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Results of the Separations Area Ground-Water Monitoring Network for 1986

Albert G. Law
John A. Serkowski
Aaron L. Schatz

Prepared for the U.S. Department of Energy
under Contract DE-AC06-77RL01030

Rockwell International
Rockwell Hanford Operations
Richland, Washington

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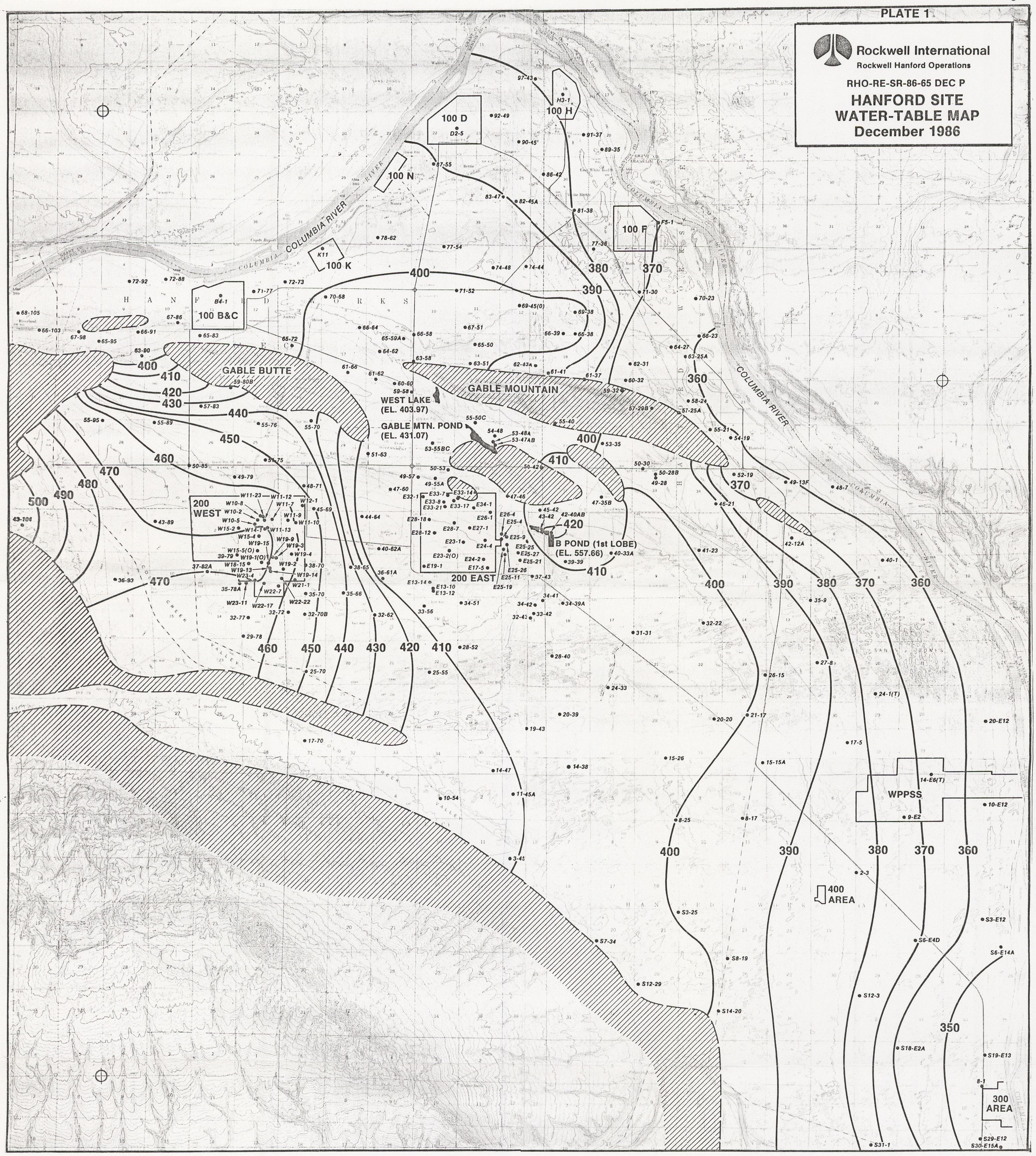

SCALE

0 1 2 3 MILES

0 1 2 3 KILOMETERS

GN MIN

1° 43' 31 MILS

21° 373 MILS

UTM GRID AND 1951 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

WELLS USED IN PREPARATION OF MAP

PONDS, WATER SURFACE ELEVATION (ft-MSL)

BASALT OUTCROPS ABOVE WATER TABLE, AS INFERRED

—10— WATER TABLE CONTOURS IN FEET ABOVE MEAN SEA LEVEL (ft-MSL) (10 FOOT CONTOUR INTERVAL)

BASE MAPS ARE PORTIONS OF HANFORD, COYOTE RAPIDS, RICHLAND AND CORRAL 15' QUADRANGLES PUBLISHED BY U.S. DEPT OF INTERIOR, GEOLOGICAL SURVEY.

The aquifer system underlying the Hanford Site is composed of an upper unconfined aquifer and multiple confined aquifers. The Rattlesnake Ridge interbed is confined by the Elephant Mountain basalt and contains the uppermost confined aquifer. The purpose of water-level measurements and water-level mapping is to assess the impacts of liquid waste discharged to the ground on the unconfined and uppermost confined aquifer.

The water table on the Hanford Site is monitored on a semiannual basis. Unconfined ground-water elevation maps are prepared from water-level measurements made in June and December. Approximately 240 wells and piezometers are used in contouring the water table. The December water-level measurements are also used to produce a Separations Area water-table map and a Separations Area depth-to-water map. These enlarged maps detail the ground-water elevations and depth-to-water in and around the 200 areas.

The water-table mound beneath U Pond has declined approximately one foot since the June 1986 water-level measurements. This is due to the deactivation of U Pond in the fall of 1984. The water-table mound beneath B Pond has declined approximately two feet since June 1986 due to PUREX being shutdown. Seasonal fluctuations along the Columbia River reflect surface water/ground water interaction.

The Rattlesnake Ridge confined aquifer is monitored quarterly in the eastern portion of the Separations Area. The December, 1986, water-level measurements in 13 wells completed in the Rattlesnake Ridge interbed were used to contour the potentiometric surface of the Rattlesnake Ridge. Areal extent of downward gradient from the unconfined aquifer to this confined aquifer is inferred from the water-table map and the contours of the potentiometric surface of the Rattlesnake Ridge.

The Hanford Site water-table map, Separations Area water-table map, and potentiometric surface of the Rattlesnake Ridge confined aquifer map are prepared by the Environmental Technology Group of the Research and Engineering function of Rockwell Hanford Operations. This map, which depicts the water-table configuration in December 1986, would have originally been issued as a Revision of drawing H-2-38396. This map and all accompanying maps are now being issued as Revisions of SD-WM-TI-273, a new document series in conformance with present management procedures.

For clarity, only the well numbers are shown on this map. The water-surface elevations measured in these wells are shown on separate sheets. Well numbers of wells in the 100 Areas have the prefix 199, wells in the 200 East and 200 West Areas have the prefix 299, and wells for the rest of the map have the prefix 699.

Note: To convert to metric, multiply elevation (ft) by 0.3048 to obtain elevation (m).

2K8702-8.1

DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE

ROCKWELL INTERNATIONAL
ROCKWELL HANFORD OPERATIONS

HANFORD SITE WATER TABLE
December 1986
SD-WM-TI-273, Revision 1

APPROVED	A.G. LAW
DATA COMPILED	A.L. SCHATZ
DATA DRAFTED	A.L. SCHATZ
MEASUREMENTS	A.L. SCHATZ
	T.R. GREEN

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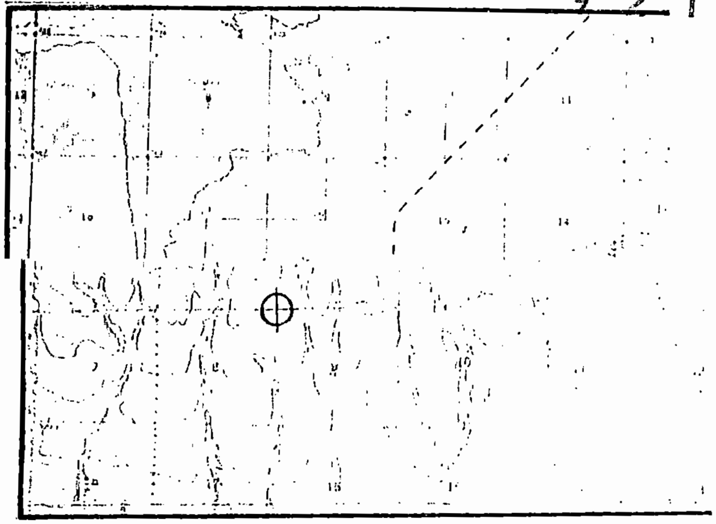

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Results of the Separations Area Ground-Water Monitoring Network for 1986

Date Completed: July 1987

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John A. Serkowski
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Environmental Technology Group
Waste Management Systems Engineering Department

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under Contract DE-AC06-77RL01030

Rockwell International
Rockwell Hanford Operations
P.O. Box 800
Richland, Washington 99352

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Field work associated with the monitoring program was performed by G. L. Wagenaar, M. A. Chamness, and D. C. Weekes. R. C. Routson provided technical guidance to the monitoring program.

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EXECUTIVE SUMMARY

The purpose of this report is to present a summary of the results for calendar year 1986 of the Rockwell Hanford Operations (Rockwell) ground-water monitoring program for radiological constituents in the Separations Area of the Hanford Site. This monitoring program is in partial fulfillment of the U.S. Department of Energy (DOE) requirement IN DOE Order 5484.1 that radioactivity in the environment be monitored and is also used for monitoring operating disposal facilities for compliance with DOE requirements.

The objectives of the monitoring program are to (1) assess the quality of ground water for compliance with Rockwell and DOE guidelines, (2) evaluate the performance of Rockwell's disposal and storage sites in the Separations Area in order to remove improperly functioning cribs from service, (3) determine the impact of waste disposal operations on the ground water, and (4) provide data for hydrologic analyses and model application.

The 1986 Separations Area unconfined aquifer monitoring network included 137 wells. Water samples were collected monthly, quarterly, or semiannually from the wells in the network. These samples were selectively analyzed for total alpha, total beta, tritium, ^{90}Sr, ^{137}Cs, ^{60}Co, ^{106}Ru, uranium, and nitrate. Average radionuclide concentrations in monitoring wells for 1986 were similar to 1985.

Water levels were measured in 221 wells to produce water table maps of the Separations Area (annually) and of the Hanford Site (semiannually).

Radionuclide concentrations in the ground water are compared with Rockwell limits, established for operational purposes (Part L of RHO-MA-139, Environmental Protection Manual). These limits were developed with the goals of minimizing contaminants in the ground water in order to attain as-low-as-reasonably-achievable (ALARA) dose rates and of meeting drinking water standards at the end of institutional control (assumed to be in 300 yr in the current edition of RHO-MA-139).

The radionuclide concentrations in the ground water are also compared with the interim derived concentration guides (DCG) issued by DOE (DOE 1986b). The DCG were developed to establish the maximum allowable radiation exposure to the public at 100 mrem/hr for exposure expected to last longer than 5 yr. It should be noted that the DCG are applicable at the point of actual exposure to members of the public, and are therefore not applicable to the Hanford Site proper. As a point of reference, observations are made in this report relating how the concentration of a radionuclide in ground water are expected to compare with the DCG when the ground water reaches the Columbia River. This reflects the reduction in concentration because of sorption, dispersion, dilution, and radioactive decay.

Guidelines were exceeded at active liquid waste disposal facilities in the following cases.

- Comparison of tritium concentrations in the ground water at the 216-A-10 and 216-A-36B cribs indicates the DCG are exceeded. However, the concentrations are expected to be below the DCG by the time the ground water from those cribs reaches the river. The tritium concentrations increased from those reported in 1985, as expected from the operation of PUREX.

- The average ^{90}Sr concentration in three wells at the 216-A-25 pond exceeded the ACL in 1986, but was below the DCG. This contamination was localized and below levels reported in 1985.

- Concentrations of ^{234}U and ^{238}U exceeded the ACL in two wells at the 216-B-62 crib, but were below the DCG. Concentrations were similar to those in 1985.

- Uranium concentration exceeded the ACL in a well at the 216-U-14 ditch when monitoring was initiated in 1986, but was below the DCG. The source is probably either the 216-U-14 ditch or the 216-U-10 pond.

For inactive disposal facilities, guidelines were exceeded in the following cases.

- The ^{90}Sr concentration exceeded the DCG and the Rockwell ACL at the inactive 216-B-5 reverse well. Since ^{90}Sr is readily sorbed on sediment, the concentration of ^{90}Sr from the reverse well is expected to be below the DCG at the Columbia River. The average ^{90}Sr concentration for 1986 was similar to that reported in 1985. Concentrations of ^{137}Cs and uranium exceeded the ACL but were below the DCG. The ^{137}Cs concentration was similar to that for 1985; the uranium analyses started in 1986.

- The ^{90}Sr concentration exceeded the ACL in one well at the inactive 216-S-1/2 cribs, but was below the DCG. The concentration was similar to that in 1985.

- Uranium concentrations remained above the DCG and the ACL in the ground water at the inactive 216-U-1/2 cribs. Modeling of groundwater flow and transport indicates the DCG will not be exceeded at the Columbia River. The concentrations in the seven monitoring wells have stabilized since completion of the remedial pumping and treatment in 1985. Effluent from the treatment was disposed to the active 216-S-25 crib, which also exhibited elevated concentrations in 1986 exceeding the ACL but below the DCG. Some of the uranium represents background levels resulting from operation of U pond. The uranium concentration in the ground water at the inactive 216-U-16 crib also exceeded the ACL but was below the DCG in one well in 1986. This is attributed to the uranium plume from the nearby 216-U-1/2 cribs.

- The concentration of ^{129}I exceeded the ACL, but was below the DCG in well 699-35-70, located just east of 200 West Area. The ^{129}I is a result of past operations in 200 West Area.

- The concentration of uranium exceeded the ACL, but was below the DCG in three wells at the 216-U-10 pond. The concentration is similar to that for 1985. The 216-U-10 pond was deactivated in 1984. A well at the nearby inactive 216-S-21 crib also exceeded the ACL for uranium because of the uranium from the 216-U-10 pond.

Nitrate is a common substance in effluent streams, and because of its mobility in ground water is used as a tracer to evaluate the extent of ground-water contamination. A map showing the extent of the nitrate plume is included in the report.

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1.0 INTRODUCTION

1.1 BACKGROUND

The U.S. Department of Energy (DOE) Hanford Site is located in southeastern Washington State, approximately 170 mi (270 km) southeast of Seattle and 125 mi (200 km) southwest of Spokane (fig. 1). The Hanford Site is used for nuclear reactor operation, reprocessing of spent fuel, and management of radioactive waste. The fuel reprocessing and radioactive waste management facilities in the 200 East and 200 West Areas are operated by Rockwell Hanford Operations (Rockwell).

Because the influence of liquid waste disposal activities extends beyond the 200 Areas, the Separations Area (see fig. 1 and appendix A.3) has been designated as the area of interest for ground-water monitoring purposes. Rockwell maintains a ground-water monitoring program for the Separations Area as part of its waste management responsibility. This monitoring program, based on the requirements of DOE Order 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements, focuses on evaluating the impact on the aquifer of liquid waste discharged to ground, as specified in DOE Order 5480.1B, Environment, Safety and Health Programs for DOE Operations (DOE 1986a).

Radionuclide concentrations in the ground water are compared with Rockwell operating limits, as defined in Part L of RHO-MA-139, Environmental Protection Manual and with DOE guidelines (DOE 1986b), which were developed to estimate exposure to radioactivity. The Rockwell limits have been established with the goals of minimizing contaminants in the ground water in order to attain as-low-as-reasonably-achievable (ALARA) (DOE 1986a) dose rates and meeting drinking water standards (EPA 1976) at the end of institutional control (assumed to be in 300 years in the current edition of RHO-MA-139) (Rockwell 1985).

Rockwell maintains an environmental monitoring program dealing with air, soil, vegetation, surface water, and ground water and issues an annual report (Elder et al. 1987). The present report expands on the ground-water monitoring results reported in the annual environmental report.

The Rockwell ground-water monitoring program for the Separations Area is coordinated with the Hanford Site ground-water monitoring program conducted by Pacific Northwest Laboratory (PNL). The PNL program is responsible for estimating and evaluating the impact of ground water on the general public from operations at the Hanford Site. A discussion of the ground water for the entire Hanford Site is included in the PNL annual environmental monitoring report (PNL 1987).

1.2 PURPOSE AND OBJECTIVES

The purpose of this report is to present ground-water data collected during calendar year (CY) 1986 and to denote the impacts of Rockwell processing operations on the unconfined aquifer. The scope of this report is

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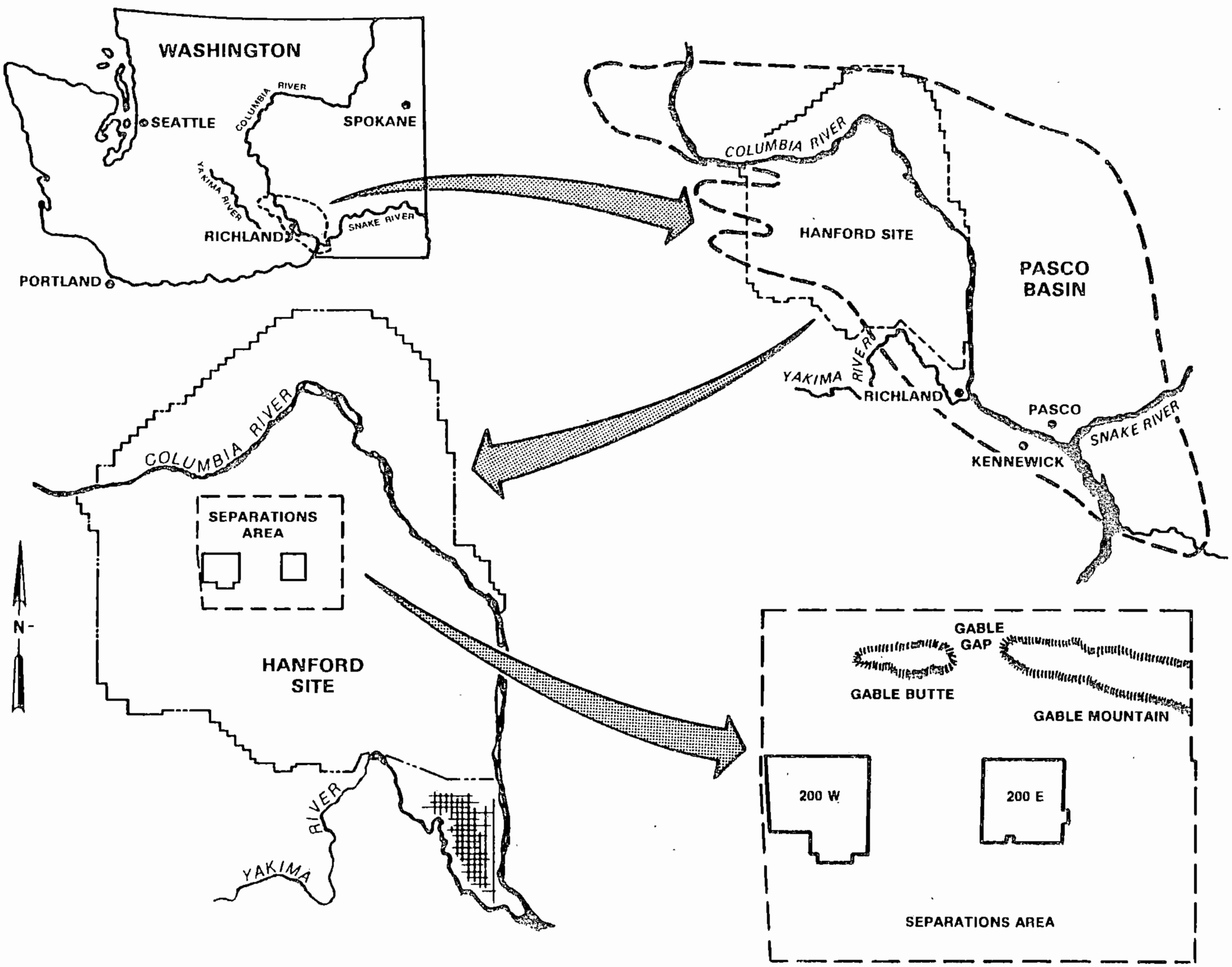

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Figure 1. Separations Area Location Map.

limited to radionuclide data only, with the exception of nitrate, which historically has been reported because it is a tracer indicating the maximum extent of contamination.

The objectives of the Rockwell ground-water monitoring program are as follows:

- Assess the quality of ground water for compliance with guidelines
- Evaluate the performance of Rockwell's disposal and storage sites in the Separations Area in order to remove improperly functioning cribs from service
- Determine the impact of waste disposal operations on the ground water
- Provide data for hydrologic analysis and model application. To complement the water quality data obtained by sampling and analyses, water-table contour maps are developed to provide basic information on the directions and rates of ground-water flow.

The Plutonium and Uranium Extraction (PUREX) Plant and associated facilities continued operation in 1986. Operation of these process plants and support facilities did not have a significant impact on the quality of the ground water during CY 1986 with the exception of tritium and nitrate. However, these increases are expected (DOE 1983). This annual report will discuss each of the active cribs and provide average contaminant concentrations in the ground water for CY 1986.

1.3 GEOHYDROLOGY

Detailed documentation of the geology and hydrology of the Separations Area is reported in Geology of the Separation Areas Hanford Site, South-Central Washington (Tallman et al. 1979), Hydrology of the Separations Area (Graham et al. 1981), and in Hydrologic Studies within the Columbia Plateau, Washington: An Integration of Current Knowledge (Gephart et al. 1979). These reports are summarized in the following paragraphs.

The Hanford Site is located within the Pasco Basin, a structural and topographic basin (see fig. 1) with boundaries defined by anticlinal structures of the basalt. Three main geologic units are located beneath the Hanford Site: in ascending order, the Columbia River Basalt Group, the Ringold Formation, and the glaciofluvial sediments. The Columbia River Basalt Group, composed of the Grande Ronde Formation, the Wanapum Formation, and the Saddle Mountains Formation, is a thick sequence of basalt flows extruded from fissures during the Miocene epoch. The Ringold Formation, a Pliocene fluvial sedimentary unit, overlies the Columbia River Basalt group except in areas where erosion has removed these sediments. The Ringold Formation is subdivided into four units (on the basis of texture), which are, in ascending order, the basal Ringold unit (sand and gravel), the lower Ringold unit (clay, silt, and fine sand with lenses of gravel), the middle

Ringold unit (occasionally cemented sand and gravel), and the upper Ringold unit (silt and fine sand). The glaciofluvial sediments, informally named the Hanford formation, were deposited on top of the Columbia River Basalt Group and the Ringold formation during the Pleistocene epoch.

1.3.1 Occurrence of Ground Water

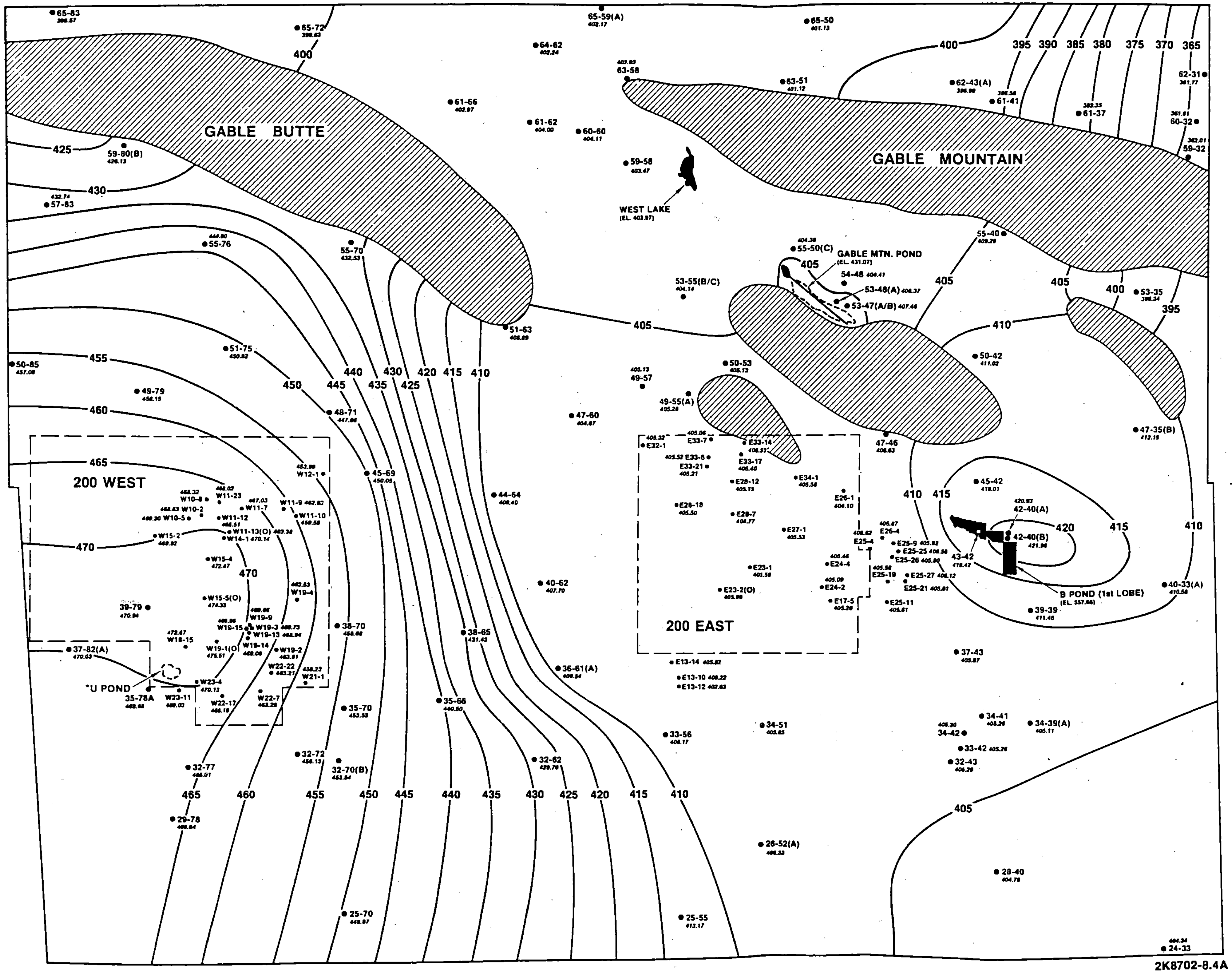
The unconfined aquifer is affected by disposal of waste water from surface and subsurface disposal sites. The depth to ground water varies from 180 to 310 ft (55 to 95 m) on the 200 Area plateau. The unconfined aquifer is contained within the Ringold Formation and the overlying Hanford formation. Beneath the unconfined aquifer is a confined aquifer system consisting of sedimentary interbeds or interflow zones that occur between dense basalt flows or flow units. The bottom of the unconfined aquifer is the uppermost basalt surface or, in some areas, a clay zone of the Ringold Formation. The thickness of the unconfined aquifer in the Separations Area varies from less than 50 to 200 ft (15 to 61 m).

The sources of natural recharge to the unconfined aquifer are rainfall from areas of high relief to the west of the Hanford Site and the ephemeral streams, Cold Creek and Dry Creek. From the recharge areas, the ground water flows downgradient and discharges into the Columbia River (see Plate 1). In the Separations Area this general flow pattern is modified by basalt outcrops and subcrops and by artificial recharge.

The unconfined aquifer beneath the Separations Area receives artificial recharge from liquid disposal areas. Cooling water disposed to ponds forms ground-water mounds beneath three high-volume disposal sites: U Pond in 200 West Area, B Pond east of 200 East Area, and Gable Mountain Pond north of 200 East Area (fig. 2). Compared with pre-Hanford conditions (Newcomb et al. 1972), the water table has risen approximately 30 ft (9 m) under B Pond and 15 ft (4.5 m) near Gable Mountain Pond. The water table under U Pond rose approximately 65 ft (20 m) while it was in operation, although it has declined about 13 ft (4.0 m) from that level since the pond was deactivated in 1984. Part of Gable Mountain Pond has been backfilled in preparation for deactivation.

1.3.2 Aquifer Properties

Large differences in aquifer properties are evident between the Hanford formation and the middle member of the Ringold Formation, the major units of the unconfined aquifer. Hydraulic conductivities range from 10 to 230 ft/day (3 to 70 m/day) for the middle Ringold unit and from 2,000 to 10,000 ft/day (610 to 3,050 m/day) for the Hanford formation. Transmissivity increases from the 200 West Area to the 200 East Area. This transmissivity increase is a result of two factors: an increase in saturated thickness of the aquifer (the result of a drop in the basalt surface), and more of the unconfined aquifer is contained within the more permeable Hanford formation.



Rockwell International

Rockwell Hanford Operations

SD-WM-TI-273, REVISION 1
RHO-RE-SR-86-65 DEC P

SEPARATIONS AREA WATER-TABLE MAP

DECEMBER 1986

WATER-TABLE CONTOURS IN FEET ABOVE MEAN SEA LEVEL (ft MSL)

FIVE-FOOT CONTOUR

WELLS USED IN PREPARATION OF MAP

PONDS, WATER SURFACE ELEVATION (ft-MSL)

BASALT OUTCROPS ABOVE WATER-TABLE, AS INFERRED 6/1984

THE SEPARATIONS AREA WATER-TABLE MAP IS PREPARED BY THE ENVIRONMENTAL TECHNOLOGY GROUP OF THE RESEARCH AND ENGINEERING FUNCTION OF ROCKWELL HANFORD OPERATIONS. THIS MAP IS PREPARED IN CONJUNCTION WITH THE HANFORD SITE WATER-TABLE MAP, SHEET SD-WM-TI-273, REVISION 1.

*FORMER LOCATION OF U POND DEACTIVATED IN 1984

0 — 1 MILE

0 — 1 KILOMETER

N

NOTE:
TO CONVERT TO METRIC, MULTIPLY ELEVATION (ft) BY 0.3048 TO OBTAIN ELEVATION (m)

Figure 2. Water Table Map for the Separations Area, December 1986.

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1.3.3 Flow Dynamics

Ground-water flow is perpendicular to the water table contours delineated in figure 2. Flow patterns are dominated by ground-water mounds under U Pond and B Pond. Flow from 200 West Area is primarily toward the east. The flow system in 200 East Area is complex due to changes in aquifer thickness and hydraulic properties, the influence of B Pond, and the basalt subcrops and structures of Gable Mountain and Gable Butte. The flow from 200 East Area and environs is northward through Gable Gap (between Gable Butte and Gable Mountain) and southeasterly toward the Columbia River. Radial flow from the mound under B Pond is eastward toward the Columbia River, in addition to its combining with the northern and southeastern flow from 200 East Area.

1.3.4 Contaminant Transport

Contaminants in ground water move along flow paths that are perpendicular to water table contours. The concentration of contaminants may be attenuated by factors within the geohydrologic system: sorption, dispersion, and dilution. For radiological constituents, the concentration may also be reduced by radioactive decay.

Sorption is the process by which contaminants are chemically bound to the surface of sediment particles in the subsurface environment. A measure of sorption is the distribution coefficient, K_d, which describes the partitioning of a solute between liquid and solid phases in the subsurface environment. The K_d is defined as the mass of solute on the solid phase per unit mass of solid phase divided by the concentration of solute in solution expressed in mL/g (Freeze and Cherry 1979). Thus, if $K_d = 0$ mL/g, the solute would move with ground water, i.e., the solute would be very mobile. A large value of K_d would denote that the solute is essentially immobile, i.e., it would be sorbed on the sediment particles.

A term to better quantify the effect of sorption in relation to ground-water flow is the retardation factor, RF:

$$RF = 1 + (\rho_b/n)K_d \quad (1)$$

where ρ_b is the bulk mass density of the soil and n is the porosity (Freeze and Cherry 1979). Typical values of ρ_b and n for the Hanford Site are 1.65 g/cm^3 and 0.35, respectively. Therefore a reasonable relationship for the Hanford Site would be

$$RF = 1 + 4.7K_d \quad (2)$$

Equation 2 may be interpreted as follows: if K_d = 0 mL/g, then RF = 1 and the solute is not retarded, i.e., it moves at the same velocity as the ground water; if K_d = 1 mL/g, then RF = 5.7 and the solute is retarded relative to the ground-water velocity by a factor of 5.7. The larger the value of RF, the greater the retardation of the solute because of sorption on the sediment particles.

The distribution coefficient is a function of the ion involved, the mineralogy of the sediments, and the chemistry of the solution. For example, tritium and nitrates are considered mobile because neither is sorbed by the soil, while plutonium is readily absorbed on sediments and is immobile.

Dispersion is the process whereby individual contaminant particles are spread out along the flow path because of sediment particles that serve as obstacles to flow. Dispersion is primarily a mechanical process.

The process of dilution occurs when water containing contaminants encounters volumes of cleaner water and the combination of the two waters results in a decrease in contaminant concentration.

The concentration of radioactive contaminants in a plume may be reduced over time by the natural decay of the radioisotopes. The half-life of a radioisotope is the time required for a quantity of radioactive material to decay to one-half of its activity. The concentration of a radioisotope will be reduced to 1% of the original concentration in less than 7 half-lives.

The attenuation mechanisms of sorption, dispersion, dilution, and radioactive decay serve as controls for the radionuclides disposed to the sediments at the Hanford Site. Thus, concentrations of contaminants at any downgradient location are lower than when disposed in a liquid waste site.

2.0 SEPARATIONS AREA GROUND-WATER MONITORING PROGRAM

The ground-water monitoring network was established to observe the radiological quality of the ground water beneath waste storage and disposal facilities in the Separations Area. The network is composed of one or more wells located downgradient from active and inactive waste sites. Two primary concerns in the operation of the monitoring program are the collection of representative ground-water samples and the identification of any condition that could enhance the migration of contaminants.

2.1 WELL NETWORK

The routine unconfined aquifer water-quality monitoring network for CY 1986 was comprised of 137 wells, a net increase of 10 from 1985 (Law and Schatz 1986, appendix B.1). Twelve monitoring wells were added and two deleted from the 1985 network (table 1). A brief discussion of the well numbering and facility numbering systems is presented in appendix A, in addition to a map identifying the perimeter of the Separations Area as used in this report, maps showing well locations, and drawings showing the location of monitoring wells at disposal facilities.

2.1.1 Well Construction

Monitoring wells are normally 6 or 8 in. (15.2 or 20.3 cm) in diameter. Most of the wells in the ground-water monitoring network are constructed of carbon-steel casing. However, during 1986, the design of wells was revised to incorporate materials deemed suitable for use in sampling for nonradioactive constituents that may leach the casing material or be absorbed on the casing. An essential feature in well construction is the use of grout, either bentonite or cement, to seal the annular space between the well casing and the soil to prevent the migration of contaminants down the outside of the well casing.

The construction method using carbon-steel casing may be referred to as the "old" method. (This method is also used for the renovation of older wells that were not sealed when constructed.) The construction process can be discussed in three stages (fig. 3). Stage 1 shows the emplacement of the outer casing of the well from the ground surface to the desired depth. This stage also represents a well that was not sealed when constructed. Stage 2 involves perforation of the outer casing and emplacement of a smaller-diameter liner casing inside the outer casing. The bottom end of the liner casing contains a packer, and is flared to be flush with the outer casing to reduce the chance of pumps or down-hole tools catching on the lip during removal from the well. Finally, in stage 3 the well is grouted by placing grout in the annular space between the liner casing and outer casing, which also flows through the perforations to seal the outside of the casing against vertical migration of contaminants. The well renovation program mentioned in previous reports (Law and Schatz 1986) was temporarily discontinued in 1986, but has been resumed in 1987.

Table 1. List of Changes to Routine Well Monitoring Network in CY 1986.

Wells added		Wells deleted	
Well no.	Waste site	Well no.	Waste site
(Existing wells added)			
299-E23-2	200 East Area	299-E25-2	216-A-1,7
299-W19-9	216-U-1/2	299-W18-12	216-Z-18
299-W19-15	216-U-1/2		
299-W19-16	216-U-1/2		
299-W19-17	216-U-1/2		
299-W19-18	216-U-1/2		
299-W21-1	200 West Area		
299-W23-4	216-S-21		
(New wells added)			
299-E17-12	216-A-45[a]		
299-E17-13	216-A-45[a]		
299-W19-20	216-U-17[a]		
299-W19-21	216-U-14		

[a]The new 216-A-45 crib and 216-U-17 crib were not activated in 1986.

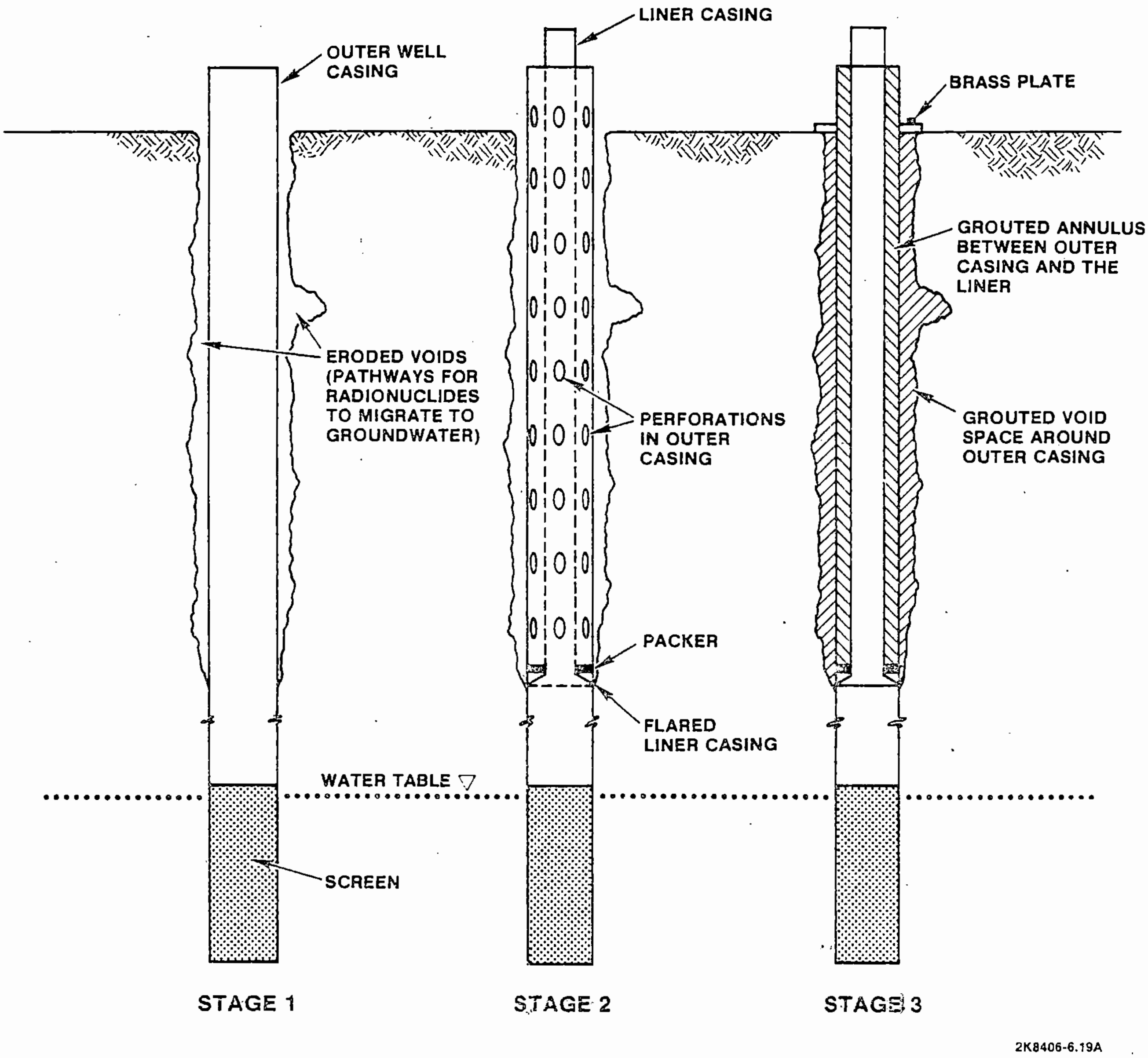

Figure 3. Idealized Cross-Sectional Views Depicting Well Construction ("Old" Method).

The "new" method of well construction uses stainless steel casing involving a pullback of the casing (fig. 4). Three stages are also used in this technique. In stage 1, two casings are emplaced: a starter casing of carbon steel to a depth of 100 ft (30.5 m) with a carbon-steel well casing of smaller diameter placed inside and extending to the desired depth. Stage 2 involves placement of a stainless steel casing with a screen at the bottom inside the other two casings. This is the only casing that is left in place. The carbon-steel well casing that was placed to the desired depth is then pulled back in stage 3, while placing a sand pack to a depth of 10 ft (3.0 m) above the top of the well screen and then bentonite grout up to a depth of 20 ft (6.1 m) below ground surface. The starter casing is also pulled back to the 20-ft (6.1 m) depth while placing bentonite. Cement grout is then placed on top of the bentonite in the upper 20 ft (6.1 m) of the well. The four wells constructed in 1986 (see table 1) are constructed in this manner.

For both construction methods, the wells are fitted with a cement collar at the ground surface and the well designation is painted on. A brass plate bearing the well number is embedded in the collar to prevent misidentification.

2.2 SAMPLING

The following criteria are used to determine sampling frequencies.

- Wells monitoring active liquid waste disposal sites are sampled monthly.
- Wells monitoring inactive liquid waste disposal sites that contain radionuclides with a high potential for being remobilized are sampled monthly.
- Wells monitoring inactive liquid waste disposal sites that contain radionuclides with a low potential for being remobilized are sampled monthly or quarterly, depending upon the level and trend of concentration.
- Wells yielding samples indicating background concentrations are sampled semiannually.

Samples are collected by PNL according to the sampling schedule listed in appendix C.

Monitoring wells with dedicated sampling pumps are pumped to remove stagnant water from the well before a sample is collected (fig. 5). Wells that do not produce enough water to support a pump are sampled by bailing.

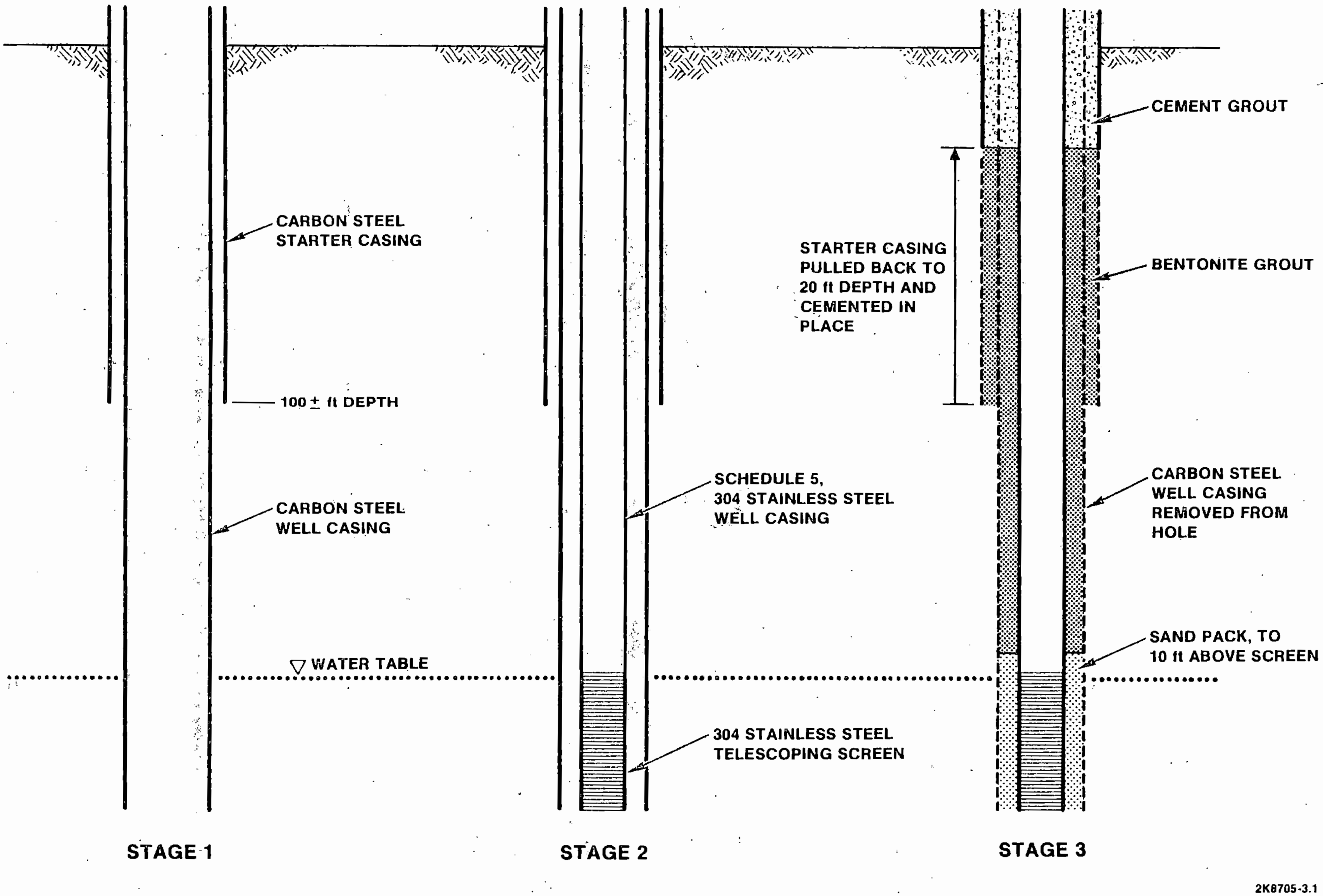

Figure 4. Idealized Cross-Sectional Views Depicting Well Construction ("New" Method).

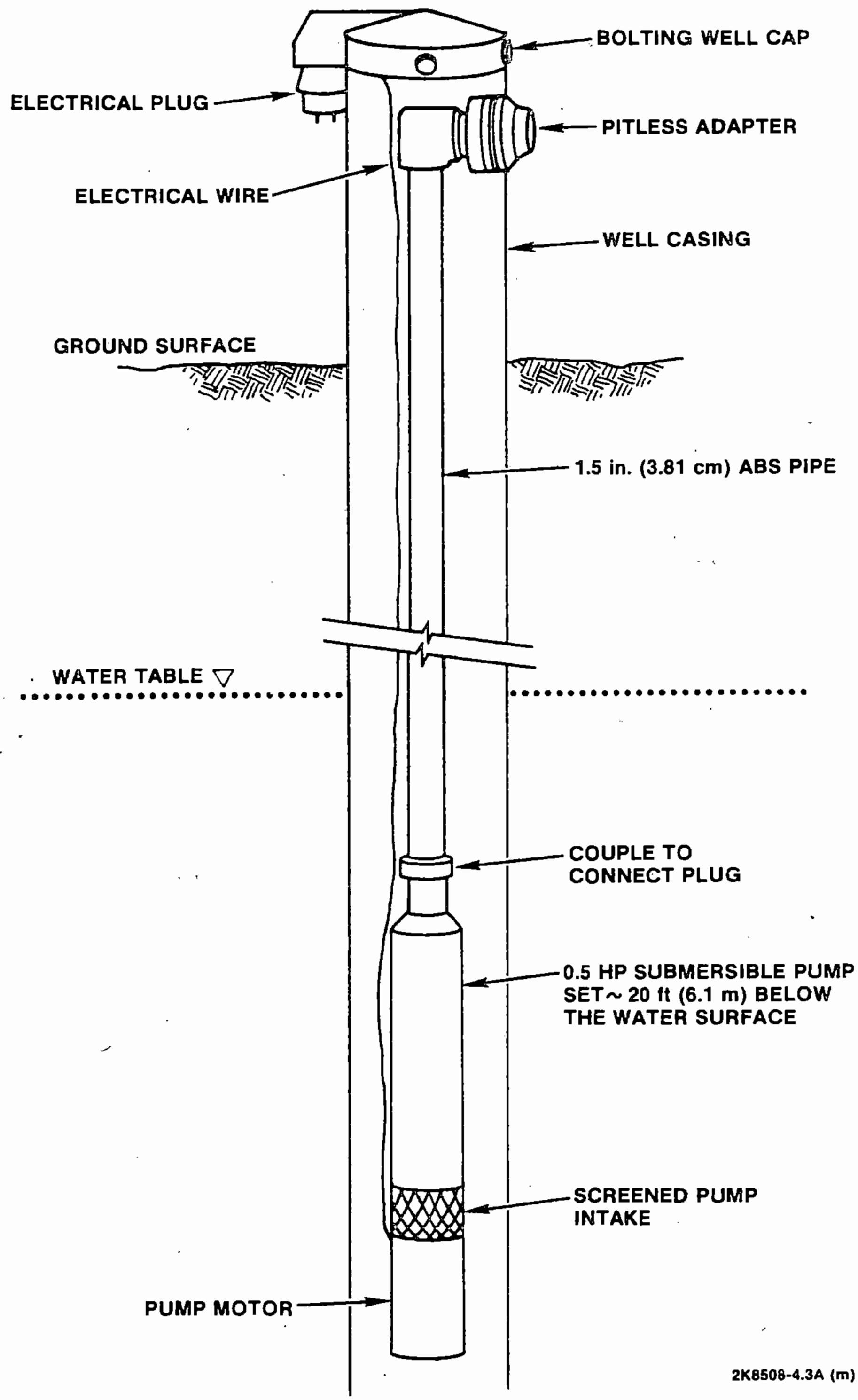

Figure 5. Cross-Sectional View of a Ground-Water Monitoring Well with Pump.

2.3 ANALYSES

Under the routine monitoring program samples are analyzed selectively for the following constituents: total alpha, total beta, tritium, uranium, ^{90}Sr, ^{137}Cs, ^{60}Co, ^{106}Ru, and nitrate. The constituent analyses conducted for each well are listed in appendix C. The selection of these parameters is based on the waste disposal history of each site. The analyses are performed by U.S. Testing in accordance with their procedures (U.S. Testing 1980). In addition to the routine program, special analyses are conducted for radionuclides requiring a more complex procedure, such as ^{129}I and ^{99}Tc.

2.4 WATER-LEVEL MEASUREMENTS

Water-level measurements are made in approximately 221 shallow wells to produce water table maps of the Hanford Site and the Separations Area. The water table maps of the Hanford Site are constructed semiannually; Plate 1 (in packet) is the water table map for December 1986. The water table map of the Separations Area (see fig. 2) is produced annually.

