Report

465-01

Burning Pads B and H Closure

Seneca Army Depot
Romulus, New York
Contract DACA87-84-C-0077

Department of the Army
Huntsville Division,
Corps of Engineers
Huntsville, Alabama

May 1985

O'BRIEN & GERE

BURNING PADS B AND H CLOSURE

SENECA ARMY DEPOT

ROMULUS, NEW YORK

CONTRACT DACA87-84-C-0077

DEPARTMENT OF THE ARMY

HUNTSVILLE DIVISION, CORPS OF ENGINEERS

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MAY, 1985

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SECTION 1 - INTRODUCTION

1.01 Background

This report presents the results of work performed by O'Brien & Gere Engineers, Inc., for the Department of the Army, Huntsville Division Corps of Engineers in connection with the development of a remedial program for open burning pads B and H at the Seneca Army Depot (SEAD) in Romulus, New York. (See Figure 1)

The burning pads were reportedly operated from 1943 until 1983 for the open burning of pyrotechnics, explosives and propellants (PEP), which had been declared obsolete or off specification. PEP contaminated wastes such as boxes and other containers were also treated at the burning pads. In May of 1982, soil samples were collected from the burning pads and analyzed for EP toxicity and total explosive content. The results of these analyses were released in a report by the U.S. Army Environmental Hygiene Agency (USAEHA), dated September 14, 1983, entitled: "Phase 2, Hazardous Waste Management Special Study No. 39-26-0147-83, DARCOM Open-Burning/ Open-Detonation Grounds Evaluation, Seneca Army Depot, Seneca, New York, 2-13 May 1982." The report concluded that soil samples from burning pads B and H contained barium and lead and were hazardous by characteristic of EP toxicity for heavy metals. A copy of this report is included as Appendix A.

1.02 Authorization and Scope

The Department of the Army, Huntsville Division Corps of Engineers, retained O'Brien & Gere Engineers, Inc. to perform a Closure

Method Analysis, (Annex A of the Contract) Develop a Construction Bid Package, (Annex B) and develop a Sampling, Analysis and Quality Control/Quality Assurance Program (Annex C) in order to effect an environmentally sound closure of burning pads B and H. This Engineering Report sets forth a summary of the work completed in connection with the Closure Method Analysis (Annex A):

Work conducted in order to prepare this report generally included:

1. A review of available data associated with open burning pads B and H.
2. A review of regulatory requirements for closure and post closure.
3. A review of existing closure and post closure plans.
4. A review of possible closure alternatives, including economic analyses.
5. Recommendation of a remedial program for closure of open burning pads B and H, including a post closure maintenance program.

A detailed description of the scope of work associated with the Closure Method Analysis (Annex A), including Modification P0000 ("A"), is included as Appendix B in this report.

SECTION 2 - GEOHYDROLOGICAL/GEOTECHNICAL SUMMARY

2.01 Topography and Drainage

The open burning pad area of the Seneca Army Depot is of low relief, as shown in Figure 2. It should be noted that the elevations shown in Figure 2 are based on an assumed elevation of 100.00 feet at the sill of the easterly concrete entrance to the dugout located at the north end of the paved access road. Land surface elevations typically range between 610 and 630 feet above mean sea level (amsl).

Surface run-off is generally directed to the northeast toward Reeder Creek which is situated approximately 500 and 1200 feet northeast of burning pads B and H respectively. Reeder Creek flows north in this vicinity and then turns due west 1700 feet north of the burning pad area. Reeder Creek is a sub-basin within the main Seneca Lake drainage basin.

2.02 Regional Geology

Unconsolidated materials at the Seneca Army Depot were deposited during the Wisconsin Stage of Pleistocene glaciation. These sediments vary locally but tend to be generally classified as glacial tills; dense horizons of unsorted and unstratified mixtures of gravel, sand, silt and clay. The finer grained silts and clays tend to be the predominant till matrix material. The thickness of the tills over the local bedrock is typically less than 30 feet.

The shallowest bedrock on the SEAD facility includes the Ludlouville Formation on the northern site portions, and the Moscow Formation to the south. Both belong to the Hamilton Group, are made up of interbedded shales and limestones, and are Middle Devonian in age.

2.03 Munitions Demolition Area Hydrogeology

A total of seven (7) groundwater monitoring wells have previously been installed in the munitions demolition area. Four of the wells (1, 5, 6 and 7) are located in the immediate area of the open burning pads as shown on Figure 2. The remaining three wells (2, 3, and 4) are located in the vicinity of the munitions detonation mound away from the burning pads under consideration, and are not critical to this evaluation. Table 1 presents a summary of boring log data.

The available logs of borings completed for the well installations characterize the geology as glacial till overlying shale bedrock with till thicknesses between 6 and 12 feet. Available data indicates that approximately one foot of weathered bedrock overlies competent rock. Shallow groundwater was encountered in the till horizon at depths between 3 and 6 feet below ground level.. These data are graphically illustrated on Figure 3 which depicts the unsaturated thickness of the site. Based on this figure, approximately 7 feet of unsaturated thickness exists at open burning pad H, and less than 4 feet at open burning pad B.

A review of available literature indicates that one hydraulic conductivity test has been conducted in the area of the burning pads. This in-situ hydraulic conductivity test from Well #7 suggests that the

hydraulic conductivity of the silty till material is on the order of 10^{-4} cm/sec. The typical range in hydraulic conductivity for glacial till is 10^{-4} cm/sec to 10^{-10} cm/sec. The value measured in Well #7 indicates that the till is comprised mainly of silt with small amounts of clay, sand and gravel.

Groundwater flow direction and gradient has been evaluated using data previously collected by Paratt Wolff, Inc. in 1981. Figure 4 illustrates the result of this assessment and indicates that groundwater flow is to the northeast under an average influencing hydraulic gradient of 0.013 ft/ft.

Using the values of hydraulic conductivity and hydraulic gradient presented above, groundwater flow velocities and the quantity of flow beneath each pad have been estimated. Applying Darcys Law:

$$V = \frac{KI}{Sy}$$

where V = groundwater flow velocity in feet/day

K = hydraulic conductivity = 1×10^{-4} cm/sec = 0.2835 ft/day

I = hydraulic gradient = 0.013 ft/ft

Sy = effective porosity = 0.3 (estimated for silt and clay)

then $V = \frac{0.2835 \times 0.013}{0.3}$

$= 0.012$ feet/day

Groundwater flow rates can also be calculated using a different form of Darcys Law.

$Q = KIA$

where Q = groundwater flow rate in gallons per day

K = hydraulic conductivity = 1×10^{-4} cm/sec = 2.1 GPD/ft^2

I = hydraulic gradient = 0.013 ft/ft

A = crossectional area of aquifer at each site

= aquifer thickness x width of site perpendicular to groundwater flow

for pad B, A = 6 x 100 = 600 ft^2

for pad H, A = 5 x 200 = 1,000 ft^2

then Q for pad B = 16.5 GPD = 6,022 gallons per year

Q for pad H = 27 GPD = 9,855 gallons per year

It should be pointed out that the information used in the above discussions and calculations is based on a single set of groundwater elevations and assumes that this information is true and correct. Since the groundwater depth and flow are critical to closure methods involving in-place containment of contaminated materials this assessment should be confirmed by additional field studies prior to developing the final design of any in-place containment closure option.

Specific information regarding the groundwater elevation in the bedrock underlying the site is not available. Regional data, however, suggests that the groundwater level in the bedrock is below the contact between the unconsolidated glacial material and the bedrock. This is confirmed at the location of Well #5 where the entire thickness of the overlying

glacial till was reported to be unsaturated. This suggests that groundwater in the bedrock, if it exists, does not act to recharge the groundwater in the glacial till.

SECTION 3 - HAZARDOUS WASTE CHARACTERISTICS ANALYSIS

3.01 Site Sampling

Three surface soil samples were collected from both burning pads B and H in May 1982 as part of the DARCOM Study (Appendix A) to determine the nature of any contamination at the sites. Groundwater monitoring wells were installed in 1981 at points upgradient and downgradient of the open burning pads. Monitoring of these wells began in January 1982 for indicator and water quality parameters to assess whether there had been any influence on groundwater quality.

In addition to these studies, the U.S. Army Environmental Hygiene Agency (USAEHA) is currently conducting a study of open burning pads B and H. This study should be reviewed for consistency with the conclusions and recommendations of this report prior to implementing the recommended remedial program.

3.02 Soil Analysis

The open burning pads served as a treatment facility for the disposal of "reactive" PEP wastes. In general the reactive characteristic of the PEP materials was eliminated by the burning process, although some small residuals of explosives may persist. Many of the explosives, initiators and propellants contained heavy metals, (See Table 2). Hence the soils were analyzed for explosives and the characteristic of EP Toxicity (40 CFR 261) in the Phase II Study.

As presented in Table 3, leachate extracted from the soil samples taken from open burning pad B contained concentrations of barium exceeding, in two of three samples, the limit established by RCRA. Leachate extracted from soils taken from open burning pad H contained

concentrations of lead that, in two of the three samples, exceeded the limit established by RCRA. In the silty or clayey type of soils identified as being in the area of the open burning pads, heavy metals such as barium or lead would tend to be attenuated or sorbed by the soils due to the soils typically moderate to high cation exchange capacity. It is then reasonable to presume that the heavy metals would be contained in the worked soils of the open burning pads.

Trace amounts of explosives were also detected in the soils. The residuals consisted of cyclotrimethylene-trinitramine (RDX) and dinitrotoluenes; degradation products of 2,4,6-trinitrotoluene (TNT). The concentrations of these compounds do not in any case exceed a total of 30 ug/g. These quantities would not likely be sufficient to cause the soil to meet the characteristic of reactivity.

3.03 Groundwater Analysis

Quarterly sampling of wells during the first year of monitoring (1982), generated data on water quality and a general indication of whether the open burning pad activity was influencing groundwater. Recorded water table elevations demonstrated that Well #5 was upgradient of the open burning pads and Wells #1, 6 and 7 were downgradient. Comparison of downgradient well concentrations to upgradient well concentrations of indicator parameters by the Student t-Test in Table 4 indicated that downgradient data were within acceptable limits of variation from background concentrations, suggesting negligible impact on groundwater.

Primary drinking water standard parameters were also analyzed in groundwater samples from the first year. Since many of the initiators and explosives were nitrate salts or nitro-organic compounds, site influence on groundwater might be detected by nitrate analysis for groundwater. The data for Wells #1, 6 and 7 indicated lower concentrations of nitrates in the downgradient wells than in the upgradient Well #5.

SECTION 4 - CONTAMINATION ANALYSIS

4.01 Regulatory Approach to Closure

The specific requirement for open burning under 40 CFR 265.382 is that it be "in a manner that does not threaten human health or the environment". Closure requirements for thermal treatment processes (40 CFR §§ 265 Subpart P) specify only that hazardous wastes or hazardous waste residues be removed from the "thermal treatment process or equipment". The open burning pads might otherwise be considered as waste piles or landfills.

If the burning pads are considered as waste piles, then "at closure, the owner or operator must remove or decontaminate all waste residues...contaminated subsoils and structures ... and manage them as hazardous wastes..." "If... the owner operator finds that not all contaminated subsoils can be practicably removed or decontaminated, he must close the facility and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills" (40 CFR 264.258(b)).

A landfill is defined in 40 CFR Part 260.10 as a "disposal facility or part of a facility where hazardous waste is placed in or on land, and which is not a land treatment facility, a surface impoundment, or an injection well". The materials or contents of burning pads B and H have, by a limited number of analyses, exhibited the characteristic of EP Toxicity and consequently might be classified as hazardous waste. Closure of landfills is specifically addressed by the regulations in 40 CFR Part 264.310. For closure of landfills the "owner or operator must cover the landfill or cell with a final cover".

Title 6 of the New York Codes, Rules, and Regulations Part 360 states that a waste pile used as a disposal facility is governed under the regulations as a secure landfill (6NYCRR360.8(c)(12)). Closure of a secure landfill under these regulations require that the closure plan address the "control of pollutant migration from the facility via groundwater, surface water, and air" (6NYCRR360.8(c)(12)(v)). Additionally, the regulations require that a minimum ten feet separation exist between any waste and an aquifer or bedrock (6 NYCRR360.8(c)(12)(i)). Design requirements outlined in 6NYCRR360.8(c)(12)(ii) further define the minimum requirements for an impermeable cap to cover the landfill as "a synthetic or natural material of acceptable composition and thickness and having a hydraulic conductivity of 10^{-7} centimeters per second or less...."

4.02 Extent of Contamination

Estimating the potential for migration of the characteristic compounds that lie as residuals from open burning first required evaluating the types of compounds that would be byproducts from burning explosives and propellants. Typical components of explosives have been listed in Table 2. Notable compounds were barium nitrate, and barium peroxide and lead styphnate, which would account for these heavy metals appearing in the EP Toxicity test. In the explosion reaction the nitro compounds react to form gaseous products of CO_2, N_2 and H_2O at a tremendous rate. Salts and oxides of the heavy metals would be left as residue from the reaction. The divalent metal ions would be strongly adsorbed by the silty or clayey type of soil found at the Seneca Army Depot. The cation exchange capacity of a soil can be related

partially to the surface area of the soil grains and to the mineral constituents of the soil. As for unreacted explosives residues, the nitrotoluenes are fairly insoluble in water and would also tend to be somewhat attenuated by silty or clayey soils. In general, migration of residuals into underlying soils from the burn pads would probably be limited by attenuation and by the relative low soil permeability.

A magnetometer survey was conducted at open burning pads B and H by O'Brien & Gere Engineers, Inc. between October 17 and 18, 1984. The purpose of this survey was to determine the aerial extent of ferrous metallic materials which may have been associated with the open burning of PEP at these locations. Although it is realized that the metallic portions of the munitions themselves are for the most part non-magnetic, it was felt that enough magnetic material may have been associated with the munitions that it would provide a reasonable indication of the horizontal extent of materials which had undergone demilitarization by open burning, and hence, the aerial extent of contaminants, as well as the potential location of any PEP which may have escaped demilitarization.

Figures 5 and 6 present the results of the magnetometer survey for open burning pads B and H respectively. Areas which showed magnetometer readings above background levels have been shaded, with the darker areas indicating a greater concentration of magnetic material. The location of these areas adjacent to the berms tend to confirm that ferrous material was burned in conjunction with the non-ferrous material. The location of these materials on and adjacent to the berms also tend to confirm that the reported practice of bulldozing demilitarized material into the berms after burning did occur.

It should be noted that magnetometer readings occur on a relative scale. This allows the presence or absence of ferrous material to be determined, but does not indicate the quantity, depth or specific type of material present.

In order to determine a likely vertical extent of contamination, a theoretical analysis was made of the amount of soil required to adsorb the portion of the contaminants, as determined by the Phase II Study, which is in excess of the limits established by RCRA for EP Toxicity.

This analysis made the following assumptions:

- There has been an unlimited source of the contaminant available for leaching for the 41 years since burning operations began.
- Average rainfall since burning operations began has been 31 inches per year. Of this about 33% infiltrates to underlying soil, while the rest is removed by runoff or evapotranspiration. These values are based on precipitation data from the Rochester-Monroe County Airport, and a water balance calculation performed in accordance with EPA Publication 530/SW-168 "Use of the Water Budget Method for Predicting Leachate Generation from Solid Waste Disposal Sites".
- The adsorption rate for lead is 2.1 pounds of lead per cubic foot of soil (lb/ft^3) and the adsorption rate for barium is 1.4 lb/ft^3. These values are based on a review of available literature.

- The concentration of barium and lead found in the extracted leachate of the EP Toxicity Tests performed for the Phase II Study represented the highest concentrations of the metals which would be found.

Based on these assumptions, a calculation was made of amount of contaminant which could have been leached into the soil over the 41 years since the facilities began operation at the concentrations indicated by the Phase II Study. The total amount of soil needed to adsorb this amount of contaminant was then calculated using the above listed theoretical adsorption rates of 2.1 lb/ft^3 for lead and 1.4 lb/ft^3 for barium. This total amount of soil was then divided by the areas of the limits of contamination as shown in Figures 5 and 6. These calculations indicated that the depth of soil required to attenuate the barium leached from burning pad B would be 10 inches, and the depth of soil required to attenuate the lead leached from burning pad H would be approximately 1 inch.

The results of the Phase II Study were based on only three samples collected from the top 6 inches at unknown locations at each burning pad. Recognizing the limited data upon which this assessment has been made, it is believed that a reasonable factor of safety would be applied if the probable depths of contamination were increased to two feet at both burning pads. Figures 5 and 6 indicate that this depth represents an elevation of 618 AMSL at burning pad B and 633 AMSL at burning pad H, respectively.

Based on the results of the magnetometer survey, coupled with the fate and transport mechanisms of the identified contaminants, the areas of contamination shown in Figures 5 and 6 were determined. These

areas represent the probable limits of contamination, based upon an engineering and scientific interpretation of the limited data available to date, which have been identified for the purpose of conducting this Closure Method Analysis and establishing the scope of the closure plans and specifications to be developed as part of Annex B. The total volume of contaminated material included within these limits is approximately 9,000 cubic yards. The exact limits and depths of contamination will be determined by a sampling and analytical program to be developed as part of Annex C to this contract and implemented during construction of the site closure.

