterization would be determined by the permit requirements of the designated disposal facility.

4.5.2 Formal Delisting Petition

Another option for handling ash is to have the ash formally removed from the hazardous-waste system by submitting a formal delisting petition to the USEPA. The petition could be submitted under 40 CFR 260.20 which allows any person to petition the administrator to revoke any provision of Parts 260 through 268, 124, 270, and 271.

The petition must provide sufficient information to the Agency to determine: (1) that the waste to be excluded is not hazardous based upon the criteria on which it was originally listed, and (2) that no other hazardous constituents are present in the waste at levels of regulatory concern.

Several petitions have been granted for incinerator ash from remedial actions. One petition was for the EPA mobile incinerator which appeared in the Federal Register Vol. 53, No. 48 Friday, March 11, 1988. And more recently a petition was granted for the Vertec site in Jacksonville, Arkansas, which appeared in the Federal Register Vol. 55, No. 165 on Friday, August 24, 1990.

A delisting petition typically takes 18 to 24 months to obtain. If the ash is delisted from the hazardous-waste regulation, it still may be a solid waste which requires disposal at a solid waste facility.

4.5.3 De Minimus Exemption

The state of New York is currently working on a de minimus criteria for contaminated environmental media. If the de minimus level was obtained on the treated residuals, the residuals would be exempt from hazardous-waste regulation. If the residuals were an environmental media (i.e., soil, native fill, etc.) they would also be exempt from solid waste regulations.

5.0 COST INFORMATION

Specific cost information is normally provided only in response to a formal request for proposal (RFP), after OHM has had the opportunity to conduct a site visit and address any operational factors that will influence costs.

Based on the results of the benchscale and analytical testing, full scale remediation is estimated to be $325 per ton. Unit cost includes the following items:

- Loading the incinerator
- Labor
- Management
- Utilities
- Equipment
- Analytical (2 samples per day)
- Chemicals
- Per diem
- Temporary ash storage and handling

The mobilization, setup, teardown, and demobilization of the TDU is a fixed cost which may range from $800,000 to $1,200,000. The system can be mobilized and setup within 11 to 14 days after completing permit requirements. Teardown at the completion of the project will require approximately 10 days. These costs are rough order of magnitude (±30 percent) and should be used for budgetary purposes only.

The TDU is capable of using less electrical power when fuel oil is added to the waste and when the primary combustion chamber temperature is reduced. Addition of fuel oil may also permit a higher feed rate. Potential cost savings may result from specific applications and will depend on local fuel and electrical costs. Minimum combustion chamber temperatures must be maintained to achieve adequate desorption and the necessary destruction of the organics.

6.0 CONCLUSION

The waste from the North Yards of the Reynolds Metals Company plant was analyzed for thermal destruction characteristics. The results of the waste analysis indicate that thermal processing is a technically feasible application for the site-specific media and contaminants found at the Reynolds Metals site, and that the use of the TDU will significantly reduce the PCB concentrations to below detectable limits. Benchscale testing using worst-case waste has demonstrated the ability of the thermal process to handle the expected variations in feed parameters.

REMEDIATION OF PCB-CONTAMINATED SOILS BY MOBILE INFRARED THERMAL DESTRUCTION

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OHM Remediation Services Corp.
Findlay, Ohio

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ABSTRACT

OHM Remediation Services Corp. (OHM), a subsidiary of OHM Corporation, completed our first commercial infrared thermal destruction project in May 1988, during which time the technical and economic feasibility of thermal destruction was proven on a large-scale project. OHM's thermal destruction unit (TDU) was first used at a Superfund site (NPL No. 238) in the state of Florida for the treatment of soils contaminated with polychlorinated biphenyls (PCBs).

The infrared TDU is a custom-designed unit, unlike any other. It has features which enhance mobility, on-site productivity and reliability, and greatly reduce the time for setup and commissioning.

A Toxic Substances Control Act (TSCA) trial burn was conducted in June 1988 to demonstrate compliance with the PCB thermal destruction performance standards of 40 CFR Part 761. In December 1988, the USEPA granted OHM a national TSCA permit for the TDU. The permit is effective in all ten USEPA regions and allows OHM to thermally destroy up to 165 tons of PCB-contaminated soils per day.

This paper discusses the introduction of the TDU to the industry, and also provides a description of the TDU process, enhancements made to the unit, past thermal destruction projects, and results of the TSCA trial burn.

INTRODUCTION TO THE INDUSTRY

Hazardous-waste thermal destruction has long been identified by the USEPA as a viable technology for the elimination of organic hazardous wastestreams. Although numerous fixed-base technologies were well established in the industry, by 1985 the application of mobile thermal destruction technology was in the experimental stage. As new technologies emerged in early 1986, OHM organized a new operating group within the company to specialize in the application of mobile thermal destruction technologies for the on-site treatment of hazardous wastes.

OHM conducted an extensive survey to evaluate the major differences between the available thermal destruction technologies in regards to mobility, processing rates, site preparation, energy requirements, waste material constraints, and maintenance requirements.

After the results of the survey were evaluated, OHM identified the conveyor-belt process as the most adaptable process for on-site thermal destruction of contaminated soils. Conveyor-belt furnaces have been used for the past 60 years for the heat treatment of metal parts; however, the use of a belt conveyor furnace for the destruction of hazardous waste was a relatively new application of the technology.

OHM then purchased a TDU from Shirco Infrared Systems (SHIRCO), a manufacturer of infrared TDUs, and made significant proprietary design modifications to the system. These mechanical and process modifications enhanced and further developed existing thermal destruction technologies as discussed in the following section.

EQUIPMENT ENHANCEMENTS

The basic TDU OHM purchased from SHIRCO had a full-scale design capacity of approximately 100 tons per day and could be operational in 21 to 28 days after arrival on site. To this basic design, OHM added features which enhanced mobility, on-site productivity and reliability, and greatly reduced the time required for setup and commissioning.

The following major modifications and upgrades were made to the unit before it was mobilized to the Florida Superfund site (OHM's first mobile infrared TDU project):

- <u>Trailer Arrangements and Weight Distribution</u>--The trailer arrangement was changed to incorporate OHM-designed hydraulic jacks to lift the unit into the operation position without having to remove the unit from its trailers. This upgrade alone reduced the setup time by 4 days. OHM also altered the arrangement of the unit's primary chamber on its frame, which reduced its overall length by 10 feet and weight by 10,000 pounds.

- <u>Scrubber Pump Arrangement</u>--The scrubber pumps were originally mounted on two separate skids that had to be wired and plumbed each time the unit was moved. With OHM's modified design, the pumps were permanently mounted on the scrubber trailer, further simplifying setup.

- <u>Computer Control and Data Logging</u>--OHM added a computer system to the unit to handle the complex and vast amount of data logging required by the USEPA. A total of 45 parameters were logged every 10 minutes, and the data stored on an IBM-industrialized computer. The computer system simplified the operation of the TDU with automatic startup and shutdown capabilities. Troubleshooting was also simplified with the chronological logging of the previous 450 alarms.

- <u>Emergency Backup Blower (Replacing Emergency Stack)</u>--OHM's largest modification eliminated the 52-foot tall insulated emergency stack. The stack was eliminated for several reasons including problems with erecting the stack and the potential of releasing unscrubbed gases into the atmosphere.

- <u>Materials Handling System</u>--OHM designed and constructed an entire materials handling system which consisted of a magnetic separator, rock crusher, weigh belt feeder, and associated conveyor systems.

These OHM modifications, made to increase the system's mobility and on-site performance, were proven successful when the unit was mechanically installed at the Florida site in less than 11 days.

PROCESS DESCRIPTION

The TDU can economically be used on projects involving between 2,000 and 50,000 tons of waste, and offers several advantages for processing soils compared to the conventional rotary kiln technology. The primary advantages are the precise solid waste retention time and reduction of gas flows which are obtained by indirectly heating the soil with radiant tubes.

The main objective of the thermal destruction process is to transform the feed material to another form (i.e., an ash acceptable for delisting) while assuring the exhaust gas products can likewise be dispersed without harm to the environment.

OHM's mobile infrared TDU consists of the following major components:

- Feed System
- Primary Chamber
- Secondary Combustion Chamber
- Pollution Control System
- Exhaust System
- Electrical and Process Control System

A process flow diagram of the TDU system is shown on Figure 1. Descriptions of the components mentioned above are given in the following subsections.

FEED SYSTEM

The purpose of the feed system is to continuously feed and distribute hazardous waste to the TDU for thermal destruction. (The waste feed must be a solid matrix which passes the paint filter test.) The feed system consists of a waste-feed hopper and weigh-belt conveyor.

Materials are fed into the unit from the feed hopper by a weigh-belt conveyor. The conveyor is completely enclosed to prevent spillage of hazardous materials as it enters the TDU. Access covers are designed so that the system can be easily decontaminated after a job is complete. The conveyor system can precisely measure, control, and record a feed rate between 6,000 to 20,000 pounds of waste per hour.

The weigh-belt conveyor is equipped with an electronic belt conveyor scale which has an accuracy of ± 0.5 percent. The scale is a weigh bridge with a single idler that is pivoted and counter balanced. The sensing element is a super precision strain gage load cell, hermetically sealed, and applied in compression. The material passing over the load cell is weighed and an analog signal is sent to a digital

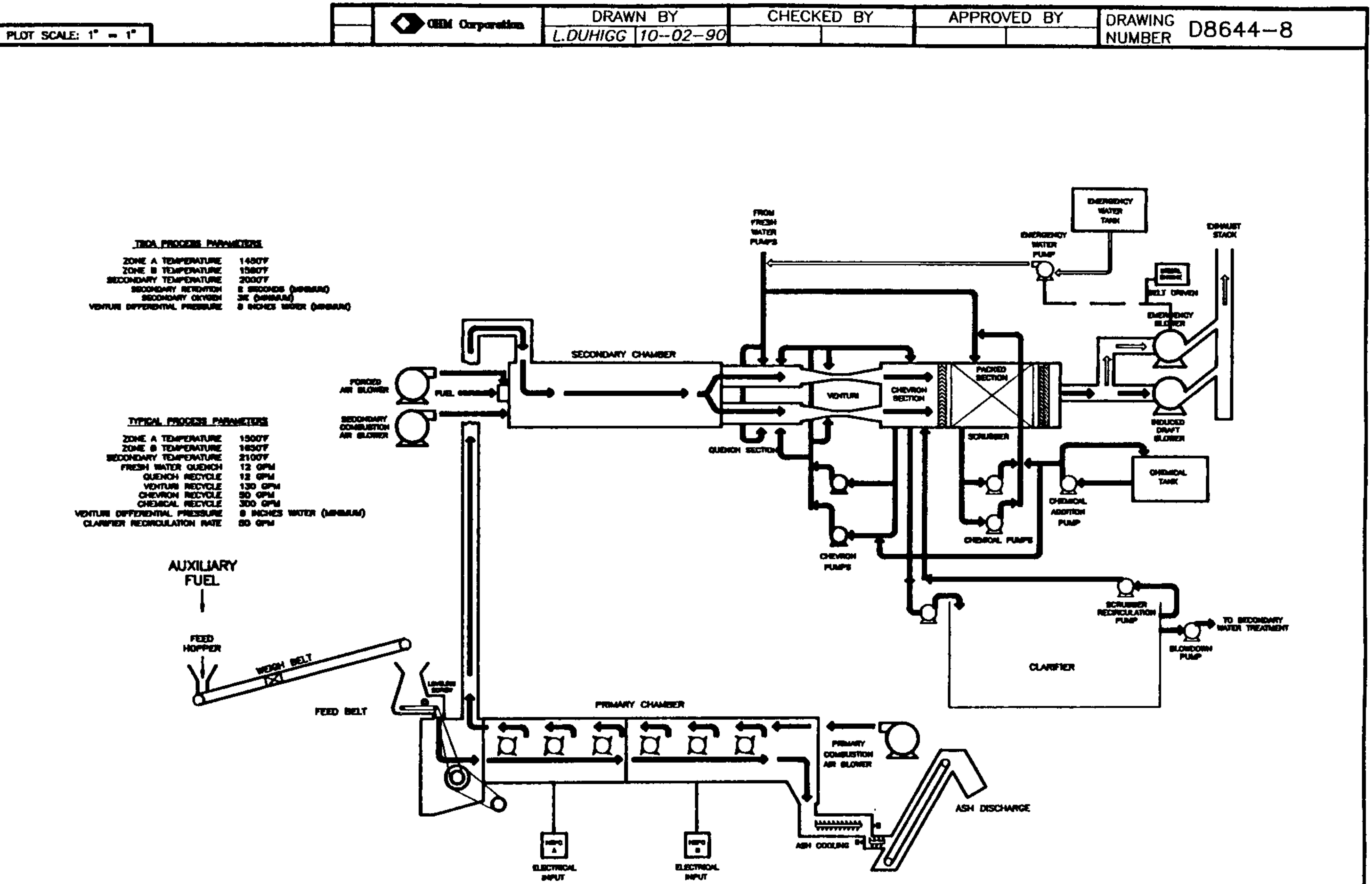

FIGURE 1

PROCESS FLOW DIAGRAM

read-out that displays totalized and instantaneous feed rates in the control van which automatically compensates belt speed to maintain a constant feed rate. Actual feed rate is continuously monitored and recorded in the control van.

Waste-Feed Cutoff System

The waste-feed system will automatically shut down when any of the following conditions deviate outside of processing parameters or otherwise fail:

- Secondary Chamber Temperature
- Secondary Chamber Oxygen Level
- Secondary Chamber Retention Time
- Stack Carbon Monoxide Level
- Primary Chamber Pressure
- Ash Discharge Conveyor Failure
- Induced Draft Blower Failure
- Scrubber Quench Temperature

PRIMARY CHAMBER (THERMAL DESTRUCTION SYSTEM)

The primary chamber consists of feed, heated processing, and discharge modules constructed of mild carbon steel. These modules are bolted together and mounted on a modified "goose neck" trailer.

The modules are insulated with 6 inches of ceramic fiber insulation on the sides and 8 inches on the top. The surface of the insulation is sealed with 1/4 inch of a high abrasion resistant refractory coating.

The processing modules are heated by transversely mounted silicon carbide resistance heating elements which are insulated from the steel shell with ceramic sleeves. Electrical connections to the heating elements are made by attaching braided steel straps to their aluminized ends with spring tensioned C-clamps. These electrical connections are protected by ventilated wire ways. The maximum heat input to the primary chamber from the electrical heating elements is 3,412,000 Btu/hr.

At the entry to the primary chamber, the waste from the weigh-belt feeder falls onto a totally enclosed conveyor belt with a leveling screw mounted over it. The leveling screw levels the waste to the effective width of the TDU. The feed material enters the primary chamber through the top of the feed module. A pneumatic control valve opens a damper when the waste feed is activated which allows the solid waste to enter the primary chamber. The waste then drops onto a high temperature stainless-steel alloy belt that transports the material through the chamber.

The belt is pulled through the chamber by a pinch drive roller system mounted in the feed module. The belt speed can be adjusted from the control panel through the use of a variable speed motor. The residence time can range from 10 to 60 minutes. The belt is supported by a series of five support rollers per module, and the belt return is supported by two rollers per module. All rollers and cakebreakers are supported by externally mounted flange bearings.

In the primary chamber, material is exposed to infrared radiation in multiple temperature control zones. Zone temperatures are controlled by automatically varying the heating element input power to maintain preset zone setpoint temperatures. As the material moves through the chamber, it is exposed to the thermal environment necessary for drying, volatilization, and pyrolysis or thermal destruction of volatiles and organics. Based on the density and thickness of the feed material, these steps may not occur in discrete phases. Particularly in the early stages, a given portion of the material may be undergoing any or all of these processes.

In order to maximize process rates, the material layer is stirred at six points in the furnace by powered rakes called cakebreakers. The cakebreakers, which are powered by 1/2-hp motors, bring fresh material to the top of the layer to ensure a uniform ash quality.

As the material moves through the chamber on the conveyor belt it is exposed to combustion air provided by means of a forced draft blower, which causes part of the organics to burn. The overall flow of the furnace gases is countercurrent to the material flow. This process feature allows for supplemental heating of the combustion air as it passes over the burned-out portions of the material layer; hence, a more energy-efficient process is achieved. The combustion air is distributed from the main air ducting and injected at strategic points in the chamber through air jets.

To remove the gases from the furnace, an induced draft blower is located at the scrubber exhaust. The blower maintains a sufficient draft on the system, assuring flow-out of the primary chamber while preventing excess, unmetered air in-leakage. The induced draft blower also prevents fugitive emissions.

Once the combusted and/or vaporized volatiles and organics leave the furnace, the fuel-rich gases pass through a gas-fired secondary combustion chamber. Handling of the ash discharged from the primary chamber is discussed below.

<u>Ash Handling and Storage</u>

By the time the ash is discharged from the primary chamber, it has reached approximately 1,200 degrees Fahrenheit and is free of any organic content. The ash is indirectly cooled in an enclosed lateral screw conveyor. A water spray system provides additional ash cooling and also moistens the ash to control fugitive dust. Cooled, moistened ash is then discharged through an inclined, enclosed bucket conveyor and transported to the temporary storage facility where it is held pending analytical verification.

The ash storage facility consists of a curbed concrete pad, adequately sloped and equipped with sumps to control run-off/run-on and facilitate decontamination. The storage area is also equipped with dividing walls to form isolation bins. Each isolation bin is sized to accommodate 12 hours of production at maximum capacity.

SECONDARY COMBUSTION CHAMBER

The purpose of the secondary chamber is to thermally destroy the combustible off-gas compounds carried in the exhaust gases from the primary chamber. In the secondary chamber, additional or excess combustion air is added and gas temperature can be increased to 2,200 degrees Fahrenheit by means of natural gas burners. The chamber is sized to provide 4 seconds of residence time at maximum gas throughput. This time and temperature combination ensures organic contaminants are fully oxidized.

The primary chamber exhaust gases enter the secondary chamber from the top just above the burner flame patterns. The resultant flow turns 90 degrees then continues to the downstream end of the chamber where they enter the pollution control system.

The secondary combustion chamber shell is constructed and insulated in a manner very similar to the primary chamber. The secondary chamber is lined with 13 inches of a ceramic fiber insulation.

The secondary chamber is fired by four propane, natural-gas, or fuel oil burners mounted on the front end of the chamber. The burner system consists of four Multifire^R burners, and has a 20-hp integral forced air blower capable of 32 inches of water column pressure. The maximum firing capacity of the burner system is 12,020,000 Btu/hr.

Excess air for combustion of entrained volatiles is provided by a secondary blower, duct work, and plenum chamber mounted on the inlet end of the chamber. This blower is equipped with a motorized inlet damper which is closed-loop controlled by the Programmable Logic Controller (PLC) based on oxygen level.

POLLUTION CONTROL SYSTEM

After passing through the secondary chamber, waste gases enter the pollution control system. This system involves removal of particulate matter, hydrochloric acid (HCl), and sulfur dioxide (SO_2) from a high temperature exhaust flow and cooling of that flow.

The hot waste gases are quenched in an Inconel transition section where fresh water is sprayed into the gas stream. The gases are cooled to their adiabatic saturation temperature of approximately 180 degrees Fahrenheit. After the quench, they enter the dual Fiberglas-reinforced plastic (FRP) venturi scrubber to capture entrained particulate matter. Water injected into the venturi throats atomizes and increases particulate precipitation as the gases enter the front section of the FRP packed-tower scrubber.

The particulate entrapped in water droplets drains into a blowdown sump in the bottom of this section. The particulate free waste gases continue into the aft section of the scrubber where a pH-controlled wash liquid is injected to neutralize acid vapor in the stream. The neutralized and cleaned gas stream exits the scrubber in a single duct leading to the exhaust system.

Blowdown Water Treatment

Scrubber blowdown water, containing suspended and dissolved solids, is treated on site prior to discharge to the publicly owned treatment works (POTW) or other approved discharge location. The blowdown water from the scrubber sump is pumped to a 10,000-gallon clarifier at a rate of 60 gallons per minute (gpm). Powdered lime, liquid sodium hydroxide, or an appropriate polymer is used as a flocking agent to precipitate suspended solids. Prior to the addition of flocculents, the pH of the water in the clarifier may be adjusted to between 9 and 10 to assist in the precipitation of heavy metals.

The clarified water flows to a 50,000-gallon reservoir for further solids settling. Supernatant from this reservoir is pumped back to the scrubber at a rate of 50 gpm, resulting in a 10-gpm accumulation in the 50,000-gallon reservoir. The 10-gpm accumulation represents the system blowdown, which can be purged continuously or batch discharged to the secondary filtration and treatment system.

The secondary water treatment system generally consists of a series of sand and bag filters for further solids removal, as necessary. An ion exchange system can also be utilized for additional heavy metals removal if dictated by discharge limitations. Finally, the treated water is pumped to 12,000-gallon holding pools for analytical verification prior to discharge. Hence, wastewater is not discharged to the POTW until the analytical results have been approved and the discharge criteria satisfied. Although concentrations of organic constituents in scrubber blowdown water are typically below detectable limits, additional treatment, including carbon filtration for organic removal, can be employed as necessary to meet local discharge requirements.

EXHAUST SYSTEM

After exiting the scrubber, the clean gas stream passes through an induced draft fan to an exhaust stack. The induced draft fan is the prime mover of the infrared TDU system. The fan maintains a negative draft on the entire system and provides the necessary pressure drop to operate the venturi scrubber.

The infrared TDU draft is controlled by a motor-operated vane damper on the inlet to the induced draft fan. The PLC controls the fan damper based on a pressure transmitter located at the longest linear distance from the induced draft fan in the soil discharge module of the primary chamber.

The 200-hp fan is equipped with a 1,788 rpm direct-drive electric motor; has a maximum static pressure of 35 inches; and exhibits a maximum flow of 30,000 ACFM at a rated temperature of 190 degrees Fahrenheit.

If the primary fan fails or a power outage occurs, emergency ventilation is provided by a backup fan which is diesel-operated. The backup fan has a maximum capacity of 14,000 CFM and is activated by the PLC. This emergency system has been successfully tested on numerous occasions without pressurization of the TDU.

ELECTRICAL AND PROCESS CONTROL SYSTEM

OHM's TDU is operated using an Allen-Bradley PLC for relay logic and control of the process. Dual Advisor2 control panels and CRT screens located in the control trailer allow the operator to monitor and control the system. The CRTs display process data such as motor, blower, and pump status; system operating temperatures, pressures, and flow rates; and continuous emissions monitoring data.

All field instrumentation and sensing elements are directly connected to the PLC by input/output panels and a data highway. Signal input/output and PID functions are processed by an Allen-Bradley PLC2/30 which provides automatic adjustment and control of process parameters to the desired setpoint condition. Process setpoints dictated by permit conditions are protected from unauthorized access via a security code. All other process functions are monitored and controlled by the PLC logic from setpoints and operator inputs via the Advisor2 control panels.

A personal computer connected to the data highway provides access to numerous system parameters for data logging and archive. System operating data is automatically logged to the PC hard drive, which can be down-loaded to floppy disk or a printer for records retention. The system can be used to generate hourly (10-minute logging rate average) or on-demand status reports. Every day, the hourly monitoring data for the previous day is printed, and a hard copy is stored with the TDU records for a quick reference. If required, the data collected between the hourly readings can be retrieved from the floppy disks.

PAST THERMAL DESTRUCTION PROJECTS

To date, OHM has used our infrared TDU for three major remediation projects. Two of the projects were at Superfund sites, and one was performed for the Canadian Department of National Defense (DND). This section describes each project, and also includes trial burn/particulate test data.

FLORIDA SUPERFUND SITE

As previously mentioned, the first application of the OHM infrared TDU was at a Superfund site in Florida. This site was formerly used to manufacture reinforcing bar from scrap iron, and was closed for economic reasons in 1982. Following closure of the plant, an environmental audit was conducted which indicated the site was contaminated with PCBs. (Equipment previously used at the site leaked hydraulic oil containing PCBs.)

A complete site evaluation was completed in 1984 which included over 500 soil borings and 1,400 samples. The PCB-contaminated materials consisted of approximately 14,000 tons of fill material and 4,000 tons of sediments from the primary settling lagoon.

OHM was contracted to excavate PCB-contaminated soils/ sediments and contain them on site pending the results of an owner-performed feasibility study. OHM worked with the client's consultant engineer to design a vault for storage/ drying of the excavated materials. Following design approval, during the summer of 1985 OHM engineers surveyed the site and oversaw field construction of the vault. OHM was able to construct the vault using materials already on site (i.e., slag material). This innovation saved the client money that would have otherwise been expended on building materials.

In the spring of 1986 OHM was asked to provide the client with remedial alternatives for handling the materials. Based on the results of the client's feasibility study, OHM offered two alternatives--excavate and landfill off site or thermal destruction. SHIRCO performed a trial burn with their pilot-scale, 80-pound-per-hour TDU. The trial burn was successful and the client chose infrared thermal destruction as the preferred technology.

In March 1987, OHM began preparing the work areas for waste storage, ash storage, and the TDU. The site had two large buildings under which all the equipment was installed (with the exception of the water-treatment system). A new impervious concrete floor was poured in all work areas. Also, an inflatable building (150 feet by 300 feet) was installed over the vault in order to control dust and moisture while the waste material was being removed.

The TDU was installed at the site in August 1987 in less than 11 days. An initial series of mechanical and electrical check-outs was performed over the next 2 weeks.

TSCA Trial Burn No. 1

Prior to the start of thermal destruction activities, the USEPA required a full-scale PCB trial burn. The trial burn was designed to demonstrate the unit's ability to comply with the standards for thermally destroying PCBs as set forth in 40 CFR 761.70(b). The trial burn (which consisted of five test runs) was conducted from September 28 to October 5, 1987.

A summary of results for all five demonstration test runs appears in Table 1. The OHM infrared mobile TDU met all the performance standards with the exception of the particulate emissions on Test Run 3. The high particulate emission of the Test Run 3 may have been the result of subisokinetic stack sampling and the operational failure of the fresh water quench system during this test.

The results of the trial burn were acceptable to the USEPA Region IV and the State of Florida for the performance of the Florida Superfund project. As a result, full-scale thermal destruction activities could commence.

Full-Scale Thermal Destruction

The full-scale operations began in October 1987 and were completed in May 1988 during which time 18,177 tons of PCB-contaminated soils and sediments were burned. The system achieved soil processing rates of up to 210 tons per day. An overview of the thermal destruction activities is given in the following paragraphs.

The project site consisted of three main working areas: (1) feed-processing area, (2) TDU area, and (3) ash storage area. In the feed-processing area, OHM screened material to be processed, removed metallic objects, reduced particle size to less than 1 inch in diameter, and staged prepared soil to await destruction. The waste material contained an assortment of different constituents including emission control dust (USEPA Hazardous Waste No. K061), furnace slag, reinforcing bar, car bumpers, and railroad ties. The entire waste handling system, designed and constructed by OHM, consisted of many components in order to handle this diverse wastestream, such as a trackhoe, grizzly classifier, magnetic separator, jaw crusher, roll crusher, front-end loader, pugmill, plastic shredder, and wood chipper.

After the waste was prepared for thermal destruction, it was sampled for PCB and moisture content and then stockpiled. All feed preparation areas were constructed in a way that the intrusion of precipitation would be prevented.

TABLE 1

TRIAL BURN NO. 1 RESULTS SUMMARY

	Test 1	Test 2	Test 3	Test 4	Test 5
Date	9-28-87	9-29-87	10-3-87	10-4-87	10-5-87
Primary Chamber Operating Parameters:					
Waste feed rate (lb/hr)	11,470	11,660	11,798	11,817	12,144
PCB concentration (mg/kg)	4,570	2,810	15,100	13,900	13,900
PCB feed rate (lb/hr)	52.4	32.8	178	164	164
Heat content (Btu/lb)	319	712	820	680	691
Moisture (%)	8.9	8.6	8.3	9.2	8.8
Total Chloride (%)	0.19	0.26	0.79	0.68	0.71
Secondary Chamber Operating Parameters:					
Chamber temperature (°F)	2,098	2,032	1,964	1,935	2,069
Exhaust temperature (°F)	2,021	1,960	1,893	1,853	1,980
Average oxygen (%)	6.9	7.0	7.0	6.9	6.0
Average carbon dioxide (%)	5.2	6.3	5.2	5.2	5.2
Average carbon monoxide (ppm)	3.0	5.0	1.0	1.0	1.0
Combustion efficiency (%)	99.99	99.99	99.99	99.99	99.99
Stack Emissions:					
Stack gas flow rate (dscfm)	6,218	5,982	7,013	6,723	7,111
Particulate concentration (gr/dscf)*	0.02	0.03	0.10	0.07	0.08
Chlorine emission (lb/hr)	<0.08	<0.07	0.22	0.16	0.12
Total RCL emission (ug/m^3)	8.0	1.3	5.3	6.8	14.9
PCB DRE (%)	>99.999999	>99.999999	>99.999999	>99.99998	>99.99998

*Corrected to 7 percent oxygen

Soil then entered the TDU by way of an enclosed belt conveyor equipped with load cells to monitor the feed rate. The resultant ash, after being discharged and quenched, was held temporarily in secure bins to await analysis. Laboratory analysis of the decontaminated soil showed the technology consistently met the USEPA criterion of less than 2 ppm PCBs, and analysis of stack samples demonstrated a PCB DRE of 99.9999 percent.

