6324 U-003-307 .29

INTERIM COVERING OF WASTE PIT 4 AT THE FEED MATERIALS PRODUCTION CENTER, WESTINGHOUSE MATERIALS CO OF OHIO - (USED AS A REFERENCE IN OU1 RI)

09/ /88

FMPC-2140
KRAUSS
8
REPORT

6324

FMPC-2140

cy(3)

INTERIM COVERING OF WASTE PIT 4

AT THE

FEED MATERIALS PRODUCTION CENTER

By

Mark J. Krauss

September, 1988

Westinghouse Materials Company of Ohio
P. O. Box 398704
Cincinnati, Ohio 45239-8704

Operated for the U. S. Department of Energy by Westinghouse Materials Company of Ohio under Contract No. DE-AC05-86OR021600.

For Presentation at the

DOE Model Conference, Oak Ridge, Tennessee

October 3-7, 1988

INTERIM COVERING OF WASTE PIT 4 AT THE FEED MATERIALS PRODUCTION CENTER

Mark J. Krauss

ABSTRACT

The Feed Materials Production Center (FMPC) is a Department of Energy (DOE) owned facility operated by Westinghouse Materials Company of Ohio (WMCO) for the purpose of producing metallic uranium fuel elements, target cores, and other uranium compounds. These materials are used at other DOE facilities in support of the U.S. defense program.

In the past, disposal of waste generated from production operations at the FMPC was accomplished by constructing waste disposal pits and landfilling the waste. As a result of this practice, the FMPC has six waste disposal pits which contain many different types of waste including uranium, thorium, construction rubble, fly ash and various other wastes unique to the FMPC. None of the waste disposal pits are currently operated for the disposal of waste and all six pits are being investigated under a sitewide Remedial Investigation/Feasibility Study to determine what effect the pits are having on the environment. Waste Pit 4 is unique among the six pits in that it contains an amount of mixed (hazardous/radioactive) waste and has been classified under the Resource Conservation and Recovery Act as a hazardous waste landfill. For this reason the U.S. Environmental Protection Agency requested that the U.S. DOE consider interim closure of Waste Pit 4 to prevent surface water infiltration. To meet this request, WMCO developed the Cover for Pit 4 project which involves placing subgrade fill onto the existing pit surface to form a domed cap over the pit, covering the cap with 0.6 meters of clay compacted to 10^{-7} cm/sec permeability, and installing a 1.1 millimeter reinforced Hypalon cover over the clay. This paper will detail the design process with the associated problems and solutions and the projected construction sequence.

INTRODUCTION

The Feed Materials Production Center is one of several facilities that comprise the U.S. Department of Energy (DOE) defense program. The FMPC produces uranium metal products used as feed materials in other DOE facilities. Typical FMPC products include billets, ingots, and fuel cores all containing various amounts of purified uranium. The FMPC is currently being operated by the Westinghouse Materials Company of Ohio (WMCO). WMCO has been the prime contractor at the FMPC since January 1, 1986.

The FMPC was constructed in 1951 and has operated as a uranium metal production facility since that time. Thirty-six years of operations have produced a large volume of radioactive and mixed waste that remains on-site at the FMPC. The waste has been stored in drums, concrete silo's, and six waste pits located in the FMPC Waste Storage Area. The pits are referred to as one through six, numbered in order of their chronological construction. The pits range in volume from 6,881 cubic meters to 173,564 cubic meters in volume. The combined volume of all six pits is estimated at 339,482 cubic meters. The pits contain a variety of wastes including uranium, thorium, various types of filter cakes, depleted uranium slag, scrap graphite, and fly ash.

