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NCBC GULFPORT
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LETTER REPORT SUBMITTING ASH STABILIZATION REPORT FOR SITE 8A NCBC GULFPORT MS
11/4/1996
ABB ENVIRONMENTAL

November 4, 1996

Southern Division
Naval Facilities Engineering Command
ATTN: Dan Owens
P.O. Box 190010
2155 Eagle Drive
North Charleston, South Carolina 29418

SUBJECT: Site 8A Ash Stabilization Report
Naval Construction Battalion Center, Gulfport, Mississippi
Navy CLEAN District I Contract Task Order No. 092
Contract No. N62467-89-D-0317

Dear Mr. Owens:

In accordance with the technical directive for CTO No. 92 issued on May 23, 1996, the following letter report is submitted to identify alternatives to secure ash located on Site 8A of the Naval Command Battalion Center (NCBC), Gulfport, Mississippi.

PURPOSE AND SCOPE

This report was prepared using U.S. Environmental Protection Agency (USEPA) guidelines for feasibility studies (USEPA, 1988). The purpose of this report is to identify three options for securing incinerated soil and the associated residual dioxin contamination left over from soil incineration (collectively referred to as ash) at Site 8A in NCBC, Gulfport, Mississippi. The two primary offsite transport mechanisms for the ash are wind erosion and stormwater runoff erosion. In order to secure the ash, both transport mechanisms must be eliminated. Future land-use plans include the continued storage of ash on the site. The systems discussed in this document were assumed to be temporary (5-year life) due to the fact that an alternative use for the site may be identified in the next few years. If an alternative use is found for the site, the temporary system may or may not be incorporated into a long-term management option. Removing the ash from the site was not considered since the underlying soil is believed to be contaminated and would require the same type of erosion control discussed in this report. Thus, initial design criteria were limited to options that met the following:

- is technically feasible,
- has at least a 5-year service life,
- eliminates wind and stormwater runoff erosion of ash,
- is able to withstand hurricane force winds (120 miles per hour [mph]), and
- does not remove ash from the site.

CONCEPTUAL MODEL

Site 8A includes approximately 9.7 acres of land located in the northwest portion of the base (see Figure 1 in Attachment A). Figure 2 (Attachment A) shows the site layout, location of the ash piles, and the three sections. A drainage ditch runs along the center of the site following a northeast to southwest axis. Collected water exits the site via three ditches (1, 2, and 3, respectively). Ditch 2 receives the bulk of the water runoff. Sediment recovery traps have been installed in ditches 1 and 2 to reduce transport of ash offsite. Ash resulting from soil incineration has been placed in piles within the trenches where soil was removed. The ash covers approximately 67 percent of the site, mostly in piles of approximately 20 cubic yards each (ABB Environmental Services, Inc. [ABB-ES], 1995). Because of the site layout and ash distribution, the site has been divided into three separate sections of 175,000 square feet (Section 1), 112,500 square feet (Section 2) , and 225,000 square feet (Section 3).

To date, the site has not been fully characterized for chemical contamination or geotechnical parameters. A full site characterization is currently being planned, and it is recommended that this characterization take place prior to implementing the erosion control systems described herein. If site characterization is performed after installation of the erosion control system, damage or modifications to the erosion control system may result. In addition, soil parameters of the ash (moisture content, bearing capacity, liquid limit, plastic index, etc.) must be obtained prior to designing and implementing an erosion control system at Site 8A. Improper soil conditions could result in damage to or the failure of the erosion control system due to differential settlement and any physical or chemical incompatibilities.

All three erosion control systems evaluated in this report require site grading. The extent of site grading will vary based on the type of erosion control system implemented, soil parameters, and site topography. Current topography of the site was not available in a large enough scale to determine site grading requirements. For the purpose of this report, it was assumed that the ash could be fully graded to roughly 3 feet above the current ground level for each section, if needed. Grading would provide for stormwater runoff to the central drainage ditch running along the northeast to southwest axis (see Figure 3 in Attachment A). Costs for grading the site have not been included since site grading was assumed to be provided by Navy personnel and equipment, and the lack of information on actual site topography and soil parameters makes it premature to determine site-grading requirements at this time.

EVALUATION PROCESS AND CRITERIA

The technical directive identified five evaluation criteria, listed as follows:

- technically feasible
- level of risk reduction
- regulatory benefits and drawbacks
- expected service life
- cost

A technology selection process logic diagram was used to identify and select three initial designs (Figure 4). A list of erosion control systems was divided into three categories: no-site grading, site grading, and site excavation. Since initial criteria limited technologies to those that did not remove ash from the site, site excavation was not considered as an option. The no-site grading option was removed from consideration because the service life of the systems under this category are not expected to meet

the minimum 5-year criteria due to poor drainage and the technical difficulties of installing the systems on uneven ground. Of the remaining systems under the site grading category, three were selected for further evaluation based on technical feasibility, estimated cost, and engineering judgment. These systems are temporary buildings, soil solidification, and a geosynthetic cap.

For each system evaluated, it was assumed that it would completely cover each individual section of the site. A conceptual design was completed and given to outside vendors (see Attachment C) to supply a cost for each system. Costs for these three conceptual designs include capital, freight, and specialized labor costs. Specialized labor includes installation specialists that are required for the correct construction of the designs. The costs presented in this report are for estimating purposes only and do not include local, State, or Federal taxes; unskilled labor; institutional controls (fences, signs, etc.); or license and permit fees. For each individual design, the lowest cost was selected as representative. All cost information obtained for this report is contained in Attachment B.

A risk assessment for the unsecured ash at Site 8 was presented in the delisting petition (ABB-ES, 1996). This risk assessment indicated that excessive lifetime cancer risk levels associated with exposure to the ash were lower than 1×10^{-6} (one in a million) for the four most likely receptors. The four most likely receptors were an adult trespasser, an occupational worker working near the site, a site worker working on the site, and an excavation worker digging into the site. Further risk calculations were not performed for this report.

Applicable rules and regulations (ARARs) pertaining to the construction and implementation of a temporary erosion control system are listed in Table 1 (Attachment C). Based on these ARARs, a permit is not required since the actions covered in this report will take place entirely onsite and are temporary in nature. The guidelines for securing Resource Conservation and Recovery Act waste sites should be followed; however, under the Comprehensive Environmental Response, Compensation, and Liability Act, full reporting and administration requirements are not necessary. This list of ARARs could change with time, so a detailed search of ARARs, and their applicability, should be done prior to the detailed design and implementation of the temporary erosion control system.

EVALUATION OF ALTERNATIVES

Alternative 1 — Temporary Structures Temporary structures would consist of a metal structural skeleton covered with a fabric skin. The structural skeleton could be constructed with either aluminum or steel. Aluminum structures are lighter and do not require permanent footings; however, aluminum is higher in material cost. Steel is lower in material cost but it requires permanent footings (concrete pads). Either structure is capable of spanning distances up to 200 feet, but in order to minimize cost, a multi-span building consisting of several spans placed side by side should be employed. Water runoff from the roof would be collected and routed toward the central site drainage ditch.

The cost for three temporary buildings is based on dimensions of 240 feet wide and 900, 700, and 460 feet long, respectively. Table 2 (in Attachment C) contains the cost data for each of the three buildings and the total price. Each building would consist of three 80-foot-wide spans placed side by side (see Attachment D-1, Temporary Buildings). The structures would be constructed of structural aluminum, and the cover would be made out of 19-ounce, vinyl-coated, translucent polyester fabric (fire resistant). Each building would have 16 fabric access doors.

Installing temporary buildings would require little grading of the site, which would be restricted to areas where the footings of the building are located, and ash movement required for coverage at the

edges of the buildings. All other ash can remain in place without further grading. Chemical characterization of the site could take place after the installation of the buildings without any adverse effects. Installation of the buildings would take approximately 16 days upon arrival of materials onsite. The use of temporary buildings as hazardous waste caps is not a widespread practice, thus regulatory acceptance of this technology may be slow or difficult to obtain.

The building would be constructed by the supplier to be able to withstand hurricane force winds (120 mph). However, flying debris may damage the fabric shell or the structure itself. Site 8A is in a relatively isolated part of the base, but it should be assumed that some damage would result if a hurricane did hit the area. If the building was damaged, the ash containment would be compromised, and the possibility for offsite migration would exist. Under normal conditions, the life of the fabric cover should be in excess of 10 years, and the life of the structure would be much longer. Periodical monitoring (monthly visual walk through) of the buildings should be done in order to ensure cover integrity. The buildings could be incorporated into future uses for the site or they could be moved to a different site.

Risks associated with incidental ingestion, inhalation, and dermal contact would not be lowered for the adult trespasser or the excavation worker (assuming both would be inside the building) since there is no barrier between the loose ash and these receptors. Risks associated with incidental ingestion, inhalation, and dermal contact would be significantly reduced for the site worker and the occupational worker since neither would be working inside the building. If damage to the structure from hurricanes were to occur, the risk reduction due to the temporary building could be eliminated. Of the three erosion control systems evaluated, installation employees face the lowest risk of inhalation, dermal contact, and incidental ingestion because of the limited site grading and speed of installation.

Alternative 2 — Soil Solidification Soil solidification is a process that combines the ash at the site with a binding agent such as Portland cement and water. Solidification would be done *in situ* by a large rototilling machine modified with a cement and water injection system and a dust suppression hood (see Attachment D-2, Soil Solidification). Prior to solidification, the site would have to be graded to design elevations that provide slope for stormwater runoff. The Portland cement and water would be injected into the soil at the same time the soil is mixed in a 5 to 10 percent weight ratio of cement to soil (e.g., 10 pounds of cement per 100 pounds of soil mixed for a 10 percent weight ratio). This produces a loosely packed moist cement mixture that is then compacted into a smooth, hard shell by a steel wheeled roller. This treatment will solidify approximately the top 12 inches of ash (solidified cap) and does not solidify any ash below this. The result is a hard flat surface resembling a pavement covering the site. A pilot test is recommended to determine the correct ratio of Portland cement and water to ash required for this site. Institutional controls (fences, locks, and warning signs) should be installed at the sight to reduce human contact with the site.

The cost of this type of system is based on solidifying 19,000 cubic yards of ash and is presented in Table 3 (Attachment C). The price includes all labor, equipment, materials, and 2,850 tons of Portland cement. This cement was estimated by assuming each cubic yard of soil weighs 1.5 tons. Thus, 19,000 cubic yards of soil weighs 28,500 tons. Assuming a 10 percent dosage of cement, 2,850 tons of Portland cement are required.

Solidification would be hurricane proof and would not require additional treatment of the site after packing. In addition, this system may be used by future designs as a subase for a load bearing surface, depending upon the soil parameters of the ash. The life of the solidified layer would be well in excess of the 5-year life required by this study. Movement of dioxin bound in the solidified layer of the site

would be eliminated, and it would be unlikely (given proper site grading and maintenance) that loose ash below the solidified layer would be exposed to wind or water. The vendor of this technology indicated that solidification of soils containing metals had been accepted by Mississippi State regulatory agencies, and that treatment of dioxins would be essentially identical.

