CURRENT STATUS OF THE WEST VALLEY STATE LICENSED LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA

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ABSTRACT

The New York State Energy Research and Development Authority (Energy Authority) retains management responsibility for the State-owned, closed, commercial low-level radioactive waste disposal area at the Western New York Nuclear Service Center in West Valley, New York. From 1963 to 1975, the facility was operated by Nuclear Fuel Services, Inc as a disposal site for low-level radioactive waste. Due to the characteristics of the soil and wet climate, water management problems were experienced from the very early years of operation. Water accumulation in several of the trenches eventually led to the cessation of burial operations. Redesigning and reworking of the covers reduced, but did not completely eliminate, the problem of water accumulation in the trenches.

In 1983, the Energy Authority assumed management responsibility for the SDA from NFS. This paper summarizes the key projects and activities under way to maintain the facility in a safe condition and to support the goal of permanent stabilization and facility closure.

SITE DESCRIPTION AND OVERVIEW

Western New York Nuclear Service Center

The Western New York Nuclear Service Center (Center) is located 50 kilometers south of Buffalo, New York near the town of West Valley (Fig. 1). The 1,350-hectare Center is the site of the world's first commercial nuclear fuel reprocessing plant. Facilities at the Center include the nuclear fuel reprocessing plant and its ancillary facilities consisting of a fuel receiving and storage pool, high-level liquid waste storage tanks, two solid waste disposal areas, and a low-level liquid waste treatment plant. One of the disposal areas is the State-licensed commercial low-level radioactive disposal area (SDA). All major facilities are located on a 100-hectare plot near the center of the site (Fig. 2). Nuclear Fuels Services Co., Inc.(NFS) operated the site from 1963 to 1982 under a lease with the State of New York. The fuel reprocessing plant has not operated since 1972, and the SDA has been shut down since 1975. In February 1982, the U. S. Department of Energy (DOE) took possession of facilities at the Center (except for the SDA) for the purpose of carrying out the West Valley Demonstration Project (WVDP). The primary purpose of the WVDP, pursuant to the West Valley Demonstration Project Act (PL 96-368), is to solidify the high-level liquid wastes stored at the Center and to decontaminate and decommission the facilities used in the project. On March 30, 1983, responsibility for the SDA was officially transferred to the Energy Authority.

State-Licensed Disposal Area

The SDA occupies approximately 6 hectares of the WNYNSC and is located southeast of the reprocessing plant. The SDA consists of two distinct sets of parallel trenches, identified as north and south disposal areas (Fig. 3).

The north disposal area consists of five long trenches (1 through 5) and two "special" trenches (6 and 7). Trench 7 is a narrow, shallow concrete vault and Trench 6 is actually a series of holes for the disposal of high-activity wastes that required immediate shielding.

The north area trenches are nominally 10 meters wide, 6 meters deep, and 180 meters long. The distance between these trenches is 1.5 to 2 meters. Two lagoons were excavated adjacent to the north trenches. The lagoons held rainwater that was pumped out of the open trenches during disposal operations to provide reasonably dry working conditions. These two lagoons were closed by filling with soil in 1975 and 1977.

The south disposal area consists of seven trenches (8 through 14). This area was developed from 1969 to 1975, and incorporated a number of changes in construction practices based upon the experience gained from operating the north area: topsoil and coarse surface materials were removed; separation distance between trenches was increased to 3 meters; trench floors were sloped away from previously disposed wastes; trenches were covered with individual caps; and cap thickness was increased to 2.4 meters (Fig. 4).

In 1975, a third lagoon was constructed adjacent to the south trenches to hold water pumped from the completed trenches, that were accumulating water. This lagoon was closed in 1991 by first installing a barrier membrane over the sediments, then filling in with native soil and adding a clay cap.

The disposal trenches were excavated into the native Lavery till which because of its high clay content and high degree of over-consolidation, is highly impermeable at depth.