Waste Pit 4 was constructed in 1960, is approximately 40,500 cubic meters in volume (67,586,400 kilograms), and covers an area of approximately 0.9 hectares. The pit is 7.3 meters deep at the deepest point, and is lined on the bottom and all sides with 30.5 centimeters of clay. The landfill contains all of the the wastes listed above for the other five waste pits as well as 7.6 cubic meters (10,841 kilograms) of a trichloride salt. This trichloride salt consists of approximately 45.0 percent barium chloride, 32.5 percent potassium chloride, and 22.5 percent sodium chloride. Under the characteristic of toxicity, this salt is defined as a hazardous waste by the Resource Conservation and Recovery Act (RCRA). This determination is based on a leachate concentration of greater that 100 parts per million of barium.

Disposal of this material into Waste Pit 4 required the FMPC declare the pit as a hazardous waste landfill. The FMPC provided information about the disposal unit in the Part A and Part B RCRA Permit Application submitted to the United States Environmental Protection Agency (USEPA) and Ohio Environmental Protection Agency (OEPA). The FMPC also began to follow the regulations established for Hazardous Waste Disposal Units under RCRA. Even though the FMPC is considered to be an operating facility, the Pit 4 landfill must be closed since disposal in the landfill was terminated in 1985. The interim closure of the landfill is being completed following the guidelines of RCRA.

In addition to the actions being taken on Pit 4 under RCRA, the FMPC has initiated a Remedial Investigation for the other waste pits. The Remedial Investigation will be followed by a Feasibility Study (RI/FS) which will evaluate alternatives and provide the best method for minimizing impact to the environment from the FMPC waste pits. The findings of the RI/FS will affect the long-term remediation efforts for Pit 4. The RI/FS and corresponding Record of Decision (ROD) will establish whether excavation of Waste Pit 4 will be required or if in place stabilization is adequate.

OBJECTIVES OF PIT COVERING

The RCRA regulations require closure of the landfill once capacity has been reached and waste is no longer being disposed of in the landfill. Simply stated, closure for hazardous waste landfills involves

placing a cover over the landfill to control the amount of surface water entering the landfill and performing groundwater monitoring to determine if wastes are leaking from the landfill. However, the closure of Waste Pit 4 is somewhat more complex than this.

As previously stated, the long-term remediation of Waste Pit 4 will occur once the ROD has been completed. However, existing groundwater monitoring data has indicated that Waste Pit 4 is affecting groundwater. Elevated levels of specific conductance have been detected between upgradient and downgradient monitoring wells. Due to this finding, OEPA requested that DOE construct a cover over Waste Pit 4 to prevent surface water from entering the landfill. It was determined that surface water that entered Waste Pit 4 was either; 1) leaking through the clay liner on the bottom of the landfill, or 2) that surface water was entering the landfill, becoming contaminated with the constituents of the waste stored in the landfill, and then spilling out of the landfill with the next ensuing rainfall (the bathtub effect). One or both of these effects are suspected as the cause for elevated specific conductance levels in groundwater. Construction of a cover is intended to prevent surface water intrusion and stop the transport of pit constituents to the groundwater.

The cover for Waste Pit 4 is also being used as a test case for the other waste pits at the FMPC. Should the construction and life of the cover in the short term prove successful, covering of some or all of the remaining waste pits may be considered. Limiting the extent of groundwater contamination is one of the FMPC's primary environmental concerns. If the cover placed onto Waste Pit 4 causes a reduced level of detectable contamination in the groundwater, in place covering of the FMPC's Waste Pits will have been demonstrated as a viable option for long-term protection of the environment.

COVER DESIGN AND CONSTRUCTION

The first step in the design of the cover for Waste Pit 4 was to determine from the EPA what criteria must be met to ensure that surface water would not penetrate the cover. Since the cover is intended as an interim barrier to surface water intrusion, the EPA did not specify the of cover thickness and type of cover material normally required for final closure of a landfill.

Instead the EPA established that the cover shall have the following characteristics:

1) A minimum of 0.61 meters of clay compacted in 15.2 centimeter lifts to 10^{-7} cm/sec permeability.

2) A synthetic liner with a minimum thickness of 1.0 millimeter.