Soil solidification would require specialized equipment and an operator. Preliminary estimates indicate that it would take about 20 working days to install the solidified cap. Once installed, the solidified cap would become part of the hazardous waste at the site because it is directly mixed with the ash in a 5 to 10 percent weight ratio. This increase in waste volume and weight may cause increased costs for future uses or treatment methods at the site. Periodical monitoring (quarterly visual site walkovers) of the site would be required to insure the integrity of the solidified layer.

Risks associated with incidental ingestion and inhalation would be significantly reduced for the adult trespasser, occupational worker, and site worker since ash erosion has been controlled. There would be no reduction in risk for the excavation worker, since this person would be digging into and below the solidified ash. Of the three erosion control systems evaluated, the soil solidification installation employees face the highest risk for incidental ingestion, inhalation, and dermal contact due to dust generation during installation.

Alternative 3 — Geosynthetic Cap A geosynthetic cap consists of a nonpermeable membrane placed over each section of Site 8A. The site would require grading to provide groundwater runoff drainage. Once the site was graded, the cap would be placed over each section and anchored down. Several alternative materials are available for a geosynthetic cap: geomembranes (polyvinyl chloride, high density polypropylene, composite plastics, etc.), specialty geosynthetic membranes (sprayed on rubberized asphalt), or geosynthetic clay membranes (bentonite mats). Geomembranes would require the welding of the plastic sheets together to form a continuous cover over the site. Depending on the material and vendor, the welds might be done onsite or offsite. The specialty geosynthetic membrane would be sprayed over a reinforcing fabric onsite to yield a single piece cap. Geosynthetic clay membranes are made of a naturally sealing clay material and do not require welding. Of the three geosynthetics listed above, only the geosynthetic clay membrane will resist leaks due to punctures and tears.

Geosynthetic caps are susceptible to lifting or blowing away due to wind forces. An anchoring system, including cables staked around the edges, sand bags, tires tied together with ropes, soil fill (clean fill, sand, bauxite, etc.), or a combination of the above, are used to keep the cap in place. The edges of the cap are buried in a trench to further anchor the cap. Since bauxite is readily available at the site, it was assumed that the anchoring system would be a layer of bauxite approximately 1-foot thick in 10-foot-wide strips on 50-foot centers. Some geosynthetics may require a protective fill (3-inch layer of fine sand) before the bauxite is placed on the cap.

The cost for the three geosynthetic caps is based on dimensions of 250 feet wide and 900, 700, and 450 feet long, respectively. Prices were obtained for several different geosynthetic caps and the lowest cost alternative was found to be a 40-milli-inch high density polyethylene (HDPE) geomembrane. Table 4 (in Attachment C) contains the cost data for all three sections and a total price. A protective fill layer between the geomembrane and bauxite anchoring layer may be necessary. Once the mat is rolled onto the site and installed the anchoring system would be placed over the cap.

The geosynthetic cap would be anchored to resist hurricane force winds and would not require any additional treatment after the system is in place. The membrane may be used in some future designs at

this site; however, it would probably result in increased costs. The life of the material would be well in excess of the 5-year lifetime required by this study. During the life of the cap, movement of the dioxin due to wind and stormwater runoff would be eliminated. This technology has been accepted by State regulatory agencies for hazardous waste and municipal landfill sites and is probably the most familiar technology to regulatory agents.

Installing the geosynthetic cap would require specialized welding machines and vendor representatives to supervise installation and guarantee performance. Installation would take approximately 10 to 15 days depending on the number of unskilled laborers and available equipment. Once installed, the mat would become part of the ash waste, which may result in increased costs for future uses or treatments. Periodical monitoring of the site would be minimal due to the anchoring system. The site should be monitored (semiannual visual inspection) to ensure the integrity of the anchoring system and site drainage pathways.

Risks associated with incidental ingestion, inhalation, and dermal contact would be significantly reduced for the adult trespasser, the occupational worker, and the site worker. Risks associated with incidental ingestion, inhalation, and dermal contact would not be reduced for the excavation worker, since this receptor would be digging below the geosynthetic cap. Installation employees face a lower risk of inhalation, dermal contact, and incidental ingestion due to the minimal activity associated with rolling the geosynthetic cap out.

CONCLUSION

This study was performed to identify three erosion control systems that could stabilize the ash currently placed on Site 8A of NCBC Gulfport and would meet the following selection criteria:

- is technically feasible,
- has at least a 5-year service life,
- eliminates wind and stormwater runoff erosion of ash,
- is able to withstand hurricane force winds (120 mph), and
- does not transport ash offsite.

The identified erosion control systems that could meet these criteria were soil solidification, temporary structures, and a geosynthetic cap. Additional criteria were evaluated for each of the three systems and are included in Table 5 (Attachment C) along with the initial selection criteria and applicable ARARs.

Based on this study, all three erosion control systems could be effectively implemented at the site. Unfortunately, due to their weakness in hurricane conditions and relatively high cost, temporary buildings do not present themselves as a good choice for this application. Based on the criteria listed in the technical directive — technical feasibility, level of risk reduction, regulatory benefits, expected service life, and cost — the geosynthetic cap would be the best erosion control system of the three evaluated.

It should be noted that parameters other than those listed in the technical directive may affect the final system choice and design. A combination of the systems evaluated above or other systems outside the scope of this study may result in maximum effectiveness. Furthermore, more exact information such as site characterization, site topography, and soil parameters may result in additional selection criteria that may shift the selection process to a new result.

While this study was limited to temporary actions at Site 8A, it is strongly recommended that any temporary action taken at the site be easily integrated into the final actions taken towards site closure.

Sincerely,

ABB ENVIRONMENTAL SERVICES, INC.

Penny Baxter, P.G.
Task Order Manager

Eric Ironside
Engineer

[08504.032]

c: Gordon Crane, NCBC Gulfport
Art Conrad, Southern Division, Naval Facilities Engineering Command
Penny Baxter, ABB-ES
Bob Fisher, ABB-ES
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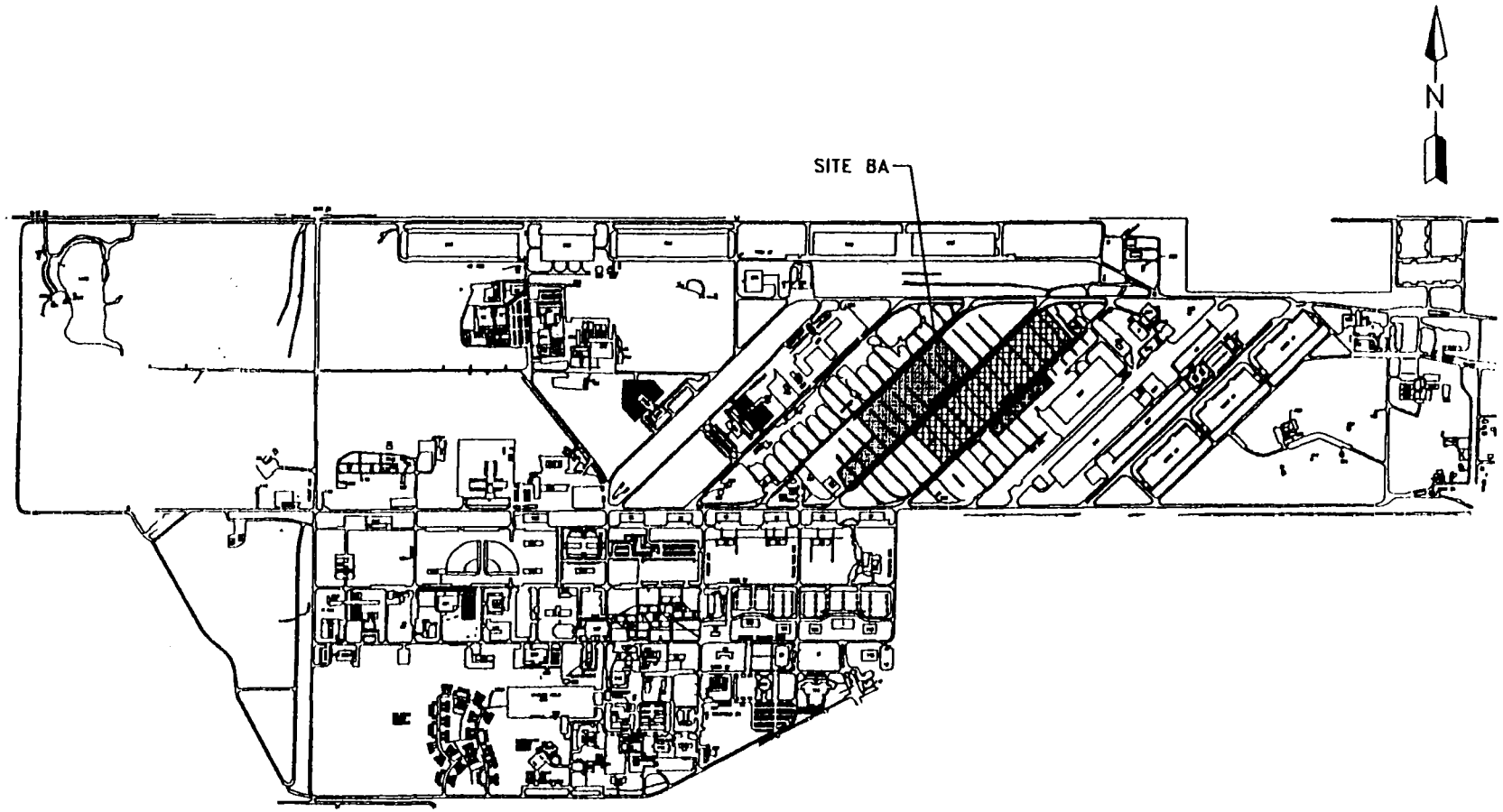
Attachments

