SURVEILLANCE AND MAINTENANCE OF THE WEST VALLEY STATE LICENSED LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA 1983-1987

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ABSTRACT

The New York State Energy Research and Development Authority is the current custodian of the State-owned, closed, commercial low-level radioactive waste disposal area (SDA) at the Western New York Nuclear Service Center in West Valley, New York. From 1963 to 1975 that facility was operated by Nuclear Fuel Services, Inc. Packaged waste was placed in long trenches excavated in the highly impermeable, silty till soil native to the site, and covered with four to eight feet of excavated soil. Due to the character of the soil and the wet climate, water management problems were experienced from the very early years of operation. Water accumulated in the open, uncompleted trenches and in covered, completed trenches. Water continued to accumulate in several of the original trenches until March 1975 when it crested the original terrain and began to seep through the cover of two trenches. Redesigning and reworking the covers have thus far reduced but not eliminated the problem of water accumulation in the trenches. In its present condition, the closed disposal area will continue to require active and continuous maintenance for the foreseeable future.

In 1983, responsibility for management of the SDA was transferred to the Energy Authority. The Energy Authority's activities related to the SDA since 1983, including recent efforts to remediate a rapid water buildup in one of the trenches, are discussed. Energy Authority assessments related to such issues as site stabilization, long-term management plan development, RCRA and closure are also briefly discussed.

SITE DESCRIPTION AND OVERVIEW

Western New York Nuclear Service Center

The Western New York Nuclear Service Center (WNYNSC) is located 30 miles south of Buffalo, New York, near the town of West Valley (Fig. 1). The 3,345 acre 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 waste disposal area (SDA). All major Center facilities are located on a 250-acre plot near the center of the site (Fig. 2). Nuclear Fuel 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 most facilities at the Center for the purpose of carrying out the West Valley Demonstration Project (WVDP) whose primary purpose, 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 New York State Energy Research and Development Authority.

State-Licensed Disposal Area

The SDA occupies approximately 15 acres southeast of the reprocessing plant and is adjacent to the NRC-licensed disposal area (NDA). The NDA is currently in the possession of DOE for use by the WVDP. The SDA consists of two distinct sets of parallel trenches, identified as north and south disposal areas (Fig. 3).

The northern area consists of five long trenches (1,2,3,4,5), and two "special" trenches (6 & 7). Trench 7 is a narrow, shallow concrete vault in which wastes were disposed and Trench 6 is actually a series of holes for the disposal of high-activity wastes requiring immediate shielding.

The northern area trenches are nominally 10m (35 feet) wide, 6m (20 feet) deep, and 180m (600 feet) long (1). The distance between these trenches was 1.5-2m (4-6 feet); however, due to the method of construction (bulldozer excavation) and instances of wall collapse, some trenches are believed to be connected. Two lagoons were excavated adjacent to the northern trenches to facilitate the pumping of rainwater out of the trenches during disposal operations to provide reasonably dry working conditions in the open end of the trench. These two lagoons have since been closed (filled with soil).

The southern disposal area consists of seven trenches (8-14). This area was developed from 1969 to 1975 and incorporated a number of changes in construction practices based upon the experience gained from the northern area:

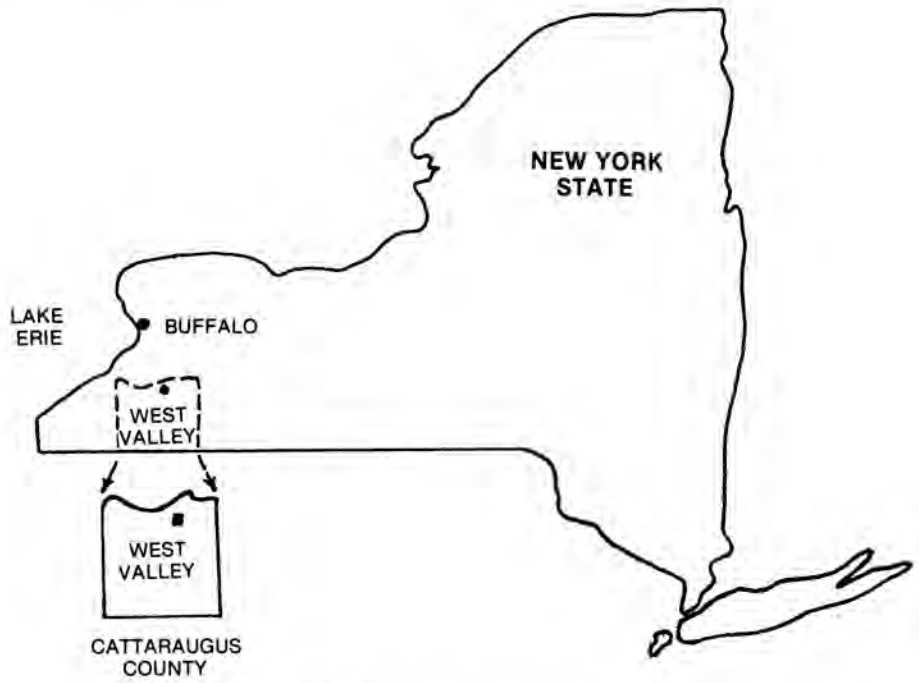

Fig. 1. Location of the Western New York Nuclear Service Center.

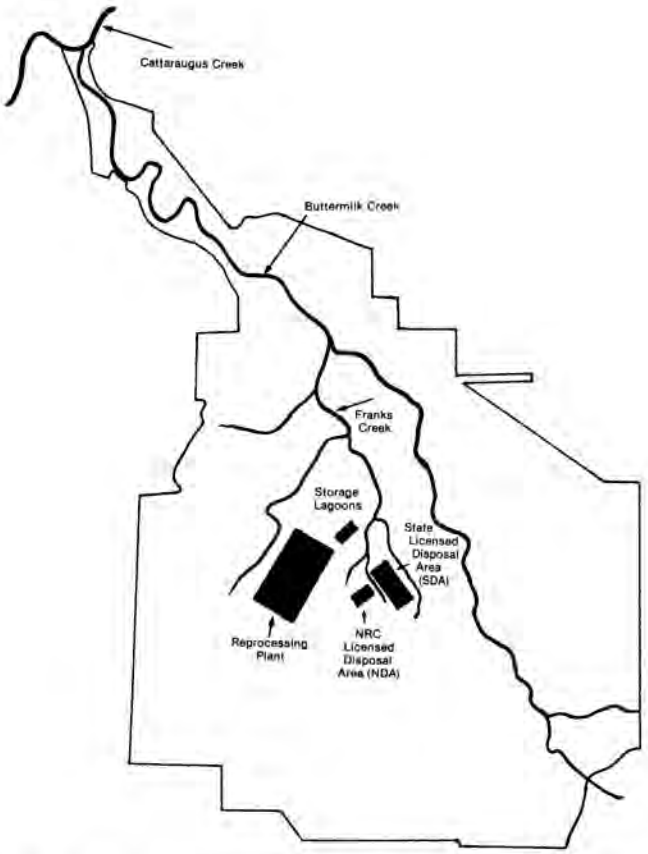

Fig. 2. Boundaries and Principal Features of the WNYNSC Site.

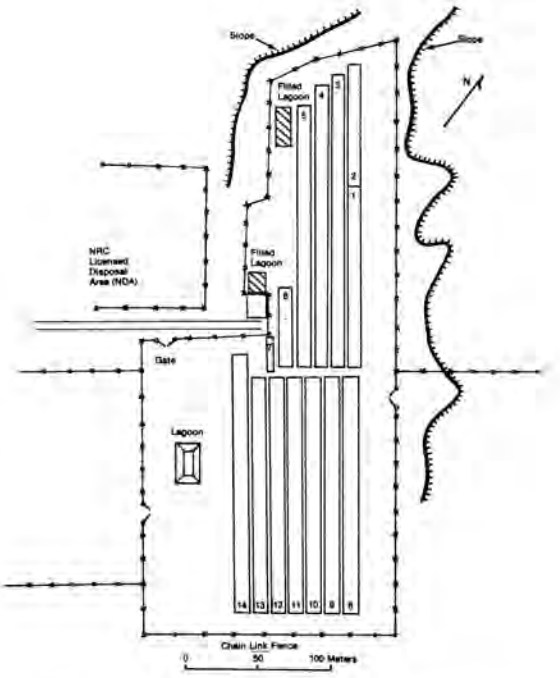

Fig. 3. State Licensed Disposal Area (SDA).