2.5 DATA INTERPRETATION, REPORTING, AND STORAGE

Data are received from the laboratory via a computer link and also in the form of a computer printout. The data are reviewed in the context of the concentration history of the well to establish the validity, and are also examined for trends that may suggest modification of the sampling frequency or require other action. The data are stored in the PNL Hanford Ground-Water Data Base for retrieval.

Radionuclide concentrations in the ground water are compared with Rockwell administrative control limits (ACL) established for operational purposes (Part L of RHO-MA-139, Environmental Protection Manual). These limits were developed with the goals of minimizing contaminants in the ground water in order to attain as-low-as-reasonably-achievable (ALARA) dose rates and of meeting EPA drinking water standards (EPA 1976) at the end of institutional control (assumed to be in 300 yr in the current edition of RHO-MA-139). The pertinent ACL are listed in table 2.

The radionuclide concentrations in the ground water are also compared with the interim derived concentration guides (DCG) issued by DOE (DOE 1986b). The DCG are listed in table 2. The DCG were developed to establish the maximum allowable radiation exposure to the public at 100 mrem/hr for exposure expected to last longer than 4 yr. It should be noted that the DCG are applicable at the point of actual exposure to members of the public, and are therefore not applicable to the Hanford Site proper. As a point of reference, observations are made in this report relating how the concentration of a radionuclide in ground water are expected to compare with the DCG when the ground water reaches the Columbia River. This reflects the reduction in concentration because of sorption, dispersion, dilution, and radioactive decay.

Table 2. Radionuclide Concentration Guidelines.

Radionuclide	Derived concentration guides (DCG)[a] (pCi/L)	RHO-MA-139 administrative control limit (ACL) (pCi/L)[b]
Tritium (^{3}H)	2.0 E+06	c
^{60}Co	5.0 E+03	3.0 E+04
^{90}Sr	1.0 E+03	3.0 E+01
^{99}Tc	1.0 E+05	2.0 E+05
^{106}Ru	6.0 E+03	1.0 E+04
^{129}I	5.0 E+02	6.0 E+01
^{137}Cs	3.0 E+03	2.0 E+03
^{234}U	5.0 E+02[d]	3.2 E+01
^{235}U	6.0 E+02	3.2 E+01
^{238}U	6.0 E+02	4.8 E+00[e]
^{238}Pu	4.0 E+02	4.4 E+02
$^{239,240}Pu$	3.0 E+02	4.0 E+01

[a]DOE (1986b).

[b]RHO-MA-139, section L.30 (C) (Rockwell 1985).

[c]Annual tritium discharge to ground water from Rockwell facilities shall not exceed 2.0 E+05 Ci/yr.

[d]For the isotopic composition of uranium in ground water in the Separations Area, the equivalent concentration of total uranium is 1.0 E+03 pCi/L.

[e]For the isotopic composition or uranium in ground water in the Separations Area, the equivalent concentration of total uranium is 1.0 E+01 pCi/L.

If the concentration of a radionuclide in the ground water at a disposal facility is found to exceed the ACL, an investigation is initiated to determine the cause. If a disposal facility is found to be the cause of exceeding the ACL, the facility is either removed from service or a deviation is written specifying the conditions under which the facility may continue to operate. The need for remedial action is also evaluated.

When little or no measurable radioactivity is evident, the background activity of the counting instrument may be greater than the activity of the sample, resulting in negative analytical values. Following DOE guidance (ERDA 1977), these negative numbers are maintained in the computation of average concentrations.

Uranium is measured chemically in the laboratory and reported as total uranium, representing the sum of ^{234}U, ^{235}U, and ^{238}U. Laboratory results for total uranium are reported in chemical units of μg/L, and are converted to the radioactivity units of pCi/L on the basis of a series of isotopic uranium analysis of ground-water samples. This conversion factor is 0.679 pCi/μg. This isotopic data also is used to compute the equivalent concentration of total uranium corresponding to the concentration of the limiting isotope for a particular guideline. In table 2, the concentration of the limiting uranium isotope, ^{234}U, for the DCG, is 500 pCi/L. The equivalent total uranium concentration is 1000 pCi/L. Similarly, a total uranium concentration of 10 pCi/L is equivalent to 4.8 pCi/L of ^{238}U, the limiting uranium isotope for Rockwell's ACL.

Nitrate is mobile in ground water, and therefore nitrate concentrations are determined to prepare maps for evaluating the extent of ground-water contamination. The maps show the EPA drinking water standards (EPA 1976) of 45 mg/L, reported as nitrate, for reference purposes only. These drinking water standards are not applicable to the Hanford Site because there is no public drinking water supply.

2.6 QUALITY ASSURANCE

Quality assurance is included in all aspects of the monitoring program: well maintenance; sampling; analytical procedures; and data interpretation, storage, and reporting. A quality control plan is in place and is being administered. The monitoring program is subject to external audits by the Rockwell Quality Program Assessment Group and to internal audits by the Rockwell Environmental Engineering Unit.

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3.0 ACTIVE DISPOSAL SITES

This section reports the results of the ground-water monitoring program at active liquid waste disposal sites in CY 1986.

Low-level radioactive liquid wastes generated in the processing facilities in the 200 Areas are discharged to the soil column for disposal. Cooling water is disposed to surface ditches and ponds. Other liquid wastes containing low-level radioactive constituents are disposed to subsurface facilities designated as cribs. Ground-water monitoring near surface ponds is discussed in section 3.1; monitoring near subsurface facilities is discussed in section 3.2.

The release of tritium in liquid waste streams from plant facilities is limited by RHO-MA-139 to 2.0 E+05 Ci/yr (table 2). During 1986, a total of 7.04 E+03 Ci of tritium were released from Rockwell facilities (Aldrich 1987).

In the following discussions of the pond and crib sites, the average, maximum, and minimum concentrations of constituents are tabulated for each ground-water monitoring well. The average concentrations are then compared with the ACL (table 2) and the DCG. The comparison with the DCG is very conservative since the DCG is applicable at the point of actual exposure to the public. The concentration of a radionuclide during transport from a site to the river will be attentuated by dispersion and dilution and by sorption and radioactive decay (see section 1.3.4) and would be further attenuated by dilution and dispersion in the Columbia River. Nitrate results are reported in terms of nitrate, rather than nitrogen. For comparison, the drinking water standard for nitrate is 45 ppm when reported as nitrate versus 10 ppm when reported as nitrogen. The 1986 results are also compared with 1985 results (Law and Schatz 1986).

3.1 SURFACE LIQUID DISPOSAL SITES

Three major ponds were in operation during 1986 for the disposal of waste water, primarily cooling water: 216-A-25 (Gable Mountain Pond) and 216-B-3 (B Pond) in 200 East Area, and the 216-U-14 ditch in 200 West Area. The locations of these ponds are shown in figure 2.

In the 200 East Area in 1986, a total of 6.42 E+09 gal (2.43 E+10 L) of liquid effluent was discharged to ponds from the following effluent streams:

- PUREX cooling water (CWL)
- B Plant cooling water (CBC)
- 242-A evaporator cooling water (ACW)
- 242-A evaporator steam condensate (ASC)
- 244-AR Vault cooling water (CAR)

- 241-A Tank Farm cooling water (CA8)
- PUREX chemical sewer (CSL).

These streams can be routed to either Gable Mountain Pond or the B Pond system, with the exception of the CSL effluent stream, which goes directly to B Pond.

In the 200 West Area, the only major surface liquid disposal facility is the 216-U-14 ditch. Several minor surface liquid waste disposal facilities that receive low volumes of effluent are not discussed: the 216-B-63 trench in 200 East Area, which receives B Plant Chemical Sewer effluent; the 216-S-10 ditch for the REDOX air conditioning water; the 216-T-1 ditch, which receives waste from the T Plant drain flush and headend wastes; the 216-T-4-2 ditch and 216-T-4 pond, which receive chemical drain compressor wastes from the 221-T and 224-T Buildings; and the powerhouse ponds in 200 East and 200 West Areas.

3.1.1 216-A-25 (Gable Mountain) Pond

Gable Mountain Pond is located north of 200 East Area and south of Gable Mountain (see fig. 2). The main pond has been reduced to a ditch about 50 ft (15.3 m) wide leading to the overflow pond (approximately 10 acres (4 ha)). A map of the pond showing the location of monitoring wells is shown in appendix A (fig. A.6 on page A-17). The overflow pond and ditch received an estimated volume of 3.58 E+08 gal (1.36 E+09 L) of effluent during 1986, an 80% reduction from the 2.1 E+09 gal (7.90 E+09 L) of effluent disposed there in 1985. Present plans call for Gable Mountain Pond to be deactivated in the fall of 1987. Deactivation will include backfilling the entire pond proper and overflow pond.

The 1984 ground-water monitoring report (Law et al. 1986) discussed elevated concentrations of ^{90}Sr in monitoring wells near the pond. The pond received ^{90}Sr in 1964 when a cooling coil broke in PUREX. In-plant monitoring and automatic diversion are now in place to preclude such a release.

When the concentration of ^{90}Sr exceeded the ACL in well 699-53-47A in 1984, five other wells were drilled immediately as part of an investigation. Well 699-53-47B, adjacent to well 699-53-47A, had similar concentrations of ^{90}Sr, while well 699-53-48B had higher concentrations. Concentrations of ^{90}Sr in the other three wells were below Rockwell guidelines. Samples were also taken from three existing downgradient wells which did not exhibit any elevated concentrations, indicating the contamination was localized. The investigation also indicated, using conservative assumptions (Law et al. 1986), the travel time to the Columbia River for ^{90}Sr would be approximately 5,000 yr. The 1984 worst condition of 906 pCi/L would decay to 7 pCi/L in 7 half-lives, or 197 yr, by radioactive decay alone, without considering dispersion of the ^{90}Sr (Law et al. 1986).

During 1986, routine monitoring was conducted in six near-field downgradient wells and five far-field downgradient wells. Concentrations of radioactive constituents in these wells are summarized in table 3. Concentrations of all radionuclides are below the DCG without any consideration of transport to the site boundary with attenuation due to radioactive decay, sorption, dispersion, and dilution. The ^{90}Sr concentration exceeds the ACL in three wells: 699-53-47A, 699-53-47B, and 699-53-48B (see fig. A.6 on page A-17). Comparison of the 1986 monitoring results with those of 1985 (Law and Schatz 1986) indicates that the ^{90}Sr concentration was about the same in well 699-53-47A (fig. 6), increased slightly in well 699-53-47B (fig. 7), and decreased significantly in well 699-53-48B (fig. 8). There was evidence that the contaminant plume moved as ^{90}Sr concentration in well 699-54-48 is in an increasing trend (fig. 9), although the average concentration of 26.2 pCi/L was below the Rockwell ACL of 30 pCi/L.

3.1.2 216-B-3 (B Pond) System

The B Pond system is composed of the 34-acre (14-ha) main pond, 216-B-3; two 11-acre (4-ha) expansion ponds, 216-B-3A and 216-B-3B; and a third expansion pond of 41 acres (17 ha), 216-B-3C. The total capacity was not completely used in 1986 with the B Pond system receiving an estimated 6.06 E+09 gal (2.29 E+10 L) of effluent, which was about 50% more than the 3.90 E+09 gal (1.50 E+10 L) received by the pond system in 1985. This increase was due to the decrease in effluent to Gable Mountain Pond.

The pond system is monitored by wells 699-42-40A and 699-42-40B (see fig. 2 and fig. A.11, page A-22). Concentrations of radionuclides, listed in table 4, are below the DCG and ACL and are similar to 1985 results.

3.1.3 216-U-14 Ditch

The portion of the old 216-U-14 ditch between the 207-U retention basin and the 242-S evaporator was activated in March 1985 to receive steam condensate waste, chemical sewer waste, and cooling water from the 224-U and 271-U Plants. The ditch is located west of 271-U Plant and north of the 242-S evaporator in 200 West Area (fig. 10). The volume of the effluent stream totaled 1.43 E+08 gal (5.42 E+08 L) in 1986.

Well 299-W19-21 (see fig. A-21 on page A-32) was constructed in 1986 to monitor the ditch. Data relating to this well in 1986 are listed in table 5. Concentrations of all radionuclides were below the DCG, but the average concentration of uranium was just above the internal ACL. The source of this uranium is under investigation.

3.2 SUBSURFACE LIQUID DISPOSAL SITES

Low-level radioactive liquid wastes from processing operations are disposed to subsurface cribs. A typical crib (fig. 11) consists of a long, trapezoidal, rock-filled trench covered with a sheet of plastic and several

Table 3. Concentrations of Radiological Constituents and Nitrate in Ground Water Near the 216-A-25 (Gable Mountain) Pond in 1986. (sheet 1 of 2)

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
Near-Field Downgradient Wells										
	MAX[a]	5.91E+00	1.55E+02			8.07E+01	5.51E+00	5.36E+00	3.91E+01	
699-53-47A	AVE[b]	2.68E+00	1.01E+02	NN[d]	NN	6.40E+01	-2.08E+00	-9.08E-01	8.31E+00	NN
	MIN[c]	4.31E-01	5.34E+01			4.17E+01	-8.60E+00	-8.11E+00	-4.06E+01	
	MAX	7.90E+00	1.79E+02			8.07E+01	6.18E+00	8.55E+00	3.36E+01	
699-53-47B	AVE	4.02E+00	1.29E+02	NN	NN	7.59E+01	7.55E-01	2.45E+00	-2.13E+00	NN
	MIN	2.36E+00	1.10E+02			6.94E+01	-4.82E+00	-3.95E+00	-5.19E+01	
	MAX	9.16E+00	4.37E+02			1.44E+00	5.66E+00	5.64E+00	3.91E+01	5.89E+00
699-53-48A	AVE	6.69E+00	4.52E+01	NN	NN	7.17E-01	-2.52E+00	-4.32E-01	-1.84E+01	5.89E+00
	MIN	1.72E-01	6.79E+00			-3.34E-02	-1.75E+01	-8.54E+00	-8.05E+01	5.89E+00
	MAX	7.14E+00	4.50E+02			3.26E+02	5.13E+00	7.03E+00	6.26E+01	
699-53-48B	AVE	9.00E-01	3.56E+02	NN	NN	2.65E+02	-7.55E-01	-7.61E-01	-4.46E-01	NN
	MIN	-5.77E-02	1.00E+01			2.01E+02	-4.13E+00	-1.13E+01	-1.21E+02	
	MAX	2.08E+00	8.07E+01			3.60E+01	7.18E+00	7.09E+00	7.73E+01	
699-54-48	AVE	1.46E+00	5.05E+01	NN	NN	2.62E+01	-7.83E-01	1.44E-01	6.51E-01	NN
	MIN	7.36E-01	3.17E+01			1.67E+01	-9.66E+00	-1.82E+01	-7.08E+01	
	MAX	1.50E+00	4.03E+01			1.97E+01				
699-54-49	AVE	9.81E-01	2.89E+01	NN	NN	1.35E+01	NN	NN	NN	NN
	MIN	3.10E-01	2.34E+01			9.83E+00				

Table 3. Concentrations of Radiological Constituents and Nitrate in Ground Water Near the 216-A-25 (Gable Mountain) Pond in 1986. (sheet 2 of 2)

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
Far-Field Downgradient Wells										
699-55-50C	MAX	1.26E+00	7.03E+00			2.34E+00				
	AVE	1.05E+00	5.99E+00	NN	NN	7.24E-01	NN	NN	NN	NN
	MIN	8.64E-01	5.03E+00			1.52E-01				
699-55-50D	MAX	5.32E+00	1.40E+01			1.62E+00				
	AVE	2.16E+00	7.96E+00	NN	NN	7.39E-01	NN	NN	NN	NN
	MIN	1.04E+00	3.91E+00			7.39E-02				
699-56-51	MAX	1.27E+00	4.18E+00			6.19E-01				
	AVE	9.78E-01	4.56E+00	NN	NN	2.66E-01	NN	NN	NN	NN
	MIN	5.98E-01	2.81E+00			-2.25E-01				
699-59-58	MAX	1.04E+00	4.66E+00			4.14E-01				
	AVE	9.56E-01	4.17E+00	NN	NN	1.37E-01	NN	NN	NN	NN
	MIN	8.73E-01	3.68E+00			-7.75E-02				
699-63-58	MAX	9.11E-01	7.37E+00			8.21E-01				
	AVE	8.76E-01	7.33E+00	NN	NN	2.90E-01	NN	NN	NN	NN
	MIN	8.41E-01	7.29E+00			-3.27E-01				

[a] Maximum.
[b] Average.
[c] Minimum.
[d] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

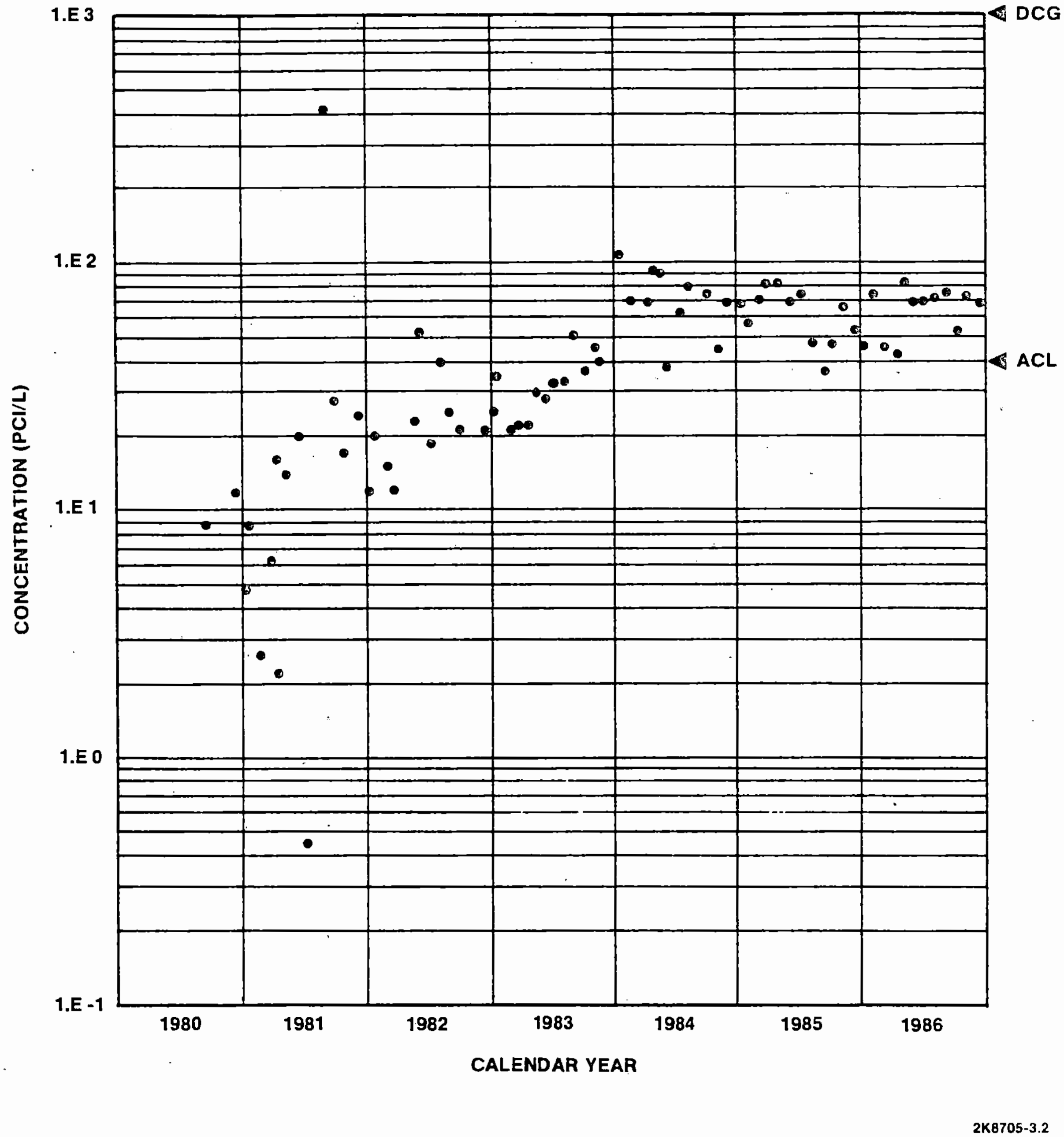

Figure 6. Concentration History of ^{90}Sr in Well 699-53-47A at the 216-A-25 (Gable Mountain) Pond.

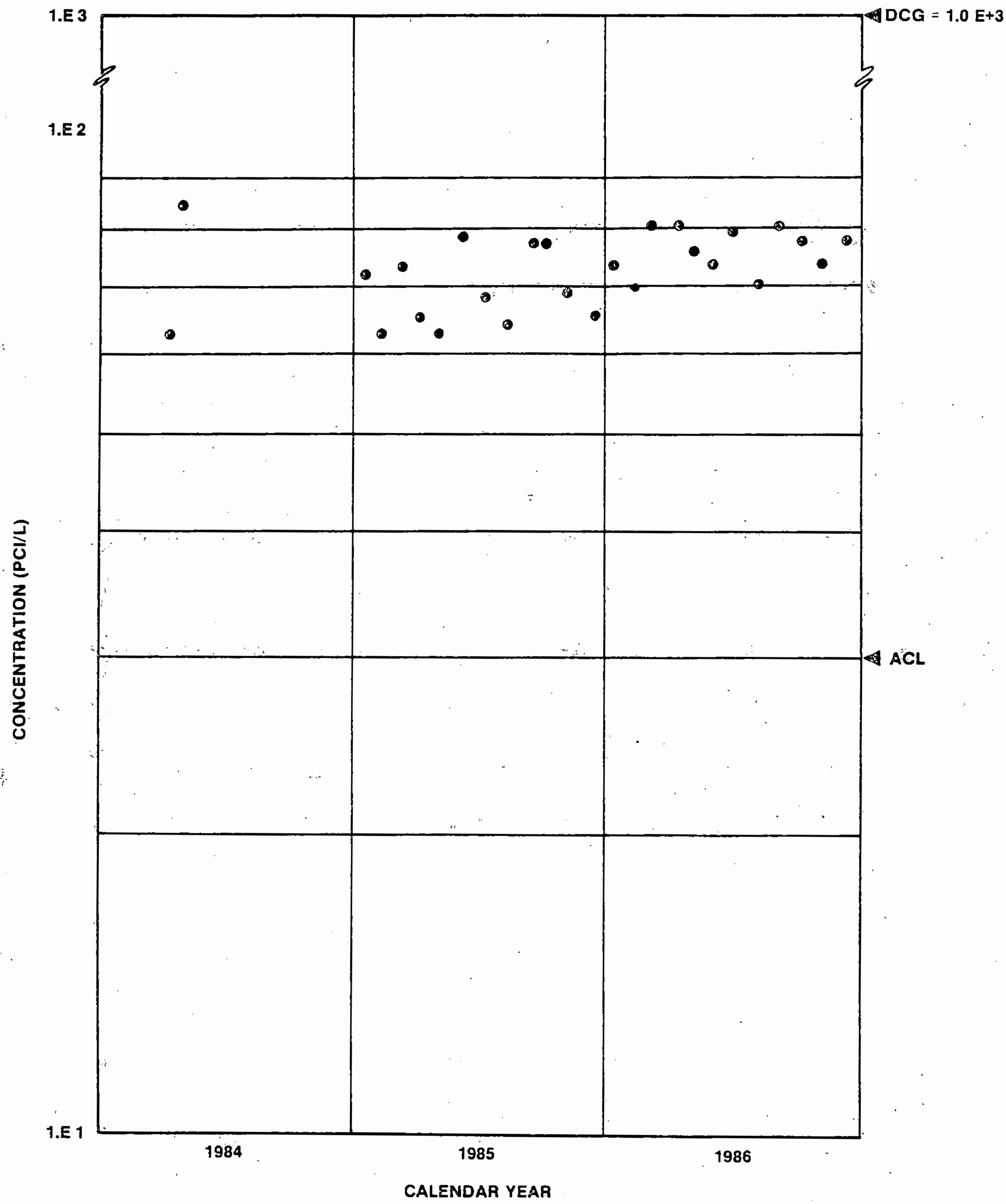

Figure 7. Concentration History of ^{90}Sr in Well 699-53-47B at the 216-A-25 (Gable Mountain) Pond.

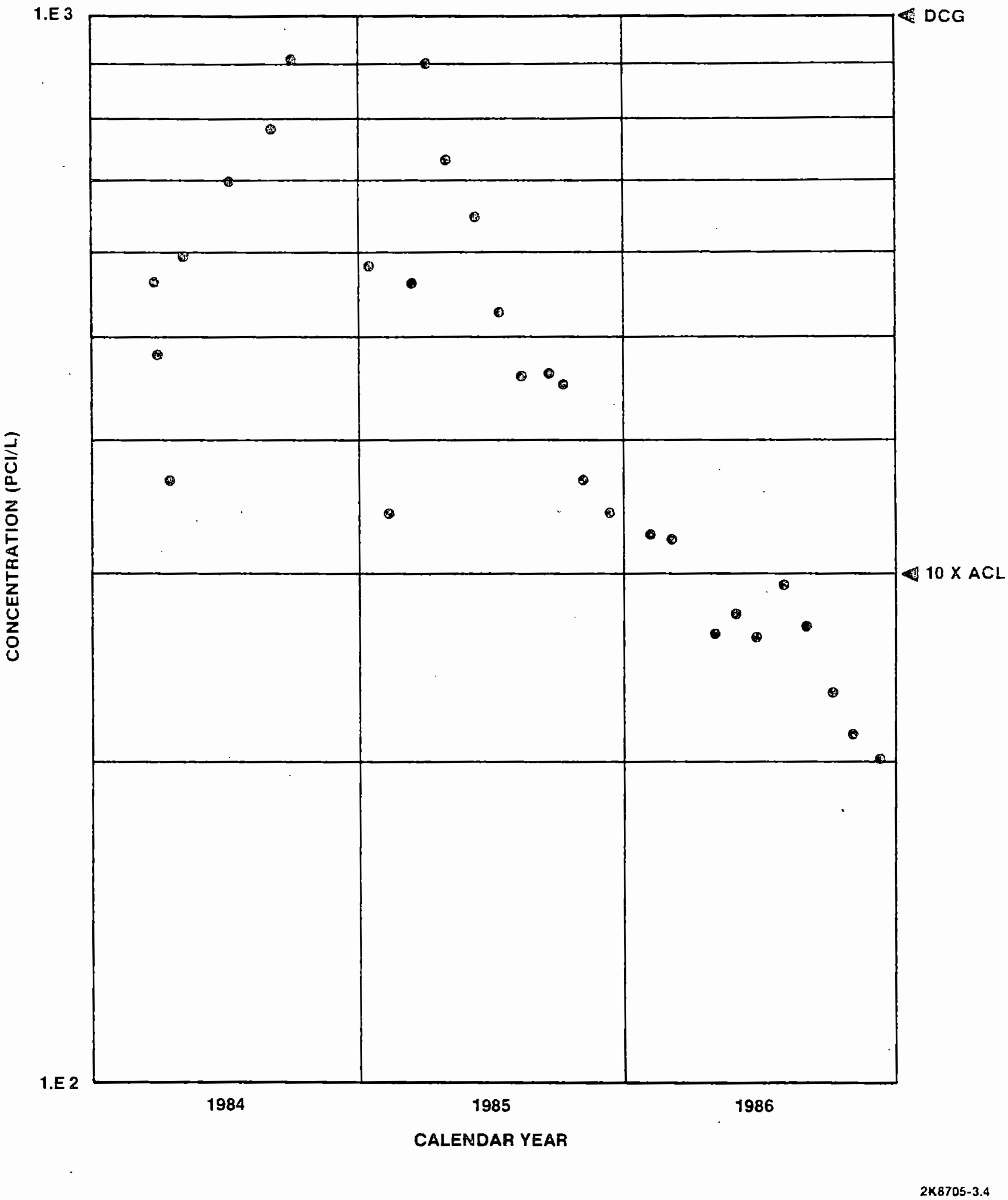

Figure 8. Concentration History of ^{90}Sr in Well 699-53-48B at the 216-A-25 (Gable Mountain) Pond.

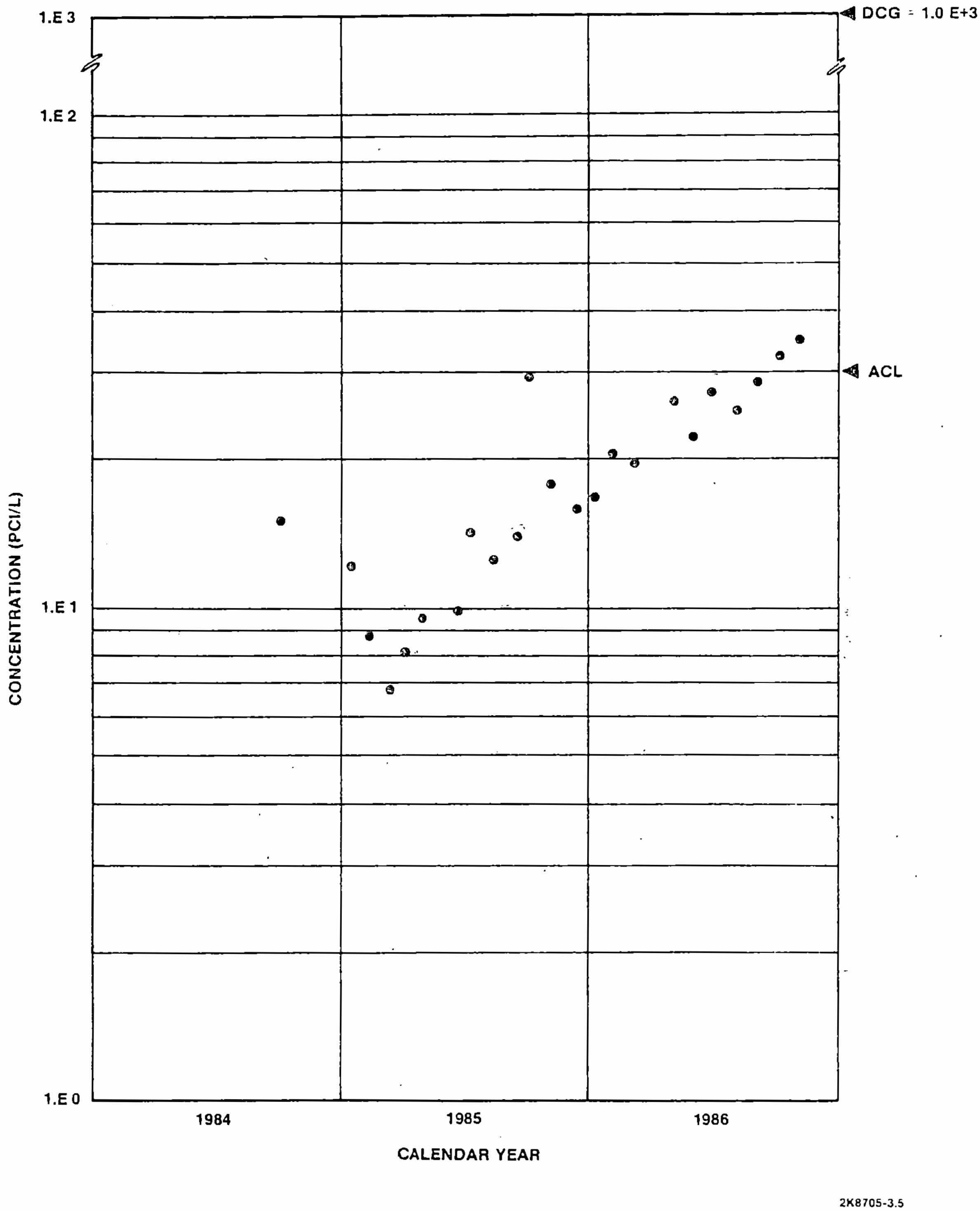

Figure 9. Concentration History of ^{90}Sr in Well 699-54-48 at the 216-A-25 (Gable Mountain) Pond.

Table 4. Concentrations of Radiological Constituents and Nitrate in Ground Water Near the 216-B-3 (B Pond) System in 1986.

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
699-42-40A	MAX[a]	1.86E+00	6.52E+00	4.65E+03	1.94E+00	1.65E+00	8.33E+00	5.34E+00	6.11E+01	7.33E-01
	AVE[b]	7.37E-01	5.05E+00	6.82E+02	9.13E-01	3.67E-01	-5.55E-01	-1.31E+00	-4.80E+00	5.21E-01
	MIN[c]	2.69E-01	3.60E+00	-1.12E+03	5.00E-01	-6.30E-02	-1.89E+01	-1.02E+01	-7.54E+01	3.34E-01
699-42-40B	MAX		5.33E+00	4.82E+03	5.10E-01	9.00E-01	6.84E+00	8.46E+00	5.73E+01	
	AVE	NN[d]	4.17E+00	8.93E+02	4.40E-01	4.82E-01	-4.09E-01	1.51E-01	1.93E+00	NN
	MIN		2.39E+00	-6.37E+01	3.10E-01	2.68E-01	-6.05E+00	-1.60E+01	-3.71E+01	

[a] Maximum.
[b] Average.
[c] Minimum.
[d] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

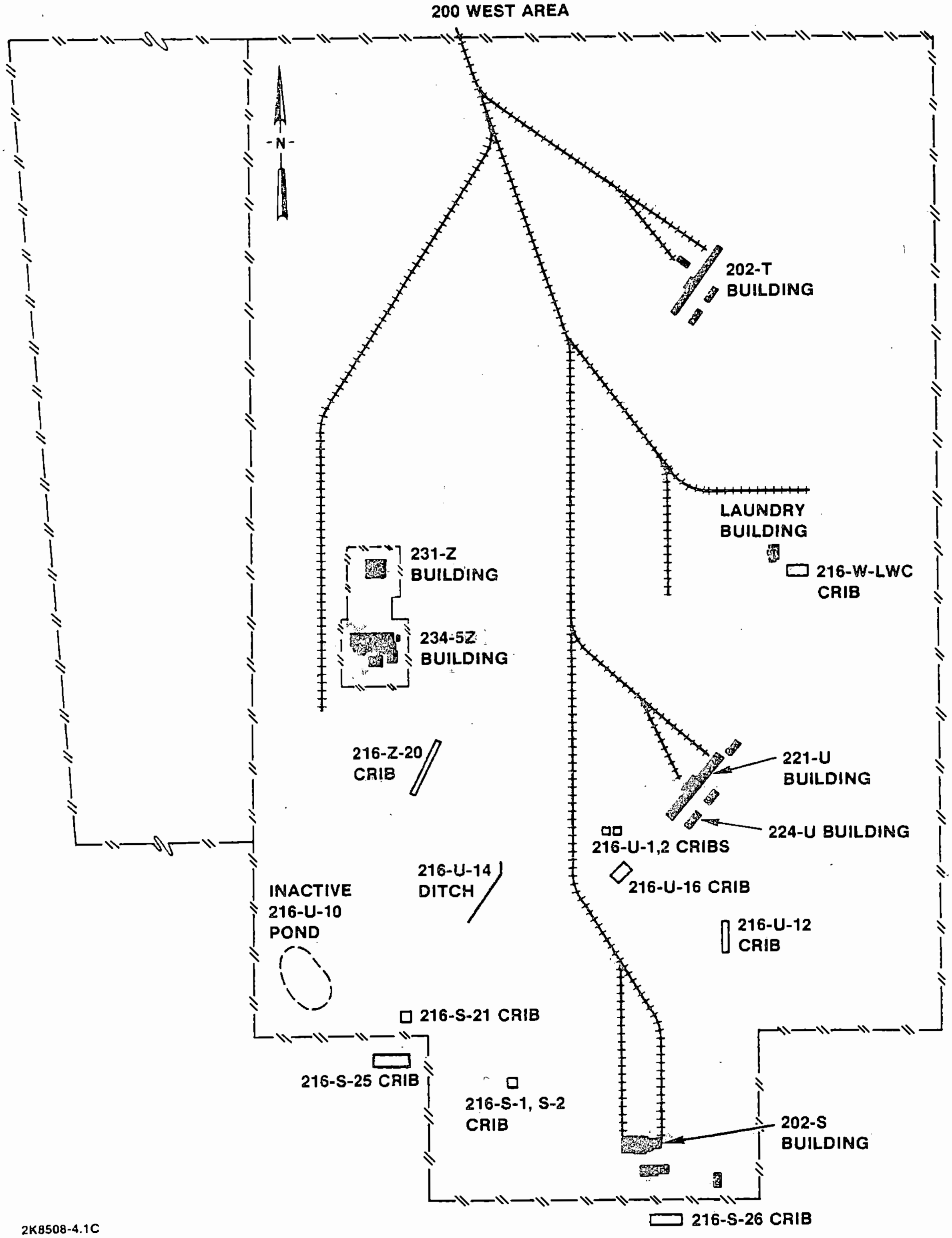

Figure 10. Location Map for Selected Waste Disposal Sites in 200 West Area.

9 2 1 2 4 6 6 2 1 5 3

Table 5. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-U-14 Ditch in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
					Effluent					
UO_3 Plant	AVE[a]	<1.35E+01	<6.87E+01	NN[b]	NA[c]	NN	NN	NA	NN	2.43E+01
					Well					
299-W19-21	MAX[d]	1.88E+01	8.18E+01	2.42E+02	1.90E+00	4.91E-01	1.60E+00	3.05E+00	7.23E+01	1.28E+01
	AVE	1.52E+01	4.81E+01	1.29E+02	1.14E+00	2.44E-01	-2.54E+00	-4.85E+00	4.15E+01	1.11E+01
	MIN[e]	1.14E+01	1.70E+01	-3.09E+02	5.00E-01	-2.39E-01	-5.99E+00	-1.84E+01	-1.18E+01	9.23E+00

[a] Average.
[b] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[c] Not available.
[d] Maximum.
[e] Minimum.

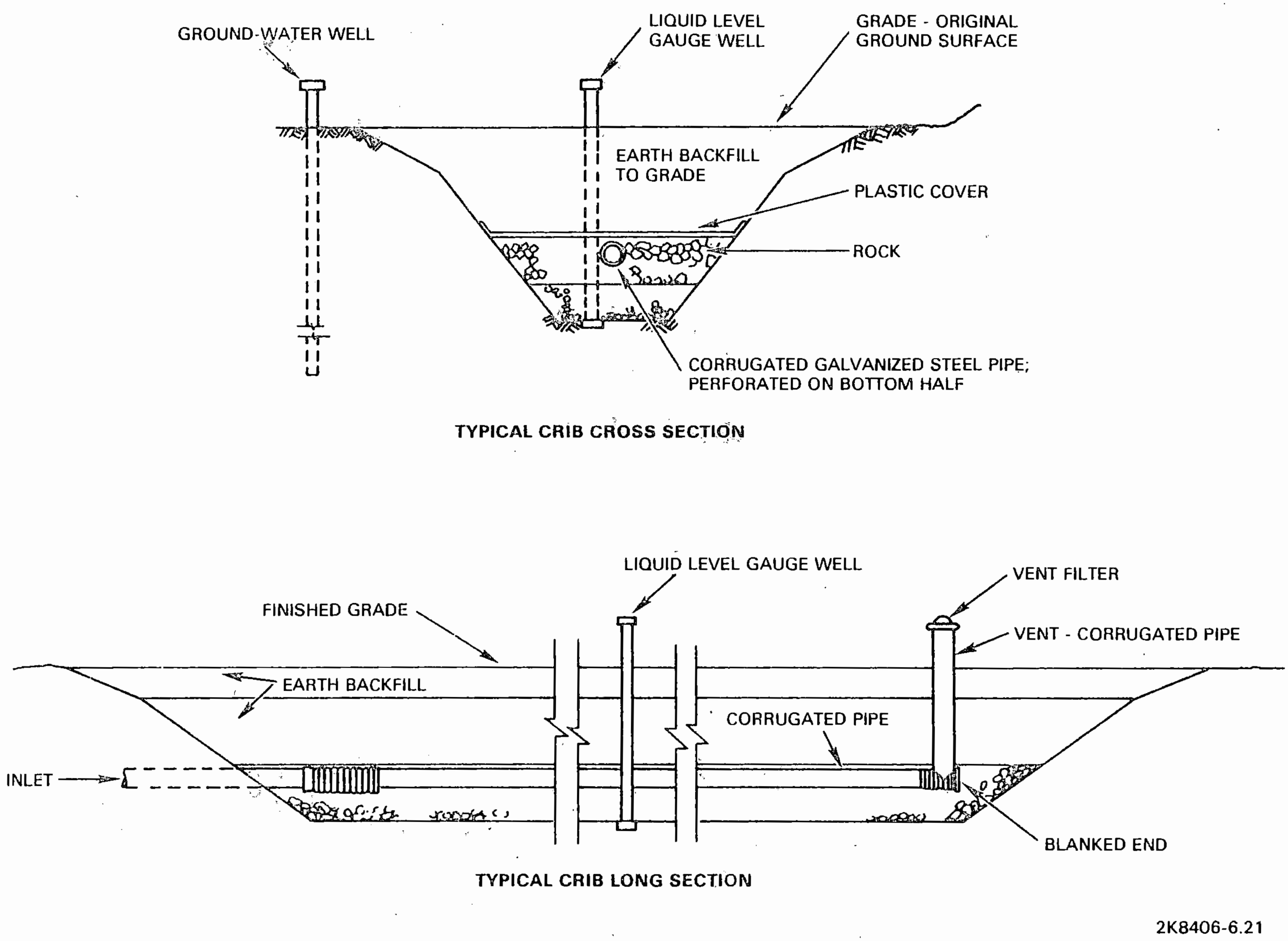

Figure 11. Typical Subsurface Liquid Waste Disposal Crib.

feet of backfill. A perforated distributor pipe disperses the waste throughout the length of the crib. Vents allow gases to escape, and liquid-level gauges are emplaced to evaluate the ability of the crib to dispose of liquid.

There were 13 cribs classified as active in 1986, as indicated in table 6. Two of these cribs, 216-A-8 and 216-S-25, did not receive any waste in 1986. Ground-water samples were collected from monitoring wells near these active crib sites (crib locations are shown in fig. 10 and 12; the location of monitoring wells at crib sites is shown in a series of maps indexed on page A-1 of appendix A).

To provide perspective on crib performance, the concentrations of radionuclides in the effluent streams reported in Aldrich (1987) are included in the table for each waste site.

Graphs depicting long-term concentration histories of selected constituents in the effluent stream and monitoring wells are presented in appendix D for cribs receiving waste water from the 202-A Building (PUREX) and associated facilities, and the 221-B Building (B Plant). Effluent concentrations are shown on the concentration history graphs only for years that disposal occurred. Ground-water data points are shown for all years that data are available. Consecutive years are connected by a solid line; a dashed line is drawn between data points when no data are provided for the intervening years.

3.2.1 216-A-8 Crib

The 216-A-8 crib receives condensate waste (A8) from the 241-AY, -AZ Tank Farms. The crib is located east of the 241-AX Tank Farm outside the 200 East Area perimeter fence (see fig. 12). The crib was in operation during 1955 to 1958, 1966 to 1976, 1978, and 1983 through 1985. No effluent was discharged to this crib in 1986.

Wells 299-E25-6 and 299-E25-9 monitor this crib (see fig. A.4, page A-15). Average concentrations of all constituents are below the DCG and ACL. The concentrations determined in 1986 (table 7) were similar to the results for 1985.

Long-term concentration histories for the monitoring wells of 216-A-8 crib are shown on pages D-3 and D-4 in appendix D. Total beta, tritium, and nitrate concentrations for 1985 are in good general agreement with the decreasing long-term trend.

3.2.2 216-A-10 Crib

The 216-A-10 crib is located south of PUREX in the 200 East Area (see fig. 12). The crib receives process condensate (PDD) waste from PUREX and was operated from 1961 to 1973, sporadically operated in 1977 and 1978, and was reactivated in 1981. During 1986, 1.95 E+07 gal (7.37 E+07 L) of liquid were discharged to the crib.

Table 6. Active Cribs in CY 1986.

Crib	Description of waste
216-A-8	241-A, AX, AY Tank Farms Steam coil condensate (A8)
216-A-10	PUREX process condensate (PDD)
216-A-30 216-A-37-2	PUREX steam condensate (SCD)
216-A-36B	PUREX ammonia scrubber waste (ASD)
216-A-37-1	242-A evaporator process condensate (AFPC)
216-B-55	B Plant steam condensate (BCS)
216-B-62	B Plant process condensate (BCP)
216-U-12	UO_3 Plant process condensate (U-12)
216-W-LWC	Laundry waste water (LWC)
216-Z-20	Waste water from 231-Z and 234-5Z (231-Z and 2904-ZA)
216-S-25	Effluent from ion exchange column, 242-S evaporator
216-S-26	Waste water from 222-S Laboratory

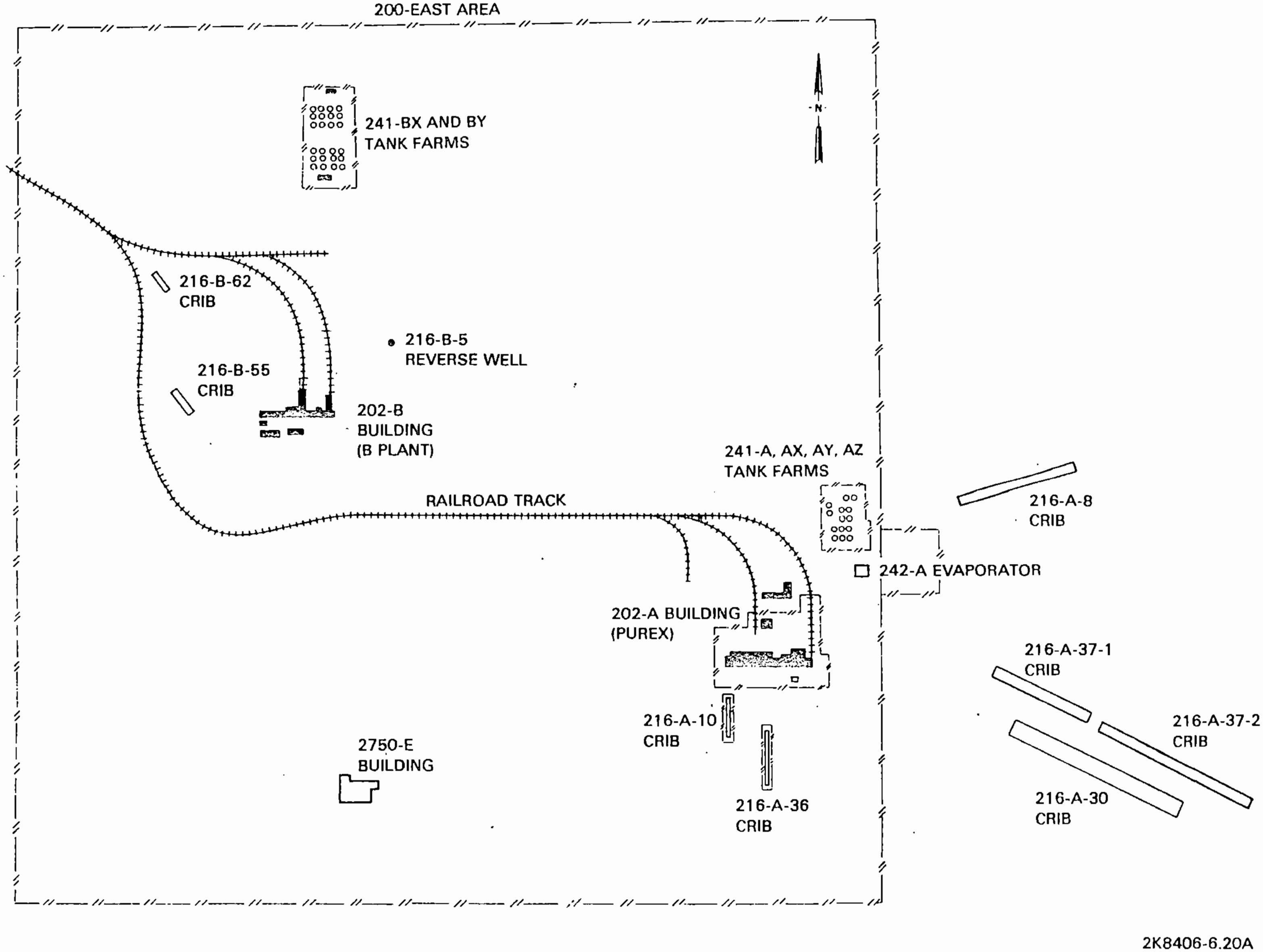

Figure 12. Location Map for Selected Liquid Waste Disposal Sites in 200 East Area.

Table 7. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-A-8 Crib in 1986.

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
299-E25-06	MAX[a]	2.60E+00	6.19E+00	1.33E+04	8.45E+00	8.44E-01	5.75E+00	6.08E+00	9.76E+01	
	AVE[b]	1.59E+00	4.69E+00	9.07E+03	3.34E+00	1.97E-01	7.02E-01	7.78E-01	7.12E+00	NN[d]
	MIN[c]	4.68E-01	3.04E+00	5.25E+03	6.80E-01	-1.80E-01	-4.47E+00	-7.06E+00	-1.03E+02	
299-E25-09	MAX	1.95E+00	1.36E+01	6.03E+03	1.10E+01	1.97E+00	6.19E+00	9.87E+00	8.26E+01	
	AVE	9.48E-01	5.26E+00	3.59E+03	4.92E+00	4.65E-01	1.86E+00	4.63E-01	1.50E+01	NN
	MIN	6.23E-01	3.63E+00	2.62E+03	2.19E+00	-3.65E-01	-2.27E+00	-1.25E+01	-5.56E+01	

[a] Maximum.
[b] Average.
[c] Minimum.
[d] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

The ground water beneath this crib is monitored by wells 299-E17-1 and 299-E24-2 (see fig. A.5, page A-16). Average concentrations of constituents monitored in these wells are listed in table 8. While tritium concentrations exceed the DCG (which are applicable at point of actual exposure to the public), the radiological parameters of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{106}Ru are below the DCG and the ACL. Concentrations of tritium and nitrate have increased during 1986 as depicted in figures 13 and 14, which reflects the operation of PUREX. This increase in tritium was predicted in DOE (1983). The tritium plume in the ground water extends to the inactive 216-A-5 crib, where well 299-E24-1 exceeds the DCG (appendix B.1).

Long-term concentration histories for the wells at the 216-A-10 crib are shown on pages D-5 and D-6 in appendix D. The increases in tritium and nitrate due to PUREX operation are apparent, but concentrations are in agreement with the established trend.

