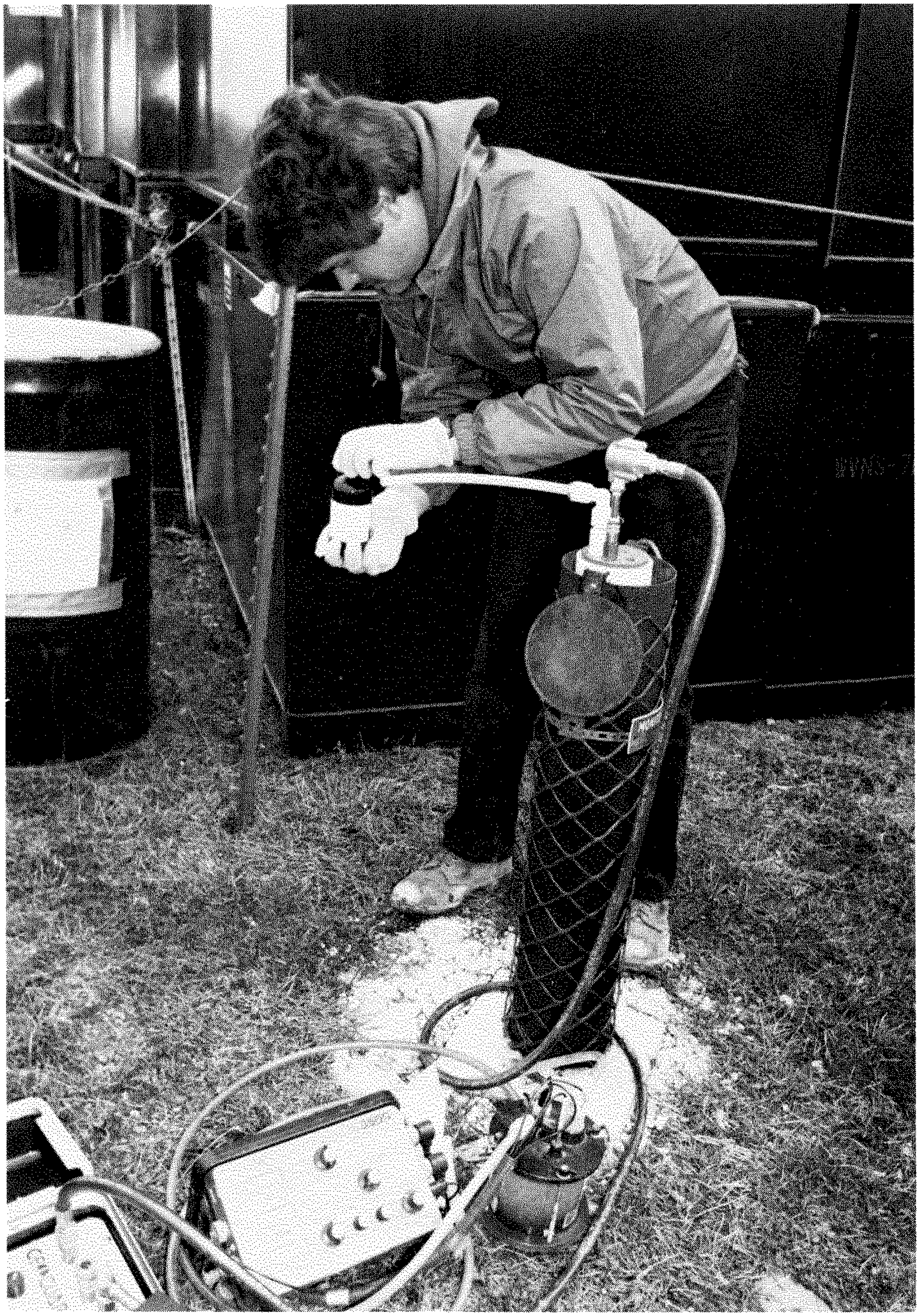


Sampling with a Dedicated Bladder Pump Installed in an On-site Groundwater Monitoring Well

3.0 Groundwater Monitoring

3.1 Geology of the West Valley Site

3. 1. 1 Geologic History

The West Valley Demonstration Project is located on the dissected and glaciated Allegheny Plateau at the northern border of Cattaraugus County in southwestern New York. The area is drained by Cattaraugus Creek, which is part of the Great Lakes – St. Lawrence watershed (Tesmer 1975). Geologic conditions encountered at the site are the result of recent events in the earth's history, including repeated glaciation during the Pleistocene epoch 1.6 million to ten thousand years ago.

The WVDP site rests immediately on a thick sequence of glacial deposits that ranges up to 150 meters (5 ft. to 500 ft.) in thickness. These glacial deposits are underlain by an ancient bedrock valley eroded into the upper Devonian shales and siltstones of the Canadaway and Conneaut Groups that dip southward at about 5 m/km (Rickard 1975). Total relief in the area is approximately 396 meters (1,300 ft.), with summits reaching 732 meters (2,400 ft.) above sea level.

Oscillations of the Laurentide ice sheet during the ice ages include four major stages of ice advance and retreat. The last of these and the one of greatest concern here was the Wisconsinan glaciation (Broughton et al. 1966).

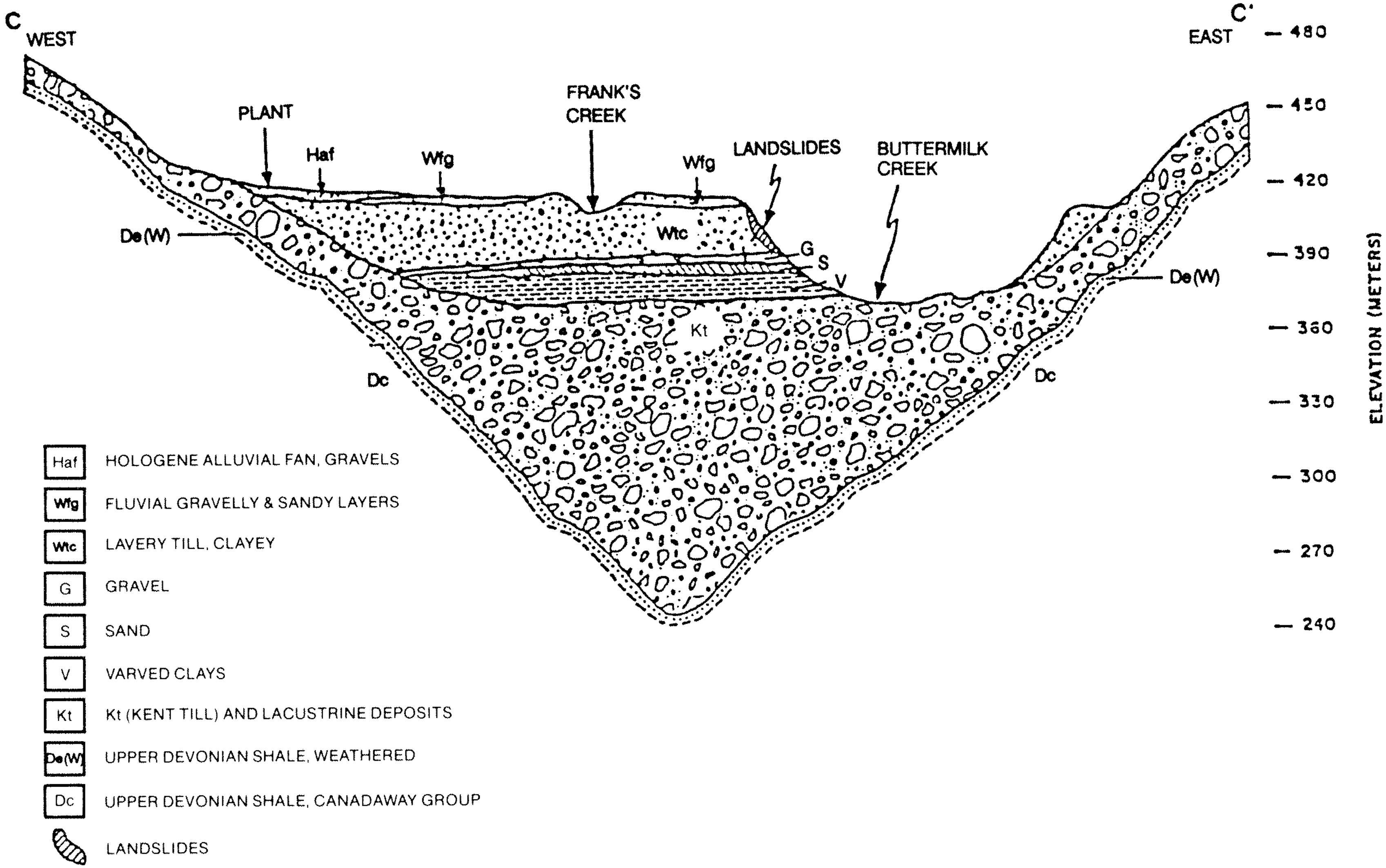
The most widespread glacial unit in the site area is the Kent till, deposited between 15,500 and 24,000 years ago toward the end of the Wisconsinan glaciation. At that time the ancestral Buttermilk Creek Valley was covered with ice. As the glacier receded, debris trapped in the ice was left behind in the vicinity of West Valley. Meltwater, confined to the valley by the debris dam at West Valley and the ice front, formed a glacial lake that persisted until the glacier receded far enough northward to uncover older drainageways. As the ice continued to melt, more material washed out and was deposited to form the lacustrine and kame delta deposits that presently overlie the Kent till. Continued recession of the glacier ultimately led to drainage of the proglacial lake and exposure of its sediments to erosion (LaFleur 1979).

About 15,000 years ago the ice began its last advance (Albanese et al. 1984). Material from this advance covered the kame delta and lacustrine deposits with as much as 40 meters (130 ft.) of glacial till. This unit, the Lavery till, is the uppermost unit throughout much of the site, with a thickness of about 24 meters (80 ft.) at the waste burial areas. The retreat of the Lavery ice left behind another proglacial lake that ultimately drained, allowing modern Buttermilk Creek to flow northward to Cattaraugus Creek. The modern Buttermilk Creek has cut the modern valley since the final retreat of the Wisconsinan glacier. Post-Lavery outwash and alluvial fans, including the fan that underlies the northern part of the WVDP, were deposited on the Lavery till between 15,000 and 14,200 years ago (LaFleur 1979).

3. 1. 2 Hydrogeology

The site can be divided into two regions: the north plateau, on which the plant and its associated facilities reside, and the south plateau, which contains the NRC-licensed disposal area (NDA) and the state-licensed disposal area (SDA) that were previously used to dispose of waste (Figs. 3-1 and 3-2).

The uppermost geologic unit on the south plateau is the Lavery till, a very compact, gray



NOTE:
Vertical scale = 1/4 horizontal scale.
Adapted from Dana et al. (1979a).

Figure 3-1. Geological Cross Section Through the North Plateau.

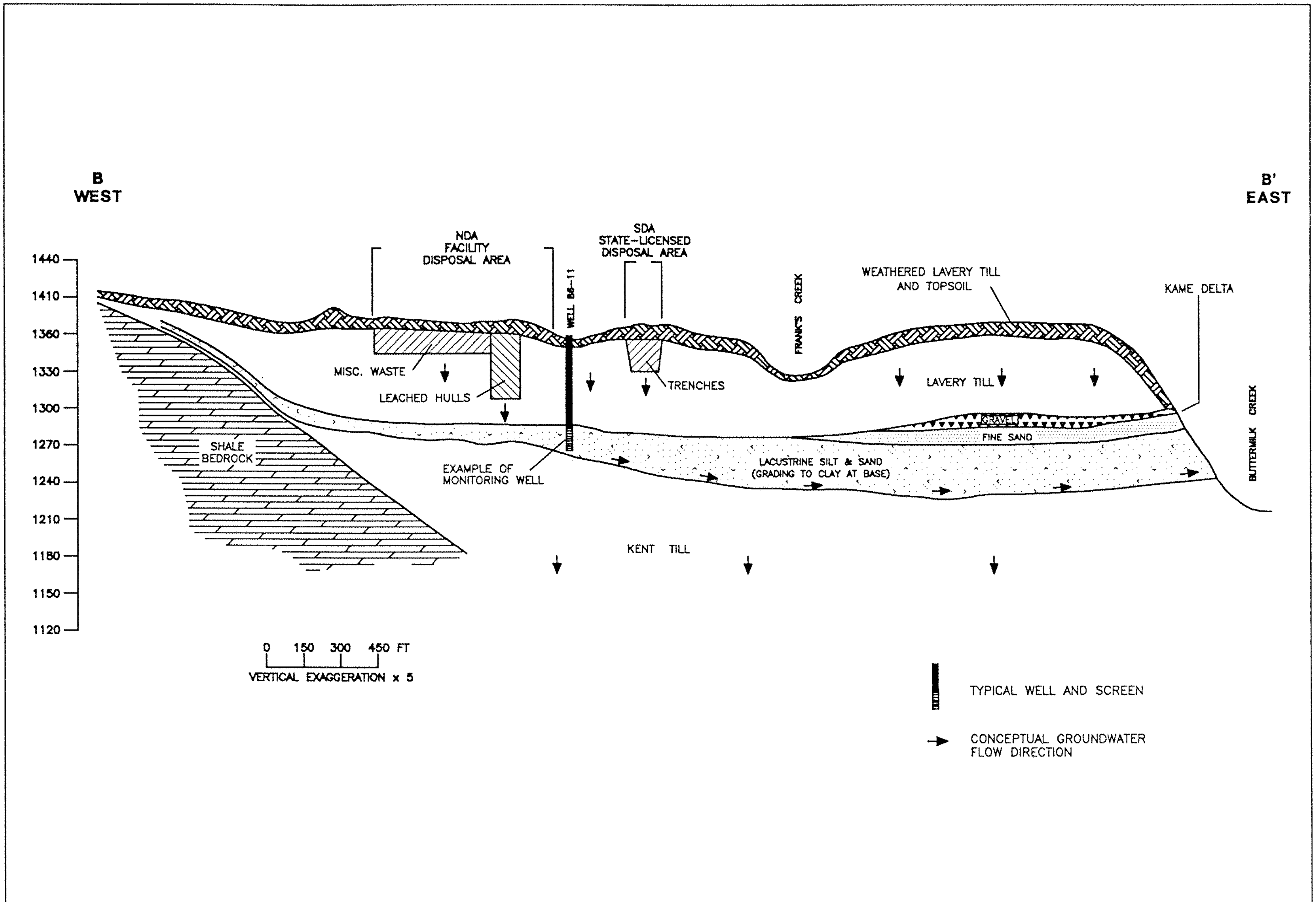


Figure 3-2. Geological Cross Section Through the South Plateau.

silty clay with scattered pods of silt to fine sand. Below this is a sequence of more permeable lacustrine silt and sand, which in turn overlies the less permeable Kent till.

North Plateau

The north plateau differs from the south plateau in that it is mantled by a sequence of alluvial sand and gravel up to 10 meters thick that is immediately underlain by the Lavery till.

The depth to the groundwater on the north plateau varies from 0 meters to 5 meters (0 ft. to 16 ft.), being deepest at the process building and intersecting the surface farther north towards the security fence. Most of the groundwater beneath the north plateau moves horizontally through the alluvial sand and gravel unit from an area southwest of the process building to the northeast, southeast, and east; a small percentage percolates downward into the underlying Lavery till (Yager 1987). Groundwater discharge from the north plateau occurs at seepage points along the banks of Frank's Creek, Erdman Brook, Quarry Creek, and at the wetlands near the northern perimeter of the security fence. The geometric mean of the hydraulic conductivity of the alluvial sand and gravel unit is 4.6 x 10^{-3} cm/sec (Bergeron et al. 1987). Recent on-site investigations (1989-1990) identified a sandy unit of limited areal extent and variable thickness within the Lavery till, primarily beneath the north plateau. This unit, called the till-sand, was not specifically identified in previous studies as a potential water-bearing/transmitting unit.