(1) topsoil and coarse surface materials were removed, (2) separation distance between trenches was increased to 3m (10 feet), (3) trench floors were sloped from previously disposed wastes, (4) trenches were covered with individual caps, and (5) cap thickness was increased to 2.4m (8 feet) (Fig. 4).

In 1971, the two lagoons in the northern disposal area were connected to the low-level liquid waste treatment facility via a pipeline. In 1975, a third lagoon was constructed adjacent to the southern trenches for pumping water from the completed trenches which were accumulating water.

OPERATION HISTORY

Disposal Operations

The SDA was licensed to handle three types of radioactive wastes: (1) by-product materials (H-3, C-14, Co-60, I-125, I-131, Cs-137, Am-241),(2) source materials (Th-232, U-238, natural uranium), and (3) special nuclear materials (U-235, Pu-238, Pu-239). From 1963 to 1975, about 66500 m^3 (2.35 million $ft.^3$) of wastes containing approximately 736,000 curies were disposed of in the SDA. These wastes included approximately 500,000 curies of by-product material, about 450,000 kg of source materials, and 55,000 kg of special nuclear materials. The waste was received from institutions, industries, government facilities, nuclear power plants, waste brokers, decontamination companies, and NFS (1,2).

Early Water Infiltration and Overflow

While the northern trenches (1-7) were being actively utilized (1963-1969), it was observed that water levels in covered completed trenches began to rise. To eliminate or reduce the amount of water entering subsequent trenches, construction and operating procedures were changed in 1968 and then utilized on the southern trenches.

In the early 1970s small increases in the levels of radioactivity (tritium) in streams adjacent to the SDA were detected by State monitoring. A study was conducted in 1973-74 to determine if there was underground migration from the disposal area. Vertical borings were made around the perimeter of the SDA and soil samples were taken and analyzed. No significant migration of radioactivity out of the trenches was detected.

Monitoring showed that 1.5-3m (5-10 feet) of water accumulated in the trenches during the first two to three years after each trench was covered and then stayed constant, with the exception of Trenches 3, 4, and 5. Following a brief period of apparent stability after individual cover mounds were established in 1969, these trenches continued to rise until March 1975, when the water reached the original soil level and seeped through the cover of Trenches 4 and 5. NFS immediately halted disposal operations and no material has been disposed of in the SDA since that time (1).

Remedial Action Programs (1975-1981)

After the water seepage incident, the New York State Department of Environmental Conservation (DEC)

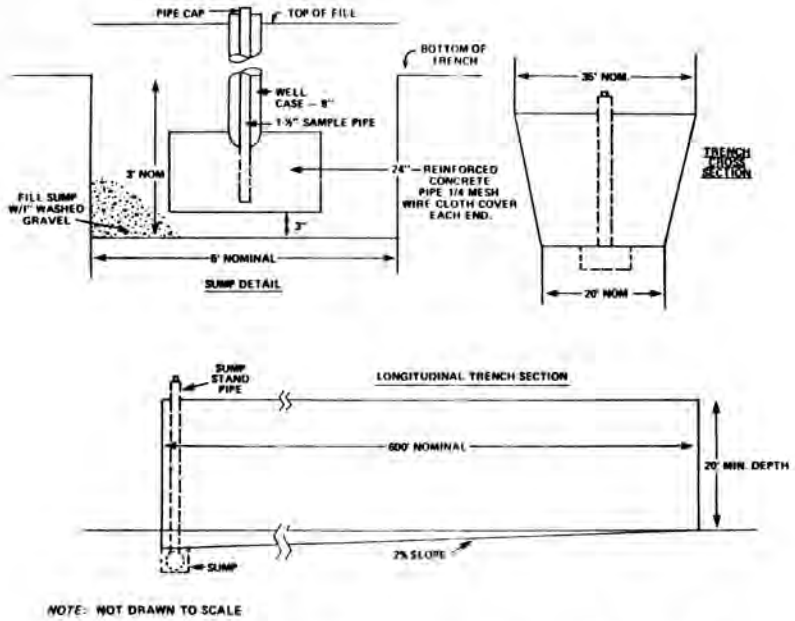

Fig. 4. Typical West Valley Trench Construction Details.

permitted NFS to pump and treat the accumulated water out of the trenches Water was pumped down about 3m (10 feet) below ground level. Approximately one million liters of water were removed from the trenches during the period March-April 1975. This water was first pumped to a holding lagoon where it was chlorinated to destroy biologically hazardous materials and then treated with other chemicals to reduce water hardness and to precipitate some of the radionuclides. After the floc settled, the water was transferred to the low-level liquid waste treatment facility for additional treatment and sampling, and discharge into surface streams. From October- November, 1975, 1.6 million liters were removed. July- October 1976 and August-November 1977 pumpouts further reduced the water level in the trenches.