OHM also performed scrubber water treatment and decontamination water treatment (two separate systems) prior to the water being discharged to an on-site spray irrigation field. The water treatment criteria were as follows: 1.0 ug/l PCBs; 0.2 mg/l lead; and 0.04 mg/l cadmium.

An important outcome of this project was the TSCA permitting of the TDU. The national USEPA requested an additional trial burn before the issuance of a national TSCA permit. This trial burn, conducted after the Florida Superfund project was complete, is discussed in the following paragraphs.

TSCA Trial Burn No. 2

The second TSCA trial burn was conducted on June 29 and 30, 1988, at the Florida Superfund site. The trial burn consisted of three test runs under identical conditions, to demonstrate OHM's ability to comply with the standards for TDUs as set forth in 40 CFR 761.70(b).

A summary of the results for the three demonstration tests performed in Trial Burn No. 2 appears in Table 2. The data indicate that the TDU meets the requirements of 40 CFR Part 761, and OHM became the first environmental services company in the nation with a TSCA-permitted infrared TDU.

The data obtained from the trial burns supports the destruction of waste with the following characteristics:

- Solid matrix which passes the paint filter test
- No POHC more difficult to thermally destroy than nonachlorobiphenyl
- Maximum total chloride content of 0.5 percent

The operating conditions demonstrated during the trial burn assure that a waste meeting the above-listed characteristics will be destroyed according to applicable thermal destruction requirements.

TABLE 2

TRIAL BURN NO. 2 RESULTS SUMMARY

	Test 1	Test 2	Test 3
Date	6-29-88	6-29-88	6-30-88
Primary Chamber Operating Parameters:			
Waste feed rate (lb/hr)	13,921	13,856	13,728
PCB concentration (mg/kg)	7,255	8,277	5,366
PCB feed rate (lb/hr)	96.97	96.52	95.63
Heat content (Btu/lb)	872	1500	786
Secondary Chamber Operating Parameters:			
Chamber temperature (°F)	1,987	1,996	1,995
Average oxygen (%)	13.5	13.6	13.4
Average carbon dioxide (%)	4.8	4.8	5.0
Average carbon monoxide (ppm)	1.2	4.3	1.1
Combustion efficiency (%)	99.99	99.99	99.99
Stack Emissions:			
Stack gas flow rate (dscfm)	6,332	6,001	6,209
Average oxygen (%)	13.8	13.5	13.3
Chlorine emission (lb/hr)	0.088	0.076	0.115
Particulate concentration (gr/dscf)*	0.053	0.061	0.056
PCB DRE (%)	>99.999992	>99.999994	>99.999995
Scrubber Parameters:			
Average scrubber pH	6.75	7.06	7.14
Average venturi pressure drop (inches water)	26.7	26.1	26.4

*Corrected to 7 percent oxygen

MINNESOTA SUPERFUND SITE

This project involved the on-site infrared thermal destruction of 2,450 tons of PCB-contaminated soil at the Twin Cities Army Ammunition Plant (TCAAP) in New Brighton, Minnesota. The contaminated soil was previously located in a waste burning pit area, and was excavated from the area in 1985 and placed in an on-site vault.

OHM's initial efforts for the project included site assessment and analysis of soil samples. Average initial contaminant levels were 70 ppm PCBs (Arochlor 1254); with maximum levels ranging to 210 ppm. The waste also contained the following metal concentrations:

	Analytical Results (ppm)	
	Average	Maximum
Arsenic	1.3	1.8
Barium	91.8	140.0
Cadmium	0.77	1.0
Chromium	11.8	32.0
Lead	85.8	240.0
Mercury	0.63	1.0
Selenium	0.2	0.3

Once the TDU system arrived on site, it was set up and completely operational in less than 14 days. Site activities included excavation of contaminated soil that had been stock-piled in the lined vault. The soil was fed into a rock crusher to remove any large debris and reduce all materials to approximately 1 inch in diameter for efficient processing through the TDU. As the soil left the rock crusher it was then transported to a pugmill where the soil was mixed with a small amount of fuel oil. The fuel oil enhanced the soils' heat content in order to reduce the electrical power demand on the primary chamber of the TDU. Upon mixing, the soil was stockpiled on the feed preparation pad for storage until it was transported to the feed conveyor.

Soil was fed into the primary chamber at a rate of 7 tons per hour. The ash resulting from the thermal proces-sing was then staged for sampling. Analytical results showed the ash contained less than 2 ppm PCBs and met the EP Tox-icity criteria for heavy metals, which demonstrated the ash could be stockpiled for use as backfill.

Off-gases from the primary chamber were directed to the secondary chamber for further destruction at approximately 2,000 degrees Fahrenheit. Air from the secondary chamber then passed through a series of scrubbers and was emitted through an exhaust stack.

The scrubber blowdown water (containing suspended and dissolved solids) and the decontamination water were treated on site prior to discharge to the POTW. The scrubber water treatment system consisted of pH adjustment, lime precipitation, and clarification. The decontamination water treatment system consisted of these components, plus carbon filtration. The treatment criteria requirements, which were the same for both water treatment systems, are given below:

PCBs	0.1 ug/l
Cadmium	2.0 mg/l
Lead	1.0 mg/l
Mercury	0.1 mg/l
pH	5.0 to 10.0

The wastewater produced as a result of the thermal treatment operations was treated such that the total amount of PCBs discharged over the entire project did not exceed the 0.01 pound limit imposed for discharge to the POTW.

In summary, TDU utilization was approximately 81 percent, and a DRE of 99.9999 percent was achieved over the 3 weeks of soil processing.

Particulate Test

Because OHM holds a national TSCA permit for the TDU, no trial burns were required by the State of Minnesota for the TCAAP project. However, during the project, OHM conducted a voluntary particulate test consisting of three USEPA Method 5 particulate sampling runs to verify compliance with the emission standards. The results of the particulate test indicated the TDU was in compliance with all requirements (see Table 3).

CANADIAN DND SITE

In August 1989, OHM was awarded a contract with the Canadian DND to operate our mobile infrared TDU for the destruction of PCB wastes at Happy Valley/Goose Bay, Labrador. This contract represents the first PCB destruction program undertaken by the Canadian government.

Goose Bay is located in a very remote portion of Labrador, where temperatures during the winter months average -40 degrees Fahrenheit. The only access to the site is by way of water or air, and because of freezing, the harbor is only available 4 to 5 months per year. Due to these constraints, extensive preproject planning by OHM was necessary to ensure the project would be conducted as efficiently as possible.

TABLE 3

PARTICULATE TEST SAMPLING RESULTS

Parameter	Run 1	Run 2	Run 3
Stack Temperature (degrees Fahrenheit)	165	163	165
Stack Flow (acfm)	8,700	8,520	9,210
(dscfm)	4,630	4,520	4,760
Oxygen Orsat (%)	14.3	14.25	13.60
Particulate Concentration (gr/dscf)	0.0032	0.0051	0.0022
Corrected to 7% Oxygen (gr/dscf)	0.0067	0.011	0.0042
Particulate Emissions (lb/hr)	0.13	0.20	0.14
Feed Rate (lb/hr)	14,150	7,210	12,280

The majority of the material processed originated from three former radar facilities which were located in Melville, Saglek, and Cartwright, Labrador. At all three locations, transformers had leaked PCB oils, contaminating the soil. The Goose Bay Air Force Base was chosen as the central location where all the PCB-contaminated waste would be processed. The northern portion of the base contained concrete bunkers, where the waste was stored to await thermal destruction. The designated TDU area was a barren field located on the southern outskirts of the base. Prior to OHM's arrival, 70 percent of the waste to be thermally destroyed had already been placed in drums and containers and placed in the bunkers.

When OHM's crew was mobilized, we were responsible for loading the balance of drums/containers of waste from the remote Saglek and Cartwright facilities onto a barge, and shipping the material over the North Labrador Sea to Goose Bay. These drums and containers, which contained a total of approximately 900 tons of PCB liquids and other PCB wastes, were then placed in the concrete bunkers previously mentioned.

In late October, OHM's TSCA-permitted TDU was mobilized via barge over 1,600 nautical miles to the project site. Early shipment of the TDU was necessary to assure arrival prior to the freezing of the harbor in November. After mobilization, OHM constructed a totally enclosed, 40,000-square-foot dome to house the TDU. The dome, which was heated, was necessary for operations to continue under arctic conditions throughout the winter months. The TDU was then set up and site-specific modifications were made. The largest alteration involved modifying the TDU to burn fuel oil. (In the past, the TDU was run on propane or natural gas; however, Goose Bay did not have natural gas available and the supply of propane was limited.) OHM also made modifications to the unit for weatherproofing and strict emissions control compliance.

A trial burn, consisting of three test runs, was conducted in January 1990 to demonstrate compliance with the highly stringent Federal and Provincial Canadian standards for thermal destruction of PCBs. The required criteria for stack emissions follow: DRE of 99.9999 percent; 50 mg/m^3 particulate at 11 percent oxygen; and 12 ng/m^3 2,3,7,8-TCDD equivalents. The ash criteria were 0.5 ppm PCBs and 1.0 ppb PCDD/PCDF. Following the trial burn, full-scale operations began. The drums/containers of waste were transported to the interim storage area concurrent with the thermal destruction process.

In mid-January 1990, OHM performed additional hazardous waste removal and treatment services including the excavation of 700 drums of frozen soil from a nearby mountainside (Melville radar facility). OHM then retrofilled over 300 in-service transformers which had originally contained PCB-contaminated oil. We also emptied a large supply of PCB storage containers, some of which were over 10 years old, and decontaminated 300 of them to contamination levels over 4 times more stringent than present levels established by TSCA.

The total quantity of waste thermally destroyed consisted of over 4,000 tons of PCB-contaminated soils, rock, wood, plastic, transformers, capacitors, steel drums, free PCB oils, and miscellaneous debris.

All water generated by the site operation was stored and treated on site with equipment specially designed by OHM for this purpose. Water from the TDU's scrubber unit was collected in storage tanks and processed through a reverse osmosis unit for reuse in the quench system. The design incorporates equalization, filtration, reverse osmosis, and backflush systems. This unique application eliminated the need to store and heat large quantities of water while awaiting analytical results. Innovations such as this, along with OHM's extensive experience and adaptability, allowed for the successful completion of this challenging project in such a remote location. At project end, all excess water was treated and discharged to the Municipal Sewage Collection System. The water-treatment criteria were as follows: 5 ug/l PCBs, and 0.25 ng/l PCDD/PCDF.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 26 1990

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

Mr. Gregory McCartney
Project Engineer
OHM Remediation Services Corporation
P.O. Box 551
Findlay, Ohio 45839-0551

Dear Mr. McCartney:

You requested clarification of regulatory requirement concerning laboratory characterization of waste for the O.H. Material Mobile Infrared Incinerator (MII). In your inquiry of October 17, 1990 to Hiroshi Dodohara of my staff, you described laboratory operations for physical and chemical analysis of waste samples, and PCB and TCLP analysis of ash material. Waste samples from 50 to 100 grams are heated in a standard laboratory electric muffle oven for 15 to 30 minutes. The ash is cooled and analyzed for PCBs and leachable metals. The characterization can be performed with less than 500 grams of waste. You requested clarification whether this procedure is exempt under laboratory exclusion 40 CFR 761.20(c)(2) or whether the activity requires a permit.

Under §761.20(c)(2) activities may be conducted without an exemption for PCBs at concentrations of 50 ppm or greater if the activity is considered processing and distribution in commerce for the purpose of disposal pursuant with §761.60. Your laboratory characterization activities do not fit either the "processing" or the "distribution in commerce" category. Specifically, under the processing exemption, you must prepare a chemical substance or mixture (1) in the same form or physical state as, or in a different form or physical state from, that in which it was received by the person so preparing such substance or mixture, or (2) as part of a PCB article containing the chemical substance or mixture. Since your laboratory activity changes the chemical nature of PCBs from the state it was received, the laboratory operations cannot be exempted. Therefore, your laboratory must obtain EPA approval.

EPA has elected to approve the O.H. Material laboratory in the form of an amendment to the existing TSCA PCB Disposal Permit. The amendment allows O.H. Material to use the laboratory for characterization of waste for the O.H. Material MII. Discharges from the furnace must be released through carbon adsorption filters. All waste generated from the laboratory operations must be disposed of in an EPA-approved PCB Disposal Facility. The MII may be used for disposal of waste generated from activities related to operations described in this paragraph. Enclosed are revised pages of the OHM TSCA PCB disposal permit. Revisions are typed in **bold** characters. We have amended the permit indicating OHM's name change to OHM Remediation Services Corporation. Please replace the pages as indicated. Questions regarding this matter should be directed to Hiroshi Dodohara on (202) 382-3959.

Sincerely,

for Elizabeth F. Bryan
Joseph J. Merenda, Director
Exposure Evaluation Division

Enclosures

cc: Regional Administrators
USEPA, Regions I-X

PCB Coordinators
USEPA, Regions I-X

Enclosure
Revised 11-27-90

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

IN THE MATTER OF	)	APPROVAL TO DISPOSE
	)	
OHM REMEDIATION SERVICES	)	OF POLYCHLORINATED
	)	
CORPORATION	)	BIPHENYLS (PCBs)
FINDLAY, OHIO		

AUTHORITY

This approval is issued pursuant to Section 6(e)(1) of the Toxic Substances Control Act of 1976, Public Law No. 94-469, and the Federal PCB Regulations, 40 CFR 761.60(e) and 761.70(a) and (b) (48 FR 13185, March 30, 1983).

EFFECTIVE DATE

This approval shall be effective from December 30, 1988 to December 29, 1991 in all ten EPA Regions.

BACKGROUND

Section 6(e)(1)(A) of the Toxic Substances Control Act (TSCA) requires that EPA promulgate rules for the disposal of polychlorinated biphenyls (PCBs). The rules implementing section 6(e)(1)(A) were published in the Federal Register of May 31, 1979 (44 FR 31514) and recodified in the Federal Register of May 6, 1982 (47 FR 19527). Those rules require, among other things, that various types of PCBs and PCB Articles be disposed of in EPA-approved landfills (40 CFR 761.75), incinerators (40 CFR 761.70), high efficiency boilers (40 CFR 761.60), or by alternative methods (40 CFR 761.60(e)) that demonstrate a level of performance equivalent to EPA-approved incinerators or high efficiency boilers. The May 31, 1979 Federal Register also designated Regional Administrators as the approval authority for PCB disposal facilities.

On March 30, 1983, EPA issued a procedural rule amendment to the PCB rule (48 FR 13185). This procedural rule change transferred the review and approval authority of mobile and other PCB disposal facilities that are used in more than one region to the Office of Pesticides and Toxic Substances (OPTS). The purpose of the amendment is to eliminate duplication of effort in the regional offices and to unify the Agency's approach to PCB disposal. The amendment gives the Assistant Administrator authority to issue nationwide approvals (i.e., approvals which will be effective in all ten EPA regions) to mobile and other PCB disposal facilities that are used in more than one region.

The solid waste generated in the MII is determined not to present an unreasonable risk of injury to human health or to the environment. In the event of a malfunction during treatment operations, the OHM MII unit is designed to shut down totally without the release of PCBs.

12. The OHM MII incinerator has a level of performance equivalent to that of the required thermal destruction methods (incinerators and high efficiency boilers).

13. Pursuant to 40 CFR 761.60(e) and the aforementioned findings, EPA finds that the OHM MII incinerator (when operated under the conditions described below) is equivalent in performance to an EPA-approved incinerator for treatment of non-liquid PCBs and that it does not pose an unreasonable risk of injury to human health or the environment.

14. On October 17, 1990, O.H. Material requested clarification of regulatory requirement concerning laboratory characterization of waste for the O.H. Material Mobile Infrared Incinerator (MII). The laboratory operations consists of physical and chemical analysis of waste samples and PCB and TCLP analysis of ash material. Waste samples from 50 to 100 grams are heated in a standard laboratory electric muffle oven for 15 to 30 minutes. The ash is cooled and analyzed for PCBs and leachable metals. The characterization can be performed with less than 500 grams of waste.

Under §761.20(c)(2) activities may be conducted without an exemption for PCBs at concentrations of 50 ppm or greater if the activity is considered processing and distribution in commerce for the purpose of disposal pursuant with §761.60. The OHM laboratory activities do not fit either the "processing" or the "distribution in commerce" category. Specifically, under the processing exemption, OHM must prepare a chemical substance or mixture (1) in the same form or physical state as, or in a different form or physical state from, that in which it was received by the person so preparing such substance or mixture, or (2) as part of a PCB article containing the chemical substance or mixture. Since the OHM laboratory activity chemically transforms the PCBs from the state it was received, the laboratory operations cannot be exempted. Therefore, OHM must obtain an EPA approval. Condition 3(e) defines the operational requirements.

2) Collect composite samples of the stored, treated soil from the disposal operation and analyze the samples in duplicate (i.e., duplicate analysis) by gas chromatography for PCB concentrations. If the concentration of PCBs in any composite samples is 2 ppm or greater, the soil must be stored (as above), reprocessed, and reanalyzed to show less than 2 ppm PCBs prior to initiation of the next disposal operation.

(c) Other waste materials which have been demonstrated to contain detectable PCBs (2 ppm) must be disposed of as if they contained PCBs at the concentration measured in the original soil feedstock.

(d) If OHM is required by other agencies to sample treated soil and analyze for polychlorinated dibenzodioxins and polychlorinated dibenzofurans (including 2,3,7,8-TCDDs and 2,3,7,8-TCDFs) the analysis must be performed using laboratory techniques with limits of quantitation below 1 parts per billion (ppb).

(e) OHM may use the laboratory for determining the applicability of the MII to treat site soil. The laboratory operations characterize waste samples through physical and chemical analysis and also through PCB and TCLP analysis of the ash material. Discharges from the furnace must be released through carbon adsorption filters. All waste generated from the laboratory operations must be disposed of in an EPA-approved PCB Disposal Facility. The MII may be used for disposal of waste generated from activities related to operations described in this paragraph.

4. <u>Incinerator Failure</u>:

If the quality control testing, as described in Conditions 2 and 3, reveals that the PCBs have not been adequately destroyed after repeated processing, the affected unit shall cease operation. The facility operator must notify the EPA PCB disposal coordinator in the appropriate EPA Regional Office and the EPA PCB Disposal Section on (202) 382-3964 during the business day of the failure or, if not during business hours, during the next regular business day, and file a written report within seven (7) days. The affected unit shall not resume operation until the problem has been corrected to the satisfaction of the EPA.

5. Process Restrictions:

The OHM Mobile Infrared Incinerator system shall operate at the following conditions whenever PCBs are being incinerated:

(a) At a minimum, the residence time in the secondary combustor shall be 2.0 seconds and the operating set point temperature shall be 2000° F with a lower limit temperature excursion of 1950° F. The unit was capable of maintaining the temperature between ± 50° F consistently during operations.

APPENDIX D

TABLE OF CONTENTS

APPENDIX D.1

TAGM SCORING TABLES

BLACK MUD POND

AREA: Black Mud Pond
ALTERNATIVE: 1A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 1A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				
TOTAL (Maximum = 20): 20				

AREA: Black Mud Pond
ALTERNATIVE: 1A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	___ X	0 4
	o Can the risk be easily controlled?	Yes No	___ ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes No	___ ___	0 2
Subtotal (Maximum = 4):	4			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	X ___	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes No	X ___	3 0
Subtotal (Maximum = 4):	3			
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	≤2 yr. >2 yr.	___ X	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	___ X	1 0
Subtotal (Maximum = 2):	0			

TOTAL (MAXIMUM = 10): 7

AREA: Black Mud Pond
ALTERNATIVE: 1A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		X 1
	o On-site or off-site land disposal		___ 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 1

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	X 3
		No	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 5

AREA: Black Mud Pond
ALTERNATIVE: 1A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 14

AREA: Black Mud Pond
ALTERNATIVE: 1A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100%	___	8
		90-99%	X	7
		80-90%	___	6
		60-80%	___	4
		40-60%	___	2
		20-40%	___	1
		< 20%	___	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes	___	0
		No	X	2
Subtotal (Maximum = 10): 10	If subtotal = 10, go to Factor 3.			
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	___	0
		On-site land disposal	X	
		Off-site destruction or treatment	___	2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100%	X	2
		60-90%	___	1
		< 60%	___	0
If Factor 2 is not applicable, go to Factor 3.				
	ii) Method of Immobilization			
	- Reduced mobility by containment		X	0
	- Reduced mobility by alternative treatment technologies		___	[illegible]
Subtotal (Maximum = 5): 2				
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible		___	5
	Irreversible for most of the hazardous waste constituents.		___	3
	Irreversible for only some of the hazardous waste constituents.		X	2
	Reversible for most of the hazardous waste constituents.		___	0
Subtotal (Maximum = 5): 2				

TOTAL (MAXIMUM = 15): 14

AREA: Black Mud Pond
ALTERNATIVE: 1A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X	2
c. Schedule of delays due to technical problems.	i) Unlikely	___	2
	ii) Somewhat likely	X	1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___	2
	ii) Some future remedial actions may be necessary.	X	1
Subtotal (Maximum = 10): 6			
2. Administrative Feasibililty			
a. Coordination with other agencies.	i) Minimal coordination is required.	___	2
	ii) Required coordination is normal.	___	1
	iii) Extensive coordination is required.	X	0
Subtotal (Maximum = 2): 0			

AREA: Black Mud Pond
ALTERNATIVE: 1A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 9

AREA: Black Mud Pond
ALTERNATIVE: 1B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 1B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes No	X ___	20 0
TOTAL (Maximum = 20): 20				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes No	___ ___	3 0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes No	___ ___	4 0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes No	___ ___	3 0
Subtotal (Maximum = 10): ___				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	___	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): ___				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		___	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): ___				

TOTAL (Maximum = 20): 20

AREA: Black Mud Pond
ALTERNATIVE: 1B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	___ X	0 4
	o Can the risk be easily controlled?	Yes No	___ ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes No	___ ___	0 2
Subtotal (Maximum = 4): 4				
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	X ___	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes No	X ___	3 0
Subtotal (Maximum = 4): 3				
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr. >2 yr.	___ X	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	___ X	1 0
Subtotal (Maximum = 2): 0				

TOTAL (MAXIMUM = 10): 7

AREA: Black Mud Pond
ALTERNATIVE: 1B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		X 1
	o On-site or off-site land disposal		___ 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 1

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	X 3
		No	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 5

AREA: Black Mud Pond
ALTERNATIVE: 1B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate X 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 14

AREA: Black Mud Pond
ALTERNATIVE: 1B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% _X_ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No _X_ 2
Subtotal (Maximum = 10): 10	**If subtotal = 10, go to Factor 3.**	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal _X_ 1 Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% _X_ 2 60-90% ___ 1 < 60% ___ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 2		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	_X_ 2
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (Maximum = 5): 2		

TOTAL (MAXIMUM = 15): 14

AREA: Black Mud Pond
ALTERNATIVE: 1B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X	2
c. Schedule of delays due to technical problems.	i) Unlikely	___	2
	ii) Somewhat likely	X	1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___	2
	ii) Some future remedial actions may be necessary.	X	1
Subtotal (Maximum = 10): 6			
2. Administrative Feasibililty			
a. Coordination with other agencies.	i) Minimal coordination is required.	___	2
	ii) Required coordination is normal.	___	1
	iii) Extensive coordination is required.	0	0
Subtotal (Maximum = 2): 0			

AREA: Black Mud Pond
ALTERNATIVE: 1B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 9

AREA: Black Mud Pond
ALTERNATIVE: 2A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 2A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				
TOTAL (Maximum = 20): 20				

AREA: Black Mud Pond
ALTERNATIVE: 2A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor		Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o	**Are there significant short-term risks to the community that must be addressed?** (If answer is no, go to Factor 2.)	Yes No	___ X	0 4
	o	**Can the risk be easily** controlled?	Yes No	___ ___	1 0
	o	**Does the mitigative effort to control risk impact the community life-style?**	Yes No	___ ___	0 2
Subtotal (Maximum = 4): 4					
2. Environmental Impacts	o	**Are there significant short-term risks to the environment that must be addressed?** (If answer is no, go to Factor 3.)	Yes No	___ X	0 4
	o	**Are the available mitigative measures reliable to minimize potential impacts?**	Yes No	___ ___	3 0
Subtotal (Maximum = 4): 4					
3. Time to implement the remedy.	o	**What is the required time to implement the remedy?**	≤2 yr. >2 yr.	X ___	1 0
	o	**Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2): 2					

TOTAL (MAXIMUM = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 2A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor		Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o	On-site treatment*		___	3
	o	Off-site treatment*		___	1
	o	On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor		Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o	Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
			No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor		Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o	Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
			20-25 yr	___	2
			15-20 yr	___	1
			< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor		Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i)	Quantity of untreated hazardous waste left at the site.	None	___	3
			≤ 25%	___	2
			25-50%	___	1
			≥ 50%	X	0
	ii)	Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
			No	X	2
	iii)	Is the treated residual toxic?	Yes	___	0
			No	___	1
	iv)	Is the treated residual mobile?	Yes	___	0
			No	___	1

Subtotal (Maximum = 5): 2

AREA: Black Mud Pond
ALTERNATIVE: 2A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X Somewhat to no confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate X Extensive ___

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Black Mud Pond
ALTERNATIVE: 2A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% _X_ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	_X_ 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: Black Mud Pond
ALTERNATIVE: 2A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 9		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	X 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 2		

AREA: Black Mud Pond
ALTERNATIVE: 2A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes _X_ 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes _X_ 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes _X_ 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 14

AREA: Black Mud Pond
ALTERNATIVE: 2B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes No	X 4 __ 0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes No	X 3 __ 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes No	X 3 __ 0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 2B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis			Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)		Yes	X	20
			No		0
TOTAL (Maximum = 20):	20				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?		Yes		3
			No		0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?		Yes		4
			No		0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?		Yes		3
			No		0
Subtotal (Maximum = 10):					
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000			5
	ii) Health risk	≤1 in 100,000			2
Subtotal (Maximum = 5):					
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable				5
	ii) Slightly greater than acceptable.				3
	iii) Significant risk still exists.				0
Subtotal (Maximum = 5):					

TOTAL (Maximum = 20): 20

AREA: Black Mud Pond
ALTERNATIVE: 2B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	Yes No	___ X	0 4
	o **Can the risk be easily controlled?**	Yes No	___ ___	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	Yes No	___ ___	0 2
Subtotal (Maximum = 4):	4			
2. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	Yes No	___ X	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	Yes No	___ ___	3 0
Subtotal (Maximum = 4):	4			
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	≤2 yr. >2 yr.	X ___	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2):	2			

TOTAL (MAXIMUM = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 2B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Black Mud Pond
ALTERNATIVE: 2B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ Somewhat to not confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate _X_ Extensive ___

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Black Mud Pond
ALTERNATIVE: 2B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% _X_ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	_X_ 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: Black Mud Pond
ALTERNATIVE: 2B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___ 1
Subtotal (Maximum = 10):	10	
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	X 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2):	2	

AREA: Black Mud Pond
ALTERNATIVE: 2B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes _X_ 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes _X_ 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes _X_ 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 15

AREA: Black Mud Pond
ALTERNATIVE: 4C

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 4C

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	**Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)**	**Yes**	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	**i) Is the exposure to contaminants via air route acceptable?**	**Yes**	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	**Yes**	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	**Yes**	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	**i) Health risk**	**≤1 in 1,000,000**	X	5
	ii) Health risk	**≤1 in 100,000**	___	2
Subtotal (Maximum = 5): 5				
. Magnitude of residual environmental risks after the remediation.	**i) Acceptable**		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 20

AREA: Black Mud Pond
ALTERNATIVE: 4C

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	X ___	0 4
	o Can the risk be easily controlled?	Yes No	X ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes No	___ X	0 2
Subtotal (Maximum = 4):	3			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	X ___	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes No	X ___	3 0
Subtotal (Maximum = 4):	3			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr. >2 yr.	___ X	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	___ X	1 0
Subtotal (Maximum = 2):	0			

TOTAL (MAXIMUM = 10): 6

AREA: Black Mud Pond
ALTERNATIVE: 4C

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		X 1
	o On-site or off-site land disposal		___ 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 1

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	X 3
		No	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 5

AREA: Black Mud Pond
ALTERNATIVE: 4C

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X Somewhat to no confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum X Moderate ___ Extensive ___

Subtotal (Maximum = 4): 3

TOTAL (MAXIMUM = 15): 15

AREA: Black Mud Pond
ALTERNATIVE: 4C

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100%	___	8
		90-99%	X	7
		80-90%	___	6
		60-80%	___	4
		40-60%	___	2
		20-40%	___	1
		< 20%	___	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes	X	0
		No	___	2
Subtotal (Maximum = 10): 7	If subtotal = 10, go to Factor 3.			
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	X	0
		On-site land disposal	___	
		Off-site destruction or treatment	___	2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100%	X	2
		60-90%	___	1
		< 60%	___	0
If Factor 2 is not applicable, go to Factor 3.				
	ii) Method of Immobilization			
	- Reduced mobility by containment		X	0
	- Reduced mobility by alternative treatment technologies		___	3
Subtotal (Maximum = 5): 2				
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible		___	5
	Irreversible for most of the hazardous waste constituents.		___	3
	Irreversible for only some of the hazardous waste constituents.		X	2
	Reversible for most of the hazardous waste constituents.		___	0
Subtotal (Maximum = 5): 2				
TOTAL (MAXIMUM = 15): 11				

