3.0 GROUNDWATER MONITORING PROGRAM

3.1 HYDROGEOLOGY OF THE SITE

The WVDP site lies within the Glaciated Allegheny Plateau section of the Appalachian Plateau Physiographic Province. The section is a maturely dissected plateau with surficial bedrock units of Devonian shales and sandstones. Bedding dips uniformly and gently (4 to 7.5 m/km) to the south. The plateau has been subjected to erosion and the deposits of repeated glaciations, resulting in accumulations of till (intermingled sand, silt, clay, gravel, and boulders), outwash, and lacustrine deposits over the area.

The site is underlain by a thick sequence of silty clay tills and a thinner layer of more granular deposits filling a bedrock valley that has been carved through Devonian shales by the precursor of Cattaraugus Creek and its tributaries. Figure 3-1 shows a generalized east-west cross section through the site. The uppermost till unit is the Lavery, a very compact gray silty clay. The Lavery is approximately 6 m (20 ft.) thick at the western boundary of the WVDP and thickens to the east. At the western edge of the developed portion of the WVDP, the Lavery is approximately 30 m (99 ft.) thick.

The upper 3 m (10 ft., approximately) of the Lavery have been chemically weathered by leaching and oxidation and mechanically weathered by biological processes. The hydraulic conductivity of the weathered till tends to be higher than that of the underlying, unweathered parent material, probably as a result of the much greater frequency of fractures in the weathered portion. *In situ* measurements of the hydraulic conductivity in the unweathered Lavery till have generally ranged between 10-8 and 10-7 cm/s.

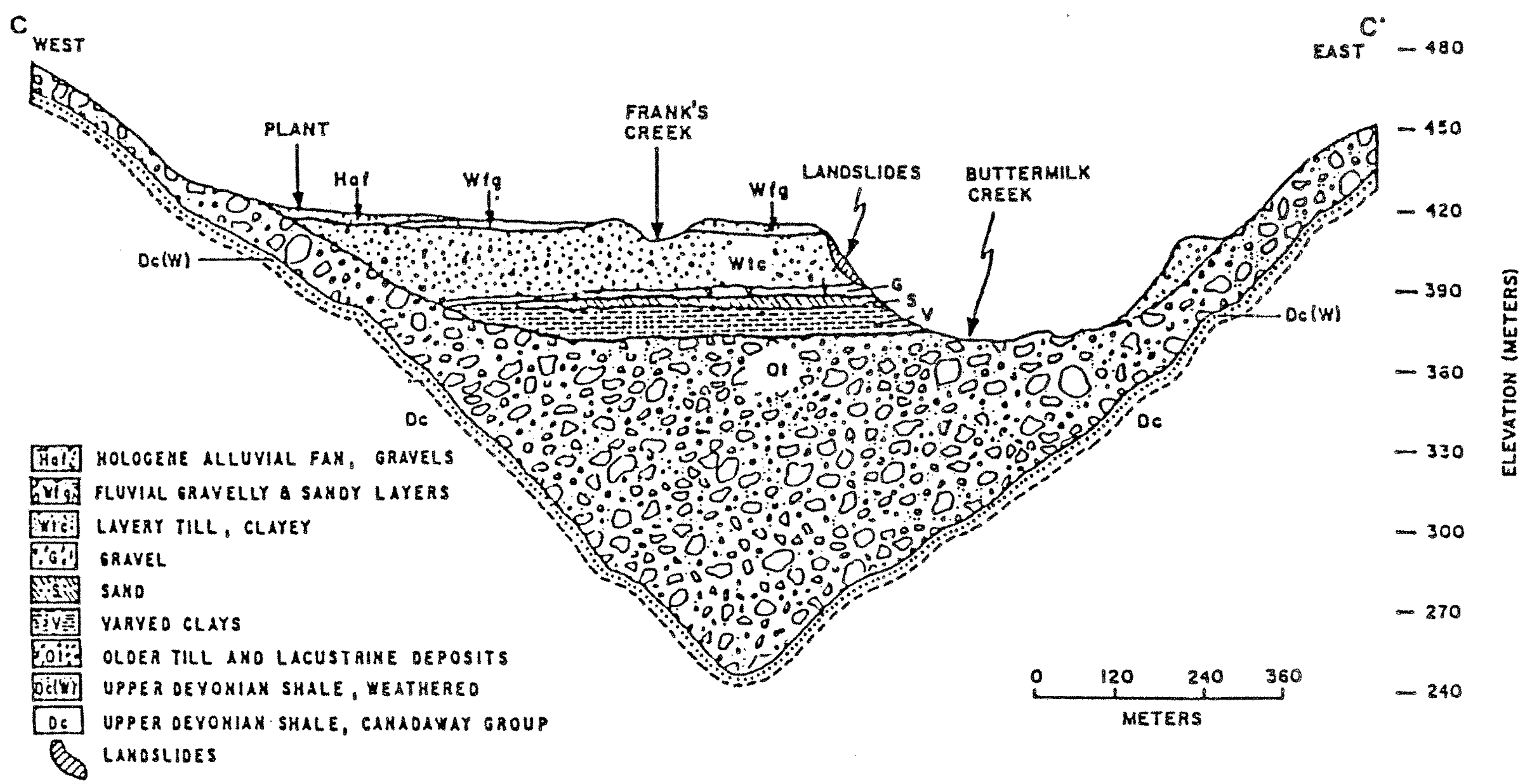
The northern portion of the WVDP site (the North Plateau) is blanketed by alluvium and glacial fluvial deposits that include sand and gravel layers. The Lavery till directly underlies these deposits.

Below the Lavery till is a more granular unit referred to locally as the Lacustrine Unit. It comprises silts, sands and, in some areas, gravels which overlie a layered (varved) clay. The Lacustrine Unit is believed to be more permeable than the Lavery, but little permeability testing has been performed in this unit. Hydraulic conductivities on the order of 10-5 to 10-4 cm/s are assumed for this unit. These values are conservative in view of the very fine-grained nature of the sandy beds that occur in the unit.

Groundwater flow beneath the site occurs in two aquifers and, to a considerably lesser extent, in the aquiclude (unweathered Lavery till) that separates them. The upper aquifer is a water-table aquifer in the weathered till in the southern portion of the site and in the alluvium and glacial fluvial deposits on the North Plateau. The water table in the weathered till tends to be transient, commonly existing only during the late winter and spring when considerable percolation into the unit occurs from the spring thaw. The primary flow in the weathered till occurs through the extensive system of fractures which has been observed in this unit.