ATTACHMENT A

FIGURES



0 800 1600

SCALE: 1 INCH = 1600 FEET

FIGURE 1

LOCATION OF FORMER HERBICIDE ORANGE STORAGE AREA SITE 8A

SITE 8A
ASH STABILIZATION REPORT

NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI

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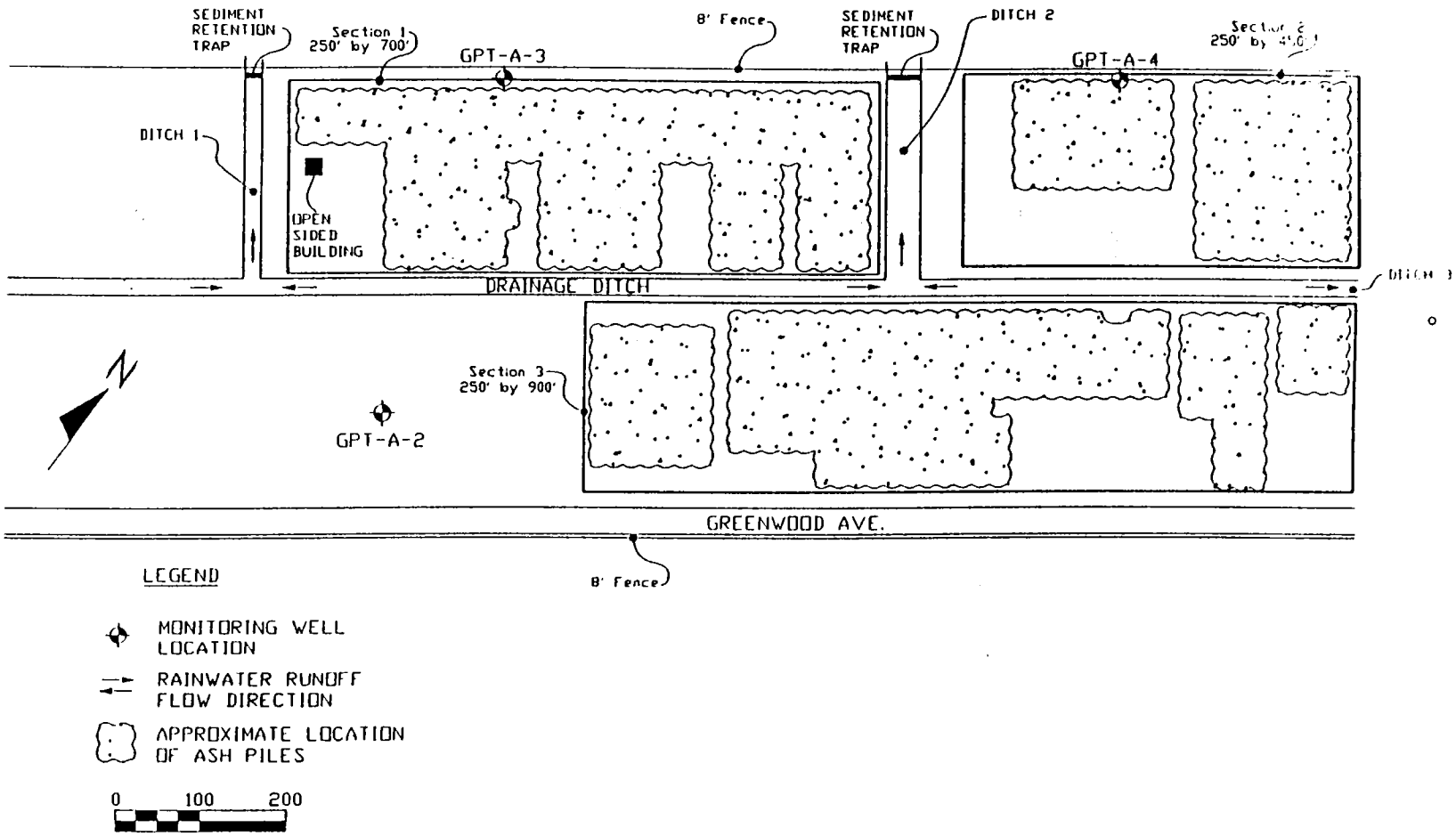


FIGURE 2

SITE 8A LAYOUT

SITE 8A ASH STABILIZATION REPORT

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

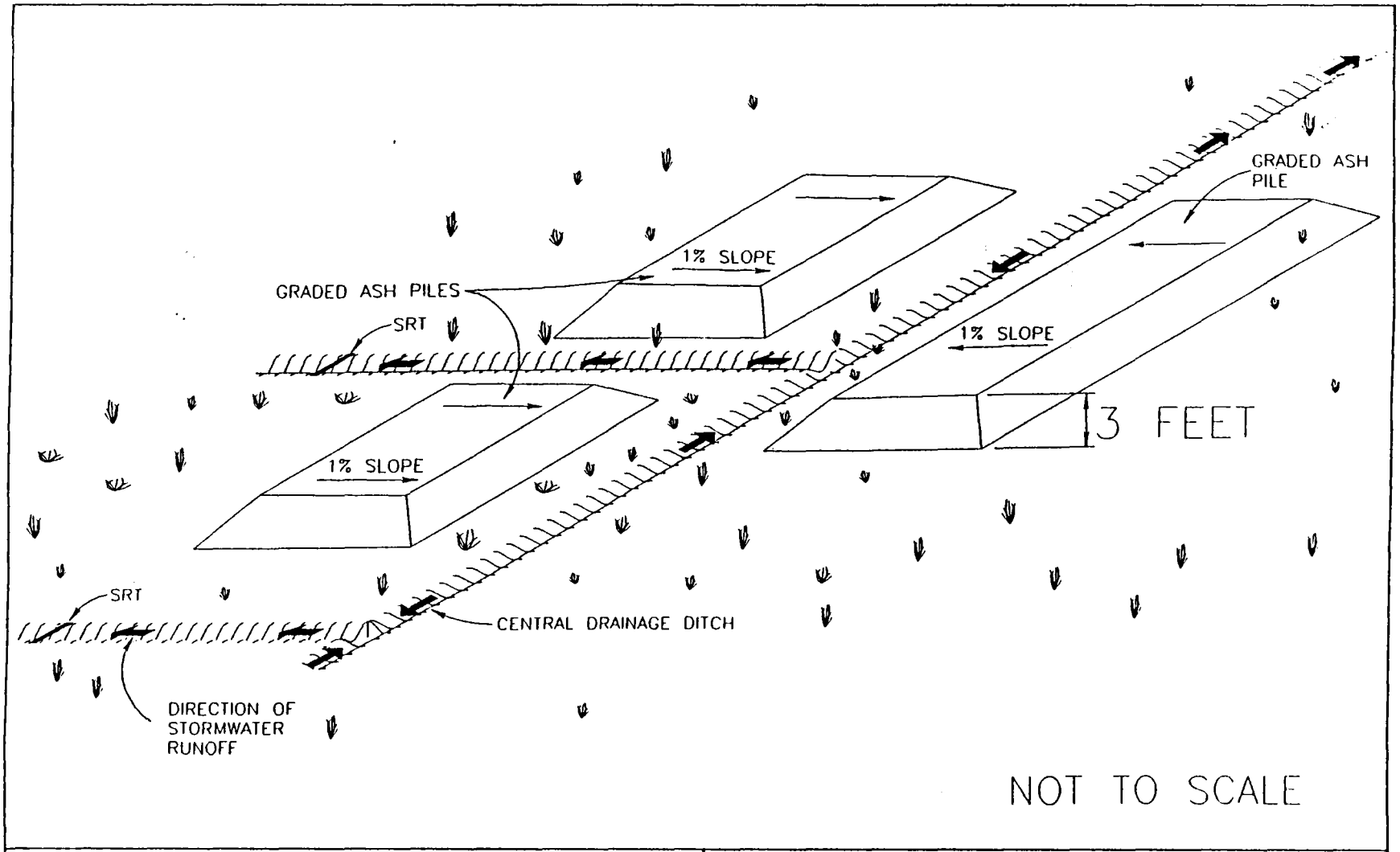
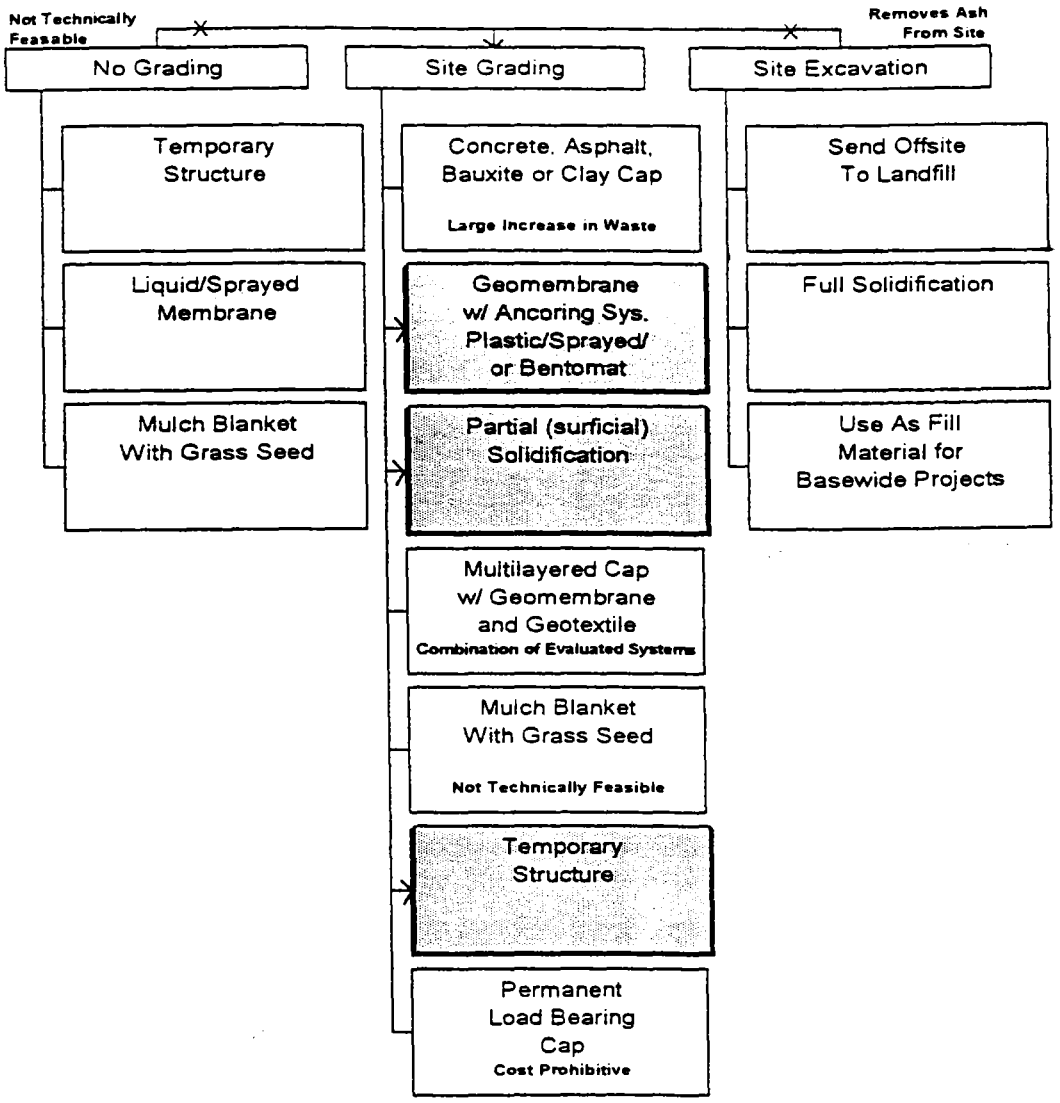


FIGURE 3

SITE 8 GRADING PROFILE

SITE 8A ASH STABILIZATION REPORT

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI



Legend

X = was not considered.