South Plateau

The water table beneath the south plateau occurs in the upper 4.5 meters (0 ft. to 15 ft.) of the Lavery till. Groundwater flow in this unit, for the most part, is vertical to the lacustrine unit. The upper, weathered portion of the Lavery till exhibits a horizontal flow, which enables groundwater to move laterally before moving downward or discharging to nearby land-surface depressions or stream channels. (Bergeron and Bugliosi 1988). Some laterally moving water eventually percolates downward into the underlying unweathered till. Values of vertical and horizontal hydraulic conductivity obtained from laboratory analysis of undisturbed cores and from field analyses of piezometer recovery tests suggest that the till is virtually isotropic. The hydraulic conductivity of the fresh, unweathered till averages 2.92 x 10^{-8} cm/sec. Hydraulic conductivity values of the fractured unweathered till are five times greater than that of the fresh, unweathered till, and the hydraulic conductivity of the fractured weathered till is ten times greater than that of the fresh, unweathered till.

The lacustrine silt sequence at the WVDP acts as a semiconfined unit that is recharged primarily from the bedrock to the west. Water levels in piezometers completed in this unit indicate a northeastward lateral flow gradient of 0.023. Minor recharge also occurs from the overlying Lavery till, making this unit a possible conduit of Lavery discharge to Buttermilk Creek. The lacustrine unit is underlain by the relatively impermeable Kent till (LaFleur 1979).

3.2 Groundwater Monitoring Program Overview

In 1990 the groundwater monitoring network was expanded to include wells for monitoring an expanded group of solid waste management units (SWMUs), increasing the number of waste management unit monitoring points on-site from 17 to 106. The two monitoring networks, referred to as "the 1990 monitoring network" and "the expanded monitoring network" are described below.

» 1990 Monitoring Network

This network contains wells installed before 1990. During 1990 the wells were each sampled eight times for the parameters outlined in Table 3-1 under the 1990 monitoring network.

» Expanded Monitoring Network

This network includes wells installed during 1990 and selected existing wells. The wells monitor specific waste management units (Table 3-2) and will be monitored for the

TABLE 3-1

SCHEDULE OF GROUNDWATER SAMPLING AND ANALYSIS

	1990 Monitoring Network	Expanded Monitoring Network
Contamination Indicator Parameters	pH* Total Organic Carbon Gross Alpha Specific Gamma Emitters Conductivity* Total Organic Halogens Gross Beta Tritium Volatile Organic Analysis Nitrate	pH* Total Organic Carbon Gross Alpha Gamma Scan Conductivity* Total Organic Halogens Gross Beta Tritium Volatile Organic Analysis
Groundwater Quality Parameters	Chloride Iron Sodium Manganese Phenols Sulfate	Chloride Iron Sodium Manganese Phenols Sulfate Magnesium Nitrate Calcium Potassium Ammonia Bicarbonate/Carbonate
EPA Interim Primary Drinking Water Standards	Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver Fluoride	Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver Fluoride Endrin Methoxychlor 2,4 D Radium Nitrate Lindane Toxaphene 2,4,5-TP Silvex Turbidity*

* Measured in field

TABLE 3 - 2

SUPER SOLID WASTE MANAGEMENT UNIT MONITORING NETWORK

Constituent SWMUs	Well Identification Number	Year Installed [1]	Well Position	Well Depth *Depth below-grade (feet)*
SSWMU No.1 - Low-Level Waste Treatment Facilities:				
• Lagoon 1	WNW-0103	90	U	21.00
• LLWTF Lagoons	WNW-0104	89	U	23.00
• LLWTF Building	WNW-0105	89	D	28.00
	WNW-0106	89	D	14.50
	WNW-0107	90	D	28.00
	WNW-0108	90	D	33.00
	WNW-0109	90	D	33.00
	WNW-0110	90	D	33.00
	WNW-0111	90	D	11.00
	WNW-0114	90	D	29.00
	WNW-0115	90	D	28.00
	WNW-0116	90	D	11.00
	WNW-86-03	86	D	25.42
	WNW-86-04	86	D	23.00
	WNW-86-05	86	D	13.00
	WNSP008	Groundwater French Drain Monitoring Point		
SSWMU No. 2 - Miscellaneous Small Units:				
	WNW-0201	89	U	20.00
• Sludge Ponds	WNW-0202	89	U	38.00
• Solvent Dike	WNW-0203	89	U	18.00
• Effluent Mixing Basin	WNW-0204	89	U	43.00
• Paper Incinerator	WNW-0205	90	D	11.00
	WNW-0206	90	D	37.80
	WNW-0207	90	D	11.00
	WNW-0208	90	D	23.00
	WNW-86-06	86	D	13.00
SSWMU No. 3 - Liquid Waste Treatment System:				
	WNW-0301	89	U	16.00
• Liquid Waste Treatment System	WNW-0302	89	U	28.00
	WNW-0305	89	D	31.00
	WNW-0306	89	D	81.00
	WNW-0307	89	D	16.00

Key:

1 Wells installed in 1989 and 1990 are considered 90-series wells.

U = upgradient C = crossgradient D = downgradient B = background

TABLE 3 - 2 (continued)

SUPER SOLID WASTE MANAGEMENT UNIT MONITORING NETWORK

Constituent SWMUs	Well Identification Number	Year Installed [1]	Well Position	Well Depth
SSWMU No. 4 - HLW Storage and Processing Area:				*Depth below-grade (feet)*
• **Vitrification Test Facility**	WNW-0401	89	U	16.00
	WNW-0402	89	U	29.00
	WNW-0403	89	U	13.00
	WNW-0404	89	U	36.50
	WNW-0405	89	D	12.50
	WNW-0406	89	D	16.80
	WNW-0407	90	D	75.50
	WNW-0408	90	D	38.00
	WNW-0409	90	D	55.00
	WNW-0410	89	U	78.00
	WNW-0411	90	U	65.50
	WNW-86-07	86	D	18.75
	WNW-86-08	86	D	19.00
	WNW-86-09	86	D	25.00
SSWMU No. 5 - Maintenance Shop Leach Fields:				
• **Maintenance Shop Leach Fields**	WNW-0501	90	U	33.00
	WNW-0502	89	D	18.00
SSWMU No. 6 - Low-Level Waste Storage Area:				
	WNW-0601	90	D	6.00
• **Hardstand**	WNW-0602	90	D	13.00
• **Lag Storage**	WNW-0603	89	D	13.00
• **Lag Storage Extension**	WNW-0604	89	D	11.00
	WNW-0605	90	D	11.00
	WNW-86-04	86	D	23.00
	WNW-86-07	86	U	18.75
	WNW-86-08	86	U	19.00

Key:

[1] Wells installed in 1989 and 1990 are considered 90-series wells.

U = upgradient C = crossgradient D = downgradient B = background

TABLE 3 - 2 (continued)

SUPER SOLID WASTE MANAGEMENT UNIT MONITORING NETWORK

Constituent SWMUs	Well Identification Number	Year Installed [1]	Well Position	Well Depth
				Depth below-grade (feet)
SSWMU No. 7 - CPC Waste Storage Area:				
• **CPC Waste Storage Area**	WNW-0701	89	U	28.00
	WNW-0702	89	D	38.00
	WNW-0703	89	D	21.00
	WNW-0704	89	D	15.50
	WNW-0705	90	D	21.00
	WNW-0706	90	U	11.00
	WNW-0707	90	U	11.00
SSWMU No. 8 - Construction and Demolition Debris Landfill:				
	WNW-0801	89	U	17.50
• **Construction and Demolition Debris Landfill**	WNW-0802	89	D	11.00
	WNW-0803	89	D	18.00
	WNW-0804	89	D	9.00
	WNGSEEP	Groundwater Seepage		
	WNDMPNE	Monitoring Points		
	WNW86-12	86	D	18.83
	WNW-NB-1S (N. Plateau Background)	90	B	13.00
SSWMU No. 9 - NRC-Licensed Disposal Area:				
	WNW-0901	90	U	136.0
• **NRC-licensed Disposal Area**	WNW-0902	90	U	128.0
	WNW-0903	90	D	133.0
• **Container Storage Area**	WNW-0904	90	D	26.00
	WNW-0905	90	D	23.00
	WNW-0906	89	D	10.00
	WNW-0907	89	D	16.00
	WNW-0908	90	U	21.00
	WNW-86-10	86	D	114.0
	WNW-86-11	86	D	120.0

Key:

1 Wells installed in 1989 and 1990 are considered 90-series wells.

U = upgradient   C = crossgradient   D = downgradient   B = background

TABLE 3 - 2 (concluded)

SUPER SOLID WASTE MANAGEMENT UNIT MONITORING NETWORK

Constituent SWMUs	Well Identification Number	Year Installed [1]	Well Position	Well Depth
SSWMU No. 10 - IRTS Drum Cell:				*Depth below-grade (feet)*
	WNW-1001	90	U	116.0
• **IRTS Drum Cell**	WNW-1002	90	D	113.0
	WNW-1003	90	D	138.0
	WNW-1004	90	D	108.0
	WNW-1005	90	U	19.00
	WNW-1006	90	D	20.00
	WNW-1007	90	U	23.00
	WNW-1008b	90	B	51.00
	WNW-1008c	90	B	18.00
SSWMU No. 11 - State-Licensed Disposal Area:				
	WNW-1101a	90	U	16.00
• **State-licensed Disposal Area**	WNW-1101b	90	U	30.00
(SDA)	WNW-1101c	90	U	110.0
	WNW-1102a	90	D	17.00
	WNW-1102b	90	D	31.00
	WNW-1103a	90	D	16.00
	WNW-1103b	90	D	26.00
	WNW-1103c	90	D	111.0
	WNW-1104a	90	D	19.00
	WNW-1104b	90	D	36.00
	WNW-1104c	90	D	114.0
	WNW-1105a	90	D	21.00
	WNW-1105b	90	D	36.00
	WNW-1106a	90	U	16.00
	WNW-1106b	90	U	31.00
	WNW-1107a	90	D	19.00
	WNW-1108a	90	U	16.00
	WNW-1109a	90	U	16.00
	WNW-1109b	90	U	31.00
	WNW-1110	90	D	20.00
	WNW-1111	90	D	21.00
Fuel Storage Area				
	R86-13A	89	C	8.00
	R86-13B	89	C	8.00
	R86-13C	90	D	6.50

Key:

1 Wells installed in 1989 and 1990 are considered 90-series wells.

U = upgradient   C = crossgradient   D = downgradient   B = background

parameters noted in Table 3-1. Sampling of these wells will be phased in during 1991. Selected sampling locations from the 1990 network were incorporated into the expanded monitoring network. Although the expanded groundwater monitoring program will not be fully implemented until 1991, monitoring of some of the new wells began in 1990.

Monitoring Wells

Four designations are often used to indicate a well's function within a groundwater monitoring program:

Upgradient well. A well installed hydraulically upgradient of the waste management unit under study that is capable of yielding groundwater samples that are representative of local conditions and that are not affected by the unit in question.

Downgradient well. A well installed hydraulically downgradient of the waste management unit that is capable of detecting the migration of contaminants from the unit under study.

Background well. A well installed hydraulically upgradient of all waste management units that is capable of yielding groundwater samples that are representative of natural conditions. In some cases, upgradient wells may be positioned downgradient of other facilities, which makes them unsuitable for use as true background wells. However, their usefulness in providing upgradient information about the unit under study is still maintained.

Crossgradient well. A well installed to the side of the major downgradient flow path.

Before 1990 the on-site groundwater monitoring network for monitoring waste management units included fifteen wells, a groundwater seep, and the outlet of a french drain. These points monitored three solid waste management units: the low-level waste treatment facility (LLWTF), the high-level waste storage and processing area (HLW), and the NRC-licensed disposal area (NDA). Each of these three waste management units was monitored using one upgradient well and several downgradient wells. The downgradient wells were positioned to maximize the probability of intercepting contaminants.

Sampling results for downgradient wells are evaluated by comparing upgradient to downgradient concentrations. Increases in amounts of monitored contaminants and increases or decreases in pH may indicate that the groundwater has been affected.

Expanded Monitoring Network

Wells are labeled as a series, beginning with the year in which they were installed. The 80- and 82-series wells, which were installed in 1980 and 1982, were sampled throughout the year. They will be phased out in 1991 as new wells are brought online to replace them (Fig.3-3).

Expansion of the groundwater program was necessary in order to adequately monitor and characterize the site's groundwater conditions. The WVDP Groundwater Protection Management Plan (WVNS 1990) established the overall framework for managing the site's groundwater resources.

Individually identified waste management units were grouped together into super solid waste management units or super SWMUs (SSWMUs). Each super solid waste management unit (see Fig. E-28 in Appendix E) has its own set of wells specified by individual identification numbers. (See Table 3-2 and section 3.2.4 below.) As in the earlier program, each unit has a set of upgradient and downgradient wells (Fig. 3-4).

When the new program is fully implemented, the analyses shown in Table 3-1 will be performed. The new parameters differ from the former in several respects. The samples collected in the new program are divided into three categories: contamination indicator parameters, for which samples are collected eight times a year; groundwater quality parameters, for which samples are collected two times a year; and EPA interim primary drinking water parameters, for which samples are collected four times per year. Samples for comparison with the EPA primary drinking water standards will be collected for one year only for a total of four samples from each well.

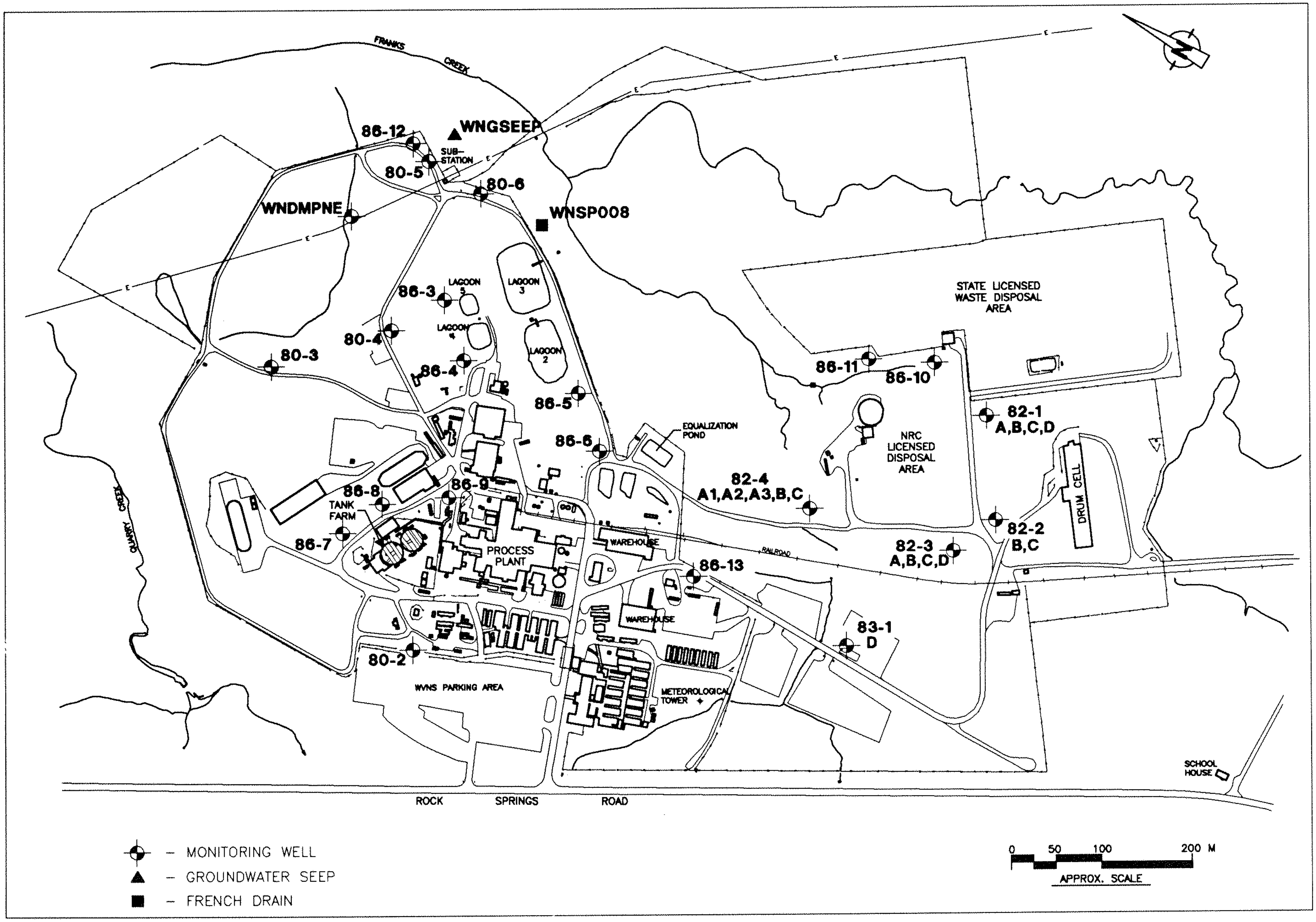


Figure 3-3. Groundwater Monitoring Points 1986–1990.

