ENVIRONMENTAL REMEDIATION TECHNIQUES AND SUCCESSES AT THE MAXEY FLATS DISPOSAL SITE

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ABSTRACT

The purpose of this paper is to discuss the highly successful technical and health and safety environmental remediation and closure performed at the Maxey Flats Disposal Site. This paper will discuss the selected technical approaches requisite to performing a safe remediation effort while achieving all objectives stated with the ROD established by the EPA Region IV. Also presented is a discussion on the integrated team approach that was established to cover engineering, construction and operations activities which ensured project performance to be safe and in compliance to the Commonwealth's ROD. The use of multi-discipline design reviews will also be discussed as to their relevance and impact to the overall project.

While lessons learned on this successful project are highlighted in this paper, the singular key element may be summarized as to the value of meticulous planning and executing every day job essentials for success. In this way the project team accomplished no incidents or accidents, throughout the entire project life. The proceeding also allows one to do it right the first time – every time.

INTRODUCTION

The 45-acre burial portion of the Maxey Flats Disposal Site, with a total of 720 acres for the entire site including buffer zones, was commercially operated from 1963 thru 1977. The site contained 52 trenches, with 274 sumps. These 20 foot deep trenches contained approximately 4.8 million cubic feet of Tritium, TRU, commercial nuclear power plant low level radioactive and biological waste. The objective of the Project was to eliminate the potential for off-site migration; to stop the accumulation of rain water in the trenches; to remove leachate from trenches; to solidify leachate from trenches into above ground bunkers (concrete vaults); to install a temporary cap over the entire site and monitor the facility for from 35 to 100 years. Figure 1 shows the Maxey Flats site mid way through the remediation project.

Fig. 1 Site mid-way through project

DESIGN DECISIONS & CRITERIA

The Commonwealth of Kentucky mandated that the waste be processed on site and buried on site in above ground concrete vaults. Duratek provided design (process and equipment/systems), procurement, construction, commissioning and operations services for the on-site grouting of

1.58 million gallons of low- level radioactive liquid waste (radioactive leachate) for the IT Corporation, who provided disposal cell and site construction and cell closure operations. The final slurry was formulated to produce a hard, homogeneous, water free matrix in the concrete vaults. After the final cure time (36 to 72 hours after solidification), vaults were visually inspected to ensure product quality.

A design basis was established to provide double contained flexible piping with integrated alarms to monitor volumes and flow rates on a real time basis during the pumping of sumps to collection tanks. Subsequently these sumps were then to be fed into the leachate storage tanks that were housed within the Leachate Storage Facility. The design had to be robust in order to successfully meet the potential unknowns contained within the leachate, such as hot particles, sources organics, Titium, Sr, Am, and Pu. This mandated a constant monitoring of operations by experienced health physics technicians. Amongst the unknowns was the actual volume and recovery rates that might be required during the project. Prior to transfer, each batch of leachate was to be sampled and analyzed. In order to reduce laboratory analysis costs and provide quick turn around of samples, a mobile lab was brought on site by Duratek to augment existing laboratory capabilities. Further, in order to eliminate input data errors, a wireless data link from the gamma spec equipment to the waste database was used. A PCP had to be performed on the batch to be solidified such that solidification was ensured within the larger disposal cells. A method had to be established to mix leachate with cement repeatedly and accurately. Of paramount importance was to provide a system to transfer mixed grouts into the on site vaults, and finally ensure no clogging of the transfer systems.

The project demanded systems that would provide for the containerization of the grout within the site per the ROD. A grout mixing system, with the ability to provide appropriate formulations to meet the client's requirements, was developed. The system was provided to treat hazardous radioactive waste for ultimate land disposal at the site. As shown on figure 2 the modular equipment systems were provided to perform mobile mixing, combined with a cement batch plant and a liquid waste handling system. The processing system was designed for radioactive waste materials processing, as well as, an EPA controlled environment.

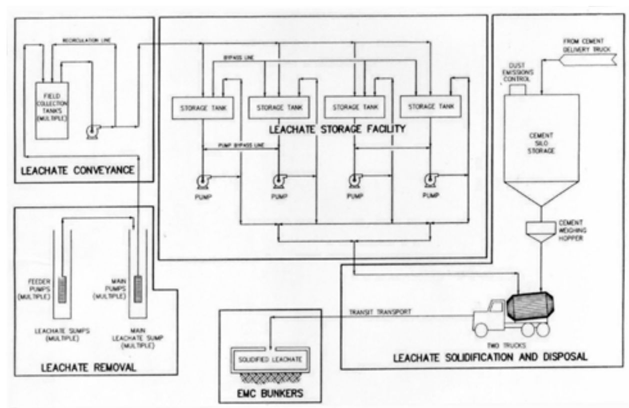

Fig. 2 Process layout

DESIGN REVIEW REQUIREMENTS

Intensive multi-discipline design reviews were used to maximize the abilities to successfully operate all selected equipment with health and safety considerations being of paramount concern. An early decision was made to utilize an existing building to house the liquid leachate processing tanks, stabilization control room, cement batching plant and a mobile transit mixer truck for solidification. This reduced construction time and cost for this facility while providing a simple and effective method for leachate solidification.