The lower aquifer is an unconfined aquifer in the Lacustrine Unit. The piezometers tapping this unit all exhibit water levels below the top of this unit. The total recharge mechanism for the unit is not well defined because of limited data. Available data, however, suggest that the unit is probably recharged from the fractured bedrock and from downward seepage through the overlying Lavery till. The bedrock recharge zone to the west is recharged at outcrops in the uplands to the west of the site. Flow in the Lacustrine unit appears to be eastward to Buttermilk Creek.

The aquiclude that separates the two aquifers is the unweathered Lavery till. Its mass permeability is extremely low, but it does permit seepage. When the weathered till is acting as a transient aquifer, a vertical gradient of unity exists in the till and causes water to move downward, but at a very low rate.



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

Figure 3-1. Generalized Geologic Cross Section at the West Valley Demonstration Project.

3.2 GROUNDWATER MONITORING PROGRAM OVERVIEW

The 1988 groundwater monitoring program consisted of two main sub-programs: on-site waste management unit and supporting on-site well monitoring and off-site drinking water well monitoring.

3.2.1 On-site Waste Management Unit Monitoring

A system of 14 wells, one groundwater seep, and a french drain outlet are included in the groundwater monitoring program for three separate waste management areas: Low-Level Radioactive Waste Lagoon System, High-Level Waste Tank Complex, and NRC-Licensed Disposal Area. The monitoring points are located around the waste management units, so that one point is hydraulically upgradient, and the remainder of the points within a given unit are hydraulically downgradient of the waste management unit. The locations of the monitoring points were selected based on known groundwater flow patterns for each of the three separate areas, and the presence and proximity of other potential sources of contamination. Comparisons between upgradient and downgradient locations allow for the detection of significant increases or changes in monitored groundwater contamination indicator parameters, as compared to upgradient conditions.

Low-level Radioactive Waste Lagoon System

Six monitoring wells are used to assess groundwater quality in the area of the low-level radioactive waste lagoon system. Well 86-6 serves as the upgradient well for this unit, while wells 80-5, 80-6, 86-3, and 86-4 are all downgradient wells. Well 86-5 is designed to monitor the groundwater quality in the immediate vicinity of former Lagoon 1, and is located downgradient of this former lagoon, in the direction of Erdman Brook. The outlet of the french drain (SPDES sampling point, WNSP008) and a groundwater seep (WNGSEEP), located along the western bank of Frank's Creek, are also included in the monitoring system for this unit. The french drain serves as a sink for surface groundwater in the immediate vicinity of the lagoon system, and provides a good indicator of groundwater quality over time. The french drain has been extensively sampled, and good long-term records are available for this location.

The groundwater seep (WNGSEEP) and wells 80-5 and 80-6 provide a measure of groundwater quality in the surficial deposits of the north plateau. The quantity of groundwater flowing beneath the lagoon system not diverted by the french drain is unknown. However, it is believed that some of the deeper groundwater, particularly on the northern sides of Lagoons 4 and 5, tends to flow generally northeastwardly towards Frank's Creek. A 1982 study of tritium in groundwater in the vicinity of the lagoon system provides evidence of this groundwater flow pattern. The locations of these monitoring sites are shown on Fig 3-2.

High-Level Waste Tank Complex

Four monitoring wells serve the high-level waste tank complex. Well 80-2 is located upgradient of the high level waste tank area, and wells 86-7, 86-8 and 86-9 are located hydraulically downgradient. These downgradient wells are located along the major groundwater flow paths passing through the tank complex, as determined by Yager [1987]. These sampling locations are shown on Fig 3-2.

Data for two additional groundwater sampling locations are reported along with data for the high-level waste tank complex to allow for comparison to a representative upgradient well. These locations, well 86-12 and the screened standpipe WNDMPNE, monitor the former non-radioactive construction and demolition debris landfill which was closed in 1986.

NRC-Licensed Disposal Area

Four wells are used to monitor the NRC-licensed disposal area. All four wells are screened within the Lacustrine Unit. Well 83-1D serves as the upgradient well for this unit. Wells 86-10, 86-11, and 82-1D serve as downgradient wells. Well 82-1D is normally dry, and was not sampled during 1988. The locations of these wells are shown on Fig 3-2.