AREA: Black Mud Pond
ALTERNATIVE: 4C

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X	2
c. Schedule of delays due to technical problems.	i) Unlikely	___	2
	ii) Somewhat likely	X	1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___	2
	ii) Some future remedial actions may be necessary.	X	1
Subtotal (Maximum = 10): 6			
2. Administrative Feasibililty			
a. Coordination with other agencies.	i) Minimal coordination is required.	___	2
	ii) Required coordination is normal.	___	1
	iii) Extensive coordination is required.	X	0
Subtotal (Maximum = 2): 0			

AREA: Black Mud Pond
ALTERNATIVE: 4C

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 9

AREA: Black Mud Pond
ALTERNATIVE: 5A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 5A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				
TOTAL (Maximum = 20): 20				

AREA: Black Mud Pond
ALTERNATIVE: 5A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	Yes No	X ___	0 4
	o **Can the risk be easily controlled?**	Yes No	X ___	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	Yes No	___ X	0 2
Subtotal (Maximum = 4):	3			
2. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	Yes No	X ___	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	Yes No	X ___	3 0
Subtotal (Maximum = 4):	3			
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	≤2 yr. >2 yr.	X ___	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2):	2			

TOTAL (MAXIMUM = 10): 8

AREA: Black Mud Pond
ALTERNATIVE: 5A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		___ 1
	o On-site or off-site land disposal		X 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___ 3
		No	X 0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 5

AREA: Black Mud Pond
ALTERNATIVE: 5A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ Somewhat to no confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate _X_ Extensive ___

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 10

AREA: Black Mud Pond
ALTERNATIVE: 5A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% _X_ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	_X_ 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: Black Mud Pond
ALTERNATIVE: 5A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Black Mud Pond
ALTERNATIVE: 5A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X 1 __ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X 1 __ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X 1 __ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Black Mud Pond
ALTERNATIVE: 5B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	**Yes** No	X ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	**Yes** No	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	**Yes** No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 5B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	X	20
		No	___	0
TOTAL (Maximum = 20): 20				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	___	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	___	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	___	3
		No	___	0
Subtotal (Maximum = 10): ___				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	___	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): ___				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		___	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): ___				

TOTAL (Maximum = 20): 20

AREA: Black Mud Pond
ALTERNATIVE: 5B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	Yes No	X ___	0 4
	o **Can the risk be easily controlled?**	Yes No	X ___	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	Yes No	___ X	0 2
Subtotal (Maximum = 4):	3			
2. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	Yes No	X ___	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	Yes No	X ___	3 0
Subtotal (Maximum = 4):	3			
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	≤2 yr. >2 yr.	X ___	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2):	2			
TOTAL (MAXIMUM = 10):	8			

AREA: Black Mud Pond
ALTERNATIVE: 5B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): ___

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	___	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 5

AREA: Black Mud Pond
ALTERNATIVE: 5B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. X 1 >5 yr. ___ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X Somewhat to no confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate X Extensive ___

Subtotal (Maximum = 4): 3

TOTAL (MAXIMUM = 15): 11

AREA: Black Mud Pond
ALTERNATIVE: 5B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: Black Mud Pond
ALTERNATIVE: 5B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___ 1
Subtotal (Maximum = 10): 9		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Black Mud Pond
ALTERNATIVE: 5B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X 1 __ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X 1 __ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X 1 __ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 13

AREA: Black Mud Pond
ALTERNATIVE: 6A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 6A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20):	0			
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10):	10			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5):	5			
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5):	5			
TOTAL (Maximum = 20):	20			

AREA: Black Mud Pond
ALTERNATIVE: 6A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** **No**	___ X	0 4
	o **Can the risk be easily controlled?**	**Yes** **No**	___ ___	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	**Yes** **No**	___ ___	0 2
Subtotal (Maximum = 4):	4			
2. Environmental **Impacts**	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** **No**	X ___	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** **No**	X ___	3 0
Subtotal (Maximum = 4):	3			
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	≤2 yr. >2 yr.	___ X	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2):	1			

TOTAL (MAXIMUM = 10): 8

AREA: Black Mud Pond
ALTERNATIVE: 6A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Black Mud Pond
ALTERNATIVE: 6A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	**i) Operation and maintenance required for a period of:**	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to ve confident _X_ Somewhat to no confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate _X_ Extensive ___

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Black Mud Pnd
ALTERNATIVE: 6A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% _X_ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	_X_ 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: Black Mud Pond
ALTERNATIVE: 6A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Black Mud Pond
ALTERNATIVE: 6A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Black Mud Pond
ALTERNATIVE: 6B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 6B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes No	X 20 0
TOTAL (Maximum = 20):	20		
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes No	3 0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes No	4 0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes No	3 0
Subtotal (Maximum = 10):			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	5
	ii) Health risk	≤1 in 100,000	2
Subtotal (Maximum = 5):			
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		5
	ii) Slightly greater than acceptable.		3
	iii) Significant risk still exists.		0
Subtotal (Maximum = 5):			
TOTAL (Maximum = 20):	20		

AREA: Black Mud Pond
ALTERNATIVE: 6B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	Yes No	___ X	0 4
	o **Can the risk be easily controlled?**	Yes No	___ ___	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	Yes No	___ ___	0 2
Subtotal (Maximum = 4): 4				
2. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	Yes No	X ___	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	Yes No	X ___	3 0
Subtotal (Maximum = 4): 3				
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	≤2 yr. >2 yr.	___ X	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2): 1				

TOTAL (MAXIMUM = 10): 8

AREA: Black Mud Pond
ALTERNATIVE: 6B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Black Mud Pond
ALTERNATIVE: 6B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ Somewhat to nc confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate _X_ Extensive ___

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Black Mud Pond
ALTERNATIVE: 6B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) **Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.**	**99-100%** ___ 8 **90-99%** ___ 7 **80-90%** ___ 6 **60-80%** ___ 4 **40-60%** ___ 2 **20-40%** ___ 1 **< 20%** ___ 0
	ii) **Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.**	**Yes** ___ 0 **No** ___ 2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**	
	iii) **After remediation, how is the untreated, residual hazardous waste material disposed?**	**Off-site land disposal** ___ 0 **On-site land disposal** ___ **Off-site destruction or treatment** ___ 2
2. **Reduction in mobility of hazardous waste.**	i) **Quantity of Available Wastes Immobilized After Destruction/ Treatment.**	**90-100%** ___ 2 **60-90%** ___ 1 **< 60%** X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) **Method of Immobilization** - **Reduced mobility by containment** - **Reduced mobility by alternative treatment technologies**	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. **Irreversibility of the destruction or treatment or immobilization of hazardous waste.**	**Completely irreversible**	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: Black Mud Pond
ALTERNATIVE: 6B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X	3
	ii) Somewhat difficult to construct. No uncertainties in construction.		2
	iii) Very difficult to construct and/or significant uncertainties in construction.		1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.		2
c. Schedule of delays due to technical problems.	i) Unlikely	X	2
	ii) Somewhat likely		1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X	2
	ii) Some future remedial actions may be necessary.		1
Subtotal (Maximum = 10): 10			
2. Administrative Feasibility			
a. Coordination with other agencies.	i) Minimal coordination is required.		2
	ii) Required coordination is normal.	X	1
	iii) Extensive coordination is required.		0
Subtotal (Maximum = 2): 1			

AREA: Black Mud Pond
ALTERNATIVE: 6B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes _X_ 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes _X_ 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes _X_ 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 14

AREA: Black Mud Pond
ALTERNATIVE: 7

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Black Mud Pond
ALTERNATIVE: 7

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes No	X ___	20 0
TOTAL (Maximum = 20):	20			
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes No	___ ___	3 0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes No	___ ___	4 0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes No	___ ___	3 0
Subtotal (Maximum = 10):	___			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	___	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5):	___			
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		___	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5):	___			
TOTAL (Maximum = 20):	20			

AREA: Black Mud Pond
ALTERNATIVE: 7

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor		Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o	Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes	X	0
			No		4
	o	Can the risk be easily controlled?	Yes	X	1
			No		0
	o	Does the mitigative effort to control risk impact the community life-style?	Yes		0
			No	X	2
Subtotal (Maximum = 4): 3					
2. Environmental Impacts	o	Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes	X	0
			No		4
	o	Are the available mitigative measures reliable to minimize potential impacts?	Yes	X	3
			No		0
Subtotal (Maximum = 4): 3					
3. Time to implement the remedy.	o	What is the required time to implement the remedy?	≤2 yr.		1
			>2 yr.	X	0
	o	Required duration of the mitigative effort to control short-term risk.	≤2 yr.		1
			>2 yr.	X	0
Subtotal (Maximum = 2): 0					

TOTAL (MAXIMUM = 10): 6

AREA: Black Mud Pond
ALTERNATIVE: 7

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		X	3
	o Off-site treatment*			1
	o On-site or off-site land disposal			0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	X	3
		No		0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr		2
		15-20 yr		1
		< 15 yr		0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X	3
		≤ 25%		2
		25-50%		1
		≥ 50%		0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes		0
		No	X	2
	iii) Is the treated residual toxic?	Yes		0
		No		1
	iv) Is the treated residual mobile?	Yes		0
		No		1

Subtotal (Maximum = 5): 5

AREA: Black Mud Pond
ALTERNATIVE: 7

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 16

AREA: Black Mud Pond
ALTERNATIVE: 7

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% _X_ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes _X_ 0 No ___ 2
Subtotal (Maximum = 10): 8	**If subtotal = 10, go to Factor 3.**	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal _X_ [illegible] Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% _X_ 2 60-90% ___ 1 < 60% ___ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 2		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	_X_ 2
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (Maximum = 5): 2		

TOTAL (MAXIMUM = 15): 12

AREA: Black Mud Pond
ALTERNATIVE: 7

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of under-taking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___ 1
Subtotal (Maximum = 10): 6		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: Black Mud Pond
ALTERNATIVE: 7

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 9

APPENDIX D.2

TAGM SCORING TABLES

LANDFILL AREA

AREA: Landfill
ALTERNATIVE: 1B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	**Yes**	X	4
		No		0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	**Yes**	X	3
		No		0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	**Yes**	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Landfill
ALTERNATIVE: 1B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20):	0			
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10):	10			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5):	5			
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5):	5			
TOTAL (Maximum = 20):	20			

AREA: Landfill
ALTERNATIVE: 1B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	___ 0 X 4
	o Can the risk be easily controlled?	Yes No	___ 1 ___ 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes No	___ 0 ___ 2
Subtotal (Maximum = 4): 4			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	___ 0 X 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes No	___ 3 ___ 0
Subtotal (Maximum = 4): 4			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr. >2 yr.	X 1 ___ 0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	X 1 ___ 0
Subtotal (Maximum = 2): 2			

TOTAL (MAXIMUM = 10): 10

AREA: Landfill
ALTERNATIVE: 1B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		___ 1
	o On-site or off-site land disposal		X 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___ 3
		No	X 0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___ 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	X 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 2

AREA: Landfill
ALTERNATIVE: 1B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Landfill
ALTERNATIVE: 1B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% _X_ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	_X_ 0
Subtotal (Maximum = 5): 0		
TOTAL (MAXIMUM = 15): 0		

AREA: Landfill
ALTERNATIVE: 1B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of under-taking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10):	9	
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	X 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2):	2	

AREA: Landfill
ALTERNATIVE: 1B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X 1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X 1 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X 1 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 14

AREA: Landfill
ALTERNATIVE: 2A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Landfill
ALTERNATIVE: 2A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 20

AREA: Landfill
ALTERNATIVE: 2A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor		Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o	**Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	Yes No	X ___	0 4
	o	**Can the risk be easily controlled?**	Yes No	___ X	1 0
	o	**Does the mitigative effort to control risk impact the community life-style?**	Yes No	___ X	0 2
Subtotal (Maximum = 4): 2					
2. Environmental Impacts	o	**Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	Yes No	X ___	0 4
	o	**Are the available mitigative measures reliable to minimize potential impacts?**	Yes No	X ___	3 0
Subtotal (Maximum = 4): 3					
3. Time to implement the remedy.	o	**What is the required time to implement the remedy?**	≤2 yr. >2 yr.	X ___	1 0
	o	**Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2): 2					

TOTAL (MAXIMUM = 10): 7

AREA: Landfill
ALTERNATIVE: 2A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*			3
	o Off-site treatment*		X	1
	o On-site or off-site land disposal			0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 1

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes		3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr		2
		15-20 yr		1
		< 15 yr		0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X	3
		≤ 25%		2
		25-50%		1
		≥ 50%		0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes		0
		No	X	2
	iii) Is the treated residual toxic?	Yes		0
		No		1
	iv) Is the treated residual mobile?	Yes		0
		No		1

Subtotal (Maximum = 5): 5

AREA: Landfill
ALTERNATIVE: 2A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	**i) Operation and maintenance required for a period of:**	**<5 yr.** X 1 **>5 yr.** ___ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	**Yes** X 0 **No** ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	**Moderate to confident** X 1 **Somewhat to not confident** ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	**Minimum** X 2 **Moderate** ___ 1 **Extensive** ___ 0

Subtotal (Maximum = 4): 4

TOTAL (MAXIMUM = 15): 13

AREA: Landfill
ALTERNATIVE: 2A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% _X_ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes _X_ 0 No ___ 2
Subtotal (Maximum = 10): 7	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal _X_ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% _X_ 1 < 60% ___ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 1		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	_X_ 2
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (Maximum = 5): 2		

TOTAL (MAXIMUM = 15): 10

AREA: Landfill
ALTERNATIVE: 2A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 5		
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: Landfill
ALTERNATIVE: 2A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	___ 1 _X_ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	_X_ 1 ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	___ 1 _X_ 0

Subtotal (Maximum = 3): 1

TOTAL (MAXIMUM = 15): 6

AREA: Landfill
ALTERNATIVE: 3A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Landfill
ALTERNATIVE: 3A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes No	___ X	20 0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes No	X ___	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes No	X ___	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes No	X ___	3 0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 20

AREA: Landfill
ALTERNATIVE: 3A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor		Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o	Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	X ___	0 4
	o	Can the risk be easily controlled?	Yes No	X ___	1 0
	o	Does the mitigative effort to control risk impact the community life-style?	Yes No	___ X	0 2
Subtotal (Maximum = 4): 3					
2. Environmental Impacts	o	Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	X ___	0 4
	o	Are the available mitigative measures reliable to minimize potential impacts?	Yes No	X ___	3 0
Subtotal (Maximum = 4): 3					
3. Time to implement the remedy.	o	What is the required time to implement the remedy?	≤2 yr. >2 yr.	X ___	1 0
	o	Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2): 2					

TOTAL (MAXIMUM = 10): 8

AREA: Landfill
ALTERNATIVE: 3A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		___ 1
	o On-site or off-site land disposal		X 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___ 3
		No	X 0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 5

AREA: Landfill
ALTERNATIVE: 3A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) **Operation and maintenance required for a period of:**	<5 yr. X 1 >5 yr. ___ 0
	ii) **Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)**	**Yes** X 0 **No** ___ 1
	iii) **Degree of confidence that controls can adequately handle potential problems.**	**Moderate to confident** X [illegible] **Somewhat to not confident** ___ (
	iv) **Relative degree of long-term monitoring required (compare with other remedial alternatives).**	**Minimum** X [illegible] **Moderate** ___ [illegible] **Extensive** ___ [illegible]

Subtotal (Maximum = 4): 4

TOTAL (MAXIMUM = 15): 12

AREA: Landfill
ALTERNATIVE: 3A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		
TOTAL (MAXIMUM = 15): 0		

AREA: Landfill
ALTERNATIVE: 3A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 5		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: Landfill
ALTERNATIVE: 3A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes	X 1
		No	___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes	X 1
		No	___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes	X 1
		No	___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 8

AREA: Landfill
ALTERNATIVE: 3B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	**Yes**	X	4
		No	___	0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	**Yes**	X	3
		No	___	0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	**Yes**	X	3
		No	___	0

TOTAL (Maximum = 10): 10

AREA: Landfill
ALTERNATIVE: 3B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				
TOTAL (Maximum = 20): 20				

AREA: Landfill
ALTERNATIVE: 3B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes	___	0
		No	X	4
	o Can the risk be easily controlled?	Yes	___	1
		No	___	0
	o Does the mitigative effort to control risk impact the community life-style?	Yes	___	0
		No	___	2
Subtotal (Maximum = 4):	4			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes	X	0
		No	___	4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes	X	3
		No	___	0
Subtotal (Maximum = 4):	3			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr.	X	1
		>2 yr.	___	0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr.	X	1
		>2 yr.	___	0
Subtotal (Maximum = 2):	2			
TOTAL (MAXIMUM = 10):	9			

AREA: Landfill
ALTERNATIVE: 3B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Landfill
ALTERNATIVE: 3B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) **Operation and maintenance required for a period of:**	<5 yr. ___ 1 >5 yr. X 0
	ii) **Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)**	**Yes** X 0 **No** ___ 1
	iii) **Degree of confidence that controls can adequately handle potential problems.**	**Moderate to confident** X 1 **Somewhat to not confident** ___ 0
	iv) **Relative degree of long-term monitoring required (compare with other remedial alternatives).**	**Minimum** ___ 2 **Moderate** X 1 **Extensive** ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Landfill
ALTERNATIVE: 3B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% _X_ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	_X_ 0
Subtotal (Maximum = 5): 0		
TOTAL (MAXIMUM = 15): 0		

AREA: Landfill
ALTERNATIVE: 3B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 5		
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: Landfill
ALTERNATIVE: 3B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 8

APPENDIX D.3

TAGM SCORING TABLES

WETLANDS

AREA: Wetlands
ALTERNATIVE: 1A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes No	X 	4 0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes No	X 	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes No	X 	3 0

TOTAL (Maximum = 10): 10

AREA: Wetlands
ALTERNATIVE: 1A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				
TOTAL (Maximum = 20): 20				

AREA: Wetlands
ALTERNATIVE: 1A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	___ X	0 4
	o Can the risk be easily controlled?	Yes No	___ ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes No	___ ___	0 2
Subtotal (Maximum = 4):	4			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	___ X	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes No	___ ___	3 0
Subtotal (Maximum = 4):	4			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr. >2 yr.	X ___	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2):	2			

TOTAL (MAXIMUM = 10): 10

AREA: Wetlands
ALTERNATIVE: 1A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		___ 1
	o On-site or off-site land disposal		X 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___ 3
		No	X 0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___ 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	X 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 2

AREA: Wetlands
ALTERNATIVE: 1A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Wetlands
ALTERNATIVE: IA

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		
TOTAL (MAXIMUM = 15): 0		

AREA: Wetlands
ALTERNATIVE: 1A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10):	9	
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2):	1	

AREA: Wetlands
ALTERNATIVE: IA

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X 1 __ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X 1 __ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X 1 __ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 13

AREA: Wetlands
ALTERNATIVE: 2A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Wetlands
ALTERNATIVE: 2A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Use of the site after remediation.	**Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)**	**Yes**	___ 20
		No	X 0
TOTAL (Maximum = 20): 0			
2. Human health and the environment exposure after the remediation.	i) **Is the exposure to contaminants via air route acceptable?**	**Yes**	X 3
		No	___ 0
	ii) **Is the exposure to contaminants via groundwater/ surface water acceptable?**	**Yes**	X 4
		No	___ 0
	iii) **Is the exposure to contaminants via sediments/ soils acceptable?**	**Yes**	X 3
		No	___ 0
Subtotal (Maximum = 10): 10			
3. Magnitude of residual public health risks after the remediation.	i) **Health risk**	**≤1 in 1,000,000**	X 5
	ii) **Health risk**	**≤1 in 100,000**	___ 2
Subtotal (Maximum = 5): 5			
4. Magnitude of residual environmental risks after the remediation.	i) **Acceptable**		X 5
	ii) **Slightly greater than acceptable.**		___ 3
	iii) **Significant risk still exists.**		___ 0
Subtotal (Maximum = 5): 5			

TOTAL (Maximum = 20): 20

AREA: Wetlands
ALTERNATIVE: 2A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor		Basis for Evaluation During Detailed Analysis			Score
1. Protection of community during remedial actions.	o	**Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** **No**	___ X	0 4
	o	**Can the risk be easily controlled?**	**Yes** **No**	___ ___	1 0
	o	**Does the mitigative effort to control risk impact the community life-style?**	**Yes** **No**	___ ___	0 2
Subtotal (Maximum = 4):		4			
2. Environmental Impacts	o	**Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** **No**	___ X	0 4
	o	**Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** **No**	___ ___	3 0
Subtotal (Maximum = 4):		4			
3. Time to implement the remedy.	o	**What is the required time to implement the remedy?**	**≤2 yr.** **>2 yr.**	X ___	1 0
	o	**Required duration of the mitigative effort to control short-term risk.**	**≤2 yr.** **>2 yr.**	X ___	1 0
Subtotal (Maximum = 2):		2			

TOTAL (MAXIMUM = 10): 10

AREA: Wetlands
ALTERNATIVE: 2A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Wetlands
ALTERNATIVE: 2A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ Somewhat to not confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate _X_ Extensive ___

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Wetlands
ALTERNATIVE: 2A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) **Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.**	**99-100%** ___ 8 **90-99%** ___ 7 **80-90%** ___ 6 **60-80%** ___ 4 **40-60%** ___ 2 **20-40%** ___ 1 **< 20%** ___ 0
	ii) **Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.**	**Yes** ___ 0 **No** ___ 2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**	
	iii) **After remediation, how is the untreated, residual hazardous waste material disposed?**	**Off-site land disposal** ___ 0 **On-site land disposal** ___ - **Off-site destruction or treatment** ___ 2
2. Reduction in mobility of hazardous waste.	i) **Quantity of Available Wastes Immobilized After Destruction/ Treatment.**	**90-100%** ___ 2 **60-90%** ___ 1 **< 60%** X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) **Method of Immobilization** - **Reduced mobility by containment** - **Reduced mobility by alternative treatment technologies**	X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	**Completely irreversible**	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		
TOTAL (MAXIMUM = 15): 0		

AREA: Wetlands
ALTERNATIVE: 2A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Wetlands
ALTERNATIVE: 2A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X 1 __ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X 1 __ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X 1 __ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Wetlands
ALTERNATIVE: 4A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

	Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1.	Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes No	X ___	4 0
2.	Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes No	X ___	3 0
3.	Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Wetlands
ALTERNATIVE: 4A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	**Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)**	**Yes** **No**	___ X	20 0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) **Is the exposure to contaminants via air route acceptable?**	**Yes** **No**	X ___	3 0
	ii) **Is the exposure to contaminants via groundwater/ surface water acceptable?**	**Yes** **No**	X ___	4 0
	iii) **Is the exposure to contaminants via sediments/ soils acceptable?**	**Yes** **No**	X ___	3 0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) **Health risk**	**≤1 in 1,000,000**	X	5
	ii) **Health risk**	**≤1 in 100,000**	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) **Acceptable**		X	5
	ii) **Slightly greater than acceptable.**		___	3
	iii) **Significant risk still exists.**		___	0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 20

AREA: Wetlands
ALTERNATIVE: 4A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	X ___	0 4
	o Can the risk be easily controlled?	Yes No	X ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes No	___ X	0 2
Subtotal (Maximum = 4):	3			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	X ___	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes No	X ___	3 0
Subtotal (Maximum = 4):	3			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr. >2 yr.	___ X	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2):	1			

TOTAL (MAXIMUM = 10): 7

AREA: Wetlands
ALTERNATIVE: 4A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		X	1
	o On-site or off-site land disposal		___	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 1

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	___	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 5

AREA: Wetlands
ALTERNATIVE: 4A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. X 1 >5 yr. ___ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum X 2 Moderate ___ 1 Extensive ___ 0

Subtotal (Maximum = 4): 4

TOTAL (MAXIMUM = 15): 13

AREA: Wetlands
ALTERNATIVE: 4A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% _X_ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes _X_ 0 No ___ 2
Subtotal (Maximum = 10): _7_	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal _X_ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% _X_ 1 < 60% ___ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): _1_		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	_X_ 2
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (Maximum = 5): _2_		

TOTAL (MAXIMUM = 15): _10_

AREA: Wetlands
ALTERNATIVE: 4A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 6		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: Wetlands
ALTERNATIVE: 4A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	___ 1 X 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X 1 ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	___ 1 X 0

Subtotal (Maximum = 3): 1

TOTAL (MAXIMUM = 15): 7

APPENDIX D.4

TAGM SCORING TABLES

POTLINER PAD AREA

AREA: Potliner Pad
ALTERNATIVE: 1A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	Yes No	___ ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 1A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20):	0			
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	___	4
		No	X	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	___	3
		No	X	0
Subtotal (Maximum = 10):	3			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5):	5			
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		___	5
	ii) Slightly greater than acceptable.		X	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5):	3			
TOTAL (Maximum = 20):	11			

AREA: Potliner Pad
ALTERNATIVE: 1A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** **No**	___ X	0 4
	o **Can the risk be easily controlled?**	**Yes** **No**	___ ___	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	**Yes** **No**	___ ___	0 2
Subtotal (Maximum = 4): 4				
. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** **No**	___ X	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** **No**	___ ___	3 0
Subtotal (Maximum = 4): 4				
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	**≤2 yr.** **>2 yr.**	X ___	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	**≤2 yr.** **>2 yr.**	X ___	1 0
Subtotal (Maximum = 2): 2				

TOTAL (MAXIMUM = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 1A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Potliner Pad
ALTERNATIVE: 1A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) **Operation and maintenance required for a period of:**	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) **Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)**	**Yes** _X_ 0 **No** ___ 1
	iii) **Degree of confidence that controls can adequately handle potential problems.**	**Moderate to confident** _X_ 1 **Somewhat to not confident** ___ 0
	iv) **Relative degree of long-term monitoring required (compare with other remedial alternatives).**	**Minimum** ___ 2 **Moderate** ___ 1 **Extensive** _X_ 0

Subtotal (Maximum = 4): 1

TOTAL (MAXIMUM = 15): 6

AREA: Potliner Pad
ALTERNATIVE: 1A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ 1 Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

.REA: Potliner Pad
ALTERNATIVE: IA

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	X 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 2		

AREA: Potliner Pad
ALTERNATIVE: 1A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
3. Availability of Services and Materials				
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X ___	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X ___	1 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X ___	1 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 13

AREA: Potliner Pad
ALTERNATIVE: 1B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 1B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes		20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No		0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No		0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes		3
		No	X	0
Subtotal (Maximum = 10): 7				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000		2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.			3
	iii) Significant risk still exists.			0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 17

AREA: Potliner Pad
ALTERNATIVE: 1B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** **No**	___ X	0 4
	o **Can the risk be easily controlled?**	**Yes** **No**	___ ___	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	**Yes** **No**	___ ___	0 2
Subtotal (Maximum = 4): 4				
2. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** **No**	___ X	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** **No**	___ ___	3 0
Subtotal (Maximum = 4): 4				
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	≤2 yr. >2 yr.	X ___	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2): 2				

TOTAL (MAXIMUM = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 1B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Potliner Pad
ALTERNATIVE: 1B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Potliner Pad
ALTERNATIVE: IB

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100%	___	8
		90-99%	___	7
		80-90%	___	6
		60-80%	___	4
		40-60%	___	2
		20-40%	___	1
		< 20%	___	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes	___	0
		No	___	2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.			
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	___	0
		On-site land disposal	___	
		Off-site destruction or treatment	___	2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100%	___	2
		60-90%	___	1
		< 60%	X	0
If Factor 2 is not applicable, go to Factor 3.				
	ii) Method of Immobilization			
	- Reduced mobility by containment		X	0
	- Reduced mobility by alternative treatment technologies		___	3
Subtotal (Maximum = 5): 0				
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible		___	5
	Irreversible for most of the hazardous waste constituents.		___	3
	Irreversible for only some of the hazardous waste constituents.		___	2
	Reversible for most of the hazardous waste constituents.		X	0
Subtotal (Maximum = 5): 0				

TOTAL (MAXIMUM = 15): 0

REA: Potliner Pad
ALTERNATIVE: 1B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Potliner Pad
ALTERNATIVE: 1B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
3. Availability of Services and Materials				
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X ___	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X ___	1 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X ___	1 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Potliner Pad
ALTERNATIVE: 1C

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 1C

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	**Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)**	**Yes**	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) **Is the exposure to contaminants via air route acceptable?**	**Yes**	X	3
		No	___	0
	ii) **Is the exposure to contaminants via groundwater/ surface water acceptable?**	**Yes**	X	4
		No	___	0
	iii) **Is the exposure to contaminants via sediments/ soils acceptable?**	**Yes**	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) **Health risk**	**≤1 in 1,000,000**	X	5
	ii) **Health risk**	**≤1 in 100,000**	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental **risks** after the **remediation.**	i) **Acceptable**		___	5
	ii) **Slightly greater than acceptable.**		X	3
	iii) **Significant risk still exists.**		___	0
Subtotal (Maximum = 5): 3				

TOTAL (Maximum = 20): 18

AREA: Potliner Pad
ALTERNATIVE: 1C

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** **No**	___ X	0 4
	o **Can the risk be easily controlled?**	**Yes** **No**	___ ___	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	**Yes** **No**	___ ___	0 2
Subtotal (Maximum = 4):	4			
. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** **No**	___ X	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** **No**	___ ___	3 0
Subtotal (Maximum = 4):	4			
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	**≤2 yr.** **>2 yr.**	X ___	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	**≤2 yr.** **>2 yr.**	X ___	1 0
Subtotal (Maximum = 2):	2			

TOTAL (MAXIMUM = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 1C

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Potliner Pad
ALTERNATIVE: 1C

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X Somewhat to not confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate X Extensive ___

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Potliner Pad
ALTERNATIVE: 1C