While performing the magnetometer survey, elemental lead and other material was noted lying on the ground surface outside both burning pads. The scraps of ferrous, lead and other non-ferrous metal that were found at the sites from projectile heads, shell casings and miscellaneous hardware would not be expected to represent a significant source for extractable concentrations of EP Toxicity heavy metals. However, since they could, in time, contribute to the heavy metal concentration of the underlying soil these surface materials should be collected and handled as part of the closure. Figures 5 and 6 delineate the limits of surface preparation within which surface materials would be collected and removed. These limits were determined based on visual observation of the two burning pads and consider the impact of the past utilization of the adjacent burning pads.

4.03 Removal of Hazardous Waste Material

Hazardous waste removal from open burning pads B and H would involve excavation of soils having the characteristic of EP Toxicity. As

a result of open burning treatment, the traces of explosives in soil would no longer appear to have the characteristics of reactivity or ignitability, hence the soils may be deposited in an approved secure land burial facility (40 CFR 264.122).

Any intact or whole munitions that might exist within the burning pad mound or surrounding soil would have to be considered potentially reactive or ignitable and, therefore, not acceptable for landfill disposal. Therefore, consideration must be given to methods for separating the larger metallic pieces from the bulk of soil. Specifics on the choice of method are discussed in a subsequent section of this report.

4.04 Transportation of Hazardous Waste

Transportation of hazardous wastes has been regulated at the Federal level, 49 CFR §§ 171-177 (1983) and by the State of New York, 6 NYCRR §§ 365. The waste must be properly manifested using a manifest form available from the New York State Department of Environmental Conservation (NYSDEC). From the Hazardous Materials Table of 40 CFR §§ 172.101 the hazard class and identification for the material would be ORM-E and NA9189 given that the soils are a hazardous waste.

There would be negligible concern for release of volatile compounds, although trailers carrying the soil should be covered to prevent losses in transit. For saturated soils excavated from below the water table the shipping container shall be free from leaks, and all discharge openings must be securely closed during transportation.

4.05 Disposal of Hazardous Waste

Initial contacts were made with disposal companies operating secure land burial facilities to determine whether soils excavated from the burn pads could be accepted. Their preliminary indications were that the waste would be accepted on the basis that the waste did not have the characteristic of reactivity. Formal waste survey forms will have to be submitted for official approval of the waste for disposal by land burial.

If explosive shells were removed from the soil and the soil did have some reactivity due to the explosives residues, the soil could be treated by thermal incineration at a controlled feed rate. The ash would then be landfilled in a secure cell.

Any unburned PEP materials or intact munitions would be treated by open-detonation as permitted by RCRA regulations, 40 CFR §§ 264.258 (1983).

SECTION 5 - METHOD OF CLOSURE

5.01 General

In this section, possible methods for the closure of burning pads B and H are presented. The methods considered and evaluated for implementation include:

1. Removal to secure permitted landfill off-site
2. Removal/On-Site Treatment/Disposal Off-Site
3. Capping to minimize hydrodynamic forces
4. In-place containment
5. Combinations of the above listed alternatives

Within these closure methods, on-site treatment of the material to be removed from the burning pad area is to be considered to the extent that it will make the material compatible for secure landfill disposal (i.e. reduce the potential of the material containing intact or whole munitions) and/or reduce the exposure of Government and Contract personnel, as well as the general public, to potentially reactive or ignitable components during its transport and disposal. The capping alternative differs from in-place containment in that it is limited to minimizing the hydrodynamic forces which could mobilize low level residual contaminants subsequent to excavation and removal of contaminated materials from the burning pads.

The general criteria used in the evaluation of these alternatives include:

- Effectiveness in eliminating further release of hazardous constituents.

- Technical feasibility and ease of implementation
- Cost/Benefit

The primary objective of the remedial program selected for implementation is to abate the release of waste contaminants from burning pads B and H into the surrounding soils and ultimately into the groundwater system. The selected program must include safety and security provisions as well as provisions for post closure maintenance.

5.02 Removal To Secure Permitted Landfill Off-Site

5.02.01 General

Disposal of the wastes at an off-site secure permitted landfill requires excavation of the wastes, containerization, transport and ultimate disposal. At the present time, there are two commercial, permitted secure land burial facilities operating in the northeast which can accept solid hazardous wastes. Both of these facilities, located in Niagara County, New York, are operated by firms which specialize in the management of hazardous wastes. Preliminary discussions with operators of disposal facilities indicate that material excavated from this site may not be acceptable for disposal without some intermediate treatment performed on site.

5.02.02 Excavation and Removal

Under this alternative, material from the burning pads will be excavated to the limits of contamination identified in Figures 5 and 6 utilizing conventional construction equipment such as bulldozers and front end loaders. Equipment of this sort has reportedly been

used in the past in handling demilitarized materials and soil at these burning pads and should, therefore, be suitable for use on this project. Surface preparation work will be accomplished using a standard tractor equipped with a suitably sized drag rake. As the contaminated soil and demilitarized material is removed from the burning pads, it will be loaded directly into enclosed containers for transportation to the ultimate disposal site. The containers will be sealed so as to prevent leaks of contaminated soil or water either on site or during transportation. Since the material will be moved directly from the burning pad to the container no temporary storage will be required.

Extreme care must be taken to minimize the loss of waste material during the excavation and transfer operations due to washout during rainfall events. The contractor will be required to cover the open area of the site with a temporary, impermeable cover during rainfall events and at that end of each working day. Following the completion of construction, the temporary cover which would be potentially contaminated by virtue of contact with contaminated material, would be disposed of at a permitted secure landfill.

During construction operations, the contractor will be required to minimize the extent of adverse environmental effects. This will include as a minimum:

- limiting the amount of exposed working area,
- providing drainage facilities including silt dams to prevent off-site migration of washed out material, and
- implementation of dust control measures.

5.02.03 Transportation

When each truck is fully loaded, it will leave the Seneca Army Depot and proceed to the ultimate disposal location. Travel will be restricted to major highways and will, when possible, avoid large population centers. A licensed hazardous waste transporter will be used for this phase of the work. All work will be done in compliance with all RCRA regulations as contained in 40 CFR Part 263, the New York Environmental Conservation Law (ECL) as contained in the New York Compilation of Rules and Regulations, Title 6, Chapter 365, and applicable New York State Department of Transportation (NYSDOT) regulations. Regulations in effect deal with the following:

- Record Keeping
- Manifest Systems
- Insurance
- Identification Numbers
- Types of Containers Required for Transportation

5.02.04 Post Closure Maintenance

After completion of excavation and removal of the contaminated wastes, the sites would be restored by regrading and seeding. No further maintenance will be required following the establishment of vegetation.

5.02.05 Site Security

Security procedures currently in effect for the Seneca Army Depot will be sufficient to provide security during construction operations at the burning pads. The entire Depot is surrounded

by an eight foot high chain link fence topped with barbed wire. Entry and exit to and from the facility is monitored 24 hours a day by armed Department of Defense (DOD) personnel.

Mobile, internal security police patrol the Depot grounds 24 hours a day, 7 days a week. Access to and from the ammunition area which contains the burning pads is controlled by a manned guard post. Further access to the burning area is controlled by a gate which can be locked. Access to the burning pad area should continue to be limited to authorized personnel during the closure operation. The Contractor will be required to adhere to procedures established by Seneca Army Depot regarding the security of controlled and limited areas.

5.02.06 Safety and Contingency Plans

Due to the potentially explosive nature of any intact materials which may have escaped destruction by burning at these sites, it will be necessary to implement personnel safety measures. These will include limiting the number of people in the area of active excavation, the use of protective shields on excavation equipment, the presence of fire extinguishers on all equipment, and any other measures deemed appropriate. Detailed procedures will be presented in the Closure Technical Plan prepared in accordance with Annex B. Due to the chemical contaminants present, all individuals entering the excavation area will be required to wear minimum safety equipment consisting of:

1. hard hat
2. safety glasses and goggles

3. respirators with replaceable filters

4. disposable rubber gloves and boots

5. non porous disposable coveralls

Additional safety equipment required on site will include an emergency eye wash drench shower, fire extinguishers, first aid kits, a self contained breathing apparatus and additional safety equipment deemed appropriate for construction operations. Detailed procedures will be presented in the Closure Technical Plan prepared in accordance with Annex B.

In conjunction with the Safety Plan, a contingency plan will be developed and presented in detail in the Closure Technical Report. The contingency plan will describe as a minimum:

1. Emergency vehicular access.
2. Procedures to evacuate personnel from within the limits of the work area in case of an emergency.
3. Methods of containing fire.
4. Procedures which would be implemented by a contractor in the event of a major health emergency crisis.
5. Procedures which would be implemented should an accident or emergency occur during off-site transport of the waste.

The contingency plan will be in accordance with the Spill Prevention Control and Counter Measure Plan, and the Installation Spill Contingency Plan which has been developed for the Seneca Army Depot. Both the safety and contingency plans will be coordinated with the Seneca Army Depot Safety Office.

5.02.07 Decontamination

All equipment which has been within the limits of the work area where it could have contacted contaminated surfaces will be thoroughly decontaminated prior to leaving the area. Decontamination will consist of a minimum of one wash using steam to remove contaminated solids. Decontamination will be done at a decontamination pad and all liquids generated as a result of equipment decontamination will be collected and hauled to an approved hazardous waste treatment facility. Prior to finalization of the project the decontamination pad will be removed and disposed of at a permitted secure landfill.

5.02.08 Implementation Schedule

It is estimated that all construction activities required under this alternative can be completed in one construction season. An implementation schedule is included as Figure 9. This schedule indicates that this closure method could be completed within 22 weeks. This means that a contractor authorized to proceed by April 1 of a given year could complete the project within one construction season.

5.02.09 Costs

The total estimated construction cost to implement this alternative is $3,778,000. A detailed cost estimate is presented in Table 5. This total cost is based on the assumption that it will be necessary to excavate and remove a total of 9,000 cubic yards of

material. Should testing indicate that it will be necessary to excavate more material, the construction costs would increase proportionally.

The cost estimate also considers that without presorting intact or whole munitions, the waste material would have to be considered potentially reactive or ignitable and, therefore, would need to be treated in some fashion by the disposer, after excavation and removal from the site, but prior to burial in a secure landfill. Transportation costs have also been adjusted to reflect the additional security requirements associated with transporting the untreated material. Since no maintenance will be necessary after closure, the construction cost is a one time cost occurring at the time of construction.

5.03 Removal/On-Site Treatment/Disposal Off-Site

5.03.01 General

Under this alternative, contaminated material would be excavated and sorted on-site to remove pyrotechnics, explosives or propellants which may have escaped demilitarization by open burning. Following sorting, the non-reactive and non-ignitable contaminated material would be transported to a permitted secure landfill off-site. Intact or whole munitions discovered as a result of the sorting would be demilitarized on-site at the detonation area.

At the present time, there are two commercial EPA-permitted secure landfills operating in the northeast which can accept solid hazardous waste. Both of these facilities, located in Niagara

County, New York, are operated by firms which specialize in the management of hazardous wastes. Discussions with these facilities indicate that in order for them to accept material excavated from burning pads B and H, pretreatment to remove any material which may have escaped demilitarization, will be necessary prior to placing the material in a landfill.

5.03.02 Excavation and On-Site Treatment

Excavation will be performed using conventional construction equipment such as bulldozers backhoes and front end loaders. Equipment such as this should be acceptable for use on this project, as it has reportedly been used in the past to handle soil and demilitarized material at these sites. Following excavation, the excavation equipment will move the excavated material to an adjacent treatment area for subsequent sorting.

The excavated material will be sorted so as to identify any shells or ammunition which has not been demilitarized. As a minimum, sorting will be accomplished by screening the material with non-metallic screens of an appropriate opening to selectively isolate material of a size which may contain live explosives. The potentially live material will be visually inspected to determine the presence of any intact explosives which have not been demilitarized. If any are suspected, Seneca Army Depot personnel will be contacted to handle them in an appropriate fashion. It is anticipated that if any explosives are detected, they will be removed to the Detonation Mound and destroyed by Seneca Army Depot Personnel. Additional forms of sorting, such as magnetic separation or air classification may also be utilized.

During excavation and sorting operation, efforts will be made to match excavation and sorting rates in order to reduce the number of times material must be handled. This will also eliminate the need to store contaminated material while waiting for sorting.

Following sorting, the non-reactive and non-ignitable material will be loaded into enclosed containers for transportation to the ultimate disposal site. These containers will be sealed so as to prevent leaks either on-site or during transportation. The containers will also serve as temporary storage for materials which have been excavated and sorted.

Care would be taken to minimize the loss of waste material during the excavation and transfer operations due to washout during rainfall events. As a minimum, the contractor will be required to cover the open area of the site and any temporary stockpiles of sorted material with a temporary, impermeable cover during rainfall and at the end of each working day. Following the completion of construction, the temporary cover would be disposed of at a permitted secure landfill.

During all construction operations, the contractor will be required to minimize the extent of adverse environmental effects. This will include as a minimum:

- Limiting the amount of exposed working area.
- Providing drainage facilities, including silt dams to prevent off-site migration of washed out materials.
- Implementation of dust control measures.

5.03.03 Transportation

When each truck is fully loaded, it will leave the Seneca Army Depot and proceed to the ultimate disposal location. Travel will be restricted to major highways and will, when possible avoid large population centers. A licensed hazardous waste transporter will be used for this phase of the work. All work will be done in compliance with all RCRA regulations as contained in 40 CFR Part 263, the New York Environmental Conservation Law (ECL) as contained in the New York Compilation of Rules and Regulations, Title 6, Chapter 365, and applicable New York State Department of Transportation (NYSDOT) regulations. Regulations in effect deal with the following:

- Record Keeping
- Manifest Systems
- Insurance
- Identification Numbers
- Types of Containers Required for Transportation

5.03.04 Post Closure Maintenance

After completion of excavation, treatment and removal of contaminated materials, the site would be restored by regrading and seeding. Once each site has been restored and vegetative growth has been established, no further maintenance will be required.

5.03.05 Site Security

Security procedures currently in effect for the Seneca Army Depot will be sufficient to provide security during construction

operations at the burning pads. The entire Depot is surrounded by an eight foot high chain link fence topped with barbed wire. Entry and exit to and from the facility is monitored 24 hours a day by armed Department of Defense (DOD) personnel.

Mobile, internal security police patrol the Depot grounds 24 hours a day, 7 days a week. Access to and from the ammunition area which contains the burning pads is controlled by a manned guard post. Further access to the burning area is controlled by a gate which can be locked. Access to the burning pad area should continue to be limited to authorized personnel during the closure operation. The Contractor will be required to adhere to procedures established by Seneca Army Depot regarding the security of controlled and limited areas.

5.03.06 Safety and Contingency Plans

Due to the potentially explosive nature of any intact materials which may have escaped destruction by burning at these sites, it will be necessary to implement personnel safety measures. These will include limiting the number of people in the area of active excavation, the use of protective shields on excavation equipment, the presence of fire extinguishers on all construction equipment, and any other measures deemed appropriate. If during on-site sorting operations, material which has not been demilitarized is identified, the appropriate Seneca Army Depot personnel will be contacted prior to further handling of the material. It is anticipated that base personnel will handle this material by removing it

to the detonation area for subsequent destruction. Detailed procedures will be presented in the Closure Technical Plan prepared in accordance with Annex B.

Due to the chemical contaminants present, all individuals entering the excavation area will be required to wear minimum safety equipment consisting of:

1. hard hat
2. safety glasses and goggles
3. respirators with replaceable filters
4. disposable rubber gloves and boots
5. non porous disposable coveralls

Additional safety equipment required on site will include an emergency eye wash drench shower, fire extinguishers, first aid kits, a self contained breathing apparatus and additional safety equipment deemed appropriate for construction operations. Detailed procedures will be presented in the Closure Technical Plan prepared in accordance with Annex B.

In conjunction with the Safety Plan, a contingency plan will be developed and presented in detail in the Closure Technical Report. The contingency plan will describe as a minimum:

1. Emergency vehicular access.
2. Procedures to evacuate personnel from within the limits of the work area in case of an emergency.
3. Methods of containing fire.
4. Procedures which would be implemented by a contractor in the event of a major health emergency crisis.

5. Procedures which would be implemented should an accident or emergency occur during off-site transport of the waste.

The contingency plan will be in accordance with the Spill Prevention Control and Counter Measure Plan, and the Installation Spill Contingency Plan which has been developed for the Seneca Army Depot. Both the safety and contingency plans will be coordinated with the Seneca Army Depot Safety Office.

5.03.07 Decontamination

All equipment which has been within the limits of the work area where it could have contacted contaminated surfaces will be thoroughly decontaminated prior to leaving the area. Decontamination will consist of a minimum of one wash using steam to remove contaminated solids. Decontamination will be done at a decontamination pad and all liquids generated as a result of equipment decontamination will be collected and hauled to an approved hazardous waste treatment facility. Prior to finalization of the project the decontamination pad will be removed and disposed of at a permitted secure landfill.

5.03.08 Implementation Schedule

It is estimated that all construction activities required under this alternative can be completed in one construction season. An implementation schedule is included as Figure 10. This schedule indicates that construction can be completed within 27 weeks. If a Contractor is authorized to begin by April 1 of a given year, construction can be completed within one construction season.

5.03.09 Costs

The total estimated construction cost to implement this alternative is $1,966,000. A detailed cost estimate is presented in Table 6. This total cost is based on the assumption that it will be necessary to excavate, treat, and remove a total of 9,000 cubic yards of material. Should testing indicate that it will be necessary to excavate more material, the construction costs would increase proportionally. Since no maintenance will be required after construction, the cost is a one time cost occurring at the time of construction.