Following a study of the trench water problem and possible remedial actions, the Energy Authority directed NFS to take corrective action to minimize infiltration of water into the north disposal area trenches. In August 1978, NFS conducted a trench cap rehabilitation program as approved by the Energy Authority and DEC. Up to that time, experience with the southern trenches indicated that 2.4m (8 foot) thick trench caps would prevent the infiltration of water. Consequently, an additional 1.2m (4 feet) of compacted silty till was placed on top of Trenches 1-5 and surface drainage improvements were implemented.

Commencing in 1978 and continuing through 1979, sharp increases in water levels in Trenches 11-14 in the south disposal area were measured. These increases were attributed to an extended dry summer period which caused desiccation cracking in the cover. In December 1979, DEC requested that NFS pump and treat water from all the disposal trenches and requested that NFS develop a plan for correcting the problem of rapid water infiltration into Trenches 11-14.

In the summer of 1980, DEC authorized NFS' rehabilitation program for Trenches 11-14 and at the request of NFS, pumping of the trenches was deferred until the rehabilitation effort was completed. The corrective action, which was taken in the fall of 1980, included stripping 0.6m (24 inches) of till and 0.2m (6 inches} of topsoil from the trench covers, placing and compacting 0.7m (28 inches) of till in layers, adding 0.3m (12 inches) of top soil, final grading, seeding, and application of mulch (3). Following completion of this work, NFS began pumping water from the trenches, but suspended the effort due to cold weather. Pumping of all trenches was completed in the spring of 1981. NFS experienced great difficulty in pumping water from Trench 1, despite installing several wells in different locations. No appreciable volume of water has ever been found in Trench 1.

Following the 1980-81 trench pumping campaign, NFS did not perform any significant remedial actions on the SDA.

PRESENT STATUS (1983-87)

In accordance with the Settlement Agreement between NFS and the Energy Authority, following NFS' termination of its lease, the Energy Authority assumed possession of the SDA and hence responsibility for surveillance and

maintenance in the spring of 1983. Energy Authority activities at the SDA are conducted to ensure protection of public health and safety and compliance with regulatory requirements of the New York State Departments of Environmental Conservation and Labor. Activities at the site generally consist of routine radiological and environmental monitoring, trench performance monitoring (water levels and subsidence measurements), site inspections and reporting, trench cover mowing, cover and drainage repairs, and security. Due to the close proximity of the West Valley Demonstration Project, DOE and its operating contractor, West Valley Nuclear Services Company, provide a number of SDA services (e.g., security coverage and health physics support) to the Energy Authority on a cost-reimbursable basis. The WVDP environmental data are available to the Energy Authority and this monitoring program provides most of the environmental data for the SDA.

Monitoring of the SDA by NFS and now the Energy Authority indicates that, despite the remedial measures described, water continues to infiltrate into the SDA trenches. Since the last pumping in 1981, most of the trench water levels have increased, with the most significant increases occurring in Trenches 2, 5, 10, and 14.

Trench 14 Water Problem

Of those trenches showing water level increases since the 1980-81 pumpdown, Trench 14 had by far exhibited the most significant increase. Between 1981 and 1986, its water level increased at a fairly moderate rate of 2.5-5cm (1-2 inches) per month; however, in June 1986, a 20cm (8 inch) increase was measured. In July, the increase was 10cm (4 inches), and in August, a 28cm (11 inch) increase was recorded.