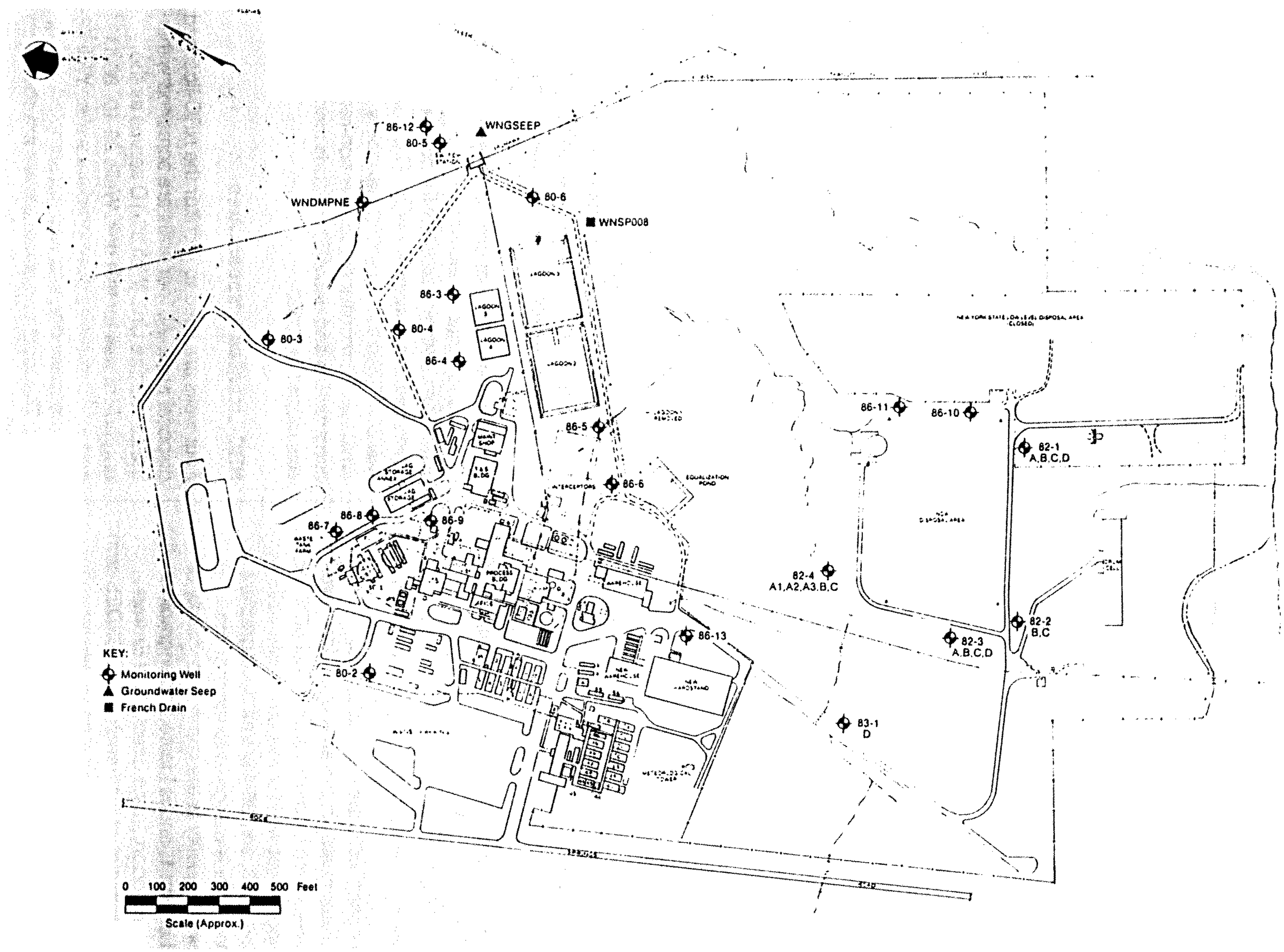


Figure 3-2. Location of On-Site Groundwater Monitoring Points

Waste Management Unit Sampling

All site wells comprising the waste management unit groundwater monitoring program were sampled three times during 1988. The first sampling period was during the first quarter of 1988 and is referred to in the data tables as 8801. Data from this sampling effort were used to complete background groundwater characterization of the waste management units. The second sampling period took place during the second and third quarters of 1988, and is designated by the code 8810. The third and final sampling period for 1988 was during the fourth quarter of 1988, and is referred to as period 8820. These latter two sampling periods correspond to the first and second semi-annual sampling periods following background characterization. The latter period was completed during one calendar quarter in order to include the data in this report, and to allow subsequent semi-annual sampling to follow the calendar year.

Prior to each sampling effort each well is sounded, a small sample is collected for radiological screening purposes, and the volume of standing water within the well casing is calculated. At the time of sampling, each well is first purged (evacuated) of at least three well casing volumes of water (one casing volume, if the well goes dry), using dedicated bailers, dedicated sampling equipment, or thoroughly cleaned equipment. (Dedicated equipment was used for all wells sampled during period 8820). Following well purging, four replicate samples are collected for each of the parameters listed in Table 3-1. Measurement of pH is performed in the field on four samples from each well, two of which are collected at the beginning of the sampling cycle, and the remaining two after all other replicate samples have been collected. This pH measurement procedure provides an indication of the homogeneity of the sampled groundwater. Samples collected for dissolved metals are filtered in the field, as the sample is obtained. Samples for total metals are also collected.

Following collection, the samples are brought to the Environmental Laboratory where proper preservation, required for certain parameters, is performed. Samples to be analyzed by off-site laboratories are shipped via overnight courier in insulated shipping containers. Samples analyzed on site are held in controlled storage until time of analysis.

Groundwater Contamination Indicator Parameters

Those parameters which serve as indicators of groundwater contamination at the WVDP are shown on Table 3-1. These indicators were selected after considering the type, quantities, and concentrations of constituents in the waste at the Project, in addition to their mobility, persistence, and detectability. These parameters are sensitive indicators of groundwater quality and at the same time are representative of wastes existing within the waste management units.

A One-Way Analysis of Variance (ANOVA) was performed for each indicator parameter for each of the three waste management units using a commercially available statistical software package [STATGRAPHICS, Statistical Graphics Corporation]. The ANOVA technique is recommended [USEPA 1989] as one of several methods suitable for comparing upgradient to downgradient groundwater monitoring data. This statistical analysis was used to compare the means for each parameter for each well within a given waste management unit to determine whether samples are derived from the same source. Once significant differences are discovered, comparisons are then made to determine which, if any, well locations are significantly different from the upgradient monitoring location.

3.2.2 Supporting Monitoring Wells and Off-site Wells

In addition to the on-site monitoring wells described above, a number of other wells (WNW80 and WNW82 Series) are sampled on a semi-annual basis. These wells are sampled for radioactivity and selected water quality parameters as indicated in Appendix E. Locations of these wells are shown in Figure 3-2 along with the wells in the waste management monitoring program.

Well 86-13, located near the below-ground gasoline and diesel fuel storage area, was sampled on the same schedule as the waste management

TABLE 3-1

SCHEDULE OF GROUNDWATER SAMPLING AND ANALYSIS

Category	Parameter	Frequency	Comment
1. EPA Interim Drinking Water Standards	Arsenic Barium Cadmium Floride Lead Mercury Nitrate (as N) Selenium Silver Radium Gross Alpha Gross Beta	Quarterly for 1st year.	Annually after 1st year except coliform and pesticides
	Coliform Bacteria Endrin Lindane Methoxychlor Toxaphene 2,4-D 2,4,5-TP Silvex		These were omitted because site history does not indicate past usage or potential for contamination
II. Groundwater Quality Indicators	Chloride Iron Manganese Phenois Sodium Sulphate	Quarterly for 1st year, annually thereafter	
III. Groundwater Contamination Indicators	Nitrate pH Conductivity Total Organic Carbon Total Organic Halogens Specific Metals Tritium Gross Alpha Gross Beta Specific Gamma Emitters	Quarterly for 1st year, semiannually thereafter	All parameters are measured in 4 replicates of each sample. Parameters selected by WVNS as indicators of waste treatment/disposal at WVDP.
IV. Groundwater Elevations		Once before collecting each well sample	

unit wells. Samples were analyzed for volatile organic fuel products, radioactivity, and selected water quality parameters. The location of this monitoring point is shown on Figure 3-2.