5.04 Capping to Minimize Hydrodynamic Forces

5.04.01 General

After excavation and removal of contaminated materials is complete there may be residual low level contaminants left in the soils beneath the burning pads. Infiltration of precipitation through the site over time may result in leaching of any residual contaminants, and subsequent migration into the underlying soil and, eventually, into the groundwater system. In order to minimize the infiltration of precipitation, the excavated sites may be backfilled with clay, thus creating an essentially impermeable cap.

5.04.02 Installation

Under this alternative, a cap composed of a suitable low permeability clay would be installed over the exhumed sites. Clay suitable for this use typically has the following properties:

Soil Property	Criteria
Permeability	1×10^{-7} cm/sec or less
Percent soil passing	
No. 200 sieve	Greater than 30
Liquid limit	Greater than 30
Plasticity Index	Greater than 15

After excavation and removal of contaminated materials is completed, limited grading will be done to insure an adequate slope for the final cover. The clay backfill would then be installed in uniform lifts of approximately six inches to the final specified depth of approximately four feet. The final thickness of the cap will be designed based on the depth of frost penetration which could damage the integrity of the cap, and the frost susceptibility of other selected fill materials. The contractor would be required to seal the working surface of the cap at the end of each day using a steel wheeled roller. This, along with the maintenance of minimum grades will minimize the infiltration of surface water during cap installation and promote proper drainage. Conventional construction equipment, such as bulldozers, pans, and sheeps foot rollers would be used for installing the cap.

Following completion of cap installation, the capped area will be covered with topsoil and seeded with vegetation to control erosion. The selected seed mix will be comprised of species adapted to the region which have a dense, shallow root system and are resistant to extremes of wet and dry.

5.04.03 Post Closure Maintenance

When vegetative growth has been established on the cap maintenance requirements will be minimal. Periodic inspections should be implemented. The inspector will observe the condition of the cap and the vegetation cover on the cap. No trees, shrubs, brush or deep rooting weeds would be allowed to germinate or establish on the cap. If visual observations indicate that low growing, deep rooting weeds have established on the cap, a weed control program will be initiated.

Inspections will also reveal any problems of erosion, insect damage, and disease, or thinning of grasses; such conditions would then be corrected. Those areas which appear to be thinning out over time will require occasional overseeding to keep the cover as dense and uniform as possible. Periodic mowing of the cap vegetative cover will be required.

5.04.04 Site Security

Installation of the cap will not require any additional security measures beyond that required for the removal/on-site treatment/ disposal alternative previously discussed.

5.04.05 Safety and Contingency

Since any explosives which may have escaped demilitarization by burning will have been removed from the sites, and since contaminanted material will not be handled during capping only a limited safety program will be necessary for the capping operation.

All contractors employees will be required to wear hard hats and steel toed boots. Safety equipment required on site during capping will include the following as a minimum:

- An emergency eye wash drench shower
- Fire extinguishers
- First aid kits.

Additional safety equipment may also be required.

The contingency plan developed for the removal/on-site treatment/and disposal work need not be modified for the capping option.

5.04.06 Decontamination

Since no contaminated material will be handled during capping operations, no specialized decontamination program will be required.

5.04.07 Implementation Schedule

Implementation of capping is dependant on completing excavation and removal activities at each burning pad. It is estimated that the total time required for capping will be two weeks for burning pad B and four weeks for burning pad H. The implementation schedule presented as Figures 9 and 10 for removal and off-site disposal and removal/on-site treatment and off-site disposal respectively will be lengthened effectively two weeks if capping is incorporated.

5.04.08 Costs

Detailed cost estimates for the removal and off-site disposal, and removal/on-site treatment/off-site disposal alternatives incorporating capping are presented in Tables 7 and 8, respectively. Maintenance costs presented in Tables 7 and 8 are based on an estimated need to maintain the sites for thirty years, and maintenance costs will occur uniformly over this period. Should the maintenance program prove to be longer or shorter, these costs will increase or decrease proportionally.

5.05 In-Place Containment

5.05.01 General

Implementation of this alternative would require isolating burning pads B and H from the environment to mitigate mechanisms capable of transporting contaminants away from the sites. This would require the installation of a low permeability cap over the burning pads to minimize vertical percolation of precipitation and installation of a groundwater control barrier to minimize horizontal movement of groundwater through the sites.

5.05.02 Control of Groundwater

In order to mitigate the off-site transport of contaminants by groundwater it will be necessary to control the movement of groundwater through the sites by lowering the groundwater table to a minimum depth of ten feet below the waste deposit, or by creating an effective groundwater barrier that will isolate the waste from the regional groundwater flow. This may be

accomplished by the installation of either an active or passive groundwater control system. An active system would consist of the installation of a series of pumping wells or well points to lower the groundwater table in the area of the burning pads. A passive system could consist of either a drain installed to intercept groundwater, or a groundwater cutoff wall which would isolate the site from contact with the regional groundwater.

An active system could be constructed by installing a series of equally spaced well points immediately upgradient of each of the burning pads. The well points would be connected by a header system to a suction pump capable of providing enough hydraulic lift to remove groundwater from each wellpoint and establish interconnecting cones of influence, thereby creating an effective barrier against groundwater movement through the sites. An alternative active system could consist of the installation of a series of wells upgradient of each site with each well having its own submersible pump. As with the wellpoint system, groundwater would be pumped out of each well and interconnecting zones of influence would be established to create a barrier against groundwater flow.

The shallow depth to bedrock and the relatively small amount of groundwater flowing through these sites, as identified in Section 2.03, makes the installation of an active system of groundwater control technically feasible. However, these systems rely on mechanical and electrical devices for operation and would have to be operated indefinitely, in order to maintain an effective groundwater barrier. Therefore, with either of these active

systems, high operation and maintenance costs extending over a long period of time may be anticipated. An active system would also necessitate the creation of a discharge point which would most likely require a discharge permit and subsequent monitoring of the discharge.

As previously discussed, a passive system could consist of either a subsurface drain or a groundwater cutoff wall. In order for a drain system to be constructed, a trench would be excavated, upgradient of each burning pad, down to a minimum depth of ten feet below the waste deposits. Filter fabric would be placed in the trench along with a perforated PVC pipe, to drain groundwater away from the site by gravity to a discharge point along Reeder Creek. The trench would then be backfilled with washed stone. It should be recognized that the low relief at the site may preclude the discharge of a gravity drain to Reeder Creek. Further analysis of the creek elevations would need to be made during final design if this option is to be considered further. As with an active system, installation of a gravity drain would require establishing a discharge point, obtaining a discharge permit, and subsequent monitoring of the discharge.

A second type of passive groundwater control system is the installation of a groundwater cutoff wall. The cutoff wall would be installed around the perimeter of each burning pad to provide a vertical barrier against groundwater movement through the site. The wall would extend from a prepared ground surface down to the top of competent bedrock. As discussed in Section 2.03 there is likely to be approximately one foot of weathered material

overlying competent bedrock. By excavating through the weathered material to competent rock, a key between the cutoff wall and rock will be achieved which will prevent migration of groundwater under the wall. The wall would likely be constructed of a soil/bentonite mixture that would have a maximum hydraulic conductivity of 1×10^{-7} cm/sec.

Since a cutoff wall would provide an adequate barrier against lateral movement of groundwater without establishing a discharge point requiring subsequent monitoring, and would not have long term operation and maintenance costs associated with it, this alternative was selected for the purposes of preparing a cost analysis for the in-place containment option.

5.05.03 Control of Percolation

Infiltration of precipitation through the site may result in leaching of contaminants and subsequent migration of the contaminants into the underlying soils and groundwater. Under this alternative the sites would be isolated from percolation of precipitation, and subsequent contaminant transport, by the installation of a low permeability cap.

Prior to installation of the low permeability cover, the two sites would be filled to suitable subgrades using uncontaminated embankment material. Capping would be performed using a combination of natural and synthetic materials. After filling to the desired subgrade was completed, two feet of low permeability soil would be placed and compacted in six inch lifts. Soils suitable for

the use are typically classified as clays and have the following properties:

Soil Property	Criteria
Permeability	1×10^{-7} cm/sec or less
Percent Soil Passing No 200 sieve	Greater than 30
Liquid Limit	Greater than 30
Plasticity Index	Greater than 15

The two foot thick compacted layer of soil would be overlain by a synthetic liner having a minimum thickness of 20 mils. A minimum of six inches of suitable bedding material, such as sand, would overlie the synthetic liner. The bedding material would be topped with a minimum of 12 inches of granular material to serve as a drainage layer. The granular material would be sandwiched between layers of filter fabric to prevent the migration of fine soil into the drainage layer. The final layer of filter fabric would be overlain by a minimum of six inches of topsoil resulting in a capping system with a minimum total thickness of four feet.

Figures 7 and 8 show conceptual cross sections of in-place containment utilizing a groundwater cutoff wall and cap for open burning pads B and H, respectively. The location of the cross sections are indicated on Figures 5 and 6.

Following placement of the topsoil on the cap and surrounding area of disturbance, the area will be seeded with vegetation to control erosion. The selected seed mix will be comprised of species adapted to the region, having a dense, shallow root system, and which are resistant to extremes of wet and dry.

5.05.04 Post Closure Maintenance and Monitoring

When vegetative growth has been established on the cap, long term maintenance will be minimal. A large portion of the maintenance effort would involve mowing the vegetative cover on the completed cap. Periodic inspections should be initiated. The inspector will observe the condition of the cap and the vegetative cover on the cap. No trees, shrubs brush, or deep rooting weeds would be permitted to germinate or establish on the cap. If low growing, deep rooted weeds did come established, a weed control program would be initiated. Inspection of the site would reveal any problems of erosion, insect or rodent damage, and disease or thinning of vegetation which would require correction. If periodic inspections detected areas of vegetation thinning out over time, these areas would require occasional overseeding to keep the cover as dense and uniform as possible. If erosion was detected, additional soil would be applied to prevent further degration of the cap.

The purpose of undertaking monitoring activities is to measure the effectiveness of the remedial program and to ascertain if wastes are being released from the site. Since the contaminant transport is via groundwater, the integrity of an in-place containment remedial action would be monitored by measuring long term changes in contaminant concentrations downgradient from each site. The monitoring program would consist of the installation of one groundwater monitoring well upgradient from each site and three groundwater monitoring wells immediately downgradient from each

site. Sampling of the upgradient wells would serve to establish background parameters for comparison with sampling results obtained from the downgradient wells. All wells would be sampled on a quarterly basis, with samples from the wells in the vicinity of burning pad B being analyzed for the presence of barium, while samples from wells in the vicinity of burning pad H would be analyzed for the presence of lead.

5.05.05 Site Security

The entire Seneca Army Depot is surrounded by an eight foot high chain link fence topped with barbed wire. Entry to and exit from the depot is monitored 24 hours a day by Armed Department of Defense (DOD) personnel. Mobile, internal security police patrol the depot grounds 24 hours a day, 7 days a week, while access to and from the ammunition area which contains the burning pads is controlled by a manned guard post. Further access to the burning pads is controlled by a gate which can be locked.

Security procedures currently in effect form the depot will be sufficient to provide security during construction at the burning pads. Access to the burning pads will be limited to authorized personnel during the closure operation, and the Contractor will be required to adhere to established procedures at the Seneca Army Depot regarding the security of controlled and limited access areas. No additional security procedures beyond those presently in effect will be required during the post closure maintenance and monitoring period.

5.05.06 Safety and Contingency Plans

Because there may be potentially explosive intact materials which escaped demilitarization by burning, personnel safety measures will be implemented. Under an in-place containment option, no cutting would be permitted during capping operations. This will limit disturbance of any unexploded material. The number of people in the area of construction at any one time will be limited to the minimum number necessary for the given activity and all equipment will be required to have fire extinguishers on board. Other measures deemed appropriate will also be undertaken. Detailed procedures will be presented in the Closure Technical Plan prepared in accordance with Annex B. Due to the chemical contaminants present, all individuals entering the construction area prior to capping will be required to wear minimum safety equipment consisting of:

1. hard hat
2. safety glasses and goggles
3. respirators with replaceable filters
4. disposable rubber gloves and boots
5. non porous disposable coveralls

Additional safety equipment required on site will include an emergency eye wash drench shower, fire extinguishers, first aid kits, a self contained breathing apparatus and additional safety equipment deemed appropriate for construction operations. Detailed procedures will be presented in the Closure Technical Plan prepared in accordance with Annex B.

In conjunction with the Safety Plan, a contingency plan will be developed and presented in detail in the Closure Technical Report. The contingency plan will describe as a minimum:

1. Emergency vehicular access.
2. Procedures to evacuate personnel from within the limits of the work area in case of an emergency.
3. Methods of containing fire.
4. Procedures which would be implemented by a contractor in the event of a major health emergency crisis.

5.05.07 Decontamination

All equipment which has been within the limits of the work area where it could have contacted contaminated surfaces will be thoroughly decontaminated prior to leaving the area. Decontamination will consist of a minimum of one wash using steam to remove contaminated solids. Decontamination will be done at a decontamination pad and all liquids generated as a result of equipment decontamination will be collected and hauled to an approved hazardous waste treatment facility. Prior to finalization of the project the decontamination pad will be removed and disposed of at a permitted secure landfill.

5.05.08 Implementation Schedule

It is estimated that all construction activities required under this alternative can be completed in one construction season. An implementation schedule is included as Figure 11. This schedule

indicates that this closure alternative would require 23 weeks to construct. If a contractor was authorized to proceed on April 1 of a given year, construction could be completed within one construction season.

5.05.09 Costs

The total estimated construction cost to implement this alternative is $587,000. A detailed cost estimate is presented in Table 9. This total cost is based on the assumption that groundwater cutoff walls will be installed to a depth of approximately 12 feet around the perimeter of the contaminated area of each burning pad, and the installation of a cap as described in Section 5.05.03 would extend approximately 10 feet outside the cutoff wall. Should testing indicate that it will be necessary to enclose a larger area with a cutoff wall and cap, or should it be necessary to install a groundwater cutoff wall deeper than 12 feet, construction costs would increase proportionally. Table 9 also presents the estimated thirty year post closure maintenance and monitoring costs associated with this alternative. This cost is estimated to be $111,600, bringing the total life cycle cost to $698,600. The maintenance and monitoring costs will occur uniformly over the thirty year post closure period.

5.06 Recommended Closure Method

The recommended closure method is in-place containment utilizing a groundwater cutoff wall and impermeable cap. This method, as described in Section 5.06 of this report, will abate the release of

contaminants from open burning pads B and H by isolating the source of contamination from the surrounding environment. As identified in Section 2.03, additional field work should be performed as part of Annex B to this contract. If in-place containment is the selected remedial alternative, it is recommended that this field work consist of the following:

1. Three additional groundwater monitor wells should be installed around each burning pad (B and H) in the glacial till to confirm and further define groundwater flow patterns and unsaturated thicknesses at these specific sites. These additional wells should be surveyed for location and elevation relative to the existing on-site datum. Additionally, in-situ hydraulic conductivity tests should be completed on all wells to further evaluate local groundwater flow velocities and rates.
2. A single bedrock groundwater monitor well should be installed mid way between the burning pads to confirm that groundwater in the bedrock is not acting to recharge the glacial till. It is estimated that this well will need to penetrate approximately 50 feet of bedrock.

Removal to a secure permitted landfill off site is costly and there may be difficulty in locating a secure permitted landfill willing to accept untreated, potentially undemilitarized waste. Although taking the intermediate step of on-site treatment will render the waste acceptable to a secure permitted landfill, it is a costly operation. While either excavation and removal or excavation, on-site treatment and removal would have the advantage of permanently removing the source of

contamination, both alternatives are more costly than the in-place containment option and require a greater degree of disturbance, handling and transport of potentially reactive and undemilitarized materials, as well as chemical contaminants. The in-place containment alternative affords a higher degree of safety to Government and Contract personnel and the general public.

Based upon the limits of contamination identified in the report, in-place containment is the least costly alternative. Should Annex C sampling and analysis indicate that the aerial extent of contamination is greater than that used for this closure method analysis, the costs for all alternatives would increase proportionally, with in-place containment remaining the least costly. If Annex C sampling and analysis indicates a greater depth of contamination than that used for purposes of this report, both options employing excavation and off-site disposal would increase in cost due to the increased volumes of materials to be handled, while the cost for in-place containment would remain the same. In-place containment has the added advantage of causing the least disturbance to contaminated soil and potentially unexploded materials, thus greatly reducing risks to construction personnel, Seneca Army Depot personnel, and the general public.

Respectfully submitted,

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Tables

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TABLE 1

SUMMARY OF BORING LOG DATA *

Well Number	Depth Drilled	Depth to Rock	Soil Type	Depth to Water (7/6/81)
1	13.0'	12.0	Till	4.3'
2	7.0'	6.5'	Till	3.75'
3	11.0'	9.5'	Till	4.1'
4	10.0'	9.5'	Till	5.85'
5	10.0'	9.0'	Till	Dry
6	9.0'	9.0'	Till	3.0'
7	6.5'	6.0	Till	4.2'

* From Parrat-Wolff Inc.; July 1981

TABLE 2

TYPICAL COMPONENTS OF PEP MATERIALS*

Lead Styphnate

Lead Azide

Tetracene

Nitrocellulose

Nitro glycerine

Sodium Sulfate

Diphenylamine

Antimony Sulfide

RDX[1]

Tetryl

PETN[2]

Aluminum

* Based on typical components of munitions disposed of in the thermal treatment unit as reported in the facility RCRA Part B Engineering Report, SEAD.