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		
TOTAL (MAXIMUM = 15): 0		

REA: Potliner Pad
ALTERNATIVE: 1C

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Potliner Pad
ALTERNATIVE: 1C

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Potliner Pad
ALTERNATIVE: 2B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	**Yes**	X	4
		No		0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	**Yes**	X	3
		No		0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	**Yes**	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 2B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	**Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)**	**Yes**		20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	**i) Is the exposure to contaminants via air route acceptable?**	**Yes**	X	3
		No		0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	**Yes**	X	4
		No		0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	**Yes**	X	3
		No		0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	**i) Health risk**	**≤1 in 1,000,000**	X	5
	ii) Health risk	**≤1 in 100,000**		2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	**i) Acceptable**		X	5
	ii) Slightly greater than acceptable.			3
	iii) Significant risk still exists.			0
Subtotal (Maximum = 5): 5				
TOTAL (Maximum = 20): 20				

AREA: Potliner Pad
ALTERNATIVE: 2B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___ 0 No _X_ 4	
	o Can the risk be easily controlled?	Yes ___ 1 No ___ 0	
	o Does the mitigative effort to control risk impact the community life-style?	Yes ___ 0 No ___ 2	
Subtotal (Maximum = 4):	4		
. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___ 0 No _X_ 4	
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No ___ 0	
Subtotal (Maximum = 4):	4		
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr. _X_ 1 >2 yr. ___ 0	
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. _X_ 1 >2 yr. ___ 0	
Subtotal (Maximum = 2):	2		

TOTAL (MAXIMUM = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 2B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Potliner Pad
ALTERNATIVE: 2B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate X 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Potliner Pad
ALTERNATIVE: 2B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___	8
		90-99% ___	7
		80-90% ___	6
		60-80% ___	4
		40-60% ___	2
		20-40% ___	1
		< 20% ___	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___	0
		No ___	2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.		
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___	0
		On-site land disposal ___	
		Off-site destruction or treatment ___	2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___	2
		60-90% ___	1
		< 60% X	0
If Factor 2 is not applicable, go to Factor 3.			
	ii) Method of Immobilization		
	- Reduced mobility by containment	X	0
	- Reduced mobility by alternative treatment technologies	___	3
Subtotal (Maximum = 5): 0			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___	5
	Irreversible for most of the hazardous waste constituents.	___	3
	Irreversible for only some of the hazardous waste constituents.	___	2
	Reversible for most of the hazardous waste constituents.	X	0
Subtotal (Maximum = 5): 0			

TOTAL (MAXIMUM = 15): 0

\REA: Potliner Pad
ALTERNATIVE: 2B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Potliner Pad
ALTERNATIVE: 2B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Potliner Pad
ALTERNATIVE: 2C

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 2C

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes No	___ X	20 0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes No	X ___	3 0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes No	X ___	4 0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes No	X ___	3 0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 20

REA: Potliner Pad
ALTERNATIVE: 2C

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor		Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o	Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	___ X	0 4
	o	Can the risk be easily controlled?	Yes No	___ ___	1 0
	o	Does the mitigative effort to control risk impact the community life-style?	Yes No	___ ___	0 2
Subtotal (Maximum = 4): 4					
. Environmental Impacts	o	Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	___ X	0 4
	o	Are the available mitigative measures reliable to minimize potential impacts?	Yes No	___ ___	3 0
Subtotal (Maximum = 4): 4					
3. Time to implement the remedy.	o	What is the required time to implement the remedy?	≤2 yr. >2 yr.	X ___	1 0
	o	Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2): 2					

TOTAL (MAXIMUM = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 2C

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Potliner Pad
ALTERNATIVE: 2C

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate X 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Potliner Pad
ALTERNATIVE: 2C

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ 1 Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% _X_ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	_X_ 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: Potliner Pad
ALTERNATIVE: 2C

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of under-taking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Potliner Pad
ALTERNATIVE: 2C

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Potliner Pad
ALTERNATIVE: 2D

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	**Yes** **No**	X ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	**Yes** **No**	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	**Yes** **No**	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 2D

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20):	0			
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	___	4
		No	X	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10):	6			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5):	5			
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		___	5
	ii) Slightly greater than acceptable.		X	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5):	3			
TOTAL (Maximum = 20):	14			

AREA: Potliner Pad
ALTERNATIVE: 2D

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes		0
		No	X	4
	o Can the risk be easily controlled?	Yes		1
		No		0
	o Does the mitigative effort to control risk impact the community life-style?	Yes		0
		No		2
Subtotal (Maximum = 4):	4			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes		0
		No	X	4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes		3
		No		0
Subtotal (Maximum = 4):	4			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr.	X	1
		>2 yr.		0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr.	X	1
		>2 yr.		0
Subtotal (Maximum = 2):	2			

TOTAL (MAXIMUM = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 2D

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		___ 1
	o On-site or off-site land disposal		X 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___ 3
		No	X 0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	___ 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	X 0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___ 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	X 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 2

AREA: Potliner Pad
ALTERNATIVE: 2D

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 4

AREA: Potliner Pad
ALTERNATIVE: 2D

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		
TOTAL (MAXIMUM = 15): 0		

REA: Potliner Pad
ALTERNATIVE: 2D

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 1		

AREA: Potliner Pad
ALTERNATIVE: 2D

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
3. Availability of Services and Materials				
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X ___	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X ___	1 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X ___	1 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Potliner Pad
ALTERNATIVE: 3A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	**Yes**	X	4
		No		0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	**Yes**	X	3
		No		0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	**Yes**	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 3A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	**Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)**	**Yes** **No**	X ___	20 0
TOTAL (Maximum = 20): 20				
2. Human health and the environment exposure after the remediation.	**i) Is the exposure to contaminants via air route acceptable?**	**Yes** **No**	___ ___	3 0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	**Yes** **No**	___ ___	4 0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	**Yes** **No**	___ ___	3 0
Subtotal (Maximum = 10): ___				
3. Magnitude of residual public health risks after the remediation.	**i) Health risk**	**≤1 in 1,000,000**	___	5
	ii) Health risk	**≤1 in 100,000**	___	2
Subtotal (Maximum = 5): ___				
4. Magnitude of residual environmental **risks** after the **remediation.**	**i) Acceptable**		___	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): ___				

TOTAL (Maximum = 20): 20

AREA: Potliner Pad
ALTERNATIVE: 3A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	___ X	0 4
	o Can the risk be easily controlled?	Yes No	___ ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes No	___ ___	0 2
Subtotal (Maximum = 4): 4				
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	___ X	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes No	___ ___	3 0
Subtotal (Maximum = 4): 4				
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr. >2 yr.	X ___	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2): 2				

TOTAL (MAXIMUM = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 3A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	o On-site treatment*		___ 3
	o Off-site treatment*		___ 1
	o On-site or off-site land disposal		X 0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___ 3
		No	X 0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X 3
		20-25 yr	___ 2
		15-20 yr	___ 1
		< 15 yr	___ 0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___ 3
		≤ 25%	___ 2
		25-50%	___ 1
		≥ 50%	X 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___ 0
		No	X 2
	iii) Is the treated residual toxic?	Yes	___ 0
		No	___ 1
	iv) Is the treated residual mobile?	Yes	___ 0
		No	___ 1

Subtotal (Maximum = 5): 2

AREA: Potliner Pad
ALTERNATIVE: 3A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	**i) Operation and maintenance required for a period of:**	**<5 yr. ___ 1** **>5 yr. X 0**
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	**Yes X 0** **No ___ 1**
	iii) Degree of confidence that controls can adequately handle potential problems.	**Moderate to confident X** **Somewhat to not confident ___**
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	**Minimum ___** **Moderate X** **Extensive ___**

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Potliner Pad
ALTERNATIVE: 3A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		
TOTAL (MAXIMUM = 15): 0		

\REA: Potliner Pad
.LTERNATIVE: 3A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	__ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	__ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 8		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	__ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	__ 0
Subtotal (Maximum = 2): 1		

AREA: Potliner Pad
ALTERNATIVE: 3A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
3. Availability of Services and Materials				
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X ___	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X ___	1 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X ___	1 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

AREA: Potliner Pad
ALTERNATIVE: 3B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	**Meets chemical specific SCGs such as groundwater standards.**	**Yes** **No**	X ___	4 0
2. Compliance with action-specific SCGs.	**Meets SCGs such as technology standards for incineration or landfill.**	**Yes** **No**	X ___	3 0
3. Compliance with location-specific SCGs	**Meets location-specific SCGs such as Freshwater Wetlands Act.**	**Yes** **No**	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 3B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes No	___ X	20 0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes No	X ___	3 0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes No	X ___	4 0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes No	X ___	3 0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 20

\REA: Potliner Pad
ALTERNATIVE: 3B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor		Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o	Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	___ X	0 4
	o	Can the risk be easily controlled?	Yes No	___ ___	1 0
	o	Does the mitigative effort to control risk impact the community life-style?	Yes No	___ ___	0 2
Subtotal (Maximum = 4): 4					
. Environmental Impacts	o	Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	___ X	0 4
	o	Are the available mitigative measures reliable to minimize potential impacts?	Yes No	___ ___	3 0
Subtotal (Maximum = 4): 4					
3. Time to implement the remedy.	o	What is the required time to implement the remedy?	≤2 yr. >2 yr.	X ___	1 0
	o	Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	X ___	1 0
Subtotal (Maximum = 2): 2					

TOTAL (MAXIMUM = 10): 10

AREA: Potliner Pad
ALTERNATIVE: 3B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: Potliner Pad
ALTERNATIVE: 3B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) **Operation and maintenance required for a period of:**	<5 yr. ___ 1 >5 yr. X 0
	ii) **Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)**	**Yes** X 0 **No** ___ 1
	iii) **Degree of confidence that controls can adequately handle potential problems.**	**Moderate to confident** X 1 **Somewhat to not confident** ___ 0
	iv) **Relative degree of long-term monitoring required (compare with other remedial alternatives).**	Minimum ___ 2 **Moderate** X 1 **Extensive** ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: Potliner Pad
ALTERNATIVE: 3B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% _X_ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	_X_ 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

REA: Potliner Pad
ALTERNATIVE: 3B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X	3
	ii) Somewhat difficult to construct. No uncertainties in construction.		2
	iii) Very difficult to construct and/or significant uncertainties in construction.		1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.		3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X	2
c. Schedule of delays due to technical problems.	i) Unlikely	X	2
	ii) Somewhat likely		1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.		2
	ii) Some future remedial actions may be necessary.	X	1
Subtotal (Maximum = 10):	8		
2. Administrative Feasibililty			
a. Coordination with other agencies.	i) Minimal coordination is required.		2
	ii) Required coordination is normal.	X	1
	iii) Extensive coordination is required.		0
Subtotal (Maximum = 2):	1		

AREA: Potliner Pad
ALTERNATIVE: 3B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X 1 __ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X 1 __ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X 1 __ 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 12

APPENDIX D.5

TAGM SCORING TABLES

NORTH YARD

AREA: North Yard
ALTERNATIVE: 1

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: North Yard
ALTERNATIVE: 1

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	**Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)**	Yes No	___ X	20 0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	**i) Is the exposure to contaminants via air route acceptable?**	Yes No	X ___	3 0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes No	X ___	4 0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes No	X ___	3 0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	**i) Health risk**	**≤1 in 1,000,000**	X	5
	ii) Health risk	**≤1 in 100,000**	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	**i) Acceptable**		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				
TOTAL (Maximum = 20): 20				

AREA: North Yard
ALTERNATIVE: 1

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor		Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o	**Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** **No**	___ X	0 4
	o	**Can the risk be easily controlled?**	**Yes** **No**	___ ___	1 0
	o	**Does the mitigative effort to control risk impact the community life-style?**	**Yes** **No**	___ ___	0 2
Subtotal (Maximum = 4):		4			
2. Environmental Impacts	o	**Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** **No**	___ X	0 4
	o	**Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** **No**	___ ___	3 0
Subtotal (Maximum = 4):		4			
3. Time to implement the remedy.	o	**What is the required time to implement the remedy?**	**≤2 yr.** **>2 yr.**	X ___	1 0
	o	**Required duration of the mitigative effort to control short-term risk.**	**≤2 yr.** **>2 yr.**	X ___	1 0
Subtotal (Maximum = 2):		2			

TOTAL (MAXIMUM = 10): 10

AREA: North Yard
ALTERNATIVE: I

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*			3
	o Off-site treatment*			1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes		3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr		2
		15-20 yr		1
		< 15 yr		0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	X	3
		≤ 25%		2
		25-50%		1
		≥ 50%		0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes		0
		No	X	2
	iii) Is the treated residual toxic?	Yes		0
		No		1
	iv) Is the treated residual mobile?	Yes		0
		No		1

Subtotal (Maximum = 5): 5

AREA: North Yard
ALTERNATIVE: 1

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 10

AREA: North Yard
ALTERNATIVE: 1

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___	8
		90-99% ___	7
		80-90% ___	6
		60-80% ___	4
		40-60% ___	2
		20-40% ___	1
		< 20% ___	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___	0
		No ___	2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**		
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___	0
		On-site land disposal ___	:
		Off-site destruction or treatment ___	2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___	2
		60-90% ___	1
		< 60% X	0
If Factor 2 is not applicable, go to Factor 3.			
	ii) Method of Immobilization		
	- Reduced mobility by containment	X	0
	- Reduced mobility by alternative treatment technologies	___	3
Subtotal (Maximum = 5): 0			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___	5
	Irreversible for most of the hazardous waste constituents.	___	3
	Irreversible for only some of the hazardous waste constituents.	___	2
	Reversible for most of the hazardous waste constituents.	X	0
Subtotal (Maximum = 5): 0			

TOTAL (MAXIMUM = 15): 0

AREA: North Yard
ALTERNATIVE: 1

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 9		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	X 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	___ 0
Subtotal (Maximum = 2): 2		

AREA: North Yard
ALTERNATIVE: I

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
3. Availability of Services and Materials				
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X ___	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X ___	1 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	X ___	1 0

Subtotal (Maximum = 3): 3

TOTAL (MAXIMUM = 15): 14

AREA: North Yard
ALTERNATIVE: 2A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes No	X ___	4 0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes No	X ___	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes No	X ___	3 0

TOTAL (Maximum = 10): 10

AREA: North Yard
ALTERNATIVE: 2A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes No	X	20 0
TOTAL (Maximum = 20): 20				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes No		3 0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes No		4 0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes No		3 0
Subtotal (Maximum = 10): ____				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000		5
	ii) Health risk	≤1 in 100,000		2
Subtotal (Maximum = 5): ____				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable			5
	ii) Slightly greater than acceptable.			3
	iii) Significant risk still exists.			0
Subtotal (Maximum = 5): ____				

TOTAL (Maximum = 20): 20

AREA: North Yard
ALTERNATIVE: 2A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** **No**	X ___	0 4
	o **Can the risk be easily controlled?**	**Yes** **No**	___ X	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	**Yes** **No**	X ___	0 2
Subtotal (Maximum = 4): 0				
2. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** **No**	X ___	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** **No**	___ X	3 0
Subtotal (Maximum = 4): 0				
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	≤2 yr. >2 yr.	___ X	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	≤2 yr. >2 yr.	___ X	1 0
Subtotal (Maximum = 2): 0				

TOTAL (MAXIMUM = 10): 0

AREA: North Yard
ALTERNATIVE: 2A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	X	2
		25-50%	___	1
		≥ 50%	___	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	X	0
		No	___	2
	iii) Is the treated residual toxic?	Yes	X	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	X	1

Subtotal (Maximum = 5): 3

AREA: North Yard
ALTERNATIVE: 2A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 8

AREA: North Yard
ALTERNATIVE: 2A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score	
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___	8
		90-99% ___	7
		80-90% X	6
		60-80% ___	4
		40-60% ___	2
		20-40% ___	1
		< 20% ___	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes X	0
		No ___	2
Subtotal (Maximum = 10): 7	If subtotal = 10, go to Factor 3.		
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___	0
		On-site land disposal X	1
		Off-site destruction or treatment ___	2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% X	2
		60-90% ___	1
		< 60% ___	0
If Factor 2 is not applicable, go to Factor 3.			
	ii) Method of Immobilization		
	- Reduced mobility by containment	X	0
	- Reduced mobility by alternative treatment technologies	___	3
Subtotal (Maximum = 5): 2			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___	5
	Irreversible for most of the hazardous waste constituents.	___	3
	Irreversible for only some of the hazardous waste constituents.	X	2
	Reversible for most of the hazardous waste constituents.	___	0
Subtotal (Maximum = 5): 2			

TOTAL (MAXIMUM = 15): 11

AREA: North Yard
ALTERNATIVE: 2A

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 5		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: North Yard
ALTERNATIVE: 2A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes ___ 1 No X 0

Subtotal (Maximum = 3): 2

TOTAL (MAXIMUM = 15): 7

AREA: North Yard
ALTERNATIVE: 2B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: North Yard
ALTERNATIVE: 2B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	**Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)**	**Yes**	X	20
		No	___	0
TOTAL (Maximum = 20): 20				
2. Human health and the environment exposure after the remediation.	**i) Is the exposure to contaminants via air route acceptable?**	**Yes**	___	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	**Yes**	___	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	**Yes**	___	3
		No	___	0
Subtotal (Maximum = 10): ___				
3. Magnitude of residual public health risks after the remediation.	**i) Health risk**	**≤1 in 1,000,000**	___	5
	ii) Health risk	**≤1 in 100,000**	___	2
Subtotal (Maximum = 5): ___				
4. Magnitude of residual environmental risks after the remediation.	**i) Acceptable**		___	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): ___				
TOTAL (Maximum = 20): 20				

AREA: North Yard
ALTERNATIVE: 2B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** _X_ 0 **No** ___ 4
	o **Can the risk be easily controlled?**	**Yes** ___ 1 **No** _X_ 0
	o **Does the mitigative effort to control risk impact the community life-style?**	**Yes** _X_ 0 **No** ___ 2
Subtotal (Maximum = 4): _0_		
2. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** _0_ 0 **No** ___ 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** ___ 3 **No** ___ 0
Subtotal (Maximum = 4): _0_		
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	**≤2 yr.** ___ 1 **>2 yr.** _X_ 0
	o **Required duration of the mitigative effort to control short-term risk.**	**≤2 yr.** ___ 1 **>2 yr.** _X_ 0
Subtotal (Maximum = 2): _0_		

TOTAL (MAXIMUM = 10): _0_

AREA: North Yard
ALTERNATIVE: 2B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: North Yard
ALTERNATIVE: 2B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident X__ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate X__ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: North Yard
ALTERNATIVE: 2B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: North Yard
ALTERNATIVE: 2B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 5		
2. Administrative Feasibililty		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: North Yard
ALTERNATIVE: 2B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes ___ 1 No X 0

Subtotal (Maximum = 3): 2

TOTAL (MAXIMUM = 15): 7

AREA: North Yard
ALTERNATIVE: 3A

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: North Yard
ALTERNATIVE: 3A

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 20

AREA: North Yard
ALTERNATIVE: 3A

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	X ___	0 4
	o Can the risk be easily controlled?	Yes No	___ X	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes No	X ___	0 2
Subtotal (Maximum = 4):	0			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	X ___	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes No	___ X	3 0
Subtotal (Maximum = 4):	0			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2 yr. >2 yr.	___ X	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤2 yr. >2 yr.	___ X	1 0
Subtotal (Maximum = 2):	0			

TOTAL (MAXIMUM = 10): 0

AREA: North Yard
ALTERNATIVE: 3A

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	X	2
		25-50%	___	1
		≥ 50%	___	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	X	0
		No	___	2
	iii) Is the treated residual toxic?	Yes	X	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	X	1

Subtotal (Maximum = 5): 3

AREA: North Yard
ALTERNATIVE: 3A

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _x_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _x_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _x_ Somewhat to not confident ___
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ Moderate _x_ Extensive ___

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 8

AREA: North Yard
ALTERNATIVE: 3A

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% _X_ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): _3_	If subtotal = 10, go to Factor 3.	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal _X_ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/Treatment.	90-100% _X_ 2 60-90% ___ 1 < 60% ___ 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 _X_ 0 ___ 3
Subtotal (Maximum = 5): _2_		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	_X_ 2
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (Maximum = 5): _2_		

TOTAL (MAXIMUM = 15): _7_

AREA: North Yard
ALTERNATIVE: 3A

ABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 5		
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: North Yard
ALTERNATIVE: 3A

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
3. Availability of Services and Materials				
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes	X	1
		No		0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes	X	1
		No		0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes		1
		No	X	0

Subtotal (Maximum = 3): 2

TOTAL (MAXIMUM = 15): 7

AREA: North Yard
ALTERNATIVE: 3B

TABLE 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes	X	4
		No		0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes	X	3
		No		0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes	X	3
		No		0

TOTAL (Maximum = 10): 10

AREA: North Yard
ALTERNATIVE: 3B

TABLE 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes	___	20
		No	X	0
TOTAL (Maximum = 20): 0				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes	X	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/ surface water acceptable?	Yes	X	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/ soils acceptable?	Yes	X	3
		No	___	0
Subtotal (Maximum = 10): 10				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤1 in 1,000,000	X	5
	ii) Health risk	≤1 in 100,000	___	2
Subtotal (Maximum = 5): 5				
4. Magnitude of residual environmental risks after the remediation.	i) Acceptable		X	5
	ii) Slightly greater than acceptable.		___	3
	iii) Significant risk still exists.		___	0
Subtotal (Maximum = 5): 5				

TOTAL (Maximum = 20): 20

AREA: North Yard
ALTERNATIVE: 3B

TABLE 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
1. Protection of community during remedial actions.	o **Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)**	**Yes** **No**	X ___	0 4
	o **Can the risk be easily controlled?**	**Yes** **No**	___ X	1 0
	o **Does the mitigative effort to control risk impact the community life-style?**	**Yes** **No**	X ___	0 2
Subtotal (Maximum = 4):	0			
2. Environmental Impacts	o **Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)**	**Yes** **No**	___ X	0 4
	o **Are the available mitigative measures reliable to minimize potential impacts?**	**Yes** **No**	___ ___	3 0
Subtotal (Maximum = 4):	4			
3. Time to implement the remedy.	o **What is the required time to implement the remedy?**	**≤2 yr.** **>2 yr.**	___ X	1 0
	o **Required duration of the mitigative effort to control short-term risk.**	**≤2 yr.** **>2 yr.**	___ X	1 0
Subtotal (Maximum = 2):	0			
TOTAL (MAXIMUM = 10):	4			

AREA: North Yard
ALTERNATIVE: 3B

TABLE 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
1. On-site or off-site treatment or land disposal	o On-site treatment*		___	3
	o Off-site treatment*		___	1
	o On-site or off-site land disposal		X	0

*Treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes.

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
2. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 4.)	Yes	___	3
		No	X	0

Subtotal (Maximum = 3): 0

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
3. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30 yr	X	3
		20-25 yr	___	2
		15-20 yr	___	1
		< 15 yr	___	0

Subtotal (Maximum = 3): 3

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score	
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None	___	3
		≤ 25%	___	2
		25-50%	___	1
		≥ 50%	X	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 5.)	Yes	___	0
		No	X	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1

Subtotal (Maximum = 5): 2

AREA: North Yard
ALTERNATIVE: 3B

TABLE 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5 yr. ___ 1 >5 yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv".)	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0

Subtotal (Maximum = 4): 2

TOTAL (MAXIMUM = 15): 7

AREA: North Yard
ALTERNATIVE: 3B

TABLE 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable, go to Factor 2.	i) Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100% ___ 8 90-99% ___ 7 80-90% ___ 6 60-80% ___ 4 40-60% ___ 2 20-40% ___ 1 < 20% ___ 0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes ___ 0 No ___ 2
Subtotal (Maximum = 10): N.A.	**If subtotal = 10, go to Factor 3.**	
	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal ___ 0 On-site land disposal ___ Off-site destruction or treatment ___ 2
2. Reduction in mobility of hazardous waste.	i) Quantity of Available Wastes Immobilized After Destruction/ Treatment.	90-100% ___ 2 60-90% ___ 1 < 60% X 0
If Factor 2 is not applicable, go to Factor 3.		
	ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 X 0 ___ 3
Subtotal (Maximum = 5): 0		
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible	___ 5
	Irreversible for most of the hazardous waste constituents.	___ 3
	Irreversible for only some of the hazardous waste constituents.	___ 2
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (Maximum = 5): 0		

TOTAL (MAXIMUM = 15): 0

AREA: North Yard
ALTERNATIVE: 3B

TABLE 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (Maximum = 10): 5		
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	X 0
Subtotal (Maximum = 2): 0		

AREA: North Yard
ALTERNATIVE: 3B

TABLE 5.7
(continued)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Score		
3. Availability of Services and Materials				
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes No	X —	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes No	X —	1 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes No	— X	1 0

Subtotal (Maximum = 3): 2

TOTAL (MAXIMUM = 15): 7

APPENDIX E

PRELIMINARY ENGINEERING REPORT
HAZARDOUS WASTE LANDFILL

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LIST OF TABLES

LIST OF DRAWINGS

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1.0
INTRODUCTION

1.1 PROJECT DESCRIPTION

Reynolds Metals Company (Reynolds) is conducting a Feasibility Study to evaluate remedial alternatives for several areas of concern at their Massena, New York, plant (Drawing 1). Several alternatives include the possibility of constructing a new on-site Hazardous Waste Landfill Facility (HWL). The HWL is to be designed and constructed in compliance with the applicable regulations governing hazardous waste disposal units in the state of New York. The proposed landfill is to have an estimated capacity of 70,000 cubic yards (cy). The waste stream is to consist primarily of contaminated soil excavated from the North Yard Area and other areas under consideration for remediation. Other associated debris from the excavation operations may also be placed in the landfill. The estimated operational life of the landfill is dependent upon the rate of excavation, but is considered to be approximately three years. This landfill will not be designed to accommodate waste streams other than from site associated remediation projects.

The landfill is tentatively to be located in the area of the existing borrow pit, occupying the northern portion of the borrow pit site, shown as Cell 1 on Drawing 1. The HWL will contain a single cell covering a total of 4.6 acres. The final design elevation is expected to exceed 270 feet National Geodetic Vertical Datum (NGVD). The area to the south of the site is currently set aside for future expansion of the landfill, if needed. Future expansion areas will be developed, pending volume requirements. Cell 1 will be developed and constructed to receive the excavated materials from the North Yard area. This material is expected to be placed in the landfill in thin lifts and compacted so that it has a minimum design shear strength of 750 pounds per square foot (psf).

Each cell in the landfill is to be constructed with an upper primary geomembrane/clay liner and a lower secondary geomembrane/clay liner, a leachate collection/leachate detection system, and an above-grade containment dike system. The HWL preliminary design is discussed in Section 2.0.

Section 3.0 presents a cost estimate for the HWL preliminary design described in Section 2.0. The cost estimate includes both capital and operations and maintenance (O&M) costs.

1.2 SITE DESCRIPTION

The site tentatively selected for the landfill is located in the west central section of Reynolds plant site, just south of Haverstock Road. This area is west of the Black Mud Pond (BMP), and about 1600 feet south of the St. Lawrence River. About 40 percent of the site is covered with trees, grasses, shrubs, with an access road running adjacent the site toward the Black Mud Pond area. Railroad spurs are present to the east, and utility lines to the south of the site, as shown on Figure 1. The surrounding terrain is gently rolling, with ground elevations ranging from 240 to 210 NGVD feet. The proposed site was used as a source of borrow soil for use on the plant during the 1970s and 1980s. This area is currently being regraded. No production, storage, or other operations were associated with this area, therefore, there are no abandoned roadways, building foundation elements, dikes, buried fire protection lines, or other buried utility lines.

1.2.1 Geology

Information was obtained on the site geology from review of existing reports from previous projects. A more detailed description of the geology of the region, plant area, and proposed HWL site is contained in the report entitled, "Final Remediation Investigation Report, Revision 2, Reynolds Metals Company, Massena, New York," dated July 2, 1990, prepared by Woodward-Clyde Consultants. The geology in the vicinity of the proposed HWL site is generally characterized by a sequence of approximately 100 feet of glacial till deposits, consisting of bouldery, silty clay, clayey silt, overlying limestone bedrock.

1.2.2 Subsurface and Geotechnical Conditions

A geotechnical investigation has not yet been conducted at the proposed HWL site to describe the subsurface conditions and ascertain the geotechnical feasibility of constructing a landfill at the site. However, numerous monitoring wells have been installed and test pits have been excavated in the area. A review of these data, together with a preliminary examination of the borrow pit and an understanding of the regional geology, indicates that the site would be suitable for construction of a landfill from a geotechnical perspective with the proposed design configuration using conventional construction techniques. However, a formal geotechnical investigation would have to be conducted prior to finalization of the landfill design to quantify stability and settlement characteristics.

1.2.3 Groundwater

Groundwater conditions near the site have been characterized by WCC in previous investigations. Monitoring wells have been installed in shallow and deep zones in the glacial till around the BMP and borrow pit area. The water table aquifer is encountered 10 to 15 ft below the surface, ranging in elevation from 215 to 225. The elevation of the proposed landfill is about 5 feet above the mean high groundwater level at the landfill. The waste would be more than 10 feet above mean high water in the vicinity of the landfill. An average of 100 ft of glacial till separates the water table aquifer from the bedrock zone.

2.0 LANDFILL DESIGN

This preliminary design has been developed to comply with New York State Department of Environmental Conservation (NYSDEC) regulations pertaining to hazardous waste landfills. The design will be used to ascertain the cost effectiveness of the HWL as a disposal option for various remedial alternatives. Preliminary design drawings for this project are included as Drawings 2 through 8.