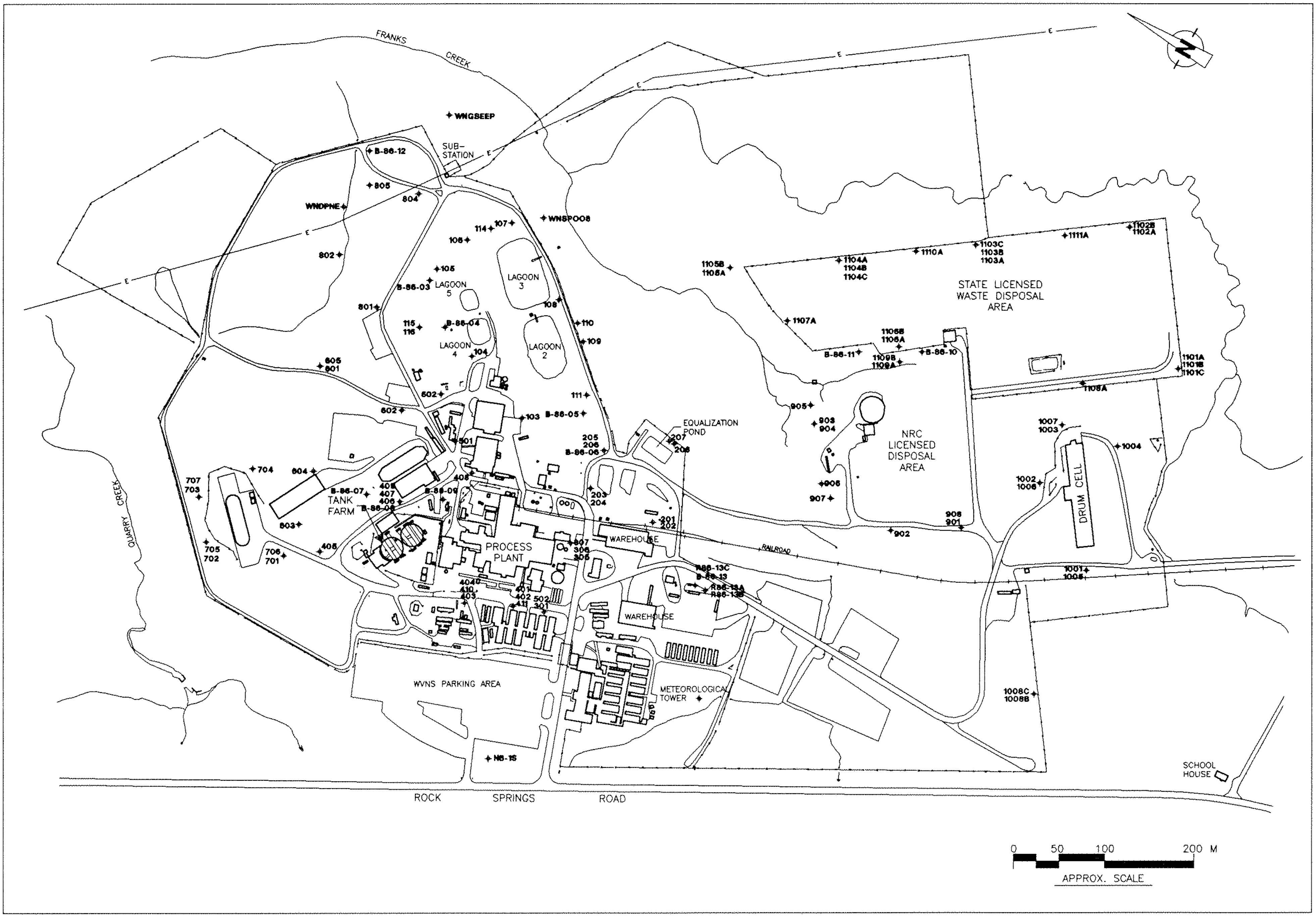


Figure 3-4. Expanded Monitoring Program Sampling Locations (SSWMUs).

Monitoring the contamination indicator parameters helps to indicate a release from a solid waste management unit to the groundwater. Depending on the results, follow-up investigations to determine the nature and extent of the release may be required. The groundwater quality parameters selected provide information essential for migration modeling and for evaluating the indicator parameter results and the potential effect of a release. Monitoring of the EPA interim primary drinking water standards on groundwater establishes a baseline for water quality. The results of all of the samples analyzed will identify their relationship to regulatory requirements and will provide information for eventual closure of the super solid waste management units.

3.2.1 Initial Development of the 90-Series Wells

New wells must be developed to condition them for sample collection. The well development process is designed to remove suspended sand, silt, and clay materials from the well before it is used to collect proper groundwater samples. This preliminary process, which removes fines from the filter pack and formation, helps ensure that only representative groundwater samples are collected for analysis. All of the 90-series wells were developed during 1990.

3.2.2 Sampling Methodology

Several different methods were used to collect groundwater samples from both waste management unit wells and other wells on-site. The method chosen depends on well construction, water depth, the water-yielding characteristics of the well, and the type of analysis to be performed.

» Peristaltic pumps

Powered by a portable generator, a peristaltic pump was used to collect samples from shallow wells. A peristaltic pump uses suction and thus tends to drive volatile chemical compounds out of solution as well as agitate the water. Samples for volatile analysis were not collected using this method. Instead, a teflon bailer was used for volatile sample collection.

» Well bailers

The bailer is the simplest system used for groundwater sample collection. A bottom-filling bailer, which is a tube with a check valve in the bottom, is lowered into the well until it reaches the desired location in the water column. The bailer is then retrieved along with the water sample. If the bailer is lowered slowly through the water column there is little chance of agitating the water. The bailer, string, and bottom-emptying device used to drain the bailer are all dedicated to the well by keeping them inside that particular well when not in use.

Teflon bailers, dedicated to individual wells, are a major part of the new groundwater monitoring program.

» Inertial pumps

An inertial pumping system has been used for several years at the WVDP as an inexpensive, dedicated sampling system for waste management unit wells. Inertial pumps use a dedicated piece of tubing with a check valve on the bottom. The tubing extends from the bottom of the well to the surface. An up-and-down motion of the tube causes water to move up and out of the well. This system, although effective, is being replaced by bladder pumps, which fully meet all regulatory requirements for groundwater monitoring.

» Bladder pumps

The bladder pump uses compressed air to gently squeeze a teflon bladder located near the bottom of the well, thus expelling the water out the sample line. The pressure is then released allowing new groundwater to flow into the bladder. A series of check valves ensures that water flows only in one direction. The drive air is always kept separate from the sample and is expelled to the surface by a separate line. For wells with low standing volume, where bladder pumps are inefficient, a dedicated teflon bailer is used for sample collection. Bladder pumps provide an effective system for groundwater sample collection. The system reduces mixing and agitation of the water within the well compared to some other sampling methods. The bladder pump is dedicated to each individual well, thus reducing the likelihood of sample contamination from the introduction of external materials into the well. The compressor and air control box are shared between the different wells but attach externally to the pump and do not come in contact with the inside of the well or the sample. The bladder system is also a low maintenance system with the only moving part being a replaceable teflon bladder. The expanded monitoring network relies upon dedicated bladder pumps and teflon bailers for sample collection. Both of these methods meet all regulatory requirements pertaining to groundwater sample collection.

Sample Collection

The groundwater monitoring year is divided into two semiannual periods. Four samples were taken from each well in the 1990 monitoring network during each semiannual period and tested for the parameters listed in Table 3-1. Before removing a sample from the well the water level is measured by using an electronic sounder. The water level measurement, well diameter, and the total depth are used to determine the standing water volume of the well.

To ensure that only representative groundwater is sampled, three well volumes are removed (purged) from the well before actual samples are collected. If three well casing volumes cannot be removed due to limited recharge, purging the well to dryness achieves the same result. Conductivity and pH are measured before and after sampling to help determine if the quality of the groundwater changed while samples were being collected.

After samples are collected, they are placed in a cooler with ice and returned to the Project's Environmental Laboratory. The samples are then either packaged for overnight delivery to an off-site contract laboratory or put into controlled storage to await on-site testing.

3.2.3 Monitoring Parameters

The groundwater parameters monitored in 1990 are shown in Table 3-1. Each of the seventeen monitoring points in the 1990 monitoring network were tested for gross alpha, gross beta, tritium, volatile organic compounds, total organic carbon, total phenols, total organic halogens, and total and soluble metals. Samples were collected for each parameter during sampling of the individual wells.

Monitoring parameters for the expanded monitoring network are also shown in Table 3-1. No routine sampling of the 90-series wells took place in 1990. But selected 90-series wells were sampled for alpha, beta, tritium, pH, and conductivity.

3.2.4 Expanded Monitoring Program: Solid Waste Management Units

The following descriptions of waste management units provide basic information about the super solid waste management units (SSWMUs) as detailed in the site's Sampling and Analysis Plan (SAP): Groundwater Monitoring Network (WVNS 1990). Monitoring wells were installed and well development was completed for all super solid waste management units (SSWMUs) during 1990. Full implementation of the expanded monitoring network will take place in 1991.

■ Low-level Waste Treatment Facility (SSWMU #1)

The low-level waste treatment facility (LLWTF) is comprised of four active lagoons – Lagoons 2, 3, 4, 5 – and Lagoon 1, an inactive lagoon that has been filled in and covered.

Lagoons 1, 4, and 5 were constructed in the surficial sand and gravel strata and Lagoons 2 and 3 penetrate into the Lavery till beneath the surficial sand and gravel. Lagoons 4 and 5 have membrane liners. A french drain (sampling point WNSP008) had been installed on the north and west sides of Lagoons 2 and 3 by the original operator of the reprocessing plant, NFS, in order to intercept and reduce groundwater seepage into Lagoons 2 and 3. The drain consists of a 15-cm diameter perforated pipe buried approximately 3 meters belowgrade. The drain extends almost to the top of the Lavery till and discharges to Erdman Brook, east of Lagoon 3.

SSWMU#1 was monitored by six existing wells, a ground seep, and monitoring point WNSP008 during 1990.

Under the expanded monitoring network the seep, WNSP008, and the 86-series wells were combined with the twelve new 90-series wells for a more comprehensive monitoring program. This new monitoring system was sampled for selected contamination indicator parameters during December 1990.

■ Miscellaneous Small Units (SSWMU #2)

SSWMU#2 consists of four small facilities east of the southern end of the former reprocessing plant. They were grouped together as a super solid waste management unit because of their closeness to each other and because of the similarity of subsurface conditions beneath the units.

The individual facilities in SSWMU#2 are:

- The sludge pond, which contains demineralized backwash sludges from the process plant water treatment system. The sludge pond consists of two shallow, excavated beds in the surficial sand unit.

- The solvent dike, which was used to catch and temporarily retain runoff from the reprocessing plant's solvent storage terrace. The solvent storage dike is not lined.

- The effluent mixing basin, which mixes nonradioactive waste streams before discharge.

- The paper incinerator, which was used to dispose of cartons received in the warehouse and general trash generated in nonradioactive areas of the plant.

Monitoring of SSWMU#2 will focus on the surficial sand and gravel layer and the till-sand unit.

The upgradient and downgradient wells used to monitor SSWMU#2 are shown in Table 3-2. Well WNW86-6 will be used to sample downgradient conditions in the surficial sands.

■ Liquid Waste Treatment System (SSWMU#3)

The liquid waste treatment system (LWTS) contains decontaminated liquid effluent from the supernatant treatment system (SSWMU #4). The liquid effluent from the LWTS is processed by the cement solidification system, producing a solid, low-level radioactive waste form suitable for disposal.

The wells used to monitor SSWMU#3 are shown in Table 3-2. Since monitoring of the two upper sand units (the surficial sand and gravel and till-sand) will provide evidence of a release, the lacustrine-kame delta deposits will not be monitored.

■ High-level Waste Storage and Processing Area (SSWMU #4)

The high-level waste storage (HLWS) and processing area includes the high-level radioactive waste tanks, the supernatant treatment system, and the vitrification facility. The high-level waste is stored in underground steel tanks inside reinforced concrete vaults. The vaults extend 40 feet below the surface into the Lavery till. It is this high-level waste that will be processed into a stable, glass waste form.

The 1990 monitoring network used a series of four monitoring wells: One upgradient well, WNW80-02, and three downgradient wells, WNW86-07, WNW86-08, and WNW86-09. Two additional sampling locations (WNW86-12 and WNDMPNE) were monitored with this unit to provide comparisons with a representative upgradient well. These additional locations monitor the former nonradioactive construction and demolition debris landfill (CDDL), which was closed in 1986. The CDDL is now classified as a separate SSWMU in the new program.

The expanded monitoring network will phase out previously existing well WNW80-02 and incorporate eleven new wells for a total of fourteen monitoring locations (see Table 3-2).

Maintenance Shop Sanitary Leach Field (SSWMU #5)

Groundwater monitoring will focus on a former leach field once used by the plant's maintenance shop to process sewage that the shop generated.

Two wells – one upgradient well (WNW0501) and one downgradient (WNW0502) – were added to this unit. As the upgradient well is downgradient of many other super solid waste management units, the background conditions will be monitored by wells WNW0301 and WNW0401.

Low-level Waste Storage Area (SSWMU #6)

The low-level waste storage area (LLWS) includes metal and fabric structures housing low-level radioactive wastes being stored for future disposal. All wastes are contained in steel cases. Currently the area contains one metal and four fabric storage structures. Additional downgradient wells will be used from adjacent SSWMUs. The area also includes the site of the old hardstand, which was used by NFS to temporarily store radioactive materials. The hardstand and the soils around it are still slightly radioactively contaminated.

Chemical Process Cell Waste Storage Area (SSWMU #7)

The chemical process cell (CPC) waste storage area is a fabric-covered structure placed on a compacted gravel floor. The CPC waste storage area contains packaged pipes, vessels, and debris from the decontamination and cleanup of the chemical process cell in the former reprocessing plant that are being stored until they can be conditioned in the planned noncontact size reduction facility for eventual disposal.