[1] cyclotrimethylene trinitramine

[2] pentacrythritol tetranitrate

TABLE 3

SOIL TESTING DATA - BURN PADS B AND H*

Sample No. and Description	EP Toxicity Metals[1] (mg/l)								Explosives[2] (µg/g)					
	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,5-TNT	2,6-DNT	2,4-DNT
4727-009 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	24.6	ND	ND	ND	1.1	ND	ND	1.6	21.0
-010 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9	ND	ND	1.5	6.0
-011 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	6.3	ND	ND	ND	4.7	ND	ND	1.6	6.6
-030 Burn Area B, 0-6 inches	ND	508	ND	ND	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
-031 Burn Area B, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	ND	ND	ND	ND
-032 Burn Area B, 0-6 inches	ND	246	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RCRA Criteria	5.0	100	1.0	5.0	0.02	5.0	1.0	5.0	--	--	--	--	--	--

ND - Not Detected

*Source: Phase 2, Hazardous Waste Management Special Study No. 39-26-0147-83
DARCOM Open-Burning/Open Detonation Grounds Evaluation, Seneca Army Depot,
Seneca, New York, 2-13 May 1982.

(1) Concentration of metals found in leachate extracted from soil sample.

(2) Concentration of explosives in soil sample.

TABLE 4

STATISTICAL ANALYSIS OF GROUNDWATER DATA*

		pH	Spec Cond µMHO	TOC mg/l	TOX mg/l
Background:	mean	7.57	715.69	30.00	0.020
Well #5	std. dev.	0.18	64.23	17.39	0.028
	sample size	16	16	16	16
Downgradient:					
Well #1	mean	7.70	757.50	22.00	0.038
	std. dev.	0.00	2.89	0.00	0.007
	sample size	4	4	4	4
	T-Criterion	2.878	2.552	2.552	2.552
	T-Value	1.331	1.275	-0.902	1.252
	Accept ?	OK	OK	OK	OK
Well #6	mean	7.80	685.00	26.75	0.042
	std. dev.	0.00	4.08	0.50	0.003
	sample size	4	4	4	4
	T-Criterion	2.878	2.552	2.552	2.552
	T-Value	2.396	-0.936	-0.336	1.572
	Accept ?	OK	OK	OK	OK
Well #7	mean	7.60	602.50	26.00	0.038
	std. dev.	0.00	2.89	0.00	0.000
	sample size	4	4	4	4
	T-Criterion	2.878	2.552	2.552	2.552
	T-Value	0.266	-3.452	-0.451	1.234
	Accept ?	OK	OK	OK	OK

*Data based on sampling from January to December 1982 Source: Letter, U.S. Army Environmental Hygiene Agency 16 May 1983 Subject: Groundwater Monitoring Results for Seneca Army Depot, NY

TABLE 5

PRELIMINARY COST ESTIMATE FOR EXCAVATION AND DISPOSAL
BURNING PADS B AND H
SENECA ARMY DEPOT

Work Item	Quantity	Unit Cost	Total Cost
Mobilization/Demobilization	LS	--	$ 55,000
Surface Preparation	11,000 SY	.50	5,500
Excavation	9,000 CY	5.00	45,000
Transportation[1]	450 Truck Loads	1,500.00	675,000
Disposal	9,000 CY	250.00	2,250,000
Backfill	2,000 CY	5.00	10,000
Topsoil and Seed	5,000 SY	2.50	12,500
Safety Program	LS	--	45,000
Decontamination	LS	--	50,000
Subtotal			$3,148,000
Contingency (20%)			630,000
Total Estimated Construction Cost			$3,778,000
30-Year Present Worth Maintenance Cost			0
Total Estimated Present Worth Construction and Maintenance Cost			$3,778,000

Notes:

1) Assumes transportation to and disposal in Niagara County, New York.

2) All costs based on 1984 dollars.

3) Annex C sampling and analysis costs have not been developed in detail and are, therefore, not included. In any case, Annex C costs will be the same for any alternative selected.

TABLE 6

PRELIMINARY COST ESTIMATE FOR EXCAVATION/
ONSITE TREATMENT AND DISPOSAL
BURNING PADS B AND H
SENECA ARMY DEPOT

Work Item	Quantity	Unit Cost	Total Cost
Mobilization/Demobilization	LS	--	$ 55,000
Surface Preparation	11,000 SY	.50	5,500
Excavation	9,000 CY	5.00	45,000
On-Site Treatment			
1) Rental of sorting equipment	LS	--	100,000
2) Manpower to operate sorting equipment (4 men x ten weeks)	40 manweeks	1,000.00	40,000
3) Front end loader and crew for use with sorting equipment	50 days	600.00	30,000
4) Safety program associated with on-site treatment	LS	--	30,000
Transportation[1]	450 Truck Loads	700.00	315,000
Disposal	9,000 CY	100.00	900,000
Backfill	2,000 CY	5.00	10,000
Topsoil and Seed	5,000 SY	2.50	12,500
Safety Program	LS	--	45,000
Decontamination	LS	--	50,000
Subtotal			$1,638,000
Contingency (20%)			328,000
Total Estimated Construction Cost			$1,966,000
30-Year Present Worth Maintenance Cost			0
Total Estimated Present Worth Construction and Maintenance Cost			$1,966,000

Notes:

1) Assumes transportation to and disposal in Niagara County, New York.
2) All costs based on 1984 dollars.
3) Annex C sampling and analysis costs have not been developed in detail and are, therefore, not included. In any case, Annex C costs will be the same for any alternative selected.

TABLE 7

PRELIMINARY COST ESTIMATE FOR EXCAVATION
AND DISPOSAL WITH CAPPING
BURNING PADS B AND H
SENECA ARMY DEPOT

Work Item	Quantity	Unit Cost	Total Cost
Mobilization/Demobilization	LS	--	$ 55,000
Surface Preparation	11,000 SY	.50	5,500
Excavation	9,000 CY	5.00	45,000
Transportation[1]	450 Truck Loads	1,500.00	675,000
Disposal	9,000 CY	250.00	2,250,000
Impermeable Cap	7,000 CY	10.00	70,000
Topsoil and Seed	5,000 SY	2.50	12,500
Safety Program	LS	--	45,000
Decontamination	LS	--	50,000
Subtotal			$3,208,000
Contingency (20%)			642,000
Total Estimated Construction Cost			$3,850,000
30-Year Present Worth Maintenance Cost			60,000
Total Estimated Present Worth Construction and Maintenance Cost			$3,900,000

Notes:

1) Assumes transportation to and disposal in Niagara County, New York.

2) All costs based on 1984 dollars.

3) Annex C sampling and analysis costs have not been developed in detail and are, therefore, not included. In any case, Annex C costs will be the same for any alternative selected.

TABLE 8

PRELIMINARY COST ESTIMATE FOR EXCAVATION/
ONSITE TREATMENT AND DISPOSAL WITH CAPPING
BURNING PADS B AND H
SENECA ARMY DEPOT

Work Item	Quantity	Unit Cost	Total Cost
Mobilization/Demobilization	LS	--	$ 55,000
Surface Preparation	11,000 SY	.50	5,500
Excavation	9,000 CY	5.00	45,000
On-Site Treatment			
1) Rental of sorting equipment	LS	--	100,000
2) Manpower to operate sorting equipment (4 men x 10 weeks)	40 manweeks	1,000.00	40,000
3) Front end loader and operator for use with sorting equipment	50 days	600.00	30,000
4) Safety program associated with on-site treatment	LS	--	30,000
Transportation[1]	450 Truck Loads	700.00	315,000
Disposal	9,000 CY	100.00	900,000
Impermeable Cap	7,000 CY	10.00	70,000
Topsoil and Seed	5,000 SY	2.50	12,500
Safety Program	LS	--	45,000
Decontamination	LS	--	50,000
Subtotal			$1,698,000
Contingency (20%)			340,000
Total Estimated Construction Cost			$2,038,000
30-Year Present Worth Maintenance Cost			60,000
Total Estimated Present Worth Construction and Maintenance Cost			$2,098,000

Notes:

1) Assumes transportation to and disposal in Niagara County, New York..
2) All costs based on 1984 dollars.
3) Annex C sampling and analysis costs have not been developed in detail and are, therefore, not included. In any case, Annex C costs will be the same for any alternative selected.

TABLE 9

PRELIMINARY COST ESTIMATE FOR IN-PLACE CONTAINMENT
INCLUDING A GROUNDWATER CUTOFF WALL AND CAP
BURNING PADS B AND H
SENECA ARMY DEPOT

Work Item	Quantity	Unit Cost	Total Cost
Mobilization/Demobilization	L.S.	--	$ 14,200
Surface Preparation	11,000 SY	.50	5,500
Groundwater Cutoff Wall	16,800 VSF	10.00	168,000
Embankment Material	8,500 CY	5.00	42,500
24" of 1 x 10^{-7} cm/sec Soil	5,300 CY	10.00	53,000
20 mil Synthetic Liner	78,000 SF	.60	46,800
6" of Bedding Material	1,350 CY	6.00	8,100
Filter Fabric	17,400 SY	1.00	17,400
12" of 1 x 10^{-3} cm/sec Drainage Layer	2,700 CY	10.00	27,000
Topsoil and Seed Entire Site	4,600 SY	2.50	11,500
Safety Program	L.S.	--	45,000
Decontamination	L.S.	--	50,000
		Subtotal	$489,000
		Contingency (20%)	$ 98,000
		Total Estimated Construction Cost	$587,000

30 Year Maintenance And Monitoring Cost

1.	Site Inspection and Routine Maintenance	
	a. Inspection - quarterly, 4 mandays/year @ $100/manday	$ 400
	b. Mowing - 4 mowings, 1 mandays/mowing @ 100/manday	400
2.	Groundwater Sampling Collection - 4 trips/year @ $100/trip	400
3.	Laboratory Analyses - 32 samples/year @ $10/analysis	320
4.	Miscellaneous Erosion Control and Grading Work - 1 manday/month @ $100/manday; also $1,000/year for materials	2,200
	Annual Post Closure Maintenance and Monitoring Cost	3,720
	30 Year Maintenance and Monitoring Cost	111,600
	Total Estimated Construction and 30 Year Maintenance and Monitoring Cost	$698,600

Notes

1) All costs based on 1984 dollars.

2) Annex C sampling and analysis costs have not been developed in and are, therefore, not included. In any case, Annex C costs will be the same for any alternative selected.

Figures

O'BRIEN & GERE

FIGURE 1

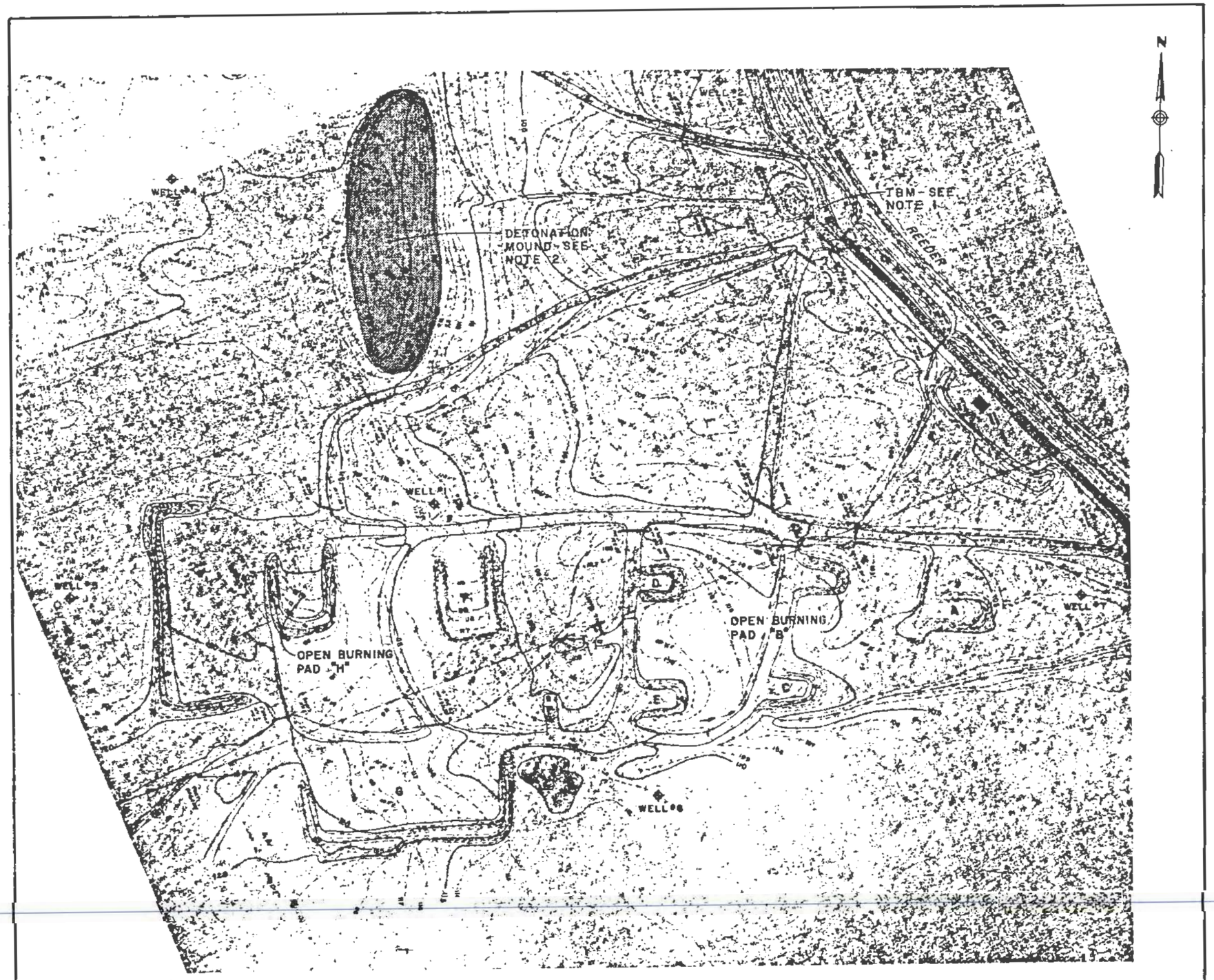
BURNING PADS "B" & "H" CLOSURE
SENECA ARMY DEPOT

LOCATION PLAN

1"=2000' 2000 0 2000 4000

O'BRIEN & GERE

FIGURE 2



1. ELEVATIONS ARE BASED ON AN ASSUMED ELEVATION OF 1000.00 FEET, LOCATED ON THE SILL OF THE EASTERLY CONCRETE ENTRANCE TO DUGOUT AT NORTH END OF PAVED ACCESS ROAD.
2. AREA SHADED IS DETONATION AREA, SUBJECT TO FREQUENT CONTOUR ALTERATION DUE TO BULLDOZING, FILLING, AND EXPLOSION.
3. TOPOGRAPHY PREPARED BY FRANK T. TRIPI AND ASSOC. FOR HIBBARD ENGINEERS.

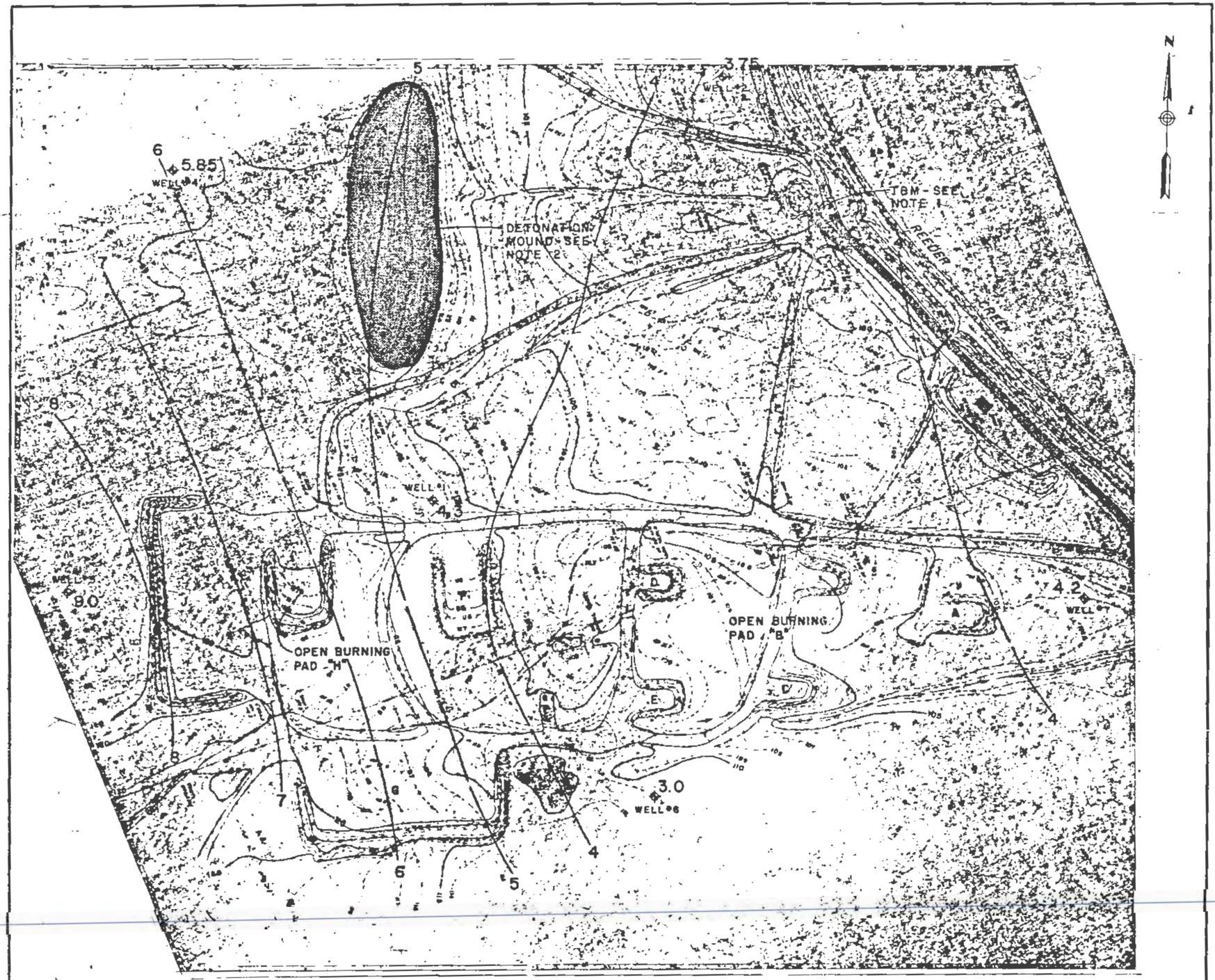
BURNING PADS "B" & "H" CLOSURE
SENECA ARMY DEPOT

SITE PLAN

100 0 100 200

O'BRIEN & GERE

FIGURE 3



1. ELEVATIONS ARE BASED ON AN ASSUMED ELEVATION OF 100.00 FEET, LOCATED ON THE SILL OF THE EASTERLY CONCRETE ENTRANCE TO DUGOUT AT NORTH END OF PAVED ACCESS ROAD.
2. AREA SHADED IS DETONATION AREA, SUBJECT TO FREQUENT CONTOUR ALTERATION DUE TO BULLDOZING, FILLING, AND EXPLOSION.
3. TOPOGRAPHY PREPARED BY FRANK T. TRIPI AND ASSOC. FOR HIBBARD ENGINEERS.
4. UNSATURATED THICKNESS INFORMATION BASED ON 7/6/81 DATA BY PARRATT-WOLFF, INC.