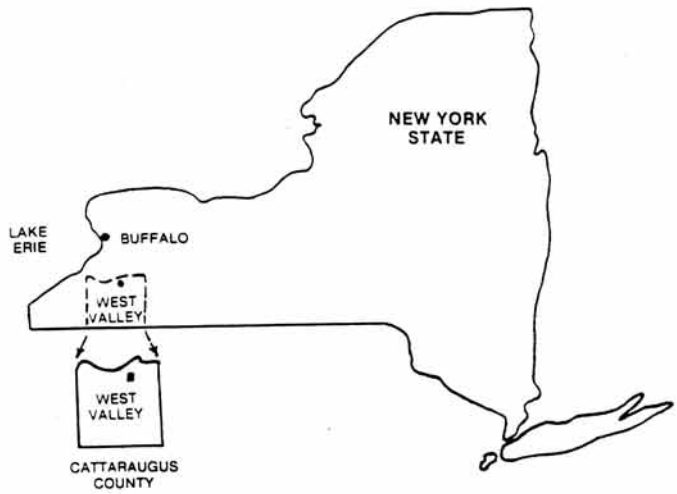

Fig. 1. Location of Western New York Nuclear Service Center.

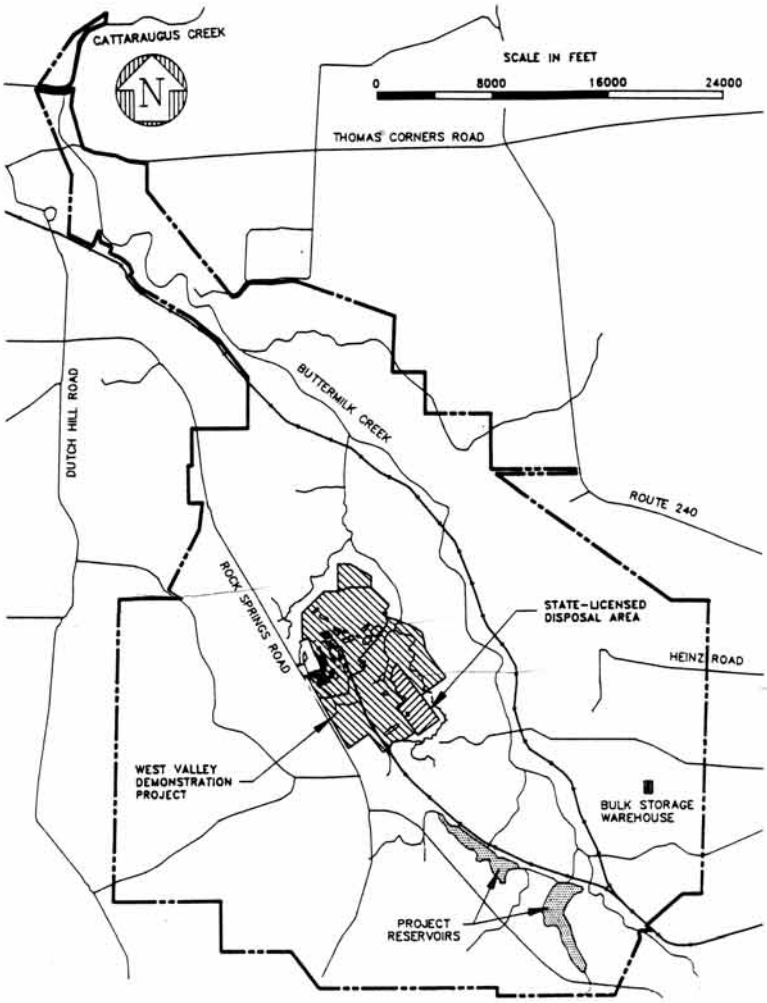

Fig. 2. Western New York Nuclear Service Center.

Samples taken from boreholes have indicated, however, that the upper 3 meters of the till is weathered as a result of desiccation. The weathered till is highly fractured and is generally more permeable than the unweathered till.

Disposal Operations

From 1963 to 1975, approximately 66,500 cubic meters of waste containing 736,000 curies were disposed in the SDA. The waste was received from institutions, industries, government facilities, nuclear power plants, waste brokers, decontamination companies, and NFS. Monitoring showed that 1.5-3 meters of water accumulated in the trenches during the first two to three years after each trench was covered and then began to level off, with the exception of Trenches 3, 4, and 5. Following a brief period of apparent stability after individual cover mounds were established in 1969, the water in these trenches continued to rise until March 1975, when the water seeped out laterally through the cover of Trenches 4 and 5. NFS immediately halted disposal operations and no material has been disposed of in the SDA since.