Shading indicates erosion control technologies evaluated in this study.

FIGURE 4

TECHNOLOGY SELECTION PROCESS LOGIC DIAGRAM

SITE 8 ASH STABILIZATION REPORT

NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

ATTACHMENT B

COST INFORMATION

ATTACHMENT B
COSTS

Naval Construction Battalion Center
Gulfport, Mississippi

Soil Solidification

Total amount of soil to solidify = 19,000 cubic yards.
Cost to solidify soil = $19.50/cubic yards

Mobilization =	10,200
Demobilization =	10,200
Solidify soil = 19.50 x 19,000 yards^3 =	370,500
Soil solidification total =	**$390,900**

Temporary Buildings

Building 1 (240 by 900 feet)

Purchasing price =	1,696,200.00
Freight =	18,200.00
Technical representative ($350 per day x 15.5) =	5,425.00
Subtotal	$1,719,825.00

Building 2 (240 by 700 feet)

Purchasing price =	1,345,700.00
Freight =	16,800.00
Technical representative ($350 per day x 15.5) =	5,425.00
Subtotal	$1,367,925.00

Building 3 (240 by 460 feet)

Purchasing price =	895,974.00
Freight =	15,400.00
Technical representative ($350 per day x 15.5) =	5,425.00
Subtotal	$916,799.00

Temporary Building Total = .. $4,004,549.00

Plyex 210. - 40 mil HDPE geomembrane

Comes in 1-acre panels (208.7 by 208.7 feet)
Freight and material costs = \$0.23 per square feet (ft^2)

Section 1 = 175,000 ft^2 x \$0.23/ft^2 = ... \$ 40,250.00
Section 2 = 112,500 ft^2 x \$0.23/ft^2 = ...25,875.00
Section 3 = 225,000 ft^2 x \$0.23/ft^2 = ... 51,750.00
Material total = ...\$ 117,875.00

Seam welding = \$2,000/day/person
8 days required = \$2,000/day/person x 8 days x 2 people = \$32,000

Total Material =..... 117,875.00
Total Labor =..... 32,000.00
Total Cost =.....\$149,875.00

Note: If punctured, this will leak (not self sealing) and will need to be patched.

Claymax 200R - Bentonite Mat

Comes in 13-foot-wide rolls, rolls overlap 6 to 12 inches
Freight and material costs = \$0.28/ft^2

Section 1 = 175,000 ft^2 x \$0.28/ft^2 = ... \$ 49,000.00
Section 2 = 112,500 ft^2 x \$0.28/ft^2 = ...31,500.00
Section 3 = 225,000 ft^2 x \$0.28/ft^2 = ...63,000.00
Material Total = ...\$ 143,500.00

Installation Oversight = \$0.07/ft^2

Section 1 = 175,000 ft^2 x \$0.07/ft^2 = ... \$ 12,250.00
Section 2 = 112,500 ft^2 x \$0.07/ft^2 = ... 7,875.00
Section 3 = 225,000 ft^2 x \$0.07/ft^2 = ...15,750.00
Labor Total = ... \$ 35,875.00

Total Material = ...\$143,500.00
Total Labor = ... 35,875.00
Total = ...\$179,375.00

Note: Mat is self sealing, no welding or patches required.

Liquid Boot - Rubberized Asphalt Emulsion

4-ounce nonwoven geotextile is rolled over graded site.
Liquid rubberized asphalt emulsion sprayed over geotextile (80 mil)

Geotextile cost	= $0.45/ft^2
Liquid boot cost	= $0.65/ft^2
Freight cost	= $0.07/ft^2
Total	**= $1.17/ft^2**

Section 1 = 175,000 x $1.17/ft^2 = ...$204,750.00
Section 2 = 112,500 ft^2 x $1.17/ft^2 = ... 131,625.00
Section 3 = 225,000 ft^2 x $1.17/ft^2 = ... 263,250.00
Material and Freight Total = ...$599,625.00

Labor = $0.11/ft^2 x (175,000 ft^2 + 112,500 ft^2 + 225,000 ft^2) = $ 56,375.00

Material and Freight Total = ...$599,625.00
Labor Total =..... 56,375.00
Total =.....$656,000.00

Note: If punctured, this will leak (not self sealing) and will need to be patched.

Anchoring Systems for Geosynthetic Cap

Note: Costs for transport to site not included. Assuming 12-inch layer of fill in 10-foot-wide strips on 50-foot intervals (92.6 yds^3/strip x 39 strips = 3,600 yd^3 total)

Costs for other anchoring systems were not obtained.

Bauxite

Already on base.

No. 67 Gravel

$11.15/ton x 1.33 tons/yd^3 = $14.87/yd^3
$14.87/yd^3 x 3,600 yd^3 = $53,532.00

No. 57 Limestone

$14.00/ton x 1.33 ton/yd^3 = $18.67/yd^3
$18.67/yd^3 x 3,600 yd^3 = $67,212.00

ATTACHMENT C

TABLES

Table 1
Applicable Rules and Regulations

Site 8 Ash Stabilization Report
Naval Construction Battalion Center
Gulfport, Mississippi

Applicable Rules and Regulations (ARARs)	ARAR Summary	Effects On Site
29 CFR Part 1910	Provides fundamental requirements to ensure worker safety on site	All work on site, such as the grading of the ash piles, would have to be conducted in accordance with these rules
OSHA [29 CFG Part 1904]	Recording and Reporting Occupational Injuries and Illnesses	Provides recordkeeping and reporting requirements for enforcement of the Act and for developing information regarding the causes and prevention of occupational illnesses. All work on site must be conducted in accordance with these rules.
Endangered Species Act Regulations [50 CFR Parts 81, 225, and 402]	Requires action to conserve endangered species within critical habitats.	If endangered species were present on site, steps would have to be taken to minimize adverse impacts to their habitat.
CERCLA 121	Waivers from ARARs may be obtained for interim measures that are expected to be followed within a reasonable time by complete measures that will attain ARARs	It is expected that the temporary systems evaluated in this report will be incorporated into or followed by complete measures that will attain ARARs within 5 years.
CERCLA 121(e)	No Federal, State or Local permit is required for the portions of a removal or remedial action conducted entirely on-site.	Permitting, record keeping, reporting, and administrative requirements under RCRA are not applicable to the temporary actions within this report.
RCRA Regulations, Interim Status Facilities, Waste Piles [40 CFR Part 265, Subpart L]	Requires that waste piles subject to dispersal from wind must be covered so that wind dispersal is controlled. Also provides requirements for monitoring and inspection of leak detection systems, if such systems are required.	These guidelines will be followed, however, the full permitting, record keeping, reporting, and administration requirements would not be applicable under CERCLA Section 121(e).
RCRA Regulations, Waste Piles [40 CFR Part 264, Subpart L]	The design and operating requirements for waste piles are not applicable if the waste pile is inside or underneath a structure that provides protection from precipitation so that neither runoff nor leachate is generated.	Long term monitoring and maintenance of the completed measures at the site will be conducted in accordance with these rules. Only applicable once the temporary action is in place.

Table 2
Installed Cost for Temporary Buildings

Site 8 Ash Stabilization Report
Naval Construction Battalion Center
Gulfport, Mississippi

Activity	Unit Price (Dollars)	Units	Estimated Quantity	Total Price (Dollars)
Building 1 (240 by 900 feet)				
Purchase Price	1,696,200.00	building		1,696,200.00
Freight	18,200.00	LS	1	18,200.00
Technical Representative	350.00	day	15.5	5,425.00
			Subtotal	**1,719,825.00**
Building 2 (240 by 700 feet)				
Purchase Price	1,345,700.00	building	1	1,345,700.00
Freight	16,800.00	LS	1	16,800.00
Technical Representative	350.00	day	15.5	5,425.00
			Subtotal	**1,367,925.00**
Building 3 (240 by 460 feet)				
Purchase Price	895,974.00	building	1	895,974.00
Freight	15,400.00	LS	1	15,400.00
Technical Representative	350.00	day	15.5	5,425.00
			Subtotal	**916,799.00**
Total				**4,004,549.00**

Note: LS = lump sum.

Table 3
Installed Cost for Soil Solidification

Site 8 Ash Stabilization Report
Naval Construction Battalion Center
Gulfport, Mississippi

Activity	Unit Price (dollars)	Units	Estimated Quantity	Total Price (dollars)
Mobilize	10,200.00	LS	1	10,200
Solidify Soil	19.50	cubic yards	19,000	370,500
Demobilize	10,200.00	LS	1	10,200
Total				**390,900**

Note: LS = lump sum.

Table 4
Installed Cost for 40-Milli-inch HDPE Membrane

Site 8 Ash Stabilization Report
Naval Construction Battalion Center
Gulfport, Mississippi

Activity	Unit Price (Dollars)	Units	Estimated Quantity	Total Price (Dollars)
Freight and Materials				
Section 1	0.23	ft^2	175,000	40,250.00
Section 2	0.23	ft^2	112,500	25,875.00
Section 3	0.23	ft^2	225,000	51,750.00
			Subtotal	**117,875.00**
Anchoring System	0.00	yd^3	3,600	0.00
Specialized Labor	2,000	Day	16	32,000.00
			Subtotal	**32,000.00**
			Total	**$149,875.00**

Note: ft^2 = square feet.
yd^3 = cubic yards.

Table 5
Individual Evaluation of Alternatives

Site 8A Ash Stabilization Report
Naval Construction Battalion Center
Gulfport, Mississippi

	Technology		
Criteria	Temporary Buildings	Soil Solidification	Geomembrane Cap
Technically Feasible	Yes	Yes	Yes
Service Life	Skin 10 to 15 years, Structure 15 to 30 years.	> 5 Years	15 to 20 years
Eliminates Erosion	Yes so long as it is not damaged	Yes	Yes
Total Installed Cost	$4,004,549	$390,900	$149,875
Capable of withstanding a hurricane	Structure Yes, Skin subject to debris damage	Yes	Yes
Does not transport ash offsite	Yes	Yes	Yes
Site Chemical Characterization	Can take place before or after installation	Should take place prior to installation	Should take place prior to installation
Level of Risk Reduction			
Site Trespasser			
Inhalation Risk	Significantly reduced	No reduction	Significantly reduced
Incidental Ingestion Risk	Significantly reduced	No reduction	Significantly reduced
Dermal Contact Risk	Slightly reduced	No reduction	Significantly reduced
Occupational Worker			
Inhalation Risk	Significantly reduced (no reduction when damaged)	Significantly reduced	Significantly reduced
Incidental Ingestion Risk	Significantly reduced (no reduction when damaged)	Significantly reduced	Significantly reduced
Dermal Contact Risk	Significantly reduced (no reduction when damaged)	No reduction	Significantly reduced
Site Worker			
Inhalation Risk	Significantly reduced (no reduction when damaged)	Significantly reduced	Significantly reduced

See notes at end of table.