3.2.3 216-A-30 Crib and 216-A-37-2 Crib

The 216-A-30 crib and 216-A-37-2 crib, located just east of the 200 East Area (see fig. 12), receive steam condensate (SCD) waste from PUREX. The 216-A-30 crib has been in continuous operation since 1961, with the exception of 1974 and 1975. The 216-A-37-2 crib began operation in 1984 with the restart of PUREX. The SCD waste stream discharged 2.02 E+08 gal (7.65 E+08 L) to these cribs during 1986. About 1.35 E+08 gal (5.10 E+08 L) of the effluent went to the 216-A-30 crib, with the remainder of the effluent, 6.74 E+07 gal (2.55 E+08 L), going to the 216-A-37-2 crib.

The 216-A-30 crib is monitored by wells 299-E16-2 and 299-E25-11 (see fig. A.7 on page A-18). The 216-A-37-2 crib is monitored by four wells, 299-E25-21 through 299-E25-24 (fig. A.10 on page A-21). Monitoring results for 1986 are listed in table 9. A comparison with results from the previous year indicates that results are similar for the two years. All constituents are below the DCG and the ACL.

The long-term concentration histories for wells 299-E16-2 and 299-E25-11 are shown in figures D-5 and D-6 of appendix D. Concentrations for 1986 are observed to fall within established trends.

3.2.4 216-A-36B Crib

Ammonia scrubber waste (ASD) discharged from PUREX is received by the 216-A-36B crib (see fig. 12), which is located just south of the PUREX Building. This disposal facility was active from 1966 to 1972, and was activated again in 1982. During 1986, 1.50 E+07 gal (5.66 E+07 L) of liquid waste were discharged to this crib.

Wells 299-E17-5 and 299-E17-9 monitor the 216-A-36B crib (see fig. A.8, page A-19). Data for 1986 are presented in table 10. The average tritium concentrations in both wells exceed the DCG (which are applicable at the site boundary) but all other constituents are below the DCG and the internal ACL.

Table 8. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-A-10 Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
						Effluent				
PUREX (PDD)	AVE[a]	9.71E+03	1.76E+04	8.19E+07	NA[b]	<5.73E+01	<6.72E+01	NA	1.30E+04	4.52E+01
						Well				
299-E17-01	MAX[c]	4.35E+00	3.73E+01	8.98E+06	3.89E+02	7.29E+00	5.51E+00	6.72E+00	4.45E+01	NN[e]
	AVE	3.24E+00	2.76E+01	6.89E+06	2.90E+02	5.84E+00	-3.15E-01	3.02E+00	-5.98E-01	
	MIN[d]	2.22E+00	2.12E+01	4.38E+06	1.85E+02	4.23E+00	-8.63E+00	-3.52E+00	-4.89E+01	
299-E24-02	MAX	1.36E+01	1.88E+01	7.01E+06	3.29E+02	4.63E+00	4.48E+00	5.64E+00	9.78E+01	NN
	AVE	9.19E+00	1.48E+01	5.50E+06	2.61E+02	3.21E+00	6.50E-03	-9.55E-01	-1.99E+00	
	MIN	5.38E+00	1.12E+01	4.82E+06	1.82E+02	2.16E+00	-4.12E+00	-4.58E+00	-3.90E+01	

[a] Average.
[b] Not available.
[c] Maximum.
[d] Minimum.
[e] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

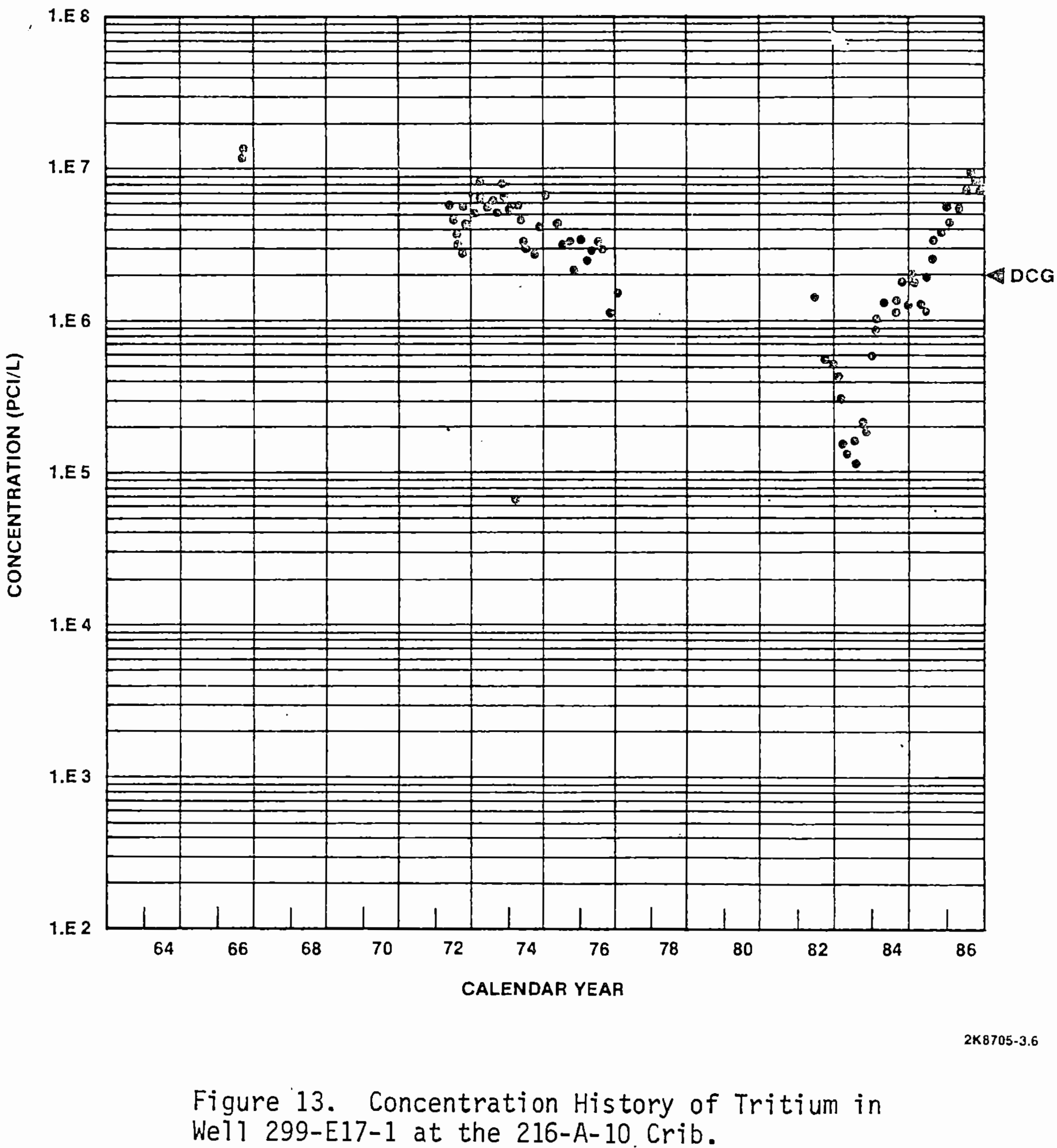

Figure 13. Concentration History of Tritium in Well 299-E17-1 at the 216-A-10 Crib.

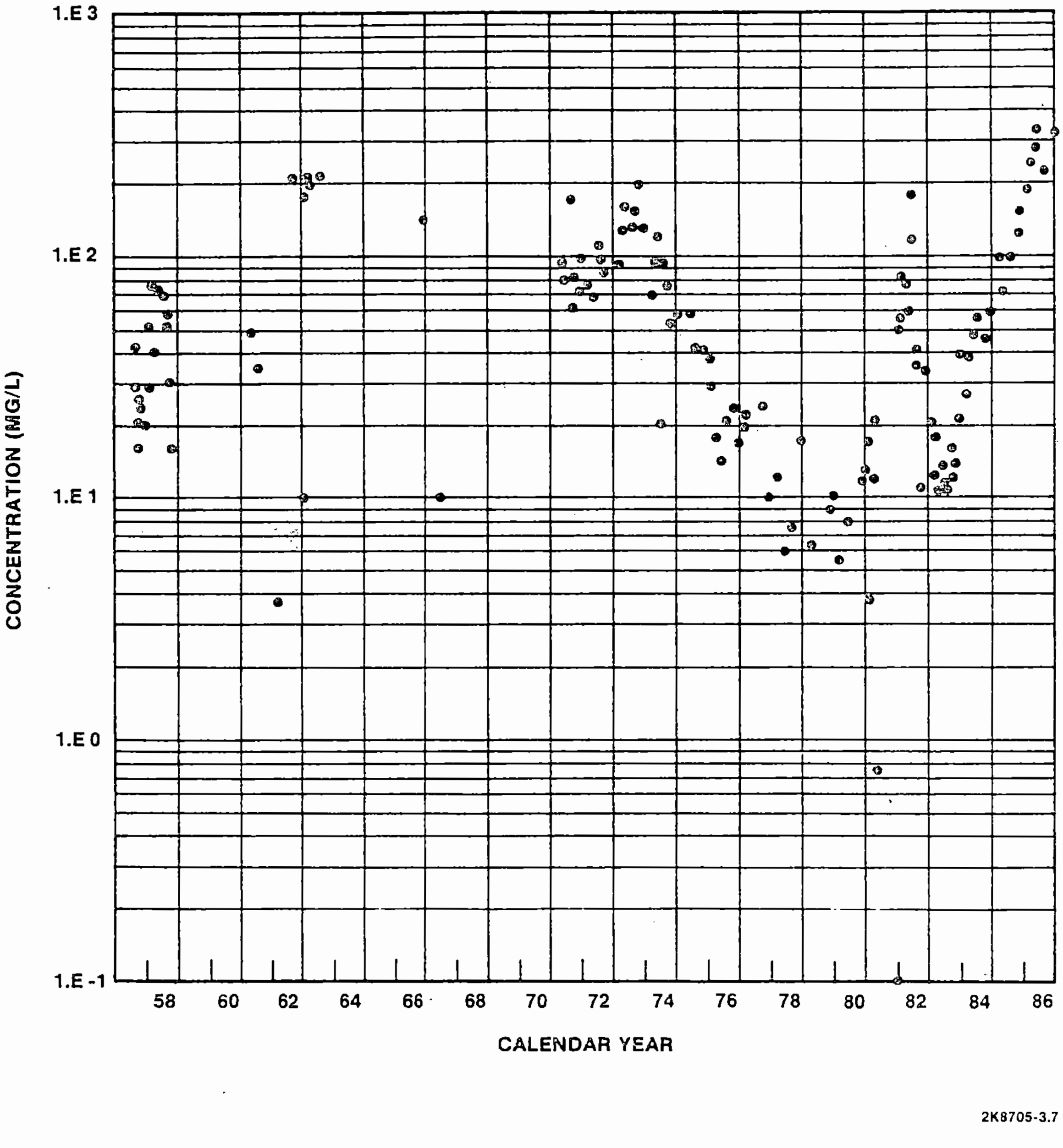

Figure 14. Concentration History of Nitrate in Well 299-E17-1 at the 216-A-10 Crib.

Table 9. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-A-30 Crib and 216-A-37-2 Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
Effluent										
PUREX (SCD)	AVE[a]	<5.43E+01	6.32E+03	7.70E+03	NA[b]	5.67E+02	3.11E+02	NA	NN[c]	NN
Wells at 216-A-30 crib										
299-E16-02	MAX[d]	2.80E+00	2.27E+01	4.43E+03	1.50E+01	7.28E-01	9.99E+00	1.24E+01	7.79E+01	
	AVE	2.17E+00	1.68E+01	2.06E+03	8.40E+00	2.18E-01	1.80E+00	-7.52E-02	2.13E+01	NN
	MIN[e]	1.50E+00	1.21E+01	2.14E+02	1.93E+00	-2.52E-01	-9.84E+00	-9.87E+00	-1.00E+02	
299-E25-11	MAX	1.89E+00	1.05E+01	3.40E+05	4.50E+01	7.79E-01	1.07E+01	5.61E+00	5.96E+01	
	AVE	1.19E+00	7.65E+00	1.64E+05	2.85E+01	2.45E-01	6.53E-01	-1.34E-01	-6.50E+00	NN
	MIN	4.32E-01	2.53E+00	-9.81E+02	1.68E+01	-9.90E-02	-8.98E+00	-1.81E+01	-6.91E+01	
Wells at 216-A-37-2 crib										
299-E25-21	MAX	2.84E+00	1.88E+01	3.49E+03	1.25E+01	5.64E-01	9.99E+00	7.04E+00	8.08E+01	
	AVE	1.84E+00	1.28E+01	2.28E+03	5.73E+00	1.73E-01	1.40E+00	3.10E-01	2.71E+01	NN
	MIN	1.27E+00	8.55E+00	1.05E+03	2.83E+00	-2.15E-01	-8.00E+00	-1.16E+01	-1.08E+01	
299-E25-22	MAX	1.79E+00	9.65E+00	1.02E+04	9.27E+00	1.33E+00	6.42E+00	9.70E+00	6.15E+01	
	AVE	1.10E+00	6.78E+00	6.67E+03	6.05E+00	3.52E-01	3.50E-01	1.29E+00	-1.81E+01	NN
	MIN	6.48E-01	4.93E+00	4.24E+03	4.69E+00	-1.77E-03	-7.26E+00	-6.04E+00	-7.41E+01	
299-E25-23	MAX	2.01E+00	3.08E+01	7.84E+03	2.30E+01	4.00E-01	4.22E+00	4.24E+00	6.38E+01	
	AVE	8.92E-01	2.14E+01	2.63E+03	8.40E+00	2.30E-01	1.30E-01	3.22E-01	6.44E+00	NN
	MIN	3.05E-01	1.64E+01	9.34E+01	5.00E-01	-3.43E-02	-8.33E+00	-9.10E+00	-7.60E+01	
299-E25-24	MAX	1.95E+00	3.32E+01	7.14E+03	2.69E+01	8.26E-01	8.25E+00	6.77E+00	7.53E+01	
	AVE	1.66E+00	2.35E+01	3.06E+03	1.18E+01	4.19E-01	-5.00E-02	3.07E+00	2.27E+01	NN
	MIN	1.36E+00	1.43E+01	3.00E+02	2.43E+00	-8.65E-02	-1.07E+01	-3.36E+00	-3.71E+01	

[a] Average.
[b] Not available.
[c] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[d] Maximum.
[e] Minimum.

9 2 1 2 4 6 6 2 1 7 5

Table 10. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-A-36B Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
					Effluent					
PUREX (ASD)	AVE[a]	<3.71E+02	8.44E+05	2.42E+06	NA[b]	3.72E+03	6.14E+03	NA	4 E+05	NN[c]
					Well					
299-E17-05	MAX[d]	1.44E+01	7.09E+01	5.06E+06	1.19E+02	3.58E+00	7.70E+00	8.03E+00	4.42E+01	9.71E+00
	AVE	9.18E+00	3.37E+01	3.88E+06	9.90E+01	2.84E+00	5.55E-01	1.51E+00	5.48E+00	6.60E+00
	MIN[e]	5.79E+00	2.29E+01	2.69E+06	8.68E+01	2.33E+00	-1.35E+01	-4.13E+00	-3.67E+01	4.30E+00
299-E17-09	MAX	5.20E+00	2.54E+01	6.62E+06	2.07E+02	5.01E+00	1.20E+01	5.09E+00	4.43E+01	
	AVE	3.90E+00	2.10E+01	5.84E+06	1.38E+02	3.67E+00	9.24E-01	-1.90E-01	1.31E+01	NN
	MIN	3.19E+00	1.75E+01	3.55E+06	9.38E+01	1.95E+00	-8.31E+00	-1.13E+01	-2.20E+01	

[a] Average.
[b] Not available.
[c] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[d] Maximum.
[e] Minimum.

The tritium concentration in well 299-E17-9 has increased over 1985 (fig. 15). As noted in the discussion for the 216-A-10 crib, operation of PUREX is expected to increase tritium concentrations in ground water. Results for other radionuclides are similar to those for 1985.

The long-term concentration histories for the two monitoring wells at the 216-A-36B crib, shown on pages D-9 and D-10 of appendix D, indicate the results for 1986 are reasonable with the tritium increasing at the same rate as the last three years.

3.2.5 216-A-37-1 Crib

Process condensate from the 242-A evaporator (AFPC) is disposed to the 216-A-37-1 crib after diversion and monitoring in the concrete 207-A Retention Basin. The crib is located outside the 200 East Area, just east of the evaporator (see fig. 12). The waste stream has been active since 1977, and in 1986 a total of 1.33 E+07 gal (5.04 E+07 L) of effluent was disposed to the crib.

The crib is monitored by four wells, 299-E25-17 through 299-E25-20 (fig. A.9 on page A-20). The monitoring results for 1986 are contained in table 11. Concentrations of radionuclides are below the DCG and the ACL and are similar to 1985 results.

Figure 16 shows the history of tritium concentration in well 299-E25-17 for the past 7 yr and reflects the startup of PUREX in 1984. Long-term concentration histories for the effluent and ground water are shown on pages D-11 through D-14 in appendix D. Increases in tritium concentrations are apparent, but within the pattern of past operations.

3.2.6 216-B-55 Crib

The 216-B-55 crib is located west of B Plant in the northwestern part of 200 East Area (see fig. 12). Steam condensate waste (BCS) from B Plant has been disposed to the crib since 1967. The volume of effluent released in 1986 was 1.12 E+06 gal (4.23 E+06 L).

Wells 299-E28-12 and 299-E28-13 monitor this crib (fig. A.13, page A-24). Concentrations of all radionuclides are observed to be below the DCG and ACL. Results of the monitoring for 1986 are listed in table 12, and are typical for this crib as illustrated in the long-term concentration history graphs shown on pages D-15 and D-16 of appendix D.

3.2.7 216-B-62 Crib

Process condensate from B Plant (BCP) has been routed to the 216-B-62 crib, which is located northwest of B Plant (see fig. 12), since 1973. In 1986, the effluent volume was 1.03 E+06 gal (3.89 E+06 L).

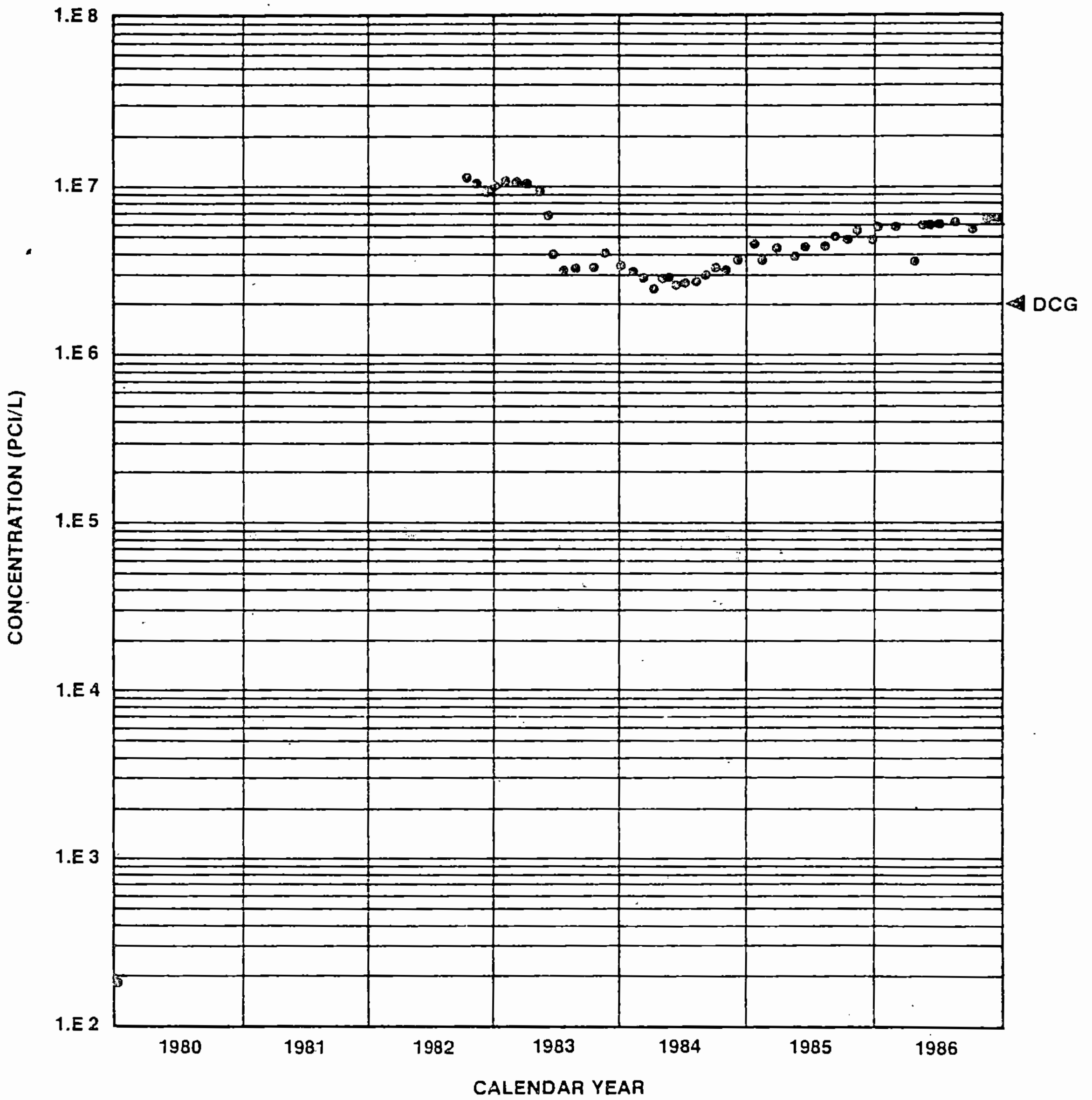

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Figure 15. Concentration History of Tritium in Well 299-E17-9 at the 216-A-36B Crib.

Table 11. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-A-37-1 Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
					Effluent					
242-A (AFPC)	AVE[a]	<2.42E+01	4.99E+03	1.11E+07	NA[b]	3.81E+02	5.62E+02	NA	NN[c]	<1.19E+00
					Well					
299-E25-17	MAX[d]	1.98E+00	1.38E+01	4.42E+05	2.48E+01	8.72E-01	6.19E+00	7.05E+00	8.60E+00	
	AVE	1.10E+00	9.19E+00	3.00E+05	1.58E+01	4.15E-01	-1.95E+00	-5.13E-01	2.54E+00	NN
	MIN[e]	5.27E-01	6.03E+00	1.88E+05	7.30E+00	1.71E-01	-1.44E+01	-7.88E+00	-7.41E+00	
299-E25-18	MAX	3.06E+00	1.15E+01	2.11E+05	2.16E+01	1.06E+00	7.12E+00	7.89E+00	9.69E+01	
	AVE	1.67E+00	6.66E+00	1.30E+05	1.68E+01	5.89E-01	6.53E-01	1.64E+00	6.90E+00	NN
	MIN	1.05E+00	3.24E+00	7.47E+04	8.28E+00	1.35E-01	-7.26E+00	-5.10E+00	-7.81E+01	
299-E25-19	MAX	1.94E+00	1.02E+02	4.39E+06	1.90E+02	6.98E-01	5.85E+00	6.45E+00	-2.90E+00	
	AVE	1.48E+00	3.01E+01	1.37E+06	1.23E+02	3.57E-01	-9.68E-02	4.42E+00	-2.94E+01	NN
	MIN	1.00E+00	9.38E+00	4.86E+05	1.37E+00	4.30E-02	-4.15E+00	2.02E+00	-4.90E+01	
299-E25-20	MAX	2.00E+00	1.65E+01	4.79E+05	1.56E+02	9.07E-01	4.47E+00	3.04E+00	8.63E+00	
	AVE	1.41E+00	1.34E+01	3.67E+05	1.35E+02	2.86E-01	6.45E-01	1.15E+00	-1.55E+01	NN
	MIN	9.94E-01	1.15E+01	1.46E+05	1.11E+02	-6.20E-02	-2.75E+00	-5.67E-01	-3.86E+01	

[a] Average.
[b] Not available.
[c] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[d] Maximum.
[e] Minimum.

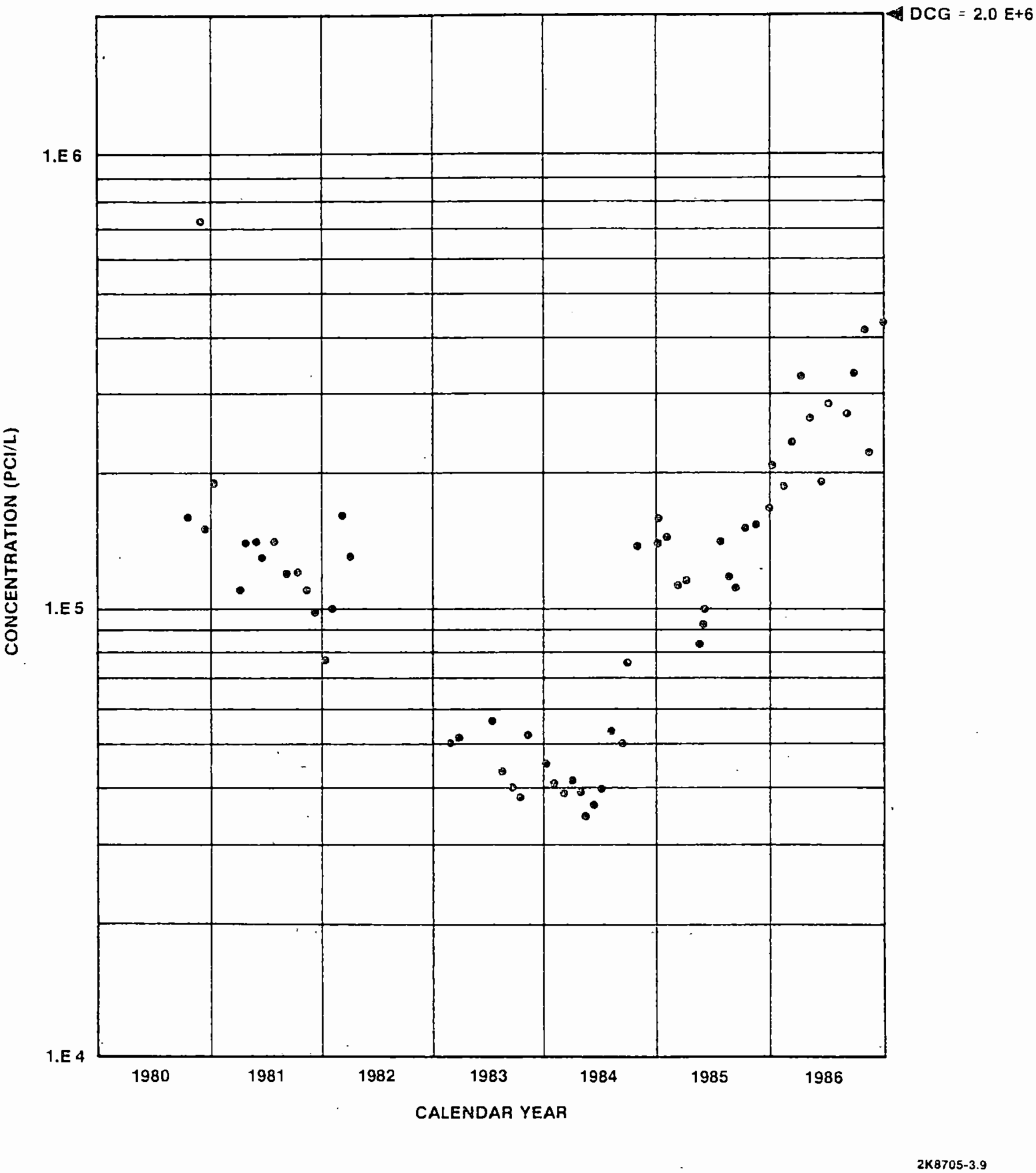

Figure 16. Concentration History of Tritium in Well 299-E25-17 at the 216-A-37-1 Crib.

9 2 1 2 4 5 6 2 1 7 9

Table 12. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-B-55 Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
Effluent										
B Plant (BCS)	AVE[a]	2.09E+02	5.42E+02	NN[b]	NA[c]	NN	NN	NA	NN	NN
Well										
299-E28-12	MAX[d]	NN	1.93E+01	1.42E+05	NN	NN	4.70E+00	4.20E+00	7.63E+01	NN
	AVE		1.35E+01	1.08E+05			4.10E-01	-1.98E+00	1.59E+01	
	MIN[e]		9.21E+00	8.12E+04			-4.82E+00	-1.34E+01	-5.73E+01	
299-E28-13	MAX	NN	9.71E+00	8.55E+03	NN	NN	4.79E+00	4.72E+00	2.66E+01	NN
	AVE		9.05E+00	7.37E+03			-2.32E+00	3.45E+00	-1.05E+01	
	MIN		5.59E+00	2.92E+03			-9.25E+00	-7.08E+00	-1.05E+02	

[a] Average.
[b] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[c] Not available.
[d] Maximum.
[e] Minimum.

Wells 299-E28-18 and 299-E28-21 (see fig. A.14 on page A-25 for well location) provide monitoring capability for this crib. Table 13 summarizes the data obtained during 1986. This crib has had elevated uranium concentrations in the ground water for several years (Law et al. 1986; Law and Schatz 1986). The concentrations of uranium are below the DCG but above Rockwell internal ACL. Figure 17 depicts the declining concentration history of total alpha in well 299-E28-18, with the total alpha being attributed entirely to the uranium. Results of an evaluation indicated the uranium was not from the 216-B-62 crib, but most likely from the inactive 216-B-12 crib, located several hundred feet to the south.

Long-term concentration history graphs for this crib, shown on pages D-17 and D-18 of appendix D, indicate that 1986 concentrations are consistent with previous data.

3.2.8 216-S-25 Crib

The 216-S-25 crib is located just outside the 200 West fence and south of the deactivated 216-U-10 pond (see fig. 10). The crib received process condensate from the 242-S evaporator from 1973 to 1980, and in 1985 was activated for a 6-mo period to receive effluent from the ion exchange column in the evaporator that treated ground water pumped from the 216-U-1/2 cribs. No effluent was discharged to the 216-S-25 crib in 1986.

The crib is monitored by three wells, 299-W23-9 through 299-W23-11 (fig. A.16, page A-27). Table 14 is a summary of the results from monitoring in 1986. All radionuclides are below the DCG but the concentration of uranium is above Rockwell's ACL. The concentration of uranium in wells 299-W23-10 and 299-W23-11 in 1986 was the same as in 1985, but the concentration increased in well 299-W23-9. Review of available information suggests that the uranium is probably from the nearby 216-U-10 pond, although the increase in uranium concentration in well 299-W23-9 in 1986 is likely due to operation of the ion exchange column in 1985.

3.2.9 216-S-26 Crib

The 216-S-26 crib receives steam condensate and sink waste from the 222-S Laboratory. The crib is located south of the 222-S Laboratory just outside the 200 West Area perimeter fence (fig. 10). Operation of the crib commenced in 1984 as a replacement for the 216-S-19 pond. During 1986, the crib received 1.09 E+07 gal (4.12 E+07 L) of effluent.

The crib is monitored by well 299-W27-1 (fig. A.17, page A-28). Average concentrations of radionuclides in the ground water near the crib (table 15) are below the DCG and the ACL.

Table 13. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-B-62 Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
Effluent										
B Plant (BCP)	AVE[a]	<7.86E+02	2.09E+06	NN[b]	NA[c]	5.18E+05	8.93E+04	NA	NN	NN
Well										
299-E28-18	MAX[d]	1.28E+02	3.84E+01	8.90E+03	7.35E+01	1.02E+00	3.83E+00	8.46E+00	3.93E+01	1.17E+02
	AVE	6.93E+01	2.24E+01	5.84E+03	5.59E+01	5.39E-01	-9.42E-01	3.62E+00	-5.10E-01	6.00E+01
	MIN[e]	4.63E+01	1.72E+01	1.25E+03	4.64E+01	1.54E-02	-8.95E+00	-2.53E+00	-1.00E+02	3.19E+01
299-E28-21	MAX	1.29E+02	2.66E+01	9.37E+03	6.06E+01	1.04E+00	5.00E+00	9.65E+00	6.24E+01	9.91E+01
	AVE	8.32E+01	1.91E+01	6.99E+03	4.70E+01	2.82E-01	-1.13E+00	-5.02E-01	-1.90E+00	6.73E+01
	MIN	4.36E+01	1.35E+01	4.71E+03	3.86E+01	-3.84E-01	-1.03E+01	-1.07E+01	-4.34E+01	4.17E+01

[a] Average.
[b] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[c] Not available.
[d] Maximum.
[e] Minimum.

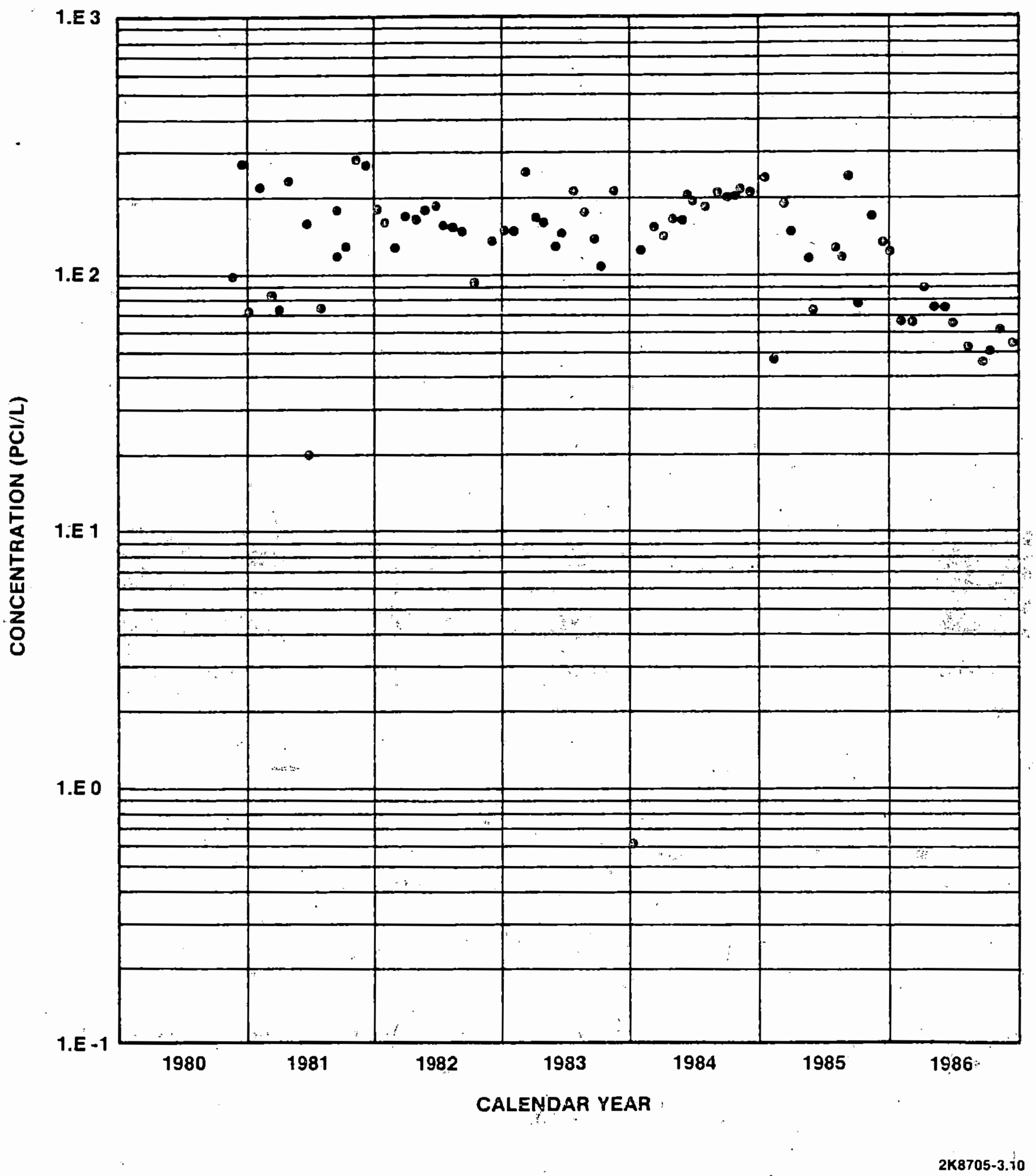

Figure 17. Concentration History of Total Alpha in Well 299-E28-18 at the 216-B-62 Crib.

9 2 1 2 4 5 6 2 1 8 3

Table 14. Concentrations of Radiological Constituents and Nitrate for Ground Water Near the 216-S-25 Crib in 1986.

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
	MAX[a]	5.92E+01	1.56E+01	1.51E+06	5.81E+02	8.76E-01	6.54E+00	8.55E+00	2.92E+01	4.33E+01
299-W23-09	AVE[b]	2.42E+01	9.51E+00	8.67E+05	2.48E+02	3.53E-01	-9.60E-01	4.02E+00	-5.77E+00	2.18E+01
	MIN[c]	7.91E+00	5.12E+00	1.51E+05	2.95E+00	-2.15E-01	-9.89E+00	-2.95E+00	-4.46E+01	1.04E+01
	MAX	3.31E+01	1.17E+01	2.31E+05	6.31E+01	1.18E+00	2.07E+00	1.01E+01	3.86E+01	2.61E+01
299-W23-10	AVE	1.96E+01	8.17E+00	6.14E+04	1.47E+01	3.04E-01	-1.72E+00	3.16E+00	-1.44E+01	1.71E+01
	MIN	7.22E+00	1.98E+00	-8.27E+02	6.50E-01	-1.39E-01	-7.35E+00	-1.53E+00	-5.54E+01	8.08E+00
	MAX	3.42E+01	2.71E+02	9.95E+05		1.12E-01	7.67E+00	6.08E+00	5.64E+01	1.89E+01
299-W23-11	AVE	1.71E+01	6.63E+01	4.82E+05	NN[d]	1.12E-01	-3.07E+00	5.12E-01	2.23E+01	1.17E+01
	MIN	1.24E+01	1.80E+01	6.23E+04		1.12E-01	-1.07E+01	-1.52E+01	-2.41E+01	4.18E+00

[a] Maximum.
[b] Average.
[c] Minimum.
[d] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

9 2 1 2 4 6 6 2 1 8 5

Table 15. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-S-26 Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
					Effluent					
222-S Laboratory	AVE[a]	6.66E+00	<1.62E+01	NN[b]	NA[c]	NN	NN	NA	NN	NN
					Well					
299-W27-01	MAX[d]	1.42E+01	1.70E+01	2.67E+04	1.18E+02	1.07E+00	2.88E+00	4.22E+00	1.10E+01	6.19E+00
	AVE	9.19E+00	1.08E+01	1.62E+04	1.04E+02	3.61E-01	-4.31E+00	6.70E-01	-2.65E+01	4.64E+00
	MIN[e]	5.81E+00	6.67E+00	7.36E+03	8.72E+01	-2.35E-01	-1.82E+01	-3.56E+00	-5.25E+01	3.24E+00

[a] Average.
[b] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[c] Not available.
[d] Maximum.
[e] Minimum.

3.2.10 216-U-12 Crib

The UO_3 Plant in 200 West Area supports the operation of PUREX. The process condensate effluent stream (U-12) from this plant is discharged to the 216-U-12 crib (see fig. 10). The volume of effluent in 1986 was 1.04 E+06 gal (3.92 E+06 L).

The monitoring well for this crib is 299-W22-22 (fig. A.20 on page A-31). Average concentrations of radionuclides in this well (table 16) are below the DCG and the ACL. These concentrations are similar to those reported in 1985.

Long-term concentration history for the monitoring well at this crib, shown on page D-19 in appendix D, provides a comparison with previous operation of the crib.

3.2.11 216-W-LWC Crib

Liquid wastes from the laundry building are directed to the 216-W-LWC crib in 200 West Area (see fig. 10). This crib was placed into operation in 1981 and during 1986 received 1.17 E+07 gal (4.43 E+07 L) of effluent.

Well 299-W14-10 (fig. A.23 on page A-34) monitors this crib. Average concentrations of radionuclides and the effluent streams are listed in table 17. Concentrations were below the DCG and the ACL and similar to last year.

3.2.12 216-Z-20 Crib

The 216-Z-20 crib receives effluent (2904-ZA and 231-Z waste streams) from the 231-Z and 234-5Z Buildings. The crib is located south of the 234-5Z Building in 200 West Area (see fig. 10), and became operational in 1981. During 1985, 9.01 E+07 gal (3.41 E+08 L) was discharged to the crib.

The 216-Z-20 crib has four ground-water monitoring wells along the length of the crib, identified as 299-W18-17 through 299-W18-20 (fig. A-24, page A-35). Results of the analyses for 1986 (table 18) are all below the DCG and the ACL and similar to the low values in 1985.

Table 16. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-U-12 Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
					Effluent					
UO Plant (U-12)	AVE[a]	3.28E+03	3.72E+03	NN[b]	NA[c]	NN	NN	NA	NN	4.17E+03
					Well					
299-W22-22	MAX[d]	1.21E+00	5.04E+00	2.41E+03	2.10E+00	7.72E-01	6.88E+00	7.48E+00	5.14E+01	8.42E-01
	AVE	7.09E-01	3.94E+00	2.04E+03	8.74E-01	2.46E-01	8.70E-01	2.49E+00	-7.71E+00	5.35E-01
	MIN[e]	8.02E-02	3.09E+00	1.60E+03	2.60E-01	-2.70E-01	-7.68E+00	-2.84E+00	-1.25E+02	2.74E-01

[a] Average.
[b] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[c] Not available.
[d] Maximum.
[e] Minimum.

Table 17. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-W-LWC Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
					Effluent					
Laundry (LWC)	AVE[a]	<2.77E+01	1.76E+02	NN[b]	NA[c]	8.37E+01	<1.01E+02	NA	NN	NN
					Well					
299-W14-10	MAX[d]	8.24E+00	8.29E+00	2.50E+03	9.50E+01	1.40E+00	5.56E+00	8.48E+00	7.05E+01	
	AVE	5.68E+00	6.32E+00	1.67E+03	7.42E+01	2.44E-01	-2.80E-02	1.59E+00	-7.27E+00	NN
	MIN[e]	3.89E+00	3.05E+00	8.70E+02	6.15E+01	-3.84E-01	-6.39E+00	-5.05E+00	-5.85E+01	

[a] Average.
[b] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[c] Not available.
[d] Maximum.
[e] Minimum.

Table 18. Concentrations of Radiological Constituents and Nitrate for the Effluent and for Ground Water Near the 216-Z-20 Crib in 1986.

		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
					Effluent					
234-5 Z (2904-AZ) 231-Z (231-Z)	AVE[a]	6.92E+02	9.30E+01	NN[b]	NA[c]	NN	NN	NA	NN	NN
					Well					
299-W18-17	MAX[d]	1.98E+00	4.00E+00	3.69E+02	1.32E+00		3.10E+00	2.26E+00	1.47E+01	
	AVE	6.02E-01	3.21E+00	1.76E+02	9.50E-01	NN	-5.32E+00	4.90E-01	-3.01E+01	NN
	MIN[e]	-1.34E-02	2.53E+00	9.28E+01	5.00E-01		-2.08E+01	-3.03E+00	-8.77E+01	
299-W18-18	MAX	3.50E+00	4.16E+00	2.22E+02	3.75E+00		9.08E+00	4.52E+00	3.46E+01	
	AVE	8.06E-01	3.08E+00	7.53E+01	1.31E+00	NN	3.87E-01	-3.24E-01	-3.58E+00	NN
	MIN	-7.63E-02	1.60E+00	-5.03E+02	4.40E-01		-6.89E+00	-6.81E+00	-8.58E+01	
299-W18-19	MAX	1.67E+00	4.61E+00	3.43E+02	3.72E+00		4.66E+00	4.03E+00	4.63E+01	
	AVE	6.61E-01	3.72E+00	1.75E+02	1.83E+00	NN	-6.10E-01	5.90E-02	-2.44E+01	NN
	MIN	2.46E-01	2.85E+00	7.13E+01	7.53E-01		-5.00E+00	-5.38E+00	-9.06E+01	
299-W18-20	MAX	1.47E+00	4.56E+00	1.78E+02	4.29E+00		5.17E+00	7.89E+00	6.98E+01	
	AVE	5.76E-01	3.90E+00	1.01E+02	2.24E+00	NN	1.50E+00	3.79E+00	-5.73E+00	NN
	MIN	4.19E-02	3.47E+00	9.68E+00	4.00E-01		-2.75E+00	-3.96E+00	-4.41E+01	

[a] Average.
[b] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[c] Not available.
[d] Maximum.
[e] Minimum.

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4.0 SEPARATIONS AREA WATER-USE SUMMARY

Water for processing, sanitary use, and power generation is obtained from the Columbia River and pumped to treatment and storage facilities in the 200 East and 200 West Areas. Summaries of water use for each area are provided in tables 19 and 20. These tables also indicate the disposal facility for each waste stream. Sanitary water is disposed to ground via septic tank drainage systems near the plant buildings. Water-use data were obtained from facility processing records and estimates and from powerhouse records.

Table 19. Water-Use Summary for 200 East Area During CY 1986.

Water use	Disposal facility No.	Volume (gal)	Volume (L)
202-A process condensate[a] (PDD)	216-A-10	1.95 E+07	7.37 E+07
202-A steam condensate[a] (SCD)	216-A-30 216-A-37-2	1.35 E+08 6.74 E+07	5.10 E+08 2.55 E+08
202-A ammonia scrubber waste[a] (ASD)	216-A-36B	1.50 E+07	5.66 E+07
242-A process condensate[a] (AFPC)	216-A-37-1	1.33 E+07	5.04 E+07
241-AY, AZ Tank Farm coil condensate[a] (A08)	216-A-8	no discharge	
PUREX chemical sewer[a] (CSL)	216-B-3	4.46 E+08	1.69 E+09
PUREX cooling water[a] (CWL) 242-A cooling water[a] (ACW) 242-A steam condensate[a] (ASC) 244-AR Vault cooling water[a] (CAR) 241-A Tank Farm cooling water[a] (CA8) B Plant cooling water[a] (CBC) Powerhouse water[a] (B3 SUM)	216-B-3 216-A-25	6.02 E+09	2.28 E+10
B Plant chemical sewer[a] (BCE)	216-B-63	1.36 E+08	5.14 E+08
B Plant steam condensate[a] (BCS)	216-B-55	1.12 E+06	4.23 E+06
B Plant process condensate[a] (BCP)	216-B-62	1.03 E+06	3.89 E+06
Water Treatment Facility	216-A-25 216-B-3	9.11 E+07	3.45 E+08
Powerhouse ash sluice Baghouse cleaning	Ash Pit	8.10 E+06	3.07 E+07
Sanitary water	Misc. Tile Fields	2.40 E+07	9.10 E+07
U.S. Ecology		4.48 E+06	1.70 E+07
Total Water Use in 200 East Area in 1986		6.98 E+09	2.64 E+10

[a]Volumes from Aldrich (1987).

Table 20. Water-Use Summary for 200 West Area During CY 1986.

Water use	Disposal facility No.	Volume (gal)	Volume (L)
Redox chemical sewer[a] (S-10)	216-S-11	5.23 E+07	1.98 E+08
222-S laboratory pond[a] (207-SL)	216-S-26	1.09 E+07	4.12 E+07
242-S process condensate[a] (RC3) (Ion Exchange Column)	216-S-25	no discharge	
UO_3 Plant process condensate[a] (U-12)	216-U-12	1.04 E+06	3.92 E+06
242-S steam condensate[a] (RC1)	216-U-14	3.96 E+06	1.50 E+07
UO_3 Plant steam condensate and cooling water (207-U)	216-U-14	1.39 E+08	5.27 E+08
231-Z cooling water[a] (231-Z) 234-5Z liquid waste[a] (2904-ZA)	216-Z-20	9.01 E+07	3.41 E+08
Laundry[a] (LWC)	216-W-LWC	1.17 E+07	4.43 E+07
Powerhouse and Water Treatment Facility	Powerhouse Pond	7.53 E+07	2.85 E+08
Powerhouse ash sluice Baghouse cleaning	Ash Pit	8.10 E+06	3.07 E+07
Sanitary water	Misc. Tile Fields	2.47 E+07	9.36 E+07
T Plant drain flush and head-end wastes	216-T-1	6.14 E+04	2.32 E+05
221-T cold chemical drain and compressor	216-T-4-2	5.07 E+06	1.92 E+07
Total Water Use in 200 West Area in 1986		4.22 E+08	1.60 E+09

[a]Volumes from Aldrich (1987).

9 3 1 2 6 6 4 2 1 2 9

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5.0 INACTIVE DISPOSAL SITES

Liquid waste disposal sites that no longer receive wastes are monitored for changes which would indicate a potential problem. While no concentration guidelines exist for inactive sites, concentrations of ground-water samples are compared with the DCG and the ACL for reference purposes. Historically, samples from two disposal sites, the 216-B-5 reverse well and the 216-S-1/2 cribs, yield concentrations greater than the Rockwell guidelines. Three other inactive sites containing elevated concentrations of uranium, the 216-U-1/2 cribs, the 216-U-10 pond and the 216-U-16 crib are discussed in this section. The 216-U-10 Pond was deactivated in late 1984 after being the major source of ground-water recharge in the 200 West Area, but the ground-water mound remains. Monitoring results for wells near other inactive liquid disposal sites are reported in appendix B.1.

5.1 INACTIVE 216-B-5 REVERSE WELL

A reverse well at the Hanford Site is a well that received liquid waste for disposal to ground. The 216-B-5 well discharged waste to the water table from 1945 to 1947. This reverse well is located northeast of the 221-B Building in 200 East Area (see fig. 12 and fig. A.12, page A-23), and received waste from this building.

A characterization study (Smith 1980) determined the concentration and distribution of radionuclides in the sediments surrounding the well. This study, in addition to gamma logs in various wells, indicates that the contamination has remained within 40 ft (12 m) of the well. The results of ground-water monitoring of well 299-E28-23 in 1986 (table 21A) reveal no significant changes. Quarterly monitoring yielded an average ^{90}Sr concentration of 5.58 E+03 pCi/L versus 6.95 E+03 pCi/L in 1985 (Law et al. 1986), and a ^{137}Cs average concentration of 2.01 E+03 pCi/L versus 3.57 E+03 pCi/L in 1985. Both ^{90}Sr and ^{137}Cs exceeded the DCG and ACL. Uranium analyses were initiated this year and the average uranium concentration exceeded the ACL but was below the DCG. Analyses of samples for plutonium indicated average concentrations of 0.02 pCi/L and 6.92 pCi/L, respectively, for ^{238}Pu and $^{239,240}Pu$ (table 21B). These concentrations are below both the DCG and ACL.