Seven new 90-series wells will be used for this groundwater monitoring network. Samples were collected from these wells for selected contamination indicator parameters during 1990.

Construction and Demolition Debris Landfill (SSWMU #8)

This disposal area was used by both NFS and the WVDP to dispose of nonhazardous and nonradioactive materials. There is no record of disposal of hazardous materials in this facility; however, there is also no evidence of waste acceptance procedures that would exclude them. The unit was closed in 1986 by a covering of a compacted clay till.

The lacustrine-kame delta is at least 100 feet below the surface. Monitoring of this SSWMU will focus on surficial deposits.

Four new 90-series wells will be used along with wells WNW86-03 and WNW86-12 to monitor SSWMU#8. The new 90-series wells were sampled for selected contamination indicator parameters during 1990.

NRC-licensed Disposal Area (SSWMU #9)

The NRC-licensed disposal area (NDA) contains radioactive wastes generated by NFS and the WVDP, including leached fuel assembly hulls and ends, sludges, spent solvents, discarded vessels and piping and other miscellaneous items. Groundwater monitoring of the NDA will use eight of the new 90-series wells and two previously existing 86-series wells (WNW86-10 and WNW86-11). Background information will be provided by wells WNW1008b and WNW1008c. Upgradient conditions will be monitored by three new 90-series wells. Locations of the wells are shown on Figure 3-4 and detailed in Table 3-2.

Integrated Radioactive Waste Treatment System Drum Cell (SSWMU #10)

The integrated radioactive waste treatment system (IRTS) drum cell contains stored cement-stabilized low-level radioactive waste produced in the cement solidification system of the liquid waste treatment system (SSWMU#3). In the future, cement-stabilized sludge-wash water and cleaning water from the noncontact size reduction facility will be stored here. This waste is currently classified as nonhazardous. The new 90-series monitoring wells will be used to surveil the groundwater in this area.

■ State-Licensed Disposal Area (SSWMU #11)

In 1990 the New York State Department of Environmental Conservation (NYSDEC) requested that the state-licensed disposal area be monitored. Twenty-one groundwater wells have been installed to monitor both the weathered and unweathered till and the lacustrine deposits beneath the SDA.

The SDA was operated by Nuclear Fuel Services, Inc. as a commercial low-level disposal facility. In addition to wastes from a wide variety of utility, industrial, and institutional customers, the SDA received a large volume of wastes from the NFS reprocessing operations. Between 1963 and 1975, 2.35 million cubic feet of low-level radioactive waste was disposed of in the SDA trenches.

The groundwater monitoring program for 1990 included sampling the twenty-one wells for gross alpha, gross beta, tritium, and gamma emitters. The results are found in Table E-16 in Appendix E. The full groundwater monitoring program for the SDA is planned to begin in mid-1991.

3.2.5 On-site Supporting Well Monitoring

In addition to specific waste management unit monitoring wells, other wells on-site have been monitored over the course of time, primarily for radiological parameters. Many of these wells were installed for purposes other than groundwater sample collection and will be decommissioned or taken out of the groundwater monitoring network as wells meeting RCRA regulations are gradually incorporated into the monitoring program.

These supporting wells (80- and 82-series) were sampled on a semiannual basis.

They comprise an on-site well monitoring network used principally to update historical data and to obtain water level measurements. During 1990 they were sampled for gross radiological constituents, tritium, isotopic gamma emitters, pH, and conductivity.

Well WNW86-13 also is included in the supporting well network. This well monitors the below-ground gasoline and diesel fuel storage area. Samples were collected from this location for selected volatile organic compounds – benzenes, toluene, and xylenes. The results of the analyses, in addition to fuel accounting coordinated by site warehouse personnel, are used to assess the integrity of the fuel tanks. Annual petro-tite testing began on these tanks during 1991 as an additional check of tank integrity. Samples to be analyzed for water quality parameters and radioactivity are also collected at this well.

3.2.6 Off-Site Groundwater Monitoring

Off-site wells, sampled for radiological parameters, pH, and conductivity, were also monitored as part of the groundwater sampling program. These wells are used by site neighbors as sources of drinking water (Fig. 3-5).

3.3 Groundwater Monitoring Results

The groundwater monitoring program at the West Valley Demonstration Project has undergone a substantial evolution, as described above. Some of the important results obtained during monitoring completed in 1990 are described below. The results rely on all aspects of the program, including proper well placement, the collection of representative groundwater samples, appropriate sample analyses, thorough data validation and quality control, data management, and data analysis or synthesis.

3.3.1 Interpretation of Groundwater Monitoring Data

Several different methods are used to help interpret the results obtained from the groundwater monitoring program.

- Presentation of Results in Tables

One of the first methods used to help interpret data is simply to format the results into tables.

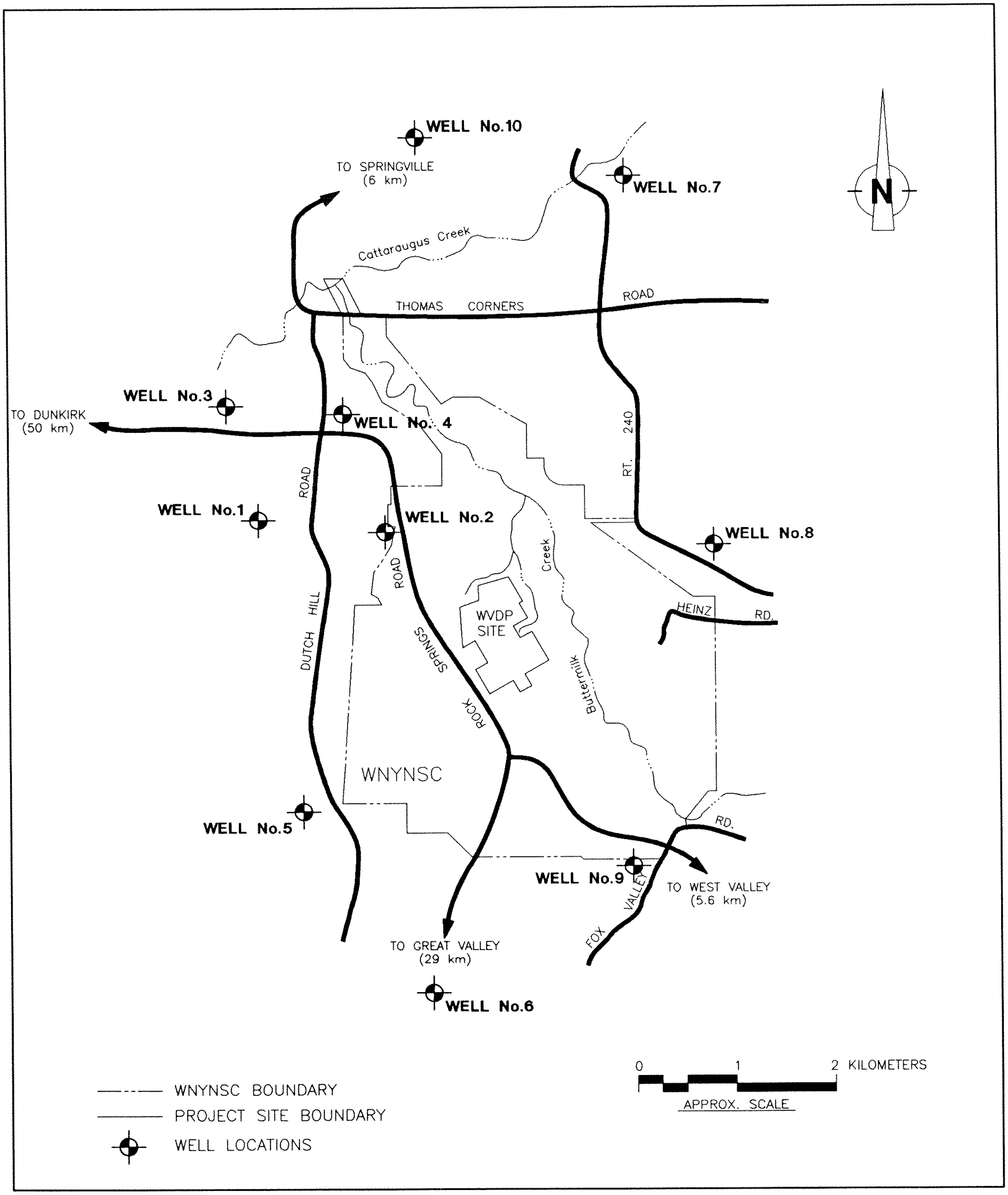


Figure 3-5. Off–Site Groundwater Monitoring Points.

Once results are in tables the data may be compared both within a single sample location and between various locations.

Appendix E provides appropriately formatted tables for the results obtained from the groundwater monitoring program carried out at the West Valley Demonstration Project during 1990. Results for the groundwater monitoring program completed during 1990 (the 1990 monitoring network) are shown in Appendix E, Tables E-3 through E-14. Results for the recently installed 90-series wells for super solid waste management units #1, #7, and #8 are shown in Appendix E, Table E-15. Note that in Tables E-3 through E-15 the hydraulic position of each well within the waste management unit is indicated. These "UP" or "DOWN" terms indicate whether a well is positioned upgradient or downgradient within the monitored waste management unit. Thus, these tables allow for comparison of data between wells within a given waste management unit on a well-to-well basis and an upgradient/downgradient basis. The New York State groundwater quality standards and selected Department of Energy concentration guides (DCGs) are also included in the table headings of Tables E-3 through E-14 for comparison to the groundwater monitoring results.

- Presentation of Results in Graphs

A second way in which selected results were prepared is through the use of trend graphs. Most of the 80- and 86-series wells in the waste management unit monitoring program have been sampled since 1986. Preparation of five-year trend graphs showing how selected key parameters have changed over time gives another perspective for looking at the data. Trend graphs, shown in Figures 3-6 through 3-17 at the end of this chapter, were prepared for pH, conductivity, gross beta, and tritium activity data for wells within a given waste management unit. These specific parameters and results were selected because these parameters tend to be sensitive to changes in chemical and/or radiological conditions. Results presented in these graphs represent annual averages. The upgradient well is indicated in each trend graph with an "UP" label. All remaining wells are downgradient from the monitored waste management unit. These types of graphs are especially valuable because they condense a lot of information into a concise, easily understandable format. The graphs show how the particular parameter changed within a given well over time and how the different wells within the specific waste management unit compare to each other. For example, Figure 3-6a shows pH data from 1986 through 1990 for selected wells monitoring the low-level waste treatment facility. It can be observed that there has been little change in pH over time for these wells and that the differences between wells has remained constant (as one looks from front to back within the same year). In this particular figure the upgradient well is shown in the middle of the graph.

In contrast, Figure 3-12 presents some interesting downward trends for averaged tritium concentrations for wells monitoring the high-level waste storage and processing area and the former construction and demolition debris landfill.

Trend graphs for the low-level waste treatment facility wells are subdivided into two five-year trend graphs per parameter in order to enhance presentation, because only six wells can be included on a given graph.

- Statistical Treatment of Groundwater Data

A third way in which results from various environmental monitoring programs may be evaluated is by using appropriate statistical tests. In this case, groundwater contamination indicator parameters (pH, conductivity, total organic carbon, total organic halogens, nitrate, tritium, gross alpha, and gross beta) were evaluated using a statistical procedure called the Analysis of Variance, or ANOVA. The ANOVA technique is a statistical method commonly used to compare several population means. The comparison allows the detection of statistically significant differences between various well locations. The tests were performed on the contamination indicator results after they were grouped together on a waste management unit basis. Thus, the results generated by the ANOVA test indicate whether there are significant differences between wells within the given waste manage-

Table 3 - 3

Summary of Groundwater Monitoring Data for the Low-Level Waste Treatment Facility

STATISTICAL DIFFERENCES OBSERVED AT DOWNGRADIENT WELLS COMPARED TO UPGRADIENT WELL WNW86-06

Parameter	WNGSEEP	WNSP008	WNW80-05	WNW80-06	WNW86-03	WNW86-04	WNW86-05
pH	lower	-	-	lower	higher	higher	-
Conductivity	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	higher
TOX	-	-	-	-	-	-	-
Tritium	higher	higher	higher	higher	higher	higher	higher
Gross Alpha	-	-	-	-	-	-	higher
Gross Beta	-	higher	-	-	-	higher	higher
Nitrate-N	higher	higher	higher	-	higher	higher	-

Note: A decrease in value is reported only for pH.

ment unit. Significant differences, once discovered, are then evaluated to determine if the differences are between upgradient and downgradient well locations. The great value of these statistical tests is that they effectively condense a lot of data.

The results of these statistical analyses are summarized in Tables 3-3 through 3-5 for the low-level waste treatment facility, the high-level radioactive waste tank complex and former construction and demolition debris landfill (the high-level waste storage and processing area), and the NRC-licensed disposal area.

As an example of how to interpret these tables, note that Table 3-3 shows that well location WNW86-05 has elevated levels of total organic carbon, tritium, and gross beta activity when compared to the upgradient well from this location, WNW86-06. A dash within the statistical summary table indicates that the downgradient well is indistinguishable from the upgradient well for the given parameter. These tables show only whether a downgradient well has a higher concentration for a given parameter (both higher and lower for pH) than the upgradient well for that particular waste management unit. It is important to note that these tables do not provide information about trends or whether the concentration at a particular sampling location is rising or falling over time.

The ANOVA procedure also provides the option for generating confidence interval plots for each of the contamination indicator parameters on a waste management unit basis. These plots are shown in Appendix E in Figures E-1 through E-26 for all the parameters shown in Tables 3-3 through 3-5.

In some cases, before using the ANOVA technique, the data set was manipulated by taking the logarithm of the values. This process, called a log-transformation, is sometimes performed for data sets that do not fit the normal, or bell-shaped, distribution. Using the ANOVA technique on log-transformed data was sometimes necessary to ensure the validity of the results from the statistical tests, since the ANOVA technique requires data sets that approximate a normal distribution. In cases where the log-transformation technique was used, the confidence interval plots, shown in Appendix E, were still derived from the non-transformed data because of the difficulty associated with interpreting graphs of the data set logarithms. In all cases where log-transformations were used, the conclusions shown in the statistical summary tables were more conservative than the non-transformed data.

The ANOVA statistical procedure is recommended by the United States Environmental Protection Agency (1989) as an appropriate method for evaluating statistically significant differences between upgradient and downgradient groundwater monitoring locations. It is important to keep in mind, however, that although a significant difference between sampling locations may exist, that difference is not always directly attributable to the waste management unit. For example, natural variability in soil geochemistry could contribute to differences between groundwater pH or conductivity, which may or may not be related to the waste management unit. In general, any particular data evaluation method should be viewed as a tool for data interpretation and not an end in itself. It is always important to ensure that the results of a particular data analysis test are supported by visually examining the data.

3.3.2 Significance of Waste Management Unit Monitoring Data

■ Low-level Waste Treatment Facility (SSWMU #1)

Table 3-3 summarizes the results of the ANOVA procedure performed on data obtained from 1990 groundwater monitoring at sample locations around the low-level waste treatment facility. As such, this table indicates where there is an indication of groundwater contamination. Several items within Table 3-3 are noteworthy.

Only two locations were shown to have a significantly higher pH than the upgradient well location. These differences may be observed by looking at the five-year trend graphs for pH (Figures 3-6a and 3-6b). In looking at these graphs it can be seen that these differences are relatively minor and that they appear consistent from one year to the next.

The results for conductivity indicate that none of the downgradient wells are higher than upgradient well WNW86-06. This fact can be seen quite readily by looking at Figures 3 -7a and 3 -7b for averaged conductivity over the past five years. All the wells, with the exception of the upgradient well, are shown to be relatively stable over time. The variation seen for conductivity in the upgradient well is attributable to its position downgradient of the sludge ponds. The sludge ponds are or have been used as settling basins for various non-radiological process streams. These streams include regeneration backflushing of the Project's demineralized water system's ion exchange columns. The backflushing contributed significant salt loading to these settling basins and so could influence the conductivity of groundwater in the immediate area.