Table 5 (Continued)
Individual Evaluation of Alternatives

Site 8A Ash Stabilization Report
Naval Construction Battalion Center
Gulfport, Mississippi

	Technology		
Criteria	Temporary Buildings	Soil Solidification	Geomembrane Cap
Incidental Ingestion Risk	Significantly reduced (no reduction when damaged)	Significantly reduced	Significantly reduced
Dermal Contact Risk	Significantly reduced (no reduction when damaged)	No reduction	Significantly reduced
Excavation Worker			
Inhalation Risk	No reduction	No reduction	No reduction
Incidental Ingestion Risk	No reduction	No reduction	No reduction
Dermal Contact Risk	no reduction	No reduction	No reduction
Installation Risk	Lowest due to least amount of grading required	Highest due to dust generation	low
Time to Install	Approximately 16 days	20 days	10 to 15 days
Amount of Site Grading	Minimal	Extensive	Extensive
Ease of Installation	Relatively complicated with drainage system, structures, and required permits.	Very straight forward, could be administrative difficulties coordinating cement trucks.	Easy to roll out in right order and cover with bauxite.
Specialized Labor	Vendor representative to guarantee integrity.	Rototiller operator and installation expert	Vendor representative to guarantee integrity.
Specialized Equipment	None	Rototiller	Welding machine
Unskilled Labor	6 to 10	Minimal (grading crew, steel wheeled roller crew)	Variable depending on schedule and budget (3 to 15)
Monitoring Requirements	Monthly visual inspections	Quarterly visual inspections	Semiannual visual inspections

See notes at end of table.

Table 5 (Continued)
Individual Evaluation of Alternatives

Site 8A Ash Stabilization Report
Naval Construction Battalion Center
Gulfport, Mississippi

Criteria	Temporary Buildings	Soil Solidification	Geomembrane Cap
Maintenance Requirements	Patching of cover as needed.	Keep cracks from forming and patch with cement when they do. Avoid heavy point loads.	Make sure cap has not blown away or has been torn or punctured.
Regulatory Acceptance	Could be some problems due to the fact that this is a relatively new idea.	Has been accepted for containing soils metals. Acceptance is expected to come readily.	Accepted for landfill liners and caps. Very familiar to regulators. Acceptance very likely
Dependence on Current Topography	Very little dependence on current site topography.	Sections may have to be consolidated into smaller areas, resulting in complicated drainage systems.	Sections may have to be consolidated into smaller areas, resulting in complicated drainage systems.
ARARs - Summary			
29 CFR Part 1910 (Provides fundamental requirements to ensure worker safety on site)	All work on site, such as the grading of the ash piles, would have to be conducted in accordance with these rules		
OSHA [29 CFR Part 1904] (Provides fundamental requirements to ensure worker safety on site)	Provides recordkeeping and reporting requirements for enforcement of the Act and for developing information regarding the causes and prevention of occupational illnesses. All work on site must be conducted in accordance with these rules.		
Endangered Species Act Regulations [50 CFR Parts 81, 225, and 402] (Requires action to conserve endangered species within critical habitats.)	If endangered species were present on the site, steps would have to be taken to minimize adverse impacts to their habitat.		
CERCLA 121 (Waivers from ARARs may be obtained for interim measures that are expected to be followed within a reasonable time by complete measures that will attain ARARs)	It is expected that the temporary systems evaluated in this report will be incorporated into or followed by complete measures that will attain ARARs within 5 years.		

See notes at end of table.

Table 5 (Continued)
Individual Evaluation of Alternatives

Site 8A Ash Stabilization Report
Naval Construction Battalion Center
Gulfport, Mississippi

Criteria	Temporary Buildings	Soil Solidification	Geomembrane Cap
CERCLA 121(e) (No Federal, State, or Local permit is required for the portions of a removal or remedial action conducted entirely on-site.)	Permitting, record keeping, reporting, and administrative requirements under RCRA are not applicable to the temporary actions within this report.		
RCRA Regulations, Interim Status Facilities, Waste Piles [40 CFR Part 265, Subpart L] (Requires that waste piles subject to dispersal from wind must be covered so that wind dispersal is controlled. Also provides requirements for monitoring and inspection of leak detection systems, if such systems are required.)	These guidelines will be followed, however, the full permitting, record keeping, reporting, and administration requirements would not be applicable under CERCLA Section 121(e).		
RCRA Regulations, Waste Piles [40 CFR Part 264, Subpart L] (The design and operating requirements for waste piles are not applicable if the waste pile is inside or underneath a structure that provides protection from precipitation so that neither runoff nor leachate is generated.)	Long term monitoring and maintenance of the completed measures at the site will be conducted in accordance with these rules. Only applicable once the temporary action is in place.		
Future Use	Could be incorporated into future use design or used elsewhere.	Can be used as a subase for future use designs.	Difficult to incorporate into future use designs.
Increases Amount of Ash Waste	No.	Yes.	Yes.

Notes: > = greater than.
CFR = Code of Federal Regulations.
OSHA = Occupational Safety and Health Administration.
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
ARAR = applicable rules and regulations.
RCRA = Resource Conservation and Recovery Act.

ATTACHMENT D

TECHNOLOGY INFORMATION

D-1 Temporary Buildings
D-2 Soil Solidification
D-3 Geomembrane Liners

ATTACHMENT D-1

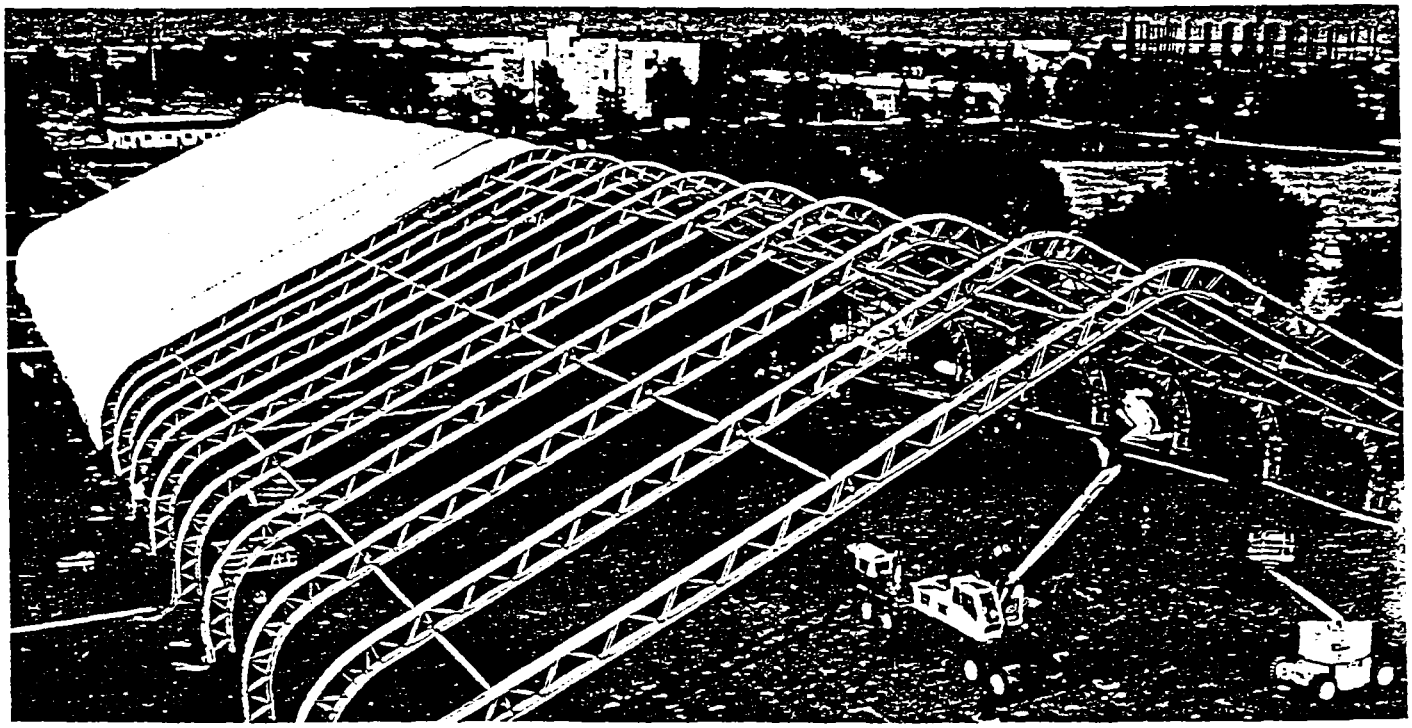
TEMPORARY BUILDINGS

13015/FAB
BuyLine 7566

FABRIC BUILDING SYSTEMS:

STRENGTH, PORTABILITY, SPEED & PRICE

CLEAR SPANS TO 200'



MANUFACTURED EXCLUSIVELY BY CANSPEC

FABRIC BUILDING SYSTEMS

Innovative Structures

The tensioned fabric structures designed and engineered by Fabric Building Systems (FBS) are architecturally unique and combine the best features of many types of construction. Like tents, FBS structures are pre-engineered in a wide range of sizes, erect quickly and relocate easily. Like domes, the geometry of the structure provides strength and rigidity, without internal supports. Like steel buildings, FBS structures are economical, durable, and adaptable.

Strong Modular Design

All FBS structures are modular and consist of an aluminum frame covered with a vinyl coated polyester fabric. The fabric is tensioned over the frame, creating a very strong shell capable of withstanding wind loads over 120 mph, and almost any snow load.

A variety of fabrics are available with a life expectancy up to 20 years or more.

Equipped with a variety of optional doors, windows, HVAC systems, insulating liners and electrical systems, these structures can provide year-round shelter in virtually any climate.

Complete Range of Sizes

Fabric Building Systems has developed fabric structure technology into a complete range of standard building sizes and styles. They range from Quik-Span™, designed for clear span application widths of 10 to 30 feet, to FBS Truss™, capable of providing a clear span in excess of 200 feet, a height of 60 feet and lengths of 740 feet or more.

In between these sizes is the FBS structure, which ranges from 30 to 100 feet in clear span width.

Pre-Engineered for Economy

All FBS structures are pre-engineered to meet the demands of almost any project, without an extensive design phase. Every FBS structure ensures compliance with applicable building codes, reduces lead time, and lowers the total project costs.