Private residential drinking water wells around the site restricted area represent the nearest unrestricted use of groundwater near the Project. These potable water wells are monitored primarily for radioactivity. One half of the wells in this group are sampled one year, the other half the next year. Locations of the wells are shown on Figure 3-3.

3.3 GROUNDWATER MONITORING RESULTS

3.3.1 Statistical Treatment of Data for Waste Management Units

The waste management unit groundwater data obtained from the collection of four replicate samples for each parameter was averaged using Cohen's Method [USEPA 1986]. This method provides a maximum likelihood estimate of the mean for data consisting of a mixture of detectable and below detection limit values (censored data). Cohen's Method assumes the censored data follow a normal distribution. When all four replicate values were greater than the limit of detection, a straight arithmetic average was used. When all replicate values were less than the detection limit, the value assigned was that of the detection limit. All radiological data were exempted from this procedure and were averaged using the actual available counting results. Averaged radiological data which were then below the 95% counting error were assigned less-than-detection limit values.

The averaged data for all the parameters measured for the waste management unit monitoring program wells are tabulated and presented in Appendix E. Graphical presentation of the 99% confidence interval about the means is also presented in Figures E-1 through E-41 for the groundwater contamination indicator parameters and selected water quality parameters. These plots were generated by the ANOVA routine, and the confidence interval provided assumes equal variances for all wells within a group. Thus the error bars around each mean value are of equal size.

The results of the ANOVA technique performed for each of the selected contamination indicator parameters for each of the three waste management units are presented in the following sections. This analysis included data from 1987 through 1988. Several of the ANOVA conclusions are derived from log transformed data in order to stabilize or equalize variances between sample locations. Strict agreement between the 99% confidence interval plots and the results shown in the statistical summary tables does not always occur, because all the confidence interval plots shown in Appendix E were derived from non-transformed data. Log transformed plots were not shown because they are not easily interpreted. In the few cases where agreement does not occur, the results shown in the summary tables are more conservative.

The statistical summary tables in this section present differences observed for indicator parameters at downgradient locations as compared an upgradient monitoring point for each of the three waste management units. Upgradient conditions represent background data for each of the monitored units. The terms "inc," "dec," "same," and "no" are used in the tables in the following manner.

Increase (inc) indicates that concentrations at the monitored downgradient points are statistically greater than at the upgradient location. Likewise, decrease (decr) indicates that downgradient concentrations are lower than upgradient values. The term "decr" is used only for pH, for which both decreases and increases are of concern. The term "same" indicates that no significant difference between upgradient and downgradient values was observed, and the term "no" indicates that downgradient concentrations are either statistically the same as or less than upgradient values. Significant decreases are not indicated for parameters other than pH, because they are not indicative of contamination.

It is important to note that the above terms do not indicate a trend within a particular well, but rather they provide information about differences be-

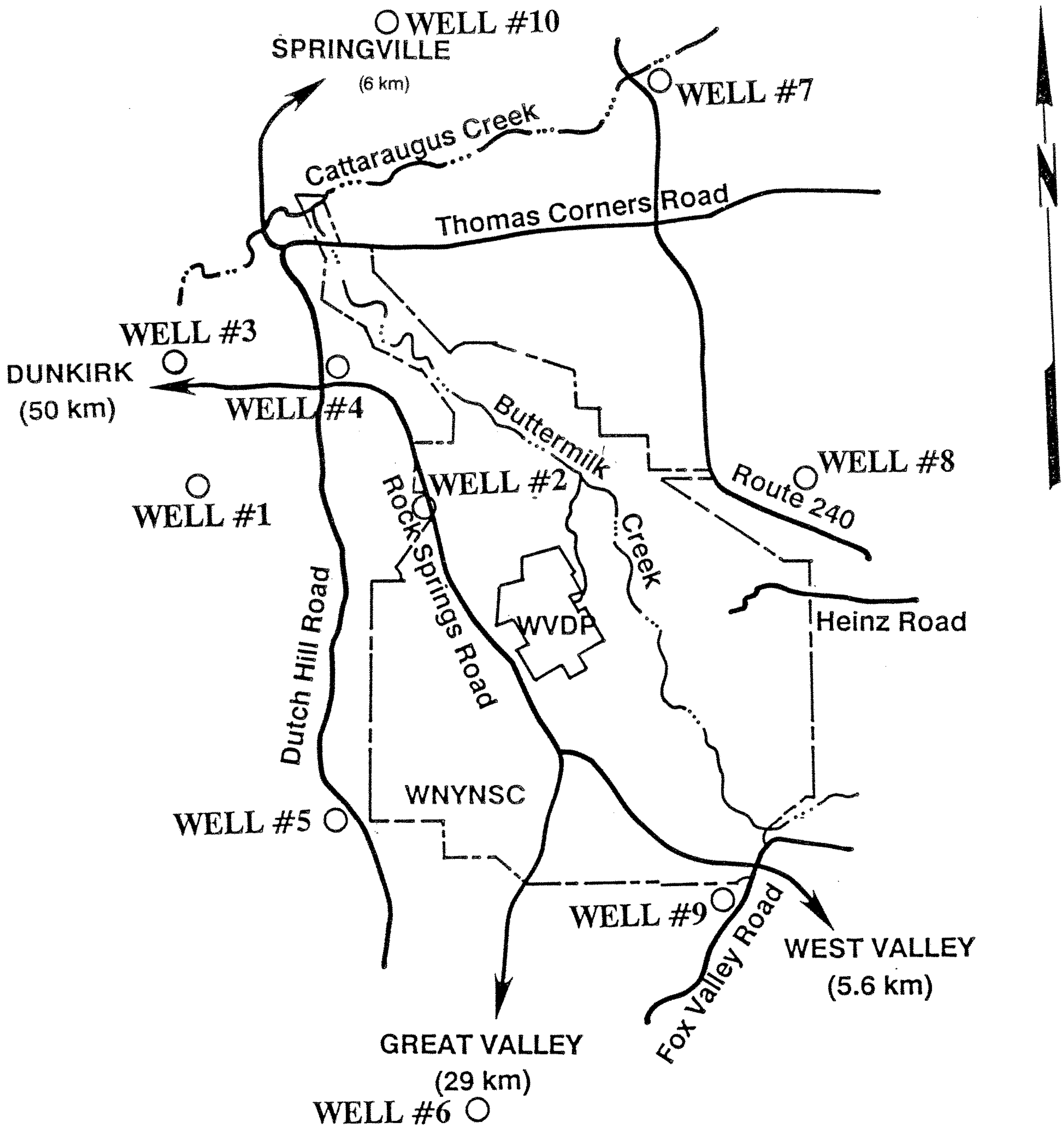


Figure 3-3. Off-Site Groundwater Wells.

