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SILO PROJECT INDEPENDENT REVIEW TEAM DOCUMENTATION - BRICK MAKER FEASIBILITY EVAUATION/FERNALD ENVIRONMENTAL MANAGEM PROJECT

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United States Government

Department of Energy

Fernald Area Office

memorandum

DATE: SEP 0 4 1996

DOE-1219-96

REPLY TO ATTN OF: FEMP:Murphy

SUBJECT: BRICK MAKER FEASIBILITY EVALUATION/FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

TO: Jack Craig, DOE-FEMP

References:

(1) "Brick Maker Report, Fernald Environmental Management Project, Soil Remediation Project," (OU2) dated May 1996.

(2) Letter from J. Reising to J. Saric and T. Schneider, "Justification for Reevaluation of the Silo 3 Remediation Alternative," dated July 10, 1996.

(3) "Disassemble and Move Brick Maker Report," SoilPak Incorporated.

(4) "Evaluation of the Shipment and Disposal of Non-Compacted Versus Compacted Pit Wastes to Envirocare," OU1.

(5) "The SoilPak System," (a description) by SoilPak Environmental Engineering and Manufacturing.

As per your request, the following report is a comprehensive evaluation by members of my staff of the potential use of the "Brick Maker" at Fernald.

The potential for the "appropriate" applicability of the Brick Maker at the FEMP has been an ongoing issue for approximately one year. Listed below are at least three different proposed applications for the Brick Maker as follows:

(A) OU1 - Waste Pits

(B) OU2 - OSDF

(C) OU4 - Silo 3 material

The purpose of this paper is to identify and explore the issues and criterion relevant to each potential "proposed application" and to determine if each proposed application is in fact feasible at the FEMP.

Recycled and Recyclable

(A) OU1 WASTE PIT APPLICABILITY/FEASIBILITY

In regard to OU1, it is imperative at the outset to emphasize the following:

(1) The FEMP is not in the treatability phase of the CERCLA process and schedules do not permit the time necessary to identify and perform "treatability studies" necessary to determine if a particular technology is feasible; and,

(2) Envirocare has a TCLP composite arrangement with the respective EPA in Utah which obviates the desirability and applicability of this technology at the FEMP. In summation, Envirocare will not accept "compacted material" without charging an additional surcharge because of their licensing requirements concerning compaction for low-level wastes and their TCLP composite sampling requirements for mixed wastes.

There are four cost classes in OU1 associated with the packaging, shipping, and disposing of non-compacted and compacted wastes. These four costs include: 1) the additional capital cost for the purchases of the compaction equipment; 2) the additional operational and maintenance costs associated with a compactor; 3) the reduced shipment costs; and, 4) the reduced disposal costs for the compacted wastes.

Whether there are significant shipping and disposal cost reductions incurred as a result of the compaction is as yet, an unresolved question. Even if the initial cost of equipment (Brick Maker) is negated, there are still the costs associated with disassembling, decontaminating, transporting, setting-up, operating, and maintaining the equipment. Listed below is a summarization of the economic feasibility analysis for the shipping and disposal of compacted versus non-compacted pit wastes:

Shipping

OU1's current shipping plans are to load the dried pit wastes as they exit the dryer into lined and covered gondola railcars for shipment to an off-site permitted commercial disposal facility. The dried pit wastes are expected to have an average loadout density of 95 lbs. per cubic foot. The gondola railcars will have a volume capacity of 2743 cubic feet and a weight capacity of 108.7 tons. As a result, the gondola cars are both weight limited and volume limited.

Compaction effects

In respect to the volume and weight limitations for the gondola railcars as described above, compacting materials to reduce transportation costs is a viable one if the material to be shipped is volume limited. Therefore, by compacting the material prior to shipment, the actual volume will be decreased, and weight (density) of the material, will be increased which will allow more material to be placed and shipped in a railcar.

OU1 Pit Wastes Cost Savings

By utilizing the 95 lbs. per cubic foot estimated loadout density, it can be determined whether the OU1 pit wastes will be volume limited or weight limited in a gondola railcar. By dividing the maximum net weight of the waste allowed in the railcar (108.7 tons) by the expected loadout density of the OU1 waste, only 2288 cubic feet of the railcar is needed to meet the weight limitations of the railcar. Since the gondola railcars have a volume capacity of 2743 cubic feet, the gondola railcar will only be filled to 83% of its volume capacity. Because the railcars will be weight limited and not volume limited, compaction of the OU1 pit wastes prior to shipment will present no cost advantage for the shipment of the wastes over the currently planned direct loadout and shipment of uncompacted waste.