A review of trench sump water level and precipitation data indicated a strong correlation between rainfall and increased water levels in the Trench (Fig. 5). 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 could be found by Energy Authority staff. The Energy Authority concluded that, although cap failure could not be completely ruled out, there was a strong possibility that water was entering the trench through a layer of weathered silty till west of Trench 14 or that water was being conducted in via a permeable unit located in that area. It is noted that during the spring and summer of 1986 there was an unusual amount of precipitation during frequent severe thundershowers and, at times, standing water was observed in the field west of the trench. The Energy Authority took prompt action to improve the drainage in the area and the rate of infiltration slowed dramatically despite continued wet weather. This fact led the Energy Authority to focus more attention on the field west of the trench.

In September 1986, a local civil engineering firm was hired to conduct an independent study of the problem and to recommend actions that could be taken to resolve the problem. A construction contractor was later engaged to implement the solution under the direction of the civil engineering contractor. In the late fall of 1986, a total of 28 soil borings were made and two test trenches were dug to characterize the suspected area. The borings ranged in depth from 3-8.5m (10-28 feet) and generally extended along the west and south side of Trench 14. Continuous split spoon samples were obtained and were preliminarily visually characterized on the spot by a qualified soil scientist. The investigation confirmed the presence of a permeable stratified sand and gravel unit within the generally impervious clayey-silt glacial drift matrix. This permeable unit was oriented such that it intersected the trench and came very close to ground surface within 27m (90 feet) of the trench. As shown in Figures 6 and 7, the size of the sand/gravel unit and its orientation provided a highly plausible explanation for both the rapid trench water buildup and the fact that the drainage improvements yielded a significant reduction in water infiltration.

Although there was some historical documentation suggesting the earlier presence of a sand/gravel unit near the surface, the discovery of this unit was unexpected. The unit ran along the side of the trench for some 30m (100 feet), reaching a maximum depth of about 4m (13.5 feet) and 1.5m (5 feet) in thickness. It extended toward the west a distance of some 50m (165 feet), and contained some 1050m^3 (1400 yd.^{3}) of sand/gravel. The Energy Authority concluded that the sand/gravel unit had the potential to compromise the integrity of the SDA, despite the apparent effectiveness of the drainage improvements. Of most concern was the observation that the lowest extent of the permeable unit within 6m (20 feet) of the trench was very close to or at the existing leachate level in the trench. If the sand/gravel unit did intersect Trench 14 at a depth of 4m (13.5 feet), any subsequent trench water level increase could have resulted in contamination of the sand/gravel unit with trench leachate. This would have made the subsequent remediation project (which involved excavation in that material) more difficult. Radiological surveys of the soil borings indicated that the unit was not contaminated at the time of the investigation; however, the Energy Authority could not be confident that it would remain clean indefinitely. Immediate action was taken to reduce trench water level and avoid any potential water inflow (or outflow) through the sand/gravel unit.

The prior State Pollution Discharge Elimination System (SPDES) permit for effluent from the on-site liquid low-level radioactive waste treatment facility, pursuant to which NFS had treated and discharged trench effluent (among other things), had expired and been replaced by a new SPDES permit issued to DOE and WVNS for the WVDP, which did not cover trench leachate. A SPDES