5.2 INACTIVE 216-S-1/2 CRIBS

The 216-S-1/2 cribs received waste from the 202-S Building from 1952 to 1956. Elevated ^{90}Sr concentrations have been observed since that period. A study (Van Luik and Smith 1982) of the concentration and distribution of contaminants indicated that the contaminants were held on sediments near the bottom of the crib. This investigation also concluded that the contamination was due to a break in a well casing within the crib. Strontium-90 has been decreasing with time and the concentrations from quarterly sampling of well 299-W22-1 averaged 2.98 E+01 pCi/L in 1986 versus

Table 21A. Concentrations of Radiological Constituents and Nitrate for Ground Water Near the Inactive 216-B-5 Reverse Well in 1986.

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
299-E28-23	MAX[a]	6.75E+01	1.30E+04	7.33E+03	1.58E+01	6.14E+03	2.16E+03	1.51E+01	6.36E+01	4.45E+01
	AVE[b]	5.49E+01	1.16E+04	5.51E+03	1.34E+01	5.58E+03	2.01E+03	9.73E+00	4.83E+00	3.35E+01
	MIN[c]	4.13E+01	9.01E+03	4.41E+03	1.14E+01	4.94E+03	1.83E+03	3.03E+00	-1.14E+02	2.53E+01

[a]Maximum.
[b]Average.
[c]Minimum.

Table 21B. Isotopic Plutonium Concentrations in Well 299-E28-23 at the Inactive 216-B-5 Reverse Well.

Isotope	Sample date		Concentration (pCi/L)
^{238}Pu	April 30, 1986		0.01
	August 11, 1986		0.03
		Average:	0.02
$^{239,240}Pu$	April 30, 1986		2.84
	August 11, 1986		11.00
		Average:	6.92

the 1985 average of 1.42 E+02 pCi/L, which is below the DCG but greater than the ACL. The present ^{90}Sr concentrations are three orders of magnitude below those measured during the 1970s. Monitoring results for the two monitoring wells, 299-W22-1 and 299-W22-2 (fig. A.15, page A-26), are listed in table 22.

5.3 INACTIVE 216-U-1/2 CRIBS

The 216-U-1/2 cribs are located southwest of the 221-U Building in the south-central part of the 200 West Area (see fig. 10). These cribs received waste from the 221-U and 224-U Buildings from 1952 to 1967.

In early 1985, it was discovered that uranium concentrations in one of the monitoring wells increased abruptly to 72,000 pCi/L. Subsequent investigation revealed that the contamination resulted from the combination of past use of this crib and the activation in 1984 of the 216-U-16 crib. Remedial action consisted of grout sealing of three wells and pumping of ground water to remove uranium through an ion exchange process. Four additional monitoring wells were constructed. The details of these activities were discussed in Law and Schatz (1986) and Delegard et al. (1986).

The cribs are now monitored by seven wells (see fig. A.18 on page A-29 for location); a list of these wells and a summary of 1986 monitoring is provided in table 23A. The uranium concentrations in the wells exceed the DCG and ACL but other radionuclides are below both of these guidelines. Ground-water transport modeling indicates that the concentration of uranium is expected to be below the DCG when it reaches the Columbia River. Isotopic uranium results for 1986 are listed in table 23B. Figure 18 illustrates the decline in uranium concentrations in well 299-W19-11 as a result of the pumping and treatment action. This well had the highest initial uranium concentration, and it was also close to the pumped well and exhibited a maximum response to pumping. The uranium concentration in the

Table 22. Concentrations of Radiological Constituents and Nitrate for Ground Water Near the Inactive 216-S-1/2 Cribs in 1986.

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
299-W22-01	MAX[a]	5.22E+00	4.39E+01	7.16E+02	4.72E+00	4.23E+01	8.55E+00	2.02E+00	7.23E+00	NN[d]
	AVE[b]	4.57E+00	3.23E+01	4.93E+02	4.00E+00	2.98E+01	1.43E+00	-3.56E+00	-1.63E+01	
	MIN[c]	3.89E+00	2.38E+01	2.77E+02	3.61E+00	1.82E+01	-2.56E+00	-1.41E+01	-2.96E+01	
299-W22-02	MAX	6.64E+00	1.57E+01	1.47E+03	3.74E+00	5.32E+00	3.20E+00	4.04E+00	2.01E+01	NN
	AVE	5.88E+00	1.29E+01	8.35E+02	3.49E+00	4.31E+00	1.89E+00	2.01E+00	-1.23E+01	
	MIN	5.27E+00	1.05E+01	4.45E+02	3.33E+00	3.31E+00	3.33E-01	-7.02E-01	-5.43E+01	

[a] Maximum.
[b] Average.
[c] Minimum.
[d] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

Table 23A. Concentrations of Radiological Constituents and Nitrate for Ground Water Near the Inactive 216-U-1/2 Crib in 1986.

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
	MAX[a]	1.39E+04	1.03E+04	1.00E+03	1.37E+02		2.88E+00	6.06E+00	3.45E+01	1.39E+04
299-W19-03	AVE[b]	9.27E+03	6.60E+03	9.05E+02	1.08E+02	NN[d]	1.96E+00	4.30E+00	-7.90E+00	8.44E+03
	MIN[c]	4.86E+03	8.76E+02	8.10E+02	6.33E+01		1.28E+00	2.79E+00	-6.36E+01	3.28E+03
	MAX	1.62E+04	1.23E+04		2.21E+02					1.59E+04
299-W19-09	AVE	9.76E+03	8.26E+03	NN	1.51E+02	NN	NN	NN	NN	9.20E+03
	MIN	3.29E+03	4.92E+03		7.57E+01					5.52E+03
	MAX	2.04E+04		1.54E+03	1.75E+02		1.34E+01	3.90E+00	0.00E+00	2.74E+04
299-W19-11	AVE	1.23E+04	NN	8.53E+02	1.25E+02	NN	5.08E+00	3.76E-01	-3.76E+01	1.20E+04
	MIN	7.62E+03		1.66E+02	3.40E+01		-6.40E+00	-2.10E+00	-1.06E+02	7.47E+03
	MAX	5.48E+03	3.25E+03		1.90E+02					2.38E+04
299-W19-15	AVE	2.37E+03	1.94E+03	NN	1.12E+02	NN	NN	NN	NN	2.79E+03
	MIN	4.12E+02	3.88E+02		2.78E+01					4.41E+02
	MAX	8.59E+03	8.58E+03		2.41E+02					8.42E+03
299-W19-16	AVE	4.45E+03	4.68E+03	NN	1.50E+02	NN	NN	NN	NN	4.32E+03
	MIN	2.16E+03	1.12E+03		1.00E+02					2.01E+03
	MAX	8.98E+03			8.68E+01					1.10E+04
299-W19-17	AVE	1.55E+03	NN	NN	2.18E+01	NN	NN	NN	NN	1.58E+03
	MIN	5.84E+01			8.45E+00					5.77E+01
	MAX	9.14E+03			8.68E+02					1.03E+04
299-W19-18	AVE	7.17E+03	NN	NN	5.34E+02	NN	NN	NN	NN	7.32E+03
	MIN	3.11E+01			2.21E+02					3.39E+03

[a] Maximum.
[b] Average.
[d] Minimum.
[c] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

Table 23B. Isotopic Uranium Concentrations in Monitoring Wells Near the 216-U-1/2 Cribs.

Well No.	Sample Date	^{234}U (pCi/L)	^{235}U (pCi/L)	^{238}U (pCi/L)
299-W19-9	2/14/86	5,810	295	5,950
299-W19-11	2/14/86	9,340	387	9,920
299-W19-16	2/14/86	2,620	76.2	2,590
299-W19-17	2/14/86	3,370	209	3,430
299-W19-18	2/14/86	4,480	206	4,590

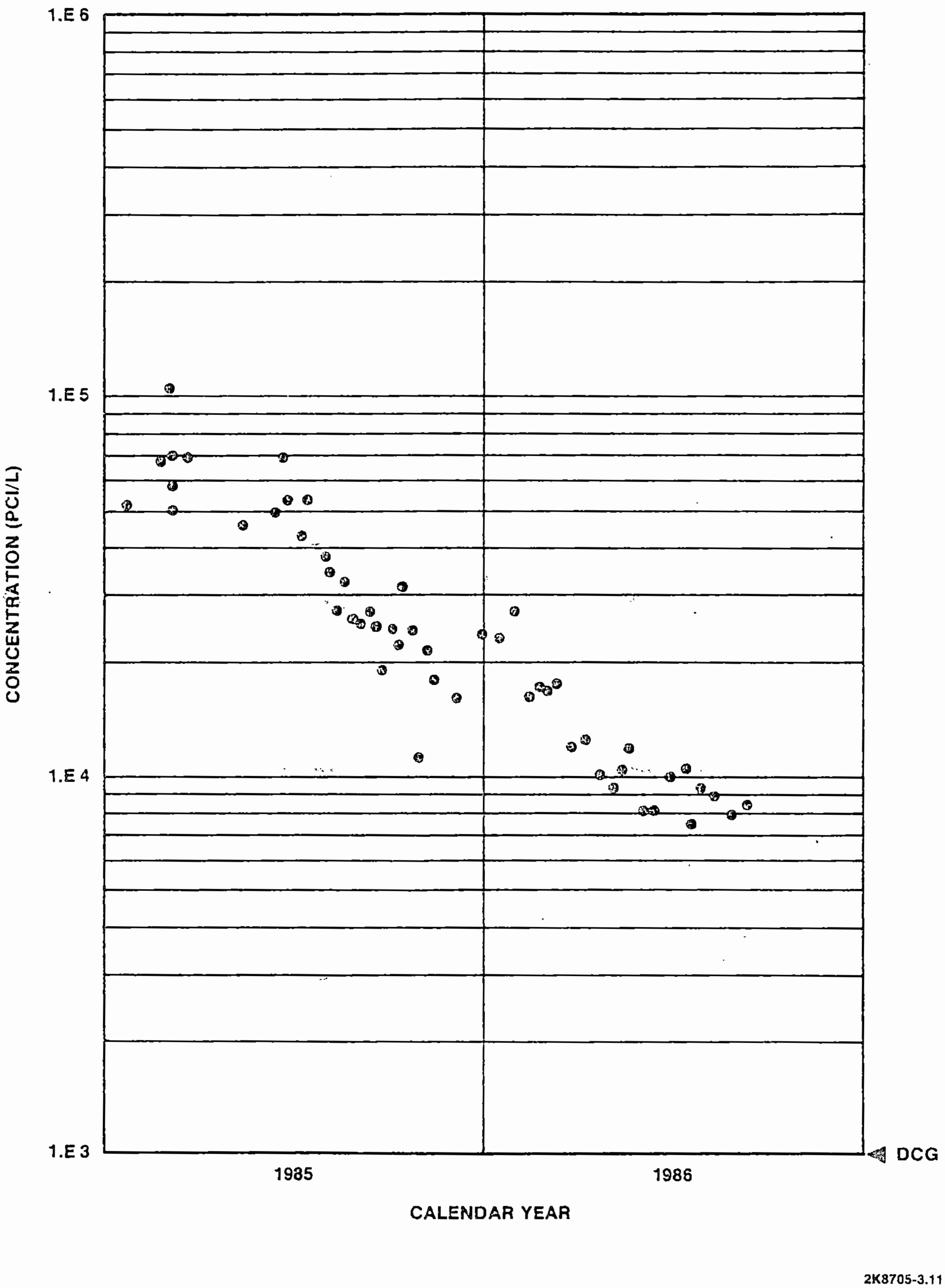

Figure 18. Concentration History of Total Uranium in Well 299-W19-11 at the 216-U-1/2 Cribs.

9 2 1 2 4 6 2 2 0 1

farthest downgradient well, 299-W19-18, trended upward in 1986 as indicated in figure 19. The need for additional remedial action is now being evaluated by Rockwell and a recommendation is forthcoming.

5.4 INACTIVE 216-U-10 (U Pond)

The 216-U-10 pond was deactivated in December 1984, after 40 yr of operation. The pond, located in the southwest corner of 200 West Area (see fig. 10), was removed from service to remove the driving force acting on the contaminated sediments of the pond bottom and as a water conservation measure.

The 1986 ground-water monitoring results for the three monitoring wells 299-W18-15, 299-W23-11, and 699-35-78A (see fig. A.19, page A-30) is summarized in table 24. Average concentrations of radionuclide constituents are below the DCG and the ACL with the exception of uranium, which is above the internal ACL. Elevated uranium concentrations were reported for 1984 and 1985 (Law et al. 1986; Law and Schatz 1986) and similar results are observed in 1986. Average uranium concentrations observed in the monitoring wells ranged between 12.2 pCi/L and 21.8 pCi/L, above the ACL of 10 pCi/L.

Uranium in the ground water at U pond also resulted in elevated concentration just above the ACL in well 299-W23-4 (appendix B.1) at the inactive 216-S-21 crib. The concentrations at all constituents in this well were below the DCG.

5.5 INACTIVE 216-U-16 CRIB

Between July 1984 and February 1985, the 216-U-16 crib received steam condensate waste, chemical sewer waste, and cooling water from 224-U and 221-U Plants. The crib is located southwest of 221-U Plant in the south-central part of 200 West Area (see fig. 10). Operation of the crib was terminated upon discovery of the uranium contamination at the nearby 216-U-1/2 cribs.

The crib is monitored by wells 299-W19-13 and 299-W19-14 (fig. A.22 on page A-33). Ground-water monitoring data for this crib in 1986 are summarized in table 25. All radionuclides are below the DCG and the ACL with the exception of uranium. This uranium concentration is just over the ACL in well 299-W19-13, which is closest to the 216-U-1/2 cribs.

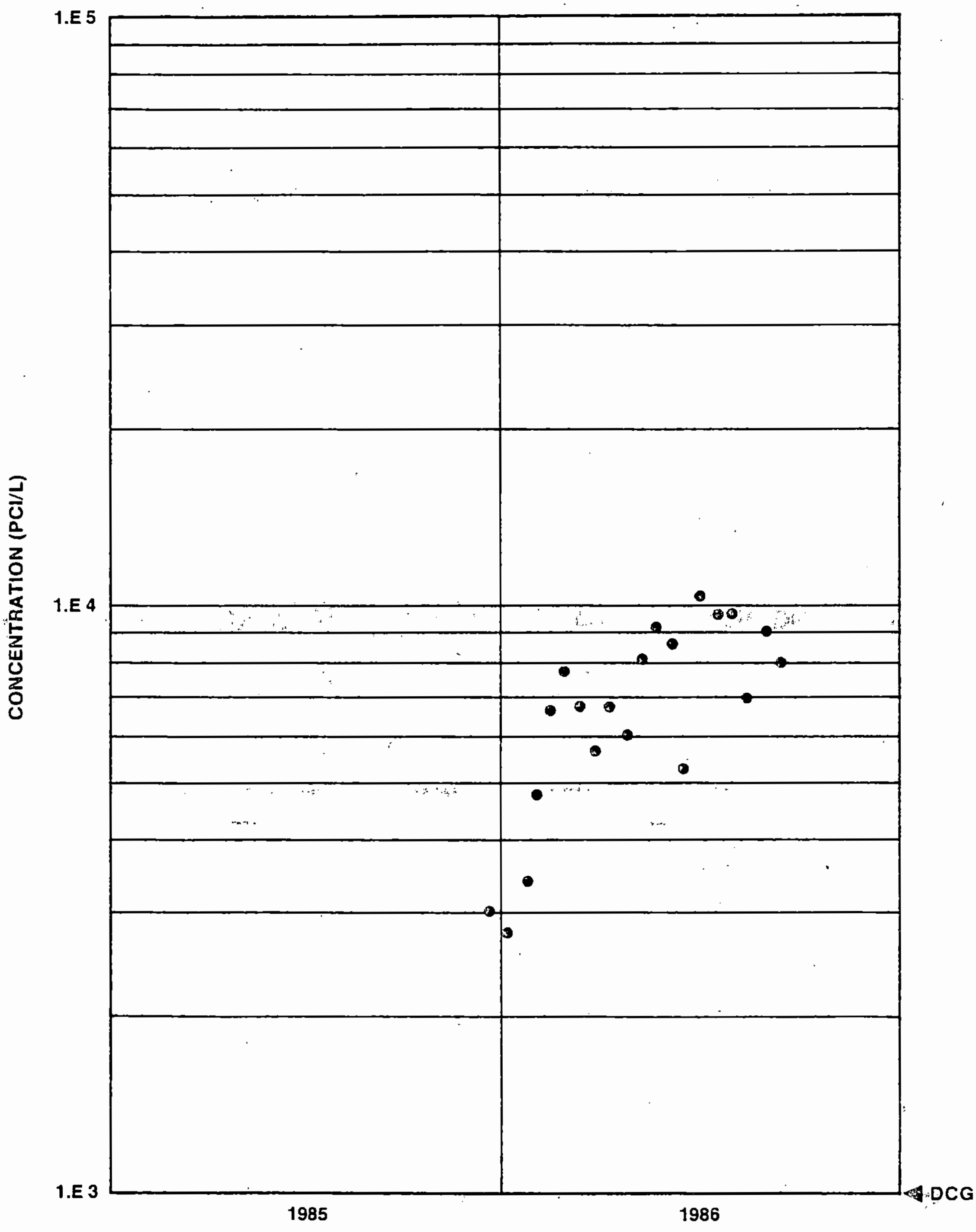

Figure 19. Concentration History of Total Uranium in Well 299-W19-18 at the 216-U-1/2 Cribs.

Table 24. Concentrations of Radiological Constituents and Nitrate for Ground Water Near the Inactive 216-U-10 Pond in 1986.

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
	MAX[a]	5.65E+01	2.17E+01	5.39E+02	5.41E+00		4.95E+00	6.10E+00	5.30E+01	4.64E+01
299-W18-15	AVE[b]	5.00E+01	1.44E+01	1.22E+02	1.60E+00	NN[d]	9.64E-01	2.53E+00	5.14E+00	3.73E+01
	MIN[c]	4.58E+01	9.67E+00	-3.16E+02	8.30E-01		-9.07E+00	-2.53E+00	-3.46E+01	2.00E+01
	MAX	3.42E+01	2.71E+02	9.95E+05		1.12E-01	7.67E+00	6.08E+00	5.64E+01	1.89E+01
299-W23-11	AVE	1.71E+01	6.63E+01	4.82E+05	NN	1.12E-01	-3.07E+00	5.12E-01	2.23E+01	1.17E+01
	MIN	1.24E+01	1.80E+01	6.23E+04		1.12E-01	-1.07E+01	-1.52E+01	-2.41E+01	4.18E+00
	MAX	1.01E+01	5.33E+00	3.20E+02	1.14E+00		5.51E+00	8.55E+00	4.62E+01	1.13E+01
699-35-78A	AVE	8.35E+00	4.36E+00	1.32E+02	6.15E-01	NN	-1.55E+00	5.83E-01	4.46E+00	6.79E+00
	MIN	6.00E+00	3.12E+00	-1.03E+02	3.90E-01		-1.11E+01	-1.13E+01	-4.88E+01	4.05E+00

[a] Maximum.
[b] Average.
[c] Minimum.
[d] Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

Table 25. Concentrations of Radiological Constituents and Nitrate for Ground Water Near the Inactive 216-U-16 Pond in 1986.

Well No.		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (pCi/L)
299-W19-13	MAX[a]	2.24E+01	1.92E+01	3.45E+02	2.67E+01	1.08E+00	8.32E+00	6.09E+00	5.48E+01	1.90E+01
	AVE[b]	1.59E+01	1.23E+01	5.40E+01	2.21E+01	3.61E-01	2.91E+00	5.93E-01	1.79E+00	1.22E+01
	MIN[c]	1.00E+01	6.11E+00	-4.31E+02	1.23E+01	1.03E-01	-3.42E+00	-3.53E+00	-3.76E+01	6.37E+00
299-W19-14	MAX	6.01E+00	1.63E+01	3.91E+02	1.52E+01	1.14E+00	9.46E+00	5.38E+00	7.32E+01	4.90E+00
	AVE	4.30E+00	8.74E+00	7.08E+01	8.28E+00	3.31E-01	1.03E+00	-1.76E+00	3.26E+00	3.14E+00
	MIN	2.99E+00	5.54E+00	-3.40E+02	4.53E+00	-1.71E-01	-9.96E+00	-1.21E+01	-1.25E+02	1.75E+00

[a] Maximum.
[b] Average.
[c] Minimum.

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6.0 CONCENTRATION PLUME MAPS

Isopleth maps have been prepared to illustrate the spatial distribution of the average concentration of several ground-water constituents in relation to processing facilities in the Separations Area. Two sets of maps have been prepared: one focuses on the Separations Area, the other addresses the region that is influenced by waste disposal operations, termed the affected area. Rockwell data has been supplemented with PNL data in the 600 Area for the construction of the maps.

Plume maps have been prepared for average concentrations of tritium and nitrate, since the high mobilities associated with these constituents indicate the maximum extent of contaminant migration. A map of the extent of total beta contamination has been prepared for the Separations Area only. The total beta concentration has decayed downgradient from the Separations Area, thus an affected area map was not appropriate.

6.1 TOTAL BETA

The total beta map for the Separations Area (fig. 20) shows the 100, 1,000, and 10,000 pCi/L isopleths. Total beta is restricted to a few locations within the 200 East and 200 West Areas. In the 200 East Area, total beta is greater than 1,000 pCi/L near the 241-BX Tank Farm and the 216-BY cribs, and greater than 10,000 pCi/L at the inactive 216-B-5 reverse well site. In the 200 West Area, total beta concentrations exceeding 1,000 pCi/L are located around the 216-S crib area and 216-U-1/2 cribs. Total beta at the latter site is associated with the uranium concentration there (see section 5.3). The total beta isopleth in 1986 were similar to those in 1985.

6.2 TRITIUM

Maps depicting tritium concentrations of the Separations Area and the affected area are shown in figures 21 and 22, respectively. Tritium isopleths for 20,000; 200,000; and 2,000,000 pCi/L are shown in these figures. The 2,000,000 pCi/L isopleth is equal to the DCG.

The tritium plume map for the Separations Area (see fig. 21) shows tritium from five sources: the inactive 216-S and 216-T crib areas and the 216-U-10 pond in 200 West Area; and the active 216-A and 216-B-55 cribs in 200 East Area.

In 200 West Area, the plume from the 216-S crib area is moving eastward and the plume from the 216-T Crib area is moving northward, both of which are caused by radial flow from the ground-water mound beneath the deactivated U Pond (see fig. 2). The large plume from the southeast corner of 200 West Area emanates from past operations in 200 West Area. Elevated tritium concentrations in the southeast corner of 200 East Area, around the 216-A crib area south of PUREX, reflect recent operations and exhibit a

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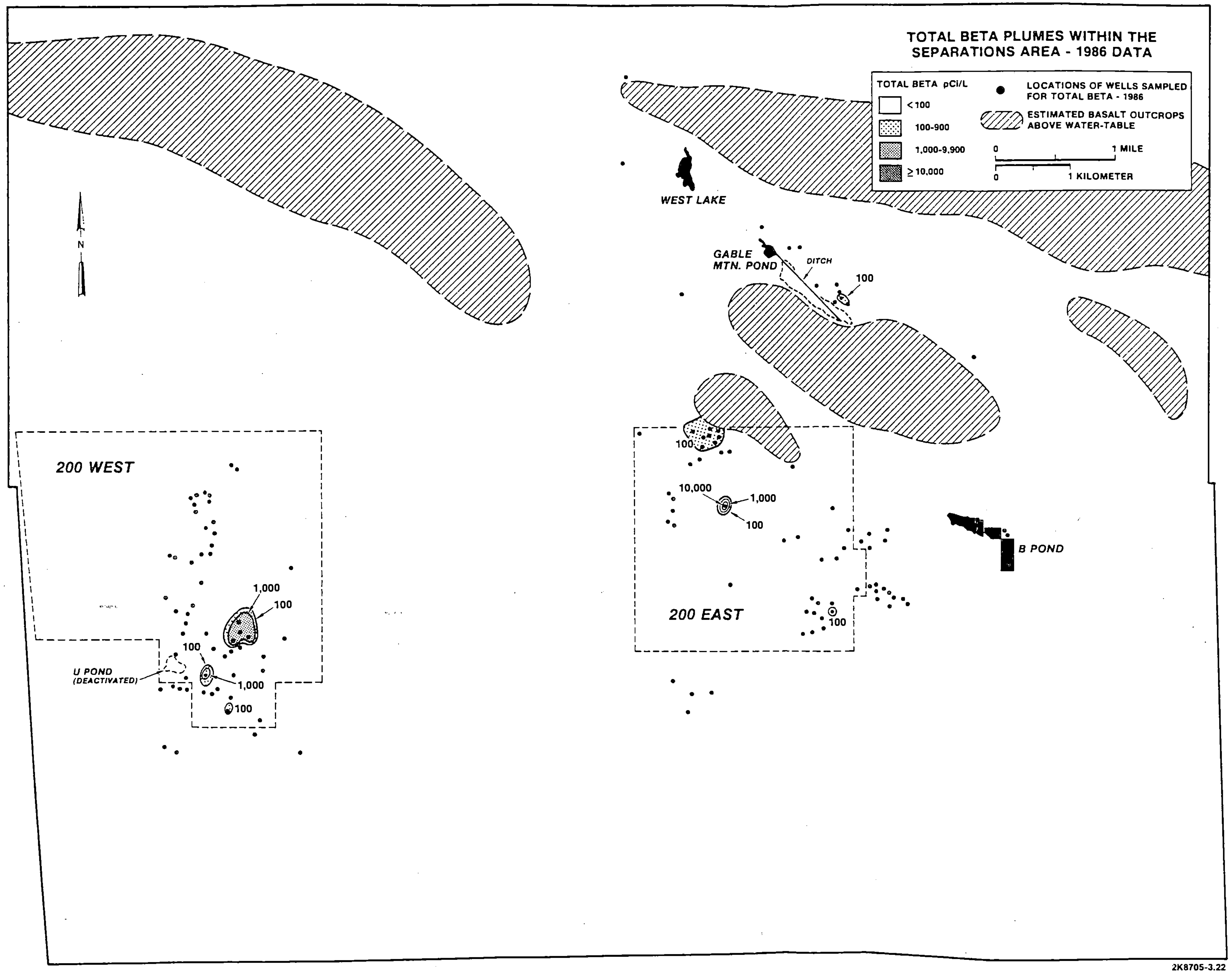

Figure 20. Total Beta Plume Map for the Separations Area, 1986.

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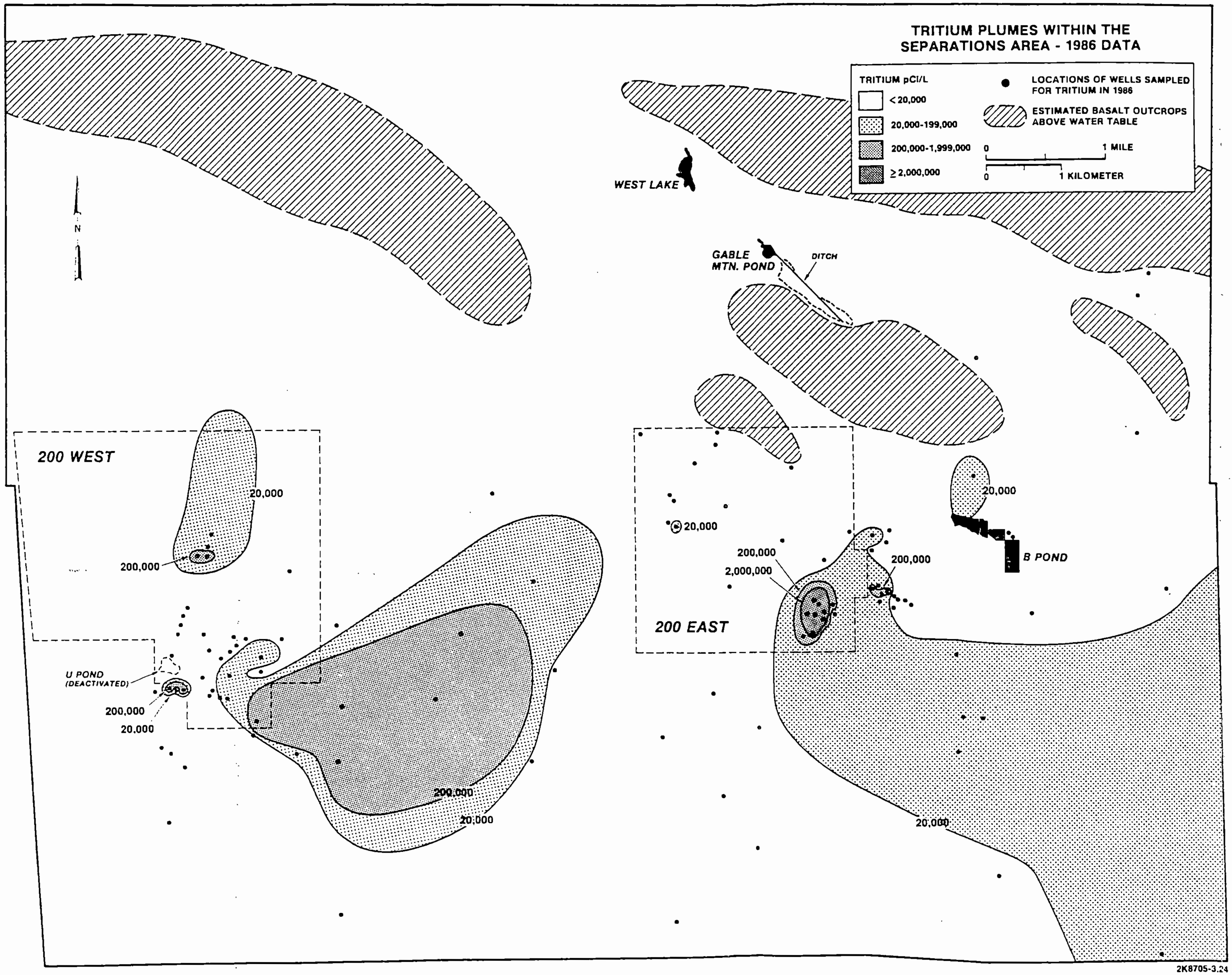

Figure 21. Tritium Plume Map for the Separations Area, 1986.

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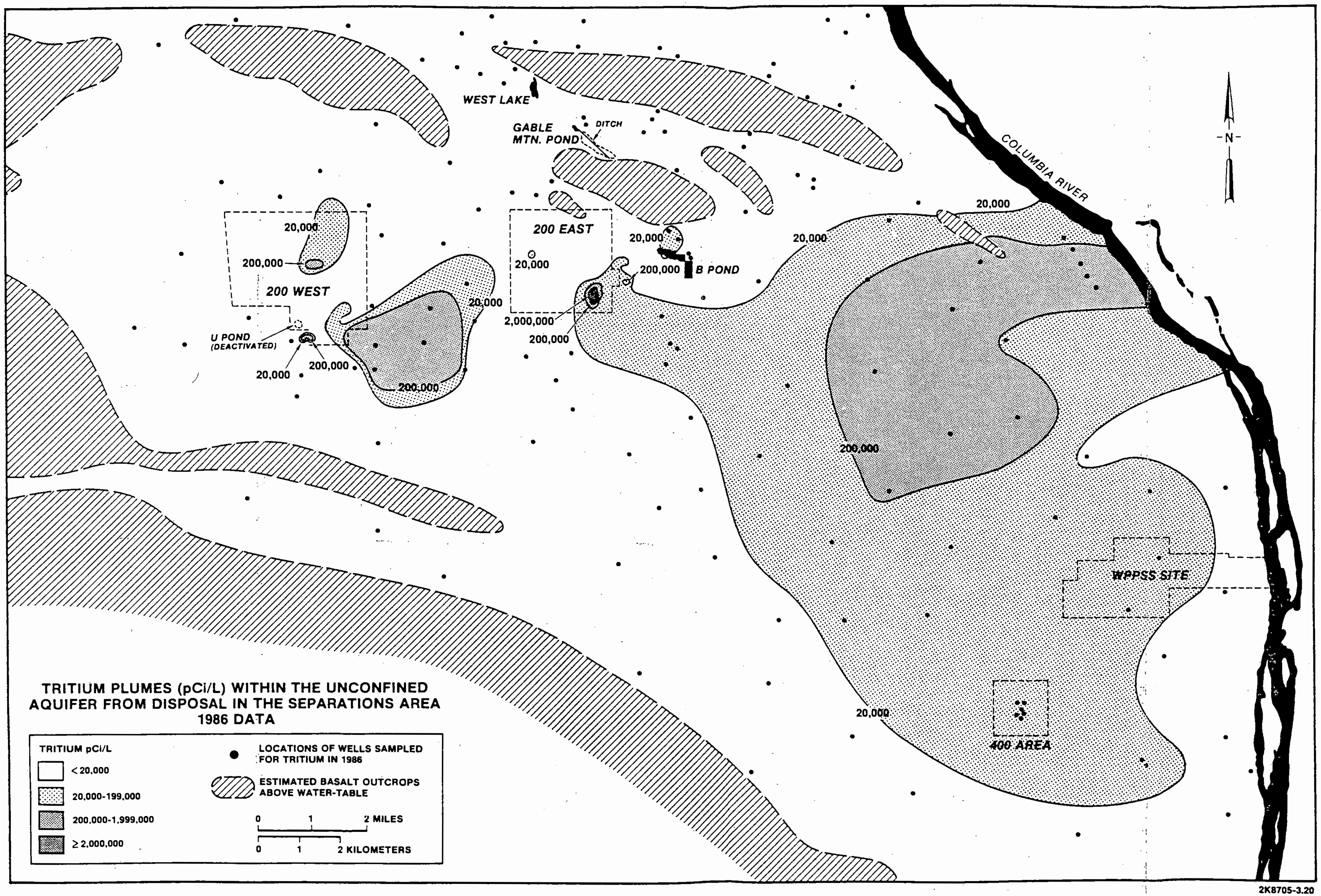

Figure 22. Tritium Plume Map for the Affected Area, 1986.

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slightly larger area in 1986 over 1985. Figure 21 reveals that the tritium plume in the southeast corner of the 200 East Area extends southeasterly in a continuous manner toward the Columbia River. The tritium plume from prior operations in 200 East Area has moved eastward and divided into two lobes: one moving eastward to the Columbia River and the other moving southeasterly toward the 400 Area (see fig. 22).

6.3 NITRATE

Figure 23 shows the nitrate plume for the Separations Area. Nitrate (reported as nitrate) isopleths have been constructed for 5, 10, 20, and 45 mg/L. The greatest concentrations of nitrate in 200 East Area surround the 216-A cribs, 216-B-62 crib, and the 216-BY cribs. In 200 West Area, the highest concentrations result from disposal to the 216-T cribs, 216-Z cribs, 216-U-1/2 cribs, and the 216-W-LWC crib. The nitrate isopleths in 200 East and 200 West Areas in 1986 were similar to those in 1985 within the limitations of the data available. PNL did not have nitrate data for 1985 so it was not possible to construct the isopleths for the Separations Area in 1985. The general flow pattern of the nitrate plume from the 200 Areas conforms to the general tritium plume flow pattern.

Nitrate concentrations for the affected area are shown in figure 24. Concentrations of nitrate exceeding 45 mg/L (equivalent to the drinking water standard) southeast from the 200 East Area are the result of past operations in 200 East Area.

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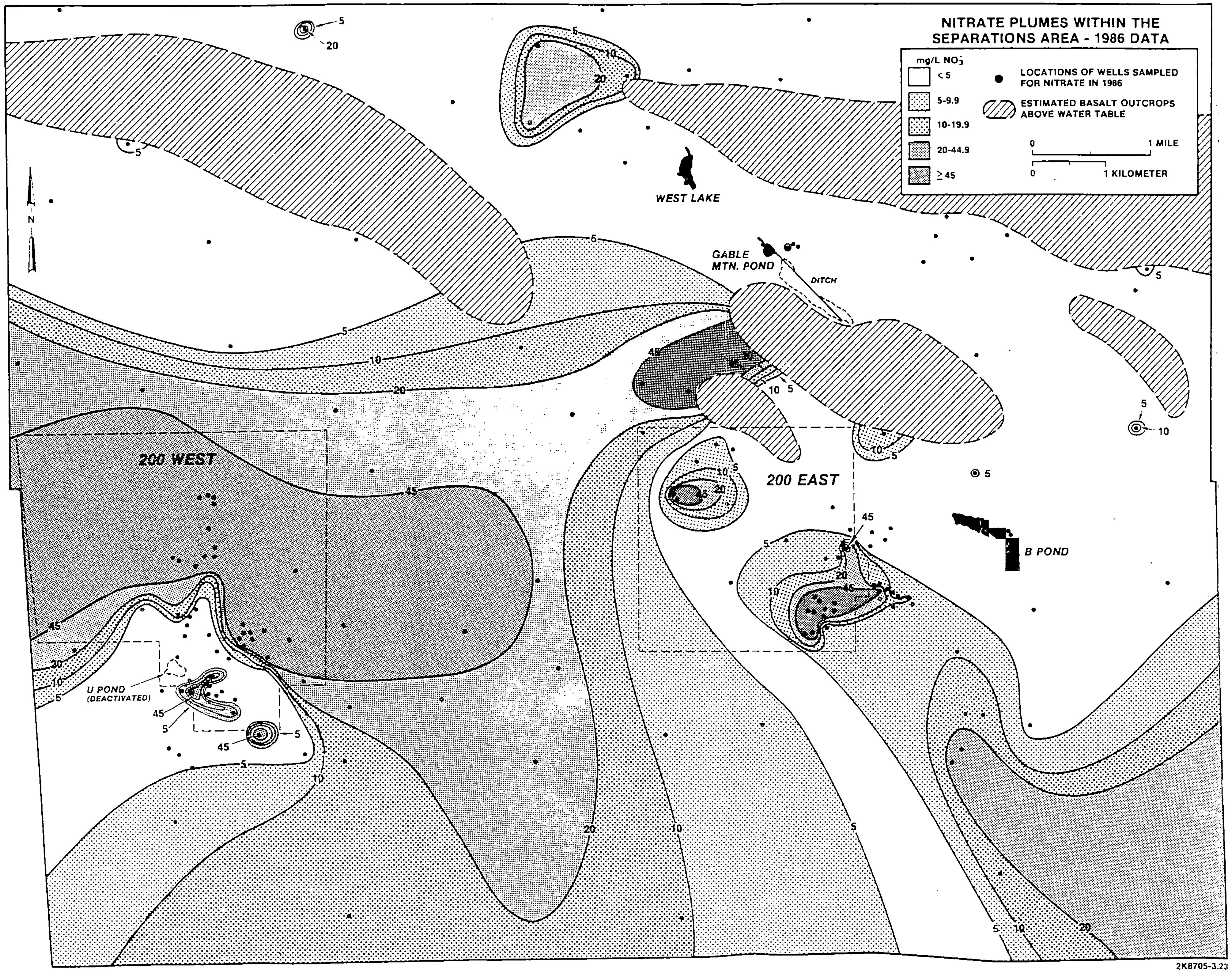

Figure 23. Nitrate Plume Map for the Separation Area, 1986.

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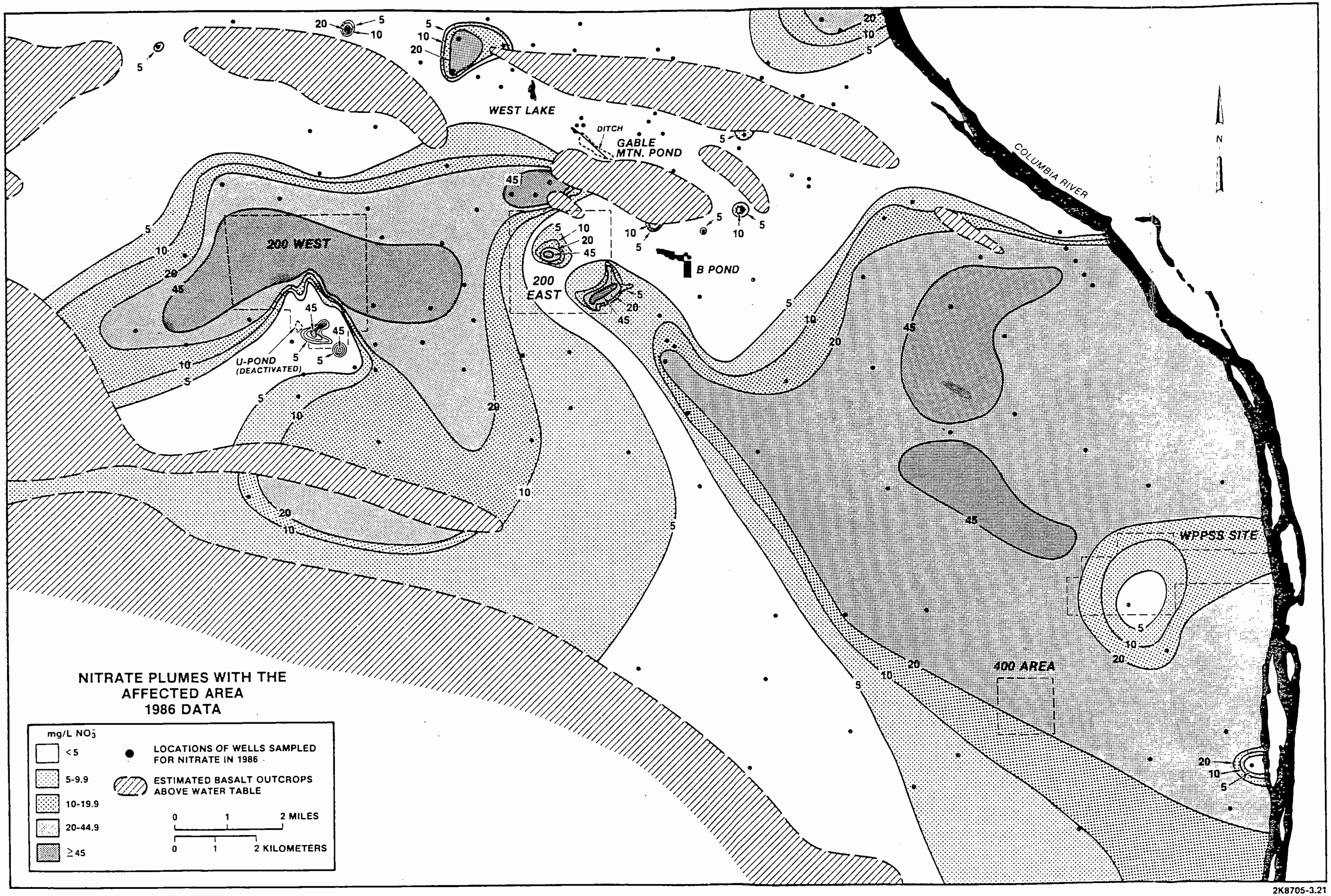

Figure 24. Nitrate Plume Map for the Affected Area, 1986.

7.0 SPECIAL GROUND-WATER SAMPLE ANALYSES

Special sampling for ^{99}Tc and ^{129}I analyses was continued in 1986. The ^{129}I analyses were conducted to monitor the cribs associated with the operation of PUREX and to monitor elevated ^{129}I concentrations associated with past operations. The ^{129}I samples were collected from four wells at three PUREX cribs, one well at a B Plant crib, and a well downgradient from 200 West Area. The ^{99}Tc analyses were run on samples collected from two wells in 200 East Area and one well in 200 West Area that exhibited elevated total beta readings.

The results of the special radionuclide sampling are listed in table 26. The 1986 results for ^{129}I at the 216-A-10 crib and 216-A-36 B crib have increased over those for 1985, when well 299-E17-1 was 23.6 pCi/L, well 299-E24-2 was 17.5 pCi/L and well 299-E17-9 was 27.4 pCi/L, these results being averages of about 6 samples. All ^{129}I samples from wells at cribs were below the DCG and the ACL. However, the well downgradient from 200 West Area, well 699-35-70 (see fig. A.2 in appendix A for well location) exceeded the Rockwell ACL while remaining below the DCG; the concentration has increased since 1985 when the average of two samples was 63 pCi/L. The ^{129}I is from prior processing operations in the 200 West Area.

The results for the ^{99}Tc analyses are below both the DCG and the ACL for all three wells.

Table 26. Special Radionuclide Analyses of Ground-Water Samples in 1986.

Disposal Facility	Well No.	^{129}I Concentration (pCi/L)	^{99}Tc Concentration (pCi/L)
216-A-10	299-E17-1 299-E24-2	29.4 39.1	NA[a]
216-A-36B	299-E17-9	31.6	NA
216-A-37-1	299-E25-20	1.53	NA
216-B-62	299-E28-21	0.76	NA
200 West Area	699-35-70	101.8	NA
216-B-44,45,46	299-E33-3	NA	2,710
216-B-48,49,50	299-E33-7	NA	3,660
216-S-3	299-W23-1	NA	8,250 7,330

[a]NA - no analyses performed.

8.0 AQUIFER INTERCOMMUNICATION

The Elephant Mountain Member, the uppermost basalt in the Saddle Mountains Formation, serves as the bottom of the unconfined aquifer and the confining layer of the underlying Rattlesnake Ridge interbed. This sedimentary interbed is considered to be the uppermost confined aquifer in the Separations Area at the Hanford Site.

A report (Graham et al. 1984) identifies areas of complete erosion of the Elephant Mountain basalt near West Lake and well 699-54-57, and suspected erosion near well 699-47-50 (fig. 25). A potential for downward migration of water from the unconfined aquifer to the confined aquifer, or aquifer intercommunication, exists if the water table of the unconfined aquifer is above the potentiometric surface of the confined aquifer in places where the confining stratum is permeable or missing.

Aquifer intercommunication could result in contamination being introduced into the Rattlesnake Ridge confined aquifer. The report by Graham et al. (1984) concluded that a downward gradient in the eroded areas did not exist in June 1982.

Monitoring of water levels in the unconfined and confined aquifer continued in 1986, along with sample collection and analyses for the tracer constituents tritium and nitrate.

Results of the confined aquifer sampling program are given in appendix B.2. Well locations are shown in figure 25. Nitrate concentrations are low, with a maximum of 1.40 E+00 ppm and a minimum of 4.00 E-02 ppm. Tritium concentrations are also low, ranging from 4.19 E+02 pCi/L to values less than background. These tritium results are not directly comparable with those of Graham et al. (1984), since the analytical methods employed for the routine analysis reported herein are not as sensitive as those employed for the previous investigation. The tritium concentration of 142 pCi/L in well 699-42-40C is higher than previously observed and may indicate intercommunication. However, this interpretation must await further analyses with a lower detection limit for tritium.

A comparison of the water table of the unconfined aquifer and the potentiometric surface of the confined aquifer, based on December 1986 measurements, is depicted in figure 25. The area with a downward hydraulic gradient east of 200 East Area is reduced from that reported for December 1985 (Law and Schatz 1986). However, well 699-42-40C is located in this area, which reinforces the need for tritium analyses with a lower detection limit.

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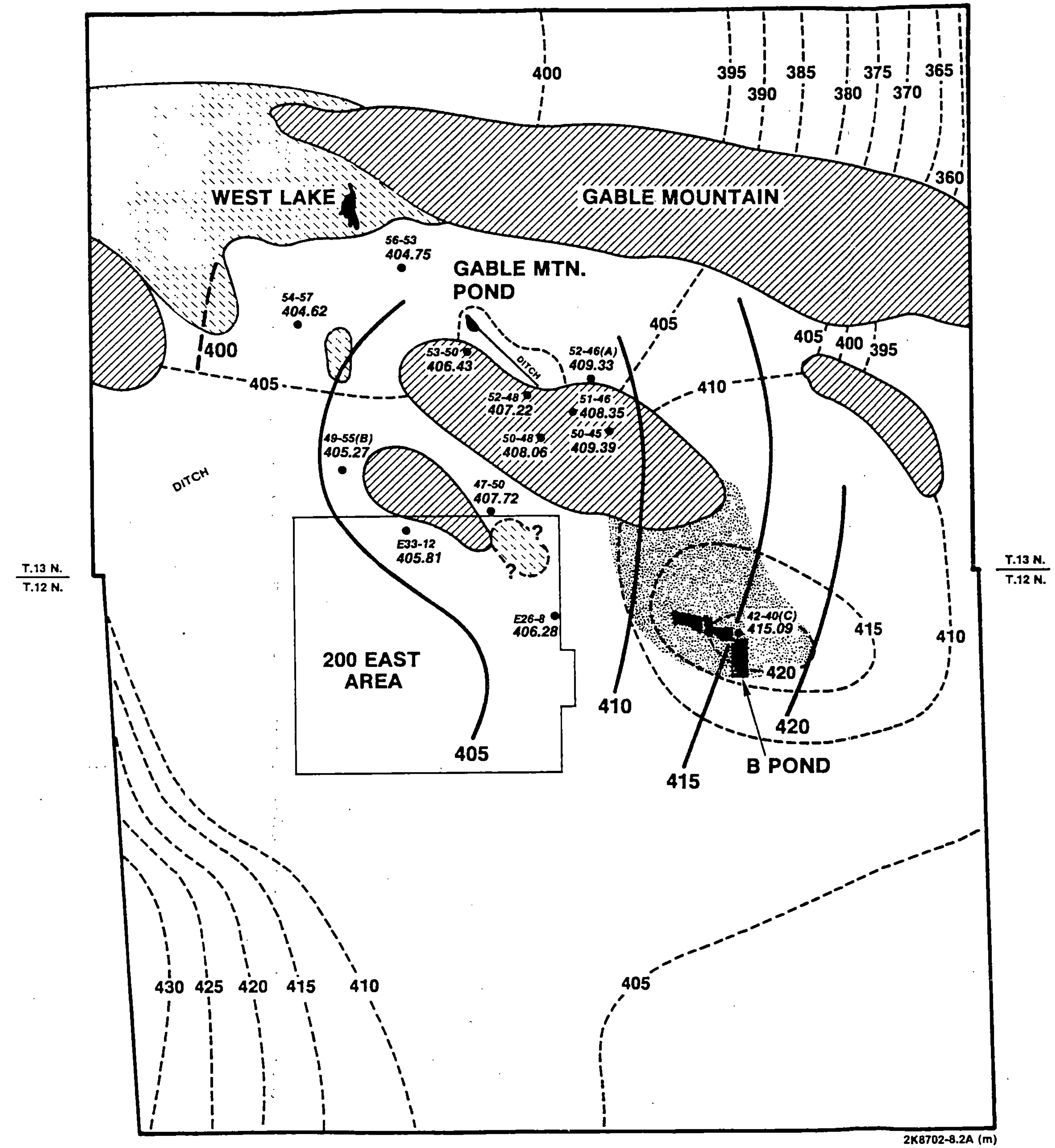

Rockwell International

Rockwell Hanford Operations

SD-WM-TI-273, REVISION 1
RHO-RE-SR-86-65 DEC P

COMPARISON OF POTENTIOMETRIC SURFACE OF THE RATTLESNAKE RIDGE CONFINED AQUIFER WITH THE WATER TABLE OF THE UNCONFINED AQUIFER

DECEMBER 1986

—400— POTENTIOMETRIC SURFACE OF THE RATTLESNAKE RIDGE IN FEET ABOVE MEAN SEA SEVEL (ft MSL)

--- 420 --- WATER-TABLE CONTOURS IN FEET ABOVE MEAN SEA LEVEL (ft MSL)

AREAS OF COMPLETE EROSION OF THE ELEPHANT MOUNTAIN BASALT (from RHO-RE-ST-12)

AREAS OF DOWNWARD HYDRAULIC GRADIENT

53-50 ● CONFINED WELLS USED IN PREPARATION OF MAP

POND

BASALT OUTCROPS ABOVE WATER TABLE, AS INFERRED 6/1984

THE RATTLESNAKE RIDGE AQUIFER, WHICH IS CONFINED BY THE ELEPHANT MOUNTAIN BASALT, IS MONITORED QUARTERLY IN THE EASTERN PORTION OF THE SEPARATIONS AREA. THE DECEMBER 1986, WATER-LEVEL MEASUREMENTS IN 13 WELLS COMPLETED IN THE RATTLESNAKE RIDGE INTERBED WERE USED TO CONTOUR THE POTENTIOMETRIC SURFACE OF THE AQUIFER. AREAL EXTENT OF DOWNWARD HYDRAULIC GRADIENT FROM THE UNCONFINED AQUIFER TO THIS CONFINED AQUIFER IS INFERRED FROM THE WATER-TABLE MAP AND THE CONTOURS OF THE POTENTIOMETRIC SURFACE OF THE RATTLESNAKE RIDGE. THIS AREA REPRESENTS THE ZONE IN WHICH DOWNWARD FLOW MIGHT OCCUR IF A PATHWAY IS AVAILABLE, SUCH AS ABSENCE OF THE ELEPHANT MOUNTAIN BASALT DUE TO EROSION. SINCE DECEMBER 1985, THE ZONE OF THE DOWNWARD HYDRAULIC GRADIENT HAS DECREASED IN SIZE.