2.1 DESIGN CONSIDERATIONS

2.1.1 Location

The landfill would utilize the existing low area of the present borrow pit, located as shown on Drawing 2. The landfill site plan is presented on Drawing 3. The landfill location is outside the 100-year floodplain.

2.1.2 Volume (Airspace)

The landfill would have an estimated total airspace of 70,000 cy. The airspace does not include the double composite geomembrane liner system, cap system, or containment dikes.

2.1.3 Height and Depth

The landfill cover system would not exceed an elevation of +270 ft NGVD at its highest point. The lowest elevation of the landfill subgrade will be at elevation 210. Drawing 5 presents typical sections of the HWL.

2.1.4 Liner System

It is anticipated that this landfill would be constructed entirely above existing grade and will consist of a low permeability liner system. A typical section of the liner system is presented on Drawing 8. An 18-inch-thick clay layer will act as the lower composite layer for the primary liner system, and a 36-inch-thick clay layer will act as the clay component for the secondary liner system. AN 80-mil HDPE liner would serve as the geomembrane component of the double composite liner system. The landfill would be designed to minimize the number of penetrations through the liner system. If the penetration is essential, a watertight seal would be provided between the penetrating structure and the liner system. To the extent possible, penetrations would be perpendicular to the surface upon which they are supported. Sharp edges of the penetrating structure will not come into contact with the geomembrane material.

2.1.5 Leachate Detection

The leachate detection system (LDS) would consist of a 3-dimensional high-density polyethylene (HDPE) structure (geonet) designed to transmit flow to a collection point. The geonet would have a high fluid flow capacity for the design gradient and anticipated normal load. From the collection point, any liquid in the leachate detection system will be conveyed to the leachate removal system via porous bank run gravel, ASTM D 448, sizes No. 6, 57, or 67.

2.1.6 Leachate Collection System

The Leachate Collection System (LCS) will collect and transfer any liquid percolating through the waste to a collection point. The leachate collection system consists of noncalcareous gravel (ASTM D 448, Size 6, 57, or 67), high density polyethylene pipe, and geotextiles. Drawing 3 presents a plan view of the LCS; Drawing 6 presents LCS details. The landfill bottom collection layer will consist of at least 12 inches of rounded/subrounded gravel, having a hydraulic conductivity greater than 1×10^{-1} cm/sec. The gravel should be clean, free of organics or other unsuitable materials. The gravel should have no particle greater than 1 inch, and should have less than 5 percent of the material by weight pass the No. 200 sieve. A composite geonet material (i.e. heat bonded geotextile) would be used on the interior below grade sideslopes as the collection layer. The geotextile would be selected to preclude clogging. Appropriate testing, such as the gradient ratio test, etc., would be conducted using the anticipated waste material, and the candidate geotextiles.

Collection pipes would be sized and spaced adequately to remove leachate from the bottom of the waste and side walls of the cell. The capacity of the mains should be greater than the sum of the capacity of the laterals. The collection pipes would be capable of withstanding the weight, stresses, and disturbance from overlying waste cover material, equipment operation, and vehicular traffic. No glues, solvents, or adhesives will be permitted for pipe connections. All pipe connections would be threaded, pressure-fitted, or thermally coupled. All elements of the system would be sized according to the water balance calculations, and would be capable of handling a peak flow of a 25-year, 24-hour storm event, approximately 4 inches in the Massena area.

2.1.7 Leachate Removal System

The Leachate Removal System (LRS) would be designed to convey any liquid within the landfill from the collection point to the discharge point. The LRS would consist of pumps and a piping network designed to carry the leachate from the collection sumps to Reynolds' on-site North Yard GAC treatment system located northeast of the proposed landfill site. The LRS sump pumps would function automatically and be accessible for maintenance. Wherever possible, the number of penetrations to the liner system would be minimized. The leachate removal pipes would be below grade. The pipes would be double-walled and at a depth below the frost penetration level of 4 feet. Thus, heat tracing and lagging of the pipes would not be necessary. All components of the leachate removal system would be sized according to a water balance calculation and would be capable of handling peak flows of the 25-year, 24-hour storm event.

2.1.8 Above-Grade Perimeter Containment

The preliminary landfill design precludes stormwater that comes in contact with the waste during the landfilling operations from leaving an area controlled by the LCS. As the height of the landfilled waste exceeds the existing ground elevation, construction of containment structures, i.e., low permeability soil dikes, would be necessary.

These containment structures would consist of low permeability (clay) dikes, with a maximum exterior slope of 3 horizontal to 1 vertical. The clay would provide a minimum cover thickness of 2 feet and a coefficient of permeability less than 1×10^{-7} cm/sec. A detail cross-section showing a typical containment dike cross section is included on Drawing 8. The clay dike would serve as a low permeability soil layer for the final side slope capping system. A minimum 40-mil HDPE geomembrane would immediately overlie the clay dike material to create a composite cap system. A 48-inch-thick soil cover would be placed over the clay dike membrane cap system necessary to protect them from desiccation, freeze-thaw damage, and to establish vegetation.

2.1.9 Final Cap

The landfill design would also include a final capping system that minimizes infiltration of water into the landfill. Design, construction, and maintenance considerations would help prevent erosion of the capping system. The capping system would consist of, in ascending order: 6 inches soil cover over the waste; a geotextile; 18-inch clay layer; a 40-mil minimum HDPE geomembrane; a 12-inch rounded/subrounded gravel drainage layer; and 30 inches of soil cover over the liner, or established vegetative cover. A plan view is presented on Drawing 3; a typical section is presented on Drawing 8.

2.2 DESIGN CONSIDERATIONS

The landfill detail design would provide for erosion and sedimentation control facilities, stormwater control systems, and access roads. Typical design details are presented on Drawings 4 and 8.

2.2.1 Erosion and Sedimentation Control Plan

The preliminary landfill design has been developed such that a project erosion and settlement control plan (ESCP) can be developed in accordance with applicable NYSDEC Regulations.

2.2.2 Stormwater Control System

Stormwater management controls would be controlled by different methods during landfill operations versus after landfill closure. The LCS would provide stormwater management during operation, in conjunction with the perimeter dike containment system.

After closure, stormwater management system to control runoff discharge of a 10-year, 2-hour storm would be in place. Drawings 4 and 8 present typical design details of the stormwater control system on the landfill after closure. The stormwater management system would also include a detention basin to provide temporary storage of the expected runoff from the design storm, with sufficient reserve capacity to accumulate precipitation and sediment prior to discharge. Preliminary design details of runoff control are presented in Drawing 3. The design details for the detention basin would be prepared as part of the detailed design. Discharge from the detention basin would be in compliance with the applicable federal and state regulations.

2.2.3 Access Road

An access road would be provided for transporting material into the landfill. This access road would not necessarily circumscribe this site, as shown on Drawing 4. The access road would include a haul road for the excavated soil from the North Yard and other areas of the plant to the landfill. At a minimum the haul road would be designed to accommodate 60,000 truck loads at 50 trips per day. The perimeter patrol road will circumscribe this site, however, it would be designed to handle light-duty road traffic. Trucking for landfill construction associated with excavation activities and construction would not use public roadways.

3.0 ESTIMATED COSTS

The costs associated with the construction, operation, closure, and post-closure for the HWL have been estimated and are presented in Table 3.1. The costs associated with the design, permitting, and required investigations for the HWL are included in the discussion of remedial alternatives. These estimated costs have been developed, using information obtained from local contractors, vendor quotes, cost estimating guides, and previous WCC experience. A more detailed cost estimate is included as Attachment 1. All cost estimates assume 1991 dollars.

3.1 CAPITAL COSTS

The direct capital costs (nonrecurring) for the HWL include costs to construct, operate, and close the facility. The capital costs were estimated using the design described in Section 2.0 and presented on Drawings 3 through 8.

The landfill operations costs include daily operation, groundwater monitoring, and stormwater treatment. Daily operation costs include equipment and manpower necessary to operate the landfill. Groundwater monitoring costs are based on sampling/analytical costs of $2,000/year for five monitoring wells. Stormwater treatment includes costs for on-site treatment at the North Yard GAC system, of 65 percent of the annual rainfall at $0.014/gallon.

Based on the above assumptions, the total direct project cost is estimated to be $2,800,000, or a cost of $40 per cubic yard. Using a conversion factor of 1.5 tons per cubic yard, the cost would be $60 per ton.

3.2 POST-CLOSURE COSTS

Costs associated with post-closure O & M consist of a number of items. The following assumptions were used to estimate the O & M costs for a 30-year post-closure period. All post-closure costs are based on 1991 dollars.

- Groundwater monitoring costs are estimated to be $22,000 per year. Analytical costs are assumed to be $2,000 per well per year (5 monitoring wells) as part of the plant-wide monitoring program. Groundwater data analysis and reporting are assumed to be included with a plant-wide monitoring program. The useful life of a well is estimated to be 10 years; for a 30-year post closure period, this would require well replacement 3 times, or an annual cost of $2,000 per year.

- Maintenance of the final cover system is estimated to be $12,000 per year. This cost assumes complete replacement of the sideslope and final cover above the upper geotextile once over the 30-year post-closure period.

- The cost of leachate pumping/treatment and leachate collection system maintenance after closure is estimated to be $7,000 per year. This cost is based on treating 10,000 gallons/year of leachate generated after closure. At a treatment cost of $014 per gallon, annual treatment cost of the leachate is about $140. O&M costs for leachate pumping and piping assumes complete replacement twice during the 30-year post-closure period (15-year life).

The post-closure O&M costs total $31,000 per year (1991 dollars).

TABLE E-1
COST SUMMARY
HAZARDOUS WASTE LANDFILL
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

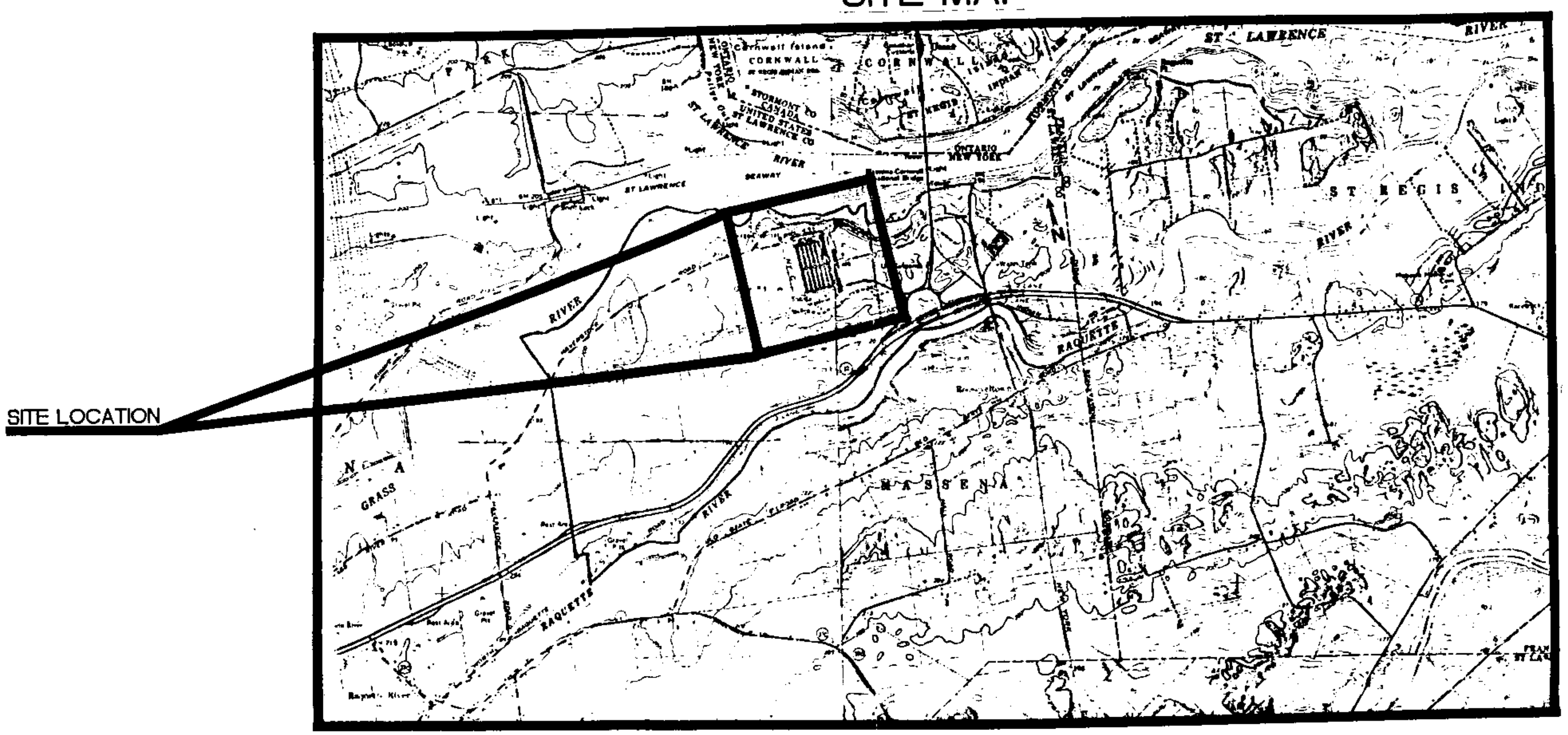
MAJOR TASK	ESTIMATED COST
SITE PREPARATION	$200,000
LINER CONSTRUCTION	$830,000
LEACHATE PUMPING TO WWTP	$100,000
LANDFILL OPERATIONS	$710,000
SIDE-SLOPE COVER SYSTEM	$680,000
FINAL COVER SYSTEM	$380,000
TOTAL FOR CONSTRUCTION, OPERATION, AND CLOSURE	$2,890,000

PROPOSED INDUSTRIAL LANDFILL

PREPARED FOR

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

SITE MAP



INDEX OF DRAWINGS

DWG. NO.	TITLE
1. . .	TITLE PAGE
2. . .	TOPOGRAPHIC MAP AND SITE PLAN
3. . .	PRIMARY COLLECTION SYSTEM AND LANDFILL CLOSURE PLAN
4. . .	ACCESS ROAD LAYOUT
5. . .	TYPICAL NORTH-SOUTH, EAST-WEST CROSS SECTIONS
6. . .	LEACHATE COLLECTION SYSTEM DETAILS
7. . .	EDGE DRAIN SYSTEM DETAILS
8. . .	COVER SYSTEM/LINER SYSTEM TYPICAL DETAILS

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

TITLE PAGE
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

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Checked by: PRJ	Rev. No.:	1
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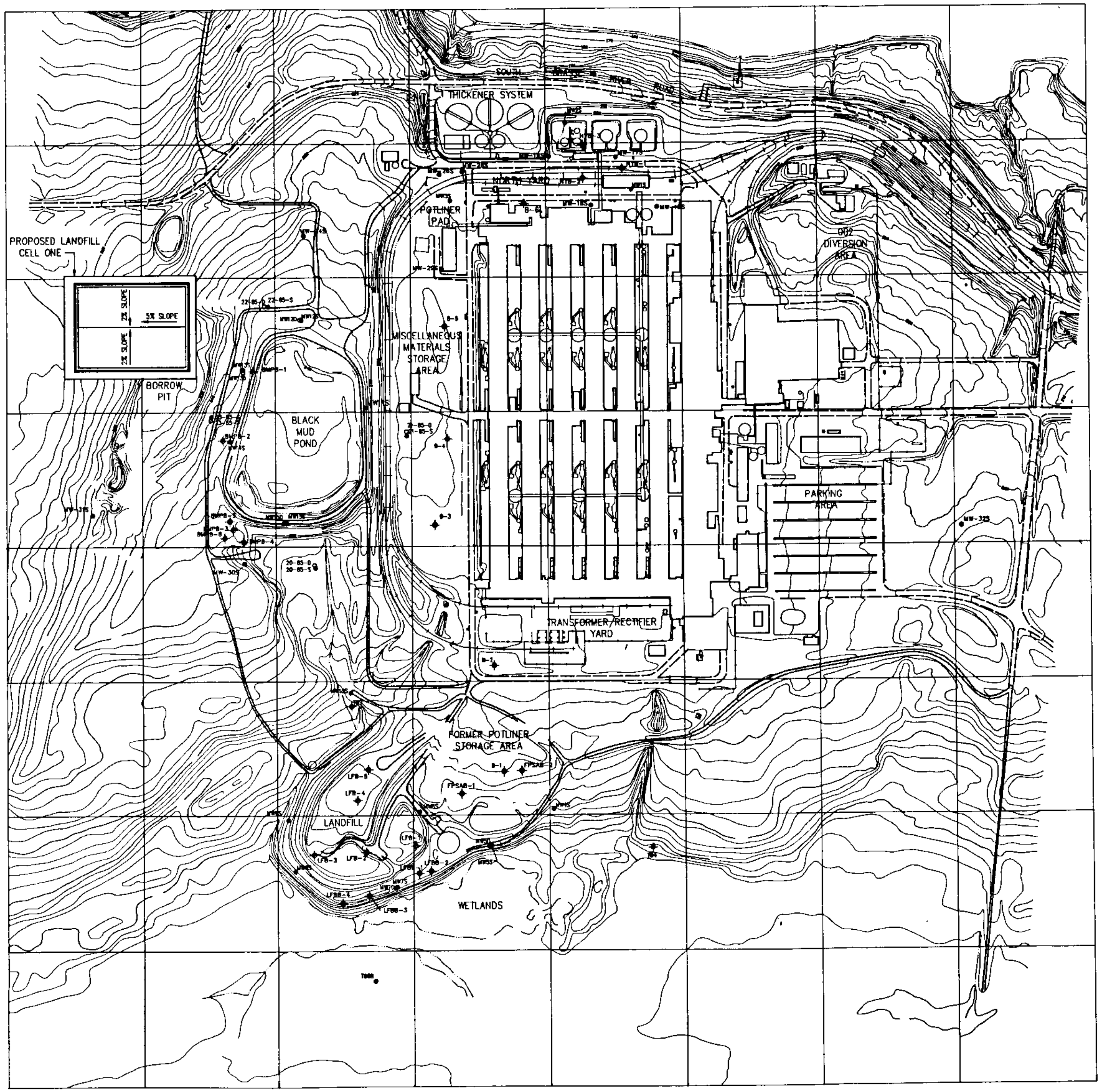

LEGEND:

- ● SHALLOW MONITORING WELL
- ○ DEEP MONITORING WELL
- ✦ SOIL BORING
- ⊗ SOIL GRAB SAMPLE
- —— CONTOUR INTERVAL: 2 FEET

plot scale: 1 = .00467

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

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TOPOGRAPHIC MAP AND SITE PLAN
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Job No.: 89C2515C-2	Drawing No. 251501	Date: 5-20-91
Checked by: CRC	Rev. No.:	2
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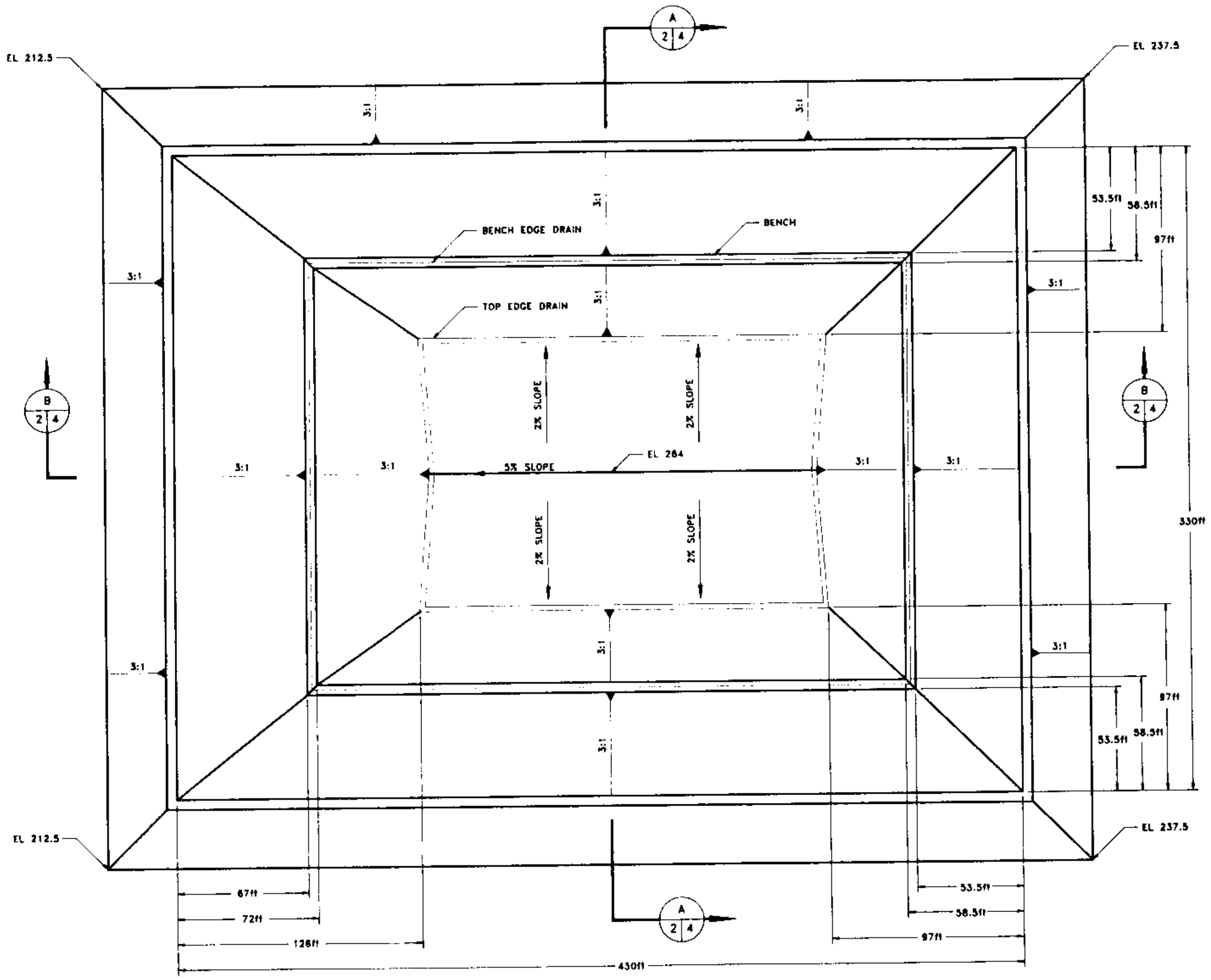
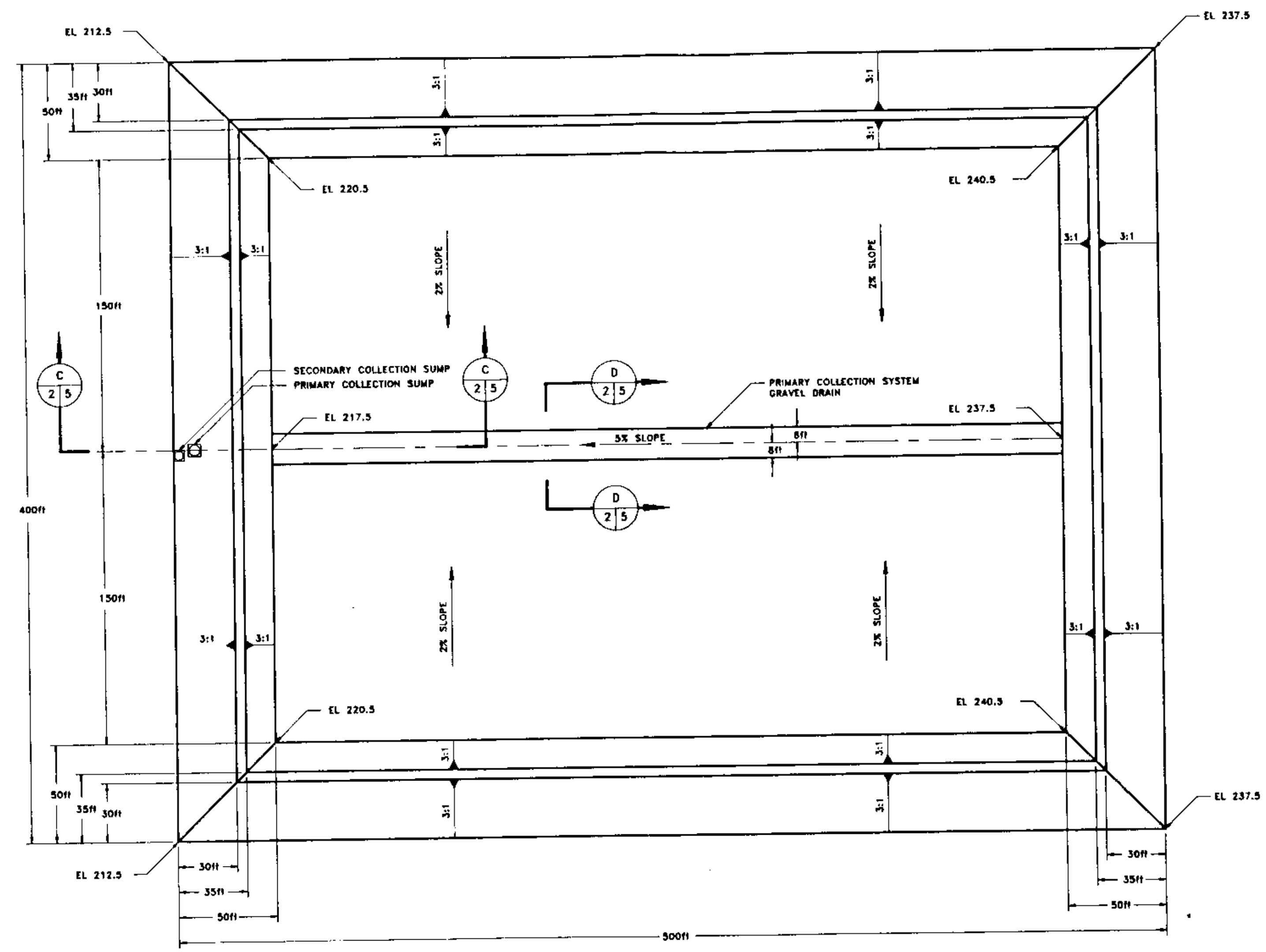


LANDFILL CLOSURE PLAN



PRIMARY LEACHATE COLLECTION PLAN

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
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PRIMARY COLLECTION SYSTEM AND LANDFILL CLOSURE PLAN
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

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Checked by: CRC	Rev. No.:	3
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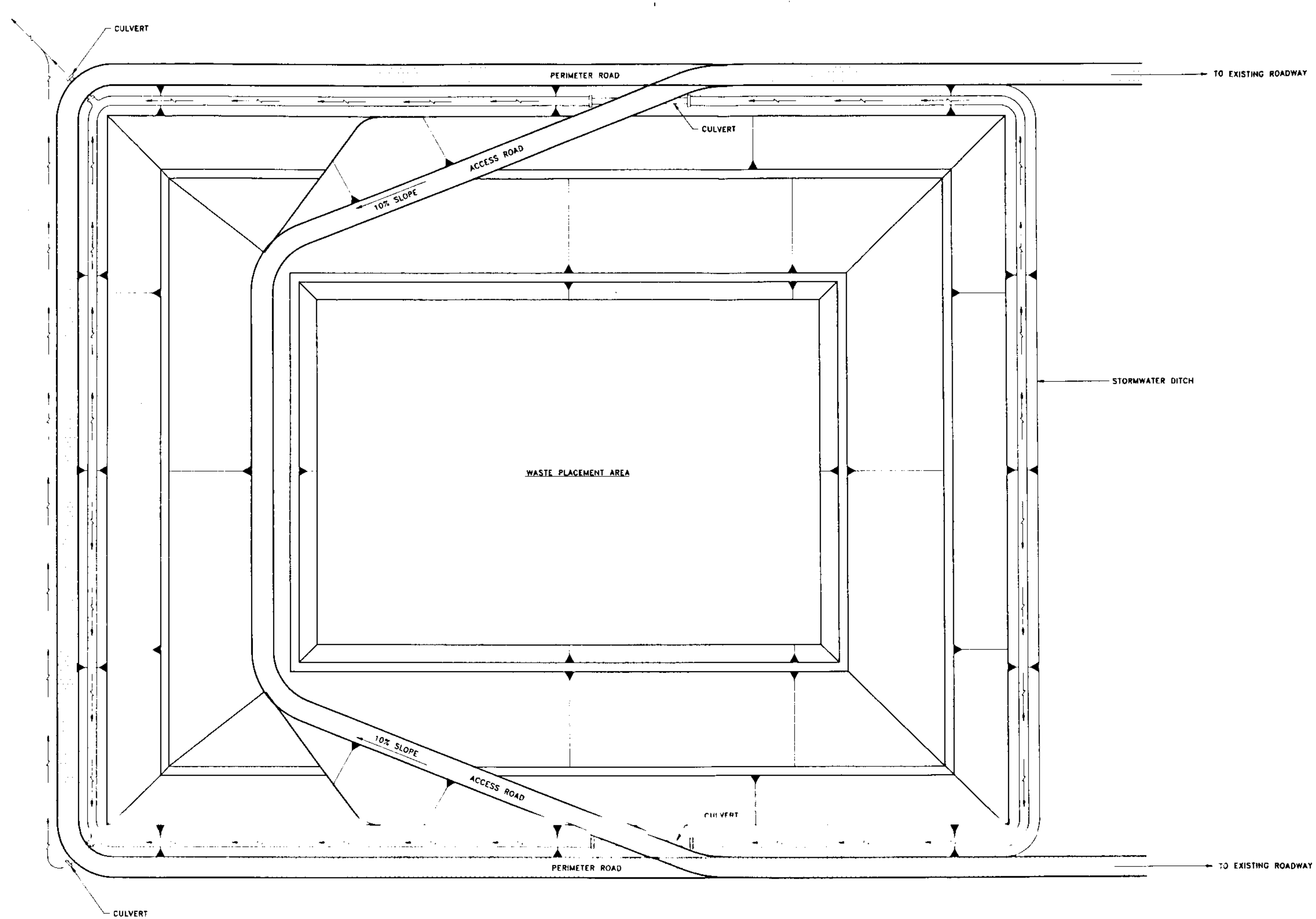