Proven Applications

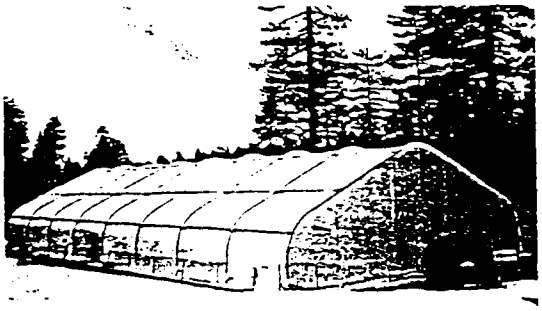
FBS structures have been proven in applications across a broad spectrum of industries. In addition to the applications shown in the accompanying photos, FBS structures have been successfully used for:

- Hazardous waste storage & remediation
- Theaters at a theme park
- Aircraft hangers
- Odor control domes for wastewater treatment
- Vehicle maintenance facilities

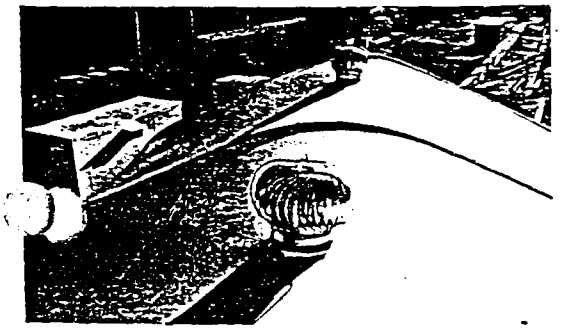
Pioneers of Fabric Structure Technology

FBS structures are manufactured exclusively by Canvas Specialty (CanSpec) in Los Angeles. Founded in 1943, CanSpec has grown to be one of the largest suppliers of fabric architectural components in the world.

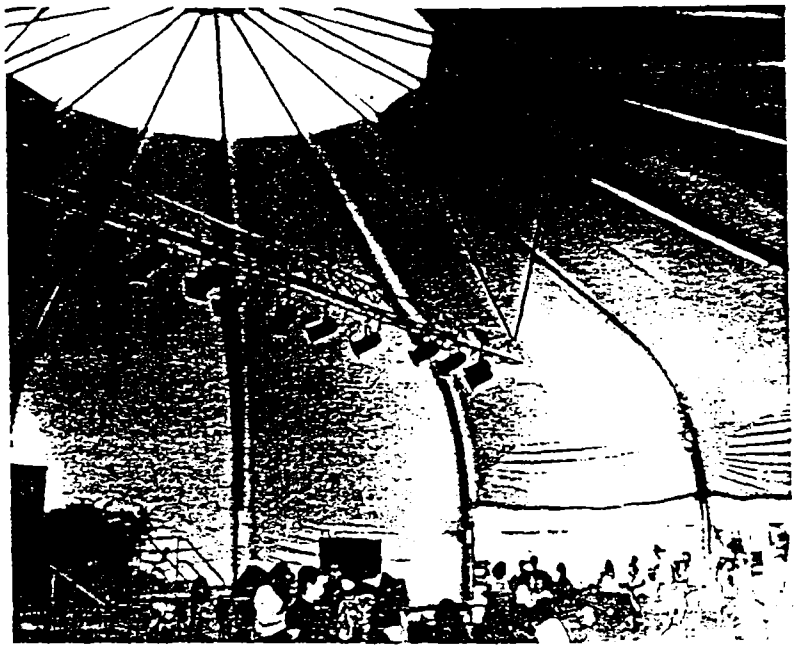
Together, FBS and CanSpec ensure clients innovative, tested designs, and quality-controlled manufacturing.



Big Bear Ski Resort, snack bar enclosure, insulating liner



Gravity vent, self cleaning fabric with acrylic top coating



Arizona State Fair, translucent skylight and roll-up side walls

FABRIC BUILDING SYSTEMS

13015/FAB
BuyLine 7566

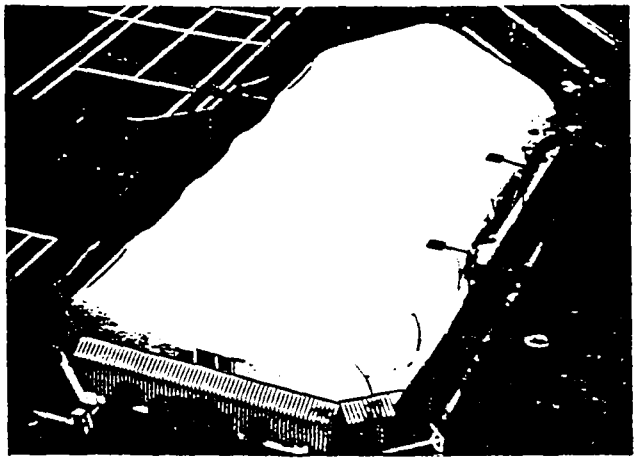
Custom Designs

The modular components developed by FBS adapt to most applications. FBS designs are easily modified to meet unique customer requirements.

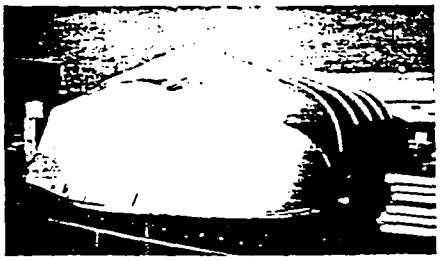
FBS and ClinSpec employ proprietary CAD software systems developed specifically for fabric architecture. Clients receive dependable, cost-effective solutions, and quick responses at every phase of every project.

Easily Enlarged or Relocated

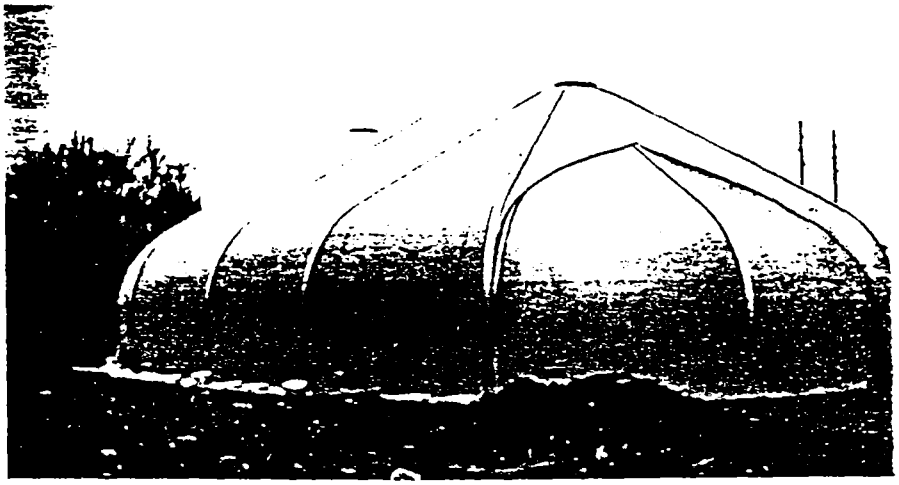
Modular design and pre-engineering provide economy and versatility, as well as the capability to enlarge or relocate a structure as needs change. Rapid, on-site installation or installation supervision keep projects on schedule, and within budget.



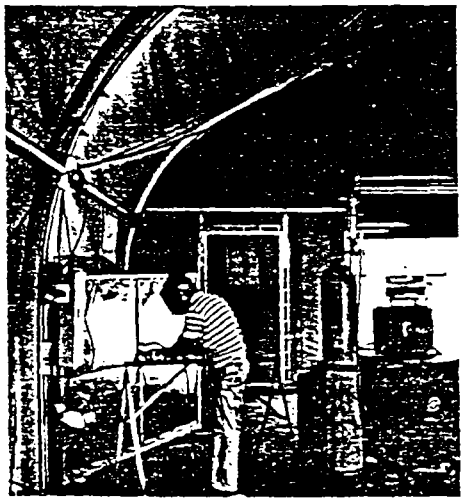
IRVINE MARRIOTT BANQUET FACILITY ON TENNIS COURT. PORTABLE FLOOR



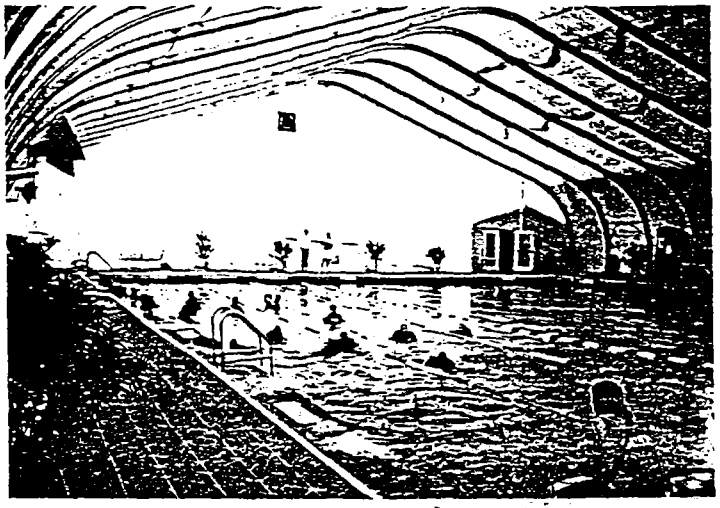
MILITARY DESERT STORM TANK MAINTENANCE SHELTER. FULL WIDTH DOOR



ERIE, PENNSYLVANIA COMPOST FACILITY. ROLLING END DOOR



U.S. NAVY MAINTENANCE STRUCTURES. FLAT END WITH ROLL-UP VEHICLE DOOR



FORT IRWIN ARMY POOL COVER. TRANSLUCENT FABRIC

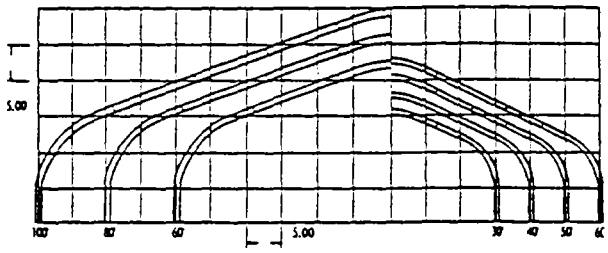
FABRIC BUILDING SYSTEMS

SPECIFICATIONS

COMMON FEATURES

MEMBRANE	Standard Fabric: Vinyl coated polyester. Fabric life expectancy (dependent upon fabric specified): 10 to 15 years is not uncommon.
STRUCTURAL FRAME	6061-T6 Aluminum or equivalent. Powder coated or anodized to color specifications. (optional)
FABRIC ATTACHMENT & TENSIONING	Provides secure weather-tight enclosure: no specialized equipment necessary.
ROOF PITCH	Standard 25° (approx. 5 in 12)
END (GABLE) WALLS	Various configurations available for different applications or appearances and can be combined as needed, including flat end, framed end, full width door end and fabric tensioned.
MODIFICATIONS	Structures can be modified to meet special needs, site conditions or engineering loads, including non-standard height, width and bay spacing. Desired modifications must be submitted to and reviewed by Fabric Building Systems.