Another noteworthy item is the elevated levels of tritium and gross beta activity shown for many of the downgradient wells within this monitored unit. The five-year trend graphs for tritium are shown in Figures 3-8a and 3-8b. As in past years, well WNW86-05 continues to show the highest levels of tritium for any of the wells monitored within this unit.

Figures 3-9a and 3-9b show five-year trend results for gross beta activity for wells within the low-level waste treatment facility area. Well WNW86-05 shows the highest levels of gross beta activity for any well monitored routinely during 1990. Location WNW86-05 is the only on-site well, routinely monitored during 1990, with gross beta activity exceeding the New York State groundwater quality standard of 1 E-06 μCi/mL.

As discussed in previous site environmental reports (WVNS 1987, 1988, and 1989), well WNW86-05 is located at the downgradient edge of former Lagoon 1. Lagoon 1 was taken out of service in 1984 because it was identified as a likely source of groundwater contamination within the localized area. At times Lagoon 1 contained water with tritium activity as high as 1E-01 μCi/mL. Although

Table 3 - 4

Summary of Groundwater Monitoring Data for the High-level Waste Storage and Processing Area

STATISTICAL DIFFERENCES OBSERVED AT DOWNGRADIENT WELLS COMPARED TO UPGRADIENT WELL WNW80-02

Parameter	WNW86-07	WNW86-08	WNW86-09	WNW86-12*	WNDMPNE*
pH	lower	lower	lower	lower	lower
Conductivity	higher	-	higher	higher	higher
TOC	-	higher	-	-	higher
TOX	-	-	-	-	-
Tritium	-	-	higher	higher	higher
Gross Alpha	-	-	-	-	-
Gross Beta	higher	higher	higher	-	higher
Nitrate-N	-	-	-	-	-

Note: A decrease in value is reported only for pH.
*Monitoring wells near the former construction and demolition debris landfill.

Lagoon 1 was filled and covered in 1984 it is not considered officially closed.

The five-year trend graphs for tritium and gross beta activity indicate that there are changes occurring over time for wells within this unit. However, differences between well locations generally exceed those changes for a given parameter within the well through time, indicating that changes in groundwater quality do not generally occur rapidly.

■ High-level Waste Storage and Processing Area (SSWMU #4)

Table 3-4 summarizes the statistically significant differences between upgradient and downgradient wells within the high-level waste storage and processing area and the construction and demolition debris landfill. As indicated in the summary table, pH is lower and conductivity higher in most downgradient monitoring wells. This is also evident when looking at the five-year trend graphs (Figs.3-10 and 3-11) for these monitoring parameters. It is interesting to note that there are several downward trends evident for conductivity, especially at well locations WNW86-07 and WNW86-08. In fact, conductivity at well location WNW86-08 was indistinguishable from concentrations in the upgradient well, WNW80-02. These long-term reductions in conductivity suggest a general improvement in chemical groundwater quality in the vicinity of the high-level waste tank complex.

Other differences between upgradient and downgradient wells within the high-level waste storage and processing area and the construction and demolition debris landfill are summarized in Table 3-4. As indicated, there are several downgradient wells that differ from upgradient well WNW80-02. Figures 3-12 and 3-13 show the five-year trend graphs for tritium and gross beta concentrations for all wells within these areas. For tritium, as for conductivity, there are wells that show downward trends over time – for example, WNW86-08 and WNW86-12. The trend graphs for gross beta results show a more stable situation with the exception of well WNW86-09, which has shown a steady rise in gross beta concentrations since monitoring began in 1986. Differences in mobility between tritium, which moves with the groundwater, and other beta-emitting isotopes are known to exist for groundwater systems (Sheppard et al. 1990). For example, isotopes such as cesium-137 and strontium-90 tend to bind significantly with soil so that their mobility within a groundwater system may be retarded. Differences in a specific isotope's mobility may be partly responsible for differences in the shape of the five-year trend graphs.

The gross beta activity measured at well WNW86-09, although below New York State's groundwater quality standard of 1E-06 μCi/mL, may indicate a continuing source of contamination upgradient of this well. Other parameters such as pH, conductivity, and tritium do not appear to be changing significantly at location WNW86-09. During the installation of new 90-series wells at areas downgradient of the main process building, other areas of elevated gross beta activity were encountered at depths similar to the 28-foot depth of well WNW86-09. During the installation of these new wells the contamination was observed to be localized at this depth rather than continuous from the surface downward (Dames & Moore 1991). This contamination may be related to current conditions within the main process building and will be the focus of attention as expanded monitoring of the new 90-series wells continues in 1991. The results of groundwater monitoring carried out within the high-level waste storage and processing area, combined with measurements of water collected within the immediate vicinity of the high-level waste tanks, continue to provide evidence supporting the integrity of the high-level waste tanks.

NRC-licensed Disposal Area (NDA) (SSWMU #9)

Table 3-5 presents the summary statistics for the groundwater contamination indicator parameters for wells monitoring the NRC-licensed disposal area (NDA). Groundwater monitoring at this area is focused upon the lacustrine silt and sand deposits. Although minor differences are noted between upgradient and downgradient wells within this monitoring unit these differences appear unrelated to the wastes stored within the disposal area. The most convincing evidence for this is that tritium concentrations for both the upgradient and downgradient wells have been at or near the detection limit since monitoring began in 1986. Figures 3-14 through 3-17 show the five-year trend graphs for the NRC-licensed disposal area.

3.3.3 Summary of Initial Sampling of 90-Series Wells

After the development process was completed for the newly installed 90-series wells, specified super solid waste management units (SSWMUs) were selected for initial sampling. Selection was based upon the need to expand monitoring in areas already monitored or in which monitoring was not currently occurring. The SSWMUs selected for initial monitoring included the low-level waste treatment facility (SSWMU #1); the chemical process cell waste storage area (SSWMU #7); and the construction and demolition debris landfill (SSWMU #8). Selection of these SSWMUs added twenty-three groundwater monitoring locations to the schedule for sample collection in December 1990. The parameters scheduled for collection from these wells included pH, conductivity, gross alpha, gross beta, and tritium.

Table E-15, in Appendix E, presents the results for initial sampling of wells monitoring the SSWMUs discussed above. Although Table E-15 provides results for only one sampling period, several of the results from these new wells are noteworthy. Of particular concern are the high pH (12.33) and conductivity (16,520 μmhos/cm@25^{0}C) values associated with well WNW0103. These values represent the highest pH and conductivity levels for any well currently monitored on-site. This well, which serves as an upgradient well for SSWMU #1, is in the vicinity of a spill of caustic sodium hydroxide (NaOH) that occurred on-site in 1984. Based on these high pH and conductivity values, it is apparent that this

Table 3 - 5

Summary of Groundwater Monitoring Data for the NRC-licensed Disposal Area (NDA)

STATISTICAL DIFFERENCES OBSERVED AT DOWNGRADIENT WELLS COMPARED TO UPGRADIENT WELL WNW83-1D

Parameter	WNW86-10	WNW86-11	WNW82-1D
pH	-	-	dry
Conductivity	higher	higher	dry
TOC	-	-	dry
TOX	-	-	dry
Tritium	-	-	dry
Gross Alpha	-	-	dry
Gross Beta	higher	-	dry
Nitrate-N	-	-	dry

Note: A decrease in value is reported only for pH.

well has intercepted water differing substantially from normal site groundwater. The extent of the spread of this material is unknown. However, the caustic material is not being detected in any other wells monitored in this unit, based upon observations of pH and conductivity data.

Well WNW0111, which is also within SSWMU#1, showed levels of gross beta activity (3.39+/-0.04E-06 μCi/mL) exceeding all the other monitored 90-series wells by at least a factor of ten. This well is positioned at the downgradient edge of former Lagoon 1 and appears to be intercepting groundwater of a quality similar to that of well WNW86-05. Two more new 90-series wells (WNW0104 and WNW0801) showed elevated levels of gross beta activity in the E-7 μCi/mL range. Continued monitoring of these new wells, combined with the expanded monitoring of all of the new 90-series wells, will help better identify and characterize areas of both chemical and radiological contamination within the groundwater at the West Valley Demonstration Project.

INITIAL SAMPLING OF 90-SERIES WELLS IN THE NEW YORK STATE-LICENSED DISPOSAL AREA (SDA)

In addition to the initial sampling of the twenty-three new 90-series wells discussed above, twenty-one new 90-series wells monitoring the SDA were sampled during 1990. Results for these initial samples are shown in Appendix E, Table E-16. The most notable results are those for well WNW1107A, which showed tritium concentrations in the low E-05 μCi/mL range. This exceeds the tritium concentration in most of the other SDA wells monitored by at least a factor of 100.

Results of groundwater monitoring in the SDA will be routinely reported to New York State Energy Research and Development Authority personnel responsible for this area. Further evaluation of data from these sampling locations may be useful only after additional sampling has been carried out.

MONITORING OF OTHER 90-SERIES WELLS

During 1991 the entire new groundwater monitoring network will be brought completely on-line for sampling. This expanded network and the use of new sampling equipment, such as well-dedicated bladder pumps, will result in a significant amount of new groundwater monitoring data for the West Valley Demonstration Project. This new information will be invaluable for beginning to fully understand and characterize the site's groundwater resources.

3.3.4 Other Supporting Wells Monitored On-Site

On-site supporting wells are those wells that are not part of the waste management unit monitoring program. These wells, which were monitored on a semiannual basis during 1990, were installed primarily to measure groundwater elevations. They will be phased out of the groundwater sampling program in 1991 as new 90-series wells, meeting all regulatory requirements for groundwater sample collection, are brought on-line.

Data resulting from sample collection from these wells (shown in Appendix E, Table E-1) are generally consistent with past observations. Elevated levels of tritium in well WNW82-4A1 continued to be detected. As discussed in previous site environmental reports (WVNS 1989) it is believed that tritium at this well is related to the placement of this well within a filled excavation made by Nuclear Fuel Services in constructing a ramp in order to aid in the disposal of a large dissolver vessel into Special Hole 9 (SH 9) in the then-active NRC-licensed disposal area (NDA). In addition to the installation of new 90-series wells to monitor this area, an interceptor trench has been installed around the downgradient edges of the NDA to collect contaminated groundwater from the NDA so it can be treated.

The continued detection of elevated levels of gross beta activity at well WNW80-03, on the north plateau, is also consistent with past monitoring results. The position of this well is downgradient of a former contaminated hardstand area and the main process plant facilities. The depth of this well, 8.0 feet, and the lack of significant tritium activity suggests a possible tie to localized surface contamination.

3.3.5 Groundwater Monitoring at the Below-grade Fuel Storage Area

Table E-2 in Appendix E presents the results from groundwater monitoring well WNW86-13, located near the below-grade gasoline and diesel fuel storage area. Results for the selected volatile organic compounds benzene, toluene, and xylene continue to provide evidence for the integrity of these underground storage tanks.

3.3.6 Comparison of Data to New York State Groundwater Quality Standards

Data tables E-3 through E-14 in Appendix E present the New York State Groundwater Quality Standards for Class GA waters for parameters measured by the West Valley Demonstration Project's groundwater monitoring program. These standards are derived from Title 6 of the New York Code of Rules and Regulations (NYCRR), Chapter X, Part 703.5. Water meeting these standards is acceptable for use as a source of drinking water. These standards provide a conservative reference for comparison to site groundwater data. (Site groundwater is not used either on-site or off-site as a source of drinking water.)

Comparing 1990 site groundwater data to these quality standards reveals the following noteworthy items: With the exception of well WNW86-05, all waste management unit wells meet the New York State quality standards for the radiological parameters monitored. Well WNW86-05, however, regularly exceeds the quality standard for gross beta activity and exceeded the tritium quality standard for one of eight samples collected. This well and its location at the downgradient edge of former Lagoon 1 was discussed in section 3.3.2. As in 1989, no other wells that were part of the existing waste management unit program during 1990 exceeded groundwater quality standards for gross alpha, gross beta, or tritium. For new 90-series wells monitored during 1990 it is apparent that well WNW0111, also near the downgradient edge of former

Lagoon 1, also exceeds the gross beta groundwater quality standard.

For wells monitoring the New York State-licensed disposal area (SDA), the tritium groundwater quality standard is exceeded at location WNW1107A. The gross alpha result at this location reported for the sample collected on December 18, 1990 is virtually at the gross alpha quality standard of 1.5 E-08 μCi/mL. However, there is a relatively large counting uncertainty associated with this result. Future sampling and analysis at this particular location will be necessary to help evaluate this parameter.

For supporting groundwater wells monitored during 1990, tritium concentrations for well WNW82-4A1, discussed above in section 3.3.4, represent the only significant exceedance of a quality standard for this grouping of wells.

A comparison of existing waste management unit groundwater monitoring data to the chemical groundwater quality standards suggests a definite site effect at location WNW86-06. Elevated levels of sodium and chloride at this location are believed to be due to the operation of the nonradioactive sludge ponds (as discussed in section 3.3.2). Results for pH fall marginally below the lower pH threshold of 6.5 at locations WNGSEEP, WNW80-06, WNW86-06, and WNW86-07. For new 90-series wells monitored during 1990, well WNW0103, with a pH of 12.33, represents the only location exceeding the quality standard range of 6.5 to 8.5 (see section 3.3.3).

The above instances in which groundwater quality standards were exceeded are believed due, in part, to past or present activities at the site. In all cases the reported concentrations are also significantly different from background concentrations.

Other instances in which groundwater quality standards are exceeded were observed at other locations. However, these are not believed directly attributable to site activities. They include elevated levels of naturally occurring sodium, iron, and manganese in both upgradient and downgradient samples. Elevated levels of some other metals (for example, lead at location WNW86-10) were present in unfiltered samples only. Samples that were collected from the same location and filtered confirmed the lack of these constituents. These sporadic exceedances of quality standards on unfiltered samples only is attributable to the incorporation of sediments and well fines into the samples. The data, taken in total, suggest that all EPA interim primary drinking water standards for trace metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag) are met when natural solid materials are excluded from groundwater samples.

Other sporadic instances in which analytical results exceeded quality standards are believed related to inadequate analytical processes. Included in this category are the results for phenols, in which the analytical detection limit of the method employed exceeds the stringent groundwater quality standard of 0.001 mg/L. Other instances include occasional positive results for elements such as mercury. These occasions are generally observed to affect an entire analytical data set, suggesting a problem during the performance of the analysis.

Continued improvements in the selection of analytical laboratories, in data validation processes, and in the interpretation of analytical results will help in the continued successful evaluation of an increasing amount of groundwater monitoring data.

3.3.7 Off-Site Groundwater Monitoring

During 1990 all of the off-site groundwater residential wells were sampled for radiological constituents, pH, and conductivity. These wells are used by site neighbors as sources of drinking water. There continues to be no evidence indicating contamination of these off-site water supplies by the WVDP. Results for these samples are found in Table C-1.8 in Appendix C.