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ACCESS ROAD LAYOUTS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Job No.: 89C2515C-2	Drawing No. 251503	Date: 5-20-91
Checked by: CRC	Rev. No.: B.T.	4
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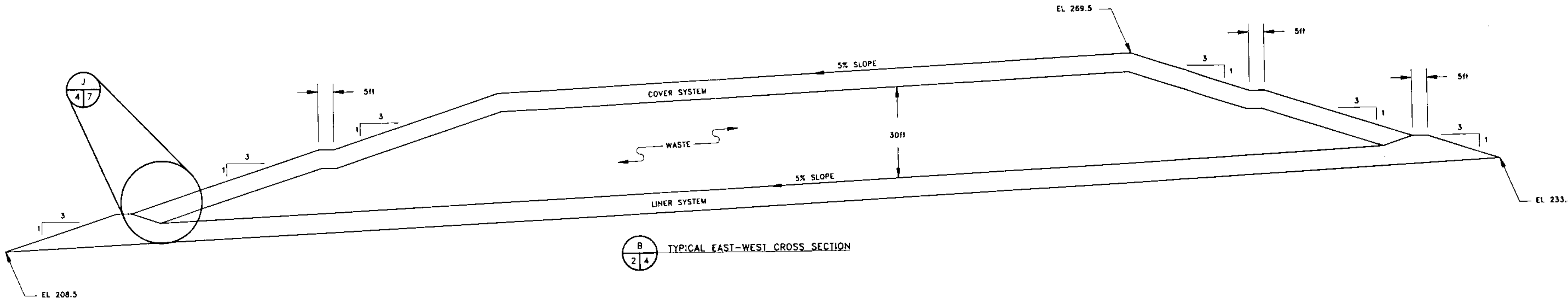
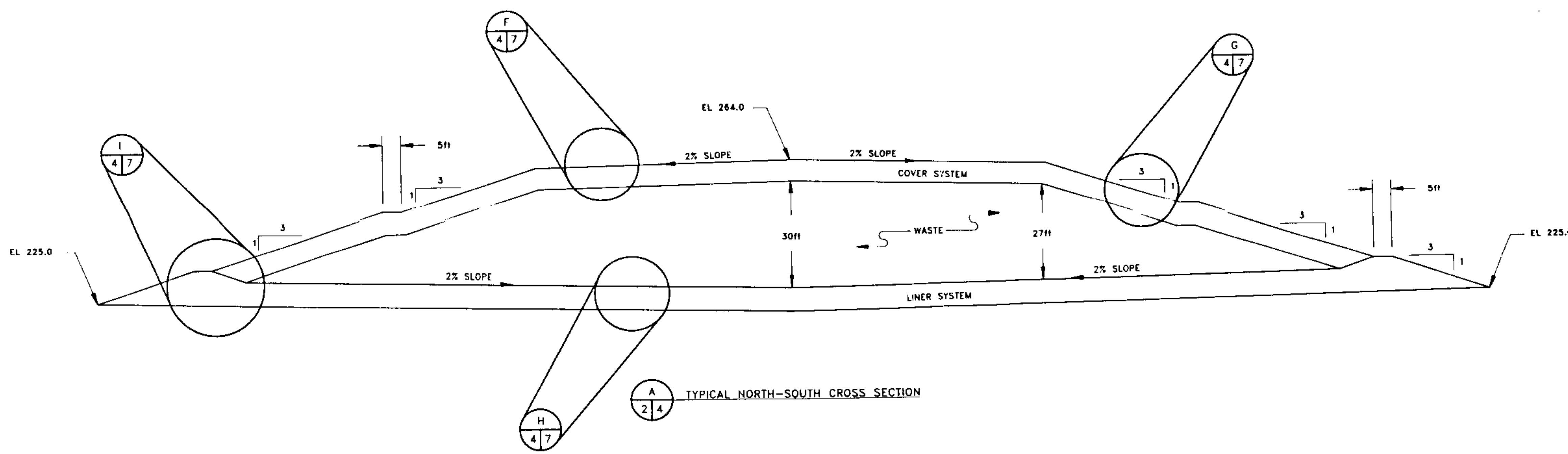


B 2 4 TYPICAL EAST-WEST CROSS SECTION



A 2 4 TYPICAL NORTH-SOUTH CROSS SECTION

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
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TYPICAL NORTH-SOUTH, EAST-WEST CROSS SECTIONS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Job No.: 89C2515C-2	Drawing No. 251504	Date: 5-20-91
Checked by: CRC	Rev. No.:	5
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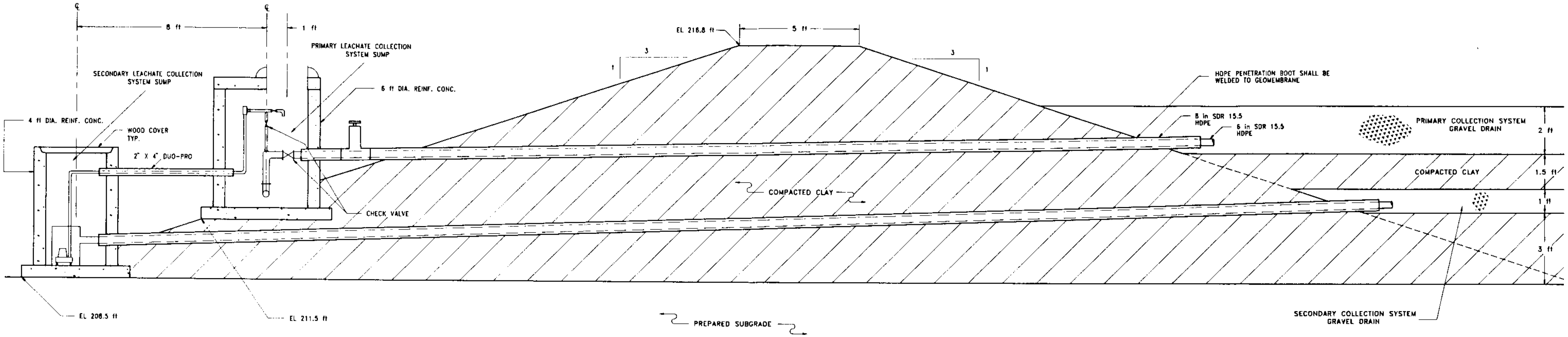
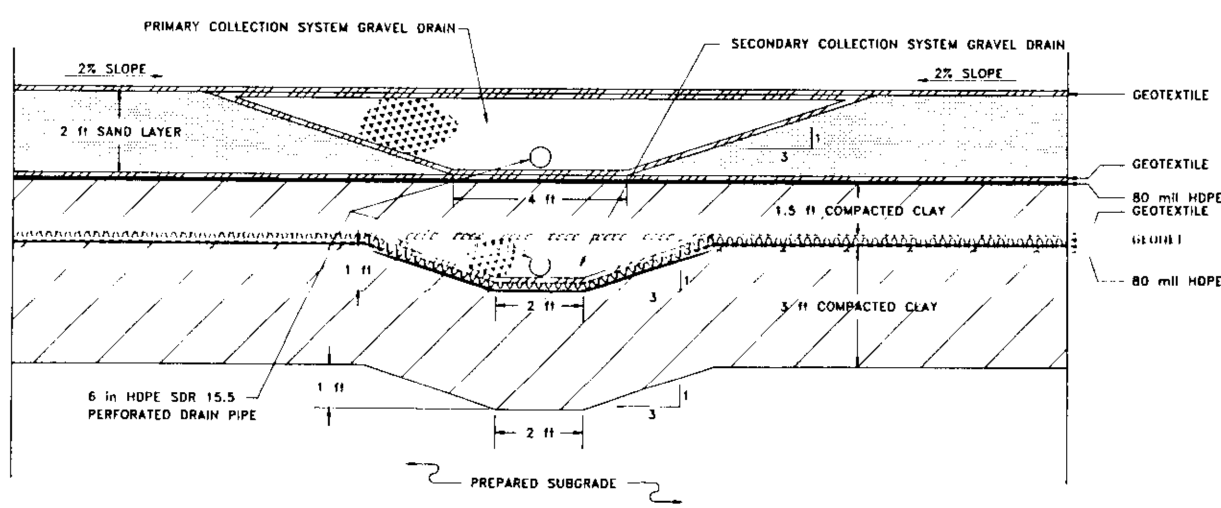


C 2/5 LEACHATE COLLECTION SYSTEM DETAIL
(N.T.S.)



D 2/5 CROSS SECTION THROUGH GRAVEL DRAINS
(N.T.S.)

REYNOLDS METALS COMPANY MASSENA, NEW YORK		
WOODWARD-CLYDE CONSULTANTS Consulting Engineers, Geologists and Environmental Scientists		
LEACHATE COLLECTION SYSTEM DETAILS REYNOLDS METALS COMPANY MASSENA, NEW YORK		
Job No.: 89C2515C-2	Drawing No. 251521	Date: 5/20/91
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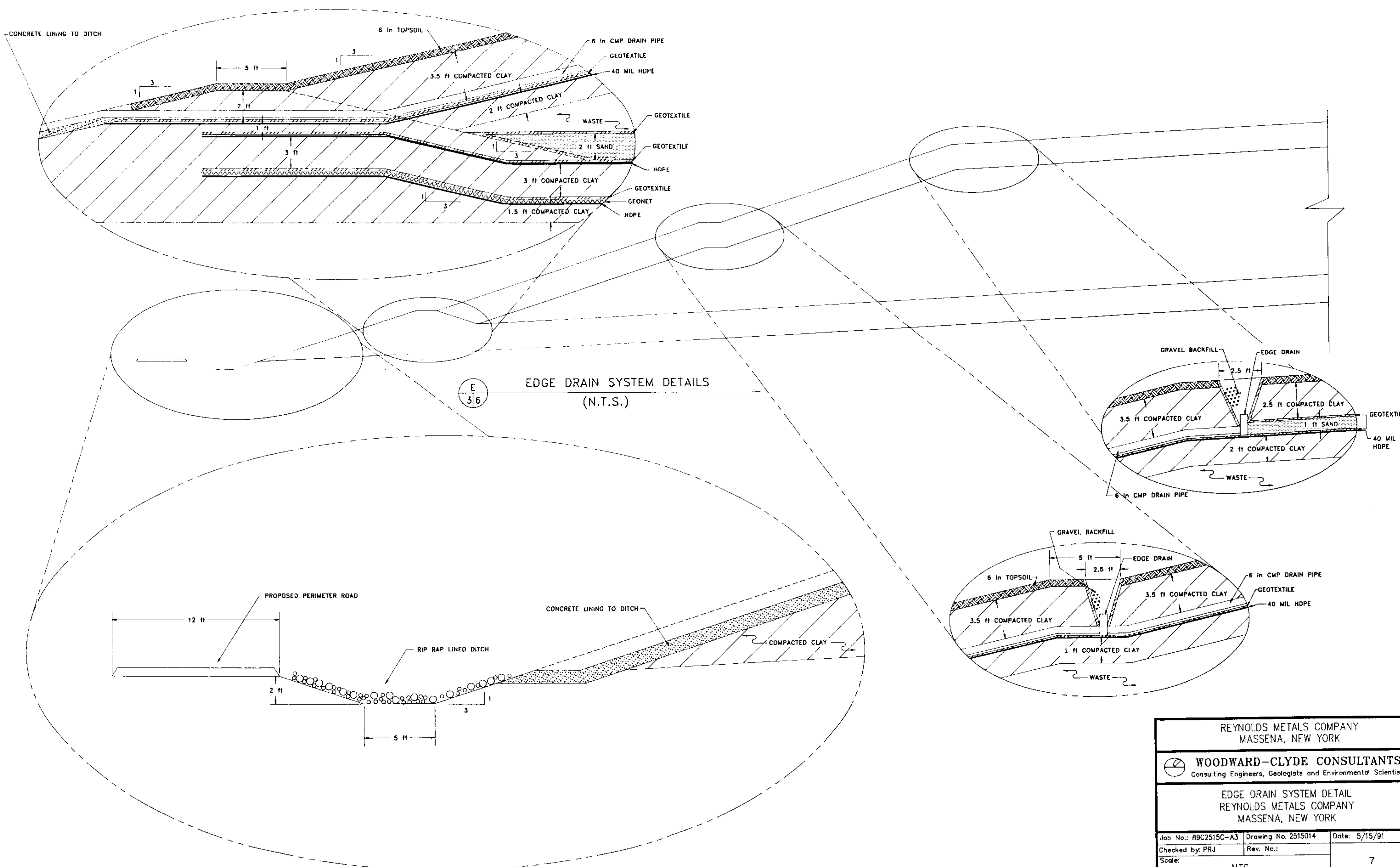

REYNOLDS METALS COMPANY MASSENA, NEW YORK		
WOODWARD-CLYDE CONSULTANTS Consulting Engineers, Geologists and Environmental Scientists		
EDGE DRAIN SYSTEM DETAIL REYNOLDS METALS COMPANY MASSENA, NEW YORK		
Job No.: 89C2515C-A3	Drawing No. 2515014	Date: 5/15/91
Checked by: PRJ	Rev. No.:	7
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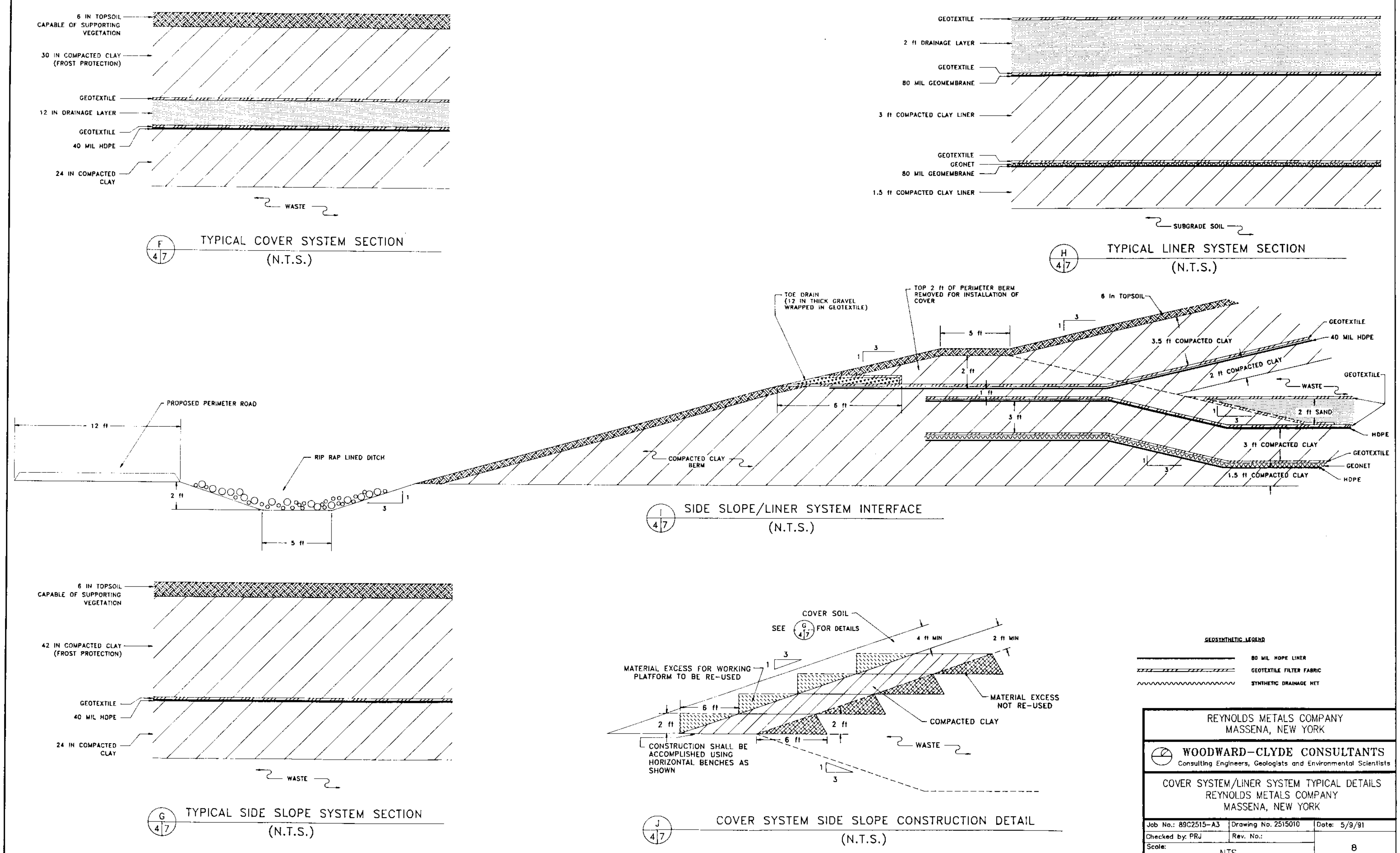

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

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COVER SYSTEM/LINER SYSTEM TYPICAL DETAILS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Job No.: 89C2515-A3	Drawing No. 2515010	Date: 5/9/91
Checked by: PRJ	Rev. No.:	8
Scale: NTS		

ATTACHMENT 1
HAZARDOUS WASTE LANDFILL COST ESTIMATE
REYNOLDS METALS COMPANY
MASSENA, NEW YORK
LANDFILL CELL NO.1

TASK	SUBTASK	PHASE	UNITS	UNIT COST	QUANTITY	COST
LEACHATE PUMPING TO WWTP						
PIPELINE INSTALLATION	EXCAVATION/BACKFILL	Excavate & Compact	lin. ft	$7 /lf	1,500	$10,500
	PIPE INSTALLATION	Purchase/Place	lin. ft	$53 /lf	1,500	$79,500
PUMPING SYSTEM	PUMPING STATION	Purchase/Place	ea.	$5,000 /ea	1	$5,000
	PUMP/CONTROLS	Purchase/Place	ea.	$3,000 /ea	1	$3,000
	MONITORING POINTS	Purchase/Place	ea.	$500 /ea	5	$2,500
						$100,500
LANDFILL OPERATIONS						
DAILY OPERATIONS	WASTE PLACEMENT	Place/Compact	cy	$8 /cy	70,000	$560,000
GROUNDWATER MONITORING	SAMPLING AND ANALYSIS		yr	$10,000 /yr	3	$30,000
STORMWATER TREATMENT	ON-SITE TREATMENT		yr	$40,000 /yr	3	$120,000
						$710,000
SIDE-SLOPE COVER SYSTEM						
SIDE-SLOPE COVER SYSTEM	CLAY DIKES	Purchase/Place	cy	$13 /yd3	10,000	$130,000
	GEOMEMBRANE	Purchase/Place	sf	$1.20 /ft2	160,000	$192,000
	GEOTEXTILE	Purchase/Place	sf	$0.30 /ft2	160,000	$48,000
	12" COARSE AGGREGATE	Purchase/Deliver	cy	$7.50 /yd3	5,000	$37,500
		Place	cy	$4.50 /yd3	5,000	$22,500
	GEOTEXTILE	Purchase/Place	sf	$0.30 /ft2	165,000	$49,500
	30" COMMON FILL	Purchase/Deliver	cy	$7.50 /yd3	12,500	$93,750
		Place	cy	$4.50 /yd3	12,500	$56,250
	6" TOPSOIL	Purchase/Deliver	cy	$10.00 /yd3	2,500	$25,000
		Place	cy	$5.00 /yd3	2,500	$12,500
	HYDROSEED	Purchase/Place	sf	$0.06 /ft2	160,000	$9,600
						$676,600
FINAL COVER SYSTEM						
COVER SYSTEM	24" CLAY CAP	Purchase/Place	cy	$13 /yd3	5,300	$68,900
	GEOMEMBRANE	Purchase/Place	sf	$0.60 /ft2	70,400	$42,240
	GEOTEXTILE	Purchase/Place	sf	$0.30 /ft2	70,400	$21,120
	12" DRAINAGE SAND	Purchase/Deliver	cy	$7.50 /yd3	5,000	$37,500
		Place	cy	$4.50 /yd3	5,000	$22,500
	GEOTEXTILE	Purchase/Place	sf	$0.30 /ft2	70,400	$21,120
	30" COMMON FILL	Purchase/Deliver	cy	$7.50 /yd3	6,600	$49,500
		Place	cy	$4.50 /yd3	6,600	$29,700
	6" TOPSOIL	Purchase/Deliver	cy	$10.00 /yd3	2,600	$26,000
		Place	cy	$5.00 /yd3	2,600	$13,000
	HYDROSEED	Purchase/Place	sf	$0.06 /ft2	160,000	$9,600
	PERIMETER DRAINAGE	Purchase/Place	lin. ft	$5 /lf	1,500	$7,500
	RETENTION POND	Construct	cy	$10 /cy	3,000	$30,000
						$378,680
TOTAL						$2,892,030

ATTACHMENT 1
HAZARDOUS WASTE LANDFILL COST ESTIMATE
REYNOLDS METALS COMPANY
MASSENA, NEW YORK
LANDFILL CELL NO.1

TASK	SUBTASK	PHASE	UNITS	UNIT COST	QUANTITY	COST
SITE PREPARATION						
MOB & DEMOB	SITE PREP.	All Equipment	ls	$3,000 /ls	1	$3,000
SITE CLEARING	TREE CUTTING	Cutting & Chipping	acre	$6,000 /Ac	5	$30,000
	STUMP REMOVAL	Removal/Disposal	acre	$3,000 /Ac	3	$7,500
	STRIPPING/GRUBBING	Excavate/Stockpile	cy	$4 /yd3	8,000	$32,000
PERIMETER ROAD	SUBBASE	Purchase/Place	sy	$12.50 /yd2	2,100	$26,250
	BINDER	Purchase/Place	sy	$10 /yd2	2,100	$21,000
	TOP	Purchase/Place	sy	$10 /yd2	2,100	$21,000
LF SUBGRADE PREPARATION	REGRADING	Cut & Fill Compact & Grade	cy	7.50 /yd3	8,000	$60,000
						$200,750
LINER CONSTRUCTION						
PRIMARY LINER	18" CLAY LINER	Purchase/Place	cy	$13.00 /yd3	9,000	$117,000
	GEOMEMBRANE	Purchase/Place	sf	$0.90 /ft2	20,000	$18,000
SECONDARY LINER LEAK DETECTION SYSTEM	DRAINAGE NET	Purchase/Place	sf	$0.60 /ft2	165,000	$99,000
	SUMPS/MANHOLE	Purchase/Place	ea.	$2,000 /ea	1	$2,000
SECONDARY LINER	36" CLAY LINER	Purchase/Place	cy	$13 /yd3	18,000	$225,000
	GEOMEMBRANE	Purchase/Place	sf	$0.90 /ft2	165,000	$148,500
LEACHATE COLLECTION SYSTEM	GEOTEXTILE	Purchase/Place	sf	$0.30 /ft2	165,000	$49,500
	24" COARSE AGGREGATE	Purchase/Place	cy	$13.00 /yd3	8,500	$110,500
	GEOTEXTILE	Purchase/Place	sf	$0.30 /ft2	165,000	$49,500
	INTERIOR PIPING	Purchase/Place	lin. ft	$3.00 /lf	1,500	$4,500
	SUMPS/MANHOLE	Purchase/Place	ea.	$2,000 /ea	1	$2,000
						$825,500

APPENDIX F

LANDFILL LEACHATE CALCULATION

INTRODUCTION

USEPA's computer model, Hydrologic Evaluation of Landfill Performance (HELP, 1989) has been used to perform a water balance to estimate quantity of water percolating the contaminated materials in the Landfill, the Former Potliner Storage Area (FPSA), and the Black Mud Pond. The purpose of this water balance is to compare leachate generation under existing conditions (with the interim cover) with the landfill after closure (with the RCRA - style cap).

The HELP model uses a water balance method to estimate the quantity of precipitation which will theoretically penetrate the cover system. Site-specific climatological and design data can be input into the model in order to assess cover performance.

To determine the quantity of rainfall penetrating the final cover, the model estimates runoff, cap drainage, and evapotranspiration. These calculations are generally based on assumptions made regarding the runoff coefficient, root zone depth, quality of plant cover, soil porosity, field capacity, and initial water content. All rainwater remaining after runoff, cap drainage, and evapotranspiration can either become leachate or can be absorbed by the contaminated materials.

Two evaluations were performed each, for the Landfill and Former Potliner Storage Areas and for the Black Mud Pond Area. The first evaluation was performed to assess existing site conditions, and the second evaluation was performed to assess the anticipated impact of the proposed RCRA final cover system (Figure II-1).

MODEL INPUTS

The information needed to run the HELP model includes climatologic, design, soil, and runoff data. To assist the user in operating the HELP model, the program has several internal data bases listing default values for data associated with weather conditions for 102 cities throughout the United States, 7 vegetation cover types, 18 soil types, and a composite soil/geomembrane liner type. The user may select default values from these data bases that best represent the expected site-specific conditions. Alternately, the user may manually input pertinent data using the prescribed format. Details of data input are presented in the HELP model documentation. Certain assumptions were made when modeling for existing conditions at the Reynolds site. For this modeling, climatological data was chosen from Burlington, Vermont, the closest internal data to Massena, New York.

For the Landfill, the existing cover system was assumed to consist of an average of four feet of medium to coarse sand, at an average slope of 5 percent. For the FPSA and the Black Mud Pond, which currently have no cover system, it was assumed all drainage to the contaminated materials would be the difference between total precipitation and total evapotransipiration.

For the proposed design of the RCRA-style cap, certain assumptions were made. All "Fraction of Leakages" (the fraction of the area of the soil liner which drains from leaks in the flexible membrane) of the 20-mil geomembrane were taken as 0.0001. This value is consistent with good construction practices with a high degree of QA/QC. The possibility of a puncture will be reduced by the use of 36-inch-thick protective cover soil, the drainage layer, and strict control of installation procedures.

RESULTS

Six outputs from the HELP model are attached. The first three are for existing conditions in the Landfill, FPSA, and the Black Mud Pond, and the last three are for capped conditions for the three areas. Each output displays input information, database information and numerical conclusions. The material entered into the model includes information such as the city and state of site, number of soil layers present, types of soils (i.e. vertical percolation layer, etc.), soil textures, the slope of the cap, the area of the cap, etc.. The database provides all soil characteristics for the soil texture chosen (i.e saturated hydraulic conductivity), and climatological data for the area chosen. After the program runs, it reports how much (cubic feet or inches) precipitation, evapotranspiration, lateral drainage, percolation or change in water storage is occurring at the site.

Based on the results of the modeling, the existing cover conditions at the Landfill and the FPSA results in approximately 57 percent effectiveness in eliminating drainage, i.e., 43 percent of the total precipitation reaches contaminated materials. For the Black Mud Pond, the existing conditions result in approximately 35 percent effectiveness in eliminating drainage, i.e., 65 percent of the total precipitation reaches the black mud.

The model results show that the final cover design for the Landfill and FPSA would result in approximately 99.9 percent effectiveness in eliminating drainage through the cap, i.e., 0.1 percent of total precipitation would reach the contaminated materials. The effectiveness of the Black Mud Pond cap design would also be 99.9 percent, i.e., 0.1 percent of total precipitation would reach the black mud. The percentages presented above are based on the average annual total precipitation for five years and the percolation from the base of the cover values generated by the HELP model.

To summarize, the final RCRA-style cover system on the Landfill and FPSA would increase the effectiveness of eliminating drainage to the Landfill and FPSA contaminated materials from 57 percent to 99.9 percent. For the Black Mud Pond, the effectiveness would increase from 35 percent to 99.9 percent.