THE POTENTIOMETRIC SURFACE OF THE RATTLESNAKE RIDGE CONFINED AQUIFER MAP IS PREPARED BY THE ENVIRONMENTAL TECHNOLOGY GROUP OF THE RESEARCH AND ENGINEERING FUNCTION OF ROCKWELL HANFORD OPERATIONS.

NOTE:
TO CONVERT TO METRIC, MULTIPLY ELEVATION (ft) BY 0.3048 TO OBTAIN ELEVATION (m).

0 — 1 MILE
0 — 1 KILOMETER

Figure 25. Comparison of Potentiometric Surface of Rattlesnake Ridge Confined Aquifer with the Water Table of the Unconfined Aquifer, December 1986.

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9.0 SUMMARY

The Separations Area ground-water monitoring network for CY 1986 consisted of 137 wells.

Samples from wells in the monitoring network were collected on a monthly, quarterly, or semiannual schedule, depending on the history of the liquid waste disposal site. Samples were analyzed selectively for total alpha, total beta, tritium, ^{90}Sr, ^{137}Cs, ^{60}Co, ^{106}Ru, total uranium and nitrate. The results of ground-water monitoring indicate that average concentrations of contaminants in most wells were essentially the same in 1986 as in 1985.

For active cribs, the DCG (which is applicable at the site boundary: the Columbia River) for tritium was exceeded at two PUREX cribs: 216-A-10 and 216-A-36B. The ACL specified in RHO-MA-139 for ^{90}Sr was exceeded in three wells near the 216-A-25 Pond. Information obtained in 1986 confirmed this is a localized situation. Disposal of effluents to the pond decreased as the main pond was reduced in width to a ditch leading the overflow pond.

The ACL guidelines for uranium were exceeded at the 216-B-62 crib although concentrations were below the DCG; the source of this uranium is probably the inactive 216-B-12 crib. Uranium concentrations above the ACL but below the DCG were also observed at the 216-U-14 ditch and the source is under evaluation.

The inactive 216-B-5 reverse well exceeded the DCG (applicable at the Columbia River) for ^{90}Sr and the ACL for ^{137}Cs and uranium. Inactive facilities exceeding Rockwell guidelines were the 216-S-1/2 cribs, 216-U-1/2 cribs, the 216-U-10 pond, and the 216-U-6 crib. The 216-S-1/2 cribs have historically had high ^{137}Cs concentrations because of localized contamination but are below the DCG. Uranium concentrations, which are above the DCG, have stabilized at the 216-U-1/2 cribs after the remedial pumping and uranium removal conducted in 1985. Possible additional action is currently being evaluated. Disposal of the effluent from the ion exchange column to the 216-S-25 crib resulted in ground-water concentrations that exceeded Rockwell guidelines but below the DCG. Ground water near the 216-U-10 pond remains elevated but below the DCG due to past disposal to the pond, which was deactivated in 1984.

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APPENDIX A

WELL NUMBERING SYSTEM, FACILITY NUMBERING SYSTEM, DEFINITION OF THE SEPARATIONS AREA, WELL LOCATION MAPS

CONTENTS

APPENDIX A.1

WELL NUMBERING SYSTEM

A detailed description of the well numbering system is given in McGhan et al. (1985). The numbering system used for well identification in the 200 Areas is a three-part system, comprised of seven digits and one letter separated by dashes (i.e., 299-E25-21). The first set of digits (299) identifies it as a well (99) in one of the 200 Areas. The second part contains the prefix E or W for 200 East or 200 West Area, and is followed by a two-digit block number (E25). These block numbers are denoted in McGhan et al. (1985) for the 200 East and 200 West Areas. The third part (21) represents the consecutive numbering of a well constructed in a given block. For example, well 299-E25-21 is identified as the 21st well drilled in block 25 of 200 East Area. Computer-generated tables from the Hanford Site Ground-Water Data Base system presented in this report use a modification of the preceding numbering system (i.e., well 299-E25-21 is identified as 2-E25-21).

Wells in the 600 Area use a different coding system. The well identification number contains three parts. The first part (699) identifies it as a well (99) in the 600 Area. The second and third parts represent the north and west Hanford Site coordinates of a well expressed in 10,000 ft. For example, well 699-35-70 has the coordinates of N034523 and W069988 (McGhan et al. 1985). Letters are added when more than one well in a zone is described by the same coordinates, such as 699-42-40A and 699-42-40B. Computer-generated tables use the format 6-35-70 to represent well 699-35-70.

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APPENDIX A.2

FACILITY NUMBERING SYSTEM

The facility numbering system is a five- or six-digit, one-letter system separated with dashes (e.g., 216-A-37-2). Liquid waste disposal facilities (crib facilities, ponds, and ditches) are identified as 216-sites; Tank Farms as 241-sites.

The letter in the second part of the number represents a zone: A, B, C, E are zones in 200 East Area, and S, T, U, W, Z are zones in 200 West Area. The third part of the number represents consecutive numbering within a zone. In some cases, an additional identification tag has been included. For example, site 216-A-37-2 is the 37th liquid waste disposal site in Zone A of the 200 East Area. The (-2) differentiates this facility from 216-A-37-1. In other cases, a letter is added. For example, site 216-A-36B represents the 36th facility in block A of 200 East Area.

The facility number may be modified for use at Tank Farms. For example, 241-A Tank Farm, 241-AX Tank Farm, 241-AY Tank Farm, or 241-AZ Tank Farm. The third part of the Tank Farms numbering system is defined as the number assigned to that tank within the farm, such as 241-A-103 Tank.

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APPENDIX A.3

DEFINITION OF THE SEPARATIONS AREA

For the purpose of ground-water monitoring the Separations Area is defined on the basis of the U.S. Public Land System and is comprised of 80 sections of land in 6 townships as follows:

- T12N, R25E:* Sections 1, 2, 11, 12, 13, 14, 23, 24
- T12N, R26E: Sections 1 through 24
- T12N, R27E: Sections 5, 6, 7, 8, 17, 18, 19, 20
- T13N, R25E: Sections 13, 14, 23, 24, 25, 26, 35, 36
- T13N, R26E: Sections 13 through 36
- T13N, R27E: Sections 17, 18, 19, 20, 29, 30, 31, 32

These townships are referenced to the Williamette meridian. The location of these townships and sections with respect to the 200 East and 200 West Areas and other Hanford Site features is depicted in figure A.1.

*Read as "township 12 north, range 25 east."

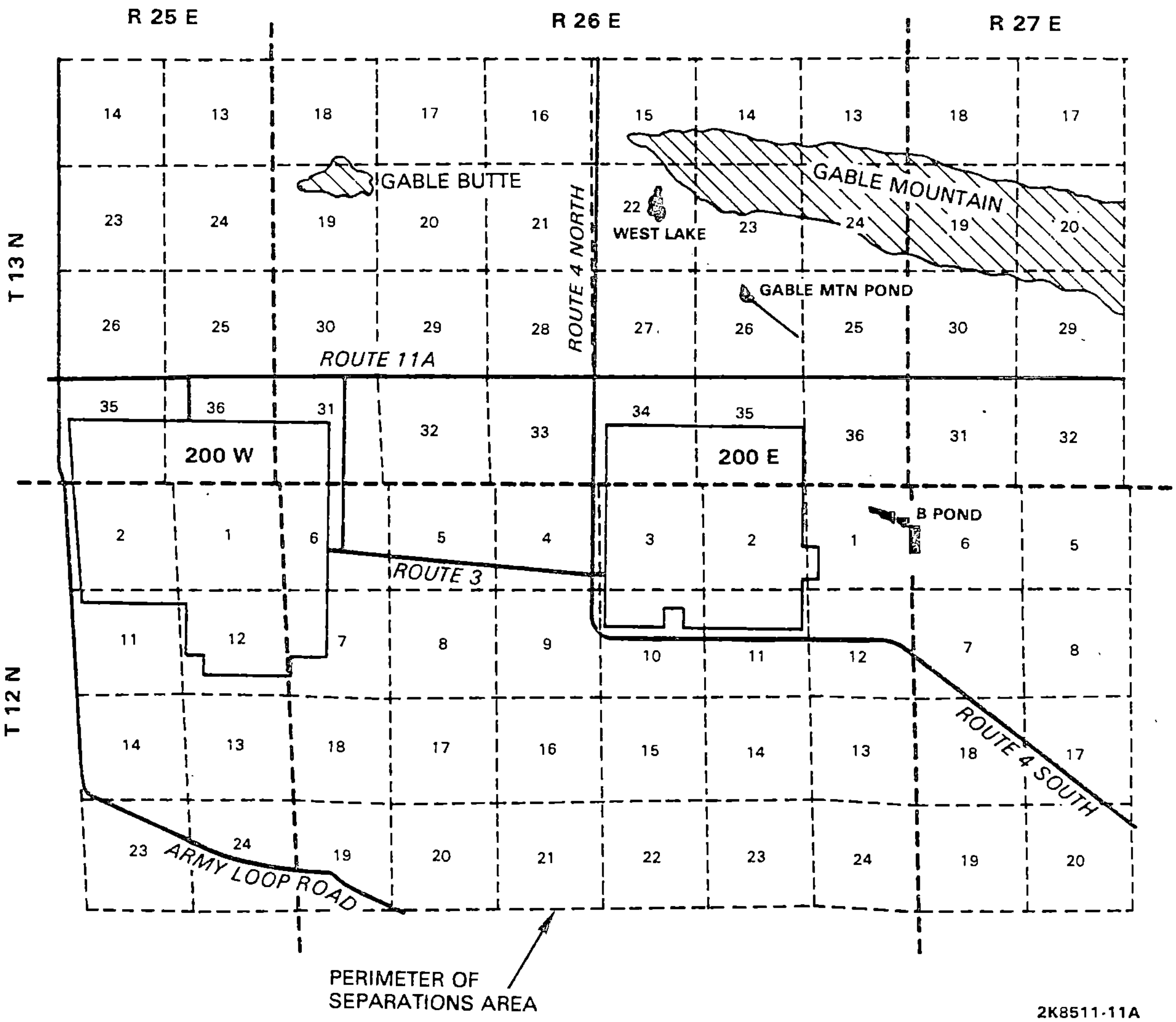

Figure A.1. Definition of the Separations Area for Ground-Water Monitoring.

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APPENDIX A.4

WELL LOCATION MAPS

Well location maps for the Separations and the Affected Areas are shown in figures A.2 and A.3.

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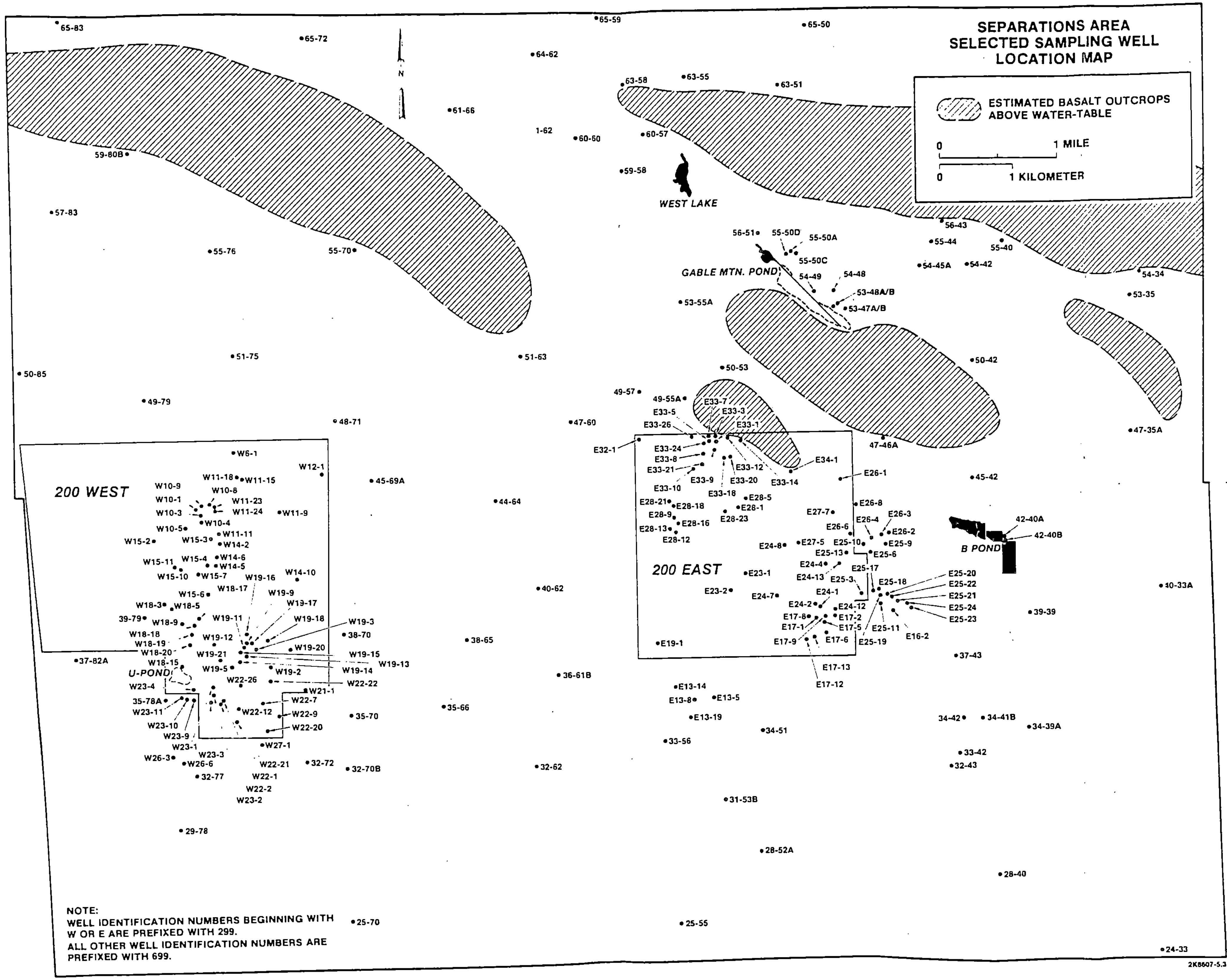

Figure A.2. Selected Sampling Wells in the Separations Area.

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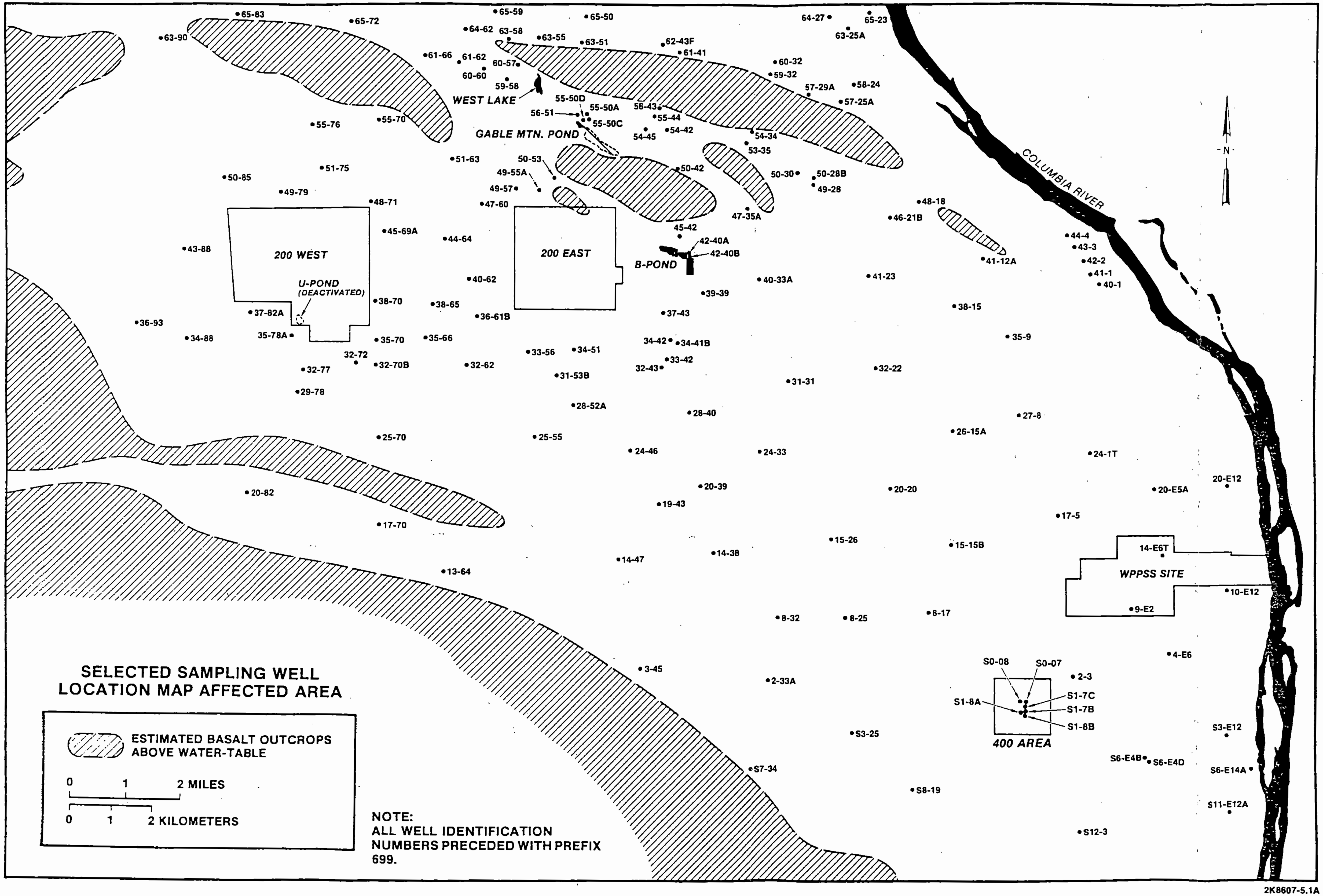

Figure A.3. Selected Sampling Wells in the Affected Area.

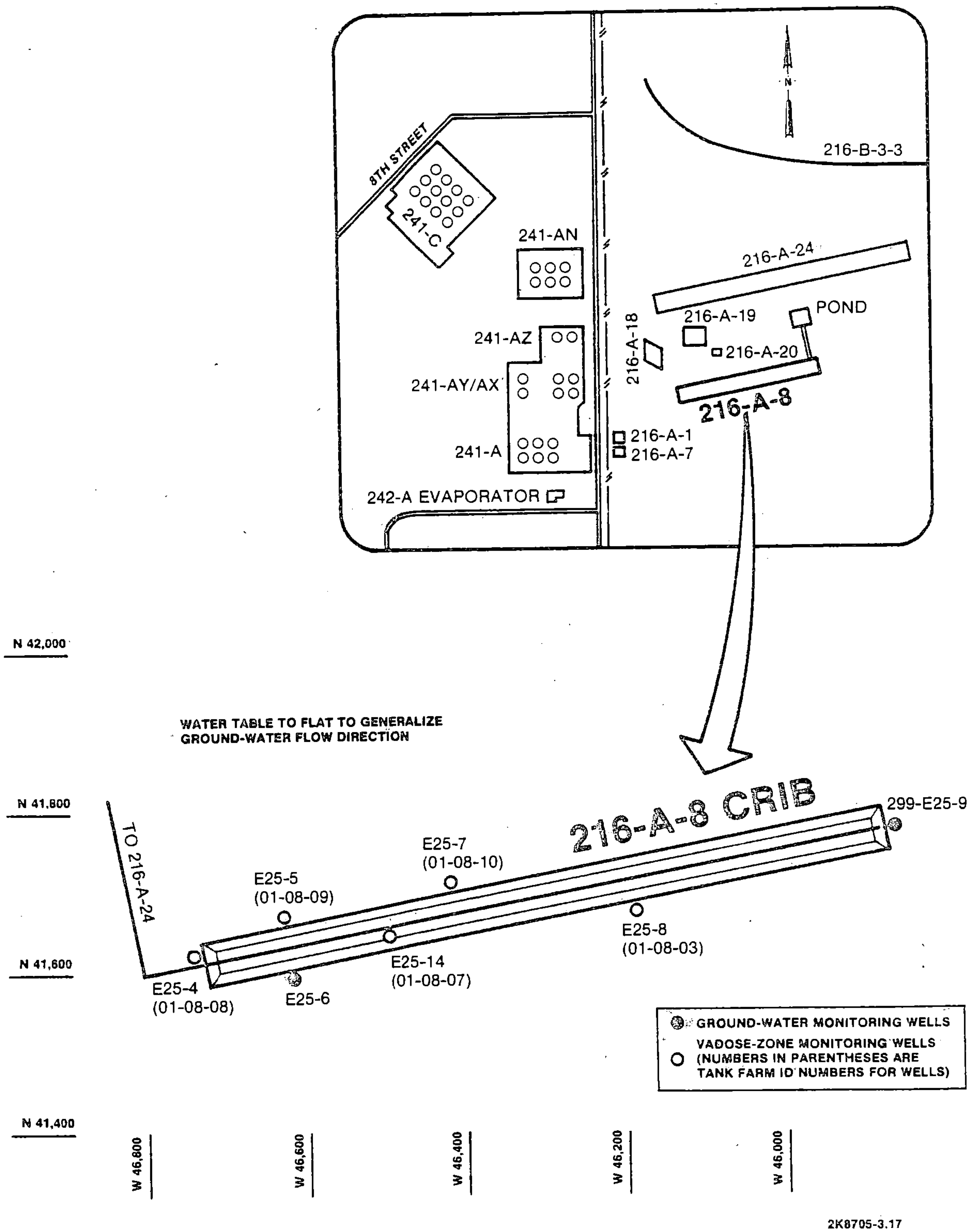

Figure A.4. Site Map of Active 216-A-8 Crib Showing Well Locations.

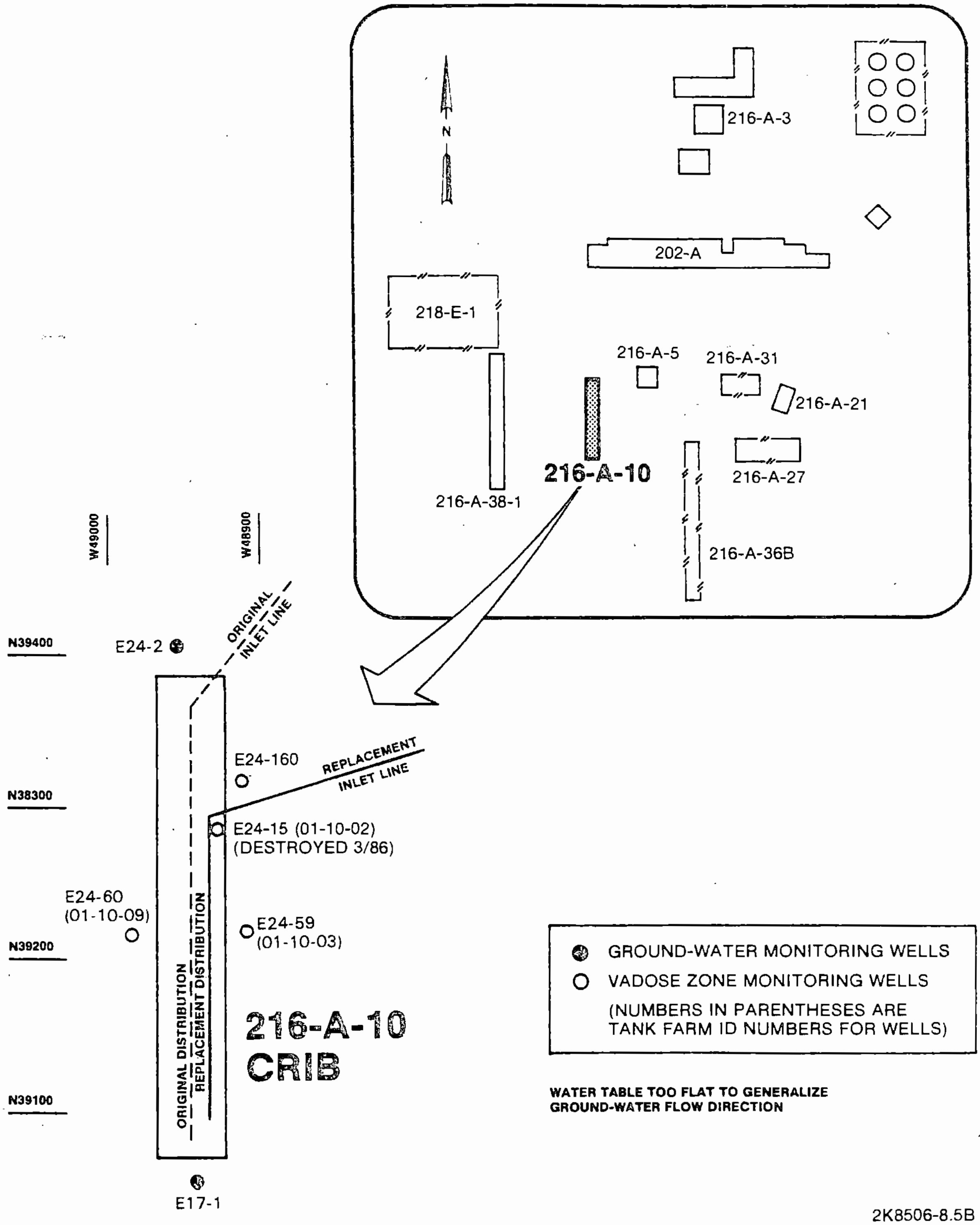

Figure A.5. Site Map of Active 216-A-10 Crib Showing Well Locations.

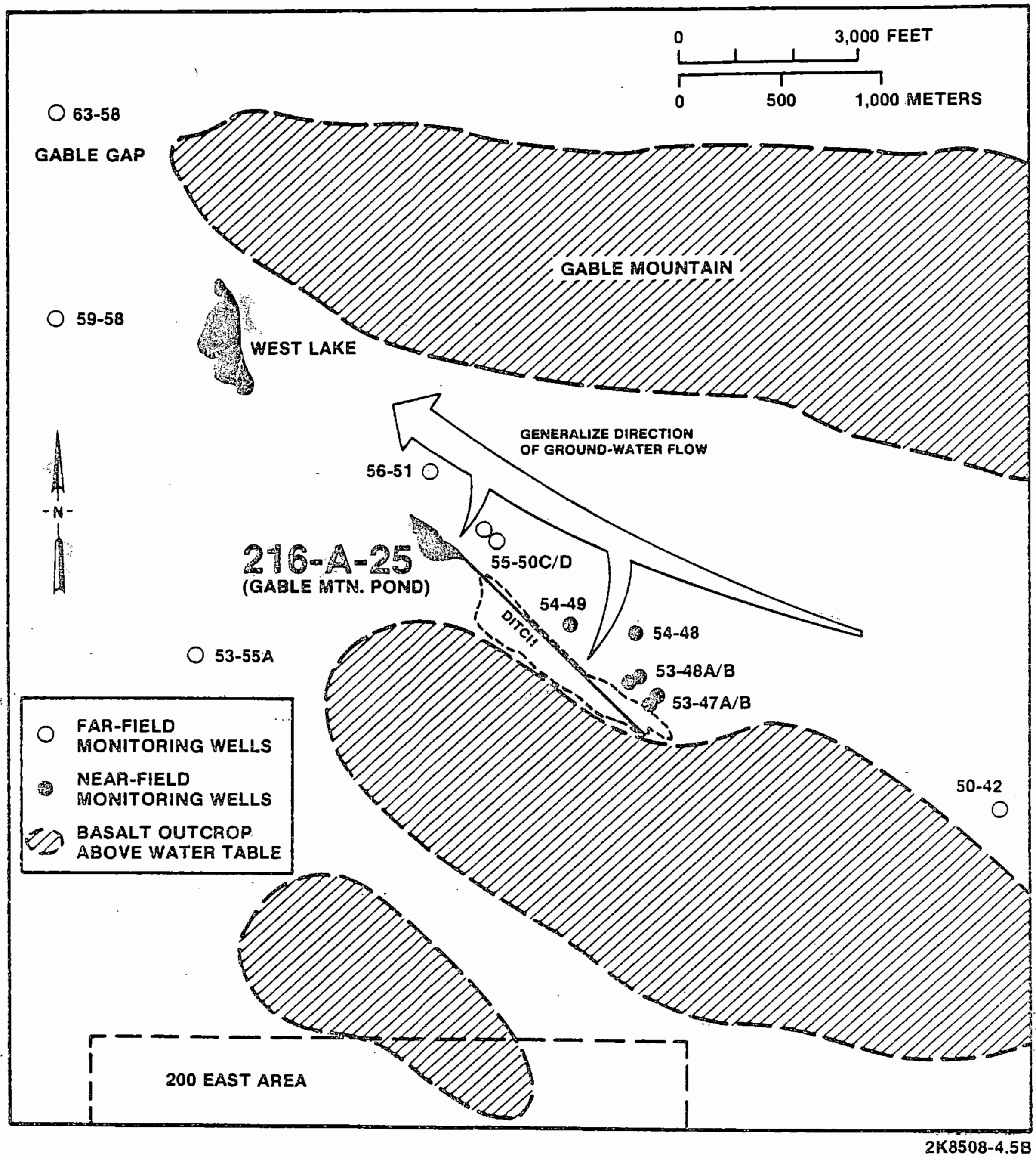

Figure A.6. Site Map of Active 216-A-25 Pond Showing Well Locations.

9212456223 9

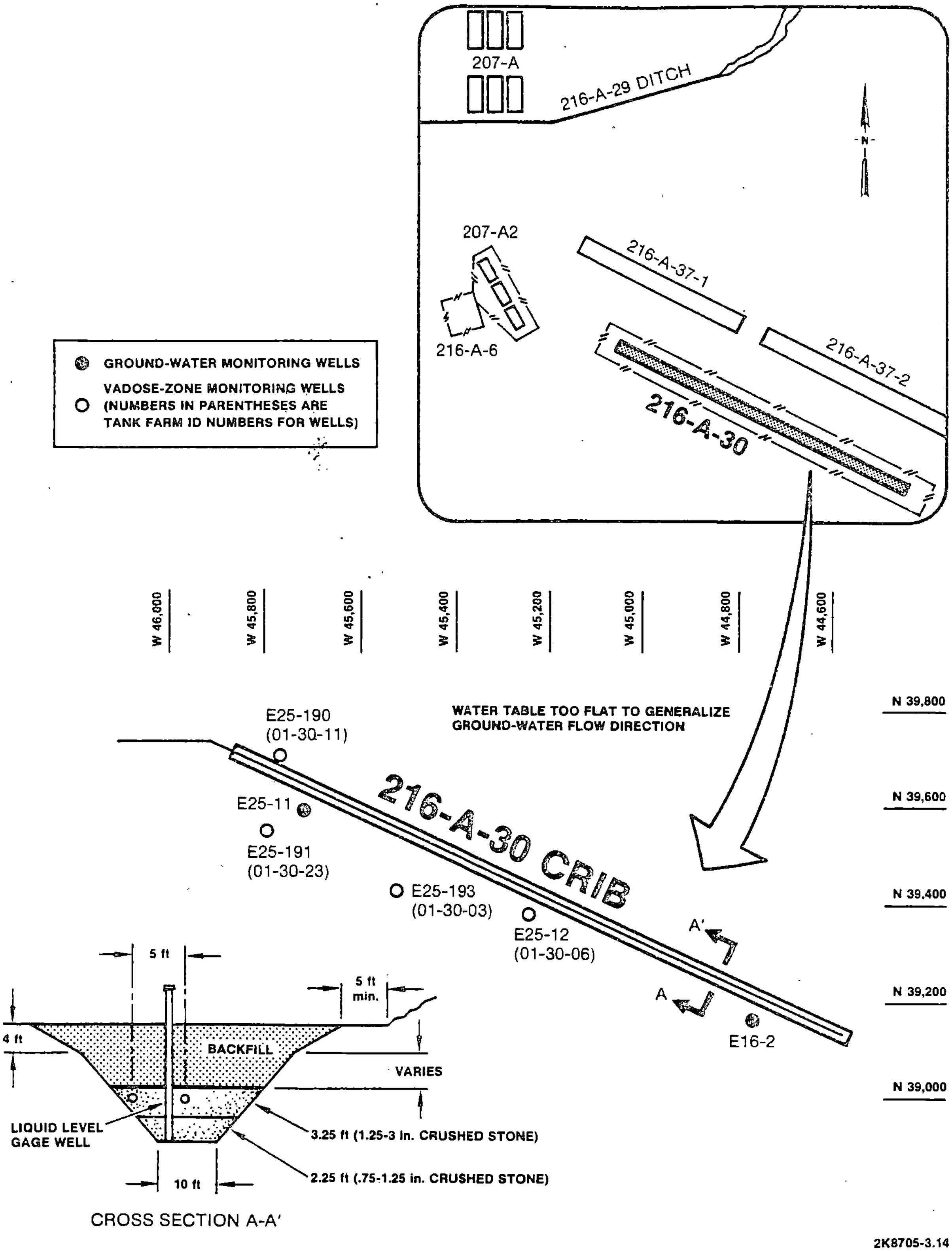

Figure A.7. Site Map of Active 216-A-30 Crib Showing Well Locations.

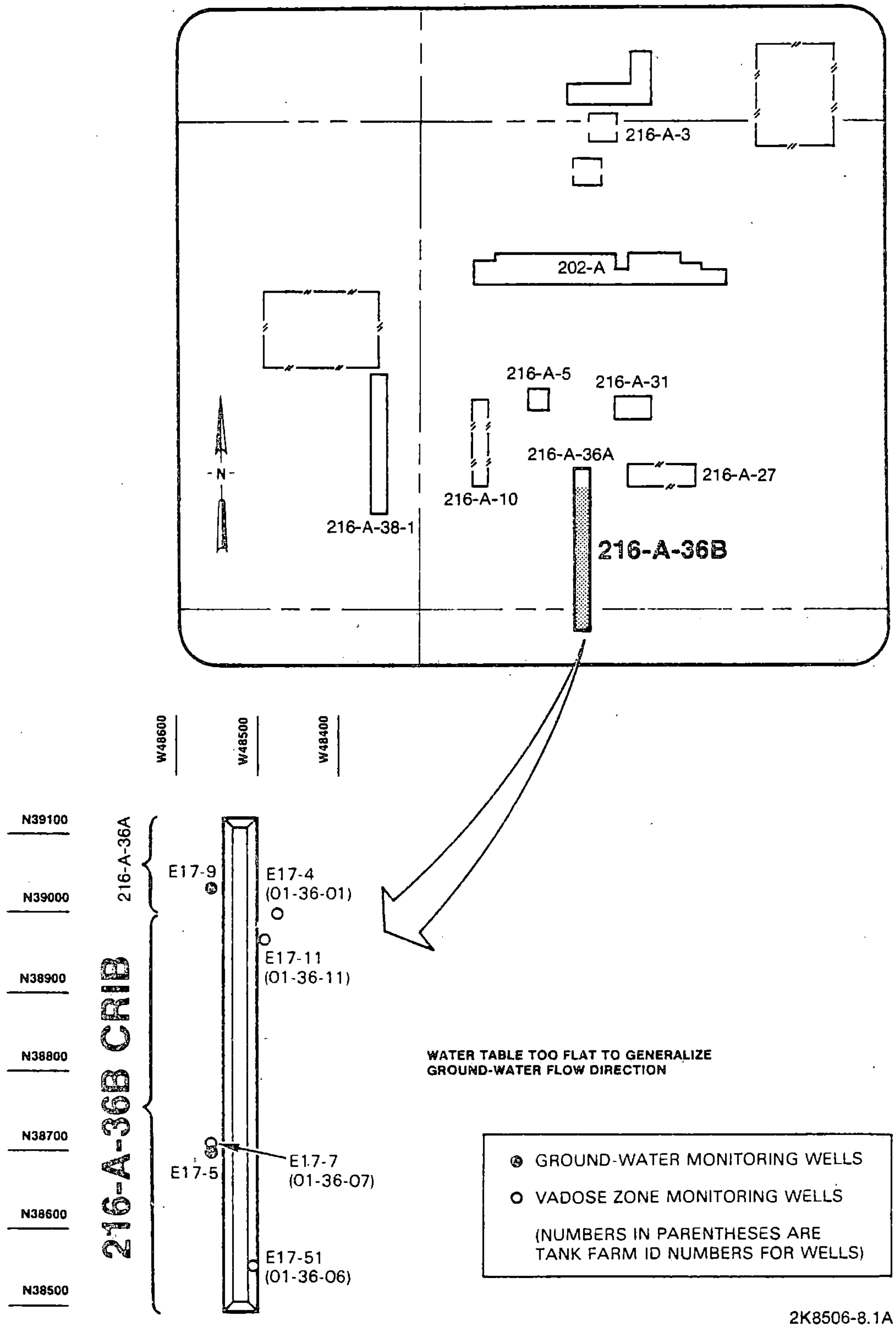

Figure A.8. Site Map of Active 216-A-36B Crib Showing Well Locations.

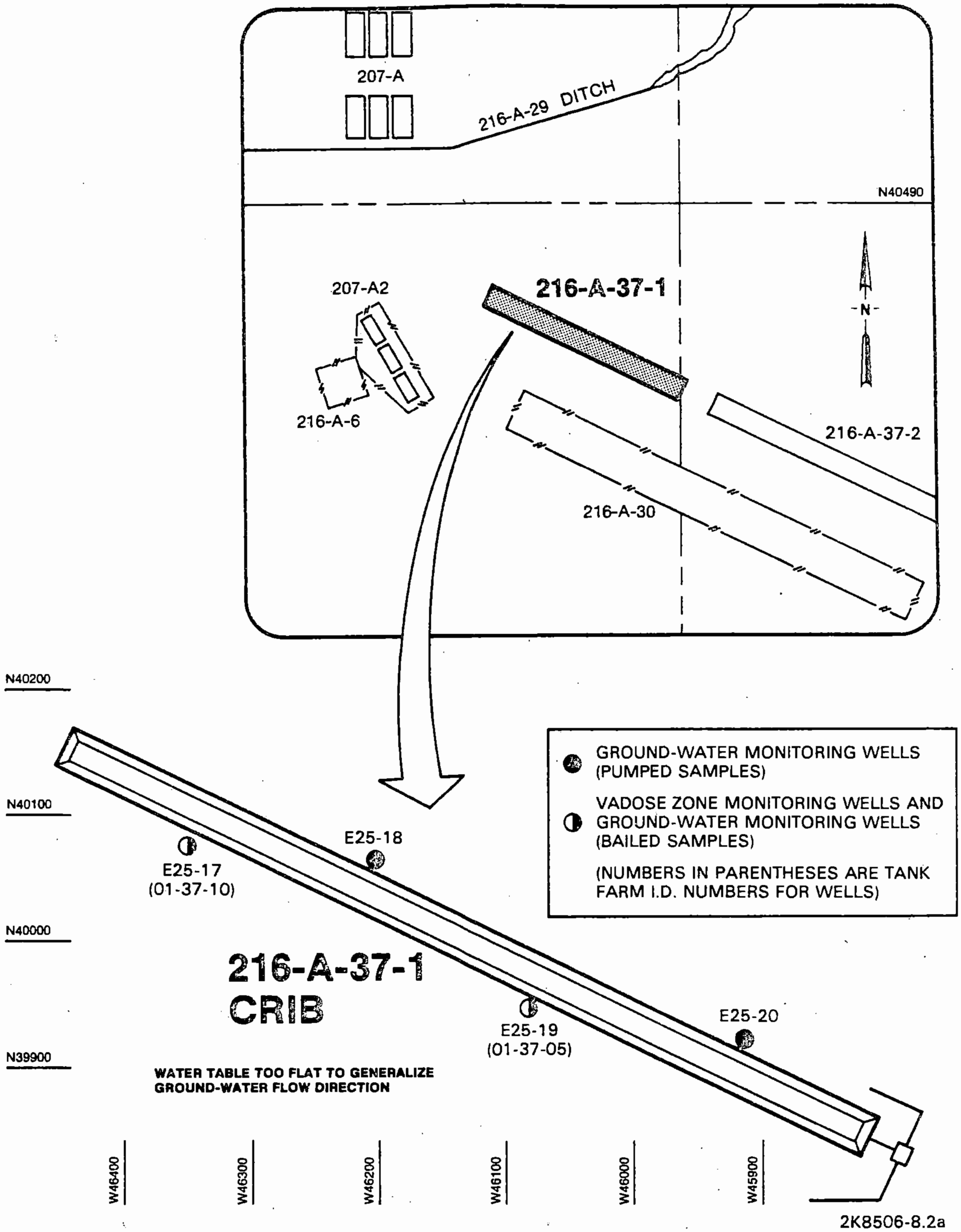

Figure A.9. Site Map of Active 216-A-37-1 Crib Showing Well Locations.

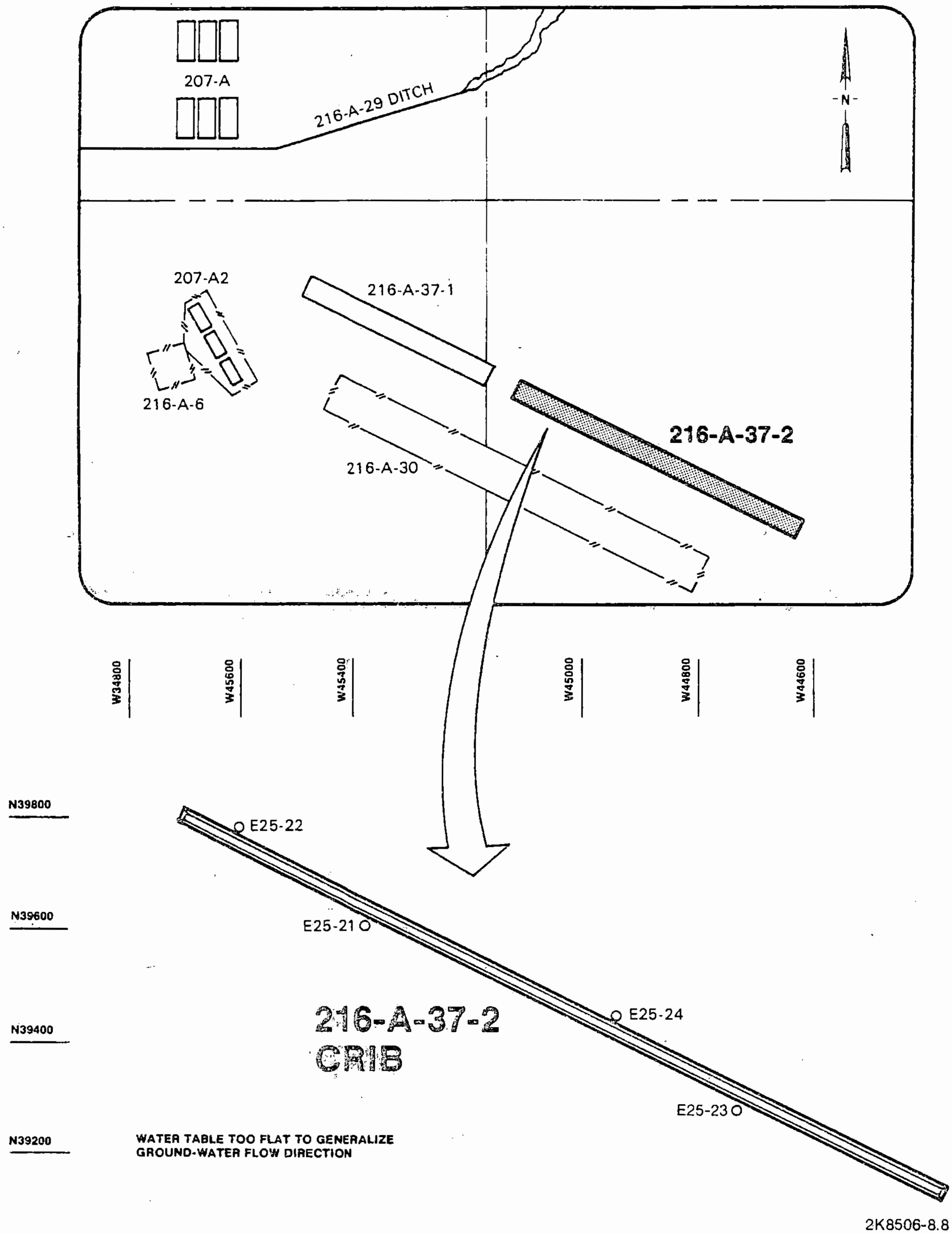

Figure A.10. Site Map of Active 216-A-37-2 Crib Showing Well Locations.

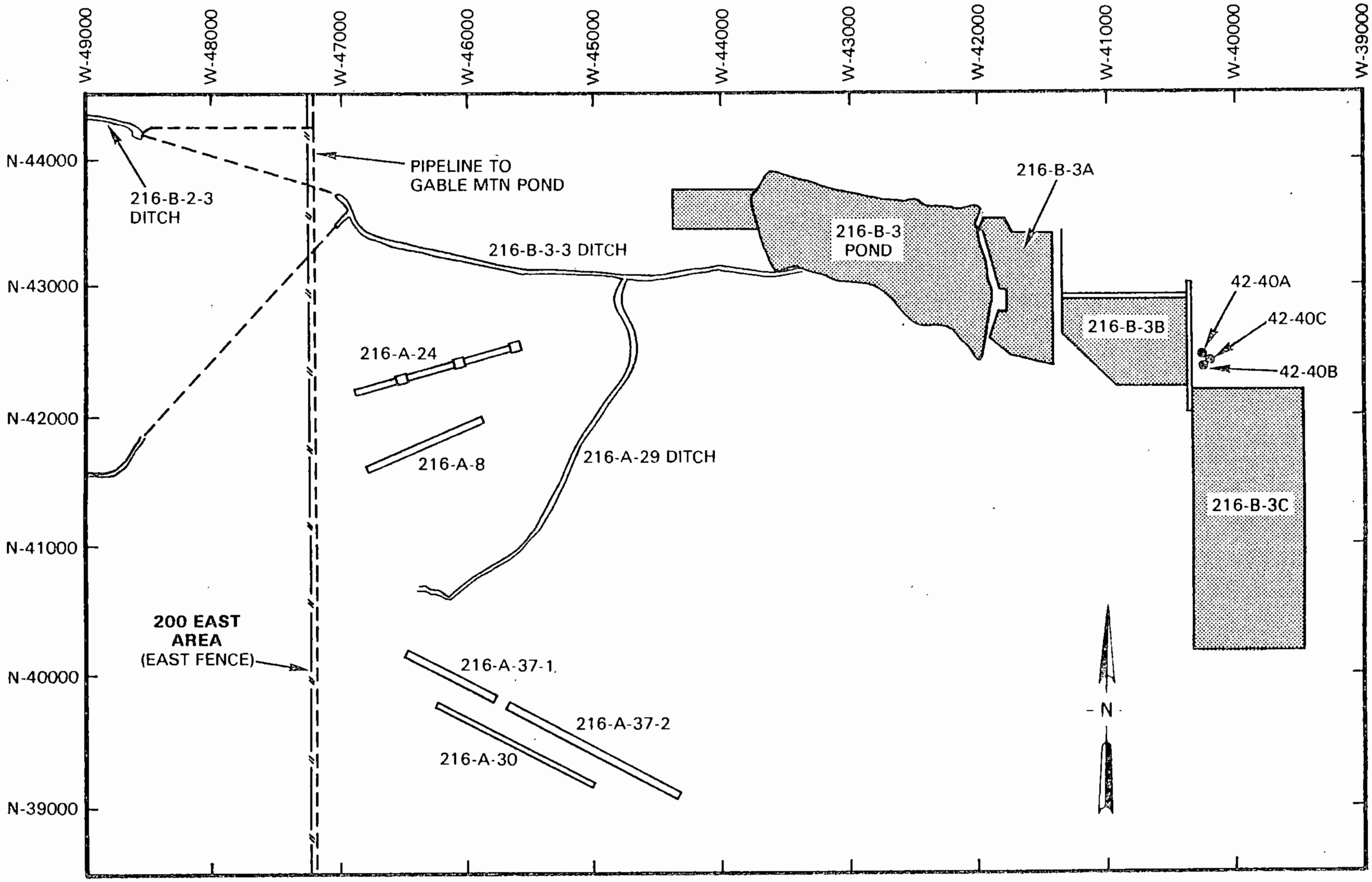

Figure A.11. Site Map of Active 216-B-3 Pond Showing Well Locations.