POST-CLOSURE SURVEILLANCE AND MAINTENANCE ACTIVITIES

NFS Activities

Following the water seepage incident, NFS pumped and treated water from the disposal trenches. From 1975 to 1977, approximately 7.6 million liters were removed from the trenches, treated, and discharged. In an attempt to minimize water infiltration, an additional 1.2 meters of clay cap material was placed over the north trenches in 1978 to duplicate the construction of the south trenches, which experienced much lower rates of water infiltration.

Beginning in 1978 and continuing through 1979, sharp increases in water levels in Trenches 11 through 14 in the south disposal area were measured. These increases were attributed to an extended dry summer period (which caused desiccation cracking in the cover) followed by a wet fall and winter. In the Fall of 1980, NFS improved the covers for Trenches 11 through 14 by stripping 15 centimeters of topsoil from the trench covers and 62 centimeters of clay cap material, placing and compacting 72 centimeters of compacted clay in layers, adding 31 centimeters of top soil, and performing final grading and seeding. Following completion of this work, NFS pumped down all of the trenches. The pumping campaign lasted from the Fall of 1980 to the spring of 1981, removing an additional 3.02 million liters of water from the trenches, and was the last significant remedial activity performed by NFS.

Site Management by the Energy Authority

In accordance with an agreement between NFS and the Energy Authority the Energy Authority assumed possession

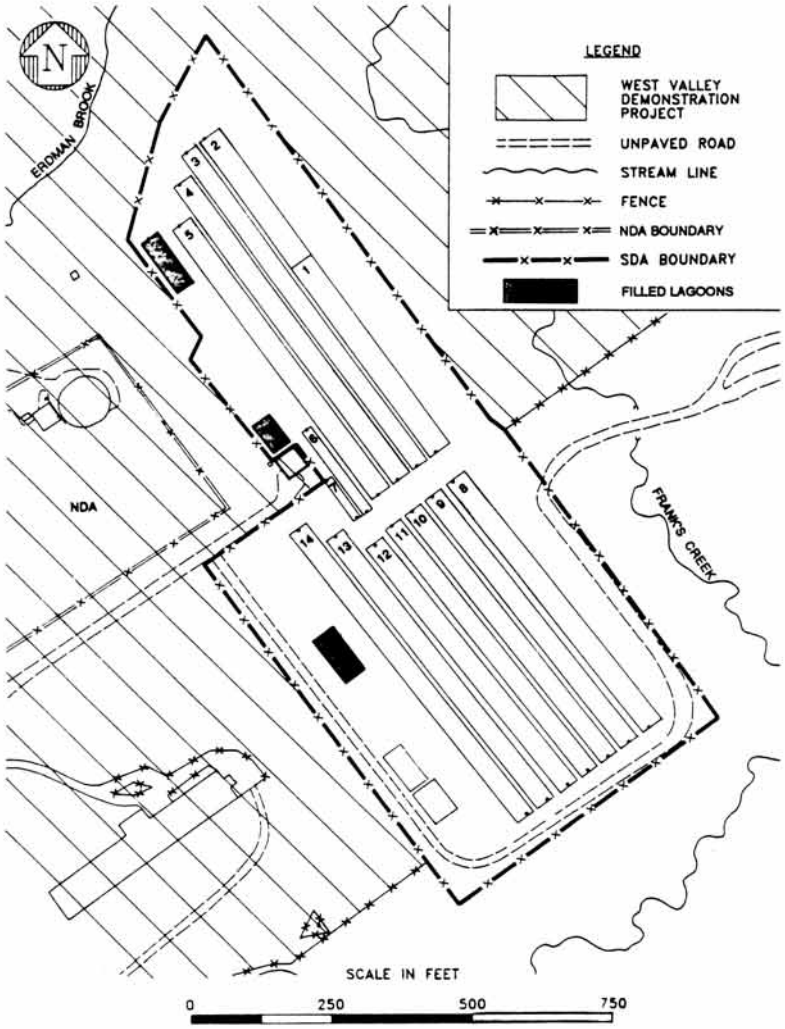

Fig. 3. State licensed disposal area (SDA).

of the SDA and hence responsibility for surveillance and maintenance in the spring of 1983.