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 REYNOLDS LANDFILL AREA EXISTING CONDITIONS
 MASSENA NEW YORK
 APRIL 19 1991

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                          BARE GROUND

                           LAYER  1
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                   VERTICAL PERCOLATION LAYER
  THICKNESS                             =     12.00 INCHES
  POROSITY                              =      0.4370 VOL/VOL
  FIELD CAPACITY                        =      0.0624 VOL/VOL
  WILTING POINT                         =      0.0245 VOL/VOL
  INITIAL SOIL WATER CONTENT            =      0.0624 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY      =      0.005799999926 CM/SEC


                           LAYER  2
                           --------

                     LATERAL DRAINAGE LAYER
  THICKNESS                             =     24.00 INCHES
  POROSITY                              =      0.4370 VOL/VOL
  FIELD CAPACITY                        =      0.0624 VOL/VOL
  WILTING POINT                         =      0.0245 VOL/VOL
  INITIAL SOIL WATER CONTENT            =      0.0624 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY      =      0.005799999926 CM/SEC
  SLOPE                                 =      5.00 PERCENT
  DRAINAGE LENGTH                       =    250.0 FEET


                           LAYER  3
                           --------

                       BARRIER SOIL LINER
  THICKNESS                             =     12.00 INCHES
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POROSITY	=	0.4370 VOL/VOL
FIELD CAPACITY	=	0.0624 VOL/VOL
WILTING POINT	=	0.0245 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4370 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.005799999926 CM/SEC

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	79.62
TOTAL AREA OF COVER	=	331056. SQ FT
EVAPORATIVE ZONE DEPTH	=	29.00 INCHES
UPPER LIMIT VEG. STORAGE	=	12.6730 INCHES
INITIAL VEG. STORAGE	=	3.9186 INCHES
INITIAL SNOW WATER CONTENT	=	0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	7.4904 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR BURLINGTON VERMONT

MAXIMUM LEAF AREA INDEX	=	3.30
START OF GROWING SEASON (JULIAN DATE)	=	125
END OF GROWING SEASON (JULIAN DATE)	=	263

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
16.60	18.10	29.20	42.70	55.20	64.90
69.60	67.10	58.80	47.90	36.60	22.60

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 77 THROUGH 81

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	1.59	2.35	2.93	2.14	2.55
	3.40	4.11	4.48	3.76	2.90	2.09

STD. DEVIATIONS	2.06	2.15	0.67	0.51	1.38	1.18
	1.75	1.67	1.67	1.38	1.26	0.74
RUNOFF						
TOTALS	0.000	0.015	0.024	0.000	0.007	0.000
	0.025	0.051	0.040	0.003	0.007	0.000
STD. DEVIATIONS	0.000	0.034	0.039	0.000	0.015	0.000
	0.057	0.097	0.049	0.005	0.013	0.000
EVAPOTRANSPIRATION						
TOTALS	0.395	0.615	1.358	2.698	2.024	3.914
	2.708	3.910	2.720	1.832	1.061	0.412
STD. DEVIATIONS	0.142	0.124	0.245	0.313	0.813	1.481
	0.896	1.325	0.497	0.122	0.110	0.087
LATERAL DRAINAGE FROM LAYER 2						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 3						
TOTALS	0.9304	0.8328	2.0172	1.5778	0.4002	0.0833
	0.0000	0.0869	0.7311	1.5772	1.2563	1.3592
STD. DEVIATIONS	0.2920	0.8655	1.3936	1.7379	0.1775	0.0590
	0.0000	0.1181	0.9625	1.7092	0.9339	1.0341

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 77 THROUGH 81

	(INCHES)		(CU. FT.)	PERCENT
PRECIPITATION	34.67	(5.239)	956476.	100.00
RUNOFF	0.172	(0.111)	4751.	0.50
EVAPOTRANSPIRATION	23.647	(2.299)	652377.	68.21
LATERAL DRAINAGE FROM LAYER 2	0.0000	(0.0000)	1.	0.00
PERCOLATION FROM LAYER 3	10.8524	(4.0922)	299395.	31.30
CHANGE IN WATER STORAGE	-0.002	(0.322)	-48.	0.00

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PEAK DAILY VALUES FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)
PRECIPITATION	2.36	65107.7
RUNOFF	0.222	6131.5
LATERAL DRAINAGE FROM LAYER 2	0.0000	0.6
PERCOLATION FROM LAYER 3	1.1547	31855.2
HEAD ON LAYER 3	0.5	
SNOW WATER	4.63	127749.7

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.1914

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0244

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FINAL WATER STORAGE AT END OF YEAR 81

LAYER	(INCHES)	(VOL/VOL)
1	1.49	0.1243
2	2.49	0.1038
3	5.24	0.4370
SNOW WATER	0.34	

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REYNOLDS FORMER POTLINER STORAGE AREA EXISTING CONDITIONS
MASSENA NEW YORK
APRIL 19, 1991

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BARE GROUND

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	1.00 INCHES
POROSITY	=	0.4370 VOL/VOL
FIELD CAPACITY	=	0.0624 VOL/VOL
WILTING POINT	=	0.0245 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0624 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.005799999926 CM/SEC

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	79.62
TOTAL AREA OF COVER	=	165528. SQ FT
EVAPORATIVE ZONE DEPTH	=	29.00 INCHES
UPPER LIMIT VEG. STORAGE	=	0.4370 INCHES
INITIAL VEG. STORAGE	=	0.0278 INCHES
INITIAL SNOW WATER CONTENT	=	0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	0.0624 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND

SOLAR RADIATION FOR BURLINGTON VERMONT

MAXIMUM LEAF AREA INDEX = 3.30
START OF GROWING SEASON (JULIAN DATE) = 125
END OF GROWING SEASON (JULIAN DATE) = 263

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
16.60	18.10	29.20	42.70	55.20	64.90
69.60	67.10	58.80	47.90	36.60	22.60

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 77 THROUGH 81

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	1.59	2.35	2.93	2.14	2.55
	3.40	4.11	4.48	3.76	2.90	2.09
STD. DEVIATIONS	2.06	2.15	0.67	0.51	1.38	1.18
	1.75	1.67	1.67	1.38	1.26	0.74
RUNOFF						
TOTALS	0.131	0.138	0.439	0.403	0.329	0.370
	0.477	0.361	0.415	0.460	0.401	0.304
STD. DEVIATIONS	0.122	0.115	0.262	0.189	0.231	0.222
	0.277	0.194	0.178	0.253	0.115	0.218
EVAPOTRANSPIRATION						
TOTALS	0.356	0.545	1.099	1.339	0.917	1.357
	1.464	1.849	1.340	0.919	0.558	0.384
STD. DEVIATIONS	0.099	0.107	0.139	0.242	0.599	0.697
	0.567	0.331	0.402	0.099	0.116	0.100
PERCOLATION FROM LAYER 1						
TOTALS	0.3818	0.8490	2.1726	1.7643	0.8099	0.8791
	1.5032	1.8907	2.7132	2.3538	1.8842	1.0374
STD. DEVIATIONS	0.4850	1.3477	1.4630	1.4743	0.6505	0.4924
	1.1389	1.2827	1.3496	1.1611	1.0471	0.8521

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 77 THROUGH 81

	(INCHES)		(CU. FT.)	PERCENT
PRECIPITATION	34.67	(5.239)	478238.	100.00
RUNOFF	4.227	(0.765)	58309.	12.19
EVAPOTRANSPIRATION	12.127	(0.750)	167275.	34.98
PERCOLATION FROM LAYER 1	18.2392	(4.0620)	251591.	52.61
CHANGE IN WATER STORAGE	0.077	(1.177)	1063.	0.22

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PEAK DAILY VALUES FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)
PRECIPITATION	2.36	32553.8
RUNOFF	0.344	4750.5
PERCOLATION FROM LAYER 1	1.9461	26844.2
SNOW WATER	4.54	62665.2

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3813

MINIMUM VEG. SOIL WATER (VOL/VOL) -0.1814

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FINAL WATER STORAGE AT END OF YEAR 81

LAYER	(INCHES)	(VOL/VOL)
1	0.07	0.0702
SNOW WATER	0.33	

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BLACK MUD POND EXISTING CONDITIONS
MASSENA NEW YORK
APRIL 19 1991

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BARE GROUND

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	1.00 INCHES
POROSITY	=	0.4370 VOL/VOL
FIELD CAPACITY	=	0.0624 VOL/VOL
WILTING POINT	=	0.0245 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0624 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.005799999926 CM/SEC

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	79.62
TOTAL AREA OF COVER	=	261360. SQ FT
EVAPORATIVE ZONE DEPTH	=	29.00 INCHES
UPPER LIMIT VEG. STORAGE	=	0.4370 INCHES
INITIAL VEG. STORAGE	=	0.0278 INCHES
INITIAL SNOW WATER CONTENT	=	0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	0.0624 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND

SOLAR RADIATION FOR BURLINGTON VERMONT

MAXIMUM LEAF AREA INDEX = 3.30
START OF GROWING SEASON (JULIAN DATE) = 125
END OF GROWING SEASON (JULIAN DATE) = 263

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
16.60	18.10	29.20	42.70	55.20	64.90
69.60	67.10	58.80	47.90	36.60	22.60

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 77 THROUGH 81

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	1.59	2.35	2.93	2.14	2.55
	3.40	4.11	4.48	3.76	2.90	2.09
STD. DEVIATIONS	2.06	2.15	0.67	0.51	1.38	1.18
	1.75	1.67	1.67	1.38	1.26	0.74
RUNOFF						
TOTALS	0.131	0.138	0.439	0.403	0.329	0.370
	0.477	0.361	0.415	0.460	0.401	0.304
STD. DEVIATIONS	0.122	0.115	0.262	0.189	0.231	0.222
	0.277	0.194	0.178	0.253	0.115	0.218
EVAPOTRANSPIRATION						
TOTALS	0.356	0.545	1.099	1.339	0.917	1.357
	1.464	1.849	1.340	0.919	0.558	0.384
STD. DEVIATIONS	0.099	0.107	0.139	0.242	0.599	0.697
	0.567	0.331	0.402	0.099	0.116	0.100
PERCOLATION FROM LAYER 1						
TOTALS	0.3818	0.8490	2.1726	1.7643	0.8099	0.8791
	1.5032	1.8907	2.7132	2.3538	1.8842	1.0374
STD. DEVIATIONS	0.4850	1.3477	1.4630	1.4743	0.6505	0.4924
	1.1389	1.2827	1.3496	1.1611	1.0471	0.8521

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 77 THROUGH 81

	(INCHES)		(CU. FT.)	PERCENT
PRECIPITATION	34.67	(5.239)	755113.	100.00
RUNOFF	4.227	(0.765)	92067.	12.19
EVAPOTRANSPIRATION	12.127	(0.750)	264118.	34.98
PERCOLATION FROM LAYER 1	18.2392	(4.0620)	397249.	52.61
CHANGE IN WATER STORAGE	0.077	(1.177)	1678.	0.22

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PEAK DAILY VALUES FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)
PRECIPITATION	2.36	51400.8
RUNOFF	0.344	7500.8
PERCOLATION FROM LAYER 1	1.9461	42385.5
SNOW WATER	4.54	98945.1

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3813

MINIMUM VEG. SOIL WATER (VOL/VOL) -0.1814

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FINAL WATER STORAGE AT END OF YEAR 81

LAYER	(INCHES)	(VOL/VOL)
1	0.07	0.0702
SNOW WATER	0.33	

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REYNOLDS MASSENA LANDFILL AND FPSA FLAT CAP DESIGN
MASSENA, NEW YORK
MAY 16, 1991

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GOOD GRASS

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	6.00 INCHES
POROSITY	=	0.4730 VOL/VOL
FIELD CAPACITY	=	0.2217 VOL/VOL
WILTING POINT	=	0.1043 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2217 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.002183999866 CM/SEC

LAYER 2

VERTICAL PERCOLATION LAYER

THICKNESS	=	30.00 INCHES
POROSITY	=	0.3808 VOL/VOL
FIELD CAPACITY	=	0.1924 VOL/VOL
WILTING POINT	=	0.1043 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1924 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000026000000 CM/SEC

LAYER 3

LATERAL DRAINAGE LAYER

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0454 VOL/VOL

WILTING POINT	=	0.0200 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0454 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.009999999776 CM/SEC
SLOPE	=	3.00 PERCENT
DRAINAGE LENGTH	=	550.0 FEET

LAYER 4

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3663 VOL/VOL
WILTING POINT	=	0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000000100000 CM/SEC
LINER LEAKAGE FRACTION	=	0.00010000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	66.43
TOTAL AREA OF COVER	=	387684. SQ FT
EVAPORATIVE ZONE DEPTH	=	28.00 INCHES
UPPER LIMIT VEG. STORAGE	=	11.2156 INCHES
INITIAL VEG. STORAGE	=	10.2283 INCHES
INITIAL SNOW WATER CONTENT	=	0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	17.9670 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR BURLINGTON VERMONT

MAXIMUM LEAF AREA INDEX	=	3.30
START OF GROWING SEASON (JULIAN DATE)	=	125
END OF GROWING SEASON (JULIAN DATE)	=	263

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
16.60	18.10	29.20	42.70	55.20	64.90
69.60	67.10	58.80	47.90	36.60	22.60

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 77 THROUGH 81

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	1.59	2.35	2.93	2.14	2.55
	3.40	4.11	4.48	3.76	2.90	2.09
STD. DEVIATIONS	2.06	2.15	0.67	0.51	1.38	1.18
	1.75	1.67	1.67	1.38	1.26	0.74
RUNOFF						
TOTALS	0.000	0.000	0.867	0.123	0.000	0.000
	0.000	0.001	0.000	0.000	0.001	0.436
STD. DEVIATIONS	0.000	0.000	1.678	0.274	0.000	0.000
	0.000	0.002	0.001	0.000	0.003	0.976
EVAPOTRANSPIRATION						
TOTALS	0.390	0.606	1.360	3.232	2.241	5.272
	3.805	4.025	2.880	1.840	1.012	0.406
STD. DEVIATIONS	0.135	0.118	0.246	0.206	1.192	1.031
	1.926	1.492	0.495	0.068	0.075	0.090
LATERAL DRAINAGE FROM LAYER 3						
TOTALS	0.4892	0.4568	0.5203	0.5297	0.5456	0.5176
	0.5259	0.5287	0.4905	0.4816	0.4573	0.4774
STD. DEVIATIONS	0.1190	0.0977	0.1300	0.0691	0.0322	0.0337
	0.0480	0.0703	0.0760	0.0858	0.1089	0.1474
PERCOLATION FROM LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)	PERCENT

PRECIPITATION	34.67	(5.239)	1120084.	100.00
RUNOFF	1.429	(2.054)	46166.	4.12
EVAPOTRANSPIRATION	27.068	(2.175)	874486.	78.07
LATERAL DRAINAGE FROM LAYER 3	6.0205	(0.8165)	194505.	17.37
PERCOLATION FROM LAYER 4	0.0002	(0.0001)	8.	0.00
CHANGE IN WATER STORAGE	0.152	(4.962)	4919.	0.44

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PEAK DAILY VALUES FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)
PRECIPITATION	2.36	76244.5
RUNOFF	1.582	51119.9
LATERAL DRAINAGE FROM LAYER 3	0.0210	677.9
PERCOLATION FROM LAYER 4	0.0000	0.0
HEAD ON LAYER 4	48.3	
SNOW WATER	4.71	152297.6

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4006

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1043

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FINAL WATER STORAGE AT END OF YEAR 81

LAYER	(INCHES)	(VOL/VOL)
1	2.17	0.3619
2	11.51	0.3837
3	5.00	0.4170
4	10.32	0.4300

SNOW WATER 0.34

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REYNOLDS MASSENA LANDFILL AND FPSA SIDE SLOPE CAP DESIGN
MASSENA, NEW YORK
MAY 16, 1991

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GOOD GRASS

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	6.00 INCHES
POROSITY	=	0.4730 VOL/VOL
FIELD CAPACITY	=	0.2217 VOL/VOL
WILTING POINT	=	0.1043 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2217 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.002183999866 CM/SEC

LAYER 2

VERTICAL PERCOLATION LAYER

THICKNESS	=	30.00 INCHES
POROSITY	=	0.3808 VOL/VOL
FIELD CAPACITY	=	0.1924 VOL/VOL
WILTING POINT	=	0.1043 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1924 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000026000000 CM/SEC

LAYER 3

LATERAL DRAINAGE LAYER

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0454 VOL/VOL

WILTING POINT	=	0.0200 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0454 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.009999999776 CM/SEC
SLOPE	=	15.00 PERCENT
DRAINAGE LENGTH	=	110.0 FEET

LAYER 4

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3663 VOL/VOL
WILTING POINT	=	0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000000100000 CM/SEC
LINER LEAKAGE FRACTION	=	0.00010000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	66.43
TOTAL AREA OF COVER	=	108900. SQ FT
EVAPORATIVE ZONE DEPTH	=	28.00 INCHES
UPPER LIMIT VEG. STORAGE	=	11.2156 INCHES
INITIAL VEG. STORAGE	=	8.3375 INCHES
INITIAL SNOW WATER CONTENT	=	0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	17.9670 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR BURLINGTON VERMONT

MAXIMUM LEAF AREA INDEX	=	3.30
START OF GROWING SEASON (JULIAN DATE)	=	125
END OF GROWING SEASON (JULIAN DATE)	=	263

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
16.60	18.10	29.20	42.70	55.20	64.90
69.60	67.10	58.80	47.90	36.60	22.60

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 77 THROUGH 81

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	1.59	2.35	2.93	2.14	2.55
	3.40	4.11	4.48	3.76	2.90	2.09
STD. DEVIATIONS	2.06	2.15	0.67	0.51	1.38	1.18
	1.75	1.67	1.67	1.38	1.26	0.74
RUNOFF						
TOTALS	0.000	0.000	0.007	0.000	0.000	0.000
	0.000	0.001	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.015	0.000	0.000	0.000
	0.000	0.002	0.001	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.390	0.607	1.361	3.221	2.247	4.914
	2.903	4.027	2.791	1.858	1.029	0.407
STD. DEVIATIONS	0.136	0.118	0.246	0.222	1.201	1.217
	1.080	1.486	0.638	0.083	0.083	0.089
LATERAL DRAINAGE FROM LAYER 3						
TOTALS	1.3325	0.6687	1.4296	1.9864	0.5903	0.2313
	0.1092	0.0607	0.0405	0.7693	0.8833	0.9926
STD. DEVIATIONS	0.9430	0.5296	1.3329	1.5948	0.2589	0.0194
	0.0069	0.0024	0.0012	1.2527	1.3252	1.1389
PERCOLATION FROM LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)	PERCENT

PRECIPITATION	34.67	(5.239)	314630.	100.00
RUNOFF	0.008	(0.014)	72.	0.02
EVAPOTRANSPIRATION	25.755	(2.292)	233731.	74.29
LATERAL DRAINAGE FROM LAYER 3	9.0944	(3.9793)	82532.	26.23
PERCOLATION FROM LAYER 4	0.0001	(0.0000)	1.	0.00
CHANGE IN WATER STORAGE	-0.188	(1.894)	-1705.	-0.54

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PEAK DAILY VALUES FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)
PRECIPITATION	2.36	21417.0
RUNOFF	0.033	303.9
LATERAL DRAINAGE FROM LAYER 3	0.2921	2650.4
PERCOLATION FROM LAYER 4	0.0000	0.0
HEAD ON LAYER 4	3.9	
SNOW WATER	4.70	42658.1

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3582

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1043

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FINAL WATER STORAGE AT END OF YEAR 81

LAYER	(INCHES)	(VOL/VOL)
1	1.46	0.2428
2	8.72	0.2907
3	0.73	0.0611
4	10.32	0.4300

SNOW WATER   0.34

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REYNOLDS MASSENA BLACK MUD POND CAP DESIGN
MASSENA, NEW YORK
MAY 16, 1991

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GOOD GRASS

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	6.00 INCHES
POROSITY	=	0.4730 VOL/VOL
FIELD CAPACITY	=	0.2217 VOL/VOL
WILTING POINT	=	0.1043 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2217 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.002183999866 CM/SEC

LAYER 2

VERTICAL PERCOLATION LAYER

THICKNESS	=	30.00 INCHES
POROSITY	=	0.3808 VOL/VOL
FIELD CAPACITY	=	0.1924 VOL/VOL
WILTING POINT	=	0.1043 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1924 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000026000000 CM/SEC

LAYER 3

LATERAL DRAINAGE LAYER

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0454 VOL/VOL

WILTING POINT	=	0.0200 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0454 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.009999999776 CM/SEC
SLOPE	=	3.00 PERCENT
DRAINAGE LENGTH	=	390.0 FEET

LAYER 4

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3663 VOL/VOL
WILTING POINT	=	0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000000100000 CM/SEC
LINER LEAKAGE FRACTION	=	0.00010000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	66.43
TOTAL AREA OF COVER	=	261360. SQ FT
EVAPORATIVE ZONE DEPTH	=	28.00 INCHES
UPPER LIMIT VEG. STORAGE	=	11.2156 INCHES
INITIAL VEG. STORAGE	=	9.6733 INCHES
INITIAL SNOW WATER CONTENT	=	0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	17.9670 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR BURLINGTON VERMONT

MAXIMUM LEAF AREA INDEX	=	3.30
START OF GROWING SEASON (JULIAN DATE)	=	125
END OF GROWING SEASON (JULIAN DATE)	=	263

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
16.60	18.10	29.20	42.70	55.20	64.90
69.60	67.10	58.80	47.90	36.60	22.60

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 77 THROUGH 81

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	1.59	2.35	2.93	2.14	2.55
	3.40	4.11	4.48	3.76	2.90	2.09
STD. DEVIATIONS	2.06	2.15	0.67	0.51	1.38	1.18
	1.75	1.67	1.67	1.38	1.26	0.74
RUNOFF						
TOTALS	0.000	0.000	0.585	0.088	0.000	0.000
	0.000	0.001	0.000	0.000	0.000	0.181
STD. DEVIATIONS	0.000	0.000	1.308	0.197	0.000	0.000
	0.000	0.002	0.001	0.000	0.000	0.404
EVAPOTRANSPIRATION						
TOTALS	0.390	0.606	1.360	3.239	2.212	5.157
	3.279	4.028	2.846	1.851	1.019	0.407
STD. DEVIATIONS	0.135	0.118	0.246	0.204	1.168	1.044
	1.694	1.486	0.592	0.070	0.077	0.090
LATERAL DRAINAGE FROM LAYER 3						
TOTALS	0.6092	0.5619	0.6694	0.7166	0.7457	0.6987
	0.6845	0.6321	0.5406	0.5290	0.5460	0.5754
STD. DEVIATIONS	0.2801	0.2228	0.2730	0.1850	0.1376	0.1326
	0.1443	0.1512	0.1326	0.1575	0.2255	0.2953
PERCOLATION FROM LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)	PERCENT

PRECIPITATION	34.67	(5.239)	755113.	100.00
RUNOFF	0.855	(1.457)	18621.	2.47
EVAPOTRANSPIRATION	26.396	(2.155)	574896.	76.13
LATERAL DRAINAGE FROM LAYER 3	7.5091	(1.9575)	163547.	21.66
PERCOLATION FROM LAYER 4	0.0002	(0.0001)	5.	0.00
CHANGE IN WATER STORAGE	-0.090	(4.864)	-1957.	-0.26

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PEAK DAILY VALUES FOR YEARS 77 THROUGH 81

	(INCHES)	(CU. FT.)
PRECIPITATION	2.36	51400.8
RUNOFF	1.275	27772.1
LATERAL DRAINAGE FROM LAYER 3	0.0324	706.3
PERCOLATION FROM LAYER 4	0.0000	0.0
HEAD ON LAYER 4	48.4	
SNOW WATER	4.71	102567.7

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4006

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1043

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FINAL WATER STORAGE AT END OF YEAR 81

LAYER	(INCHES)	(VOL/VOL)
1	1.46	0.2428
2	10.46	0.3486
3	5.00	0.4170
4	10.32	0.4300

SNOW WATER 0.34

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APPENDIX G

REMEDIATION OF THE NORTH YARD

APPENDIX G

TABLE OF CONTENTS

1.0
INTRODUCTION

The North Yard Area represents the primary area for receipt of raw materials at the Reynolds Plant with virtually all raw materials passing through this area. A materials loading area, located in the southwest corner of the North Yard handles one-third of the finished product shipments from the plant.

Significant disruptions to shipments of materials in and out of the North Yard Area can have devastating effects on the operation of the plant, particularly when disruptions to raw materials shipments occur. Also, as described in Section 19.1 of the Final FS, temporary plant shutdowns are not feasible. The purpose of Appendix G is to describe present operations in the North Yard Area and to provide an explanation of possible methods to remediate the area without shutting down plant operations.

2.0
DESCRIPTION AND FUNCTION OF THE NORTH YARD

Figure G-1 depicts the general layout of the North Yard Area. All materials enter and leave the North Yard Area by rail car or by truck. A description of raw materials received in the North Yard Area is discussed. Shipments of finished product from the North Yard are also discussed.

2.1 RAW MATERIALS

The primary raw materials received at the plant through the North Yard include:

- Coke
- Coal Tar Pitch
- Aluminum Oxide (Alumina)
- Fuel Oil
- Soda Ash
- Fluoride
- Sodium Hydroxide (Caustic)

COKE

Coke is one of the primary materials used for the production of electrodes for the reduction cells. Coke is brought in by rail car and is unloaded in the Unloading Shed on Track No. 3. The coke is discharged from the rail cars to an underground hopper where the material is then transferred to the storage silos (22D and 22E) via bucket elevator and conveyor.

Coke is shipped by barge to a terminal near Pittsburgh, Pennsylvania where it is transferred to rail cars for transport to the Reynolds plant. Approximately 50 rail cars of coke are received at the North Yard each month.

Coke handling equipment both at the barge terminal and in the North Yard is currently set up for rail car shipments only. It is possible that coke could be brought into the Reynolds plant by truck instead of rail, although modifications would likely need to be made in materials handling equipment. Present coke storage facilities available at the Reynolds site would enable the plant to operate for approximately 12 days without new coke shipments.

COAL TAR PITCH

Coal tar pitch (pitch) is another primary material used in the production of electrodes for the reduction process. Pitch is brought in by both rail car and by truck. Approximately 16 rail cars and 20 truck loads of pitch are received in the North Yard each month.

Rail cars are unloaded on Track No. 6 near the Pitch Pump House (PPH). Trucks are also unloaded from the roadway directly between the PPH and Track No. 6. Pitch from rail cars is heated by portable heaters located near the PPH and insulated trucks are offloaded immediately upon arrival. After the pitch is heated to decrease the viscosity, the pitch is discharged into the underground heated tank (G-Tank) prior to being pumped to heated storage tanks located north of the PPH (Tanks 22B, 22C, and 22F). From these tanks, the pitch is pumped, as needed, to the plant via heated insulated pipes. The Reynolds plant currently has available storage for pitch of approximately 12 working days.

ALUMINUM OXIDE

Aluminum oxide (alumina) is the basic raw material for production of aluminum. The aluminum oxide is "reduced" in the pots to form molten aluminum which is molded into ingots, which represents the finished product from this plant. The ingots are then shipped via truck from three loading docks in the plant.

Alumina is received at the Reynolds plant via rail car and is unloaded in the North Yard at the Unloading Shed on Track No. 4. The alumina is discharged from the rail cars to an underground hopper where the material is then transferred to storage silos (50A through 50H) via bucket elevator and conveyor.

Approximately 215 rail cars of alumina are unloaded in the North Yard every month. Present alumina storage facilities available at the Reynolds site would enable the plant to operate approximately 15 to 20 working days without new alumina shipments.

FUEL OIL

Fuel oil required is stored in above-ground storage tanks located northeast of the PPH (Tanks 67A and 67B - Figure G-1). Number 6 (Bunker C) fuel oil is presently stored in these tanks which are steam heated and insulated. Pumps located in the PPH transfer the oil from the trucks, to the storage tanks and from the storage tanks to the plant. Fuel oil stored in these tanks represents a backup service of fuel which is used infrequently.

Tanker truck loads of Bunker C fuel oil are unloaded into these tanks on an "as needed" basis.

SODIUM CARBONATE

Sodium carbonate (soda ash) is primarily used for neutralization of scrubber liquor generated in the fume control system. Soda ash is received in the North Yard via rail car and is unloaded in the Unloading Shed on Track No. 4. The soda ash is discharged from the rail cars into an underground hopper where the material is then transferred to storage silos (24C and 24D) via bucket elevator and conveyor.

Approximately 5 rail cars of soda ash are unloaded in the North Yard every month. Present soda ash storage facilities available at the Reynolds site would enable the plant to operate approximately one month without new soda ash shipments.

ALUMINUM FLUORIDE

Aluminum fluoride is essential to maintain proper electrolyte chemistry. Aluminum fluoride is received in the North Yard in a similar manner to that of soda ash. Rail cars are unloaded in the Unloading Shed on Track No. 4. The aluminum fluoride is discharged from the rail cars into an underground hopper where the material is then transferred to storage silos (24A and 24B) via bucket elevator and conveyor.

Approximately 4 to 5 rail cars of aluminum fluoride are unloaded in the North Yard every month. Present aluminum fluoride storage facilities available at the Reynolds site would enable the plant to operate approximately one month without new aluminum fluoride shipments.

SODIUM HYDROXIDE

Sodium hydroxide is used primarily for digestion of fluoride-containing solids, from the fume control system. Sodium hydroxide is received in the North Yard via truck and rail car and is stored in two horizontal above-ground storage tanks (70A and 70A-1 on Figure G-1). Approximately 15 to 20 tanker trucks and one rail car load of sodium hydroxide are unloaded in the North Yard every month. Present sodium hydroxide storage facilities available at the Reynolds site would enable the plant to operate for approximately one month without new sodium hydroxide shipments.

SUMMARY

The North Yard receives primary raw materials which are essential to continuous operation of the Reynolds plant. Shipments of coke, pitch, and alumina are the most critical shipments due primarily to the volume of materials required and the limited storage available for these materials.

Rail cars are the predominant method of transport of raw materials into the North Yard Area. Each rail car is capable of transporting approximately four times the volume of material that an over-the-road tractor-trailer is capable of transporting. Therefore, raw materials which are required in large quantity are typically shipped in by rail car.