Table 3-2
Statistical Summary of Groundwater Monitoring Data from Low-Level Radioactive Lagoon Area: Differences Observed at Downgradient Wells Compared to Well WNW86-6

Parameter	WNGSEEP	WNSP008	WNW80-5	WNW80-6	WNW86-3	WNW86-4	WNW86-5
pH	same	same	same	decr	inc	inc	same
conductivity	no	no	no	no	no	no	no
Nitrate-N	no	no	no	no	no	no	no
TOC	no	no	no	no	no	no	no
Barium	no	no	no	no	inc	inc	no
Manganese	no	no	no	inc	no	no	inc
Sodium	no	no	no	no	no	no	no
Tritium	inc	inc	inc	inc	inc	inc	inc
Gross beta	no	inc	no	no	no	inc	inc
Gross alpha	no	no	no	no	no	no	inc
Cesium-137	no	no	no	no	no	no	no
Cobalt-60	no	no	no	no	no	no	no

Notes: For pH, “same” indicates no change, “decr” indicates decrease.
For all parameters, “no” indicates lack of significant increase, and “inc” indicates increase as compared to upgradient location.

tween upgradient (background) and downgradient monitoring data. In all cases, significance was judged at the 99% confidence interval.

3.3.2 Low-Level Radioactive Waste Lagoon System

Table 3-2 presents the statistical summary results for the Low-Level Radioactive Waste Lagoon system monitoring unit. The only significant differences in pH between upgradient and downgradient locations occurred for wells 80-6, 86-3, and 86-4. The range for pH in this monitoring unit for 1988 was 6.22 (well 80-6) to 7.52 (well 86-3) which is within the range found in natural systems in the area. Only minor increases were noted for two other chemical indicator parameters (barium [Ba] and manganese [Mn]). The cause of these differences is unknown.

The following codes have been used in the tables and plots that follow: 8701 through 8704 correspond to the four quarterly sampling periods of 1987; and 8801, 8810, and 8820 correspond to the first quarter of 1988, the first semi-annual of 1988, and the second semi-annual sample period of 1988, respectively.

Significant differences were observed for tritium at all the downgradient monitoring locations. This is easily explained, since tritium was consistently below the detection limit of 1 E-7 μCi/mL at upgradient well 86-6, while it was consistently detected at levels ranging from 2.8 E-7 to 1.9 E-5 μCi/mL at downgradient monitoring locations (see Figure 3-4 and Table E-10).

Differences (inc) in gross beta levels relative to the upgradient well were noted over a much smaller area than for tritium, and occurred at locations WNSP008, 86-4, and 86-5 (Figure 3-2). Increased gross alpha activity, as compared to upgradient groundwater, occurred only at well 86-5.

Neither cesium-137 nor cobalt-60 was detected in any of the groundwater samples collected in this or any other waste management unit. (See tables in Appendix E for detection limits.)

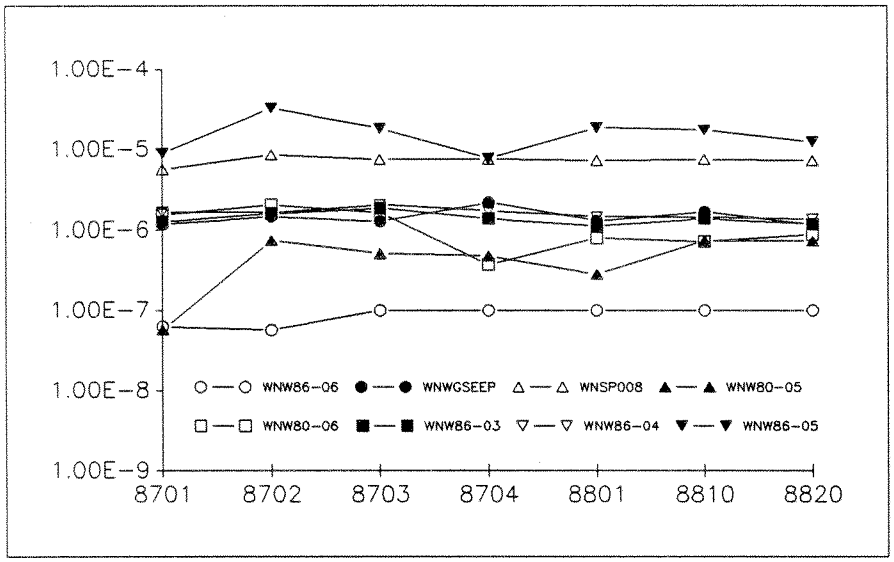


Figure 3-4
Comparison of tritium concentrations (μCi/mL) in 1987 and 1988 samples from wells near the Low-Level Radioactive Waste Lagoon Area. (Note log scale.)

The data from groundwater monitoring in the Low-Level Radioactive Lagoon System seem to indicate that wastes in this unit have influenced groundwater quality in the localized area surrounding the lagoons. Tritium was detected at levels significantly greater than at the upgradient location. During 1982 and since, tritium has been monitored in groundwater in the North Plateau region which includes the lagoon system. Monitoring during 1982 indicated that Lagoon 1 was a likely source of tritium contamination to the groundwater in this vicinity. Tritium activity within Lagoon 1, while it was in use, was at times as high as 1 E-1 μCi/mL, and provided a localized point source for potential contamination. During the 1982 study, tritium concentration gradients in groundwater suggested that the flow path in this North Plateau region was northeasterly towards the western bank of Frank's Creek [Marchetti 1982]. These observations caused Lagoon 1 to be removed from active service in 1984.