Disposal

When the OU1 pit wastes have been dried, off-site disposal at a permitted commercial disposal facility is required consistent with the OU1 Record of Decision (ROD). The wastes being removed from the dryer are classified as low level wastes per DOE Order 5820.2A, and currently there are only 2 existing facilities that are able to accept the pit wastes. These two facilities are the Nevada Test Site located in Nevada and Envirocare Inc., located in Utah. The OU1 performed economic analyses for the disposal of OU1 wastes at the two locations and determined that Envirocare represented the overall least cost alternative to the DOE.

Compaction effects

Envirocare must follow certain requirements for disposing of its waste according to its license issued by the Nuclear Regulatory Commission (NRC). Any wastes disposed of at Envirocare, whether received in bulk or in containers, are first dumped out on the ground and transported via dump truck to the disposal cell. At the cell, the wastes are required to be spread in one foot lifts and compacted to at least 90% Standard Procter (ASTM D-698).

Debris by itself may be disposed of at Envirocare, but it must be intermixed with soil-like wastes in no more than a 7% to 10% mixture in order to receive Envirocare's $7.00 per cubic foot disposal price. Even though it is cost prohibitive, debris by itself may be disposed of at Envirocare, but Envirocare requires that the debris must first be blended with other soil-like wastes or slurry around the debris to meet their compaction requirements. This disposal cost has been quoted by Envirocare at $18.00 per cubic foot. If compacted wastes are received at Envirocare, the cost prohibitive charge of $18.00 per cubic foot would apply in that Envirocare would be required to take the additional blending steps.

Cost Savings

Testing conducted on OU1 pit wastes with surrogate materials at J.C. Steele (samples submitted by Doug Maynard, DOE-OH) found no more than a 50% increase in density can be expected for OU1 wastes (95 versus 140 lbs. per cubic foot). If it is assumed that OU1 compacted wastes will be disposed of at Envirocare at the debris price of $18.0-0 per cubic foot versus $7.00 per cubic foot (uncompacted) OU1 would be required to have a density increase of over 250% in order to break even with the higher debris disposal costs. The NTS disposal costs are estimated to be $22.00 per cubic foot in fiscal year 1998, thereby continuing to make NTS an economically unattractive alternative.

In summation, the above analysis indicates that compaction of OU1 wastes offers virtually no cost advantage for the shipment of the OU1 wastes, and significantly higher costs for the actual disposal. Therefore, because compaction is not economically sound it should not be considered further.

A compactor has the effect of actually adding an additional step in the treatment trane.

(B) OU2 APPLICABILITY/FEASIBILITY

In the ROD for the FEMP OU2 (dated June 1995) the FEMP agreed that engineering evaluations would be performed during the Remedial Design process if an emerging technology"...is developed that may significantly reduce the volume, toxicity, or mobility of waste."

The FEMP specifically identified "Brickmaker Technology" as one of the two key technologies having potential benefit to the planned OSDF. The FEMP conducted an investigation of the development status of this technology, finding it to still be in the field testing stage. The extrusion technology and soil processing is well established, but its actual application to the processing of vast amounts of soil is less developed.

The FEMP performed an evaluation of the Brickmaker Technology based on schedule, cost, performance, and implementability. This criterion, combined with an accelerated 10-year remediation schedule requiring Phase 1 OSDF design at the FEMP by October 1996, leads the FEMP to conclude that the benefits of the Brickmaker Technology are only marginal and would add significant cost to OSDF construction and operation.

Even though the Brickmaker Technology could reduce the volume of soil in the OSDF by approximately 13% with the greater compaction of the soil. The cost of implementing the Brickmaker technology is in the excess of 10M dollars. The FEMP does not believe that the limited benefits to the Brick Maker Technology offsets the increased cost.

CONCLUSIONS

Schedule

Based on the description of the Brick Maker Technology, the schedule impacts as a result of implementing the Brick Maker Technology could be minimized by scaling up the number of extrusion and placement systems. A seperate design submittal would be required with the system operational by March 1998. However, the construction cost of the Brick Maker system is not in the current 10-year accelerated site restoration plan and would probably require diversion of funds from other projects, potentially affecting the overall site schedule.