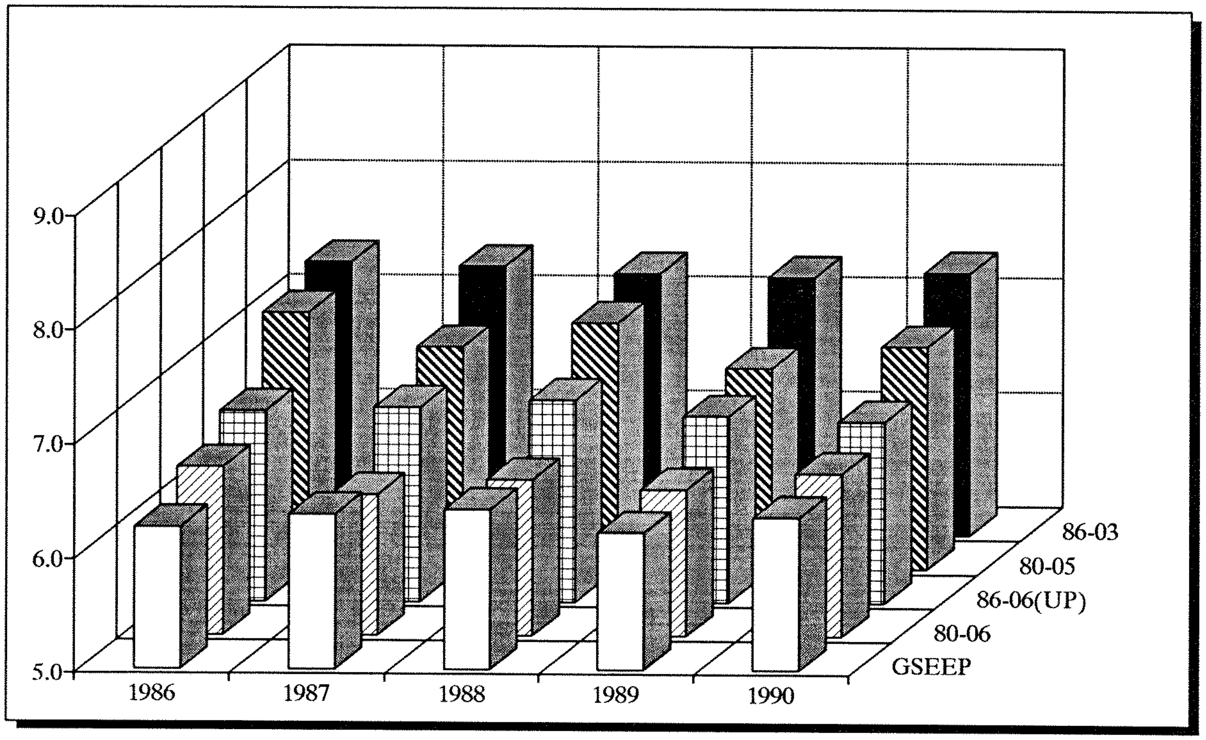


Figure 3-6a. ***Five-Year Trend of Averaged pH in Selected Low-Level Waste Treatment Facility Wells.***

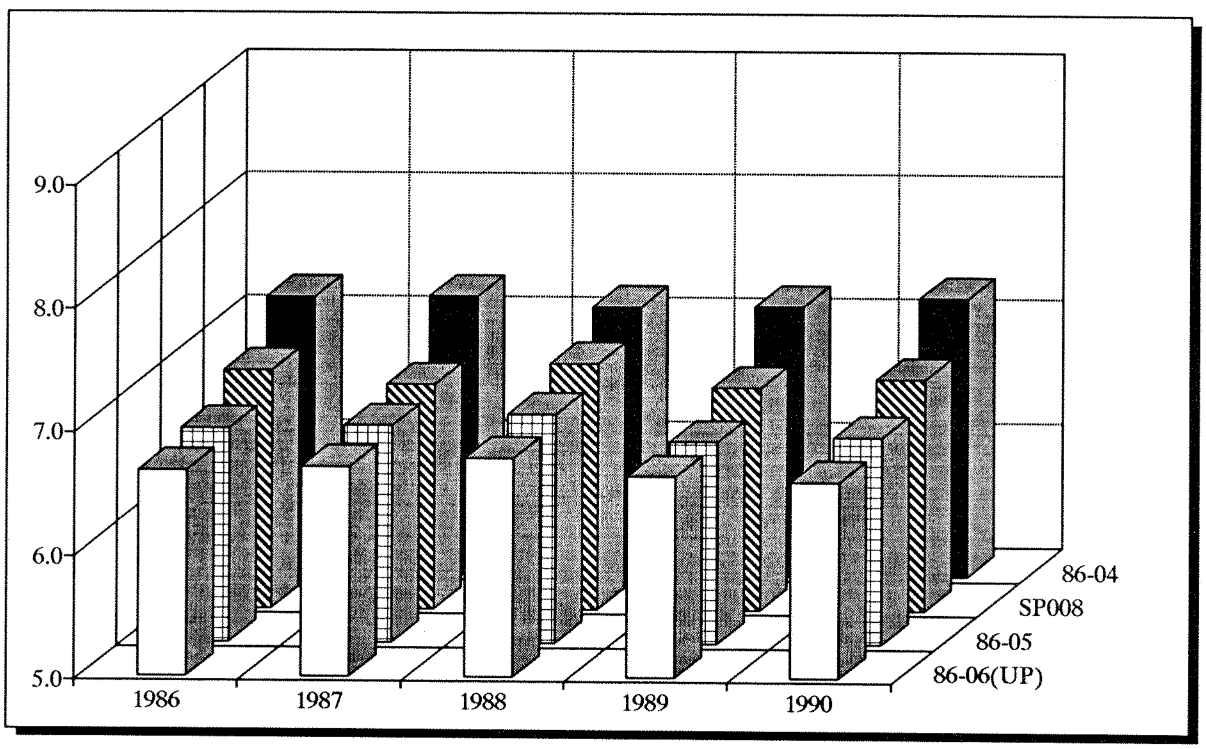


Figure 3-6b. ***Five-Year Trend of Averaged pH in Selected Low-Level Waste Treatment Facility Wells.***

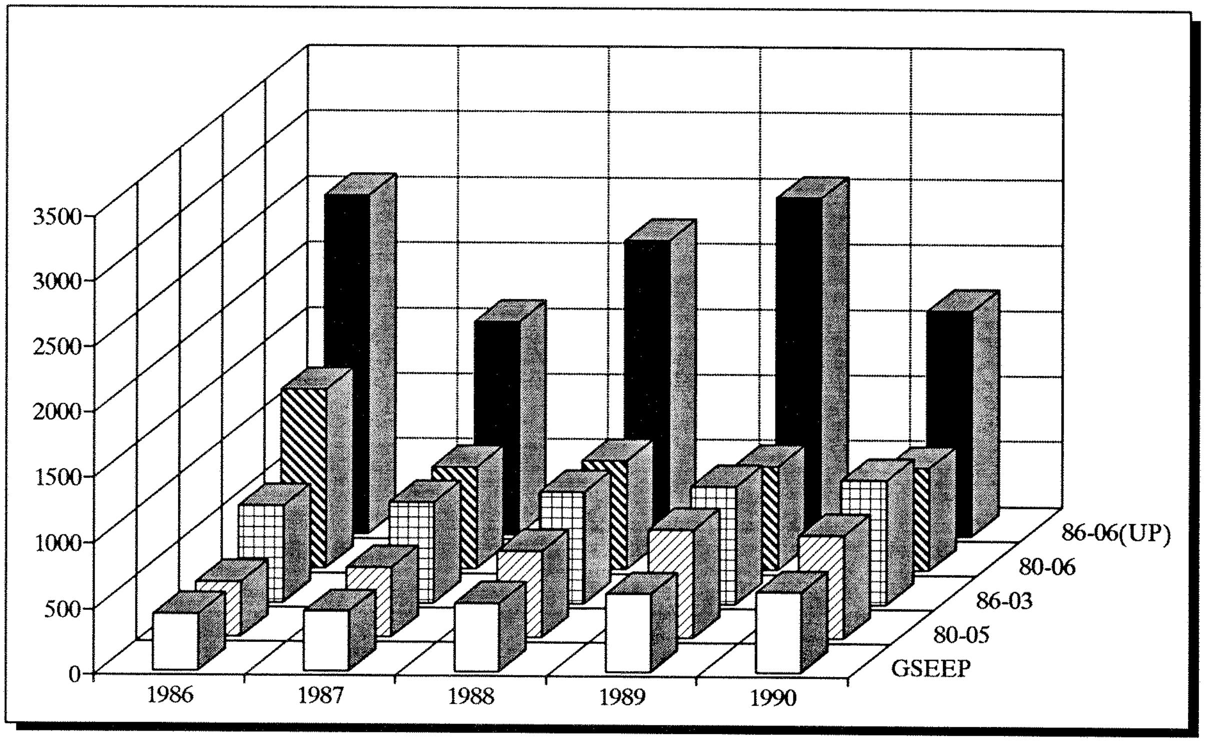


Figure 3-7a. *Five-Year Trend of Averaged Conductivity (umhos/cm) in Low-Level Waste Treatment Facility Wells.*

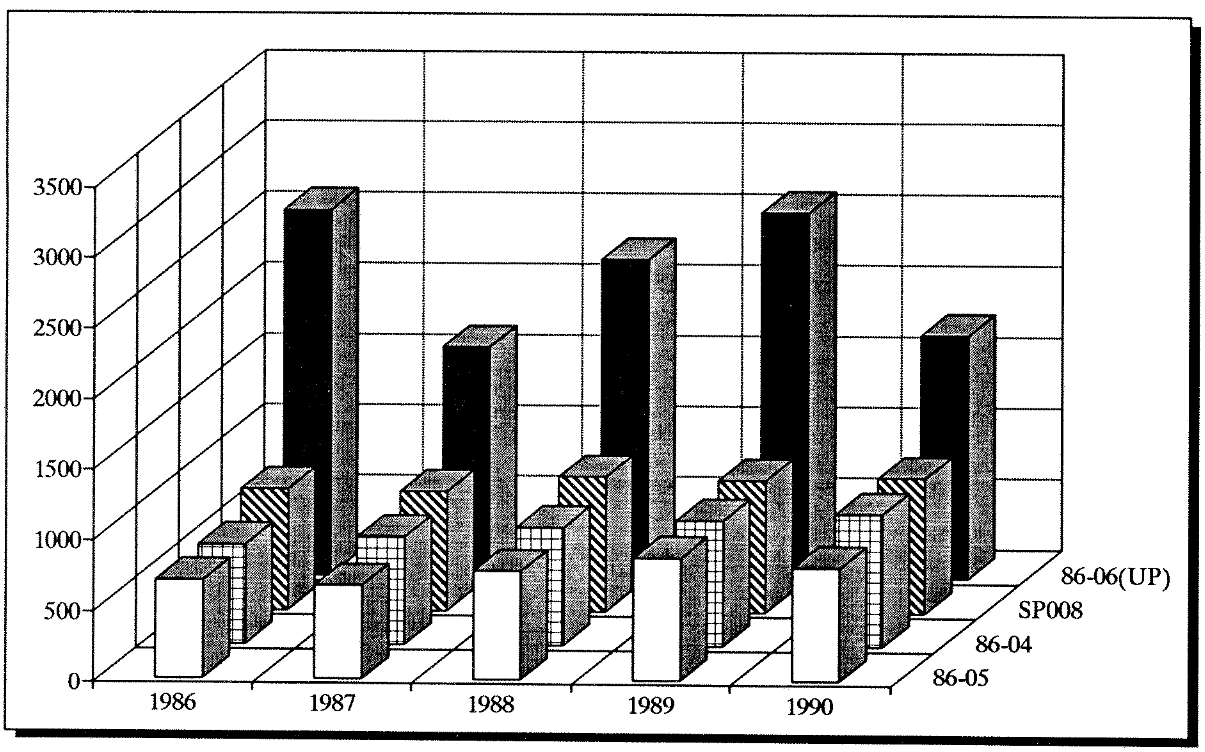


Figure 3-7b. *Five-Year Trend of Averaged Conductivity (umhos/cm) in Low-Level Waste Treatment Facility Wells.*

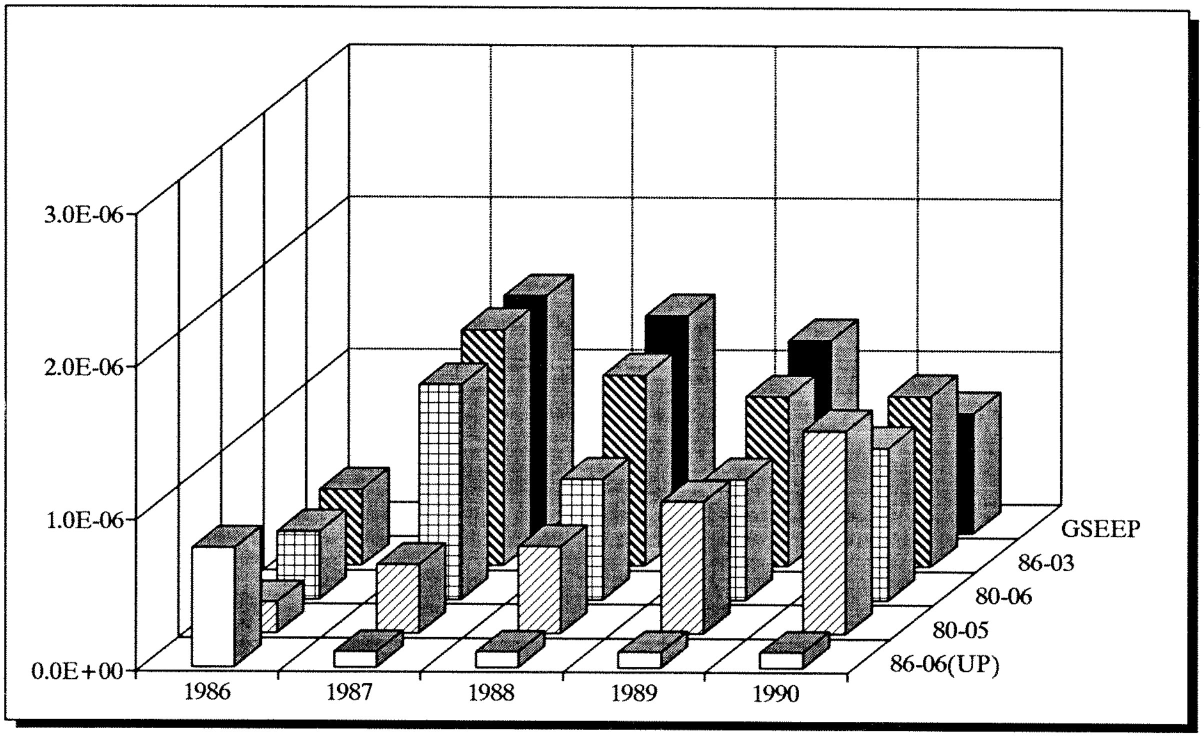


Figure 3-8a. *Five-Year Trend of Averaged Tritium Activity (uCi/ml) in Low-Level Waste Treatment Facility Wells.*