Since that time it appears that the level of tritium contamination in groundwater in the vicinity of the lagoon system has steadily decreased. Figure 3-5 shows the 7-year history of tritium concentration in WNSP008. Tritium concentrations at this groundwater monitoring location have decreased from about 4 E-5 μCi/mL in 1982 to 7 E-6 μCi/mL in 1988. This represents approximately a six-fold decrease in concentration over this 7-year period. Thus the concentration of tritium is decreasing at a rate about 4 times greater than expected from the 12.3-year radiological half life. This suggests that the former Lagoon 1 may have been influencing groundwater quality within this region. However, wastes treated in the Low-Level Waste Treatment Facility have also contained reduced levels of tritium, ranging from 5.8 E-6 to 4.5 E-5 μCi/mL in the discharge of Lagoon 3 during the period from 1986 to 1988. Thus, the actual impact of the closure of Lagoon 1 is difficult to evaluate.

Groundwater monitoring during 1988 at well 86-5, located immediately downgradient of the former Lagoon 1, yielded tritium concentrations similar to

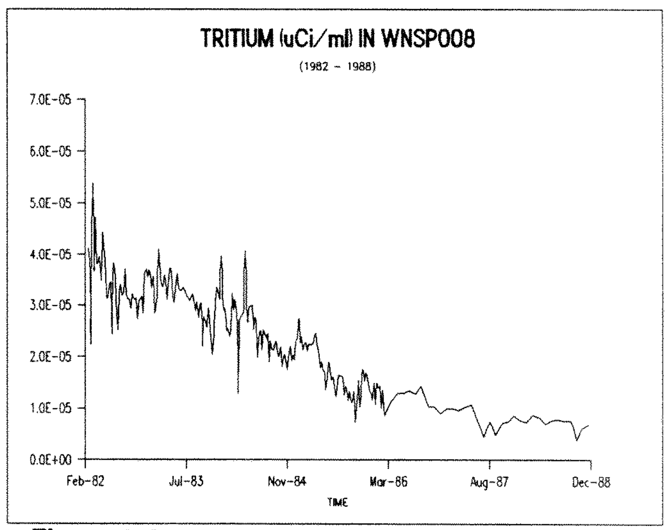


Figure 3-5
Tritium concentrations over the last 7 years at the Low-Level Radioactive Lagoon System Waste Management Unit monitoring point, WNSP008.

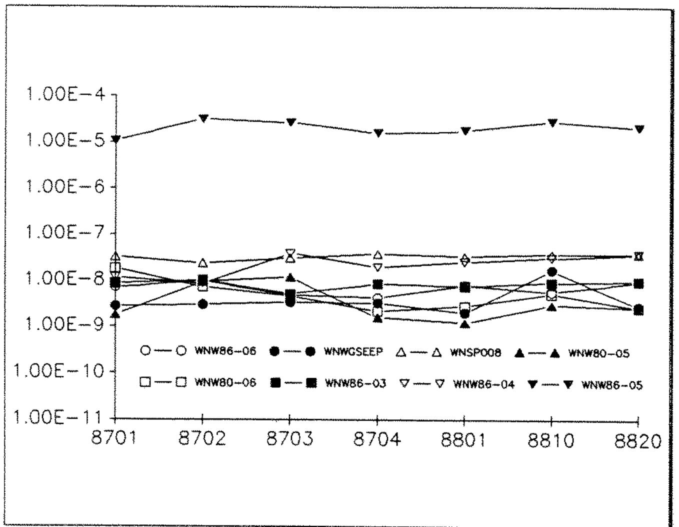


Figure 3-6
Comparison of gross beta concentrations (μCi/mL) in 1987 and 1988 samples from wells near the Low-Level Radioactive Waste Lagoon Area. (Note log scale.)

data obtained during 1987 (shown in Figure 3-4). Likewise, gross beta activities at this location remained relatively high, ranging from 1.8 E-5 to 2.8 E-5 μCi/mL as shown in Figure 3-6. Measurement of strontium-90 on a sample collected in

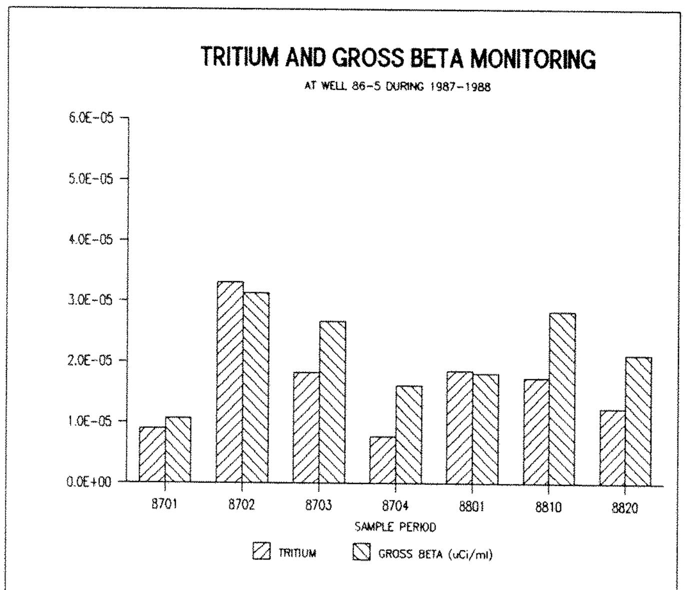


Figure 3-7
Tritium and gross beta monitoring results from Well 86-5 in the Low-Level Radioactive Waste Lagoon Area.

1987 (7.76 E-6 μCi/mL) indicated that most of the gross beta activity (1.61 E-5 μCi/mL) could be attributed to strontium-90, if assumed in equilibrium with its decay product, yttrium-90. Figure 3-7 presents the data for tritium and gross beta activity at well 86-5 during 1987 and 1988. Additional monitoring is underway in the immediate vicinity of former Lagoon 1 to fully assess the extent of contamination in this localized region.

One additional observation within this waste management unit is the consistent difference in conductivity between upgradient well 86-6 and the downgradient wells in this unit. Conductivity for the upgradient well is consistently much greater than that observed for any of the downgradient locations (see Figures 3-8 and Table E-7). It appears that groundwater in the immediate vicinity of well 86-6 is being affected by sodium and chloride ions, which are both mobile and soluble. The source of these ions may be the two sludge ponds south of well 86-6.