LEGEND

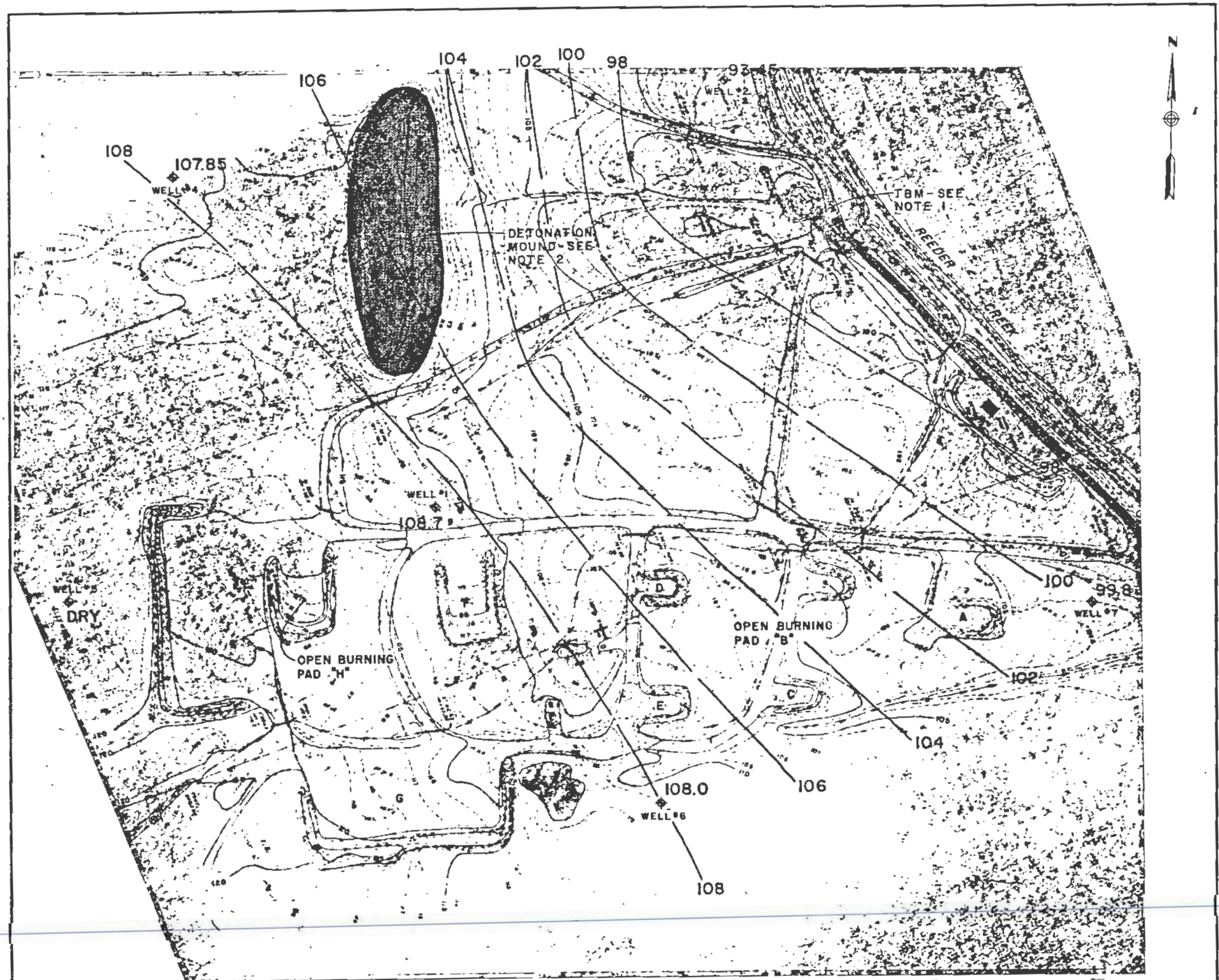
- 4 ——— UNSATURATED THICKNESS CONTOUR (FEET)
- 4.2 UNSATURATED THICKNESS
- WELL #6 GROUNDWATER MONITORING WELL

BURNING PADS "B" & "H" CLOSURE
SENECA ARMY DEPOT

GENERALIZED UNSATURATED THICKNESS MAP

O'BRIEN & GERE

FIGURE 4



1. ELEVATIONS ARE BASED ON AN ASSUMED ELEVATION OF 100.00 FEET, LOCATED ON THE SILL OF THE EASTERLY CONCRETE ENTRANCE TO DUGOUT AT NORTH END OF PAVED ACCESS ROAD
2. AREA SHADED IS DETONATION AREA, SUBJECT TO FREQUENT CONTOUR ALTERATION DUE TO BULLDOZING, FILLING, AND EXPLOSION.
3. TOPOGRAPHY PREPARED BY FRANK T. TRIPI AND ASSOC FOR HIBBARD ENGINEERS
4. INFORMATION BASED ON GROUNDWATER ELEVATION DATA COLLECTED 7/6/81 BY PARRATT-WOLFF.

102 ——— RELATIVE GROUNDWATER ELEVATION CONTOUR

108.7 GROUNDWATER ELEVATION

WELL 6 GROUNDWATER MONITORING WELL

BURNING PADS "B" & "H" CLOSURE
SENECA ARMY DEPOT

GENERALIZED GROUNDWATER FLOW MAP

100 0 100 200

O'BRIEN & GERE

FIGURE 5

LEGEND

- MODERATE MAGNETIC READING
- HIGH MAGNETIC READING
- LIMITS OF SURFACE PREPARATION
- PROBABLE LIMITS OF CONTAMINATION (TO ELEVATION OF 618 FEET AMSL)

NOTE:
TOPOGRAPHY PREPARED BY ERDMAN, ANTHONY, ASSOCIATES, P.C. FOR BUFFALO DISTRICT CORPS OF ENGINEERS, AUG. 1984.

BURNING PADS "B" & "H"
CLOSURE

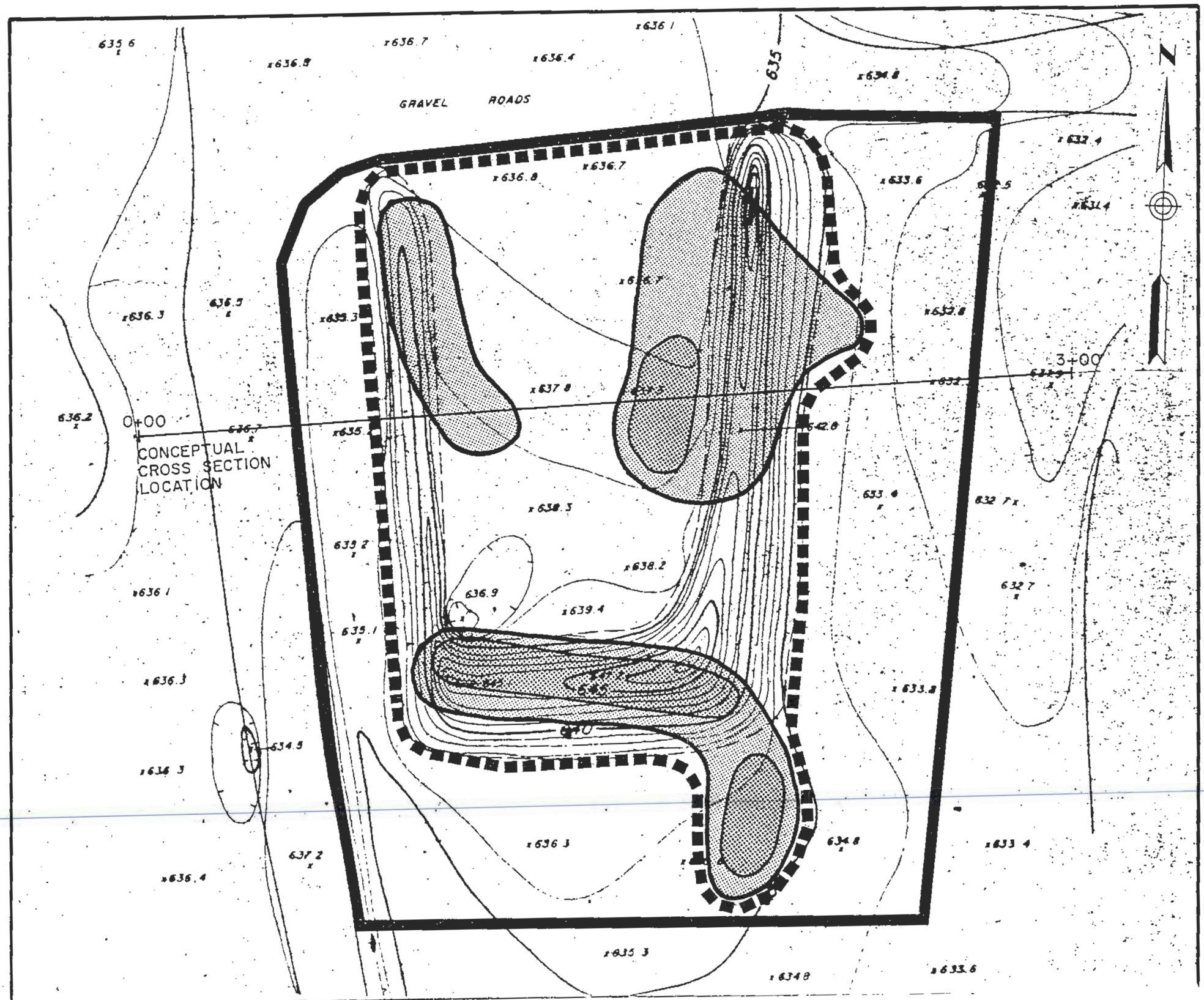
SENECA ARMY DEPOT

OPEN BURNING PAD "B"

1" = 30' 0 30 60

O'BRIEN & GERE

FIGURE 6



LEGEND

- MODERATE MAGNETIC READING
- HIGH MAGNETIC READING
- LIMITS OF SURFACE PREPARATION
- PROBABLE LIMITS OF CONTAMINATION (TO ELEVATION OF 633 FEET AMSL)

NOTE:
TOPOGRAPHY PREPARED BY ERDMAN, ANTHONY, ASSOCIATES, P.C. FOR BUFFALO DISTRICT CORPS OF ENGINEERS, AUG. 1984.

BURNING PADS "B" & "H" CLOSURE

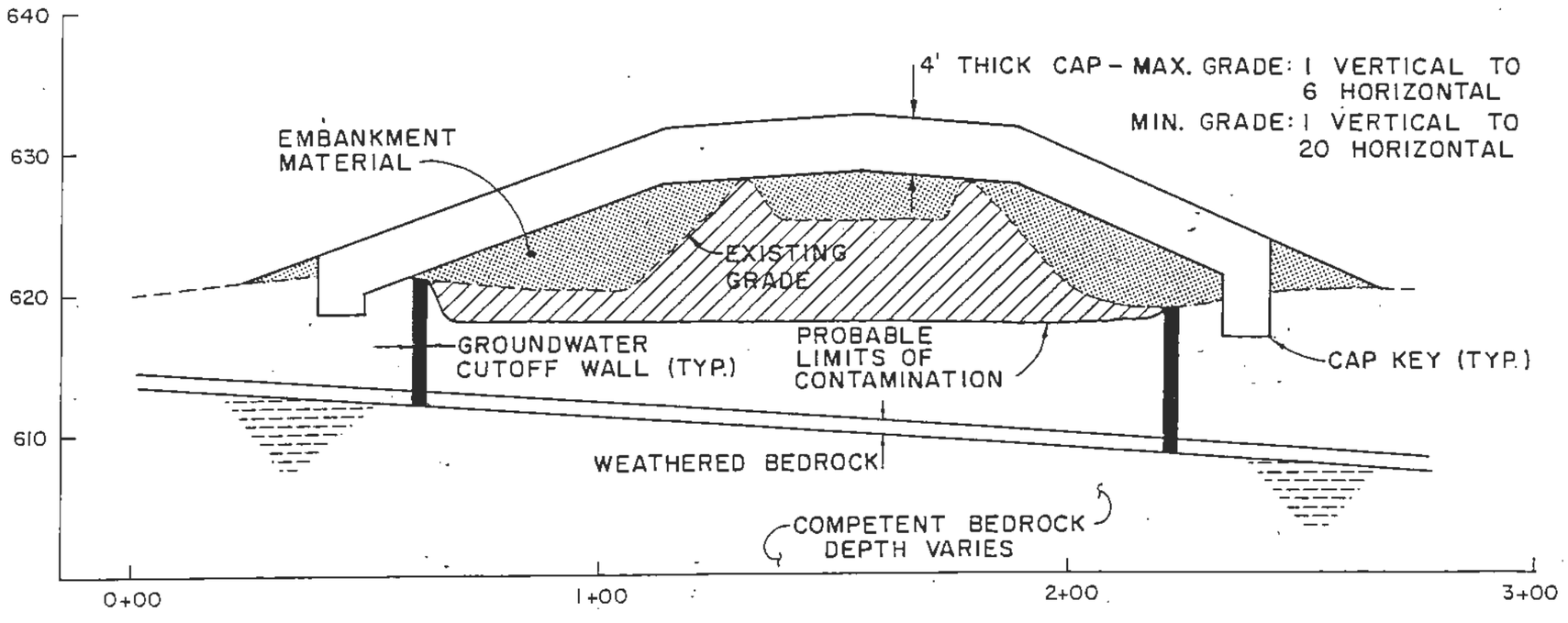
SENECA ARMY DEPOT

OPEN BURNING PAD "H"

1" = 30'

0 30 60

FIGURE 7



SCALE: 1"= 10' VERT.
1"= 30' HORIZ.

BURNING PADS "B" & "H"
CLOSURE

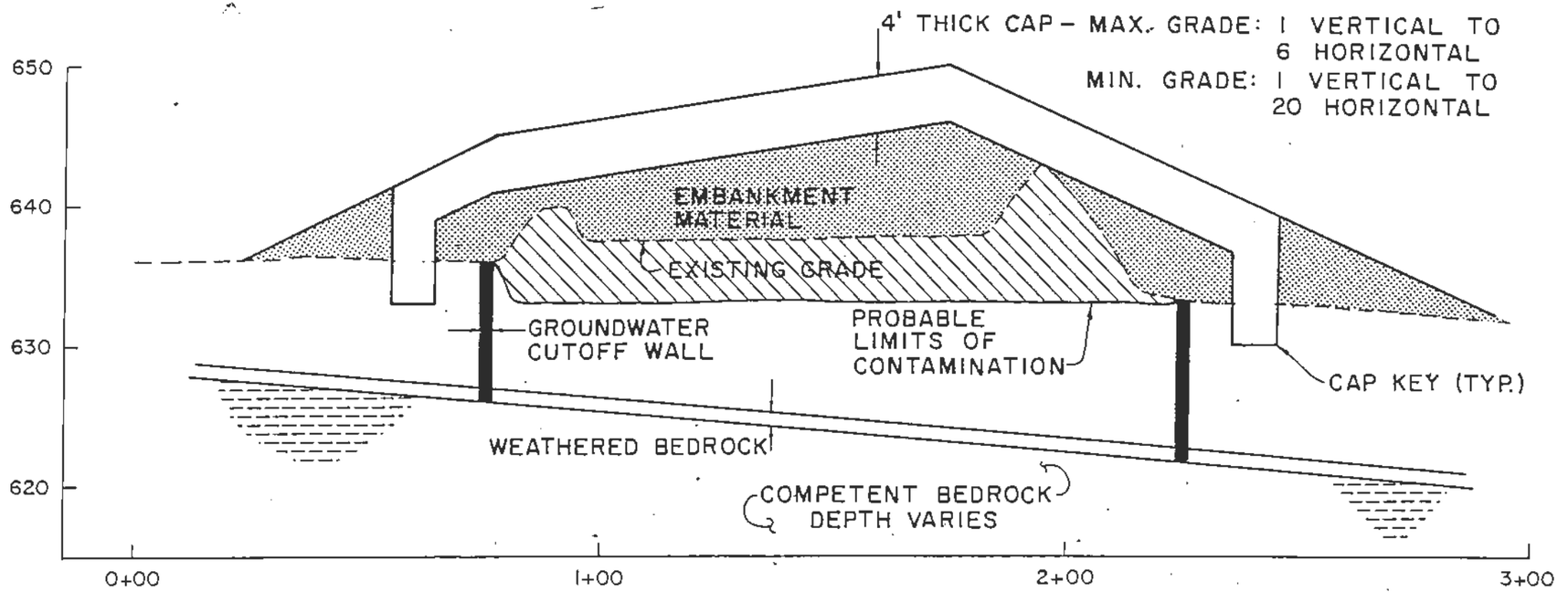
SENECA ARMY DEPOT

OPEN BURNING PAD "B"

CONCEPTUAL
CROSS SECTION
SHOWING IN-PLACE
CONTAINMENT

O'BRIEN & GERE
ENGINEERS, INC.