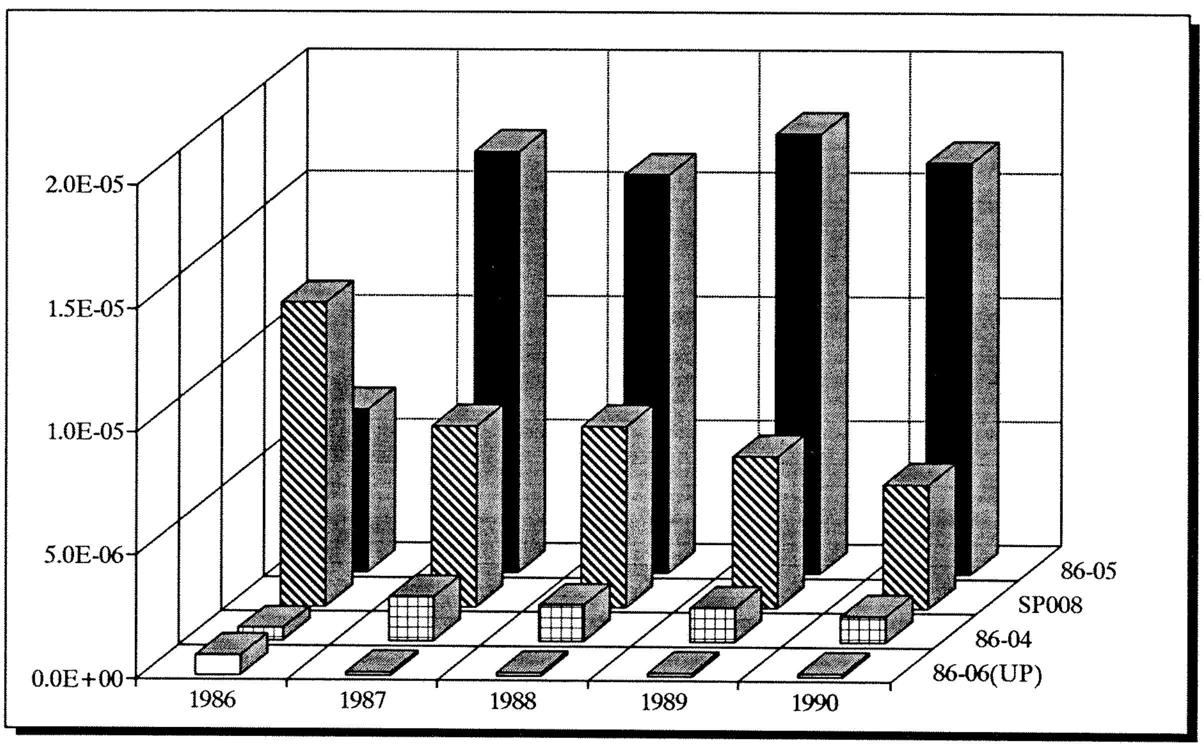


Figure 3-8b. *Five-Year Trend of Averaged Tritium Activity (uCi/ml) in Low-Level Waste Treatment Facility Wells.*

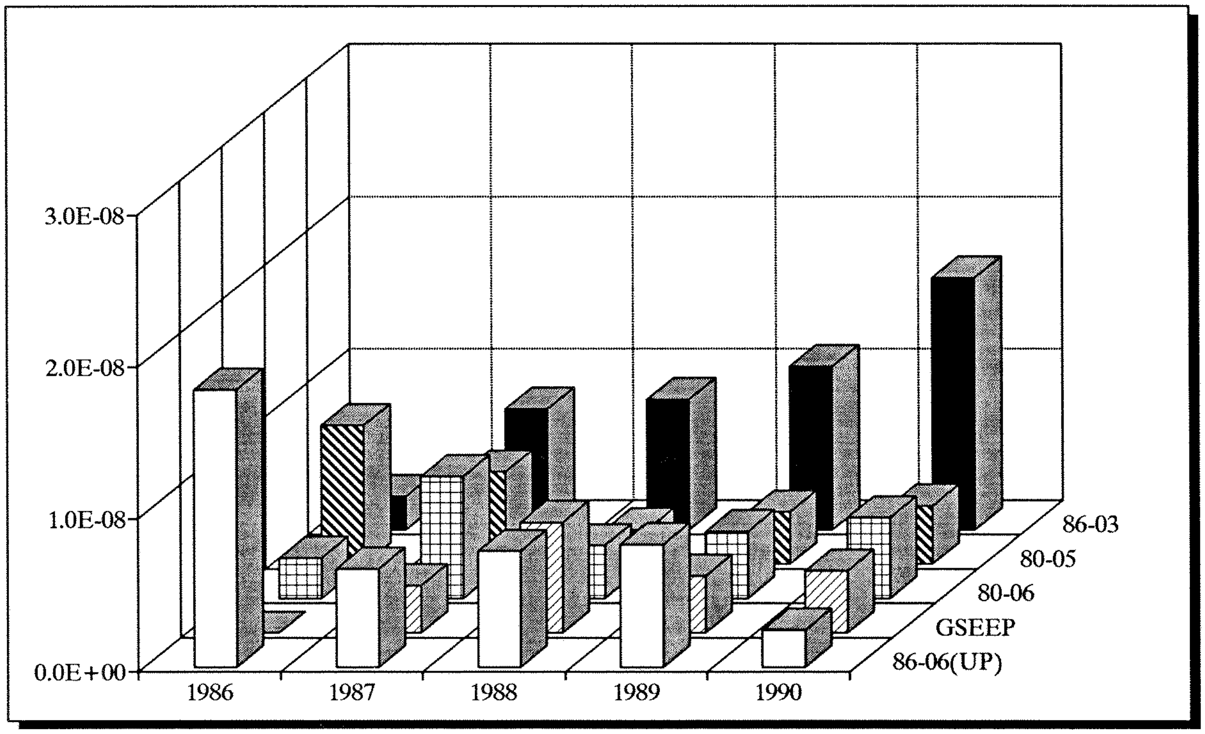


Figure 3-9a. ***Five-Year Trend of Averaged Gross Beta Activity (uCi/ml) in Selected Low-Level Waste Treatment Facility Wells.***

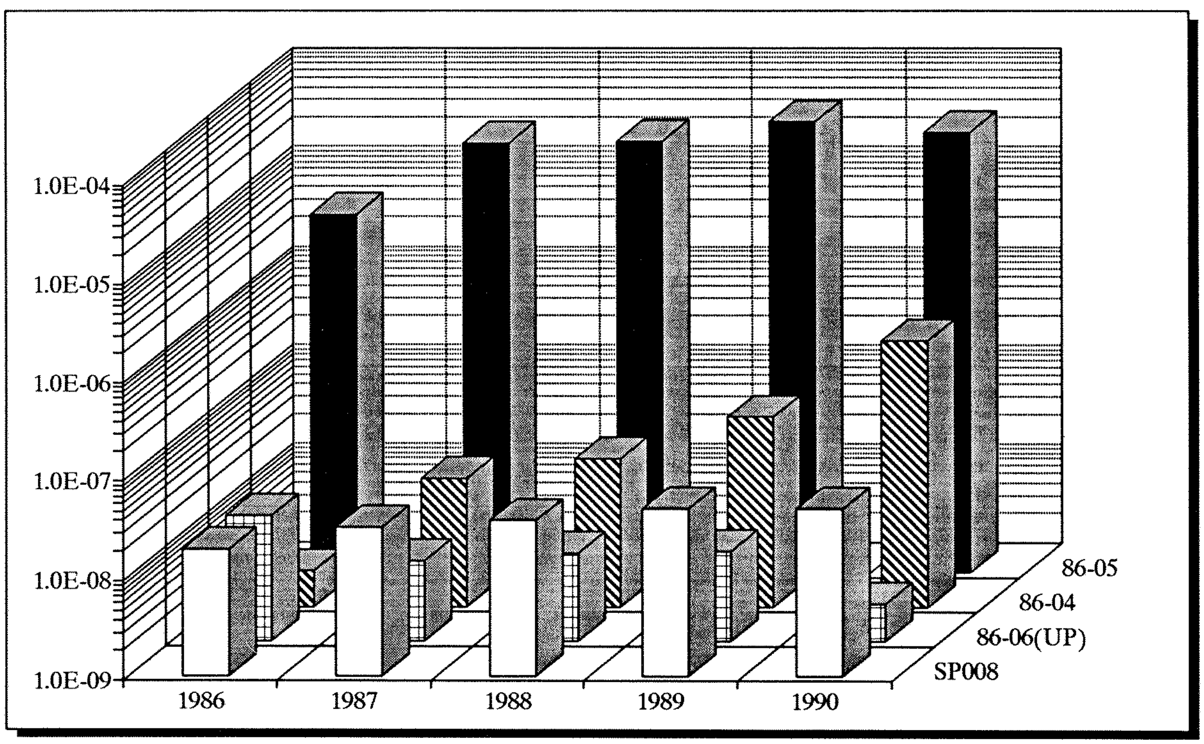


Figure 3-9b. ***Five-Year Trend of Averaged Gross Beta Activity (uCi/ml) in Selected Low-Level Waste Treatment Facility Wells. (Note Log Scale).***

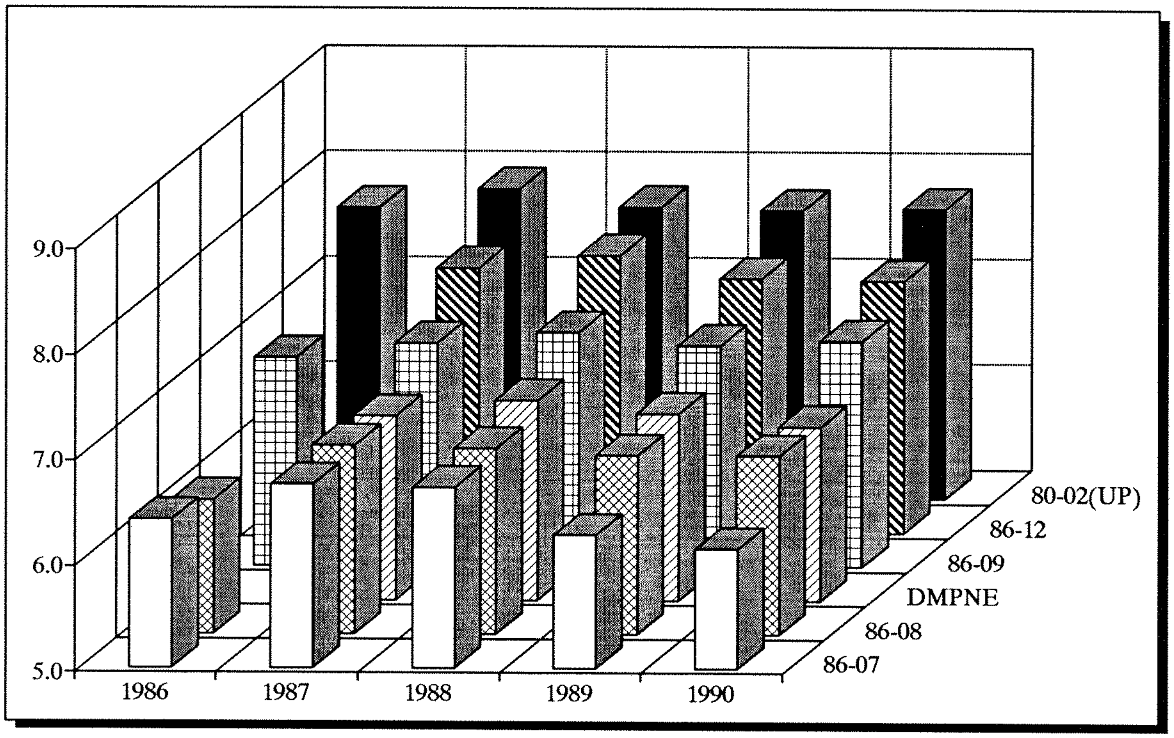


Figure 3-10. ***Five-Year Trend of Averaged pH in High-Level Waste Storage and Processing Unit Wells.***

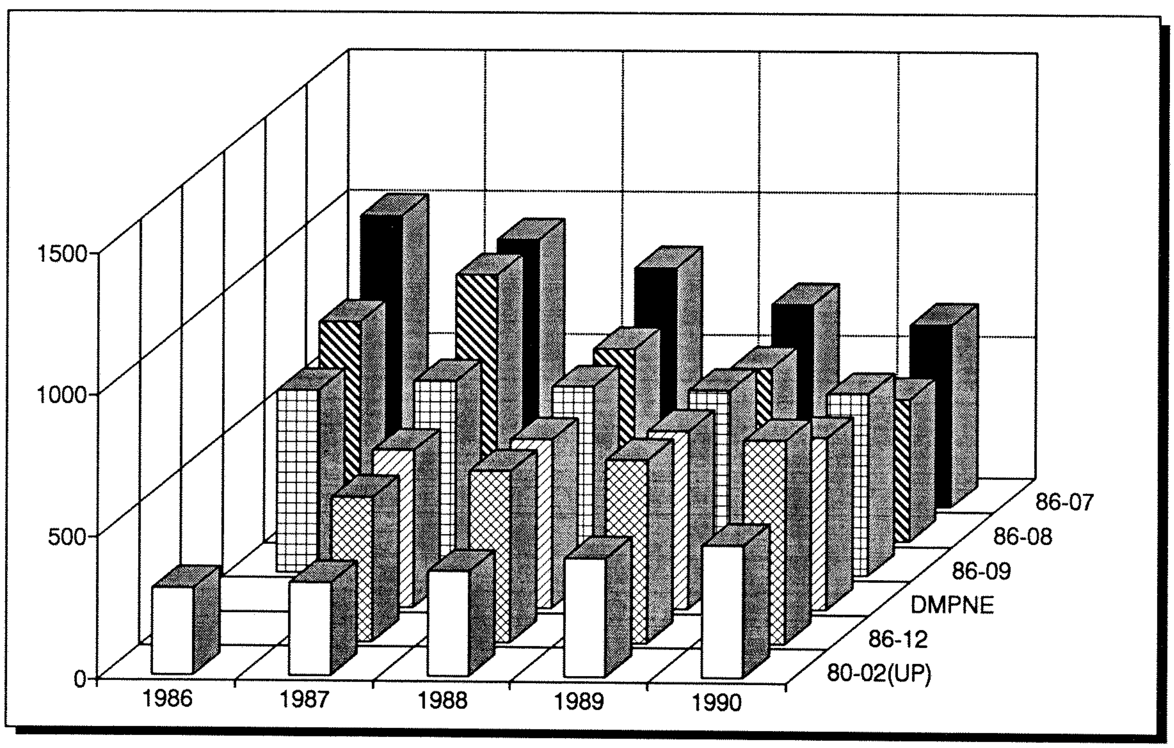


Figure 3-11. ***Five-Year Trend of Averaged Conductivity (umhos/cm) in High-Level Waste Storage and Processing Unit Wells.***

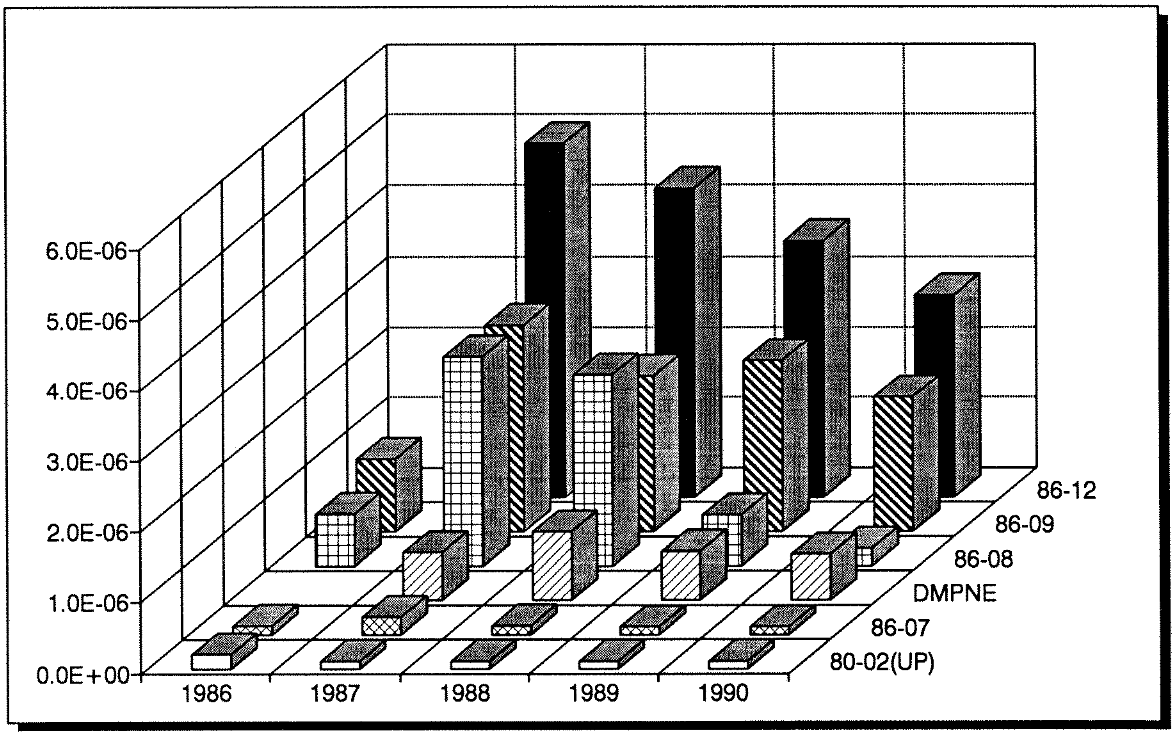


Figure 3-12. ***Five-Year Trend of Averaged Tritium Activity (uCi/ml) in High-Level Waste Storage and Processing Unit Wells.***