A design review of the system, operations and waste form was held between engineering design, operations, QA, ES&H and construction personnel, to ensure that all interests were accommodated. This not only ensured ease of operation, but also helped to maintain ALARA, with respect to personnel exposure to the waste throughout the planned project performance period. Duratek's Process Control Program (PCP) ensured that solidification and stabilization were achieved for each type of waste being treated. Calculations built into this program enable its application to a wide variety of waste types; the final waste form in every case being a monolithic solid containing no free water. All equipment was designed for remote operation from a remote located control panel. These were located in a clean area, whether located at the sumps, in the leachate storage facility or atop the disposal vaults. Equipment components were designed with interlocks and alarms to preclude unsafe operation or operator error. These remote controlled systems, which were used for transfer of leachate from the sumps, are shown on figures 3 and 4.

Fig. 3 Field control panel with alarms

Fig. 4 Onsite radio chem laboratory.

PROJECT OVERVIEW

The project execution phases included Preliminary Engineering, Design, Equipment Procurement/Construction Management Operational Startup/Commissioning and Operations, which were specifically accomplished in compliance with the ROD. Using it's proven Process Control Program (PCP) Duratek identified the specific chemical and radiological components in the waste, then conducted tests to establish cement formulations to optimize a recipe for volume reduction, conformance with requirements of 10CFR61 and Commonwealth of Kentucky laws and regulation for Class A waste.

Fig. 5 LSF interior

The team designed and procured modularized systems that was subsequently transported to the site for erection. The self-contained systems were installed in an existing

Commonwealth of Kentucky building, as shown in figure 5, which was modified to suit remote leachate liquids handling operations. These modifications included an emergency ventilation system, contingency connections and filters, as well as provision of a raised grating around all equipment. The grating was well above the bermed area to maintain the building clean radiologically throughout the project. The cement module, as shown in figure 6 was created outside the building, as was the Transportation Mixing Station to minimize the transfer of liquid waste between the tanks and the cement batch plant/mixer location. Figure 7 shows the ready mix trucks that were used to both mix and transport leachate/grout mix to the disposal cells for unloading. The discharge of the ready mix trucks was modified as shown in figure 7 to ensure a sealed filling of the grout into the disposal cells. Each system was designed to meet "worst case scenario" conditions.

Fig. 6 Truck filling at LSF

Fig. 7 Modified cement trucks

SUCCESSES BASED ON PLANNING

The system underwent intensive startup testing and operators were thoroughly trained and drilled, prior to production runs. More importantly an aggressive design review ensured proper operation at the earliest point in the project, which is the design phase. The system worked successfully during the grouting campaign allowing us to complete the project on schedule. The work was completed without a lost or restricted workday, and was also used in support of D&D operations at the site, which took place after the successful completion of the leachate grouting operations. Success began by holding team planning meetings, which were held in conjunction with the design review meetings. Due to physical location of the design, construction, operations and management companies these planning meeting were held on a bi- monthly basis while only four major design reviews were required. Once we were on site the philosophy of planning meetings were augmented with safety meetings, which were held on a daily basis. "Plan the work and work the plan" was a daily occurrence at the Maxey Flats site.

LESSONS LEARNED

In conclusion, successes and lessons learned on this most challenging environmental restoration project were quite significant. The team operated on site for seven (7) years without a lost time accident. The actual design and construction period lasted 3 years while the operations including D & D efforts took approximately 4 years. In that time period the team solidified 1.58 million gallons of leachate and process water, which contained over 13,800 curies. The client's appreciation on the project performance generated an additional performance bonus in excess of the contractual amount mandated. Further the Project Manager (Robin Shult), the Site Operations Manager (Greg Rice) and the Engineering Manager (Marty Brownstein) were specifically recognized by the client for their efforts in making the Maxey Flats remediation project a success.

With respect to lessons learned on this most challenging project the following are strongly recommended to ensure success:

- Solve chronic rain water problems by better vault waterproofing and additional efforts on grading operations
- Expand testing of all systems during startup
- Provide access roads to inner liner areas
- Provide a bunker ventilation and water control system. Figure 8 shows the ventilation systems used at Maxey Flats)

Fig. 8 Bunker ventilation system

Bolstered by the level of teamwork and communications provided by the team, client, regulators and stakeholders, throughout the project performance. "Doing things right the first time – all the time" really pays off in project performance.