FBS STRUCTURE & FBS QUIK-SPAN™



MODULAR DESIGN
Clear spans from 10' to 100', lengths are multiples of standard bay spacing or modified to meet project requirements. (Available to metric standards)

FRAME
Structural aluminum frame, braced with purlins and cross bracing.

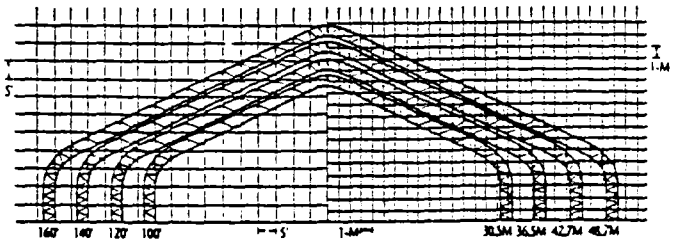
BAY SPACING
Standard 10' thru 20', dependent on snow/wind loads.

DESIGN AND PERFORMANCE
Designed to comply with applicable building codes and standard design loads:

A. Live 10 lbs. – 45 lbs./sq. ft. including snow load.
B. Wind 70 mph - 120 mph.

Custom designs are available.

FBS TRUSS



MODULAR DESIGN
Clear spans from 100' to 200' (five foot increments), lengths are multiples of standard bay spacing or modified to meet project requirements. (Available to metric standards)

TRUSS FRAME
Structural composite metal truss frame, braced with purlins and cross bracing.

BAY SPACING
Standard 20', optional 15' thru 25', dependent on snow/wind loads.

DESIGN AND PERFORMANCE
Designed to comply with applicable building codes and standard design loads:

A. Live 25 lbs. – 80 lbs./sq. ft. including snow load.
B. Wind 90 mph - 160 mph.

FBS INSTALLATIONS (PARTIAL LISTING)

Government/Military Project	Location	Application
Operation Desert Storm	South West Asia	Vehicle Maint. Shelters
EG & G	Denver, CO	Rocky Flats Nuclear Waste Storage
Rust Engineering	Fernald, OH	Hazardous Waste
National Guard	U.S. Virgin Isl.	Hangar

Commercial Project	Location	Application
Orange County Fair	Newport Beach, CA	Exhibit
McDonnell Douglas	Long Beach, CA	Warehouse
State Fairgrounds	Phoenix, AZ	Theater
String's In The Mountains	Steam Boat Springs, CO	Concert Theater
Marriott Hotel	Irvine, CA	Special Events

FABRIC BUILDING SYSTEMS, INC.

4919 80th Ave., Circle East
Sarasota, Florida 34243
Phone (~~813~~ 941) 351-6096, Fax (~~813~~ 941) 351-1020

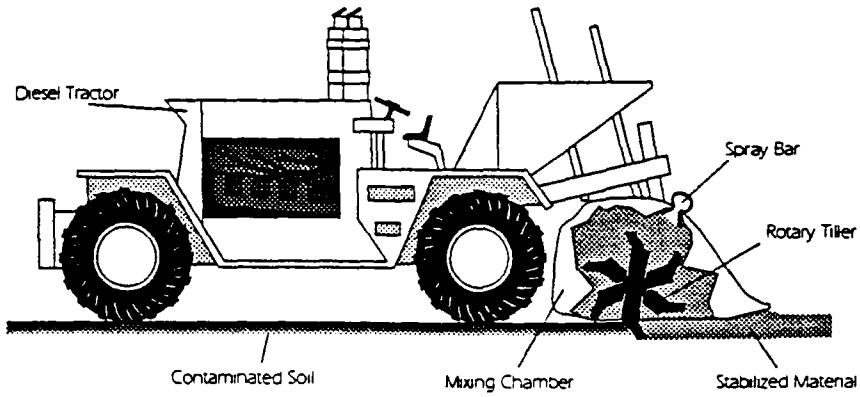
FBS Structures are manufactured exclusively by CanSpec.

ATTACHMENT D-2

SOIL SOLIDIFICATION

Work Plan

ENRECO will stabilize the soil by mixing it with a small dosage—i.e., 10%—of portland cement. Portland cement will be blended with soil using a rotary soil stabilizer. This device consists of a large rotating drum with car-



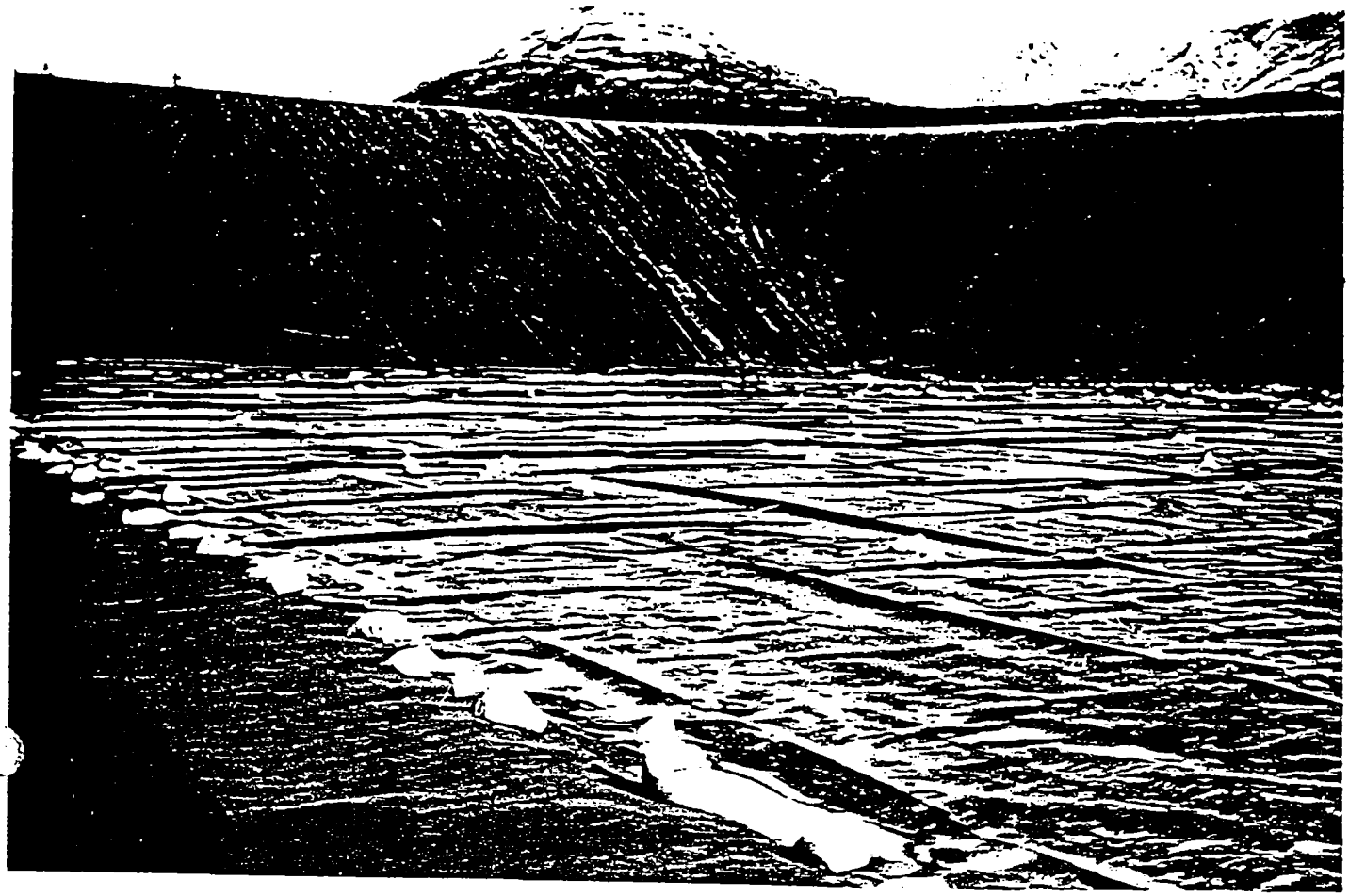
bide blades attached to its surface. As the drum rotates, these blades vigorously blend soil and reagents. The depth to which these blades cut can be regulated by hydraulically raising or lowering the drum.

Reagents are delivered to the site in pneumatic trucks, then conveyed from the truck to a soil stabilizer via a four-inch hose. Reagents exit the hose through a spray bar within the stabilizer's mixing chamber. If water is necessary to dissolve the reagent or for dust suppression, it is added via a second spray bar within the stabilizer's mixing chamber. As reagents and water flow into the mixing chamber, the stabilizer slowly travels atop a layer of contaminated soil while the stabilizer's blades vigorously blend the components.

Treatment dosages are regulated by carefully delineating the area into which each truckload of reagent should be blended, then evenly distributing and mixing the reagent within this area. After treating soil within a delineated area, the treatment's efficacy is substantiated by collecting samples of treated soil and measuring pertinent physical or chemical properties to ensure that the soil complies with performance criteria. If a quality control sample fails to comply with the project's performance criteria, the area from which the sample was obtained will be retreated.

ATTACHMENT D-3

GEOMEMBRANE LINERS

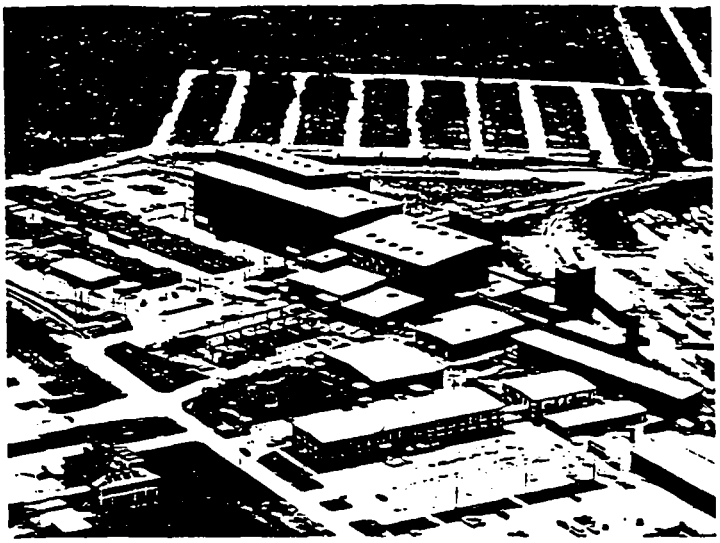


GSE™

PLEASE NOTE! Our new name is:

GSE Lining Technology, Inc.
19103 Gundle Road
Houston, TX 77073-3598
800-435-2008 713-443-8564
FAX: 713-875-6010
(A Gundle/SLT Environmental, Inc. Company)

GUNDLE.
YOUR SINGLE
SOURCE FOR
LINING SYSTEMS,
INSTALLATION
AND SERVICE.
HELPING YOU
TO MAKE THE
RIGHT CHOICE.