Between 1983 and 1986, the Energy Authority and DOE sponsored a project to evaluate options for long-term management of the SDA. The study (1) called for the development of an interim plan to improve management practices pending development and implementation of a long term management strategy. In implementing this interim management plan, the Energy Authority has focused its efforts on minimizing water infiltration through an active maintenance program, establishing a comprehensive environmental monitoring program, and collecting site specific data to allow for decisions to be made on ultimate stabilization and closure of the SDA.

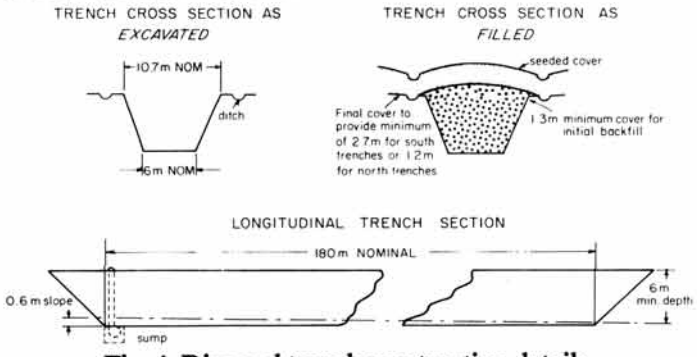

Fig. 4. Disposal trench construction details.

TRENCH 14 INFILTRATION CONTROL EFFORTS

Sand and Gravel Body Removal Project

Between 1981 and 1986, Trench 14 water level increased at a rate of 2.5 to 5 centimeters per month; however, in June 1986, during a relatively rainy summer, a 20 centimeter increase was measured. This was followed by increases of 10 centimeters and 28 centimeters in July and August respectively (2).

Initially suspecting trench cover failure, the cover of Trench 14 and the drainage ditch between Trenches 13 and 14 were inspected for defects (potholes, desiccation cracking, etc.). No visible defects were seen by Energy Authority staff. The Energy Authority focused on the area west of Trench 14 as a potential source of water infiltration. Regrading of the area showed a dramatic reduction in water infiltration even though wet weather continued. Further investigation revealed the existence of a large sand and gravel body near the south end of Trench 14 that extended west to near the surface. Historic notes from burial operations indicate the sand and gravel body may extend through Trenches 13 and 14, ending in Trench 12. During the summer of 1987, the sand and gravel body west of Trench 14 was removed and replaced with compacted silty clay till.

As a result of the removal of the sand and gravel body, infiltration rates into Trench 14 were reduced to approximately 8 centimeters per year.

Infiltration Controls Project

In January 1991, during an unusual period of high rainfall and snow melt, the water levels in Trench 14 increased by 18 centimeters and by 51 centimeters in adjacent Trench 13. The Trench 13 water increase was attributed to the water level in Trench 14 reaching the sand and gravel body between the trenches, and flow into Trench 13 was now possible. From previous pump down activities it was known that the void volume in Trench 13 was significantly less than (approximately one-third) that in Trench 14. A detailed examination of the caps on Trenches 12, 13, and 14 showed no obvious or major deficiencies.

At this point, it was unclear what portion of the most recent source of water resulted from surface water infiltrating through cracks in the cap as opposed to lateral ground water movement through fractures in the weathered till. Consequently, the Energy Authority focused its efforts on developing engineering solutions that would address both potential pathways, while in parallel undertaking to evaluate the source of water accumulation. The case for lateral groundwater movement through the weathered till was supported by the observation of high water levels in many of the existing shallow ground water wells. Likewise the notion of vertical infiltration was supported by the periodic formation of sinkholes in the trench caps.(3)

To evaluate the shallow groundwater flow regime and define subsurface lithologic conditions in the vicinity of Trenches 13 and 14, 24 shallow piezometers were installed west and south of Trench 14 in April 1991. Because a single source for water infiltration was not identified, an engineering solution to address both horizontal and vertical water influx was developed. The infiltration controls consisted of a vertical barrier wall, or slurry wall to divert groundwater flow in combination with a geomembrane cover to divert precipitation away from the trenches.