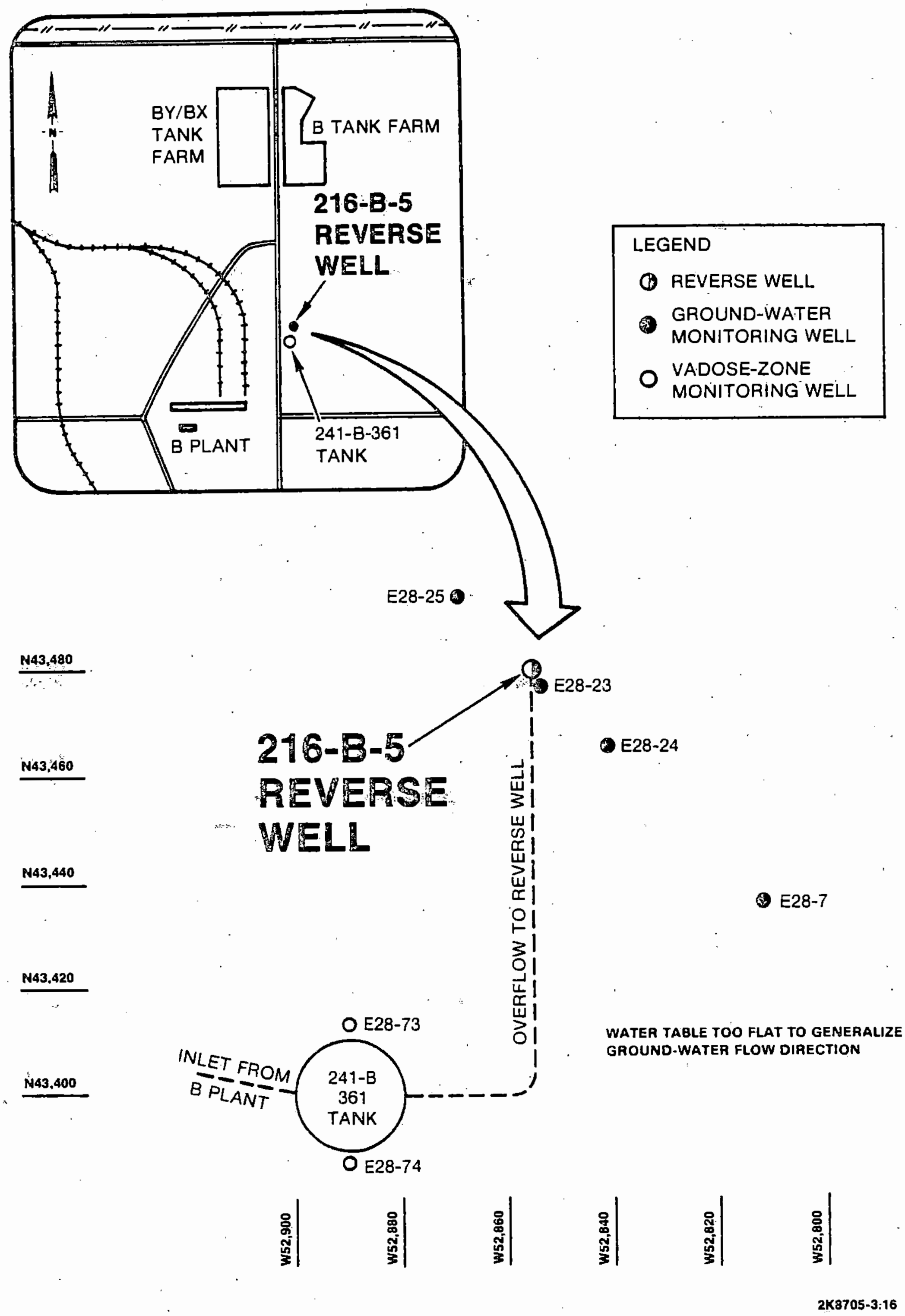

Figure A.12. Site Map of Inactive 216-B-5 Reverse Well Showing Well Locations.

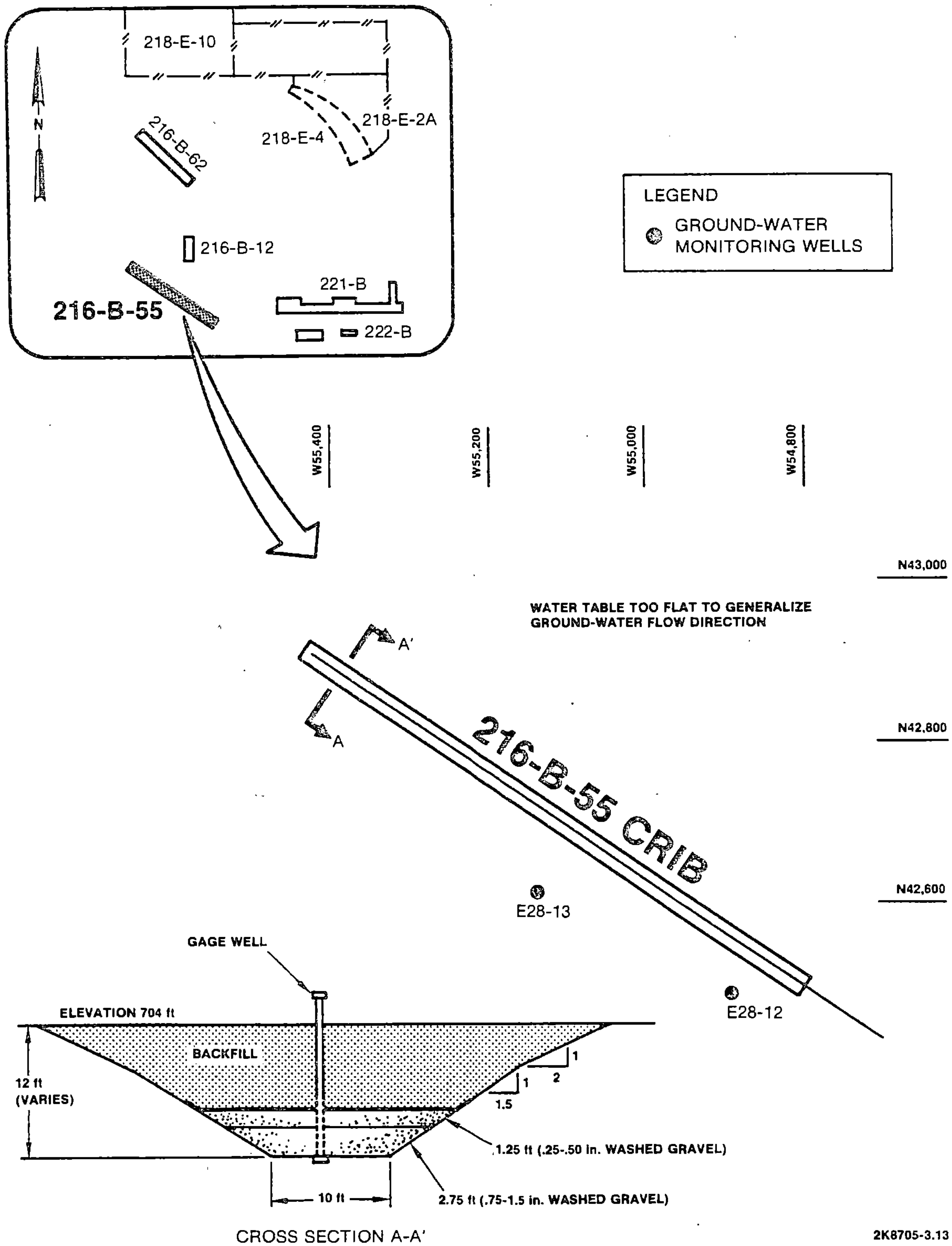

Figure A.13. Site Map of Active 216-B-55 Crib Showing Well Locations.

9 2 1 2 4 6 6 2 2 4 6

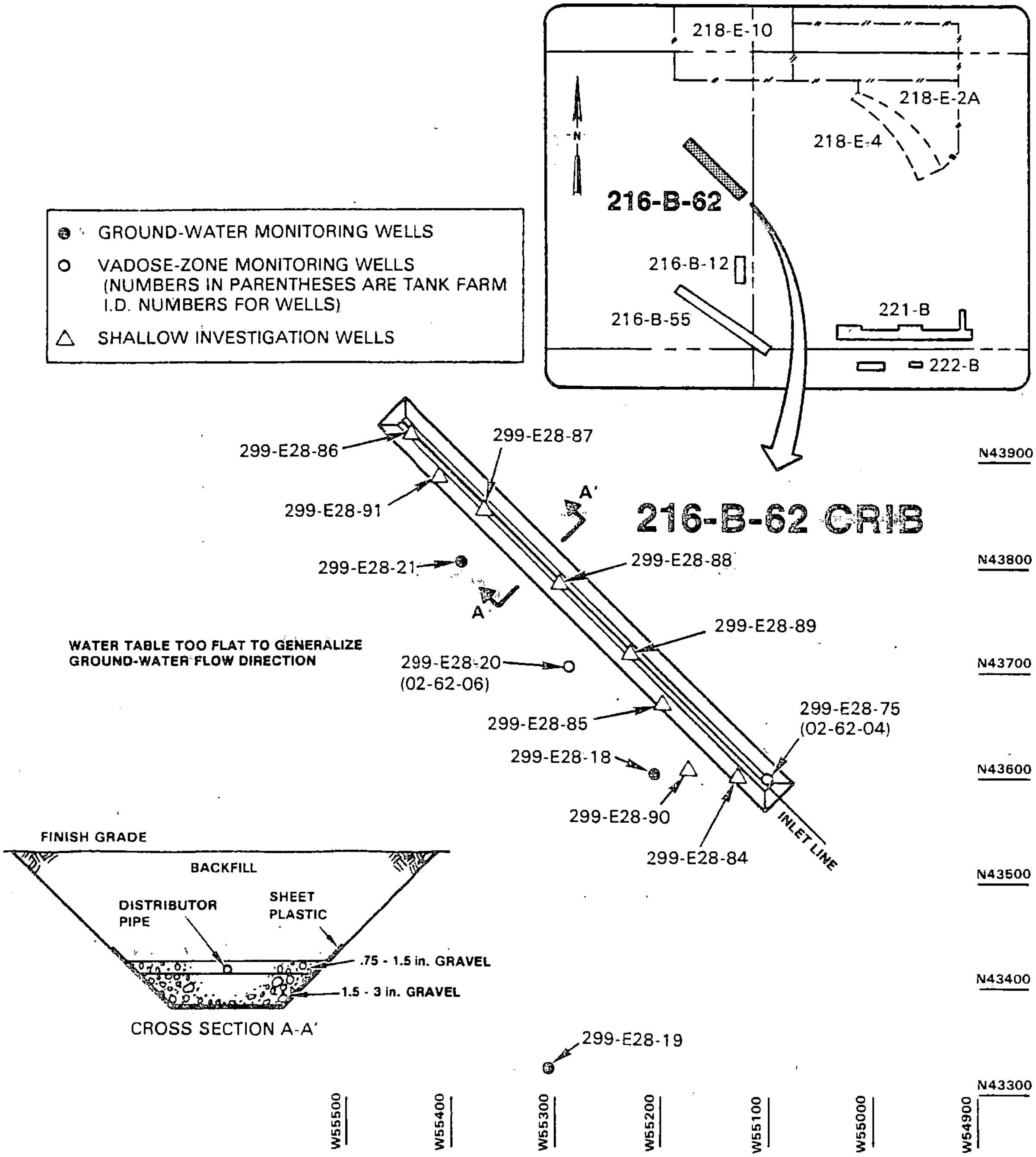

Figure A.14. Site Map of Active 216-B-62 Crib Showing Well Locations.

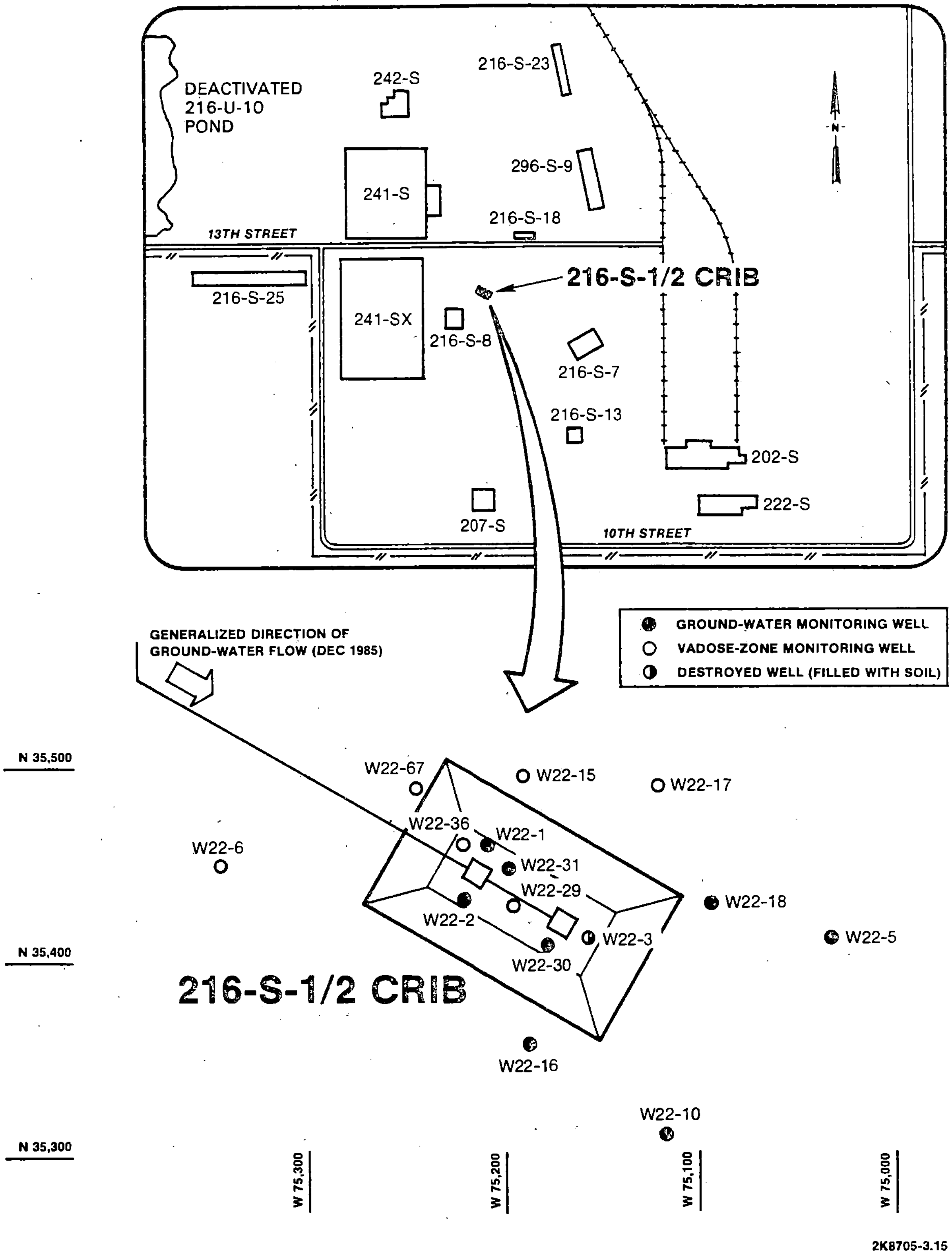

Figure A.15. Site Map of Inactive 216-S-1/2 Crib Showing Well Locations.

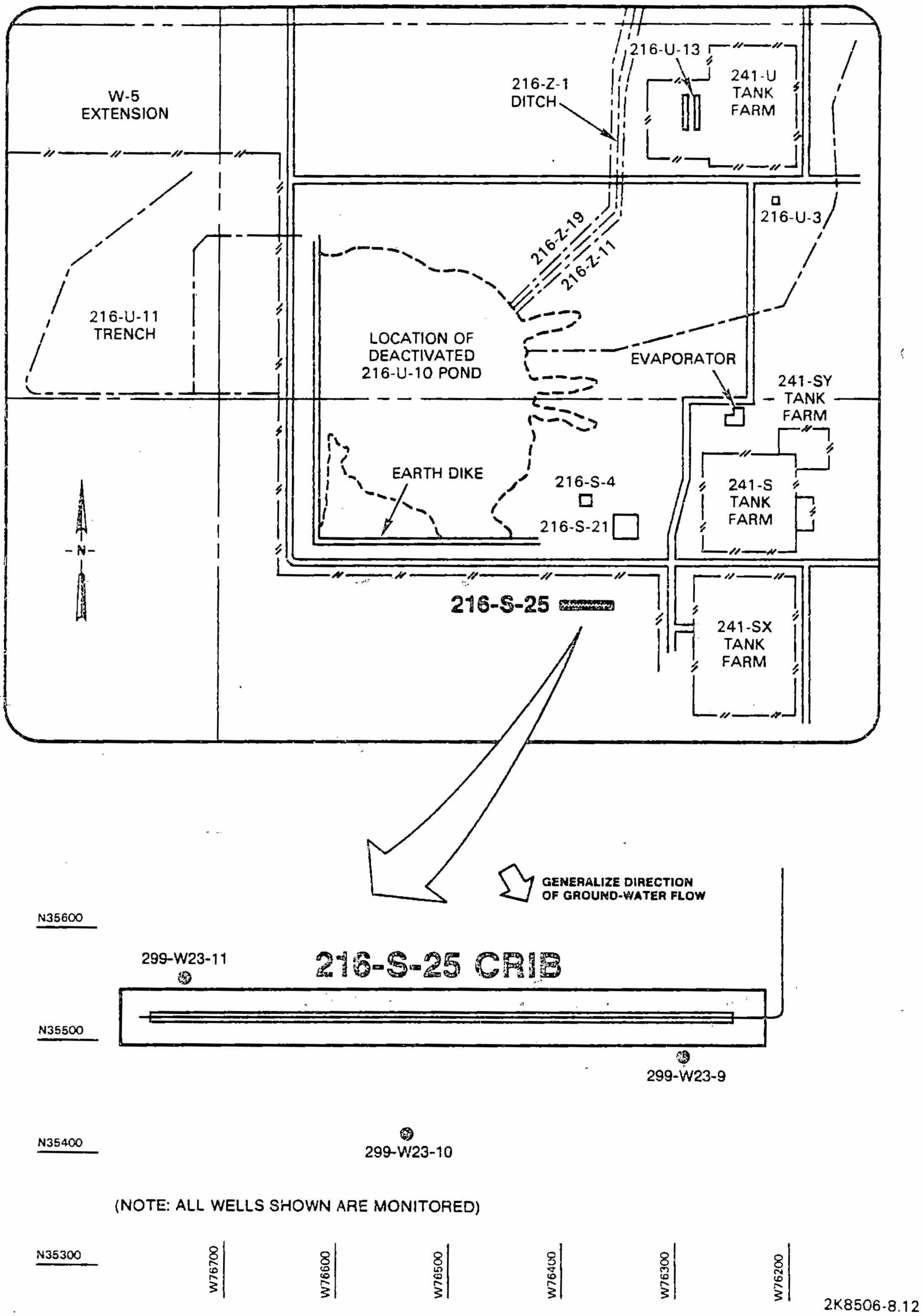

Figure A.16. Site Map of Inactive 216-S-25 Crib Showing Well Locations.

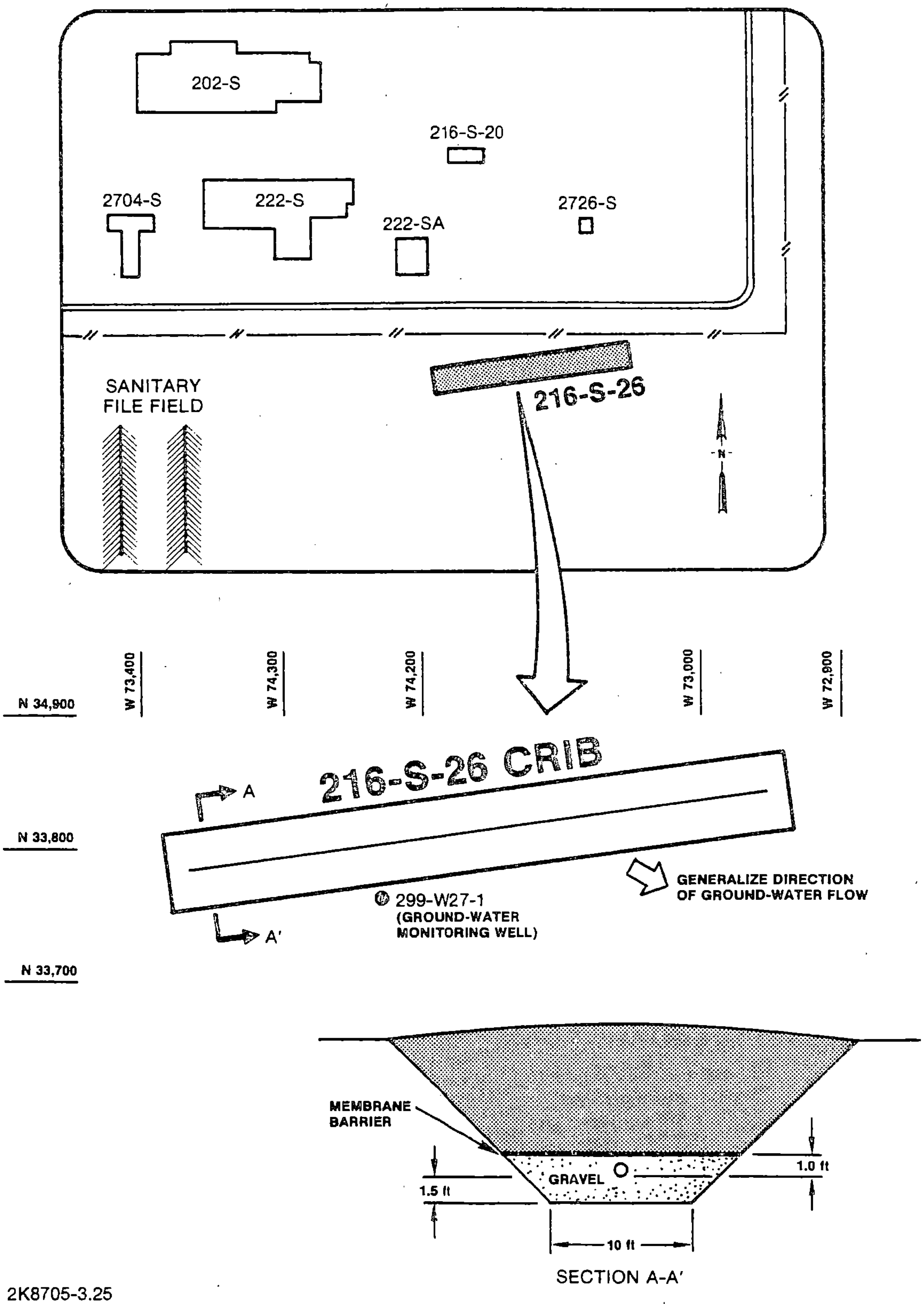

Figure A.17. Site Map of Active 216-S-26 Crib Showing Well Locations.

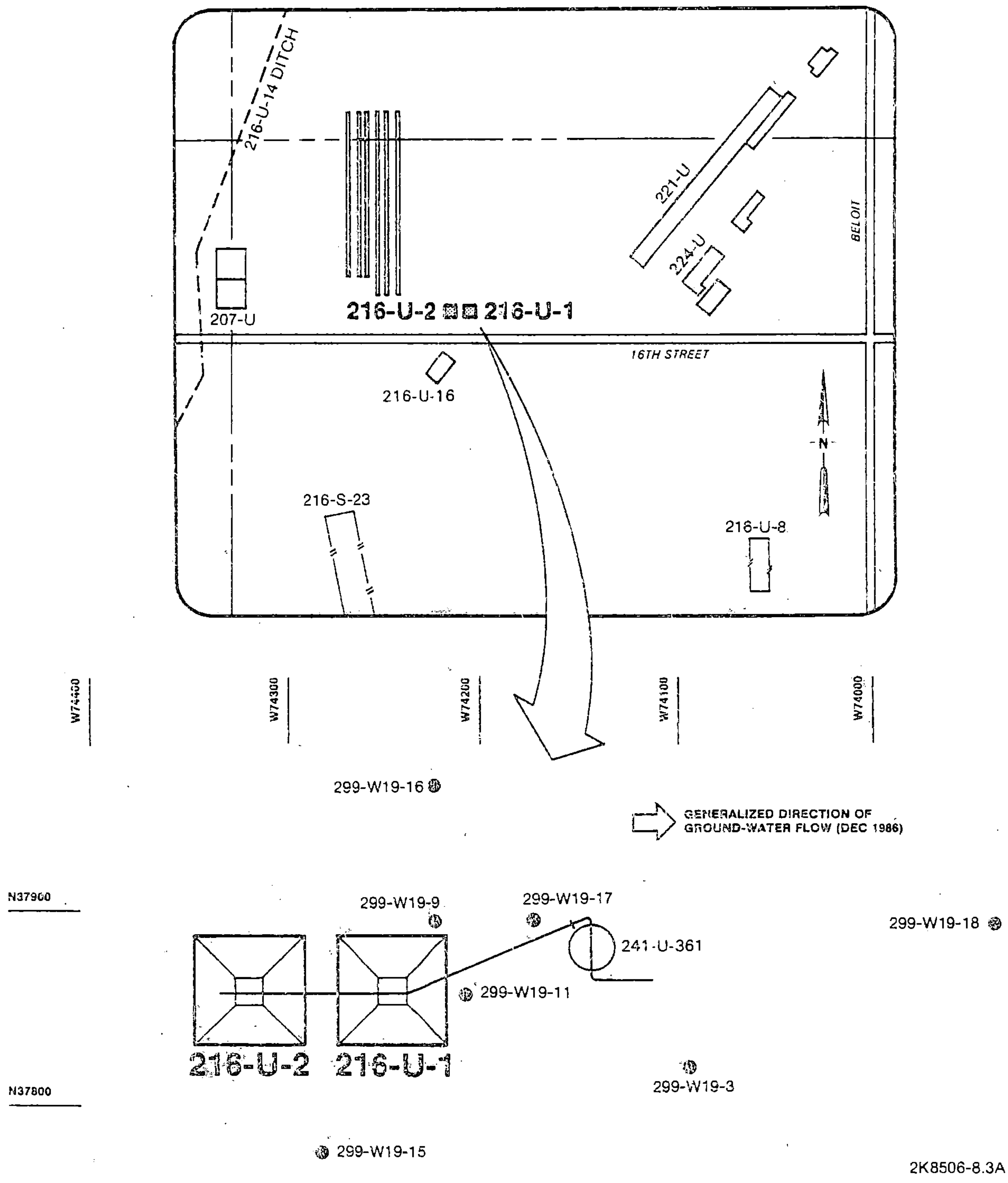

Figure A.18. Site Map of Inactive 216-U-1/2 Cribs Showing Well Locations.

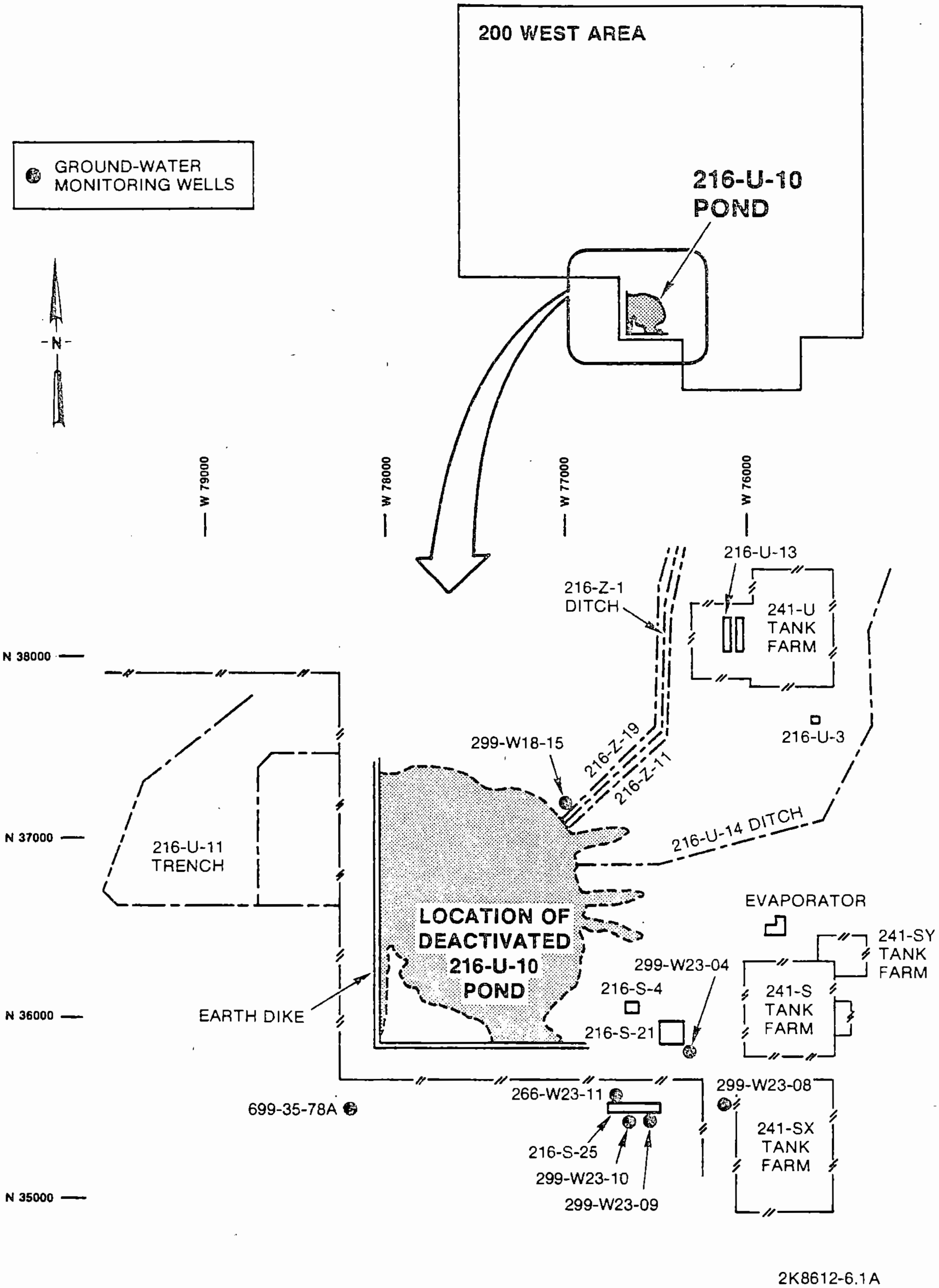

Figure A.19. Site Map of Inactive 216-U-10 Pond Showing Well Locations.

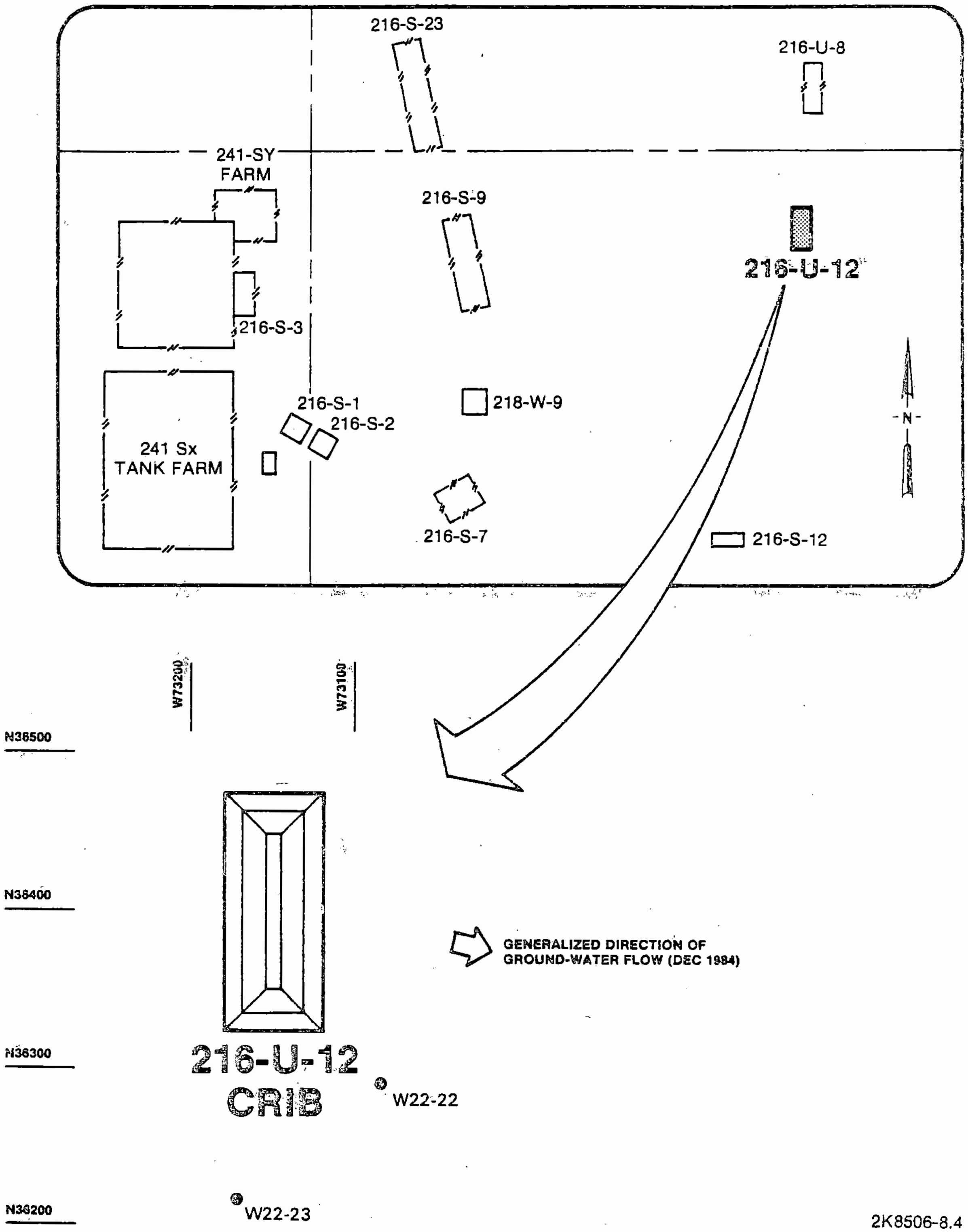

Figure A.20. Site Map of Active 216-U-12 Crib Showing Well Locations.

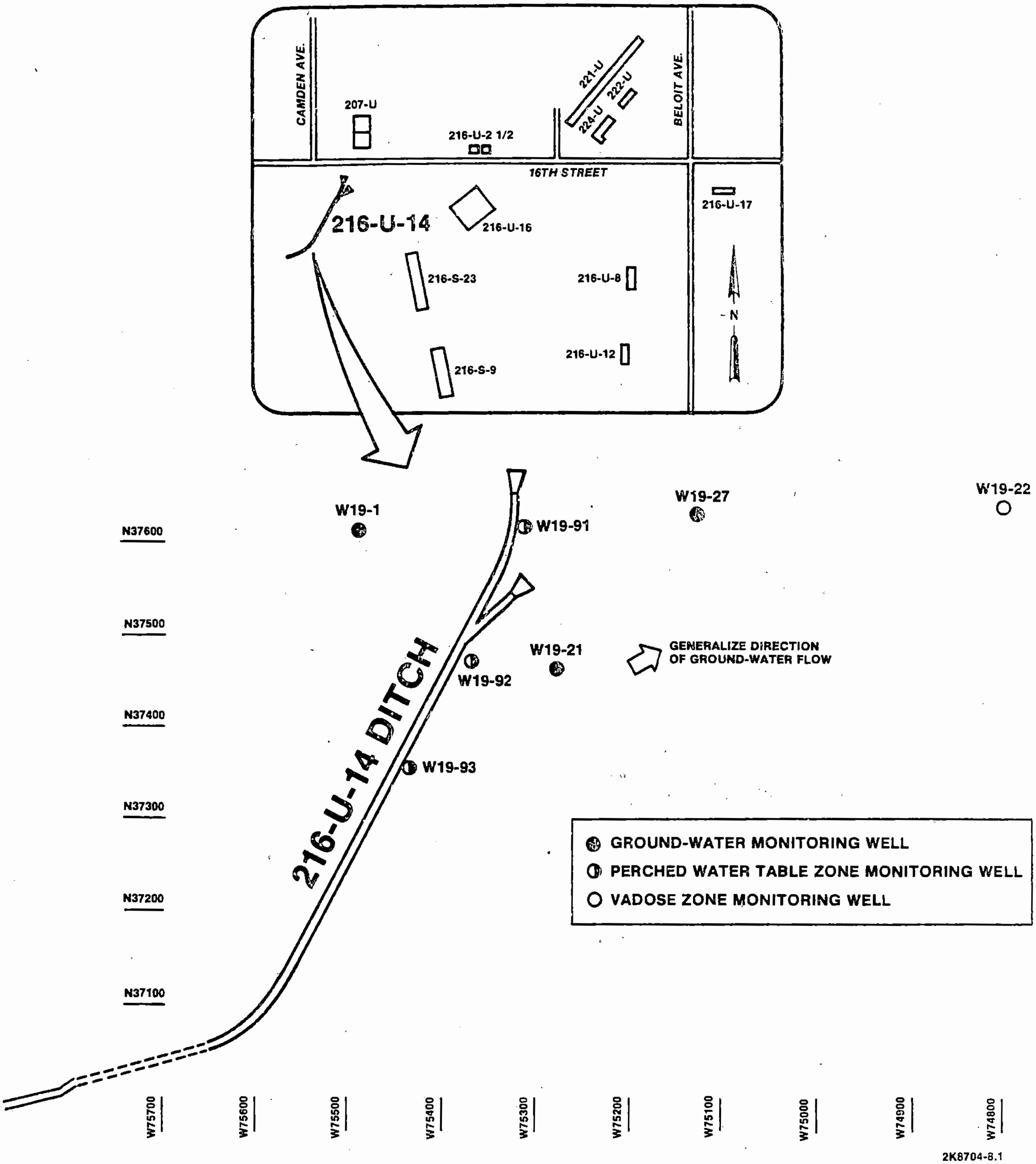

Figure A.21. Site Map of Active 216-U-14 Ditch Showing Well Locations.

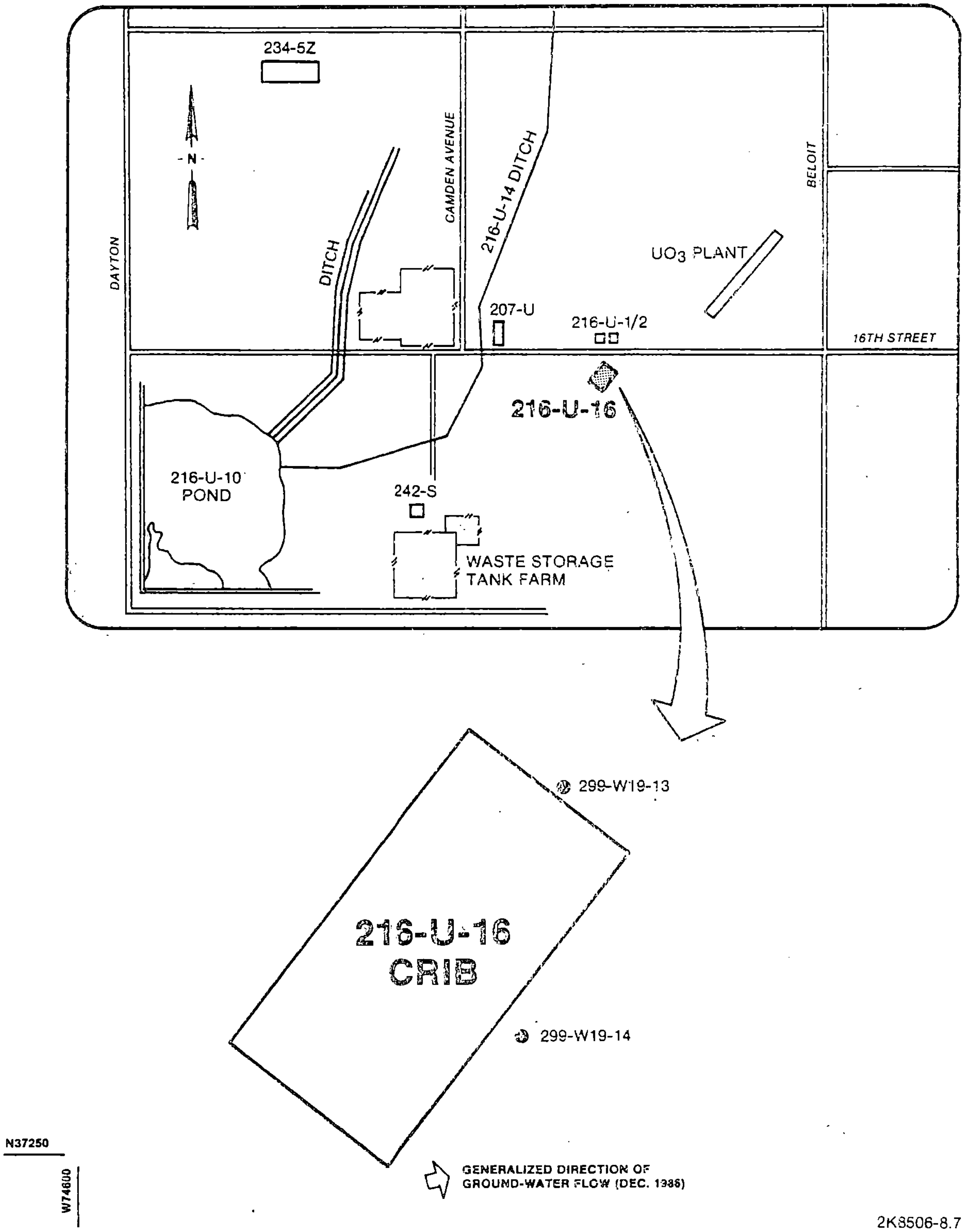

Figure A.22. Site Map of Inactive 216-U-16 Crib Showing Well Locations.

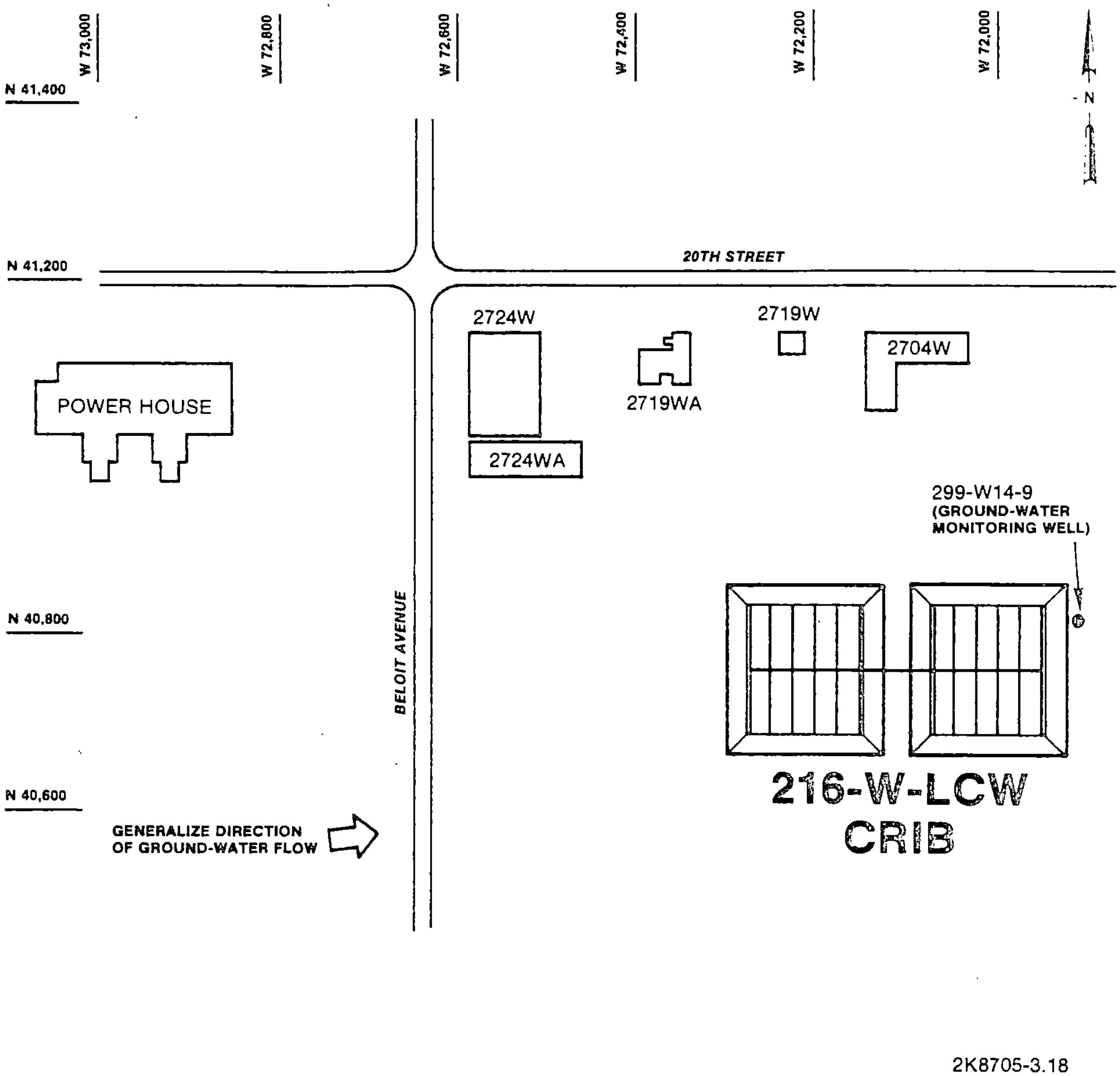

Figure A.23. Site Map of Active 216-W-LWC Crib Showing Well Locations.

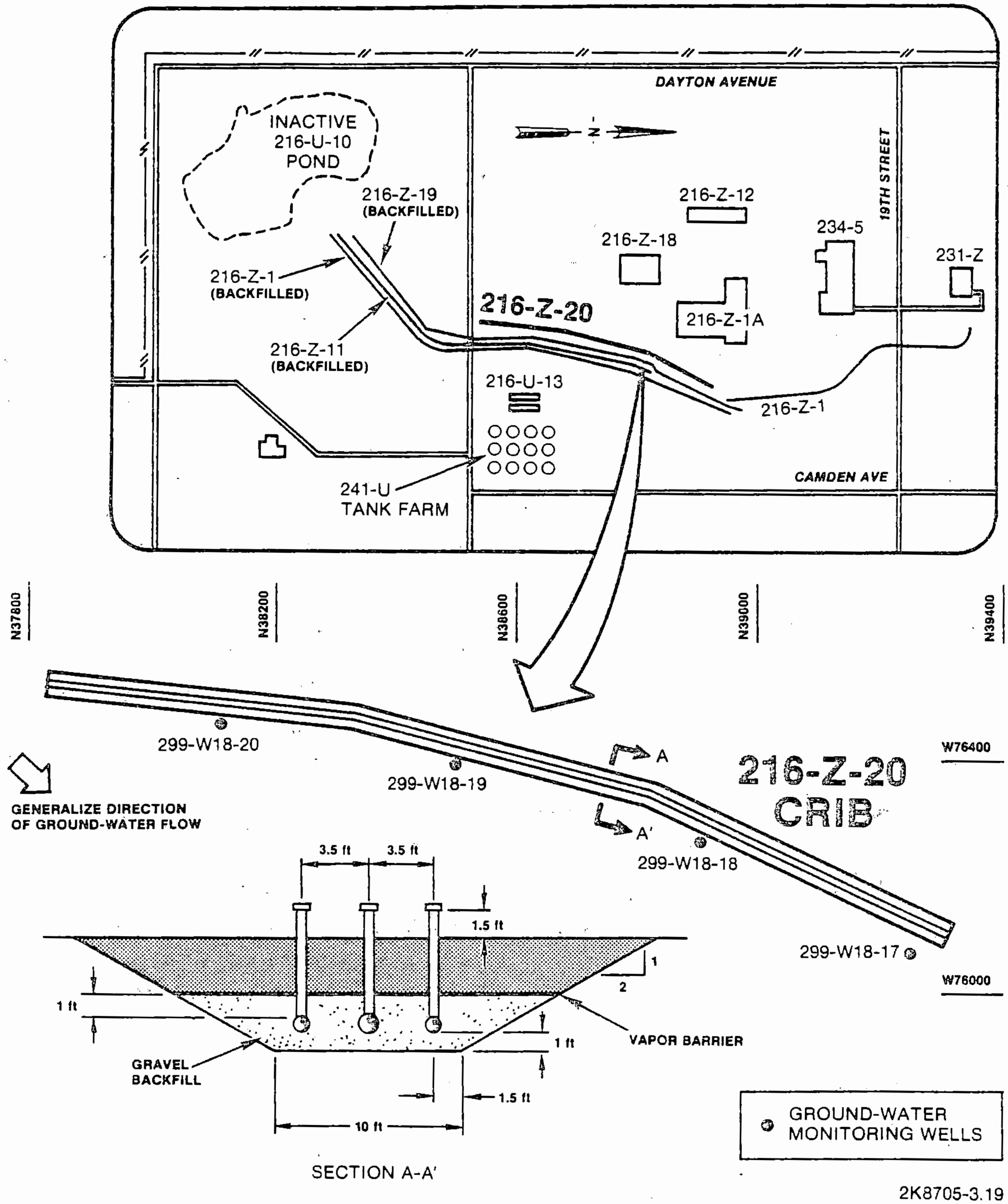

Figure A.24. Site Map of Active 216-Z-20 Crib Showing Well Locations.