3) Adequate grading to enhance surface water runoff.

4) Strict adherence to the liner manufacturer specifications regarding installation and hold-down system since the liner will be exposed to weather (wind, rain, snow, etc.).

WMCO initiated design of the interim cover based on these three criteria, but also with several other considerations as well.

The final design calls for fill material to be placed on the landfill to form a crown which will provide a sloped surface for water to run off. Then 0.61 meters of clay with 10^{-7} cm/sec permeability will be placed over the fill material to prevent any surface water from entering the landfill. And finally, a 1.1 millimeter thick, reinforced Chlorosulfonated Polyethylene (Hypalon) will be placed over the clay to prevent surface water from ever reaching the clay. This design resulted from the following considerations:

1) One of the main criteria that WMCO established in design of the cover was complete coverage of the landfill. A topographical survey was made of the existing surface and compared to the original landfill construction drawings. The centerline of the original 3.1 meter wide berm around the landfill was established and the cover was designed to extend a minimum of 0.9 meter, and an average of 3.0 meters, beyond this centerline. The landfill is encompassed by an asphalt road on three sides which could not be moved. This limited the length of the cover extension in certain areas. However, using a minimum of a 0.9 meters extension beyond the centerline of the 3.0 meter berm, complete coverage was achieved. This should prove more that adequate in preventing water from migrating underneath the cover and entering the landfill.

2) The cover was designed to minimize the amount of material that would have to be added to the landfill to provide an adequate slope for surface water to runoff. Since the potential exists for having to excavate the entire pit once the ROD is made, the amount of fill material needed to be minimized. The existing surface of the landfill is a shallow dome of soil surrounded completely by a earthen berm. The earthen berm forms the edge of the landfill. The design calls for fill material to be placed on the landfill between the crown of the existing dome and the earthen berm. This will provide sufficient slope to allow water to flow from the top of the dome outward in all directions, over the earthen berm, and into a perimeter ditch that will be excavated around the landfill. The amount of fill material required to provide this slope is approximately 3,250 cubic meters. Should excavation of the landfill be required, it is anticipated that the fill material will be handled as

low-level radioactive waste, adding to the cost of excavation and increasing the amount of waste for disposal. For this reason, attempts were made wherever possible to minimize the amount of fill material placed on the landfill.

3) The design of the landfill cover was completed with consideration given to the surface of the waste in the landfill. Construction of the cover must be performed leaving the existing landfill surface undisturbed. This is necessary because the exact depth of the current cap of soil on the landfill is not accurately known and inadvertent exposure of waste is undesirable. Heavy earthmoving equipment required to transport and grade the soil on the landfill is expected to generate dust and cause any surface contaminants to become airborne. In order to limit the amount of contaminants at the surface, WMCO placed a restriction in the construction specification prohibiting the contractor from performing any excavation or regrading on the pit surface. The design of the cover had to integrate the concept of achieving the desired slope for the cover without regrading while minimizing the amount of fill material to be added to the landfill. This resulted in a design that calls for the placement of zero to 0.9 meters of fill material over certain sections of the landfill. This will provide the desired slope with minimal addition of material.

4) The design had to accommodate the possibility of upgrading the interim cover to a final closure cover in the event that in place closure of the landfill is pursued. The closure plan for this landfill depicts a two phased approach to closure. The first phase is m cover and the second phase consists of placing a 15.2 centimeter layer of drainage material such as sand or gravel over the hypalon cover and 76.2 centimeters of soil over the drainage layer. This provides 91.4 centimeters of natural cover over the hypalon placing it below the frost line and reducing the possibility of damage. The surface of the soil used in the final cover will be seeded and maintained to prevent erosion. In addition, the three percent to six percent slope of the interim cover will be maintained to enhance surface water runoff from the landfill.