FIGURE 8



SCALE: 1" = 10' VERT.
1" = 30' HORIZ.

BURNING PADS "B" & "H"
CLOSURE

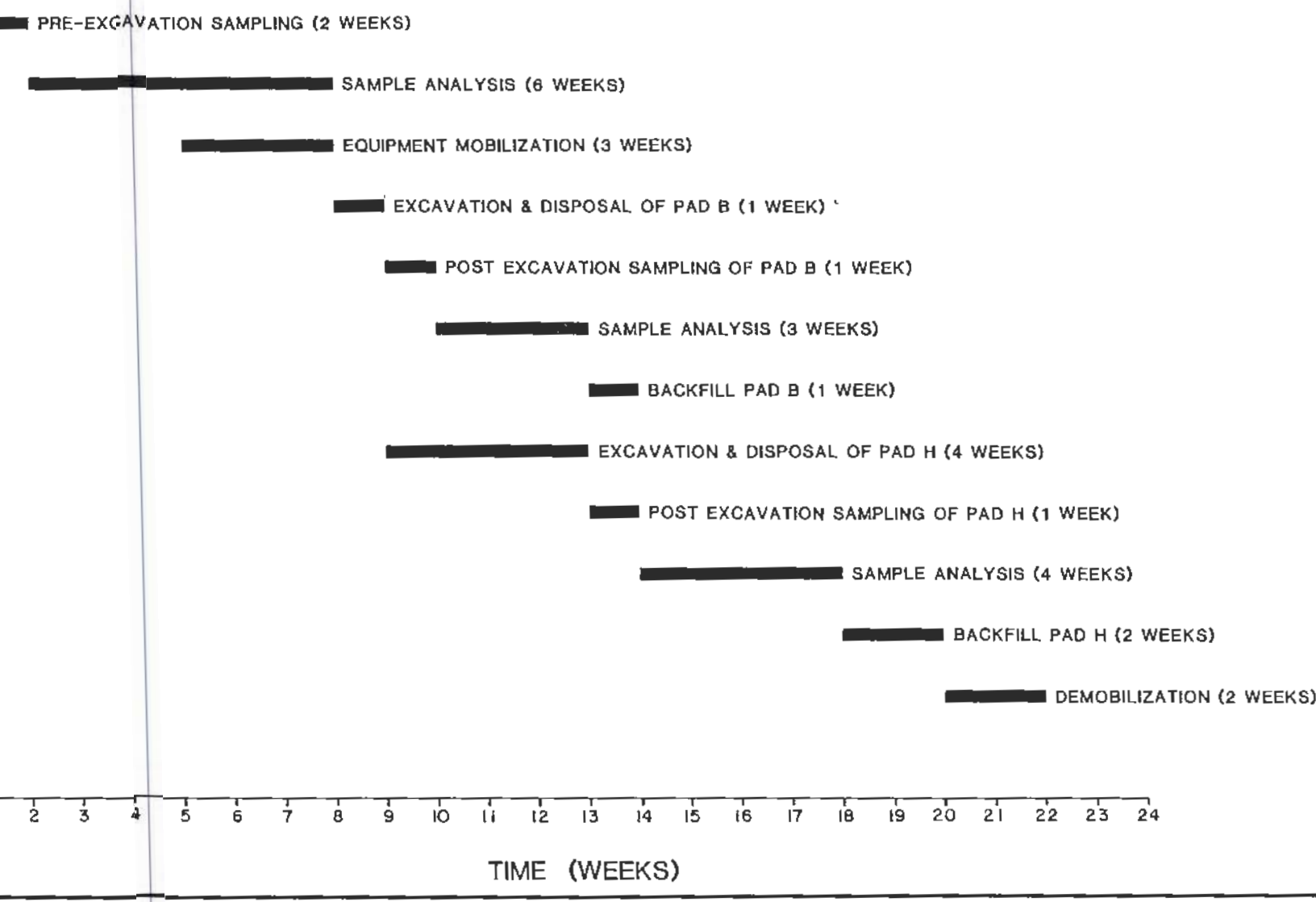
SENECA army DEPOT

OPEN BURNING PAD "H"

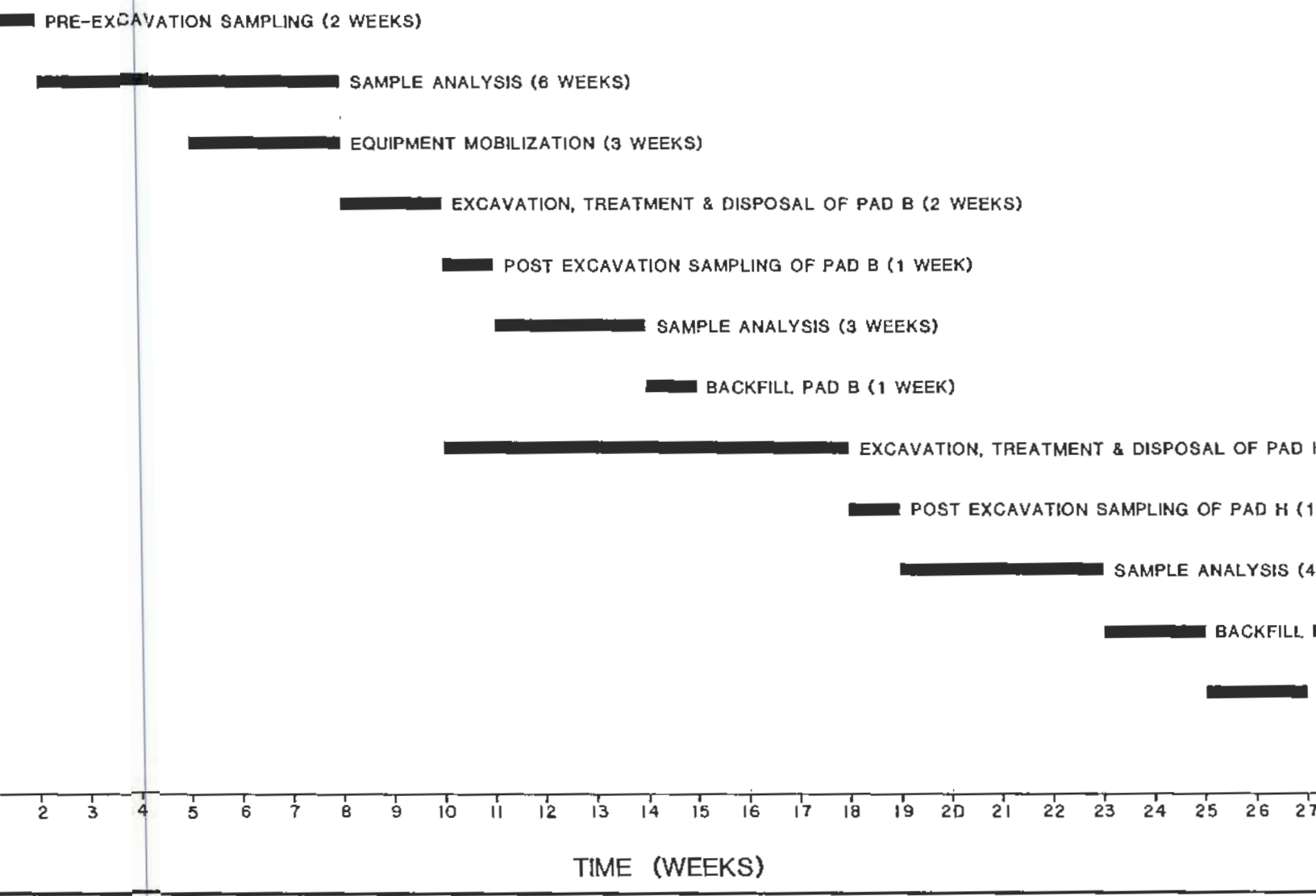
CONCEPTUAL
CROSS SECTION
SHOWING IN-PLACE
CONTAINMENT

O'BRIEN & GERE
ENGINEERS, INC.

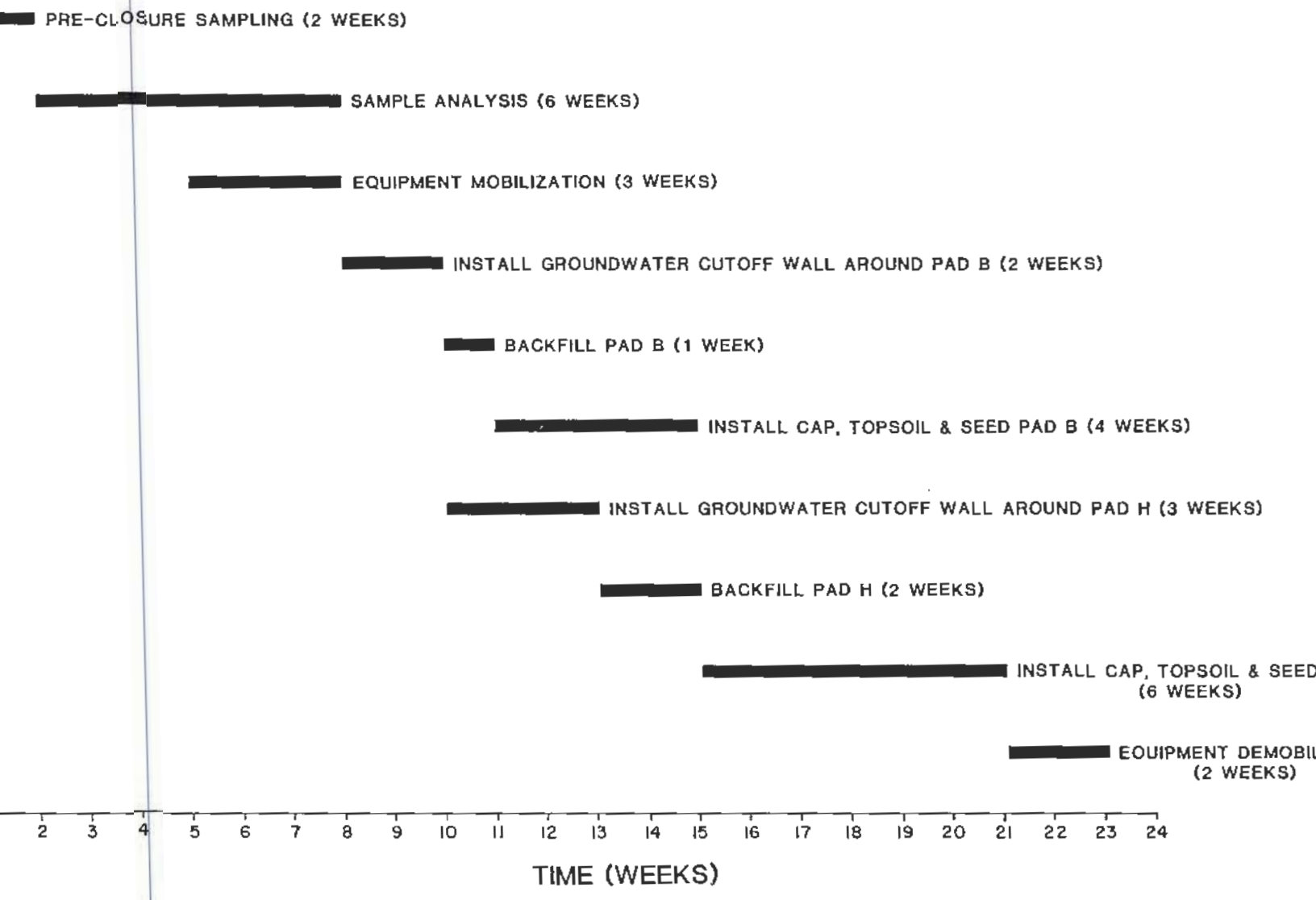
CLOSURE IMPLEMENTATION SCHEDULE
EXCAVATION & DISPOSAL ALTERNATIVE



CLOSURE IMPLEMENTATION SCHEDULE
EXCAVATION, TREATMENT & DISPOSAL ALTERNATIVE



CLOSURE IMPLEMENTATION SCHEDULE
IN-PLACE CONTAINMENT ALTERNATIVE



Appendices

APPENDIX A

"PHASE 2, HAZARDOUS WASTE MANAGEMENT SPECIAL
STUDY NO. 39-26-0147-83
DARCOM OPEN-BURNING/OPEN-DETONATION GROUNDS EVALUATION
SENECA ARMY DEPOT, SENECA, NEW YORK
2-13 MAY 1982

DEPARTMENT OF THE ARMY
U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

Mr. Newell/csp/AUTOVON
584-2024

REPLY TO ATTENTION OF

HSHB-ES-H/WP

14 SEP 1983

SUBJECT: Phase 2, Hazardous Waste Management Special Study No. 39-26-0147-83, DARCOM Open-Burning/Open-Detonation Grounds Evaluation, Seneca Army Depot, Seneca, New York, 2-13 May 1982

Commander
US Army Materiel Development and
Readiness Command
ATTN: DRCSG
5001 Eisenhower Avenue
Alexandria, VA 22333

1. Copies of subject report are inclosed.

2. The information contained in this report is based on a limited number of samples taken for the specific purposes of this study and may not be representative of the total situation at the installation. Therefore, pending promulgation of final environmental standards and complete interpretation of all data, this report should be used for informational purposes only and should not be released to other agencies without your approval.

FOR THE COMMANDER:

Robert R. Waller, MAJ, MSC
for NELSON H. LUND, P.E.
Colonel, MSC
Director, Environmental Quality

1 Incl
as (10 cy)

CF:
HQDA (DASG-PSP) wo incl
Cdr, DARCOM (DRCIS-A)
Cdr, DESCOM
Cdr, HSC (HSPA-P)
Cdr, TEAD (SDSTE-AE)
Cdr, SEAD (2 cy)
Cdr, WRAMC (PVNTMED Actv)
Cdr, MEDDAC, Ft Devens (PVNTMED Actv) (2 cy)
Cdr, AMCCOM [DRSMC-ISE(R)/DRSMC-DS(R)/DRSMC-SG(R)]
C, USAEHA-Rgn Div North

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

REPLY TO ATTENTION OF

HSHB-ES-H/WP

PHASE 2
HAZARDOUS WASTE MANAGEMENT SPECIAL STUDY NO. 39-26-0147-83
DARCOM OPEN-BURNING/OPEN-DETONATION GROUNDS EVALUATION
SENECA ARMY DEPOT
SENECA, NEW YORK
2-13 MAY 1982

1. AUTHORITY. Letter, DRCIS-A/DRCSG, HQ DARCOM, 13 March 1981, subject: Request for Services, Open-Burning/Open-Detonation Grounds, with initial indorsement, HSPA-P, HQ HSC, 20 March 1981.

2. REFERENCES. A list of references is included in Appendix A.

3. PURPOSE AND OBJECTIVES.

a. The overall purposes of the DARCOM Open-Burning/Open-Detonation Grounds Eyaluation are:

(1) To evaluate the status of OB/OD grounds relative to existing Federal hazardous waste regulations (references 1 through 6, Appendix A).

(2) To evaluate the potential for contaminant migration from OB/OD grounds to the ground and surface waters (reference 7, Appendix A).

(3) To determine, based on these evaluations, which OB/OD grounds are the best sites for continued future OB/OD operations.

b. The specific objectives of the SEAD site investigation are:

(1) To determine the total explosive content of soil and residue samples from active OB/OD grounds at SEAD.

(2) To determine if the soil and residues at active OB/OD grounds at SEAD are hazardous wastes by characteristic of EP toxicity for heavy metals content.

(3) To determine the need for additional sampling and analyses of OB/OD areas at SEAD based on results of these data.