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APPENDIX B

RESULTS OF THE UNCONFINED AND CONFINED AQUIFER GROUND-WATER MONITORING NETWORKS IN CY 1985

CONTENTS

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APPENDIX B.1

RESULTS OF THE UNCONFINED AQUIFER GROUND-WATER MONITORING NETWORK IN CY 1985

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Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 1 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX[a]		9.54E+00	1.46E+02						
299-E13-05	AVE[b]	NN**	7.05E+00	3.22E+01	NN	NN	NN	NN	NN	NN
(216-B-18)*	MIN[c]		5.64E+00	-1.26E+02						
	MAX		4.89E+00				2.41E+00	6.81E+00	4.80E+01	
299-E13-08	AVE	NN	4.62E+00	NN	NN	NN	3.43E-01	3.95E+00	2.50E+00	NN
(216-B-21)*	MIN		4.23E+00				-1.38E+00	-5.63E-01	-6.90E+01	
	MAX		6.24E+00							
299-E13-14	AVE	NN	5.48E+00	NN	NN	NN	NN	NN	NN	NN
(216-B-29)*	MIN		4.40E+00							
	MAX		6.07E+00							
299-E13-19	AVE	NN	5.70E+00	NN	NN	NN	NN	NN	NN	NN
(216-B-28)*	MIN		5.14E+00							
	MAX	2.80E+00	2.27E+01	4.43E+03	1.50E+01	7.28E-01	9.99E+00	1.24E+01	7.79E+01	
299-E16-02	AVE	2.17E+00	1.68E+01	2.06E+03	8.40E+00	2.18E-01	1.80E+00	-7.52E-02	2.13E+01	NN
(216-A-30)	MIN	1.50E+00	1.21E+01	2.14E+02	1.93E+00	-2.52E-01	-9.84E+00	-9.87E+00	-1.00E+02	
	MAX	4.35E+00	3.73E+01	8.98E+06	3.89E+02	7.29E+00	5.51E+00	6.72E+00	4.45E+01	
299-E17-01	AVE	3.24E+00	2.76E+01	6.89E+06	2.90E+02	5.84E+00	-3.15E-01	3.02E+00	-5.98E-01	NN
(216-A-10)	MIN	2.22E+00	2.12E+01	4.38E+06	1.85E+02	4.23E+00	-8.63E+00	-3.52E+00	-4.89E+01	
	MAX	7.22E+01	1.15E+03	1.35E+05	2.60E+02	5.18E+00	1.41E+01	6.22E+01	7.99E+02	9.98E+00
299-E17-02	AVE	1.66E+01	3.28E+02	7.99E+04	1.80E+02	4.78E+00	2.84E+00	4.92E+01	2.66E+02	8.89E+00
(216-A-27)*	MIN	6.14E+00	1.19E+02	5.94E+04	8.59E+01	4.07E+00	-6.88E+00	3.91E+01	3.17E+01	6.53E+00
	MAX	1.44E+01	7.09E+01	5.06E+06	1.19E+02	3.58E+00	7.70E+00	8.03E+00	4.42E+01	9.71E+00
299-E17-05	AVE	9.18E+00	3.37E+01	3.88E+06	9.90E+01	2.84E+00	5.55E-01	1.51E+00	5.48E+00	6.60E+00
(216-A-36B)	MIN	5.79E+00	2.29E+01	2.69E+06	8.68E+01	2.33E+00	-1.35E+01	-4.13E+00	-3.67E+01	4.30E+00
	MAX		1.17E+02	2.98E+05	3.74E+01					
299-E17-06	AVE	NN	4.84E+01	7.53E+04	9.67E+00	NN	NN	NN	NN	NN
(200-EAST)	MIN		7.49E+00	5.43E+01	3.40E-01					
	MAX		2.56E+01	6.47E+06	3.22E+02	2.38E+00	1.07E+01	6.76E+00	2.59E+01	
299-E17-08	AVE	NN	1.61E+01	5.06E+06	2.34E+02	1.26E+00	6.43E+00	-3.97E+00	-5.35E+01	NN
(216-A-38)*	MIN		1.21E+01	2.06E+06	1.86E+02	1.71E-01	1.72E+00	-1.05E+01	-1.82E+02	
	MAX	5.20E+00	2.54E+01	6.62E+06	2.07E+02	5.01E+00	1.20E+01	5.09E+00	4.43E+01	
299-E17-09	AVE	3.90E+00	2.10E+01	5.84E+06	1.38E+02	3.67E+00	9.24E-01	-1.90E-01	1.31E+01	NN
(216-A-36B)	MIN	3.19E+00	1.75E+01	3.55E+06	9.38E+01	1.95E+00	-8.31E+00	-1.13E+01	-2.20E+01	

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 2 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
299-E17-12 (216-A-45)	MAX	7.90E+00	2.22E+01	1.88E+06	9.74E+01	6.92E-01	6.33E+00	7.48E+00	4.08E+01	4.45E+00
299-E17-12 (216-A-45)	AVE	3.11E+00	1.61E+01	1.16E+06	6.13E+01	3.52E-01	1.54E+00	-6.94E-01	-7.40E+00	2.55E+00
299-E17-12 (216-A-45)	MIN	1.12E+00	8.97E+00	4.82E+05	3.86E+01	-1.57E-03	-8.65E+00	-2.20E+01	-7.41E+01	1.32E+00
299-E17-13 (216-A-45)	MAX	1.62E+01	1.36E+01	2.91E+06	1.22E+02	6.66E-01	8.95E+00	3.06E+00	7.60E+00	9.91E+00
299-E17-13 (216-A-45)	AVE	1.02E+01	1.27E+01	2.53E+06	1.14E+02	5.02E-01	4.93E+00	-7.53E-01	-1.42E+01	7.27E+00
299-E17-13 (216-A-45)	MIN	7.52E+00	1.08E+01	2.05E+06	1.06E+02	3.06E-01	2.56E+00	-3.54E+00	-3.96E+01	3.48E+00
299-E23-02 (200-EAST)	MAX		8.06E+00	1.06E+04	5.00E-01					
299-E23-02 (200-EAST)	AVE	NN	8.06E+00	1.06E+04	5.00E-01	NN	NN	NN	NN	NN
299-E23-02 (200-EAST)	MIN		8.06E+00	1.06E+04	5.00E-01					
299-E24-01 (216-A-5)*	MAX		4.56E+01	1.01E+07	4.96E+02	1.14E+01	3.20E+00	1.61E+00	5.30E+01	
299-E24-01 (216-A-5)*	AVE	NN	3.14E+01	9.02E+06	4.23E+02	1.06E+01	1.20E-01	-2.36E+00	-1.56E+01	NN
299-E24-01 (216-A-5)*	MIN		2.02E+01	7.70E+06	3.85E+02	8.60E+00	-3.84E+00	-4.55E+00	-5.45E+01	
299-E24-02 (216-A-10)	MAX	1.36E+01	1.88E+01	7.01E+06	3.29E+02	4.63E+00	4.48E+00	5.64E+00	9.78E+01	
299-E24-02 (216-A-10)	AVE	9.19E+00	1.48E+01	5.50E+06	2.61E+02	3.21E+00	6.50E-03	-9.55E-01	-1.99E+00	NN
299-E24-02 (216-A-10)	MIN	5.38E+00	1.12E+01	4.82E+06	1.82E+02	2.16E+00	-4.12E+00	-4.58E+00	-3.90E+01	
299-E24-04 (216-A-9)*	MAX		7.00E+00	2.54E+04	4.41E+00	4.67E-01	6.33E+00	5.64E+00	2.58E+01	
299-E24-04 (216-A-9)*	AVE	NN	5.26E+00	1.65E+04	3.36E+00	3.28E-01	3.23E+00	2.46E+00	-1.47E+01	NN
299-E24-04 (216-A-9)*	MIN		3.87E+00	1.14E+04	2.36E+00	1.84E-01	-1.38E+00	-3.53E+00	-5.28E+01	
299-E24-08 (216-C-3,4,5)*	MAX		7.34E+01	6.68E+03	9.92E+00		9.90E+00	8.43E+00	4.38E+01	
299-E24-08 (216-C-3,4,5)*	AVE	NN	4.45E+01	4.28E+03	6.82E+00	NN	6.67E-02	2.72E-01	3.60E+00	NN
299-E24-08 (216-C-3,4,5)*	MIN		2.31E+01	1.34E+03	2.86E+00		-7.66E+00	-8.09E+00	-6.27E+01	
299-E24-12 (216-A-21,31)*	MAX		5.66E+01	9.14E+05	6.97E+01	3.58E+00	7.83E+00	1.26E+01	3.94E+01	
299-E24-12 (216-A-21,31)*	AVE	NN	4.23E+01	3.93E+05	6.23E+01	3.21E+00	5.28E-01	5.66E+00	3.33E+00	NN
299-E24-12 (216-A-21,31)*	MIN		2.52E+01	1.93E+05	5.31E+01	2.63E+00	-3.83E+00	-5.05E-01	-2.94E+01	
299-E24-13 (241-A)*	MAX		7.66E+00		3.13E+00					
299-E24-13 (241-A)*	AVE	NN	6.55E+00	NN	2.82E+00	NN	NN	NN	NN	NN
299-E24-13 (241-A)*	MIN		5.66E+00		2.49E+00					
299-E25-03 (216-A-6)*	MAX		5.43E+00							
299-E25-03 (216-A-6)*	AVE	NN	4.77E+00	NN	NN	NN	NN	NN	NN	NN
299-E25-03 (216-A-6)*	MIN		3.67E+00							
299-E25-06 (216-A-8)	MAX	2.60E+00	6.19E+00	1.33E+04	8.45E+00	8.44E-01	5.75E+00	6.08E+00	9.76E+01	
299-E25-06 (216-A-8)	AVE	1.59E+00	4.69E+00	9.07E+03	3.34E+00	1.97E-01	7.02E-01	7.78E-01	7.12E+00	NN
299-E25-06 (216-A-8)	MIN	4.68E-01	3.04E+00	5.25E+03	6.80E-01	-1.80E-01	-4.47E+00	-7.06E+00	-1.03E+02	

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 3 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX	1.95E+00	1.36E+01	6.03E+03	1.10E+01	1.97E+00	6.19E+00	9.87E+00	8.26E+01	
299-E25-09	AVE	9.48E-01	5.26E+00	3.59E+03	4.92E+00	4.65E-01	1.86E+00	4.63E-01	1.50E+01	NN
(216-A-8)	MIN	6.23E-01	3.63E+00	2.62E+03	2.19E+00	-3.65E-01	-2.27E+00	-1.25E+01	-5.56E+01	
	MAX	2.02E+00	7.45E+00				4.98E+00	3.54E+00	3.05E+01	1.26E+00
299-E25-10	AVE	1.52E+00	6.25E+00	NN	NN	NN	6.92E-01	-2.59E+00	-3.34E+00	1.00E+00
(216-A-18,19)*	MIN	9.86E-01	5.52E+00				-6.32E+00	-6.40E+00	-7.66E+01	8.56E-01
	MAX	1.89E+00	1.05E+01	3.40E+05	4.50E+01	7.79E-01	1.07E+01	5.61E+00	5.96E+01	
299-E25-11	AVE	1.19E+00	7.65E+00	1.64E+05	2.85E+01	2.45E-01	6.53E-01	-1.34E-01	-6.50E+00	NN
(216-A-30)	MIN	4.32E-01	2.53E+00	-9.81E+02	1.68E+01	-9.90E-02	-8.98E+00	-1.81E+01	-6.91E+01	
	MAX		1.14E+01		5.09E+02					
299-E25-13	AVE	NN	9.65E+00	NN	3.90E+02	NN	NN	NN	NN	NN
(241-AX)*	MIN		7.47E+00		2.58E+02					
	MAX	1.98E+00	1.38E+01	4.42E+05	2.48E+01	8.72E-01	6.19E+00	7.05E+00	8.60E+00	
299-E25-17	AVE	1.10E+00	9.19E+00	3.00E+05	1.58E+01	4.15E-01	-1.95E+00	-5.13E-01	2.54E+00	NN
(216-A-37-1)	MIN	5.27E-01	6.03E+00	1.88E+05	7.30E+00	1.71E-01	-1.44E+01	-7.88E+00	-7.41E+00	
	MAX	3.06E+00	1.15E+01	2.11E+05	2.16E+01	1.06E+00	7.12E+00	7.89E+00	9.69E+01	
299-E25-18	AVE	1.67E+00	6.66E+00	1.30E+05	1.68E+01	5.89E-01	6.53E-01	1.64E+00	6.90E+00	NN
(216-A-37-1)	MIN	1.05E+00	3.24E+00	7.47E+04	8.28E+00	1.35E-01	-7.26E+00	-5.10E+00	-7.81E+01	
	MAX	1.94E+00	1.02E+02	4.39E+06	1.90E+02	6.98E-01	5.85E+00	6.45E+00	-2.90E+00	
299-E25-19	AVE	1.48E+00	3.01E+01	1.37E+06	1.23E+02	3.57E-01	-9.68E-02	4.42E+00	-2.94E+01	NN
(216-A-37-1)	MIN	1.00E+00	9.38E+00	4.86E+05	1.37E+00	4.30E-02	-4.15E+00	2.02E+00	-4.90E+01	
	MAX	2.00E+00	1.65E+01	4.79E+05	1.56E+02	9.07E-01	4.47E+00	3.04E+00	8.63E+00	
299-E25-20	AVE	1.41E+00	1.34E+01	3.67E+05	1.35E+02	2.86E-01	6.45E-01	1.15E+00	-1.55E+01	NN
(216-A-37-1)	MIN	9.94E-01	1.15E+01	1.46E+05	1.11E+02	-6.20E-02	-2.75E+00	-5.67E-01	-3.86E+01	
	MAX	2.84E+00	1.88E+01	3.49E+03	1.25E+01	5.64E-01	9.99E+00	7.04E+00	8.08E+01	
299-E25-21	AVE	1.84E+00	1.28E+01	2.28E+03	5.73E+00	1.73E-01	1.40E+00	3.10E-01	2.71E+01	NN
(216-A-37-2)	MIN	1.27E+00	8.55E+00	1.05E+03	2.83E+00	-2.15E-01	-8.00E+00	-1.16E+01	-1.08E+01	
	MAX	1.79E+00	9.65E+00	1.02E+04	9.27E+00	1.33E+00	6.42E+00	9.70E+00	6.15E+01	
299-E25-22	AVE	1.10E+00	6.78E+00	6.67E+03	6.05E+00	3.52E-01	3.50E-01	1.29E+00	-1.81E+01	NN
(216-A-37-2)	MIN	6.48E-01	4.93E+00	4.24E+03	4.69E+00	-1.77E-03	-7.26E+00	-6.04E+00	-7.41E+01	
	MAX	2.01E+00	3.08E+01	7.84E+03	2.30E+01	4.00E-01	4.22E+00	4.24E+00	6.38E+01	
299-E25-23	AVE	8.92E-01	2.14E+01	2.63E+03	8.40E+00	2.30E-01	1.30E-01	3.22E-01	6.44E+00	NN
(216-A-37-2)	MIN	3.05E-01	1.64E+01	9.34E+01	5.00E-01	-3.43E-02	-8.33E+00	-9.10E+00	-7.60E+01	

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 4 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
299-E25-24	MAX	1.95E+00	3.32E+01	7.14E+03	2.69E+01	8.26E-01	8.25E+00	6.77E+00	7.53E+01	
(216-A-37-2)	AVE	1.66E+00	2.35E+01	3.06E+03	1.18E+01	4.19E-01	-5.00E-02	3.07E+00	2.27E+01	NN
	MIN	1.36E+00	1.43E+01	3.00E+02	2.43E+00	-8.65E-02	-1.07E+01	-3.36E+00	-3.71E+01	
299-E26-02	MAX		8.18E+00	9.28E+03	2.66E+00					
(216-A-24)*	AVE	NN	5.37E+00	5.06E+03	1.68E+00	NN	NN	NN	NN	NN
	MIN		3.47E+00	3.33E+03	1.01E+00					
299-E26-04	MAX		6.55E+00	6.35E+04	2.43E+00					
(216-A-24)*	AVE	NN	5.61E+00	4.75E+04	1.71E+00	NN	NN	NN	NN	NN
	MIN		4.86E+00	3.69E+04	3.30E-01					
299-E26-06	MAX	1.68E+00	7.41E+00	4.36E+03	1.53E+00	1.28E+00	7.35E+00	4.71E+00	4.85E+01	
(401-A)	AVE	8.08E-01	5.12E+00	2.43E+03	1.25E+00	5.33E-01	5.37E+00	2.60E+00	2.89E+01	NN
	MIN	2.78E-01	2.82E+00	8.41E+02	1.02E+00	1.62E-01	3.44E+00	1.41E+00	-2.93E+00	
299-E27-05	MAX		5.34E+01				-8.54E-01	1.12E+01	6.90E+01	
(216-C-10)*	AVE	NN	4.55E+01	NN	NN	NN	-5.30E+00	4.83E+00	-1.75E-01	NN
	MIN		4.04E+01				-9.61E+00	-4.59E+00	-3.05E+01	
299-E27-07	MAX	1.53E+00	6.58E+00		2.32E+00					
(241-C)*	AVE	1.22E+00	5.00E+00	NN	2.07E+00	NN	NN	NN	NN	NN
	MIN	7.95E-01	3.87E+00		1.89E+00					
299-E28-09	MAX	1.30E+01	1.09E+01							9.03E+00
(216-B-12)*	AVE	1.16E+01	8.91E+00	NN	NN	NN	NN	NN	NN	7.47E+00
	MIN	1.04E+01	6.89E+00							5.93E+00
299-E28-12	MAX		1.93E+01	1.42E+05			4.70E+00	4.20E+00	7.63E+01	
(216-B-55)	AVE	NN	1.35E+01	1.08E+05	NN	NN	4.10E-01	-1.98E+00	1.59E+01	NN
	MIN		9.21E+00	8.12E+04			-4.82E+00	-1.34E+01	-5.73E+01	
299-E28-13	MAX		9.71E+00	8.55E+03			4.79E+00	4.72E+00	2.66E+01	
(216-B-55)	AVE	NN	9.05E+00	7.37E+03	NN	NN	-2.32E+00	3.45E+00	-1.05E+01	NN
	MIN		5.59E+00	2.92E+03			-9.25E+00	-7.08E+00	-1.05E+02	
299-E28-16	MAX	9.13E+00	8.50E+00							6.52E+00
(216-B-12)*	AVE	8.01E+00	7.89E+00	NN	NN	NN	NN	NN	NN	5.76E+00
	MIN	6.69E+00	7.20E+00							4.95E+00
299-E28-17	MAX	2.33E+01								
(216-B-6,10B)*	AVE	1.57E+01	NN	NN	NN	NN	NN	NN	NN	NN
	MIN	8.60E+00								

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Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 5 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX	1.28E+02	3.84E+01	8.90E+03	7.35E+01	1.02E+00	3.83E+00	8.46E+00	3.93E+01	1.17E+02
299-E28-18	AVE	6.93E+01	2.24E+01	5.84E+03	5.59E+01	5.39E-01	-9.42E-01	3.62E+00	-5.10E-01	6.00E+01
(216-B-62)	MIN	4.63E+01	1.72E+01	1.25E+03	4.64E+01	1.54E-02	-8.95E+00	-2.53E+00	-1.00E+02	3.19E+01
	MAX	1.29E+02	2.66E+01	9.37E+03	6.06E+01	1.04E+00	5.00E+00	9.65E+00	6.24E+01	9.91E+01
299-E28-21	AVE	8.32E+01	1.91E+01	6.99E+03	4.70E+01	2.82E-01	-1.13E+00	-5.02E-01	-1.90E+00	6.73E+01
(216-B-62)	MIN	4.36E+01	1.35E+01	4.71E+03	3.86E+01	-3.84E-01	-1.03E+01	-1.07E+01	-4.34E+01	4.17E+01
	MAX	6.75E+01	1.30E+04	7.33E+03	1.58E+01	6.14E+03	2.16E+03	1.51E+01	6.36E+01	4.45E+01
299-E28-23	AVE	5.49E+01	1.16E+04	5.51E+03	1.34E+01	5.58E+03	2.01E+03	9.73E+00	4.83E+00	3.35E+01
(216-B-5)*	MIN	4.13E+01	9.01E+03	4.41E+03	1.14E+01	4.94E+03	1.83E+03	3.03E+00	-1.14E+02	2.53E+01
	MAX		5.27E+01	9.00E+03	1.60E+01					
299-E32-01	AVE	NN	4.95E+01	7.87E+03	1.51E+01	NN	NN	NN	NN	NN
(200-EAST)	MIN		4.62E+01	6.74E+03	1.42E+01					
	MAX		1.50E+02			7.42E-01	2.89E+00	2.01E+01	3.00E+01	
299-E33-01	AVE	NN	1.29E+02	NN	NN	4.06E-01	-1.61E+00	1.08E+01	2.04E+01	NN
(216-B-43)*	MIN		1.15E+02			-1.31E-01	-4.53E+00	2.12E+00	8.62E+00	
	MAX		1.21E+03	1.34E+03		7.30E-01	7.68E+00	7.27E+01	3.63E+01	1.06E+00
299-E33-03	AVE	NN	6.40E+02	1.14E+03	NN	4.30E-01	2.75E-01	4.26E+01	-1.03E+01	1.06E+00
(216-B-44,45)*	MIN		1.29E+02	8.54E+02		2.76E-01	-2.87E+00	7.89E+00	-1.04E+02	1.06E+00
	MAX		2.87E+02			3.05E-01	7.91E+00	5.34E+01	4.76E+01	
299-E33-05	AVE	NN	2.53E+02	NN	NN	1.82E-01	2.35E+00	3.18E+01	-1.20E+01	NN
(216-B-47)*	MIN		2.26E+02			-1.84E-03	-2.99E+00	1.83E+01	-8.48E+01	
	MAX		8.64E+02			1.11E+00	5.55E+00	1.17E+02	4.50E+01	1.65E+00
299-E33-07	AVE	NN	6.54E+02	NN	NN	7.02E-01	-4.34E+00	7.93E+01	6.25E+00	1.65E+00
(216-B-48,49)*	MIN		4.96E+02			2.04E-01	-1.57E+01	5.18E+01	-4.46E+01	1.65E+00
	MAX		1.84E+02			5.49E-01	4.82E+00	5.05E+00	4.25E+01	
299-E33-08	AVE	NN	1.21E+02	NN	NN	2.22E-01	-1.77E+00	-5.47E-01	1.08E+00	NN
(216-B-41)*	MIN		7.67E+01			-1.16E-02	-8.94E+00	-5.56E+00	-4.50E+01	
	MAX		1.73E+02	5.07E+02	1.19E+01	1.47E+00	1.79E+01	1.26E+01	-4.31E+01	
299-E33-09	AVE	NN	1.04E+02	2.28E+02	8.70E+00	9.51E-01	9.75E+00	3.45E+00	-6.24E+01	NN
(241-BY)*	MIN		3.78E+01	2.93E+01	5.22E+00	6.66E-01	3.44E+00	-6.77E+00	-8.91E+01	
	MAX		9.86E+00	7.98E+03	6.42E+00	1.08E+00	4.47E+00	2.43E+00	5.64E+01	
299-E33-10	AVE	NN	8.77E+00	6.67E+03	5.55E+00	5.82E-01	-1.75E-02	1.08E-01	-6.07E+00	NN
(216-B-35,41)*	MIN		7.98E+00	5.71E+03	4.94E+00	-1.10E-01	-1.10E+01	-1.61E+00	-7.56E+01	

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 6 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX		1.49E+01			2.66E+00	6.19E+00	6.82E+00	1.44E+01	
299-E33-18	AVE	NN	1.20E+01	NN	NN	8.12E-01	4.25E-01	3.16E+00	-1.36E+01	NN
(216-B-7A,7B)*	MIN		8.77E+00			-2.11E-01	-8.62E+00	-1.51E+00	-3.77E+01	
	MAX		1.55E+01		4.96E+00	2.01E+00				
299-E33-20	AVE	NN	1.20E+01	NN	2.63E+00	1.77E+00	NN	NN	NN	NN
(216-B-7,11)*	MIN		7.30E+00		1.01E+00	1.53E+00				
	MAX		5.16E+00				5.00E+00	2.25E+00	6.26E+01	
299-E33-21	AVE	NN	4.52E+00	NN	NN	NN	1.27E-01	-1.26E+00	2.70E+00	NN
(216-B-36)*	MIN		4.10E+00				-7.83E+00	-6.07E+00	-4.96E+01	
	MAX		1.71E+02			2.60E+00	3.44E+00	7.89E+00	3.43E+01	
299-E33-24	AVE	NN	1.09E+02	NN	NN	7.73E-01	-4.20E-01	1.12E+00	2.72E+00	NN
(216-B-57)*	MIN		6.12E+01			-2.26E-01	-9.89E+00	-3.35E+00	-2.62E+01	
	MAX		1.65E+02			6.91E-01	6.55E+00	1.62E+01	2.60E+01	
299-E33-26	AVE	NN	1.56E+02	NN	NN	3.10E-01	1.67E+00	8.04E+00	9.03E+00	NN
(216-B-61)*	MIN		1.49E+02			-6.54E-02	-6.07E+00	-7.33E+00	-1.22E+01	
	MAX	7.17E+00	7.09E+00	7.37E+02			8.31E+00	9.60E+00	4.20E+01	
299-E34-01	AVE	2.72E+00	5.97E+00	3.49E+02	NN	NN	1.30E+00	1.04E+00	1.67E+01	NN
(216-B-63)	MIN	1.76E+00	3.34E+00	-4.04E+02			-1.13E+01	-1.45E+01	-1.69E+01	
	MAX		1.30E+02			1.20E+00	1.24E+00	3.55E+00	5.20E+01	
299-W10-01	AVE	NN	5.67E+01	NN	NN	6.89E-01	-3.00E-01	1.44E+00	1.12E+01	NN
(216-T-5)*	MIN		1.60E+01			1.38E-01	-3.10E+00	-5.63E-01	-6.45E+01	
	MAX	1.43E+01	1.27E+02			9.30E-01	-6.89E-01	1.62E+01	1.75E+01	
299-W10-03	AVE	1.39E+01	9.38E+01	NN	NN	7.14E-01	-8.24E-01	9.80E+00	6.07E+00	NN
(216-T-32)*	MIN	1.34E+01	6.07E+01			4.97E-01	-9.59E-01	3.39E+00	-5.36E+00	
	MAX		5.93E+01			3.01E-01	5.51E+00	1.01E+01	2.47E+01	
299-W10-04	AVE	NN	4.92E+01	NN	NN	-1.06E-02	4.32E+00	7.93E+00	1.04E+01	NN
(216-T-36)*	MIN		4.35E+01			-2.66E-01	3.30E+00	5.63E+00	-1.73E+01	
	MAX	1.50E+00	3.48E+01		1.65E+02	6.10E-01	8.26E+00	5.65E+00	7.47E+01	
299-W10-08	AVE	1.29E+00	2.93E+01	NN	1.35E+02	4.34E-01	3.56E+00	-5.64E-01	2.58E+01	NN
(241-T)*	MIN	9.50E-01	1.84E+01		1.08E+02	1.63E-01	1.03E+00	-6.78E+00	-1.76E+01	
	MAX	2.81E+00	4.88E+01		4.33E+02	2.67E-01	2.41E+00	1.21E+01	-2.89E+01	
299-W10-09	AVE	2.22E+00	4.25E+01	NN	3.54E+02	1.62E-01	1.09E+00	7.83E+00	-3.35E+01	NN
(241-T)*	MIN	1.42E+00	3.63E+01		2.69E+02	-2.98E-02	0.00E+00	3.51E+00	-4.03E+01	

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 7 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX	3.30E+00	4.51E+01			1.45E-01	3.51E+00	1.50E+01	1.71E+01	
299-W11-11	AVE	2.60E+00	4.40E+01	NN	NN	1.11E-01	2.63E+00	6.44E+00	-1.81E+01	NN
(216-T-18)*	MIN	2.06E+00	4.26E+01			5.61E-02	1.72E+00	-2.25E+00	-7.70E+01	
	MAX		1.78E+01							
299-W11-15	AVE	NN	1.74E+01	NN	NN	NN	NN	NN	NN	NN
(216-T-32)*	MIN		1.71E+01							
	MAX		6.02E+01			4.06E-01	6.66E+00	1.07E+01	5.53E+01	
299-W11-18	AVE	NN	5.75E+01	NN	NN	2.10E-01	2.53E+00	5.58E+00	3.61E+01	NN
(216-T-35)*	MIN		5.62E+01			-3.97E-02	-3.19E-01	0.00E+00	1.03E+01	
	MAX	6.19E+00	5.74E+01		3.51E+02	4.67E-01	2.41E+00	1.80E+01	-8.04E+00	
299-W11-23	AVE	5.06E+00	5.47E+01	NN	2.91E+02	2.19E-01	-2.07E+00	1.20E+01	-3.06E+01	NN
(241-T)*	MIN	4.42E+00	5.00E+01		2.29E+02	4.14E-02	-7.35E+00	2.53E+00	-7.23E+01	
	MAX	2.34E+00	5.50E+01		3.22E+02	8.24E-01	6.54E+00	7.02E+00	4.03E+01	
299-W11-24	AVE	1.44E+00	4.70E+01	NN	2.83E+02	3.23E-01	-9.93E-01	4.57E-01	3.51E+01	NN
(241-T)*	MIN	9.08E-01	4.29E+01		2.40E+02	4.07E-02	-4.82E+00	-4.52E+00	3.23E+01	
	MAX	2.44E+00	5.02E+01	2.04E+05		2.99E+00	5.77E+00	1.07E+01	3.47E+01	
299-W14-02	AVE	2.11E+00	3.63E+01	1.79E+05	NN	2.50E+00	1.38E+00	5.03E+00	1.86E+01	NN
(216-T-26,27)*	MIN	1.91E+00	2.30E+01	1.54E+05		2.09E+00	-5.43E+00	1.01E+00	-2.93E+00	
	MAX		4.87E+01	8.08E+05	3.69E+02					
299-W14-05	AVE	NN	3.44E+01	3.65E+05	2.61E+02	NN	NN	NN	NN	NN
(241-TX)*	MIN		2.07E+01	2.13E+04	1.57E+02					
	MAX		4.20E+01	2.05E+05	1.45E+02					
299-W14-06	AVE	NN	2.98E+01	1.76E+05	1.29E+02	NN	NN	NN	NN	NN
(241-TX)*	MIN		1.88E+01	1.51E+05	1.14E+02					
	MAX	8.24E+00	8.29E+00	2.50E+03	9.50E+01	1.40E+00	5.56E+00	8.48E+00	7.05E+01	
299-W14-10	AVE	5.68E+00	6.32E+00	1.67E+03	7.42E+01	2.44E-01	-2.80E-02	1.59E+00	-7.27E+00	NN
(216-W-LWC)	MIN	3.89E+00	3.05E+00	8.70E+02	6.15E+01	-3.84E-01	-6.39E+00	-5.05E+00	-5.85E+01	
	MAX		5.88E+01		9.56E+01	3.04E-01	1.67E+00	5.88E+00	2.25E+01	
299-W15-03	AVE	NN	5.46E+01	NN	9.18E+01	1.42E-01	-2.73E+00	-1.90E+00	-1.21E+01	NN
(216-TY)*	MIN		5.18E+01		8.54E+01	-1.48E-01	-1.07E+01	-1.61E+01	-3.79E+01	
	MAX		1.43E+01	5.60E+05	7.70E+02					
299-W15-04	AVE	NN	1.06E+01	4.79E+05	7.11E+02	NN	NN	NN	NN	NN
(216-T-19)*	MIN		6.64E+00	3.10E+05	6.64E+02					

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 8 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX	1.40E+00	6.64E+00		1.05E+01					
299-W15-06	AVE	1.17E+00	5.86E+00	NN	8.64E+00	NN	NN	NN	NN	NN
(216-Z-9)*	MIN	8.47E-01	5.19E+00		7.22E+00					
	MAX	1.87E+00	3.29E+01		7.39E+01	5.22E-01	3.30E+00	1.88E+01	5.40E+00	
299-W15-07	AVE	1.63E+00	2.84E+01	NN	6.71E+01	2.49E-01	3.20E+00	1.17E+01	-4.78E+00	NN
(216-Z-7)*	MIN	1.48E+00	2.57E+01		6.14E+01	5.79E-02	3.10E+00	6.59E+00	-1.39E+01	
	MAX	2.27E+00	1.82E+01		1.27E+02					
299-W15-10	AVE	1.42E+00	1.46E+01	NN	1.04E+02	NN	NN	NN	NN	NN
(216-Z-16)*	MIN	5.72E-01	1.11E+01		8.20E+01					
	MAX	2.53E+00	2.53E+01		2.41E+02	1.55E-01	8.27E+00	5.63E+00	4.38E+01	
299-W15-11	AVE	2.17E+00	2.14E+01	NN	2.09E+02	8.09E-02	2.48E+00	-2.12E+00	2.08E+01	NN
(216-Z-16)*	MIN	1.70E+00	1.79E+01		1.86E+02	4.17E-02	-6.42E+00	-1.33E+01	-1.05E+01	
	MAX	1.24E+00	5.38E+00							
299-W18-05	AVE	9.90E-01	4.63E+00	NN	NN	NN	NN	NN	NN	NN
(216-Z-12)*	MIN	7.10E-01	3.83E+00							
	MAX	2.35E+00	1.07E+01		1.21E+01					
299-W18-09	AVE	1.50E+00	5.53E+00	NN	1.07E+01	NN	NN	NN	NN	NN
(216-Z-18)*	MIN	7.95E-01	3.21E+00		7.97E+00					
	MAX	5.65E+01	2.17E+01	5.39E+02	5.41E+00		4.95E+00	6.10E+00	5.30E+01	4.64E+01
299-W18-15	AVE	5.00E+01	1.44E+01	1.22E+02	1.60E+00	NN	9.64E-01	2.53E+00	5.14E+00	3.73E+01
(216-U-10)*	MIN	4.58E+01	9.67E+00	-3.16E+02	8.30E-01		-9.07E+00	-2.53E+00	-3.46E+01	2.00E+01
	MAX	1.98E+00	4.00E+00	3.69E+02	1.32E+00		3.10E+00	2.26E+00	1.47E+01	
299-W18-17	AVE	6.02E-01	3.21E+00	1.76E+02	9.50E-01	NN	-5.32E+00	4.90E-01	-3.01E+01	NN
(216-Z-20)	MIN	-1.34E-02	2.53E+00	9.28E+01	5.00E-01		-2.08E+01	-3.03E+00	-8.77E+01	
	MAX	3.50E+00	4.16E+00	2.22E+02	3.75E+00		9.08E+00	4.52E+00	3.46E+01	
299-W18-18	AVE	8.06E-01	3.08E+00	7.53E+01	1.31E+00	NN	3.87E-01	-3.24E-01	-3.58E+00	NN
(216-Z-20)	MIN	-7.63E-02	1.60E+00	-5.03E+02	4.40E-01		-6.89E+00	-6.81E+00	-8.58E+01	
	MAX	1.67E+00	4.61E+00	3.43E+02	3.72E+00		4.66E+00	4.03E+00	4.63E+01	
299-W18-19	AVE	6.61E-01	3.72E+00	1.75E+02	1.83E+00	NN	-6.10E-01	5.90E-02	-2.44E+01	NN
(216-Z-20)	MIN	2.46E-01	2.85E+00	7.13E+01	7.53E-01		-5.00E+00	-5.38E+00	-9.06E+01	
	MAX	1.47E+00	4.56E+00	1.78E+02	4.29E+00		5.17E+00	7.89E+00	6.98E+01	
299-W18-20	AVE	5.76E-01	3.90E+00	1.01E+02	2.24E+00	NN	1.50E+00	3.79E+00	-5.73E+00	NN
(216-Z-20)	MIN	4.19E-02	3.47E+00	9.68E+00	4.00E-01		-2.75E+00	-3.96E+00	-4.41E+01	

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 9 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX	6.46E+00	5.43E+01	1.02E+05	5.34E+02	1.05E+01	3.91E+00	3.54E+00	3.23E+01	5.37E+00
299-W19-02	AVE	3.94E+00	4.91E+01	8.67E+04	3.46E+02	8.30E+00	-1.50E+00	-5.05E+00	4.63E+00	3.12E+00
(216-U-8)*	MIN	2.15E+00	3.76E+01	6.07E+04	1.90E+02	6.02E+00	-9.91E+00	-2.12E+01	-4.09E+01	1.22E+00
	MAX	1.39E+04	1.03E+04	1.00E+03	1.37E+02		2.88E+00	6.06E+00	3.45E+01	1.39E+04
299-W19-03	AVE	9.27E+03	6.60E+03	9.05E+02	1.08E+02	NN	1.96E+00	4.30E+00	-7.90E+00	8.44E+03
(216-U-1,2)*	MIN	4.86E+03	8.76E+02	8.10E+02	6.33E+01		1.28E+00	2.79E+00	-6.36E+01	3.28E+03
	MAX		2.09E+01	3.54E+02	5.73E+00					7.27E+00
299-W19-05	AVE	NN	1.89E+01	2.08E+02	4.97E+00	NN	NN	NN	NN	5.87E+00
(216-S-23)*	MIN		1.68E+01	4.18E+01	3.61E+00					4.35E+00
	MAX	1.62E+04	1.23E+04		2.21E+02					1.59E+04
299-W19-09	AVE	9.76E+03	8.26E+03	NN	1.51E+02	NN	NN	NN	NN	9.20E+03
(216-U-1,2)*	MIN	3.29E+03	4.92E+03		7.57E+01					5.52E+03
	MAX	2.04E+04		1.54E+03	1.75E+02		1.34E+01	3.90E+00	0.00E+00	2.74E+04
299-W19-11	AVE	1.23E+04	NN	8.53E+02	1.25E+02	NN	5.08E+00	3.76E-01	-3.76E+01	1.20E+04
(216-U-1,2)*	MIN	7.62E+03		1.66E+02	3.40E+01		-6.40E+00	-2.10E+00	-1.06E+02	7.47E+03
	MAX	5.36E+00	7.15E+00	3.98E+02	5.34E+00	6.14E-01	1.72E+00	1.13E+01	1.15E+01	3.28E+00
299-W19-12	AVE	4.58E+00	6.00E+00	9.23E+01	3.90E+00	2.56E-01	-1.71E+00	1.61E+00	-2.35E+01	2.21E+00
(241-U)*	MIN	4.06E+00	4.66E+00	-1.54E+02	2.53E+00	-2.93E-02	-5.99E+00	-6.20E+00	-5.90E+01	1.07E+00
	MAX	2.24E+01	1.92E+01	3.45E+02	2.67E+01	1.08E+00	8.32E+00	6.09E+00	5.48E+01	1.90E+01
299-W19-13	AVE	1.59E+01	1.23E+01	5.40E+01	2.21E+01	3.61E-01	2.91E+00	5.93E-01	1.79E+00	1.22E+01
(216-U-16)*	MIN	1.00E+01	6.11E+00	-4.31E+02	1.23E+01	1.03E-01	-3.42E+00	-3.53E+00	-3.76E+01	6.37E+00
	MAX	6.01E+00	1.63E+01	3.91E+02	1.52E+01	1.14E+00	9.46E+00	5.38E+00	7.32E+01	4.90E+00
299-W19-14	AVE	4.30E+00	8.74E+00	7.08E+01	8.28E+00	3.31E-01	1.03E+00	-1.76E+00	3.26E+00	3.14E+00
(216-U-16)*	MIN	2.99E+00	5.54E+00	-3.40E+02	4.53E+00	-1.71E-01	-9.96E+00	-1.21E+01	-1.25E+02	1.75E+00
	MAX	5.48E+03	3.25E+03		1.90E+02					2.38E+04
299-W19-15	AVE	2.37E+03	1.94E+03	NN	1.12E+02	NN	NN	NN	NN	2.79E+03
(216-U-1,2)*	MIN	4.12E+02	3.88E+02		2.78E+01					4.41E+02
	MAX	8.59E+03	8.58E+03		2.41E+02					8.42E+03
299-W19-16	AVE	4.45E+03	4.68E+03	NN	1.50E+02	NN	NN	NN	NN	4.32E+03
(216-U-1,2)*	MIN	2.16E+03	1.12E+03		1.00E+02					2.01E+03
	MAX	8.98E+03			8.68E+01					1.10E+04
299-W19-17	AVE	1.55E+03	NN	NN	2.18E+01	NN	NN	NN	NN	1.58E+03
(216-U-1,2)*	MIN	5.84E+01			8.45E+00					5.77E+01

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 10 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX	9.14E+03			8.68E+02					1.03E+04
299-W19-18	AVE	7.17E+03	NN	NN	5.34E+02	NN	NN	NN	NN	7.32E+03
(216-U-1,2)*	MIN	3.11E+01			2.21E+02					3.39E+03
	MAX	1.38E+02	1.45E+02	1.30E+03	8.45E+02	8.32E-01	3.45E+00	4.06E+00	4.35E+01	1.39E+02
299-W19-20	AVE	1.13E+02	9.72E+01	1.05E+03	6.44E+02	4.45E-01	3.00E-01	-1.18E-01	1.98E+00	1.11E+02
(216-U-17)	MIN	6.61E+01	5.16E+01	5.10E+02	4.87E+02	1.04E-01	-2.66E+00	-5.12E+00	-4.22E+01	8.69E+01
	MAX	1.88E+01	8.18E+01	2.42E+02	1.90E+00	4.91E-01	1.60E+00	3.05E+00	7.23E+01	1.28E+01
299-W19-21	AVE	1.52E+01	4.81E+01	1.29E+02	1.14E+00	2.44E-01	-2.54E+00	-4.85E+00	4.15E+01	1.11E+01
(216-U-14)	MIN	1.14E+01	1.70E+01	-3.09E+02	5.00E-01	-2.39E-01	-5.99E+00	-1.84E+01	-1.18E+01	9.23E+00
	MAX	1.81E+00			4.42E+01					8.76E-01
299-W21-01	AVE	1.81E+00	NN	NN	4.42E+01	NN	NN	NN	NN	8.76E-01
(200-WEST)	MIN	1.81E+00			4.42E+01					8.76E-01
	MAX	5.22E+00	4.39E+01	7.16E+02	4.72E+00	4.23E+01	8.55E+00	2.02E+00	7.23E+00	
299-W22-01	AVE	4.57E+00	3.23E+01	4.93E+02	4.00E+00	2.98E+01	1.43E+00	-3.56E+00	-1.63E+01	NN
(216-S-1,2)*	MIN	3.89E+00	2.38E+01	2.77E+02	3.61E+00	1.82E+01	-2.56E+00	-1.41E+01	-2.96E+01	
	MAX	6.64E+00	1.57E+01	1.47E+03	3.74E+00	5.32E+00	3.20E+00	4.04E+00	2.01E+01	
299-W22-02	AVE	5.88E+00	1.29E+01	8.35E+02	3.49E+00	4.31E+00	1.89E+00	2.01E+00	-1.23E+01	NN
(216-S-1,2)*	MIN	5.27E+00	1.05E+01	4.45E+02	3.33E+00	3.31E+00	3.33E-01	-7.02E-01	-5.43E+01	
	MAX		1.02E+01	7.61E+04	4.83E+00	-6.73E-02	2.07E+00	3.38E+00	8.58E+00	
299-W22-12	AVE	NN	8.49E+00	3.83E+04	4.10E+00	-1.64E-01	-8.63E+00	4.99E+00	-3.18E+01	NN
(216-S-7)*	MIN		6.78E+00	5.19E+02	3.37E+00	-2.60E-01	-1.07E+01	1.61E+00	-7.21E+01	
	MAX		5.26E+01	7.47E+05		6.27E-01	1.13E+01	1.46E+01	9.39E+00	
299-W22-20	AVE	NN	4.49E+01	6.10E+05	NN	3.77E-01	4.91E+00	1.08E+01	-2.65E+01	NN
(216-S-20)*	MIN		3.95E+01	3.62E+05		2.42E-01	9.99E-01	7.58E+00	-7.04E+01	
	MAX	2.82E+01	2.33E+02		1.37E+01	1.69E-01	3.71E+00	5.89E+00	-2.82E+00	
299-W22-21	AVE	2.26E+01	2.12E+02	NN	1.32E+01	1.32E-01	-1.49E+00	4.52E+00	-2.30E+01	NN
(216-S-13)*	MIN	1.62E+01	1.81E+02		1.27E+01	8.38E-02	-9.66E+00	1.18E+00	-5.16E+01	
	MAX	1.21E+00	5.04E+00	2.41E+03	2.10E+00	7.72E-01	6.88E+00	7.48E+00	5.14E+01	8.42E-01
299-W22-22	AVE	7.09E-01	3.94E+00	2.04E+03	8.74E-01	2.46E-01	8.70E-01	2.49E+00	-7.71E+00	5.35E-01
(216-U-12)	MIN	8.02E-02	3.09E+00	1.60E+03	2.60E-01	-2.70E-01	-7.68E+00	-2.84E+00	-1.25E+02	2.74E-01
	MAX		1.91E+01	4.24E+04		7.00E-01	7.42E+00	5.64E+00	3.82E+01	
299-W22-26	AVE	NN	1.53E+01	3.79E+04	NN	4.70E-01	3.53E+00	5.10E+00	6.23E+00	NN
(216-S-9)*	MIN		1.14E+01	2.94E+04		2.06E-01	1.03E+00	4.02E+00	-3.68E+01	

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 11 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX	8.18E+00	3.47E+03	1.19E+03	7.65E+01	2.97E-01	3.00E+00	6.80E+00	4.14E+01	
299-W23-01	AVE	8.18E+00	2.38E+03	1.12E+03	5.85E+01	1.96E-01	-2.20E-01	-4.68E+00	1.13E+01	NN
(216-S-3; 241-S)*	MIN	8.18E+00	1.14E+03	1.04E+03	4.09E+01	1.18E-01	-6.54E+00	-1.83E+01	-1.61E+01	
	MAX		1.80E+02		7.33E+00	7.81E-01	3.83E+00	4.53E+00	7.50E+01	
299-W23-02	AVE	NN	1.09E+02	NN	3.86E+00	3.52E-01	5.94E-01	3.53E-01	4.45E+01	NN
(241-SX)*	MIN		3.29E+01		2.07E+00	-1.53E-02	-1.38E+00	-7.52E+00	2.88E+01	
	MAX		1.39E+01		1.49E+00	3.82E-01	5.99E+00	4.52E+00	4.81E+01	
299-W23-03	AVE	NN	8.16E+00	NN	7.75E-01	1.24E-01	1.24E+00	3.36E+00	4.29E+01	NN
(241-SX)*	MIN		5.18E+00		2.50E-01	-2.91E-01	-3.30E+00	1.34E+00	3.50E+01	
	MAX	3.15E+01	1.19E+01	4.76E+03	2.68E+00	4.71E-01	6.60E+00	-6.10E-01	2.91E+01	1.54E+01
299-W23-04	AVE	2.21E+01	9.14E+00	2.23E+03	1.32E+00	4.37E-01	6.20E-02	-1.07E+01	-1.48E+00	1.22E+01
(216-S-21)*	MIN	1.68E+01	5.86E+00	8.60E+02	5.60E-01	4.05E-01	-1.02E+01	-3.29E+01	-3.84E+01	8.89E+00
	MAX	5.92E+01	1.56E+01	1.51E+06	5.81E+02	8.76E-01	6.54E+00	8.55E+00	2.92E+01	4.33E+01
299-W23-09	AVE	2.42E+01	9.51E+00	8.67E+05	2.48E+02	3.53E-01	-9.60E-01	4.02E+00	-5.77E+00	2.18E+01
(216-S-25)	MIN	7.91E+00	5.12E+00	1.51E+05	2.95E+00	-2.15E-01	-9.89E+00	-2.95E+00	-4.46E+01	1.04E+01
	MAX	3.31E+01	1.17E+01	2.31E+05	6.31E+01	1.18E+00	2.07E+00	1.01E+01	3.86E+01	2.61E+01
299-W23-10	AVE	1.96E+01	8.17E+00	6.14E+04	1.47E+01	3.04E-01	-1.72E+00	3.16E+00	-1.44E+01	1.71E+01
(216-S-25)	MIN	7.22E+00	1.98E+00	-8.27E+02	6.50E-01	-1.39E-01	-7.35E+00	-1.53E+00	-5.54E+01	8.08E+00
	MAX	3.42E+01	2.71E+02	9.95E+05		1.12E-01	7.67E+00	6.08E+00	5.64E+01	1.89E+01
299-W23-11	AVE	1.71E+01	6.63E+01	4.82E+05	NN	1.12E-01	-3.07E+00	5.12E-01	2.23E+01	1.17E+01
(216-U-10)*	MIN	1.24E+01	1.80E+01	6.23E+04		1.12E-01	-1.07E+01	-1.52E+01	-2.41E+01	4.18E+00
	MAX	1.93E+00	5.17E+00	4.74E+02	8.68E+00					
299-W26-03	AVE	1.40E+00	4.22E+00	2.26E+02	2.81E+00	NN	NN	NN	NN	NN
(216-S-6)*	MIN	1.07E+00	3.29E+00	1.02E+02	7.53E-01					
	MAX	2.58E+00	5.17E+00	3.78E+02	2.63E+00	4.10E-01	2.57E+00	7.11E+00	7.33E+00	
299-W26-06	AVE	1.71E+00	4.50E+00	1.92E+02	1.97E+00	1.34E-01	6.70E-01	2.50E+00	-1.64E+01	NN
(216-S-5)*	MIN	1.22E+00	3.89E+00	8.93E+01	1.50E+00	-1.70E-01	-2.56E+00	-5.56E+00	-3.98E+01	
	MAX	1.42E+01	1.70E+01	2.67E+04	1.18E+02	1.07E+00	2.88E+00	4.22E+00	1.10E+01	6.19E+00
299-W27-01	AVE	9.19E+00	1.08E+01	1.62E+04	1.04E+02	3.61E-01	-4.31E+00	6.70E-01	-2.65E+01	4.64E+00
(216-S-26)	MIN	5.81E+00	6.67E+00	7.36E+03	8.72E+01	-2.35E-01	-1.82E+01	-3.56E+00	-5.25E+01	3.24E+00
	MAX	7.71E-01	1.31E+01							
699-32-72	AVE	3.68E-01	7.53E+00	NN	NN	NN	NN	NN	NN	NN
(216-S-19)*	MIN	0.00E+00	2.44E+00							

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 12 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX	1.01E+01	5.33E+00	3.20E+02	1.14E+00		5.51E+00	8.55E+00	4.62E+01	1.13E+01
699-35-78A	AVE	8.35E+00	4.36E+00	1.32E+02	6.15E-01	NN	-1.55E+00	5.83E-01	4.46E+00	6.79E+00
(216-U-10)*	MIN	6.00E+00	3.12E+00	-1.03E+02	3.90E-01		-1.11E+01	-1.13E+01	-4.88E+01	4.05E+00
	MAX	1.86E+00	6.52E+00	4.65E+03	1.94E+00	1.65E+00	8.33E+00	5.34E+00	6.11E+01	7.33E-01
699-42-40A	AVE	7.37E-01	5.05E+00	6.82E+02	9.13E-01	3.67E-01	-5.55E-01	-1.31E+00	-4.80E+00	5.21E-01
(216-B-3)	MIN	2.69E-01	3.60E+00	-1.12E+03	5.00E-01	-6.30E-02	-1.89E+01	-1.02E+01	-7.54E+01	3.34E-01
	MAX		5.33E+00	4.82E+03	5.10E-01	9.00E-01	6.84E+00	8.46E+00	5.73E+01	
699-42-40B	AVE	NN	4.17E+00	8.93E+02	4.40E-01	4.82E-01	-4.09E-01	1.51E-01	1.93E+00	NN
(216-B-3)	MIN		2.39E+00	-6.37E+01	3.10E-01	2.68E-01	-6.05E+00	-1.60E+01	-3.71E+01	
	MAX	1.50E+00	5.47E+00			9.88E-01				
699-50-42	AVE	1.11E+00	4.82E+00	NN	NN	6.34E-01	NN	NN	NN	NN
(216-A-25)	MIN	7.12E-01	4.17E+00			3.75E-01				
	MAX	5.91E+00	1.55E+02			8.07E+01	5.51E+00	5.36E+00	3.91E+01	
699-53-47A	AVE	2.68E+00	1.01E+02	NN	NN	6.40E+01	-2.08E+00	-9.08E-01	8.31E+00	NN
(216-A-25)	MIN	4.31E-01	5.34E+01			4.17E+01	-8.60E+00	-8.11E+00	-4.06E+01	
	MAX	7.90E+00	1.79E+02			8.07E+01	6.18E+00	8.55E+00	3.36E+01	
699-53-47B	AVE	4.02E+00	1.29E+02	NN	NN	7.59E+01	7.55E-01	2.45E+00	-2.13E+00	NN
(216-A-25)	MIN	2.36E+00	1.10E+02			6.94E+01	-4.82E+00	-3.95E+00	-5.19E+01	
	MAX	9.16E+00	4.37E+02			1.44E+00	5.66E+00	5.64E+00	3.91E+01	5.89E+00
699-53-48A	AVE	6.69E+00	4.52E+01	NN	NN	7.17E-01	-2.52E+00	-4.32E-01	-1.84E+01	5.89E+00
(216-A-25)	MIN	1.72E-01	6.79E+00			-3.34E-02	-1.75E+01	-8.54E+00	-8.05E+01	5.89E+00
	MAX	7.14E+00	4.50E+02			3.26E+02	5.13E+00	7.03E+00	6.26E+01	
699-53-48B	AVE	9.00E-01	3.56E+02	NN	NN	2.65E+02	-7.55E-01	-7.61E-01	-4.46E-01	NN
(216-A-25)	MIN	-5.77E-02	1.00E+01			2.01E+02	-4.13E+00	-1.13E+01	-1.21E+02	
	MAX	3.30E+00	1.12E+01			1.63E+00	5.00E+00	4.04E+00	5.31E+01	
699-53-55A	AVE	1.19E+00	7.84E+00	NN	NN	5.47E-01	7.57E-01	-1.17E+00	-9.12E+00	NN
(216-A-25)	MIN	2.50E-01	4.25E+00			2.78E-02	-6.39E+00	-1.02E+01	-5.80E+01	
	MAX	2.08E+00	8.07E+01			3.60E+01	7.18E+00	7.09E+00	7.73E+01	
699-54-48	AVE	1.46E+00	5.05E+01	NN	NN	2.62E+01	-7.83E-01	1.44E-01	6.51E-01	NN
(216-A-25)	MIN	7.36E-01	3.17E+01			1.67E+01	-9.66E+00	-1.82E+01	-7.08E+01	
	MAX	1.50E+00	4.03E+01			1.97E+01				
699-54-49	AVE	9.81E-01	2.89E+01	NN	NN	1.35E+01	NN	NN	NN	NN
(216-A-25)	MIN	3.10E-01	2.34E+01			9.83E+00				

Table B.1. Results of the Unconfined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 13 of 13)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
699-55-50C (216-A-25)	MAX	1.26E+00	7.03E+00	NN	NN	2.34E+00	NN	NN	NN	NN
	AVE	1.05E+00	5.99E+00			7.24E-01				
	MIN	8.64E-01	5.03E+00			1.52E-01				
699-55-50D (216-A-25)	MAX	5.32E+00	1.40E+01	NN	NN	1.62E+00	NN	NN	NN	NN
	AVE	2.16E+00	7.96E+00			7.39E-01				
	MIN	1.04E+00	3.91E+00			7.39E-02				
699-56-51 (216-A-25)	MAX	1.27E+00	4.18E+00	NN	NN	6.19E-01	NN	NN	NN	NN
	AVE	9.78E-01	4.56E+00			2.66E-01				
	MIN	5.98E-01	2.81E+00			-2.25E-01				
699-59-58 (216-A-25)	MAX	1.04E+00	4.66E+00	NN	NN	4.14E-01	NN	NN	NN	NN
	AVE	9.56E-01	4.17E+00			1.37E-01				
	MIN	8.73E-01	3.68E+00			-7.75E-02				
699-63-58 (216-A-25)	MAX	9.11E-01	7.37E+00	NN	NN	8.21E-01	NN	NN	NN	NN
	AVE	8.76E-01	7.33E+00			2.90E-01				
	MIN	8.41E-01	7.29E+00			-3.27E-01				

* Inactive disposal facility.
** Analysis not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[a] Maximum.
[b] Average.
[c] Minimum.