5) The design also accommodates certain existing structures on and around the landfill. Several wells are located around the landfill for the purpose of monitoring groundwater. The wells vary in depth from 3 meters to 60 meters. The height of each wellhead is approximately 0.6 meters above ground level. These wells are still actively used and will remain in use for several years. It was therefore necessary to design the cover with as little impact to the wells as

possible. The slope of the surface cover was altered near the wells and the location of the perimeter drainage ditch was established so that the wellhead height above the surface remained at least one foot. Specific attention was given to ensure the contractor is aware of the wells around the landfill. The construction specifications call for the repair or replacement of wells damaged during cover construction. The wells will either be flagged or painted to enhance visibility and help prevent earthmoving equipment from striking the wells. A series of telephone poles and lines had to be relocated so that communications with the FMPC Waste Storage Area could be maintained. The road which surrounds three sides of the landfill also proved to be a problem by limiting the amount of room available for water to drain from the cover. Each of these structures would not be difficult to design around if considered individually, but taken together they resulted in several revisions to the original design since changing one aspect of the design always had an affect in other areas. What resulted was a middle ground in which all structures are affected to some degree, but none in a severely adverse way.

6) One of the primary concerns of the Environmental Protection Agency was the ability of the reinforced Hypalon to withstand the effects of weathering. This included the stability of the Hypalon during a high wind situation which can produce negative loading and pull the Hypalon from the clay surface underneath causing it to tear. Two design techniques were employed to prevent the Hypalon from being torn.

The first involves securing the Hypalon into the clay liner. The widths of the Hypalon sheets as they are placed onto the landfill will vary from 14.6 meters to 15.8 meters. At every other seam were these sheets are joined together, the edge of one sheet will be placed into a trench that has been excavated 0.3 meters into the clay. The trench will be backfilled with clay and compacted to secure the Hypalon in the clay. The adjoining sheet will then be welded to the exposed surface of the sheet that is secured in the clay. The welding is done with an adhesive. In this manner, every 30 meter width of Hypalon will be tied into the clay liner. At the perimeter of the Hypalon, where the transition is made from synthetic liner to soil, the Hypalon will be secured in a trench excavated to a depth of 1.2 meters. This extra depth at the perimeter is intended to take the Hypalon well below the frost line. It is expected that a large amount of water will be shed from the Hypalon and enter the ground at the Hypalon perimeter. The anchoring of the Hypalon below the frost line is intended to prevent the freeze/thaw cycle from disrupting the anchor placement.

The second design feature used to prevent the Hypalon from blowing off the landfill surface is the placement of pillows on the Hypalon. These pillows are two sections of 0.6 meter by 0.9 meter panels of Hypalon welded together on three sides and then filled with a minimum 90 kilograms of sand. The fourth side is sealed and the pillow shaped weight is welded onto the Hypalon surface. The pillows are placed at 15 meter intervals over the entire cover area and act as weights in preventing the Hypalon from being lifted from the clay surface. With the combination of the trenched anchors and weighted pillow hold down systems, tearing of the liner due to winds is not anticipated.