Slurry wall construction began in early September 1992, and was completed in three weeks. The excavated native soil was used in combination with bentonite clay and water to form a highly impermeable barrier to horizontal water flow. The objective for the project was to ensure that all cracks, fissures, and coarse deposits that could transmit water to the trench were cut off. The slurry wall was aligned to run along the west side of Trench 14 and deflect around both the north and south ends (Fig. 5). The 276-meter long slurry wall is approximately 0.9-meters wide and extends 9-meters below existing grade. While the primary intent of the slurry wall was isolate the trench from the adjacent weathered till, the underlying unweathered till was known to contain isolated sand and gravel deposits. Since it could not be determined for certain if these sand and gravel deposits intersected the trenches, it was decided to extend the wall to a level below the lowest trench elevation, thereby eliminating any possibility of a deeper ground water infiltration route.

The membrane cover, which is comprised of very low-density polyethylene (VLDPE), will extend from the center line of Trench 12 across Trenches 13 and 14 and end just west of the slurry wall. The membrane will be extended to Trench 12 since it is believed that Trenches 12, 13, and 14 may be interconnected by a sand and gravel body. A drainage channel will carry all diverted precipitation away from the trenches.

Following completion of the slurry wall, preparation of the surface of the trenches began for installation of the membrane cover. This work included stripping the grass cover from the trench caps, regrading areas to accommodate membrane cover installation, and excavating the primary drainage channel for the membrane cover. Due to heavy rain and snow in November, installation of the membrane cover has been delayed until the Spring of 1993.

After installation of the slurry wall, Trench 14 has showed a drop in infiltration rate from the previous two years (Fig. 6). Although the membrane cover has not yet been installed, the grading work done as part of surface preparation is having a short-term positive effect by enhancing runoff. In the longer term, however, an unprotected soil cover could enhance infiltration due to effects of erosion and desiccation cracking. Therefore, the membrane will be installed as soon as weather permits.

TRENCH 14 LEACHATE TREATMENT PROJECT

Although the rate of water accumulation in Trench 14 has been reduced by past remedial actions, water levels are near their historical high point. Consequently, the Energy Authority has initiated plans to pump and treat the leachate.

RCRA Compliance Issues

The leachate in the SDA trenches results from the percolation of water through radioactive wastes that were disposed of prior to passage of the Resource Conservation and Recovery Act (RCRA) and its associated regulations. While the leachate in Trench 14 contains both radionuclides and hazardous constituents, there is no specific information that details the sources of the hazardous constituents found in the leachate. Disposal records document only the radionuclides present in the disposal trenches. In the absence of this information, the Energy Authority believes a listed hazardous waste designation is not warranted, but has elected to protectively file a RCRA Part A application to store and treat potentially mixed radioactive and hazardous wastes at the SDA. Discussions are currently under way with regulatory agencies regarding the RCRA status of the leachate. The Energy Authority will continue to manage the leachate as radioactive mixed waste until this issue is resolved.

Status of the Leachate Treatment System Design

A summary of the major constituents in Trench 14 leachate is included as Table I. Treatability studies have been performed to investigate the applicability and effectiveness of a variety of technologies toward reducing the levels of hazardous and radioactive components in Trench 14 leachate. Carbon adsorption, biological treatment, ultraviolet oxidation, evaporation, and ion exchange were tested. The treatability study concluded that the leachate treatment system should be based on a three-stage treatment train consisting of biological treatment in the form of a batch activated-sludge reactor followed by filtration units, carbon polishing columns, and ion-exchange resin beds (Fig. 7). The batch biotreatment process is highly effective in reducing the organic content of the leachate. The carbon columns will remove trace organics not removed in the bioreactor. The ion exchange beds will remove radionuclides, except tritium, to below regulatory discharge limits.