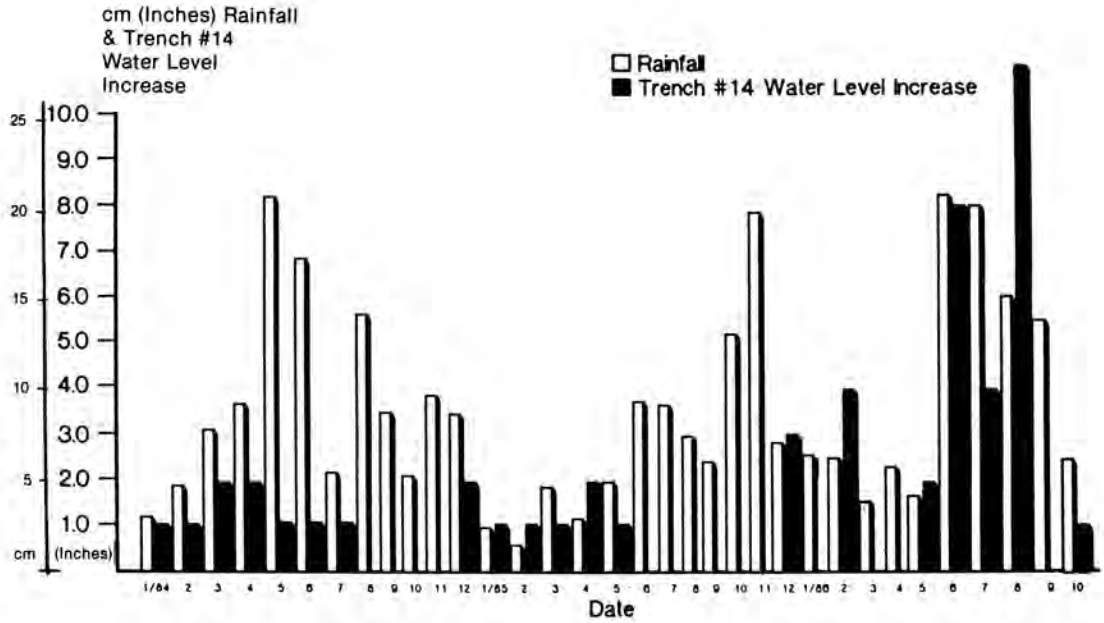

Fig. 5. Trench 14 Performance 1984-1986.

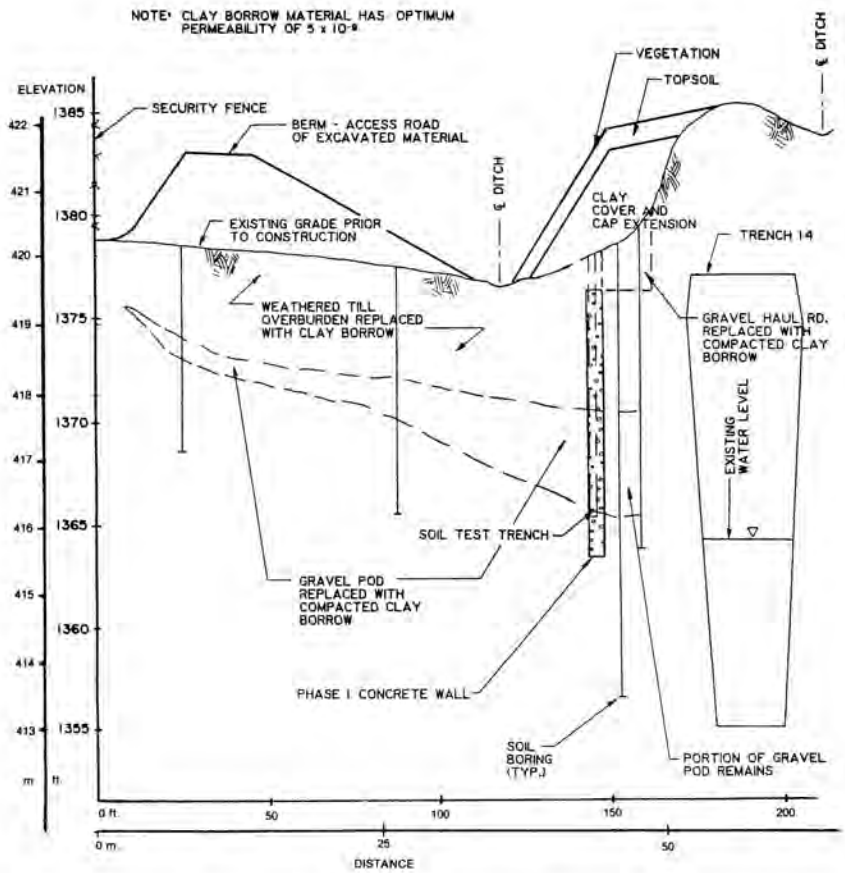

Fig. 6. Trench 14 Maintenance Project.