2.2 KEY COMPONENTS OF THE NORTH YARD

Raw materials and finished product are handled and transferred in the North Yard by several key components, which include:

- Roadways
- Rail lines
- Unloading Shed
- Pump Pitch House
- Truck Loading Dock

Although the basic function of these components was explained briefly in Section 2.1, a more detailed discussion is provided in this section. Figure G.1 presents the general layout of the North Yard.

ROADWAYS

The two main roadways in the North Yard Area are located to the north and to the south of the rail lines and are oriented in an east-west direction. Cross roads (oriented north-south) are located at the east and west ends of the North Yard.

These roadways are used for transport of raw materials and finished product into and out of the North Yard as well as for movement of Reynolds vehicles and equipment. The roadway north of the railroad tracks, near the PPH, is also used as a temporary parking area during the unloading of pitch from tank trucks.

RAIL LINES

Three main rail lines traverse the North Yard and are indicated as Track Nos. 3, 4 and 5. A fourth rail line (Track No. 6) exists as a siding to the north of Track No. 5. A cross-over track is present between Track No. 3 and Track No. 4 directly within the North Yard. Other cross-over tracks are available to the east and west of the North Yard.

Reynolds owns and maintains all rail lines inside the plant boundaries. Rail lines outside the plant boundaries are maintained by Conrail. Presently, Reynolds must coordinate rail shipments and rail car movements with Conrail.

UNLOADING SHED

The Unloading Shed represents the primary unloading area for alumina, coke, soda ash, and fluoride. As indicated in Section 2.1, raw materials are discharged into underground hoppers and conveyed by bucket elevator to overhead conveyors which transport the materials to silos for temporary storage.

The Unloading Shed is vital to transfer of raw materials from trucks and rail cars. Due to the limited storage capacity available at the Reynolds plant, the Unloading Shed could not be taken out of service for more than several days.

PITCH PUMP HOUSE

The Pitch Pump House includes the following main components:

- Heat Transfer Medium (HTM) system
- Pitch Pumps and G-tank
- Fuel Oil Pump

The HTM system is used to maintain pitch in a flowable and pumpable form. The HTM system consists of a single burner located in the western end of this building which is used to heat the oil within the HTM system. A network of pipelines transport the heated oil to coils and heating jackets within the pitch system.

The HTM system operates continuously and is only shut down for maintenance or repair. The HTM system can be shut down for no more than two to three days. Any scheduled shutdown of the HTM system generally requires approximately two to three weeks advance notice so that plant operations may be coordinated around the shutdown.

As indicated in Section 2.1., G-tank and the pitch pumps are used to transfer pitch from tanker trucks and rail cars to the pitch storage tanks. G-tank and the pitch pumps are located in the basement of the PPH. Although a supply of pitch can be stored at the Reynolds plant for approximately 12 working days of operation, the pitch pumps and associated piping between the pitch storage tanks and the main plant area represent the critical link in the pitch system. The flow of pitch from the storage tanks, through the pumps, and to the final destination in the Reynolds plant can only be interrupted briefly for periods not to exceed several working days.

TRUCK LOADING DOCK

A truck loading dock is located in the southeast corner at the North Yard as indicated on Figure G-1. Approximately one third of the finished aluminum product which is produced by the Reynolds Plant is shipped from this area. The present loading dock is oriented in a north-south direction, requiring all trucks to approach this loading dock from a north to south direction in the North Yard.

3.0
REMEDIAL APPROACH

Section VII of the FS describes a total of five alternatives for remediation of the North Yard. Remedial methods included relatively nonintrusive methods such as in situ capping as well as traditional intrusive methods incorporating excavation. Both remedial approaches are described in this section and impacts on North Yard operations are discussed.

3.1 REMEDIAL ALTERNATIVES INVOLVING CAPPING

In situ capping is the primary remedial approach for Alternative 1 as an interim measure until final remediation occurs when the plant closes. The primary purpose of the asphalt composite cap was to reduce rainwater infiltration and eliminate human contact with contaminants in the soil.

A asphalt-composite cap was selected over use of traditional asphalt caps with the primary objective of providing additional reduction in rainwater infiltration over traditional asphalt. The asphalt-composite cap would be installed in non-traffic areas over a compacted soil and an 8-inch coarse stone subbase (Figure II-2) and would include the following components:

- A two inch thick asphalt top coat
- A two inch thick asphalt base coat
- A layer of asphalt-impregnated nonwoven polypropylene geotextile
- A layer of spray sealant

The asphalt-composite cap would be keyed into existing buildings, foundations, and other structures to provide a continuous, impermeable barrier to reduce rainwater infiltration. Since installation of an asphalt-composite cap is difficult around railroad tracks, the cap would be placed up to the existing ballast.

Alternative 1 includes in situ capping with no significant intrusive excavation activities during the operational lifetime of the plant (assumed 30 years). It is likely that capping activities could be performed with minimal interference to North Yard operations if remedial activities are coordinated with plant activities.

The asphalt-composite cap could be installed upon completion of minimal grading and compacting to provide a suitable subbase for cap installation. It was assumed that the existing railroad tracks would not be disturbed during cap installation.

3.2 REMEDIAL ALTERNATIVES INVOLVING EXCAVATION

Alternatives 2A, 2B, 3A, and 3B include excavation of contaminated soil and fill materials as part of remediation of the North Yard. Excavation alternatives would cause significantly more disruption than alternatives which include only in situ capping. It is likely that soil and fill materials would need to be excavated up to a depth of 7 feet in some areas and would entail removal and eventual replacement of segments of railroad lines and other facilities in and around contaminated areas.

As indicated in Section 2, rail lines located in the North Yard are vital for transport of raw materials into the Reynolds plant. Therefore, remediation of the North Yard using excavation alternatives would require either a complete plant shutdown or would need to be performed in a phased approach, with remedial activities coordinated with plant operations.

It is not known at this time if or when the Reynolds plant will be shut down permanently. Therefore, a phased approached was developed for alternatives 2A, 2B, 3A and 3B in order to allow cleanup of the North Yard Area without delaying remedial action until plant shutdown.

Should excavation of contaminated material become part of the selected remedial alternative for the North Yard, several preliminary tasks would need to be completed prior to the commencement of excavation activities. These preliminary tasks would include:

- Construction of a NYSDEC approved landfill
- Installation of a temporary equipment and material staging area to be used during remedial activities
- Replacement/relocation of the PPH
- Replacement/relocation of above ground storage tanks
- Modifications to the loading dock
- Modifications of rail lines

3.2.1 Preliminary Tasks

Construction of Landfill Cell

Prior to excavation and removal of any contaminated material in the North Yard, a NYSDEC approved landfill cell would need to be constructed to accept the excavated material or treated residuals form the North Yard. Since the on-site landfill is a component of remedial alternatives for other areas of concern at the Reynolds plant, it is likely that, if selected, the landfill cell would be installed prior to the commencement of remedial activities plant-wide.

Installation of Equipment and Material Staging Area

An equipment and material staging area should be installed prior to commencement of remedial activities in the North Yard. The staging area would most likely be positioned on the west side of the main plant, near the Potliner Pad Area. The staging area would serve the following purposes:

- Provide an area where equipment used for remedial activities could be stored and not hinder North Yard operations

- Provide an area where excavated materials could be served, classified, sorted, shredded, or otherwise prepared for treatment and/or disposal.

- An equipment wash pad would also be constructed for equipment decontamination prior to leaving the plant site.

The staging area would have to be arranged so that equipment could enter from a "dirty" area and exit to a "clean" area. The staging area would enable most material handling tasks to be performed outside the North Yard Area, which would reduce disruption of North Yard operations. All non essential equipment would be staged in this area.

Relocation of the PPH

Results of remedial investigations indicated that soils with the highest levels of PCB contamination are primarily located in the area of the PPH and pipe bridge. Past investigations have also detected contamination at varying levels within the PPH. Asbestos is also found in the PPH and is used for insulation of piping and vessels.

Due to the relatively high levels of soil contamination in and around the PPH and the perceived difficulty in performing an adequate decontamination of the PPH, it is assumed that the PPH will be replaced with a new PPH. The new PPH would be located to the east of the existing PPH and would include new pitch pumps, and a new HTM burner system.

Because of the age of the equipment involved, perceived residual contaminant levels, and difficulty in decontamination, it was assumed that all equipment as well as the PPH itself would be replaced. The proposed area for the new PPH would need to be remediated in one of the initial phases of the remediation to allow for construction of the new PPH.

Construction of the new PPH would need to be completed and brought into full operation prior to demolition of the existing PPH. It is estimated that it would take several days to perform the actual changeover from the existing PPH to the new PPH. Since this changeover would require shutting the HTM system down, approximately 2 to 3 weeks preparation by Reynolds personnel would be required to build up a surplus of pitch materials adequate to carry through the shutdown.

A significant amount of asbestos was used within the existing PPH for pipe and vessel insulation. This asbestos would need to be removed in an approved manner prior to demolition and removal of the structure. All demolition debris and asbestos associated with the PPH would be handled and disposed of in an approved manner.

Replacement/Relocation of Existing Storage Tanks

Five above ground storage tanks exist in three diked areas north of the PPH. Three pitch storage tanks are located in one diked area northwest of the PPH. Fuel oil storage tanks are located in the two other diked areas northeast of the PPH. Each of these tanks and related piping is insulated with asbestos and the contents and piping of the pitch storage tanks is heat-traced by the HTM system. The oil storage tanks are heated with steam.

Results of remedial investigations in the storage tank area indicated elevated soil contamination levels were found in and around the pitch tanks with residual contamination also being detected near the fuel oil storage tanks.

These tanks were installed during construction of the Reynolds plant and their present overall condition is not known. These tanks would need to be emptied and moved in order to remove soil contamination beneath the tanks. Movement of these tanks would likely not be feasible since the integrity and overall condition is not immediately known and they are presently covered with asbestos which would need to be removed.

In order to perform an effective remediation at this tank farm area, all above ground storage tanks would be removed and replaced. A new fuel oil tank would be installed near the northeast corner of the Reynolds Plant (southeast corner of the North Yard). The existing fuel tanks would then be removed and the former fuel storage area would then be remediated. Pitch tanks would then be installed in the then cleaned diked areas formerly occupied by the fuel oil tanks. The existing pitch tanks would then be removed and soil contamination within this diked area would then be remediated.

Modifications to the Loading Dock

A loading dock currently exists at the southeast part of the North Yard Area and is presently used for loading aluminum ingots onto trucks for off-site transport. This loading dock handles approximately one-third of all shipments of aluminum out of the Reynolds facility and its use cannot therefore be discontinued.

The existing loading dock is oriented in a north-south direction, requiring trucks to use the eastern end of the North Yard for maneuvering. Remedial activities performed at the eastern end of the North Yard would likely interfere with the function of this loading dock. Therefore, this loading dock would need to be modified to allow trucks to approach the loading area from an east-west direction. This would eliminate the need for truck turning areas in the North Yard. Modifications to the loading area would need to be completed prior to initiation of remedial activities in the eastern end of the North Yard.

Railroad Track Modifications

Railroad tracks in the North Yard would need to be modified to provide flexibility and maintain a consistent and efficient flow of rail cars through the North Yard. Only a portion of some of the tracks can be taken out of service at any one time. Additional cross-over tracks and switches may be required. Sections of track may also need to be extended and switches may need to be moved to ensure efficient and unhindered rail car movement through the North Yard.

3.2.2 Excavation of North Yard Soils

In order to minimize disruption of normal activities in the North Yard, excavation of contaminated soils would need to be performed in a phased approach and would involve remediation of individual areas instead of large-scale excavation of the entire area. All excavations in the North Yard would have to be in compliance with existing Occupational Safety and Health Administration (OSHA) regulations. The remediation of the North Yard assumes that no shoring or sheeting will be necessary, based on conversations with plant personnel and local contractors. However, the possibility of sheeting and shoring being required should be investigated in more detail if Alternatives 2A, 2B, 3A, or 3B are chosen. It is envisioned that remediation of the North Yard would be performed in the following phases:

Phase	Description
1A	Remediate area near coke storage silos and carbon plant
1B	Construction of new loading dock and fuel oil tank
1C	Remediate fuel oil storage area
1D	Construction of new PPH and HTM system
2	Remediate areas to south and east of the Unloading Shed near east end of Track No.3
3	Remediate areas to the west of the Unloading Shed near west end of Track No. 3
4	Remediate areas to north and east of the Unloading Shed between Track Nos. 3 and 5
5	Remediate areas west of the Unloading Shed between Track Nos. 3 and 5 to the switching track between Tracks 3 and 4.
6	Remediate areas west of Phase 5 between Track Nos. 3 and 5
7	Remediate areas between Track No. 5 and the northern road-east end

Phase	Description
8	Remediate areas between Track No. 5 and the north road - west of Phase 7
8A	Remove old pitch tanks
8B	Remove PPH and HTM system. Remediate soil within diked areas for former pitch tanks, top of dikes, and area between diked areas and South Grasse River Road.

Preliminary actions as discussed in Section 3.2.1 would need to be completed either prior to initiation of remedial phases or would need to be performed before work on specific phases begins.

The general remedial approach within each phase is discussed below.

GENERAL APPROACH

Contaminated soil from each area of the North Yard would be excavated and removed to the depth of perceived contamination. It was assumed for the purposes of this FS that soils in the North Yard Area would be excavated to depths ranging from 2 to 7 feet. Confirmatory soil samples would be taken at regular intervals to verify that sufficient removal of contaminated soil has been completed. Due to the sensitivity of North Yard operations to the duration of disruptions, an on-site laboratory, capable of PCB analyses by GC-ECD, would be established for confirmatory sample analysis. This would reduce the turn-around for analytical results from several days to a few hours.

Upon receipt of satisfactory analytical results from the soil sampling task, each area would be backfilled with clean fill, compacted, graded and capped with macadam. This macadam cap (for remediated areas) would be different from the asphalt-composite cap (for contaminated areas) described in Section 3.1; the macadam cap would consist of 4-inches of base course and

2-inches of binder. Railroad tracks, roadways, and other vital components of the North Yard within each phase area would be replaced prior to commencement of remedial activities on other areas.

In effect, portions of the North Yard would be remediated one at a time. Each area would be restored to a usable condition prior to commencement of work on adjacent areas.

PHASE 1A

Phase 1A would entail removal of contaminated soils and fill materials near the existing coke storage silos and the carbon plant area and would include areas between the south road and the existing buildings. The south road itself would not be disturbed.

PHASE 1B

A new fuel oil system would be installed in an area east of the metal service building and/or west cast house. This system would include a storage tank with a capacity of 200,000 gallons of No. 2 fuel oil, recirculation pumps, an unloading station, connecting pipes, and controls. A new loading dock would be built on the northeast corner of the metal service building, oriented east-west.

PHASE 1C

After removal of the existing fuel oil tanks from the diked areas north east of the PPH, contaminated soil and fill materials within those diked areas would be removed for treatment and/or disposal. After sufficient cleanup levels have been achieved, the area would be backfilled with clean fill, compacted, and paved to return the area to its original condition.

Remedial work for this phase could not be initiated until the new fuel storage tanks are installed southeast of the North Yard (Figure G-1) and the existing fuel oil storage tanks are removed from the diked areas.

PHASE 1D

A new pitch pump house, a new pitch unloading station, new pitch storage tanks, and a new HTM system would be constructed after the fuel oil tank area is remediated. These new facilities would consist of new storage, piping and pumping systems. The new pitch and HTM systems would tie into the existing system at the northern end of the pipe bridge.

PHASE 2

Phase 2 would entail removal of contaminated soil and fill materials to the south and east of the Unloading Shed. The eastern end of Track No. 3 would also need to be removed from service during remedial efforts.

Coke shipments are presently unloaded at the Unloading Shed. Rail cars of coke are brought into the North Yard from the east end and are routed directly to the Unloading Shed by Track No. 3, approaching the Shed from an east to west direction. Shutdown of the east end of Track No. 3 would require rail cars of coke be re-routed to the west side of the Unloading Shed and would approach the Shed from a west to east direction.

Upon completion of remedial activities, the area would be backfilled with clean fill, compacted, and paved. Sections of Track No. 3 disrupted during remedial activities would be replaced in preparation for Phase 3.

PHASE 3

Phase 3 would entail removal of contaminated soil and fill materials to the west of the Unloading Shed and would include removal of the western portion of Track No. 3 during remediation. Rail cars would have access to the Unloading Shed from the east and could be unloaded in this manner as a temporary measure during remedial activities to the west of the Unloading Shed.

PHASE 4

Phase 4 would entail removal of contaminated soil and fill materials to the north and east of the Unloading Shed. The eastern end of Track No. 4 would also need to be removed from service during remedial efforts.

Shutdown of the east end of Rail No. 4 would require rail cars to be re-routed to approach the Unloading Shed from the west instead of from the east as they are presently unloaded. Therefore Rail No. 3 would need to be operational to allow rail cars to pass through the North Yard to the western end where they could be switched to appropriate tracks.

Upon completion of remedial activities, the area would be backfilled with clean fill, compacted, and paved. Sections of Track No. 4 and 5 disturbed during remedial activities would be replaced in preparation for Phase 5.

PHASE 5

Phase 5 would involve removal of contaminated soil and fill materials west of the Unloading Shed to the cross track between Track Nos. 3 and 4. This portion of Track No. 4 would need to be taken out of service, although the eastern end of Track No. 4 would be available for transport of rail cars into the Unloading Shed. Track Nos. 5 and 6 would also be available for rail car movement.

Upon completion of remedial activities, the area would be backfilled with clean fill, compacted, and paved. Sections of Track No. 4 disrupted during remedial activities would be replaced in preparation for Phases 7 and 8.

PHASE 6

Phase 6 would involve removal of contaminated soil and fill materials west of the Phase 5 area and would involve removal of soil and fill materials primarily around Track No. 4. Rail cars could still unload in the Unloading Shed using Track No. 4 by approaching the Unloading Shed from the east.

Upon completion of remedial activities for Phase 6, the area would be backfilled with clean fill, compacted, and paved. Sections of Track No. 4 which were disrupted during Phase 6 would be replaced. Completion of Phase 6 would bring rail lines 3 and 4 back to full operation.

PHASE 7

Phase 7 would involve removal of contaminated soil and fill materials from the east road west to near the overhead pipe bridge between the north road and the Phase 5 area. The east side of Track Nos. 5 and 6 would be taken out of service for Phase 7. Rail cars would still be able to unload pitch from Track No. 6 but would need to approach the PPH area from the west instead of from the east.

Upon completion of remedial activities, the area would be backfilled with clean fill, compacted, and paved. Sections of Track Nos. 5 and 6 disturbed during remedial activities would be replaced in preparation for Phase 8. The north road would not be excavated and would remain in service.

PHASE 8

Phase 8 would involve removal of contaminated soil and fill materials west of Phase 7. Excavation activities would be completed around G-Tank, although the tank itself would not be removed until a later phase.

Upon completion of Phase 8, Track No. 5 would be returned to full operation. Most of Track No. 6 would also be available for rail car storage, although the section of Track No. 6 near G-Tank would not be available for use.

PHASE 8A

Phase 8A would involve removal of the existing PPH and G-Tank. The new PPH would need to be operational prior to commencement of work activities associated with 8A.

As explained in previous sections, the PPH would need to be demolished and removed due to the expected high levels of soil contamination in the area and the extreme difficulties in fully decontaminating the existing structure.

PHASE 8B

Phase 8B represents the final phase in North Yard remedial activities and would entail remediation of the area of the former pitch tanks. These tanks would be removed in a preliminary step (Section 3.2) and new pitch tanks would be installed in the former location of the fuel oil storage tanks.

Contaminated soil and fill materials in and around the former pitch tank area would be removed during this final phase. Upon completion of remedial activities, the area would be backfilled with clean fill, compacted, and paved to return the area to pre-excavation conditions, possibly for use later as a location for additional storage tanks.

ESTIMATED COSTS

Table G-1 presents an estimate of direct capital costs in 1991 dollars for the remediation of the North Yard area described in Section 3.2.2. These costs have been developed using information obtained from local contractors, vendor quotes, cost estimating guides, and previous WCC experience. The direct capital costs are estimated to be $3,400,000.

PRELIMINARY SCHEDULE

It is anticipated that the North Yard remediation should take approximately three construction seasons following completion of the Preliminary Tasks. A preliminary schedule for remediation is as follows:

- First Year: Phases 1A, 1B, 1C, 2 and 3
- Second Year: Phases 1D, 4, 5 and 6
- Third Year: Phases 7, 8, 8A and 8B

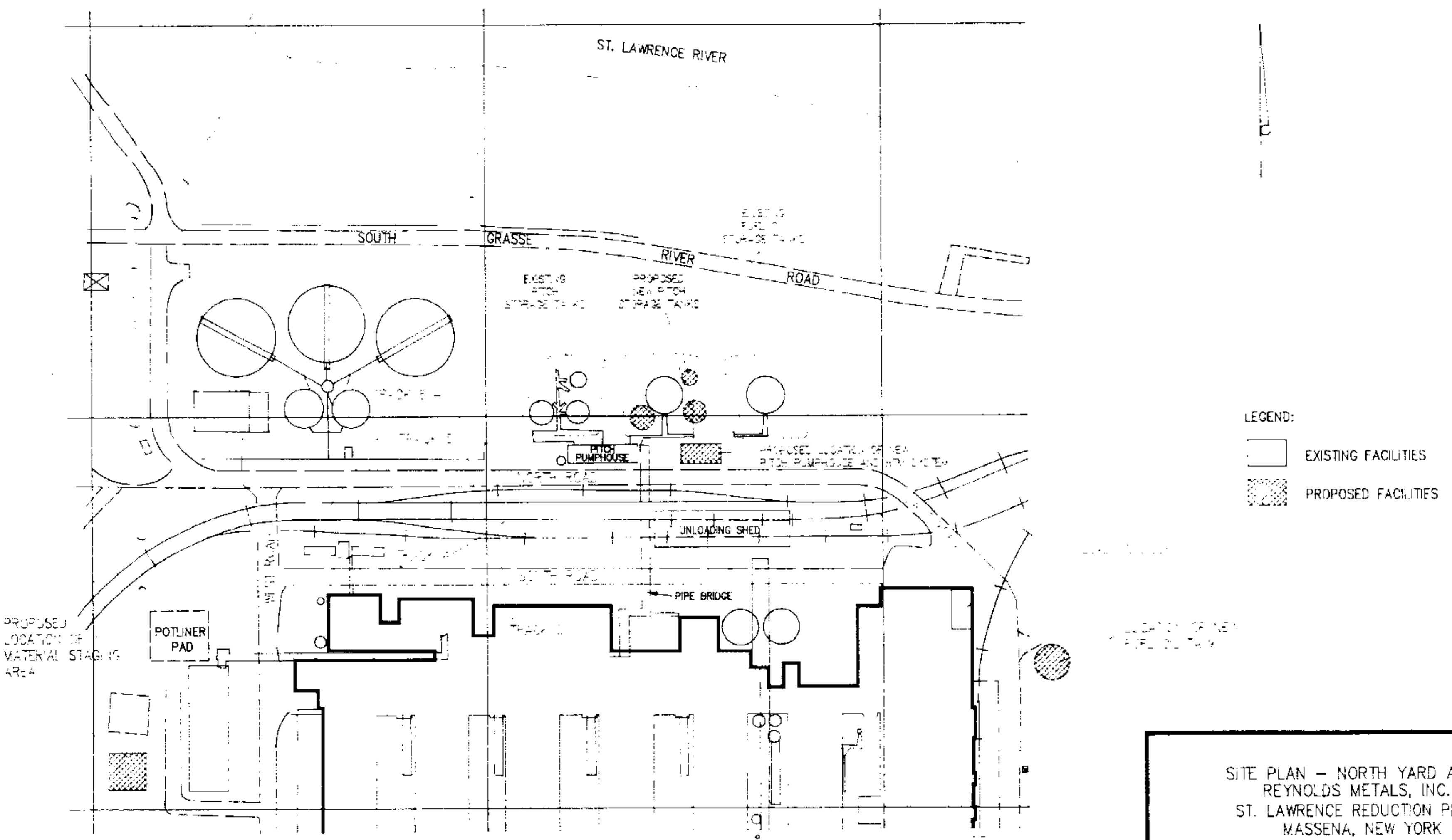
TABLE G-1
CAPITAL COST ESTIMATE SUMMARY (1)
NORTH YARD REMEDIATION

REMEDIAL ACTION	UNITS	UNIT COST	QUANTITY	COST
*******************	*****	****	********	****
A. SITE PREPARATION				
1. Mobilization	ls	3,000	1	$3,000
2. Const. Yard Prep.	ls	$10,000	1	$10,000
3. Equipment Wash Pad	ls	$50,000	1	$50,000
SITE PREPARATION TOTAL				$63,000
B. EXCAVATION/HANDLING (2)				
1. Carbon Plant Area	cy	$10	3,600	$36,000
2. North Yard Rail	cy	$7	11,300	$79,100
3. PPH and Pitch Trans.	cy	$7	1,900	$13,300
4. Oil Storage Tank Area	cy	$7	1,300	$9,100
5. North Slope to Road	cy	$7	1,800	$12,600
6. Haul for Disp.	cy	$3	22,885	$68,655
EXCAVATION AND HANDLING SUBTOTAL				$218,755
PLUS 25% FOR HEALTH & SAFETY				$54,689
EXCAVATION AND HANDLING TOTAL				$273,444
C. REMOVE/REPLACE NORTH YARD RAIL LINES				
1. Remove/Replace using Existing Rail	lf	$100	3,000	$300,000
2. Additional New Track	lf	$120	300	$36,000
REMOVE/REPLACE RAIL LINES SUBTOTAL				$336,000
PLUS 25% FOR HEALTH & SAFETY				$84,000
REMOVE/REPLACE RAIL LINES TOTAL				$420,000
D. BACKFILL – PURCHASE AND PLACE				
1. Carbon Plant Area				
Sand	cy	$13	2,592	$33,696
Crusher Run	cy	$19	1,728	$31,968
2. North Yard Rail				
Crusher Run	cy	$19	13,560	$250,860
3. PPH and Pitch Trans.				
Sand	cy	$13	6,720	$87,360
Crusher Run	cy	$19	3,360	$62,160
Topsoil	cy	$15	860	$12,900
4. Oil Storage Tank Area				
Spread and Grade	cy	$4	400	$1,600
5. North Slope to Road				
Topsoil	cy	$15	860	$12,900
BACKFILL TOTAL			30,080	$493,444

TABLE G-1
CAPITAL COST ESTIMATE SUMMARY (1)
NORTH YARD REMEDIATION

REMEDIAL ACTION	UNITS	UNIT COST	QUANTITY	COST
*******************	*****	****	********	****
E. MACADAM CAP				
1. Carbon Plant Area	sf	$2.00	14,500	$29,000
2. North Yard Rail	sf	$1.50	60,000	$90,000
3. PPH and Pitch Trans.	sf	$1.50	5,000	$7,500
4. Oil Storage Tank Area	sf	$1.50	30,000	$45,000
5. Pitch Storage Tk Area	sf	$1.50	20,000	$30,000
MACADAM CAP TOTAL			129,500	$201,500
F. GRADING AND SEEDING				
1. North Slope to Road				
Grading	sf	$0.12	15,000	$1,800
Seeding	sf	$0.05	15,000	$750
Sod on Slope	sf	$0.50	25,000	$12,500
2. Swale Construction	lf	$7	400	$2,800
GRADING AND SEEDING TOTAL				$17,850
G. MECHANICAL WORK	ls	$1,884,000	1	$1,884,000
DIRECT CAPITAL COSTS				$3,353,238

Notes
(1) This cost estimate does not include disposal or treatment costs. See Part VII for total remediation cost estimate.
(2) Volumes indicated here are based on the phased remediation scenarios presented in this appendix and do not necessarily correlate with those in Appendix A.



Rev. No.	Date	Type of Revision	Checked by:

SITE PLAN – NORTH YARD AREA
REYNOLDS METALS, INC.
ST. LAWRENCE REDUCTION PLANT
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-3	Drawing No. 95150510	Date: 5/23/91
Drawn by: D.E.G.	Checked by: M.K.	FIGURE G-1
Scale: 0 — 100 FEET		

Memorandum **Woodward-Clyde Consultants**

To: P. Jacobson
Plymouth Meeting

From: Roy Ambrose

Office: Denver Design Center

Date: 20 May 91

Subject: Estimate for the Mechanical Work, Reynolds Metals
W.O. No. 89C2515C (Task 3)

As you requested, enclosed are copies of the estimate for the removal and replacement of the mechanical process equipment for the north yard area including all items as discussed on our site visit on 07 May 91.

The following discussion is intended as clarification/background information as to the contents of each estimate sheet.

Estimate Sheet No. 1, Truck Loading Dock, Area 1C

The proposed loading dock shall be located on the northeast corner of the existing warehouse running east/west in the building. The estimate includes breaking-out the existing concrete, excavation, filling the existing dock, new concrete, door, siding, lighting and a 50' by 100' apron for the trucks to maneuver into the loading dock.

Total cost for this portion: $49,638

Estimate Sheet No. 2, Asbestos Materials Removal

It shall be necessary to remove the asbestos materials from all of the equipment in the fuel oil and pitch storage areas prior to any equipment removals. The estimate was based on the Asbestos Abatement Guidelines, Section 2-101 in the Richardson Rapid System. The guidelines conform with EPA and OSHA regulations. The work shall be performed by a licensed contractor specializing in asbestos removal. The materials shall be disposed of to a state specified landfill.

Total cost for this portion: $115,808

APPENDIX H

CEMENT KILN TSDFs