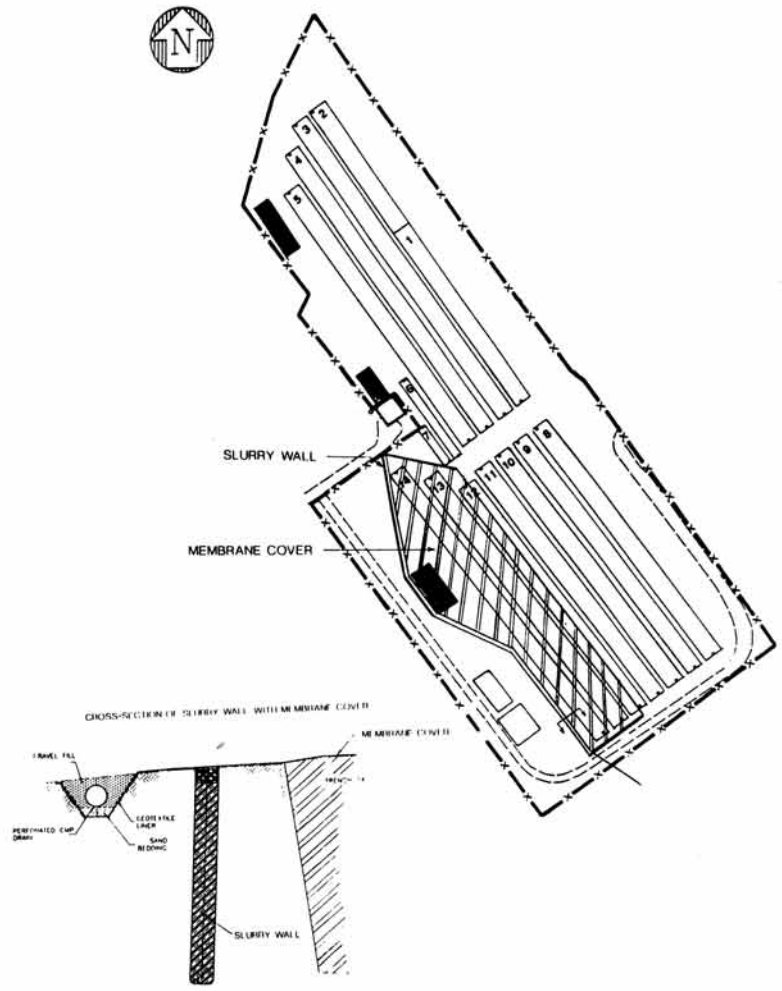

Fig. 5. Infiltration controls project.