Gundle's intensive research efforts assure continual improvements in existing products, while hastening new product development.

Gundle Lining Systems, Inc. is the leading manufacturer worldwide of High Density Polyethylene (HDPE) and Very Low Density (VLDPE) lining systems. Our high performance barriers and fluid drainage media prevent environmental damage which may result from the seepage of hazardous or other waste materials. In addition to manufacturing these lining systems under stringent quality control procedures, we also install them. Gundle's unique Wedge Welding Machine and patented Extrusion Welding Systems ensure that the installed liner system will have seams as strong as the sheet.

Since January, 1982, Gundle has manufactured more than 1 billion square feet of HDPE & VLDPE membranes for installations throughout the United States, Canada and in 60 other countries. Our remarkable growth and success are clearly reflected in our industry leading facilities. Our manufacturing complex has benefitted from several major expansions, twice increasing our manufacturing capacity by 100 percent.

Waste containment needs, in all segments of our markets, have created a continual demand for our products. Gundle remains responsive to its customers by applying high quality-assurance standards to every phase of operations, from raw materials specifications to precise installation procedures. There are good reasons for selecting Gundle products to help meet national and local government regulations. They help protect the environment and preserve groundwater.

The industry's most modern plant is capable of producing 500,000,000 sq. feet of lining products annually.

Gundle uses state-of-the-art thermal analysis (DSC and TGA) to measure polymer stability and composition.

R&D

Gundle's ongoing research improves our existing products and procedures, while hastening the development of new products. For example, we conduct long-term aging studies using our own weatherometer, pressurized differential scanning calorimeter, and thermogravimetric analyzer, the most advanced, computerized testing devices available. We also carry out new product development in-house with laboratory scale production equipment. And we continue to evaluate advances in welding technology that have led to automation of the welding process.

MANUFACTURING

Gundle flexible linings are manufactured in the industry's most modern plant, capable of producing 500,000,000 sq. feet of lining products annually. Our unique process produces liner material up to 34 ft. wide seamless widths ranging from 20 to 140 mils in thickness. This is the widest range of completely unseamed HDPE and VLDPE sheets in the world. We also have in-house manufacturing facilities for Gundnet® drainage net, Gundline® VL VLDPE, Gundline® HDT textured liner, Gundline HDC, conductive liner, Gundline HDW® white surfaced reflective liner, other multicolored liners, and Fabri-Net (Gundnet bonded to geotextile).

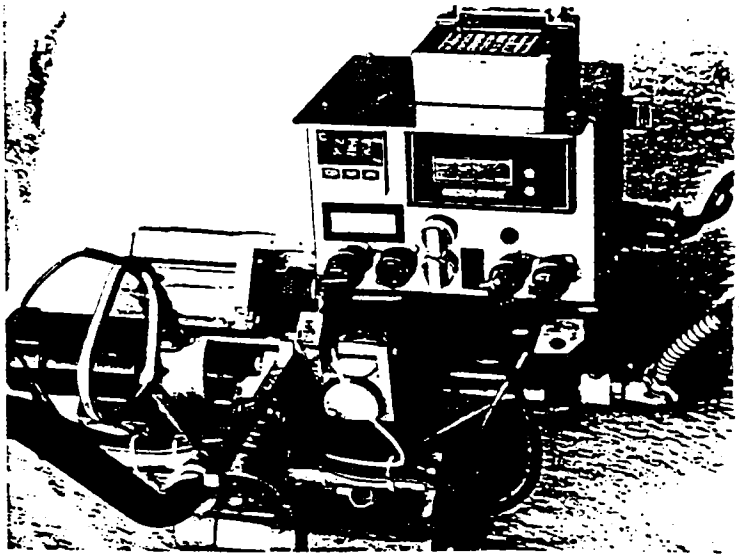
QUALITY CONTROL

Before the resins that will be made into Gundle liners are brought into the plant, our staff chemists conduct a series of quality-assurance tests in our laboratory. We also extensively test finished liners to confirm that they meet our exacting specifications. These tests assure that the liner is resistant to the specific materials to be contained. Sample welds from field installations are sent to Gundle's laboratory for ASTM tensile testing that includes both shear and peel resistance.

GUNDLE'S HOT WEDGE WELDING SYSTEM ENSURES DEPENDABLE SEAM INTEGRITY

Gundle's hot wedge welding adds system versatility, speed, and performance to Gundle's seaming capabilities. Together with the patented "mixing tip" fillet extrusion welders, Gundle offers the most advanced systems available today. The Gundle hot wedge welder offers a number of important advantages over traditional seaming methods. As the welder propels itself along the sheets, it draws a hot wedge between them. The heated sheets are then fed between a set of pressure rollers, creating a dual track seam. Pressures, temperature, and power voltage are monitored and recorded during welding, providing state of the art process control and welding consistency.

The welder has enough power to weld vertical seams and yet, with its modern materials and innovative design, is 40% lighter than other welders, reducing operator fatigue and errors. Using appropriate temperature and speed settings, the hot wedge welded seams provide excellent results in peel and shear destructive tests.



Gundle's hot wedge welding process creates a fully integrated weld between liner sheets.

Both the Gundle extrusion weld and the Gundle hot wedge weld result in a truly homogeneous bond between the liner sheets. There is no interface between the sheets which could be disrupted by absorbed solvents. Both Gundle seams offer the same chemical resistance as Gundle membranes and both can be used with Gundline® HD, Gundline HDT, Gundline VL, Gundline HDC, and Gundline HDW.

QUALITY INSTALLATIONS

Other suppliers require a customer to contract separately for installation. Gundle provides customers with completely installed HDPE lining systems. And every Gundle employee connected with the installation of our lining systems receives extensive training in membrane technology and application techniques. Our Project Managers, Foremen and Welding Technicians are full-time professionals.

WHAT DOES ALL THIS MEAN TO YOU?

Whether it's rugged Gundline HD, Gundline VL for flexibility and elongation, Gundline HDT for slope stability, Gundline HDW for installation efficiency and damage detection, Gundline HDC for leak location, or Gundnet and Fabri-Net for fluid drainage, you can be assured of quality and performance for a wide range of lining applications. The reasons: exacting requirements for raw materials, state-of-the-art manufacturing technology, execution of extensive quality control procedures and expert installation using Gundle's highly effective hot wedge welding system. It's a combination that has made Gundle the world leader in lining systems.

GSE™

For environmental lining solutions...the world comes to GSE.™

GSE™ HyperFlex®
Premium Grade
HDPE Geomembrane

GSE HyperFlex is a premium grade, high density polyethylene (HDPE) geomembrane produced from a specially formulated, virgin polyethylene resin. This resin is the only polyethylene resin designed specifically for HDPE geomembrane applications. **HyperFlex** has outstanding chemical resistance, mechanical properties, environmental stress crack resistance, dimensional stability and thermal aging characteristics. **HyperFlex** contains approximately 97.5% polymer and 2.5% carbon black, anti-oxidants and heat stabilizers; no additives, fillers or extenders are used. **HyperFlex** has excellent resistance to UV radiation and is suitable for exposed conditions.

PROPERTY	TEST METHOD	NOMINAL VALUES					
Thickness, mils (mm)	ASTM D 751/1593/5199	30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)	120 (3.0)
Density, g/cc	ASTM D 792/1505	0.944	0.944	0.944	0.944	0.944	0.944
Tensile Properties (each direction)	ASTM D 638, Type IV						
Strength at Break, lb/in-width (N/mm)	Dumbell, 2 ipm	150 (26)	200 (34)	300 (52)	400 (69)	500 (86)	600 (103)
Strength at Yield, lb/in-width (N/mm)	Gauge lengths per	72 (12)	96 (16)	144 (25)	192 (33)	240 (41)	288 (50)
Elongation at Break, %	NSF Std. 54	700	750	800	800	800	800
Elongation at Yield, %		15	15	15	15	15	15
Tear Resistance, lb (N)	ASTM D 1004	25 (111)	33 (146)	50 (222)	66 (293)	83 (369)	100 (445)
Puncture Resistance, lb (N)	FTMS 101, Method 2065	45 (200)	60 (267)	90 (400)	120 (533)	150 (667)	180 (800)
Carbon Black Content, %	ASTM D 1603	2-3	2-3	2-3	2-3	2-3	2-3
Carbon Black Dispersion	ASTM D 3015	A1/A2	A1/A2	A1/A2	A1/A2	A1/A2	A1/A2
Dimensional Stability (each direction), %	ASTM D 1204, 100°C 1 hr	±1	±1	±1	±1	±1	±1
Environmental Stress Crack Resistance, hr	ASTM D 1693, Cond. B	>2000	>2000	>2000	>2000	>2000	>2000
Tensile Impact Strength, ft-lb/in² (mJ/mm²)	ASTM D 1822	381 (801)	381 (801)	381 (801)	381 (801)	381 (801)	381 (801)
Low Temperature Brittleness, °F (°C)	ASTM D 746, Cond. B	<-120 (-84)	<-120 (-84)	<-120 (-84)	<-120 (-84)	<-120 (-84)	<-120 (-84)
Oxidative Induction Time, minutes	ASTM D 3895, 200°C Pure O_2, 1 atm	100	100	100	100	100	100
Ozone Resistance	ASTM D 1149, 7 days 100 ppm	No Cracks	No Cracks	No Cracks	No Cracks	No Cracks	No Cracks
Water Absorption, % wt. change	ASTM D 570	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Moisture Vapor Transmission, g/m²day	ASTM E 96	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Melt Flow Index, g/10 minutes	ASTM D 1238,Cond.190/2.16	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0

GSE HyperFlex is available in 24 ft (7.3 m) widths and up to 8,000 lb (3,600 kg) rolls. Other material thicknesses are available upon request.

This information is provided for reference purposes only and is not intended as a warranty or guarantee. GSE assumes no liability in connection with the use of this information. Check with GSE for current, standard minimum quality assurance procedures.

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A Gundle/SLT Environmental, Inc. Company

ATTACHMENT E

REFERENCES

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ATTACHMENT F

GLOSSARY

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ABB-ES	ABB Environmental Services, Inc.
ARAR	applicable rules and regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CTO	contract task order
ELCR	excessive lifetime cancer risk
HDPE	high density polyethylene
mil	milli-inch
mph	miles per hour
NCBC	Naval Command Battalion Center
RCRA	Resource Conservation and Recovery Act
USEPA	U.S. Environmental Protection Agency