CONSTRUCTION SEQUENCE SUMMARY

All of the criteria discussed above influenced the design of the cover to some degree. Some of the criteria were not identified at the start of the project which caused many changes during the design process. However, a final design was achieved and is summarized as follows. All organic material growing within the construction area, but outside of the landfill boundaries will be stripped from the surface. A perimeter ditch will be excavated around the landfill outside of the landfill limits which will carry surface water runoff from the completed cover. All excavated soil and organic material will be placed onto the landfill surface and combined with 3,823 cubic meters of fill material (soil). The fill material will be graded to form a domed shape over the landfill providing a three percent to six percent slope. The fill material will be spread and compacted in 15 centimeter lifts to ninety percent compaction with reference to standard proctor. A test strip will then be developed over top of the fill material of the clay cover material. The clay strip will be tested with successive rolling of compaction equipment to determine the number of passes required to achieve the desired permeability. The clay will be combined with the an amount of bentonite as specified by a soils lab so that 10^{-7} cm/sec permeability is achieved. The lab will also specify the density necessary to reach this permeability, and this density will be the controlling factor in determining the number of compaction equipment passes. The clay liner will then be placed over the fill material in 15 centimeter lifts to the depth of 0.6 meters while maintaining the three percent to six percent slope. Approximately 5,352 cubic meters of clay will be required to cover the 0.9 hectares of landfill to a depth of 0.6 meters. Once the clay layer is complete, the Hypalon sheets will be unrolled and placed onto the landfill one at a time. Where specified the clay will be trenched, the Hypalon placed into the trench, and the clay backfilled and compacted over the Hypalon to hold it in place. All sheets of Hypalon will be welded together and the entire perimeter of the Hypalon will be placed into a 1.2 meter deep hold down trench. The pillow hold down system will be installed on the surface of the Hypalon when Hypalon placement is complete, and a vent will be placed at the cap of the landfill. This vent will penetrate through the Hypalon and clay to allow escape of any gases generated in the landfill. Finally, rock

channel protection (rip rap) will be placed in the perimeter drainage ditch where potential erosion areas exist and the remaining exposed soil areas will be seeded with grass or crown vetch. The cover will be inspected weekly to determine if any damage to the liner has occurred, and the Hypalon will be tested annually for tear strength. Repairs will be made as required.

POTENTIAL PROBLEMS AND RECOMMENDATIONS

The majority of problems encountered in covering this landfill as part of RCRA closure related to approval of the design and approval of the method of construction. The engineering and physical effort involved in covering the landfill are rather simple. Maintaining contact with the Environmental Protection Agency during the design of a RCRA landfill cover is recommended if the project is to be completed on schedule. Agreements with the EPA should be reviewed with the EPA at least monthly during the design process and specific details about the design should be presented to the EPA as they are developed. Without these reviews, the EPA may not be satisfied with the final design and request that modifications be made before construction begins. This results in delays and potential cost increases that were not originally budgeted. If the EPA is kept informed during the design process, changes can be made as the design progresses and cost impacts are realized before the project is bid for construction.

From a technical aspect, one of the main concerns of this particular project was the time period for placement of the Flexible Membrane liner. The FML sheets cannot be welded together in temperatures of less than ten degrees Centigrade unless artificial heat is used on the liner. And even with artificial heat, the quality of the welding is reduced. To meet the ten degree criteria, the project obviously had to be scheduled so that FML installation occurs on days when the temperature rises above ten degrees Centigrade. Due to delays in starting construction, the installation of the FML for this project is scheduled for late November/early December. Should the weather prove too cold to install the FML, the completed clay liner will remain exposed through the winter until the FML can be completed in the warmer spring weather. Erosion and damage to the clay liner is anticipated over the winter months. Construction will be carried out at an accelerated rate so that installation of the FML can be completed this year. The point here is to allow enough time after the expected date of construction completion so that if delays are encountered, the installation of the FML can still be accomplished in warm weather.

SUMMARY

The covering of the FMPC's Waste Pit 4, a Resource Conservation and Recovery Act hazardous waste landfill, is being completed as interim closure of this disposal unit. The landfill is 0.9 hectares in size at the surface and contains approximately 40,523 cubic meters of primarily radioactive waste mixed with 0.3 cubic meters of a trichloride salt classified as hazardous due to the barium content.

The cover will consist of 3,823 cubic meters of fill material placed on the landfill to form a dome shaped cap. The fill material will be overlain with 0.6 meters of clay compacted to a permeability of 10^{-7} cm/sec. The clay will be covered with 1.1 millimeters of Chlorosulfonated Polyethylene (Hypalon) as the final layer of cover material.

The intent of the cover is prevent surface water from entering the landfill and carrying contaminants into the groundwater. The cover is expected to last a minimum of five years when the landfill will either be excavated, or additional cover materials are placed over the interim cover as a final in place closure.