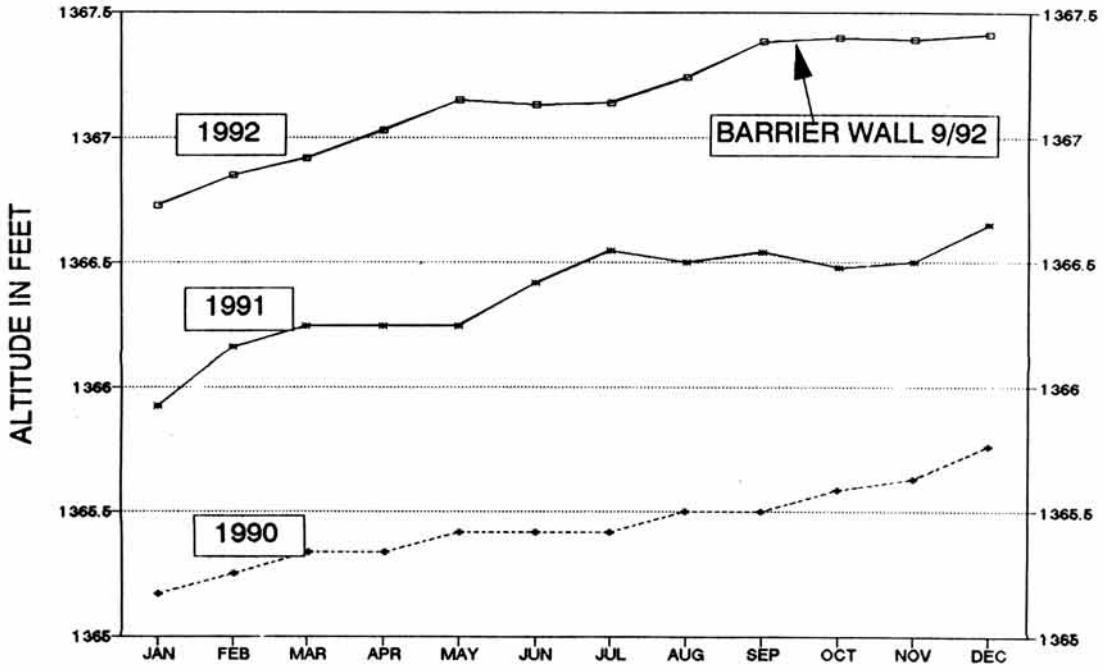

Fig.6. Trench 14 water levels 1990, 1991, & 1992.

During process development, the Energy Authority installed three storage tanks as a contingency to store untreated leachate in the event leachate levels were to rise to the point of the weathered/unweathered till interface. One of these tanks was filled with 28,350 liters of leachate in March 1991. The two remaining tanks have a capacity of 79,400 liters each and have not yet been used. Plans are to incorporate all three tanks into the treatment system. The smaller tank will be used as an initial feed tank to accept leachate from the Trench 14 sump pump. The remaining two larger tanks will be used to store and batch transfer treated leachate to the final discharge point.

The Engineering Report containing the design basis for the treatment system was submitted to both EPA and DEC for approval in December 1992. The Energy Authority is currently in the process of soliciting bids for detailed design, construction, and operation of the treatment system, and anticipates having the system operational by spring 1994. Following an initial pilot phase operation, the system will be operated as needed to maintain water levels well below the weathered/unweathered till interface.

SITE CHARACTERIZATION AND LONG TERM PLANNING

Environmental Impact Statement

In 1989, the Energy Authority entered into an agreement with DOE to prepare a joint Environmental Impact Statement (EIS) for completion of the West Valley Demonstration Project and closure of facilities at the Center. The EIS will review closure alternatives ranging from the no action alternative to the "green field" alternative (complete exhumation and off-site disposal of all contaminated materials) with several intermediate alternatives considered for each facility. A contractor was selected in late 1992 to prepare the EIS.

Environmental information for the EIS is now being collected. Data will include: water quality, air sampling, soils sampling, radiation surveys, source term evaluation, geology, seismology, ecology, pathway assessment, socio-economics, and cultural resources. SDA-specific information, collected as part of the Energy Authority's site maintenance and monitoring program, will be used to supplement the WVDP EIS data collection program.

TABLE I
Major Constituents In Trench 14 Leachate

Concentration	Constituent in Leachate (ppm)
BOD_5	5,300
Methylene Chloride	78
Benzene	1.1
Toluene	34
Xylenes (total)	18
Phenols	7.4
Radionuclide	**Concentration in Leachate (μci/ml)**
Cs-137	2.24×10^{-4}
Sr-90	1.84×10^{-4}
H-3	4.98×10^{-1}
I-129	2.90×10^{-5}
C-14	1.19×10^{-4}
Note: Highest detected values are reported	

RCRA Facility Investigation (RFI)

In March 1992, the Energy Authority signed a RCRA Section 3008(h) Administrative Order on Consent (the Consent Order) with DOE, EPA, and the New York State