Performance

The main measure of performance for the Brick Making Technology is reduction of volume. The OSDF contains approximately 2.5 million cubic yards of impacted soil. Of that 2.5 million, 900,000 cubic yards are needed for infilling and compaction around debris, and 600,000 cubic yards are needed for cushion and berm systems to protect the liner and cap. The 1.5 million cubic yards described above is not available for extrusion because bricks cannot be used to backfill around debris, and the cushion and berms would be difficult to construct out of bricks. The volume of soil that is available for extrusion is approximately 1 million cubic yards.

To summarize the volume reduction gained by the Brick Maker process, 13% reduction of 1 million cubic yards saves 130,000 cubic yards of disposal facility space. The OSDF has 2.5 million cubic yards of soil and is 3,700 feet long, therefore there is 675 cubic yards of soil per foot. The 13% reduction saves about 200 feet of disposal facility, or 5 percent of the total length. This reduction is not considered significant to the scope of the project.

A second measure of performance for the extrusion system is its ability to reduce the permeability of the contaminated soil by compaction. The 13% greater compaction on the soil will decrease the permeability slightly, but the impacted soil at planned compaction rates is already at or near to 10-7 cm/sec. The slight decrease in permeability is not considered a significant performance enhancement for the OSDF.

COST

The current cost estimate for completion of one cell in the OSDF is approximately 12 million dollars. That includes constructing the cell, placing the waste, and constructing the cap. One cell contains about 350,000 cubic yards of material. If Brick Making Technology reduces the volume of soil by 130,000 cubic yards, then it saves about half of one cell, or 6 million dollars.

An estimate of the capital costs for the two 90-ton per hour extrusion systems is 10 million dollars. The operating costs for the two extrusion systems are estimated to be 4 million dollars per year. Therefore, a 14 million dollar expenditure would be required for

the initial equipment costs and estimated first year equipment usage but would not include the additional costs necessary for the special hand compaction required around the brick cubes to minimize differential settlement of the capping system.

Based on these gross estimates, the implementation of an extrusion system in the OSDF would cause a disproportionally large increase in cost, and the cost savings originally contemplated cannot be realized.

Implementability

Since the technology used to process, extrude, and handle soil is readily available, the implementability of the Brick Maker system at the FEMP would not be difficult. The design of the handling and stacking of the extruded soil would be similar to that planned for debris; although larger equipment may be required.

RECOMMENDATIONS - OU2 OSDF

The Brick Maker Technology evaluation indicated that there would be no adverse impact on the schedule and the implementability of the technology is not prohibitive, but the cost of implementation is great and the performance improvement in minimal. As a result of this evaluation, the Brick Maker Technology will not be further studied in conjunction with the OSDF. This finding has been communicated to the regulatory agencies on May 28, 1996, with the transmittal of the Technologies Reports.

(C) OU4 - SILO 3 MATERIAL

As part of the DOE-FEMP remedial management strategy developed for the implementation of the vitrification technology for OU4, the DOE has performed several advanced treatability study tests at the Catholic University of America Vitreous State Laboratory (VSL), and the FEMP laboratories. In addition, the DOE-FEMP has been performing pilot-scale testing as part of the VITPP Phase I program. These post ROD tests have yielded valuable insight into the application of the vitrification technology to the Silo 1,2, and 3 residues. However, throughout this process, continued schedule delays, cost growth, and technical concerns related to the treatability studies have resulted in the DOE-FEMP reassessing the overall project for opportunities to accelerate schedule, reduce project costs, and optimize the Remedial Design/Remedial Action (RD/RA) process using data obtained from the treatability study programs.

The physical, chemical, and radiological characteristics associated with the Silo 3 residues make it a leading candidate for alternative treatment and the means by which the Operable OU4 remediation project schedule could be accelerated. Consistent with the OU4 ROD, it has been determined that the alternative solidification/stabilization methods considered for the Silo 3 residues would perform in a manner which is protective of human health and the environment. For this reason a Performance Based Contract will be evaluated for the Alternative Treatment method, thus the "Brick Maker Technology" may or may not be utilized.

CONCLUSION

The Brick Maker could possibly be used at the FEMP in OU4 however, this decision will be determined after the "Performance Based Contract" is evaluated for the Alternative Treatment method.

Johnny Reising

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