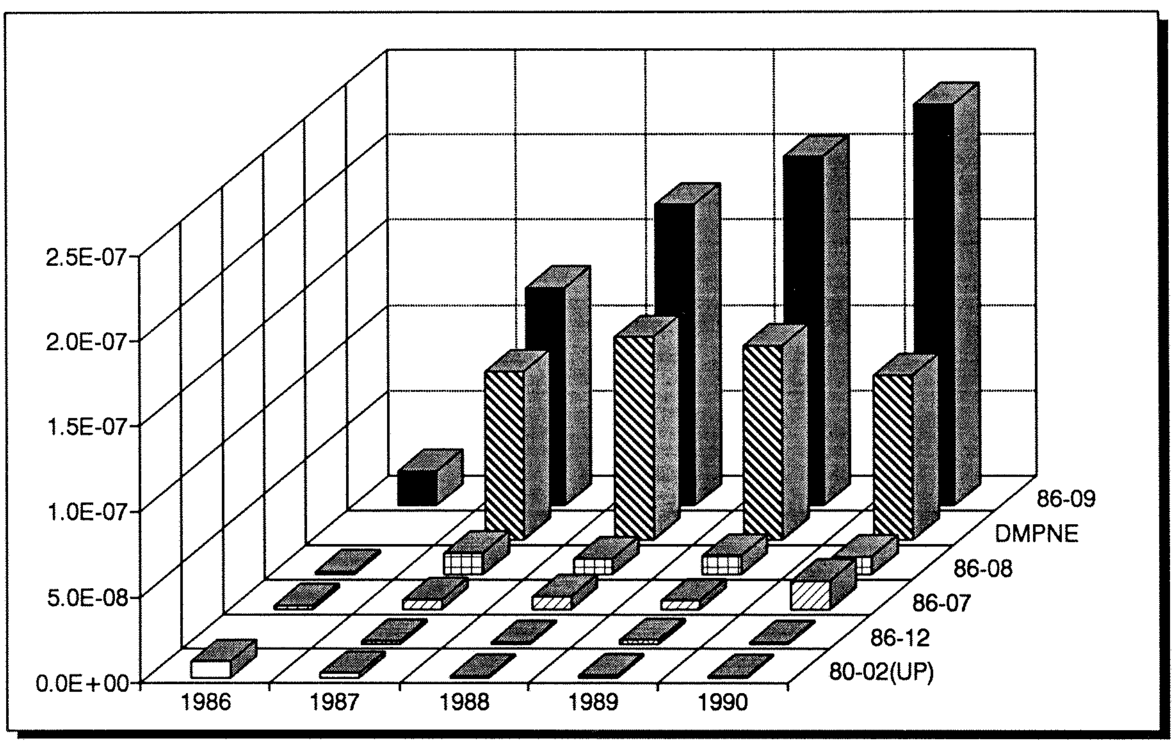


Figure 3-13. ***Five-Year Trend of Averaged Gross Beta Activity (uCi/ml) in High-Level Waste Storage and Processing Unit Wells.***

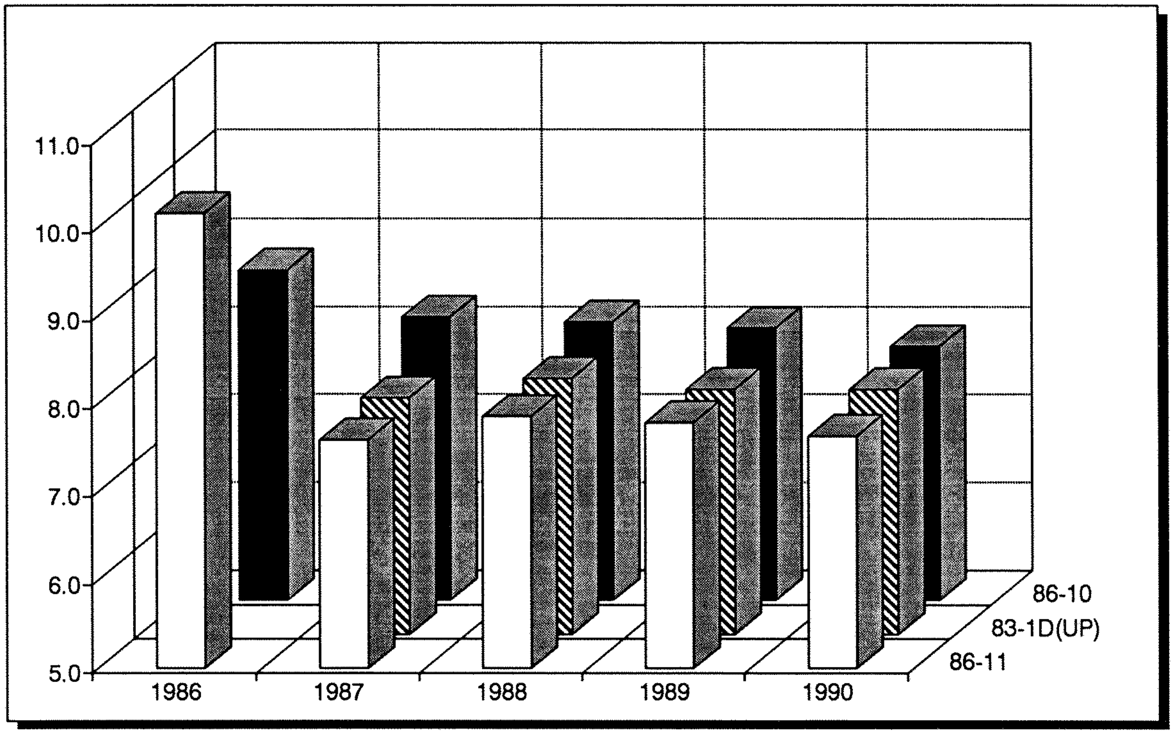


Figure 3-14. *Five-Year Trend of Averaged pH in NRC-Licensed Disposal Area Wells.*

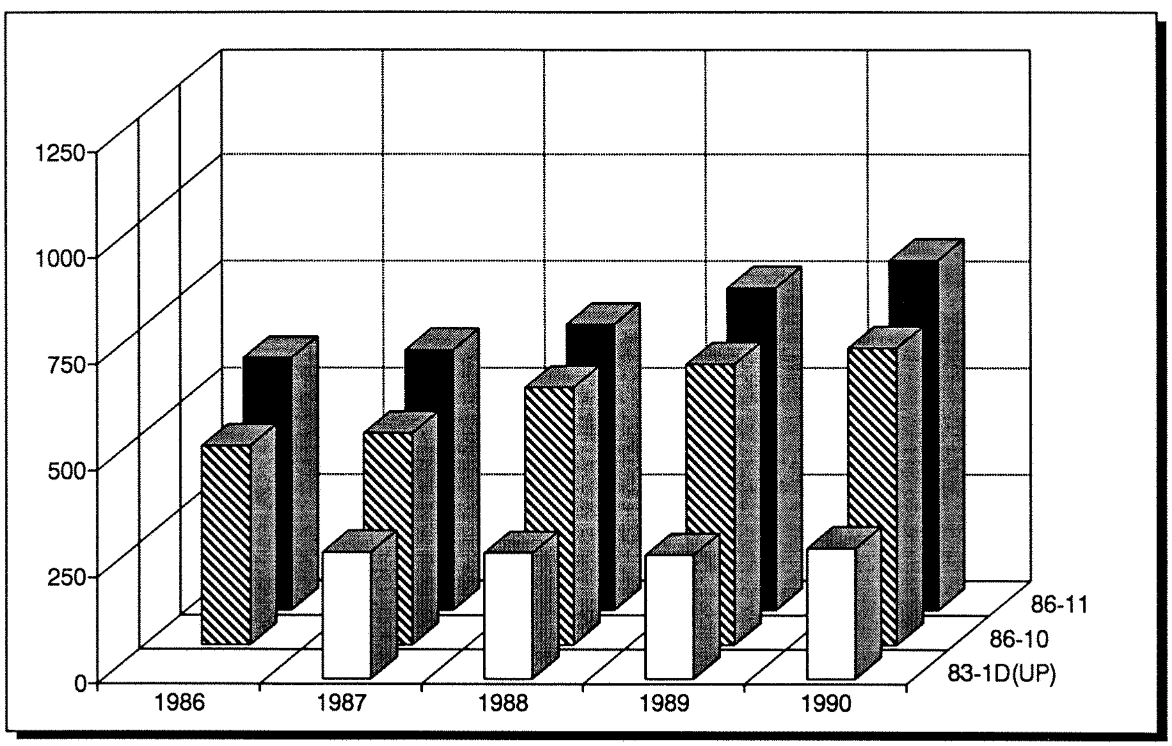


Figure 3-15. *Five-Year Trend of Averaged Conductivity (umhos/cm) in NRC-Licensed Disposal Area Wells.*

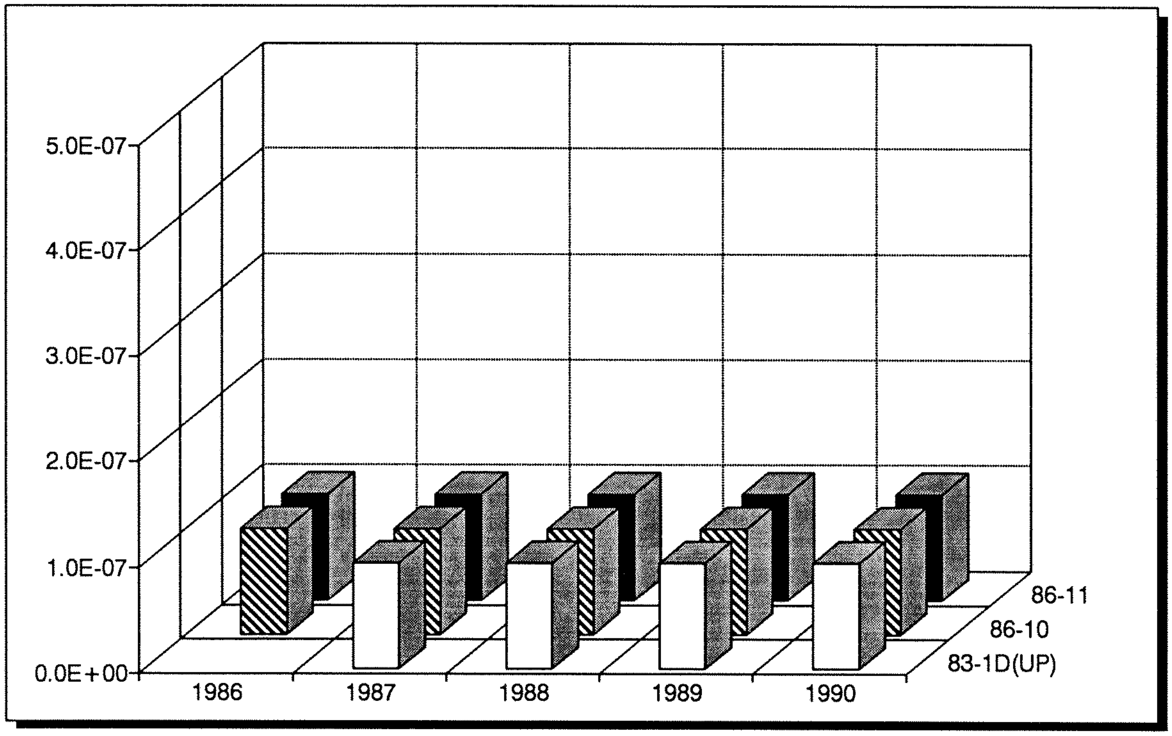


Figure 3-16. *Five-Year Trend of Averaged Tritium Activity (uCi/ml) in NRC-Licensed Disposal Area Wells.*

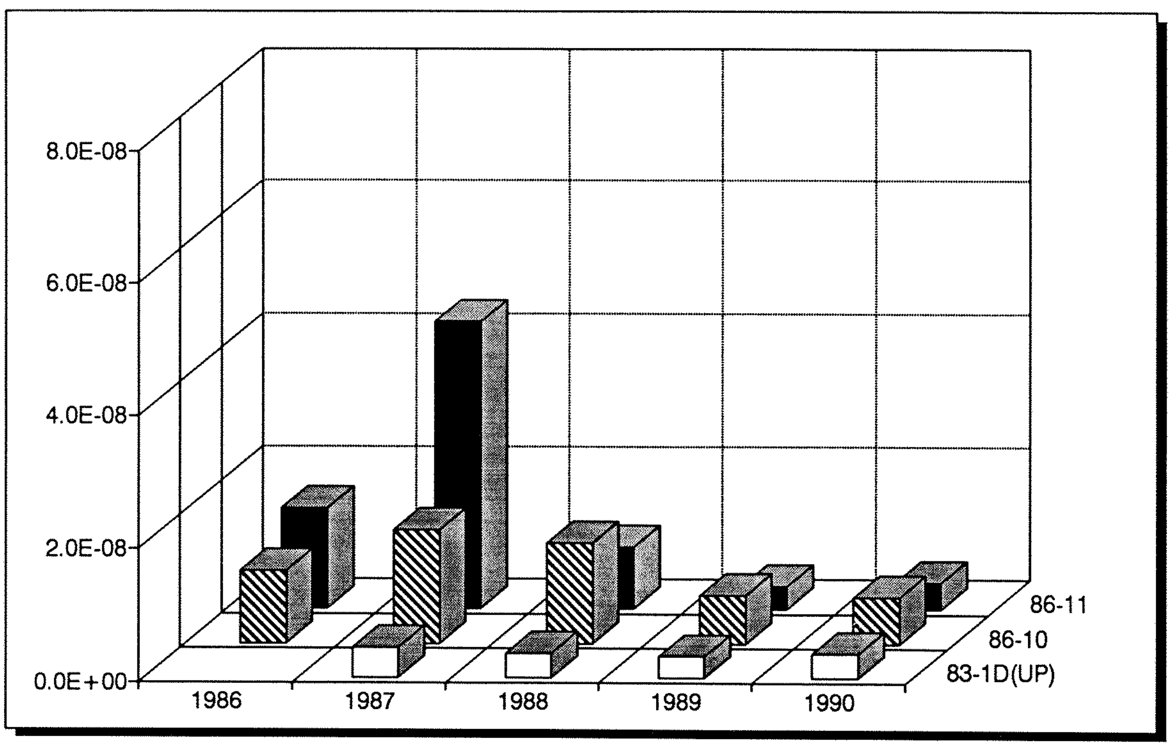


Figure 3-17. *Five-Year Trend of Averaged Gross Beta Activity (uCi/ml) in NRC-Licensed Disposal Area Wells.*