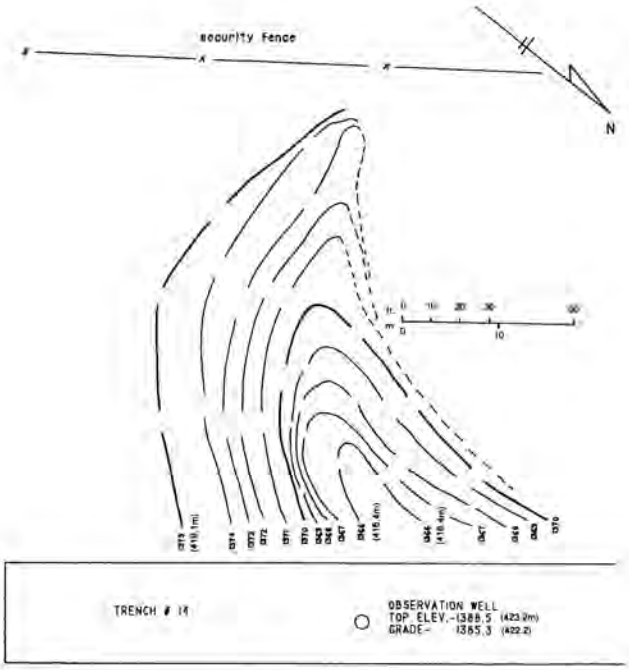

Fig. 7. Elevation of Sand/Gravel Unit Lower Boundary.

permit amendment covering the leachate would have taken too long to obtain. After reviewing the available options, the Energy Authority requested and was granted permission to lower the water level in Trench 14 by transferring the water into two of the adjacent trenches. This was done in early February 1987. A total of 114,000 liters (30,000 gallons) of leachate were pumped into Trenches 13 and 12.

To provide additional protection against water entering the trench, and to create a wall against which the planned extensive excavation work in the sand/gravel unit could be conducted, a subsurface concrete wall was installed immediately west of Trench 14 (Fig. 6). The wall was started and completed on February 17, 1987. It was a minimum of 1.2m (4 feet) thick, 40m (130 feet) in length, and contained some 320m^3 (420 yd.^{3}) of concrete.

In the summer of 1987, the Energy Authority completed the remainder of the remedial action project. The effort consisted of removing the entire sand/gravel unit west of the concrete wall, replacing it with compacted silty/till clay from a nearby borrow area, grading the affected area for more effective drainage and establishing a vegetation cover. By the end of the 1987 working season, the project had been essentially completed. Only some cleanup work remains. As of the writing of this paper, some five months have lapsed without a significant water level increase in Trench 14. The total level increase in the past 18 months (since August, 1976) was 18cm (7 inches), well below the previous rate. The Energy Authority continues to closely monitor the trench to determine the success of this effort.

Efforts are continuing to acquire a SPDES permit amendment allowing treatment and discharge of the remaining leachate in Trench 14. Current plans are to conduct this pumpout in 1988. The Energy Authority also is taking steps to obtain SPDES permitting sufficient for treatment and discharge of leachate from the other trenches at the site, so that they can be quickly dealt with should any of them require such action.

Current Site Management Activities

Between 1983 and 1986, the Energy Authority and the Department of Energy sponsored a project to evaluate options for the long-term management of the SDA. The project was conducted by Envirosphere Company. The objective of each long-term management alternative was to place the SDA in a condition eventually requiring only passive custodial care and monitoring to protect the public health and safety and the environment. The study evaluated several site- stabilization technologies including structural covers, soil covers, dynamic compaction, grouting, and continued active maintenance. Due primarily to uncertainties regarding the long-term performance of the active stabilization technologies, the Natural Stabilization/Active Maintenance alternative was selected as the recommended approach. This approach consists of continuing active maintenance while waiting for natural processes to stabilize the trenches. Should one of the other options prove more attractive in the future, then it might be implemented (3). The study also called for the development of an interim plan to improve management practices pending development and implementation of a long-term site management strategy. Some parts of the recommended plan have been

implemented and others are being assessed for possible implementation in the summer of 1988. Additional improvements in the drainage system, installation of an integrated groundwater monitoring network, a geophysical survey of the waste units, and an improved inventory/records control system are expected to be completed within the next year.

The Energy Authority is in the process of reviewing existing and proposed regulations that may be applicable to the continued management of the SDA. One of the more significant issues is the applicability of RCRA (Resource Conservation and Recovery Act) regulations on hazardous wastes. A leachate sampling effort and a detailed inventory of disposal records is under way and should provide useful data in making such determinations.

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1. U.S. Department of Energy, "Western New York Nuclear Service Center Study," TID-28905, U.S. Department of Energy (1978).

2. Envirosphere Company, "Site Characterization of the LLRW Disposal Area at West Valley, New York," New York State Energy Research and Development Authority Report (Not Yet Published).

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