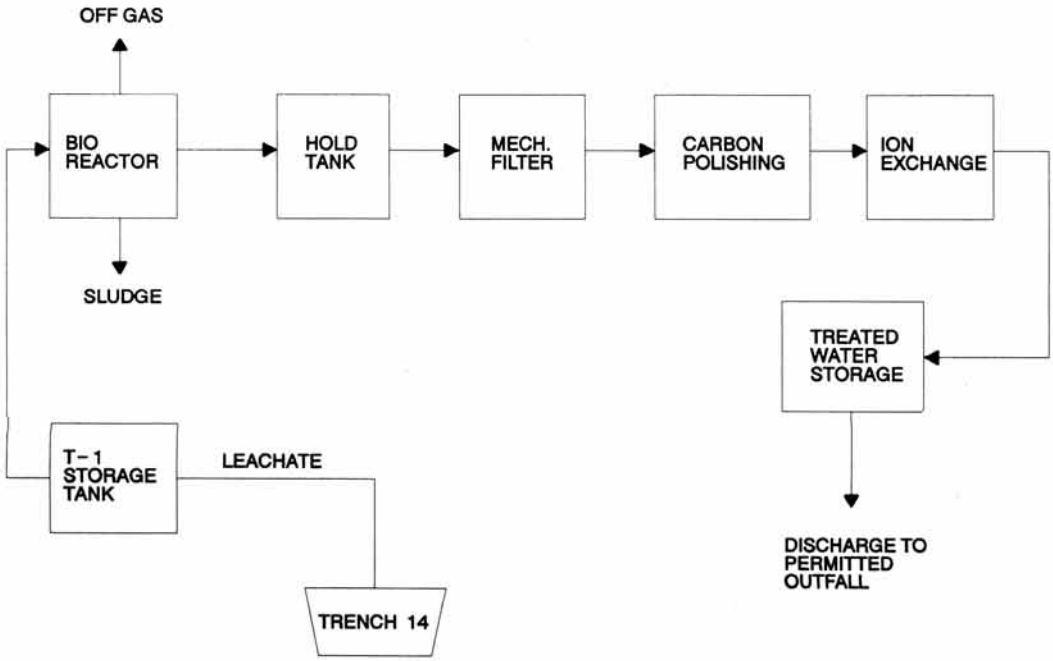

Fig. 7. Trench 14 leachate Treatment System Process Flow Sheet.

Department of Environmental Conservation (DEC). The Consent Order directs the Energy Authority and DOE to conduct investigations at the Center. The Energy Authority is conducting a RCRA Facility Investigation (RFI) to determine if there have been any releases of RCRA regulated hazardous wastes or hazardous constituents from SDA waste management units, and, if releases are identified, to determine the nature and extent of contamination. The Consent Order also designated the Infiltration Controls Project and the Trench 14 Leachate Treatment Project as Interim Measures.

In June 1992, the Energy Authority submitted an RFI workplan to EPA and DEC. The scope of the RFI workplan includes a review of historical information, including data collected as part of the on-site environmental monitoring program and as part of EIS site characterization, and defines an investigative program for collection of additional data. To minimize duplication of effort, data collected for the RFI is being integrated with the data collection process for the EIS. The RFI workplan also includes a data management plan, a QA/QC plan, a health & safety plan, and a community relations plan. The main area of focus for the Energy Authority will be the 14 disposal trenches and the three closed lagoons within the SDA.

The plan includes extensive soil sampling and installation of additional monitoring wells in selected locations. EPA and DEC have provided comments, and final approval of the RFI workplan is expected in February 1993. Field sampling is scheduled to begin in May 1993. A final RFI report will evaluate data collected and address the need for further corrective measures studies. The draft report is scheduled to be submitted to EPA and DEC by the end of 1994.

CONCLUSIONS

The Energy Authority is continuing to maintain the SDA in a condition that protects public health and safety and the environment. Ongoing environmental monitoring and characterization is being performed in support of facility closure. Although previous efforts have reduced water infiltration, they have not completely eliminated the problem. Efforts are continuing to further reduce water infiltration. A system for treatment of contaminated trench water is under design and expected to be operational in the spring of 1994.

An ongoing effort to characterize the site for potential releases of hazardous constituents will be completed by the end of 1994. To evaluate alternatives for long-term management of the SDA, a joint (DOE/Energy Authority) EIS is being prepared.

REFERENCES

1. Envirosphere Company, "Executive Summary of the Site Stabilization Study for the LLRW Disposal Area at West Valley, New York," New York State Energy Research and Development Authority Report 87-14-e (1986).
2. ANDERSON, D.B.,"Surveillance and Maintenance of the West Valley State Licensed Low-Level Radioactive Waste Disposal Area 1983-1987", New York State Energy Research and Development Authority (1988).
3. BLICKWEDEHL R.R., "Evaluation of Alternate Infiltration Control Plans; State Licensed Disposal Area- Western New York Nuclear Service Center West Valley, New York" Dames & Moore Report #10805-509-203 (1991).