4. GENERAL.

a. Abbreviations and Definitions. Definitions of terms and abbreviations used in this report are included in Appendix 8.

b. Personnel Contacted. Installation personnel contacted during this investigation were:

(1) COL Robert J. Hudak, Commander

(2) Mr. T. Battaglia, Environmental Coordinator

(3) Mr. G. Kittel, Chief Engineer

(4) Mr. M. Olschewske, Munitions Supervisor

(5) Mr. J. Jensen, Supervisor, OB/OD Grounds

c. Background. A general background description of OB/OD operations and a discussion of environmental issues related to OB/OD are included in Appendix C.

d. Installation. A general description of SEAD, its location and operations, can be found in reference B, Appendix A.

e. OB/OD Operations. Active OB/OD operations are located in the northwestern part of SEAD, just north of the ammunition disassembly area (see Appendix D). The OB/OD area has been in use since 1941. Items disposed have been principally fuzes; projectiles with TNT, Composition B, and amatol; and explosive-contaminated trash.

f. Sampling. A study team from this Agency visited SEAD in May 1982 (reference 9, Appendix A). The team took a total of 32 samples from the two active OB/OD areas. A summary of sampling procedures is provided in paragraph 3a, Appendix C.

5. FINDINGS AND DISCUSSION.

a. Analytical Data. A summary of the analytical data is shown in the following Table, and a description of findings for each active area follows. Detailed analytical results are contained in Appendix E.

b. Demolition Area.

(1) An analysis of the eight surface soil samples from this area (see Appendix D) showed cadmium in all samples, but at levels below the RCRA minimum of 1.0 mg/L. Explosives were also present in all eight samples, but in very small quantities.

(2) Five of eight soil samples contained measurable concentrations of explosives; the highest value encountered was 61 ug/g of 2,4,6-TNT in one soil sample.

TABLE. SUMMARY OF ANALYTICAL RESULTS

Area Sampled	Explosives Analysis	EP Toxicity Metals Analysis	Remarks
Demolition Area	8 samples - measurable quantities of explosives in all samples; RDX in 5 samples at 1.2-1.7 ug/g; Tetryl in 3 samples at 16.0-32.0 ug/g; 2,4,6-TNT in 3 samples at 1.4-61 ug/g; and 2,4-DNT in 5 samples at 1.1-1.9 ug/g.	8samples - Cd in all 8 samples from 0.16-0.45 mg/L. No other metals were detected in any samples.	Despite the presence of low le of Cd in all samples, they wer hazardous wastes by characteri of EP toxicity.
Burn Areas B through H	24 samples - 1 sample from area F had 9,270 ug/g TNT, 23 ug/g 2,6-DNT, 45 ug/g 2,4-DNT, and 7.0 ug/g RDX. Nineteen other samples had measurable concentrations of explosives all under 50 ug/g total including RDX at 1.0-4.7 ug/g, tetryl at 2.7 ug/g, TNT at 1.1-46.0 ug/g, 2,6-DNT at 1.5-1.6 ug/g, and 2,4-DNT at 1.8-21.0 ug/g.	24 samples - Pb in 5 samples from Areas F and H, with 2 over the hazardous waste limit at 6.3 and 24 mg/L, Ba in 2 soil samples from Area B at 246 and 508 mg/L which are over the hazardous waste limit; Cd in 3 samples from Areas E, F, and G at 0.12, 0.12, and 0.14 mg/L, respectively. No other were detected in any samples.	Two soil samples each from Are and F wer hazardous waste by Ba and Pb content, respectively. other samples were hazardous w by characteristic of EP toxici

c. Burning Ground Area.

(1) Twenty-four soil samples were taken from seven burn pads at the burning ground. These soil samples are all considered surface samples since the native soils in this area average only 6 inches in depth, overlying fractured shale bedrock. Some burn pads are constructed solely of crushed shale.

(2) Two soil samples from burn pad H contained lead at 6.3 mg/L and 24.6 mg/L, which is over the RCRA limit of 5.0 mg/L. Barium in two samples from burn pad B exceeded the RCRA limit of 100 mg/L, with concentrations of 246 mg/L and 508 mg/L.

(3) The RDX was present in 18 of the 24 soil samples, but in trace quantities. The highest concentration of explosives was one sample from burn pad F, with 2,4,6-TNT at 9,270 ug/g. The explosive 2,4-DNT was found in five soil samples; four of these samples had concentrations of 2,4-DNT of less than 22 ug/g, with one sample at 45 ug/g.

(4) Although there are several isolated samples with moderate levels of lead, barium, and 2,4,6-TNT in certain pads at the burning ground, the low number of total contaminated soil samples does not warrant additional sampling at this time.

6. CONCLUSIONS. Based upon the analytical results described in the preceding paragraphs, the following conclusions can be drawn about OB/OD operations at SEAD.

a. The soil samples from the OD areas are not hazardous by characteristic of EP toxicity for heavy metals content.

b. The soil samples from two of the burning ground pads (H and B) */ contain lead and barium, respectively, which are hazardous by characteristic of EP toxicity for heavy metals content.

c. The soil samples from several of the OB/OD areas contain measurable concentrations of explosives, including RDX, tetryl, 2,4,6-TNT and 2,4-DNT within the 6 inches of soil sampled.

d. The relatively low number of contaminated soil samples does not warrant additional subsurface sampling; therefore, no further work is planned at this time.

e. The information contained in this report is based on a limited number of samples taken for the specific purposes of this study and may not be representative of the total situation at the installation. Therefore, pending promulgation of final environmental standards and complete interpretation of all data, this report should be used for informational purposes only and should not be released to other agencies without your approval.

7. RECOMMENDATIONS. Recommendations pertaining to the overall DARCOM OB/OD Grounds Evaluation will be addressed in the final report covering all DESCOM sites to be issued in First Quarter, FY 84.

8. ADDITIONAL INFORMATION. For additional information or assistance, contact the Chief, Waste Disposal Engineering Division, this Agency, AUTOVON 584-2024.

Edward L. Newell Jr.

EDWARD L. NEWELL, JR
Environmental Engineer
Waste Disposal Engineering Division

APPROVED:

Frederick W. Boecher

FREDERICK W. BOECHER
MAJ, MSC
Chief, Waste Disposal Engineering Division

APPENDIX A

REFERENCES

1. Public Law (PL) 94-580, Resource Conservation and Recovery Act of 1976, 21 October 1976.

2. Title 40, Code of Federal Regulations (CFR), 1982 rev, Part 261, Identification and Listing of Hazardous Waste.

3. Title 40, CFR, 1982 rev, Part 262, Standards Applicable to Generators of Hazardous Waste.

4. Title 40, CFR, 1982 rev, Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

5. Title 40, CFR, 1982 rev, Part 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

6. Interim Final Rules, Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, and EPA Administered Permit Programs, 47 Federal Register (FR) 32349, 26 July 1982.

7. Letter, HSE-ES/WP, this Agency, 2 March 1982, subject: Phase I, Hazardous Waste Special Study No. 39-26-0147-82, DARCOM Open Burning/Open Detonation Ground Evaluation, March-November 1981.

8. Installation Assessment of Seneca Army Depot Records Evaluation Report No. 157, January 1980, USATHAMA, Aberdeen Proving Ground, MD.

9. Letter, HSE-ES-T, this Agency, 13 July 1982, subject: Phase II, Hazardous Waste Management Special Study No. 39-26-0147-82, Ravenna Army Ammunition Plant, Seneca Army Depot, Letterkenny Army Depot, 2-13 May 1982.

10. Letter, HSHB-ES/WP, this Agency, 17 May 1983, subject: Draft Interim Environmental Criteria for Open Burning and Open Detonation (OB/OD) Grounds (USAEHA Control No. 39-26-0197-83).

APPENDIX B

ABBREVIATIONS AND DEFINITIONS

BG	burning ground
COR	Contracting Officer's Representative
CWP	Contaminated Waste Processor
demolition range	same as OD grounds, sometimes including OB grounds
detonation	A violent chemical reaction within a chemical compound or a mechanical mixture evolving heat and pressure and which proceeds through the reacted material toward the unreacted material at a supersonic velocity, exerting extremely high pressure on the surrounding medium, forming a propagating shock wave which is originally of supersonic velocity.
disposal	The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.
EPA	US Environmental Protection Agency
EP toxicity	An extraction test to evaluate the leachability of eight different metals from a hazardous waste. The metals are arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), silver (Ag), and selenium (Se).
EWI	Explosive Waste Incinerator
facility	All contiguous land and structures, other appurtenances, and improvements on the land used for treating, storing, or disposing of hazardous waste. For permitting purposes a facility may consist of an entire installation or any part or combination of parts of that installation where treatment, storage, or disposal operations are located (see OB grounds, OD grounds, OB area, OD area, and demolition range).
ground water	Water below the surface in a zone of saturation.

ignitability	A characteristic of solid waste whereby the waste is capable, under standard temperature and pressure, of causing fire through friction, adsorption of moisture, or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it presents a hazard.
leachate	Any liquid, including suspended components in the liquid, that has percolated through or drained from hazardous waste.
OB	open burning
OB area	That area or portion of the facility where open-burning operations are conducted (syn OB-grounds).
OB grounds	That area or portion of the facility where open-burning operations are conducted (syn -OB area).
OD	open detonation
OD area	That area or portion of the facility where open-detonation operations are conducted (syn-OD grounds, demolition range).
OD grounds	That area or portion of the facility where open-detonation operations are conducted (syn-OD area, demolition range).
open burning	Combustion of any material without the following characteristics: (1) Control of combustion air. (2) Containment of combustion reaction in an enclosed device. (3) Control of gaseous combustion product emissions. This definition includes open detonation.
PEP	pyrotechnics, explosives, and propellants
RCRA	Resource Conservation and Recovery Act of 1976

reactivity	A characteristic of a solid waste whereby the waste is: (1) Capable of detonation or explosion if subjected to a strong initiating source or if heated under confinement. (2) Readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.
SEAD	Seneca Army Depot
treatment	Any method, technique, or process designed to change the chemical, physical, or biological character or composition of any hazardous waste so as to recover energy or material resource from the waste, or to render such waste nonhazardous, or less hazardous, or safer to transport.
USATHAMA	US Army Toxic and Hazardous Materials Agency

APPENDIX C

OB/OD BACKGROUND

1. GENERAL.

a. As part of routine operations, the Department of Defense produces, stores, and uses large quantities of munition items commonly referred to as PEP. Each year large quantities of PEP and PEP-related materials must be disposed of as waste. These wastes include manufacturing wastes and residues; items in storage or manufacture which have failed quality assurance tests; out-of-date and obsolete explosives, propellants, and munitions items; and any unsafe munitions items, components, or explosives. Other related wastes include materials which may have become contaminated by contact with PEP during production, storage, and handling.

b. At present, OB/OD of PEP and PEP-contaminated wastes are the safest and most effective means of destroying many items, decontaminating large metal objects, and reducing combustible materials to a smaller volume. The Army has developed an EWI and a CWP for the incineration of PEP and PEP-contaminated wastes. These units are expensive to construct and difficult to operate. Also, due to the size and infrequent, small quantities of some of the wastes requiring open-flame treatment, an EWI or CWP is often impractical or economically unjustifiable. The OB/OD are presently the most economical methods available for disposal of many PEP and PEP-contaminated wastes.

2. REGULATIONS.

a. The RCRA and the regulations promulgated through it (references 1 through 6, Appendix A) set forth standards and guidance for the "cradle to grave" management of hazardous wastes. Under these regulations (reference 2, Appendix A), one of the criteria for designating a waste as hazardous is reactivity, which is defined to include wastes which may detonate from strong initiation or when heated under confinement, and specifically includes "forbidden," "Class A," and "Class B" explosives as specified by the Department of Transportation in 49 CFR. This definition includes most PEP wastes and certain PEP-contaminated wastes.

b. The OB/OD meet the definition of hazardous waste treatment (reference 2, Appendix A). The regulations prohibit the open burning of hazardous waste. However, an exemption is granted for OB/OD of waste explosives and propellants which cannot be safety disposed of by other means (40 CFR 265.832). This exemption is only from the prohibition on OB and does not in any way exempt the facility or its operations from compliance with all other applicable regulations for treaters, storers, and disposers of hazardous waste. The OB/OD is also subject to regulations under the Clean Air Act and may require waivers or permits under existing state air pollution abatement plans.

c. The OB/OD are regulated as a Thermal Treatment process under 40 CFR 265. Under the general facility requirements of these regulations, OB/OD facilities must have waste analysis plans, training plans, inspection plans, contingency plans, closure plans, and comply with recordkeeping requirements. Facilities must also comply with specific quantity distance requirements which parallel those already in use by the Department of Defense.

d. There are presently no 40 CFR 264, Phase II regulations for OB/OD facilities. It is expected, however, that the EPA will eventually issue some type of standards for such facilities. A separate, ongoing project at this Agency is the development of interim standards for DARCOM, consistent with existing regulations which will be applicable to OB/OD facilities.

e. According to the hazardous waste definition (reference 2, Appendix A), residues from hazardous waste treatments are, themselves, considered to be hazardous until proven otherwise. Since the original PEP wastes treated are hazardous by characteristic of reactivity, the residues must also be considered reactive until proven otherwise. It is the explosive content of the PEP wastes which make them reactive, and, though there are presently no established environmental regulatory standards for concentrations of explosive compounds, such materials may present an environmental problem due to their chemical properties. Hence, the amount of explosive in the waste residue should be measured. Also, since many PEP wastes contain toxic heavy metals, there is the potential for some of these metals to be released from the waste to the environment. The waste residues should, therefore, be analyzed for the characteristic of EP toxicity to determine if they are a hazardous waste based on heavy metals content. The incomplete combustion or detonation of a PEP waste could lead to the formation of byproducts. These byproducts will be chemically different from the pure compounds and may not be reactive enough to detonate but, because of their composition, may still present a significant ignitability hazard. Additional testing should, therefore, be performed to determine if the waste residues are, in fact, ignitable.

f. Presently, most OB facilities bury the ash and residues onsite, while the very nature of OD operations causes any residues to be incorporated into the soil. Either of these processes constitutes disposal as defined in 40 CFR 261, and, should the residues be hazardous, the OB or OD area could be construed as a hazardous waste disposal site and subject to regulation as such. Should the residues be nonhazardous, OB/OD areas could still be considered solid waste disposal sites and subject to existing applicable regulations.

g. The main thrust of the Federal hazardous waste regulations is the protection of ground water. Hazardous waste disposal sites are required, under new regulations (reference 6, Appendix A), to install ground-water monitoring systems which will measure the impact of the disposal facility on

the uppermost aquifer. As previously mentioned, there are explosive and heavy metals constituents in PEP wastes which could migrate from the OB/OD facility to the ground water and/or surface water. Analysis of soil and residue samples for EP toxicity (heavy metals leachability) and explosive content, coupled with a knowledge of site geology, will allow for assessment of the potential of any given site to contaminate the ground water due to OB/OD operations.

3. OB/OD STUDY. In order to evaluate the status of OB/OD operations relative to the previously discussed Federal regulations, 27 DARCOM installations were visited and 1,125 soil and residue samples taken to be analyzed for EP toxicity (heavy metals leachability) and total explosive content (reference 7, Appendix A).

a. Sampling.

(1) Samples of soil and residue were taken from all active OB/OD areas at the installations visited. The primary consideration in taking the samples was the safety of the study team.

(2) In order to insure the safety of the study team, soil samples at OB areas were taken with a remotely operated, trailer-mounted drill rig, unless soil characteristics or site conditions were not conducive to drilling and/or drill rig access. Due to physical layout and soil characteristics, some OB areas had to be hand-sampled.

(3) At active OB areas at each sample point, samples were taken of any surface residues present plus soil samples at depths of 0 to 6 inches and 6 to 18 inches. It was felt that this depth of sampling would provide information on the presence of contamination from recent OB operations while limiting the total number of samples requiring analysis.

(4) At OD areas at each sampling point, only surface soil samples were taken and no drilling was done due to the potential for encountering unexploded ordnance in these areas. However, since the OD process violently disturbs the soil at the site, it was felt that surface samples of resettled soil would provide a reasonably homogeneous sample of OD residues.

(5) The actual number and location of samples taken at each OB/OD area was determined onsite by the study team leader, based on the size and configuration of the area, its level of activity, and the variety of materials being open burned and/or open detonated. The individual samples taken are not necessarily representative of the overall situation at any given location. The analyses do, however, represent the range of potential contaminants and concentrations that may be expected at OB/OD areas. The issue of what constitutes a representative sample for determining whether the

residues are hazardous wastes and the OB/OD areas are hazardous waste disposal facilities is presently being investigated and must be evaluated before the final status of OB/OD areas can be resolved.

b. Analysis and Data Evaluation.

(1) The measurement of EP toxicity will determine if the soils and residues are hazardous by that characteristic. However, a conclusion to this evaluation is frustrated by the lack of environmental regulatory standards for concentrations of explosives in soil or water. Therefore, the explosives content data cannot be used directly to determine if the soils or residues are hazardous. There are also insufficient data available on the migration potential of these compounds from the soil to the ground water and/or surface water. A complete evaluation of the total environmental impact of OB/OD operations and their potential effect on ground water will require research and development on the mobility/leachability of explosive compounds leading to the setting of standards for acceptable environmental soil and water concentrations of these compounds.

(2) Evaluation of the soil and residues for reactivity and ignitability is also not possible at this time because there are no available EPA-approved tests for explosive reactivity or solid ignitability. The EPA and USATHAMA are currently working on the development of methods to evaluate explosives reactivity. The EPA is also investigating methods to test solids ignitability. Development of these tests will be essential to the total evaluation of OB/OD residues, and efforts should be made to standardize such tests as soon as possible. A representative group of samples with high concentrations of explosives from each installation is being retained by this Agency and is available for testing, pending standardization.