The radiological characteristics of well 86-6 do not appear significantly influenced by this higher level of conductivity. However, the suitability of this well

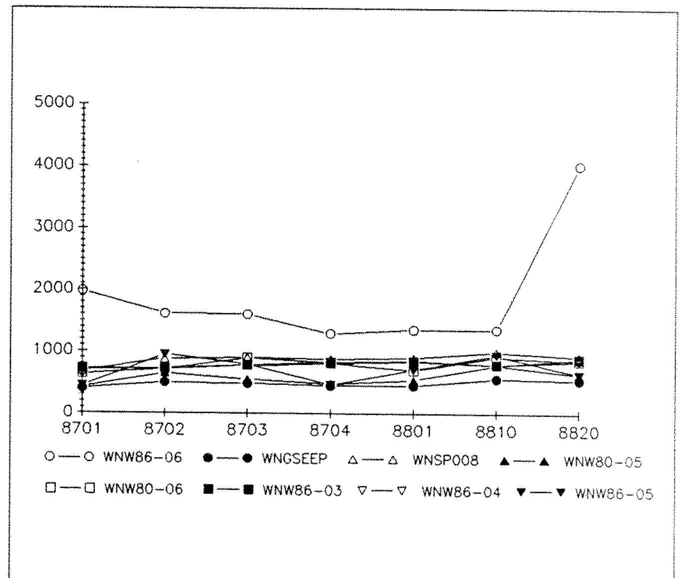


Figure 3-8
Comparison of conductivity (μmhos/cm @ 25 °C) in 1987 and 1988 sampling results from wells near the Low-Level Radioactive Waste Lagoon area.

to serve as the upgradient well for the lagoon monitoring system is currently under review.

3.3.3 High Level Radioactive Waste Tank Complex

Significant differences between upgradient and downgradient monitoring locations within this waste management unit are shown in the statistical summary Table 3-3. These differences are similar to those monitored during 1987. The two-year trend for tritium and gross beta at well 86-9, which exhibited the greatest number of significant differences between upgradient and downgradient well locations, is shown in Figure 3-9. These data indicate that little change has occurred at this locations over the two-year period. Data for pH and conductivity for upgradient well 80-2 and downgradient well 86-9 (Figures 3-10 and 3-11) were relatively stable during 1987 and 1988. It is pertinent to note that the bulk of the high-level waste is stored under alkaline conditions. Thus, leaks from this tank would cause increases rather than the observed decreases in downgradient pH values. Further, tank monitoring data do not indicate tank leakage.

3.3.4 NRC-Licensed Disposal Area Monitoring Unit

Table 3-4 shows that the only significant differences observed between upgradient and downgradient monitoring locations in the NRC-Licensed Disposal Unit were for conductivity, caused in part by increased dissolved sodium concentrations. These differences may be a result of variances in well depths of 17.1m (56 ft.) for well 83-1D and 35.7 m (117 ft.) and 35 m (115 ft.) for downgradient wells 86.10 and 86.11 respectively.

No significant differences were observed for any of the monitored radiological parameters within this unit.

Table 3-3

Statistical Summary of Groundwater Monitoring Data from High-Level Radioactive Waste Tank Complex Area: Differences Observed at Downgradient Wells Compared to Upgradient Well WNW80-02

Parameter	WNW86-7	WNW86-8	WNW86-9	WNW86-12*	WNDMPNE*
pH	decr	decr	decr	same	decr
Conductivity	inc	inc	inc	inc	inc
Nitrate-N	no	no	inc	no	no
TOC	no	no	no	no	no
Barium	no	no	inc	inc	no
Manganese	inc	inc	no	no	no
Sodium	inc	no	no	inc	inc
Tritium	no	inc	inc	inc	inc
Gross beta	inc	inc	inc	no	inc
Gross alpha	no	no	inc	no	no
Cesium-137	no	no	no	no	no
Cobalt-60	no	no	no	no	no

Notes: For pH, "same" indicates no change, "decr" indicates decrease.
For all parameters, "no" indicates lack of significant increase, and "inc" indicates increase as compared to upgradient location.
* Monitoring wells near former cold dump.

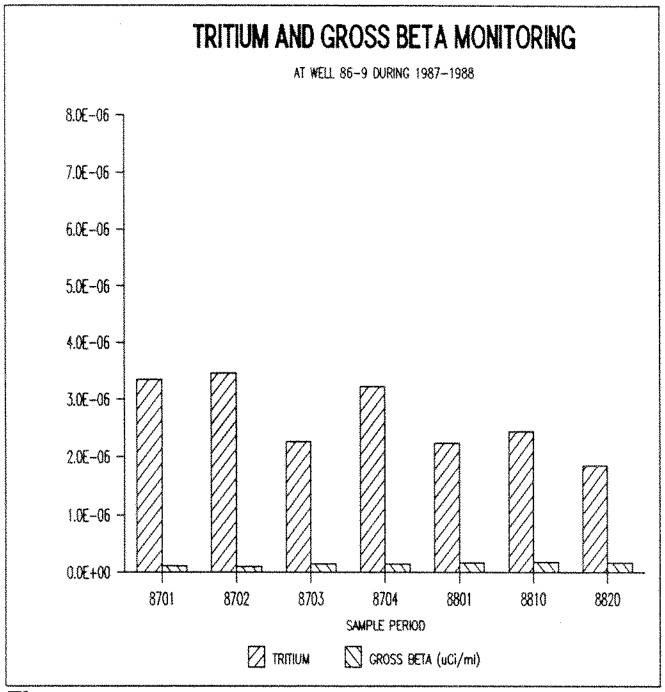


Figure 3-9
Tritium and gross beta monitoring results from well WNW86-9 in the High-Level Radioactive Waste Management Unit.

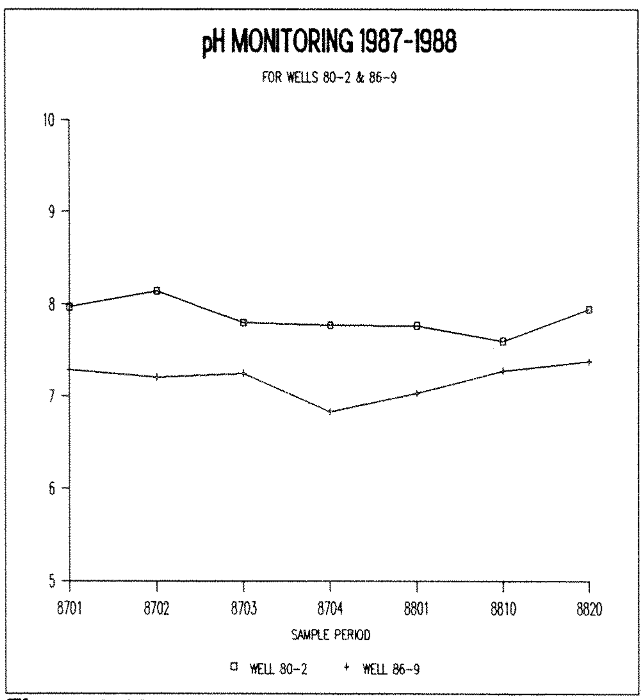


Figure 3-10
pH data from wells WNW80-2 and WNW86-9 in the High-Level Radioactive Waste groundwater monitoring Unit.