(3) The compilation of the data discussed above, plus satisfaction of the identified data gaps, will allow for a complete assessment of the status of DARCOM OB/OD facilities relative to existing (and expected) Federal hazardous waste regulations. Such a data base will permit assessment of which sites show the best potential for future continued OB/OD operations.

APPENDIX E

ANALYTICAL RESULTS - SEAD

TABLE E-1. DEMOLITION AREA

Sample No. and Description	EP Toxicity*								Explosives†					
	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
4727-001 Demolition Crater No. 2	ND	ND	0.19	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	1.6
-002 Demolition Crater No. 2	ND	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9
-003 Demolition Crater No. 4	ND	ND	0.16	ND	ND	ND	ND	ND	ND	1.4	1.6	ND	ND	1.9
-004 Demolition Crater No. 4	ND	ND	0.16	ND	ND	ND	ND	ND	ND	ND	32.0	ND	ND	ND
-005 Demolition Crater No. 6	ND	ND	0.17	ND	ND	ND	ND	ND	ND	1.3	16.3	2.2	ND	ND
-006 Demolition Crater No. 6	ND	ND	0.18	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND	1.7
-007 Demolition Crater No. 8	ND	ND	0.17	ND	ND	ND	ND	ND	ND	1.7	ND	1.4	ND	1.1
-008 Demolition Crater No. 8	ND	ND	0.45	ND	ND	ND	ND	ND	ND	ND	ND	61	ND	ND

TABLE E-2. BURNING GROUND AREA

Sample No. and Description	EP Toxicity*								Explosives†					
	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
4727-009 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	24.6	ND	ND	ND	1.1	ND	ND	1.6	21.0
-010 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9	ND	ND	1.5	6.3
-011 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	6.3	ND	ND	ND	4.7	ND	ND	1.6	6.6
-012 Burn Area F, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.2	ND	24.0	ND	1.3
-013 Burn Area F, 0-6 inches	ND	ND	0.12	ND	ND	ND	ND	ND	ND	2.7	ND	46.0	ND	ND
-014 Burn Area F, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.0	ND	9270	23.0	45.0
-015 Burn Area D, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	7.4	ND	ND
-016 Burn Area D, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND
-017 Burn Area D, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND	ND	ND
-018 Burn Area E, 0-6 inches	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
-019 Burn Area E, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND	ND	ND	ND
-020 Burn Area E, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	ND	ND	ND	ND
-021 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND
-022 Burn Area G, 0-6 inches	ND	ND	0.14	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND
-023 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND
-024 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND
-025 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND
-026 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7	ND	6.7	ND	ND
-027 Burn Area C, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
-028 Burn Area C, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND
-029 Burn Area C, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
-030 Burn Area B, 0-6 inches	ND	508	ND	ND	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
-031 Burn Area B, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	ND	ND	ND	ND
-032 Burn Area B, 0-6 inches	ND	246	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE E-3. ANALYTICAL LIMITS*

	As	Ba	Cd	Cr	Hg	Pb	Se	Ag
Detection Limit	0.5	10	0.1	0.5	0.02	0.5	0.1	0.5
RCRA Criteria Limit	5.0	100	1.0	5.0	0.02	5.0	1.0	5.0

* All units in mg/L
† All units in ug/g
‡ Detection limit for all explosives was 1.0 ug/g.
ND - not detected

RODOLFO BONGIOVANNI
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Chief, Chromatographic Analysis Branch
Organic Environmental Chemistry Division

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Radiological and Inorganic Chemistry Division

APPENDIX B

SCOPE OF WORK - ANNEX A

APPENDIX A

ANNEX A

CLOSURE METHOD ANALYSIS

1.0 STATEMENT OF SERVICES

The AE shall perform and complete services as set forth herein to prepare a closure method analysis that will lead to a construction bid package (Annex B) for a fixed price contract for closure of open burning pads B and H located in the Munitions Destruction Area at Seneca Army Depot, NY.

1.1 Detailed Statement of Services.

1.1.1 Scope of Work. The AE shall provide professional design and engineering services, as detailed in this Annex, for the preparation of an engineering report covering the detailed closure method analysis for open burning pads B and H. The analysis shall consist of a technical review of all feasible methods of closure of OB Pads B and H under RCRA of 1976, specifically the facility closure provisions of 40 CFR 265, Subparts F, G and P as applicable, and any applicable State of New York statutes. An economic cost analysis shall be provided for the closure methods required in paragraph 2.2.5.

1.1.2 Facilities to be Addressed. The facilities to be addressed for this contract shall be the open burning pads B and H and associated structures, fences, roads, natural and man-made drainageways and utilities showing in part in reference 7.31 in Appendix A.

1.2 Reference Documents. See Appendix A.

2.0 DESCRIPTION OF WORK

2.1 Background and Records Evaluation.

2.1.1 Regulatory Requirements for Closure and Post-Closure. The AE shall evaluate, reference and cite regulatory requirements for closure and post-closure as presented in 40 CFR 265, Subparts F, G and P as applicable, and any prevailing State of New York Statues for closure and post-closure of open burning pads B and H at Seneca Army Depot, NY.

2.1.2 Review of Existing Closure and Post-Closure Plans. The AE shall evaluate and review the existing closure and post-closure plans for adequacy and compliance with regulations and statues cited in paragraph 2.1.1. The AE shall incorporate and use the existing closure and post-closure plans to the maximum extent possible in the closure method analysis.

2.1.3 Review of Available Data. The AE shall compile, analyze and review all available data in paragraph 1.2, Reference Documents, for this task. The AE shall also compile, analyze and review publications available for this task from the Major Army Commands (MACOMs), US Army Toxic and Hazardous Materials Agency (USATHAMA), US Army Environmental Hygiene Agency (USAEHA) and the Huntsville Engineer Division. Point of contact for each of the Army agencies will be provided by the Contracting Officer.

2.2 Engineering Report.

2.2.1 General. The AE shall develop and provide in the Engineering Report all necessary engineering and technical analysis for the formulation of specifications and detailed plan drawings for the final closure work. The Engineering Report shall contain, as a minimum, a Geohydrological Geotechnical summary, Hazardous Waste Characteristics Analysis, Contamination Analysis and

Method for Closure. The Engineering Report shall be structured so that applicable sections may be incorporated into the construction bid package to the maximum extent possible. All data presented shall be in accordance with State of New York, US Environmental Protection Agency (USEPA) and Department of Transportation (DOT) regulations and the regulations of any/all states through which the wastes will be transported (as applicable). If a state has not assumed interim authorization for hazardous waste management, the Federal Hazardous Waste Management Regulations implementing RCRA of 1976 shall be followed. The AE shall indicate in all applicable contract documents that the contractor shall be responsible for obtaining all necessary permits, insurance, manifests and approvals from federal, state and local authorities, as required, to conduct closure action operations at open burning pads B and H.

2.2.2 Geohydrological/Geotechnical Summary. The AE shall summarize all existing and pertinent geohydrological/geotechnical information reviewed and analyzed in paragraph Background and Records Evaluation. The summary presented shall be pertinent and essential for the formulation of closure methods and for preparation of design specifications and plans.

2.2.3 Hazardous Waste Characteristics Analysis. The AE shall summarize all existing and pertinent hazardous waste sampling and results of analysis reviewed and analyzed in paragraph Background and Records Evaluation. The summary presented shall be pertinent and essential for the formulation of the closure methods and for preparation of design specifications and plans.

2.2.4 Contamination Analysis. The AE shall discuss the environmental effects or potential effects of hazardous waste contamination based upon various Federal and State regulatory and statutory criteria for open burning

pads B and H. The discussion shall be directed toward the optimum method of mitigating immediate and long-term affects, including during post-closure period, based upon available data and applicable regulatory and statutory requirements as tasked in paragraph 2.1, Background and Records Evaluation. The information presented shall be pertinent and essential for the evaluation and formulation of the closure method and for preparation of design specifications and plans.

2.2.5 Methods for Closure.

2.2.5.1 The AE shall develop and present an analysis for the following method for open burning pads B and H.

2.2.5.1.1 Removal/on-site treatment/disposal off-site.

2.2.5.1.2 Removal to secure permitted landfill off-site.

2.2.5.1.3 Capping to minimize hydrodynamic forces.

2.2.5.1.4 Combination of 2.2.5.1.1 through 2.2.5.1.3 listed above.

2.2.5.2 The closure analysis shall address methods, detailed procedures and cost estimates for the following considerations as a minimum: personnel safety, site securities, environmental effects, strategy of excavation, removal and loading operations, temporary storage of hazardous waste, strategy for handling the anticipated mixture of hazardous waste contaminated soil, prevention of transporter leaks on-site and during transport, vehicle decontamination and decontamination verification prior to leaving the site, transport operations, accident and spill emergency procedures on-site and during transport, prevention of rain water access to exhumed sites, transportation routes, modes of transport and required permits/manifests to transport through all states on the transport route.

2.2.5.3 The closure analyses shall also include recommendation for interim actions such as temporary covering or immediate removal to a temporary storage site. Interim actions would have to balance the environmental hazard and schedule against the additional program cost of a recommended temporary action.

2.2.5.4 The analysis of closure shall be complete, thorough and all conclusions and recommendations shall be justified. The cost analysis of closure shall cover, to the extent possible, all itemized costs included in implementing the work. The costs shall be listed in the form of detailed itemized breakdowns and the explanation of the costs shall include the technical state-of-the-art feasibility, risks, regulatory requirements and schedule associated with the closure method. The cost analysis must show life cycle costs and include post closure care and groundwater monitoring.

2.2.5.5 The AE shall recommend the closure method based upon all factors involved. The closure method shall be complete enough so that an independent evaluation can be made.

2.2.5.6 The AE shall assist the installation Commander in obtaining the regulatory approval of the closure method selected and approved by the Department of the Army. The AE shall assist the installation Commander, in technical matters relating to the closure method selected and in meeting with the regulators.

2.2.5.7 The AE shall make recommendations concerning post closure care and groundwater monitoring for the method of closure required to be analyzed in paragraph 2.2.5.1.

2.3 Professional Engineer Certification. The Engineering Report shall be reviewed and sealed by a State of New York registered Professional Engineer employed by the AE.

3.0 SUBMITTALS

3.1 General. All work and services under this Annex A shall be completed by 2 January 1985 and the overall completion date is 31 December 1985. Submittals shall be made in accordance with the following schedule:

3.1.1 Background and Records Evaluation and Engineering Reports.

3.1.1.1 Draft Report - 1 Nov 84.

3.1.1.2 Final Report - 2 Jan 85.

4.0 DISTRIBUTION OF SUBMISSIONS

ADDRESSEE	DRAFT	FINAL
Commander US Army Materiel Development & Readiness Command ATTN: DRCIS-EF and DRCIS-A 5001 Eisenhower Avenue Alexandria, VA 22333	1 copy	1 copy
Commander DARCOM Installation & Services Activity ATTN: DRCIS-RI-IC Rock Island, IL 61299	1 copy	1 copy
Commander Seneca Army Depot ATTN: SDSSE-ADE Romulus, NY 14541	3 copies	3 copies
Commander US Army Engineer Division, Huntsville ATTN: HNDED-PM PO Box 1600 Huntsville, AL 35807	4 copies	4 copies
Director DARCOM Field Safety Activity ATTN: DRXOS-C Charlestown, IN 47111	1 copy	1 copy

ADDRESSEE	DRAFT	FINAL
Chief, DARCOM Security Support Activity ATTN: DRXPX-O Fort Gillem Forest Park, GA 30050	1 copy	1 copy
Commander US Army Environmental Hygiene Agency ATTN: HSHB-ES Aberdeen Proving Ground, MD 20110	1 copy	1 copy
Commander US Army Toxic and Hazardous Materials Agency ATTN: DRXTH-AS Aberdeen Proving Ground, MD 20110	1 copy	1 copy
New York District ATTN: NANEN-NO 26 Federal Plaza New York, NY 10007	2 copies	2 copies
DESCOM ATTN: DRSDS-RM-EF Chambersburg, PA 17201	1 copy	1 copy

pads B and H. The discussion shall be directed toward the optimum method of mitigating immediate and long-term affects, including during post-closure period, based upon available data and applicable regulatory and statutory requirements as tasked in paragraph 2.1, Background and Records Evaluation. The information presented shall be pertinent and essential for the evaluation and formulation of the closure method and for preparation of design specifications and plans.

2.2.5 Methods for Closure.

2.2.5.1 The AE shall develop and present an analysis for the following method for open burning pads B and H.

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2.2.5.1.2 Removal to secure permitted landfill off-site.

2.2.5.1.3 Capping to minimize hydrodynamic forces.

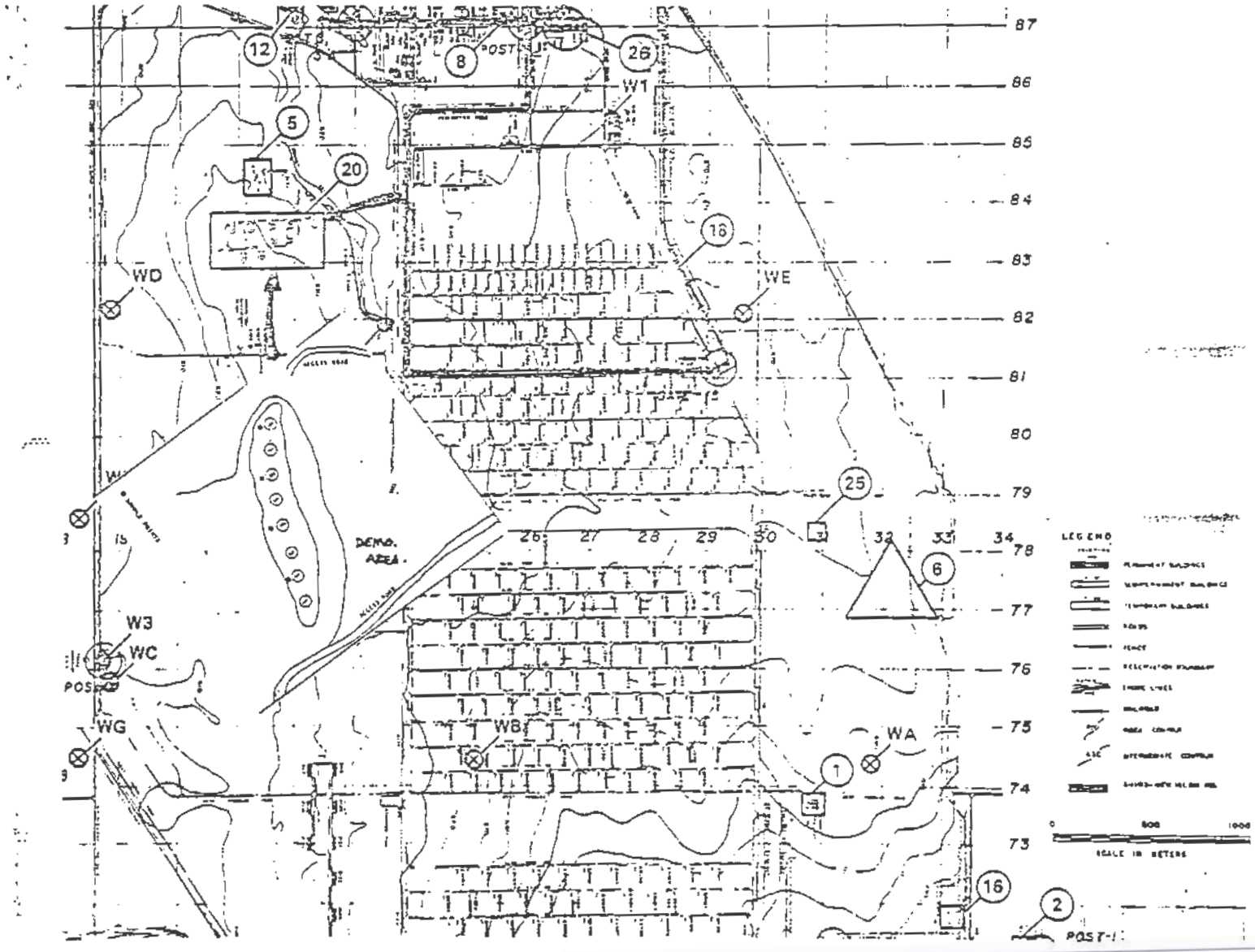
2.2.5.1.4 Combination of 2.2.5.1.1 through 2.2.5.1.3 listed above.

2.2.5.1.5 Closure in Place

2.2.5.2 The closure analysis shall address methods, detailed procedures and cost estimates for the following considerations as a minimum: personnel safety, site securities, environmental effects, strategy of excavation, removal and loading operations, temporary storage of hazardous waste, strategy for handling the anticipated mixture of hazardous waste contaminated soil, prevention of transporter leaks on-site and during transport, vehicle decontamination and decontamination verification prior to leaving the site, transport operations, accident and spill emergency procedures on-site and during transport, prevention of rain water access to exhumed sites, transportation routes, modes of transport and required permits/manifests to transport through all states on the transport route.

APPENDIX D

OB/OD AREAS - SEAD



References

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Title 40, Code of Federal Regulations (CFR), Part 260 EPA General REgulations for Hazardous Waste Management, 1980.

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"Use of the Water Budget Method for Predicting Leachate Generation from Solid Waste Disposal Sites, EPA Publication 530/SW-168.