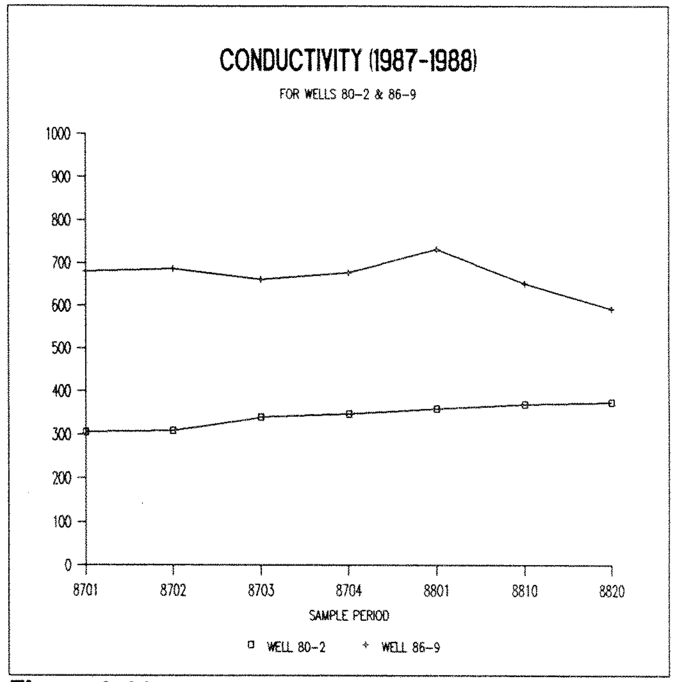


Figure 3-11
Conductivity data (μmhos/cm @ 25 °C) from wells WNW80-2 and WNW86-9 in the High-Level Radioactive Waste groundwater monitoring unit.

3.3.5 Significance of Waste Management Unit Monitoring

The above discussions indicate that real differences do exist between upgradient and downgradient groundwater monitoring locations within waste management units monitored at the Project.

Groundwater quality in the vicinity of the lagoon system has apparently improved since Lagoon 1 was taken out of service in 1984. The improvement is indicated by the 7-year trend plot for tritium at location WNSP008 (Figure 3-5). Whether this decrease in tritium concentration was caused by the removal from service of Lagoon 1 or by processing water with lower tritium activity in the current lagoon system is not clear. Additional monitoring in this unit may be required to fully assess the movement of contaminated groundwater in the immediate vicinity of former Lagoon 1, where gross beta activities are at a level of 1.1 E-5 to 3.1 E-5 μCi/mL.

Table 3-4

Statistical Summary of Groundwater Monitoring from NRC-Licensed Disposal Area: Differences Observed at Downgradient Wells Compared to Upradient Well WNW83-1D

Parameter	WNW86-10	WNW86-11	WNW82-1D
pH	same	same	dry
Conductivity	inc	inc	dry
Nitrate-N	no	no	dry
TOC	no	no	dry
Barium	no	no	dry
Manganese	no	no	dry
Sodium	inc	inc	dry
Tritium	no	no	dry
Gross beta	no	no	dry
Gross alpha	no	no	dry
Cesium-137	no	no	dry
Cobalt-60	no	no	dry

Notes: For pH, "same" indicates no change, "decr" indicates decrease.
For all parameters, "no" indicates lack of significant increase, and "inc" indicates increase as compared to upgradient location.

In the high-level radioactive waste tank complex area, differences between upgradient and downgradient monitoring locations appear consistent with past analyses. The differences observed do not appear to be widening. Additionally, the changes noted for pH are opposite those expected, if alkaline wastes were entering the groundwater from this location. Groundwater monitoring in the vicinity of the NRC-Licensed Disposal Area revealed no significant increases in monitored radiological parameters at downgradient locations. The differences noted for conductivity may be a function of the differing well depths between upgradient and downgradient locations.

The waste management unit groundwater monitoring program at WVDP is currently under review and will probably be expanded to incorporate changes in the regulatory environment and in suggested methods of data analysis [USEPA 1989]. It is anticipated that new monitoring locations will be selected and instrumented, and that areas which now indicate contamination will be analyzed using methods designed to evaluate changes at these locations in addition to comparisons with upgradient locations. These additions will provide better resolution between current Project activities and past impacts to the local environment. The added information will allow for increased understanding of the processes occurring in each of the monitored waste management units.

3.3.6 Other Supporting Wells Monitored On Site

"Supporting" wells monitored on site include those wells which are not part of the waste management unit monitoring program. These wells are monitored on a semiannual cycle. The data are shown in Table E-1 and are consistent with past data. Of interest is the repeated detection of elevated levels of tritium at well location WNW82-4A1 located to the north of the disposal area. However, adjacent wells WNW82-4A2 and 4A3, which are at approximately the same depth, exhibit significantly lower tritium concentrations than well WNW82-4A1, as they have in past years. This provides reassurance that there is no general movement of tritium in the groundwater in this area.

3.3.7 Groundwater Monitoring at the Below-Grade Fuel Storage Area

Table E-2 presents results for groundwater monitoring in the vicinity of the below-ground gasoline and diesel fuel storage area. Analyses for selected volatile organic constituents were consistent with past years and do not indicate any groundwater contamination. Monitoring of other selected parameters at this location are also consistent with past data and are not indicative of contamination.

3.3.8 Off-site Groundwater Monitoring

The results are presented in Table C-1.6 from samples collected from nearby off-site private residential wells used for drinking water by site neighbors. Tritium, considered the best indicator of contamination, was not detected at any of the off-site well locations at the detection limit of 1 E-7 μCi/mL. No other constituents that would indicate contamination by Project activities were detected. The DOE derived concentration guide (DCG) for tritium in drinking water is 2 E-3 μCi/mL. The off-site water supply results are less than 0.005% of the recommended limit.