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APPENDIX B.2

RESULTS OF THE CONFINED AQUIFER GROUND-WATER MONITORING NETWORK IN CY 1985

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Table B.2. Results of the Confined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 1 of 2)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
299-E26-08	MAX[a] AVE[b] MIN[c]	NN*	NN	1.23E+02 1.23E+02 1.23E+02	1.30E-01 1.30E-01 1.30E-01	NN	NN	NN	NN	NN
299-E33-12	MAX AVE MIN	NN	NN	4.19E+02 4.19E+02 4.19E+02	1.80E-01 1.80E-01 1.80E-01	NN	NN	NN	NN	NN
699-42-40C	MAX AVE MIN	NN	NN	1.70E+02 1.42E+02 1.13E+02	1.58E+00 1.04E+00 5.00E-01	NN	NN	NN	NN	NN
699-47-50	MAX AVE MIN	NN	NN	3.24E+02 3.24E+02 3.24E+02	4.00E-02 4.00E-02 4.00E-02	NN	NN	NN	NN	NN
699-49-55B	MAX AVE MIN	NN	NN	-9.26E+01 -9.78E+01 -1.03E+02	1.06E+00 7.80E-01 5.00E-01	NN	NN	NN	NN	NN
699-50-45	MAX AVE MIN	NN	NN	-1.11E+01 -3.70E+01 -6.28E+01	5.00E-01 3.15E-01 1.30E-01	NN	NN	NN	NN	NN
699-50-48B	MAX AVE MIN	NN	NN	4.58E+01 -5.61E+01 -1.58E+02	1.30E-01 1.30E-01 1.30E-01	NN	NN	NN	NN	NN
699-51-46	MAX AVE MIN	NN	NN	6.19E+01 2.43E+01 -1.34E+01	5.00E-01 3.60E-01 2.20E-01	NN	NN	NN	NN	NN
699-52-46A	MAX AVE MIN	NN	NN	2.14E+02 2.25E+01 -1.69E+02	5.00E-01 4.95E-01 4.90E-01	NN	NN	NN	NN	NN
699-52-48	MAX AVE MIN	NN	NN	5.76E+01 -1.07E+01 -7.89E+01	5.00E-01 4.25E-01 3.50E-01	NN	NN	NN	NN	NN
699-53-50	MAX AVE MIN	NN	NN	1.22E+02 1.10E+01 -1.00E+02	2.58E+00 1.40E+00 2.20E-01	NN	NN	NN	NN	NN

Table B.2. Results of the Confined Aquifer Ground-Water Monitoring Network in CY 1986. (sheet 2 of 2)

Well no. (waste site)		Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)	Nitrate (mg/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	^{60}Co (pCi/L)	^{106}Ru (pCi/L)	Uranium (ug/L)
	MAX			-8.05E+00	5.00E-01					
699-54-57	AVE	NN	NN	-2.89E+01	3.40E-01	NN	NN	NN	NN	NN
	MIN			-4.97E+01	1.80E-01					
	MAX			1.76E+02	5.00E-01					
699-56-53	AVE	NN	NN	1.25E+02	3.15E-01	NN	NN	NN	NN	NN
	MIN			7.48E+01	1.30E-01					

* Analyses not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).

[a] Maximum.

[b] Average.

c Minimum.

APPENDIX C

SEPARATIONS AREA CONFINED AND UNCONFINED AQUIFER GROUND-WATER MONITORING SCHEDULES FOR CY 1986

CONTENTS

Tables:

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Table C.1. Separations Area Unconfined Aquifer Ground-Water Monitoring Schedule for CY 1987. (sheet 1 of 6)

Well	EMA[a] No.	Site monitored	Sample method	Total alpha	Total beta	^{90}Sr	^{137}Cs	^{106}Ru	^{60}Co	^{3}H	NO_3	U	Iso. U	Iso. Pu
299-E13-5	2314	216-B-18	P[b]	--[c]	Q[d]	--	--	--	--	Q	--	--	--	--
299-E13-8	2334	216-B-21	P	--	Q	--	Q	Q	Q	--	--	--	--	--
299-E13-14	2340	216-B-29	P	--	Q	--	--	--	--	--	--	--	--	--
299-E13-19	2352	216-B-28	P	--	Q	--	--	--	--	--	--	--	--	--
299-E16-2	2372	216-A-30	B[e]	M[f]	M	Q	M	M	M	M	M	--	--	--
299-E17-1	2328	216-A-10	P	M	M	Q	M	M	M	M	M	--	--	--
299-E17-2	2367	216-A-27	B	M	M	Q	Q	Q	Q	M	M	Q	--	--
299-E17-5	2511	216-A-36B	P	M	M	Q	M	M	M	M	M	Q	--	--
299-E17-6	2512	200 East	P	--	M	--	--	--	--	Q	Q	--	--	--
299-E17-8	2513	216-A-38	P	--	M	Q	Q	Q	Q	M	M	--	--	--
299-E17-9	2514	216-A-36B	P	M	M	Q	M	M	M	M	M	--	--	--
299-E17-12	2399	216-A-45	P	M	M	M	M	M	M	M	M	M	M	M
299-E17-13	2400	216-A-45	P	M	M	M	--	M	M	M	M	M	M	M
299-E23-2	2376	200 East	B	--	M	--	Q	--	--	Q	Q	--	--	--
299-E24-1	2317	216-A-5	B	--		S	M	Q	Q	M	M	--	--	--
299-E24-2	2326	216-A-10	P	M	M	M	Q	M	M	M	M	--	--	--
299-E24-4	2329	216-A-9	B	--	M	S	M	Q	Q	M	M	--	--	--
299-E24-8	2355	216-C-3, -4, -5	P	--	M	--	Q	Q	Q	M	M	--	--	--
299-E24-11		216-A-38	P	--	M	Q	Q	Q	Q	Q	Q	--	--	--
299-E24-12	2521	216-A-21, -31	P	--	M	Q	--	Q	Q	M	M	--	--	--
299-E24-13	2383	241-A	B	--	Q	--	--	--	--	--	Q	--	--	--
299-E25-2	2316	216-A-1, -7	B	--	S[g]	--	--	--	--	S	S	--		--
299-E25-3	2318	216-A-6	B	--	Q	--	Q	--	--	--	--	--	--	--
299-E25-6	2343	216-A-8	B	M	M	Q	Q	Q	Q	M	Q	--	--	--
299-E25-9	2344	216-A-8	B	M	M	Q	Q	Q	Q	Q	Q	Q	--	--
299-E-25-10	2363	219-A-18, -19, -20	P	Q	Q	--	Q	Q	Q	--	--	Q	--	--

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Table C.1. Separations Area Unconfined Aquifer Ground-Water Monitoring Schedule for CY 1987. (sheet 2 of 6)

Well	EMA No.	Site monitored	Sample method	Total alpha	Total beta	^{90}Sr	^{137}Cs	^{106}Ru	^{60}Co	^{3}H	NO_3	U	Iso. U	Iso. Pu
299-E25-11	2370	216-A-30	B	M	M	Q	M	M	M	M	M	--	--	--
299-E25-13	2523	241-AX	B	--	Q	--	--	--	--	--	Q	--	--	--
299-E25-17	2386	216-A-37-1	B	M	M	Q	Q	Q	Q	M	M	--	--	--
299-E25-18	2387	216-A-37-1	P	M	M	Q	Q	Q	Q	M	M	--	--	--
299-E25-19	2388	216-A-37-1	B	M	M	Q	Q	Q	Q	M	M	--	--	--
299-E25-20	2389	216-A-37-1	P	M	M	Q	Q	Q	Q	M	M	--	--	--
299-E25-21	2391	216-A-37-2	P	M	M	Q	M	M	M	M	M	--	--	--
299-E25-22	2392	216-A-37-2	P	M	M	Q	M	M	M	M	M	--	--	--
299-E25-23	2393	216-A-37-2	P	M	M	Q	M	M	M	M	M	--	--	--
299-E25-24	2394	216-A-37-2	P	M	M	Q	M	M	M	M	M	--	--	--
299-E26-2	2364	216-A-24	B	--	Q	--	--	--	--	Q	Q	--	--	--
299-E26-4	2362	216-A-24	B	--	Q	--	--	--	--	Q	Q	--	--	--
299-E26-6	2369	401-A Cooling	P	Q	Q	Q	Q	Q	Q	Q	Q	--	--	--
299-E27-5	2551	216-C-10	P	--	Q	--	Q	Q	Q	--	--	--	--	--
299-E27-7	2557	241-C	P	Q	Q	--	--	--	--	--	Q	--	--	--
299-E28-7	2404	216-B-5	P	Q	Q	Q	Q	Q	Q	--	--	Q	S	Q
299-E28-9	2357	216-B-12	B	Q	Q	--	--	--	--	--	--	Q	--	--
299-E28-12	2380	216-B-55	B	--	M	--	M	M	M	M	--	--	--	--
299-E28-13	2324	216-B-55	P	--	M	--	M	M	M	M	--	--	--	--
299-E28-16	2325	216-B-12	P	Q	Q	--	--	--	--	--	--	Q	--	--
299-E28-17	2519	216-B-6-10B	B	Q	--	--	--	--	--	--	--	Q	--	--
299-E28-18	2524	216-B-62	P	M	M	Q	M	M	M	M	M	M	S	--
299-E28-19		216-B-62	P	Q	Q	--	--	--	--	--	--	Q	--	--
299-E28-21	2556	216-B-62	P	M	M	Q	M	M	M	M	M	M	S	--
299-E28-23	2390	216-B-5	B	Q	Q	Q	Q	Q	Q	Q	Q	Q	S	Q
299-E28-24	2560	216-B-5	P	Q	Q	Q	Q	Q	Q	--	--	Q	S	Q
299-E28-25	2561	216-B-5	P	Q	Q	Q	Q	Q	Q	--	--	Q	S	Q
299-E32-1	2358	200 East	P	--	S	--	--	--	--	S	S	--	--	--

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Table C.1. Separations Area Unconfined Aquifer Ground-Water Monitoring Schedule for CY 1986. (sheet 3 of 6)

Well	EMA No.	Site monitored	Sample method	Total alpha	Total beta	^{90}Sr	^{137}Cs	^{106}Ru	^{60}Co	^{3}H	NO_3	U	Iso. U	Iso. Pu
299-E33-1	2301	216-B-43	P	--	Q	Q	Q	Q	Q	--	--	--	--	--
299-E33-3	2303	216-B-44, -45, -46	P	--	Q	S	Q	Q	Q	Q	--	--	--	--
299-E33-5	2308	216-B-47	P	--	Q	Q	Q	Q	Q	--	--	--	--	--
299-E33-7	2305	216-B-48, -49, -50	P	--	Q	Q	Q	Q	Q	--	--	--	--	--
299-E33-8	2300	216-B-41	P	--	Q	Q	Q	Q	Q	--	--	--	--	--
299-E33-9	2299	241-BY	B	--	Q	Q	Q	Q	Q	Q	Q	--	--	--
299-E33-10	2306	216-B-35, -41	P	--	Q	S	Q	Q	Q	Q	Q	--	--	--
299-E33-18	2309	216-B-7A, -7B	P	--	Q	S	Q	Q	Q	--	--	--	--	--
299-E33-20	2332	216-B-7A, -7B, -11A, -11B	B	--	Q	S	--	--	--	--	Q	--	--	--
299-E33-21	2353	216-B-36	P	--	Q	--	Q	Q	Q	--	--	--	--	--
299-E33-24	2520	216-B-57	P	--	Q	Q	Q	Q	Q	--	--	--	--	--
299-E33-26	2382	216-B-61	P	--	Q	Q	Q	Q	Q	--	--	--	--	--
299-E34-1	2374	216-B-63	P	M	M	--	M	M	M	M	--	--	--	--
299-W10-1	2892	216-T-5	B	--	Q	Q	Q	Q	Q	--	--	--	--	--
299-W10-3	2885	216-T-32	B	Q	Q	Q	Q	Q	Q	--	--	--	--	--
299-W10-4	2886	216-T-36	P	--	Q	S	S	S	S	--	--	--	--	--
299-W10-8	2996	241-T	P	Q	Q	Q	Q	Q	Q	--	Q	--	--	--
299-W10-9	3009	241-T	P	Q	Q	Q	Q	Q	Q	--	Q	--	--	--
299-W11-11	2887	216-T-18	P	Q	Q	Q	Q	Q	Q	--		--	--	--
299-W11-15	2961	216-T-32	P	--	Q	--	--	--	--	--	--	--	--	--
299-W11-18	2963	216-T-35	P	--	Q	S	Q	Q	Q	--	--	--	--	--
299-W11-23	2616	241-T	P	Q	Q	Q	Q	Q	Q	--	Q	--	--	--
299-W11-24	3010	241-T	P	Q	Q	Q	Q	Q	Q	--	Q	--	--	--
299-W14-2	2895	216-T-26, -27, -28	P	Q	Q	S	Q	Q	Q	Q	--	--	--	--
299-W14-5	3007	241-TX	P	--	Q	--	--	--	--	Q	Q	--	--	--
299-W14-6	3008	241-TX	P	--	Q	--	--	--	--	Q	Q	--	--	--

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9 2 1 2 4 6 6 2 2 3 6

Table C.1. Separations Area Unconfined Aquifer Ground-Water Monitoring Schedule for CY 1987. (sheet 4 of 6)

Well	EMA No.	Site monitored	Sample method	Total alpha	Total beta	^{90}Sr	^{137}Cs	^{106}Ru	^{60}Co	^{3}H	NO_3	U	Iso. U	Iso. Pu
299-W14-10	3018	216-W-LWC	P	M	M	Q	M	M	M	M	M	--	--	--
299-W15-3	2894	241-TY	B	--	Q	S	S	S	S	--	Q	--	--	--
299-W15-4	2896	216-T-19	P	--	Q	--	--	--	--	Q	Q	--	--	--
299-W15-6	2934	216-Z-9	B	Q	Q	--	--	--	--	--	Q	--	--	--
299-W15-7	2960	216-Z-7	P	Q	Q	S	Q	Q	Q	--	Q	--	--	--
299-W15-10	2609	216-Z-16	P	Q	Q	--	--	--	--	--	Q	--	--	--
299-W15-11	2610	216-Z-16	P	Q	Q	Q	Q	Q	Q	--	Q	--	--	--
299-W18-5	2933	216-Z-12	P	Q	Q	--	--	--	--	--	--	--	--	--
299-W18-9	2965	216-Z-18	B	Q	Q	--	--	--	--	--	Q	--	--	--
299-W18-15	3015	216-U-10	P	M	M	--	Q	Q	Q	M	M	M	S	S
299-W18-17	3016	216-Z-20	B	M	M	--	Q	Q	Q	Q	Q	--	--	--
299-W18-18	3017	216-Z-20	P	M	M	--	M	M	M	M	M	--	--	--
299-W18-19	3019	216-Z-20	P	M	M	--	M	M	M	M	M	--	--	--
299-W18-20	3020	216-Z-20	B	M	M	--	Q	Q	Q	Q	Q	--	--	--
299-W19-2	2928	216-U-8	P	Q	Q	Q	Q	Q	Q	Q	Q	Q	--	--
299-W19-3	2929	216-U-1, -2	P	Q	Q	Q	Q	Q	Q	Q	Q	Q	S	--
299-W19-5	2968	216-S-23	P	--	Q	--	--	--	--	Q	Q	--	--	--
299-W19-9	2624	216-U-1/2	P	M	M	S	M	M	M	Q	M	M	S	--
299-W19-11	2619	216-U-1	P	M	--	Q	Q	Q	Q	Q	Q	M	S	--
299-W19-12	2618	241-U	P	Q	Q	Q	Q	Q	Q	Q	Q	Q	--	--
299-W19-13	2622	216-U-16	P	M	M	Q	M	M	M	M	M	M	--	--
299-W19-14	2623	216-U-16	P	M	M	Q	M	M	M	M	M	M	--	--
299-W19-15	2625	216-U-1/2	P	M	M	S	M	M	M	Q	M	M	S	--
299-W19-16	2626	216-U-1/2	P	M	M	S	M	M	M	Q	M	M	S	--
299-W19-17	2627	216-U-1/2	P	M	M	S	M	M	M	Q	M	M	S	--

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Table C.1. Separations Area Unconfined Aquifer Ground-Water Monitoring Schedule for CY 1987. (sheet 5 of 6)

Well	EMA No.	Site monitored	Sample method	Total alpha	Total beta	^{90}Sr	^{137}Cs	^{106}Ru	^{60}Co	^{3}H	NO_3	U	Iso. U	Iso. Pu
299-W19-18	2628	216-U-1/2	P	M	M	S	M	M	M	Q	M	M	S	--
299-W19-19		216-U-17	P	M	M	Q	Q	Q	Q	M	M	M	Q	--
299-W19-20	2629	216-U-17	P	M	M	Q	Q	Q	Q	M	M	M	Q	--
299-W19-21		216-U-14	P	M	M	Q	Q	Q	Q	M	M	M	M	Q
299-W19-23		216-U-17	P	M	M	Q	Q	Q	Q	M	M	M	M	Q
299-W19-24		216-U-17	P	M	M	Q	Q	Q	Q	M	M	M	M	Q
299-W19-25		216-U-17	P	M	M	Q	Q	Q	Q	M	M	M	M	Q
299-W19-26		216-U-17	P	M	M	Q	Q	Q	Q	M	M	M	M	Q
299-W19-27		216-U-14	P	M	M	Q	Q	Q	Q	M	M	M	M	Q
299-W21-1		200W		S	S	--	S	S	S	--	--	S	--	--
299-W22-1	2919	216-S-1	P	Q	Q	Q	Q	Q	Q	Q	Q	--	--	--
299-W22-2	2920	216-S-1, -2	P	Q	Q	Q	Q	Q	Q	Q	Q	--	--	--
299-W22-10	2632	216-S-1/2	P	Q	Q	Q	Q	Q	Q	--	--	--	--	--
299-W22-12	2912	216-S-7	P	--	Q	S	S	S	S	Q	Q	--	--	--
299-W22-18	2633	216-S-1/2	P	Q	Q	Q	Q	Q	Q	--	--	--	--	--
299-W22-20	2926	216-S-20	P	--	Q	S	S	S	S	Q	--	--	--	--
299-W22-21	2931	216-S-13	P	Q	Q	S	S	S	S	--	Q	--	--	--
299-W22-22	2939	216-U-12	P	M	M	Q	M	M	M	M	M	M	--	--
299-W22-26	2954	216-S-9	P	--	Q	S	S	S	S	Q	--	--	--	--
299-W23-1	2898	216-S-3; 241-S	B	--	Q	S	Q	Q	Q	--	Q	--	--	--
299-W23-2	2910	241-SX	B	--	Q	Q	Q	Q	Q	--	Q	--	--	--
299-W23-3	2911	241-SX	B	--	Q	Q	Q	Q	Q	--	Q	--	--	--
299-W23-4		216-S-21	P	Q	Q	--	--	--	--	Q	Q	Q	S	--
299-W23-9	2993	216-S-25	B	M	M	Q	M	M	M	M	M	M	Q	--
299-W23-10	2994	216-S-25	P	M	M	Q	M	M	M	M	M	M	Q	--
299-W23-11	2995	216-U-10	P	M	M	--	M	M	M	M	M	M	Q	--

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Table C.1. Separations Area Unconfined Aquifer Ground-Water Monitoring Schedule for CY 1987. (sheet 6 of 6)

Well	EMA No.	Site monitored	Sample method	Total alpha	Total beta	^{90}Sr	^{137}Cs	^{106}Ru	^{60}Co	^{3}H	NO_3	U	Iso. U	Iso. Pu
299-W26-3	2917	216-S-6	P	Q	Q	--	--	--	--	Q	Q	--	--	--
299-W26-6	2520	216-S-5	P	Q	Q	Q	Q	Q	Q	Q	Q	--	--	--
299-W27-1	2621	216-S-26	P	M	M	Q	Q	Q	Q	Q	Q	Q	Q	Q
699-32-72	6868	216-S-19	P	M	M	--	--	--	--	--	--	--	--	--
699-35-78A	4869	216-U-10	P	M	M	--	Q	Q	Q	M	Q	M	Q	--
699-42-40A	4874	216-B-3	B	M	M	Q	M	M	M	M	Q	Q	Q	Q
699-42-40B	4875	216-B-3	P	--	M	Q	M	M	M	M	Q	--	--	--
699-50-42	4610	216-A-25	P	S	S	Q	--	--	--	--	--	--	--	--
699-53-47A	4866	216-A-25	P	M	M	M	M	M	M	--	--	--	--	--
699-53-47B	4600	216-A-25	P	M	M	M	M	M	M	--	--	--	--	--
699-53-48A	4893	216-A-25	P	M	M	M	M	M	M	--	--	--	--	--
699-53-48B	4894	216-A-25	P	M	M	M	M	M	M	--	--	--	--	--
699-54-48	4895	216-A-25	P	M	M	M	M	M	M	--	--	--	--	--
699-54-49	4732	216-A-25	P	M	M	M	--	--	--	--	--	--	--	--
699-53-55A	4867	216-A-25	P	M	M	Q	Q	Q	Q	--	--	--	--	--
699-55-50C	4887	216-A-25	P	Q	Q	Q	--	--	--	--	--	--	--	--
699-55-50D	4730	216-A-25	B	Q	Q	Q	--	--	--	--	--	--	--	--
699-56-51	4733	216-A-25	P	M	M	Q	--	--	--	--	--	--	--	--
699-59-58	4734	216-A-25	P	S	S	S	--	--	--	--	--	--	--	--
699-63-58	4741	216-A-25	P	S	S	S	--	--	--	--	--	--	--	--

[a]Identification number used in PNL data base.
[b]Pump.
[c]Analyses not necessary (as determined from inventory, effluent history, or gross alpha/beta analyses).
[d]Quarterly.
[e]Bailer.
[f]Monthly.
[g]Semiannually.

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Table C.2. Separations Area Confined Aquifer Monitoring Schedule for CY 1987.

Well	EMA[a] No.	Site monitored	Sample method	^3H	NO_3
299-E26-8	2395	Rattlesnake Ridge	Bailer	S[b]	S
299-E33-12	2294	Rattlesnake Ridge	Bailer	S	S
699-42-40C	4881	Rattlesnake Ridge	Bailer	S	S
699-47-50	4882	Rattlesnake Ridge	Bailer	S	S
699-49-55B	4743	Rattlesnake Ridge	Bailer	S	S
699-50-45	4759	Rattlesnake Ridge	Bailer	S	S
699-50-48	4883	Rattlesnake Ridge	Bailer	S	S
699-51-46	4884	Rattlesnake Ridge	Bailer	S	S
699-52-46A	4885	Rattlesnake Ridge	Bailer	S	S
699-52-48	4886	Rattlesnake Ridge	Bailer	S	S
699-53-50	4849	Rattlesnake Ridge	Bailer	S	S
699-54-57	4469	Rattlesnake Ridge	Bailer	S	S
699-56-53	4892	Rattlesnake Ridge	Bailer	S	S

[a]Identification number used in PNL data base.
[b]Semiannually.

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APPENDIX D

LONG-TERM CONCENTRATION HISTORIES OF SELECTED LIQUID WASTE DISPOSAL SITES AND MONITORING WELLS

CONTENTS

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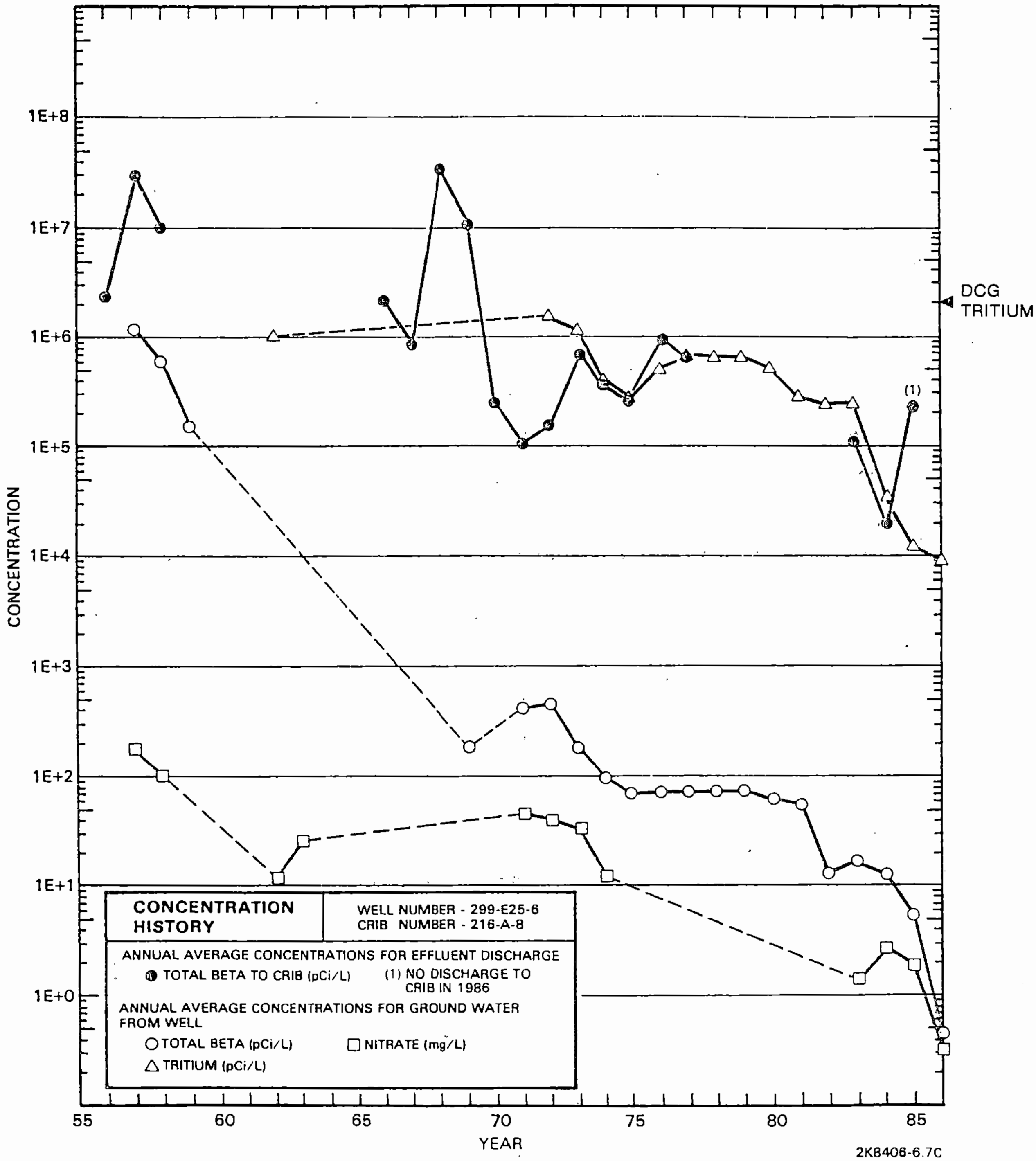
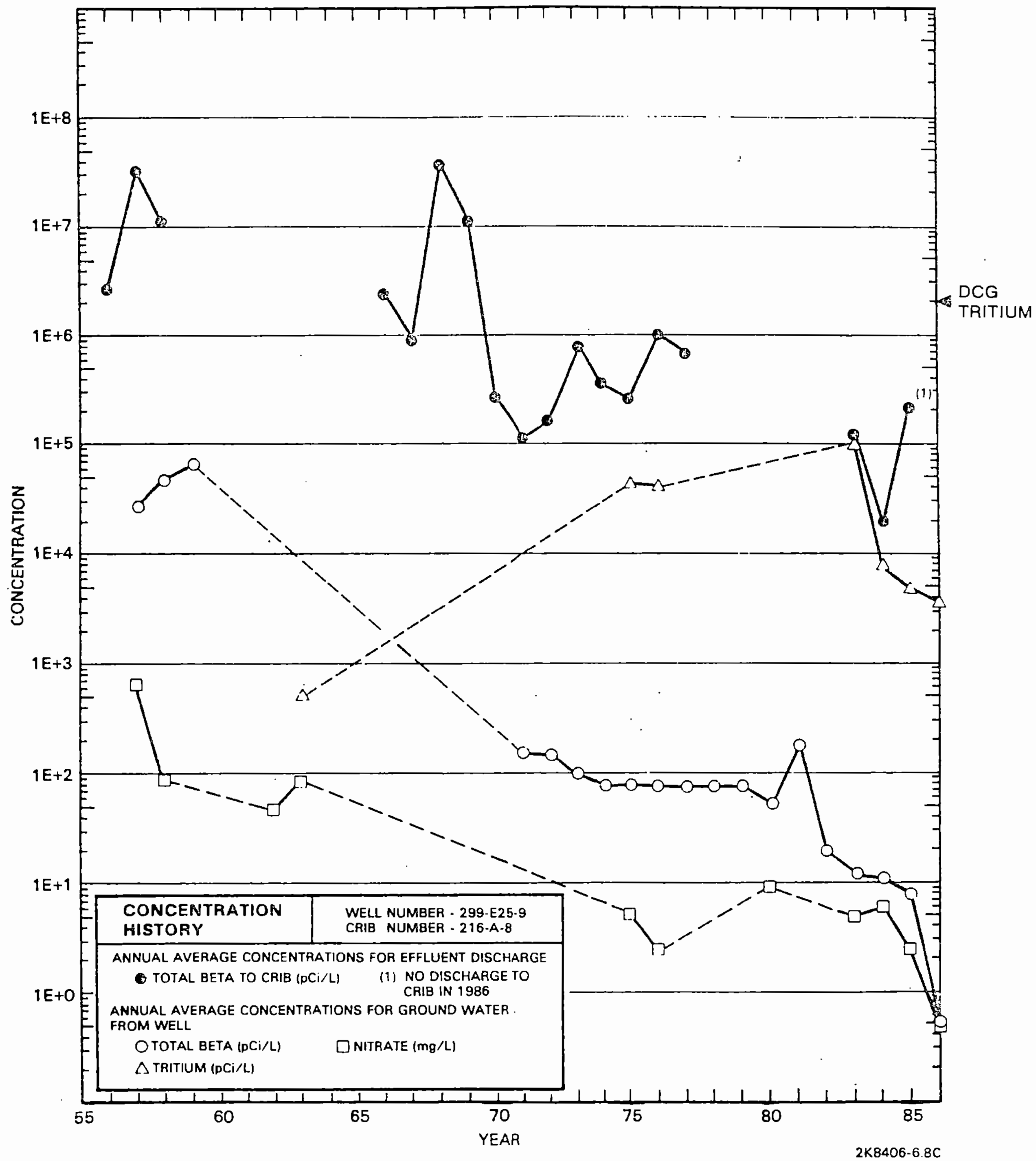


Well 299-E25-6, Crib 216-A-8



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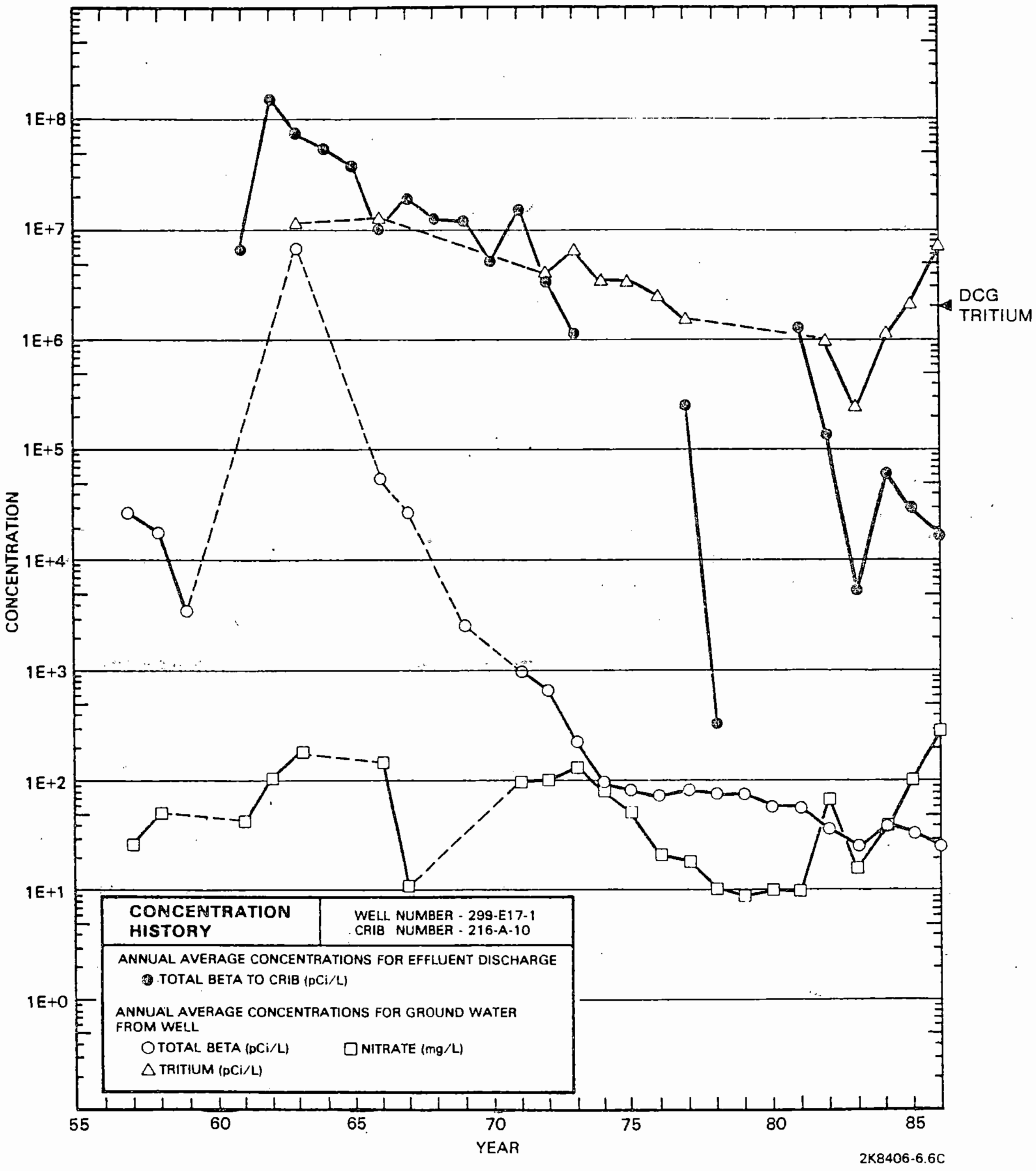
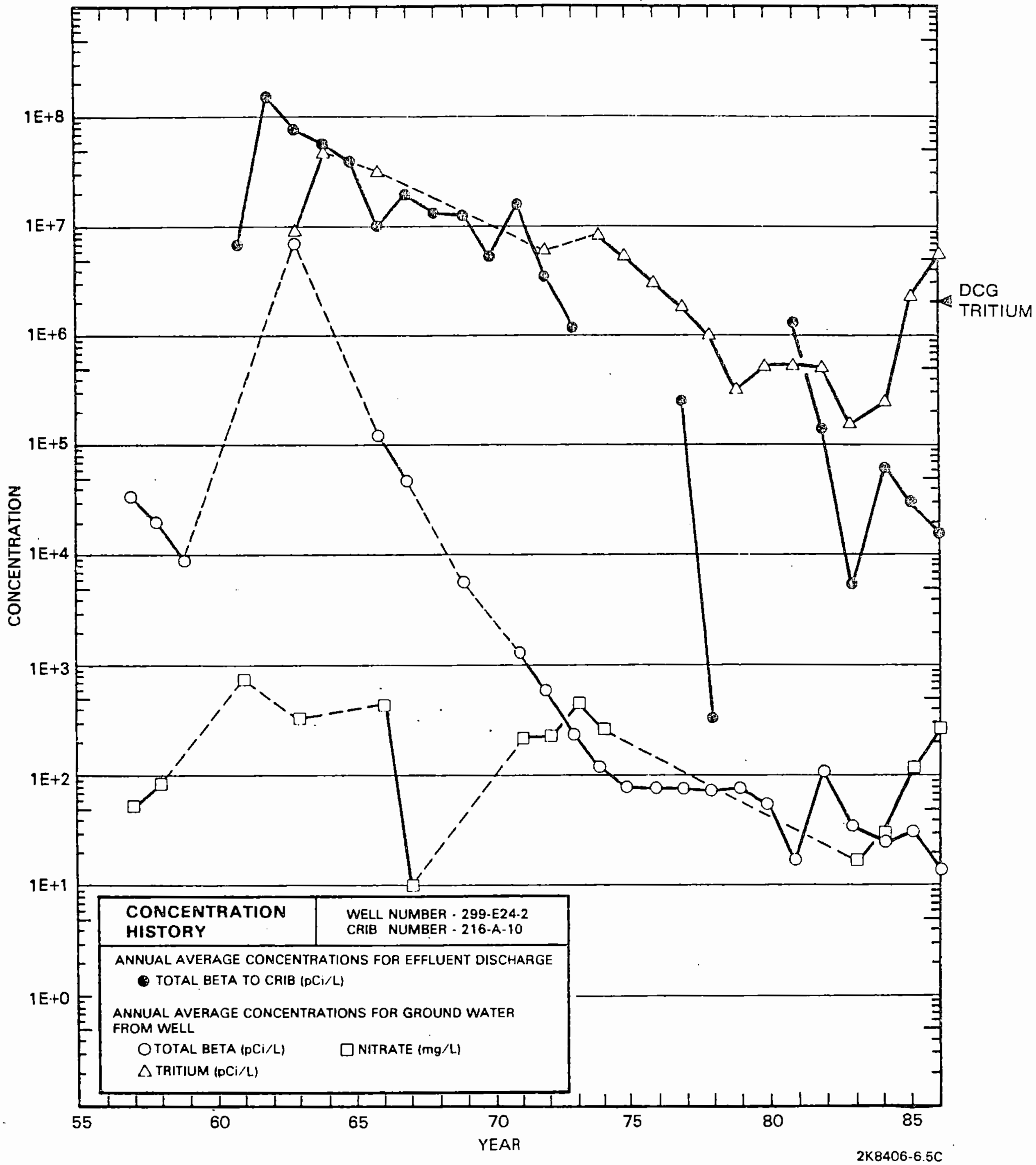


Well 299-E17-1, Crib 216-A-10



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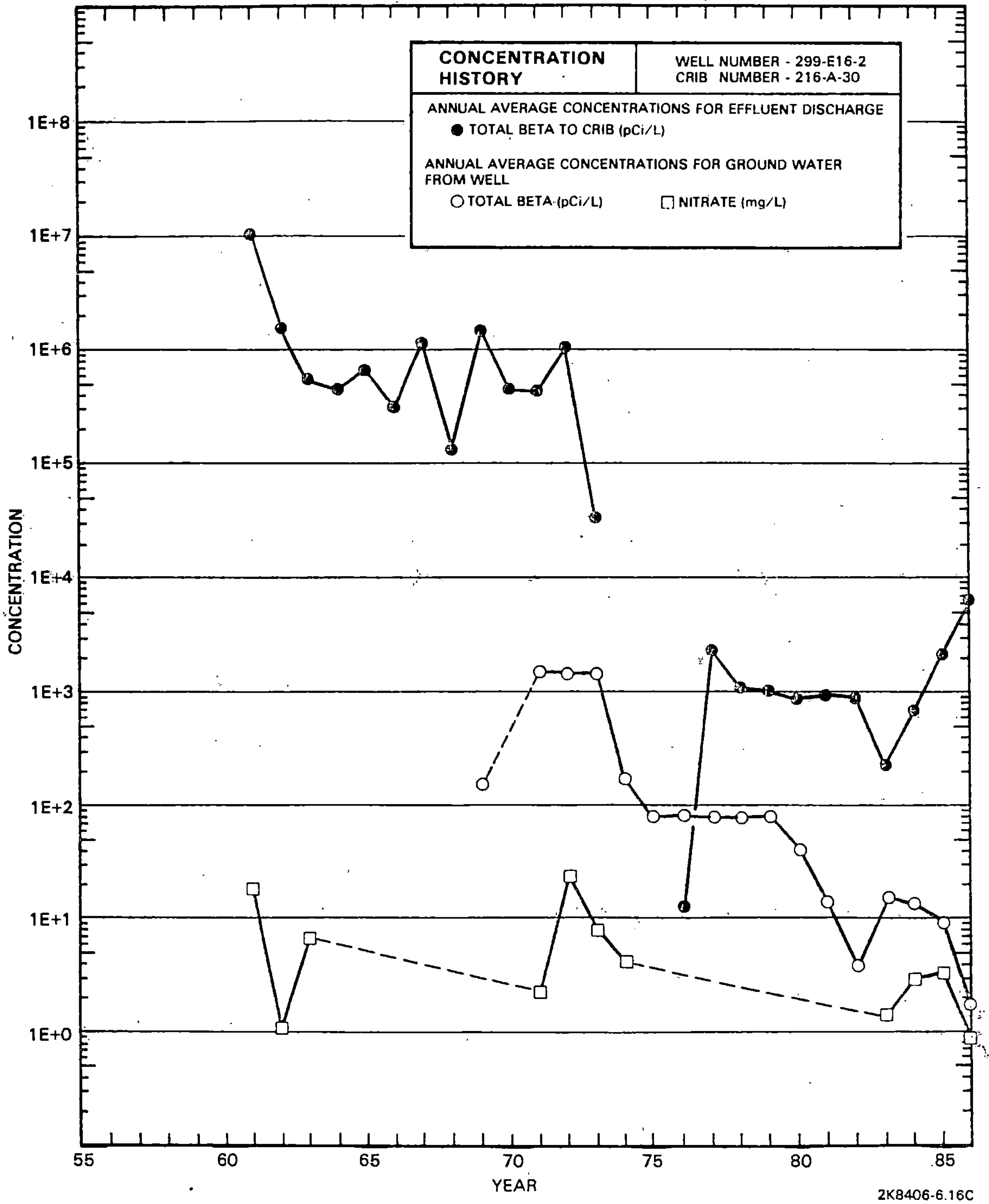

Well 299-E16-2, Crib 216-A-30

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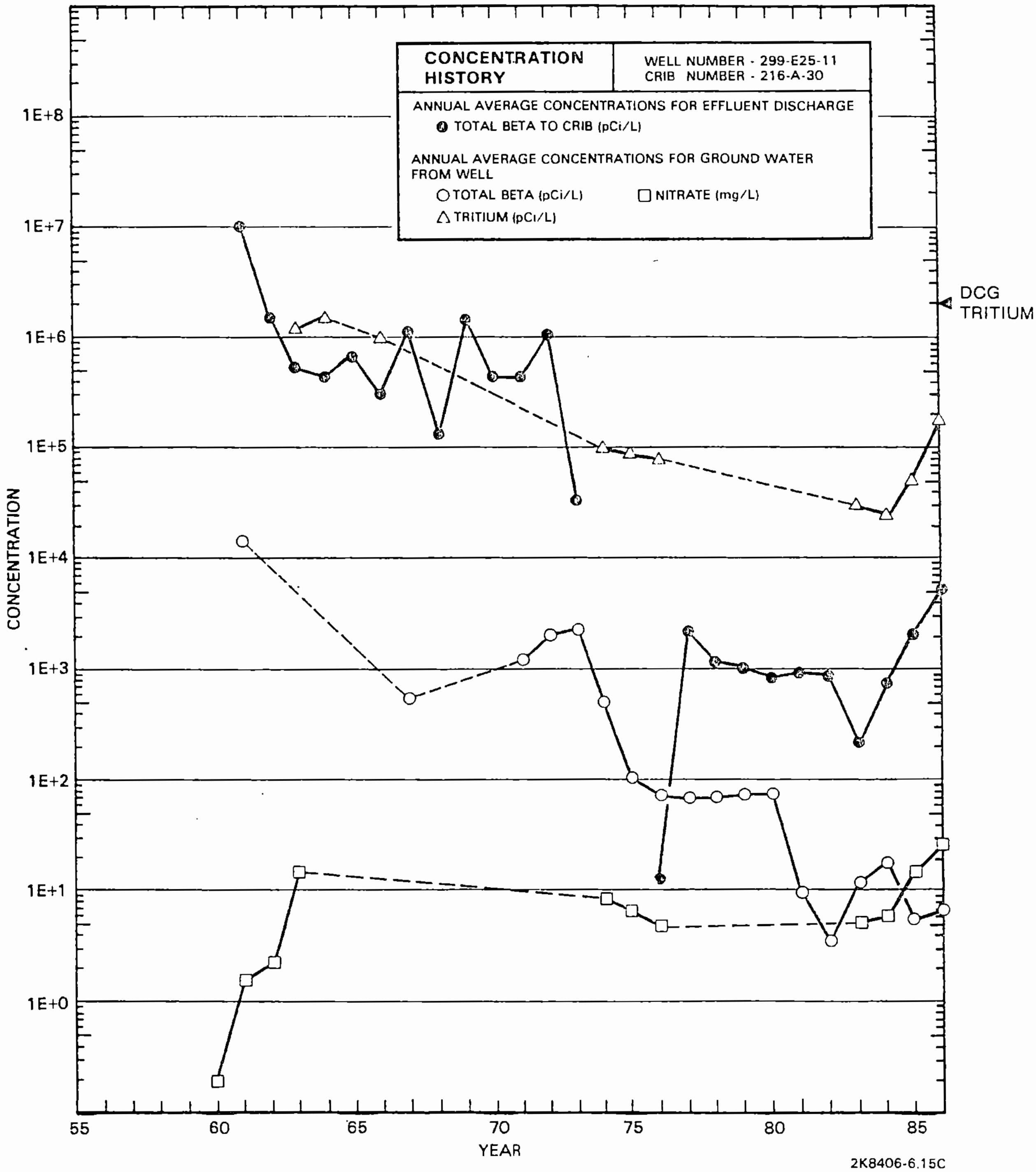
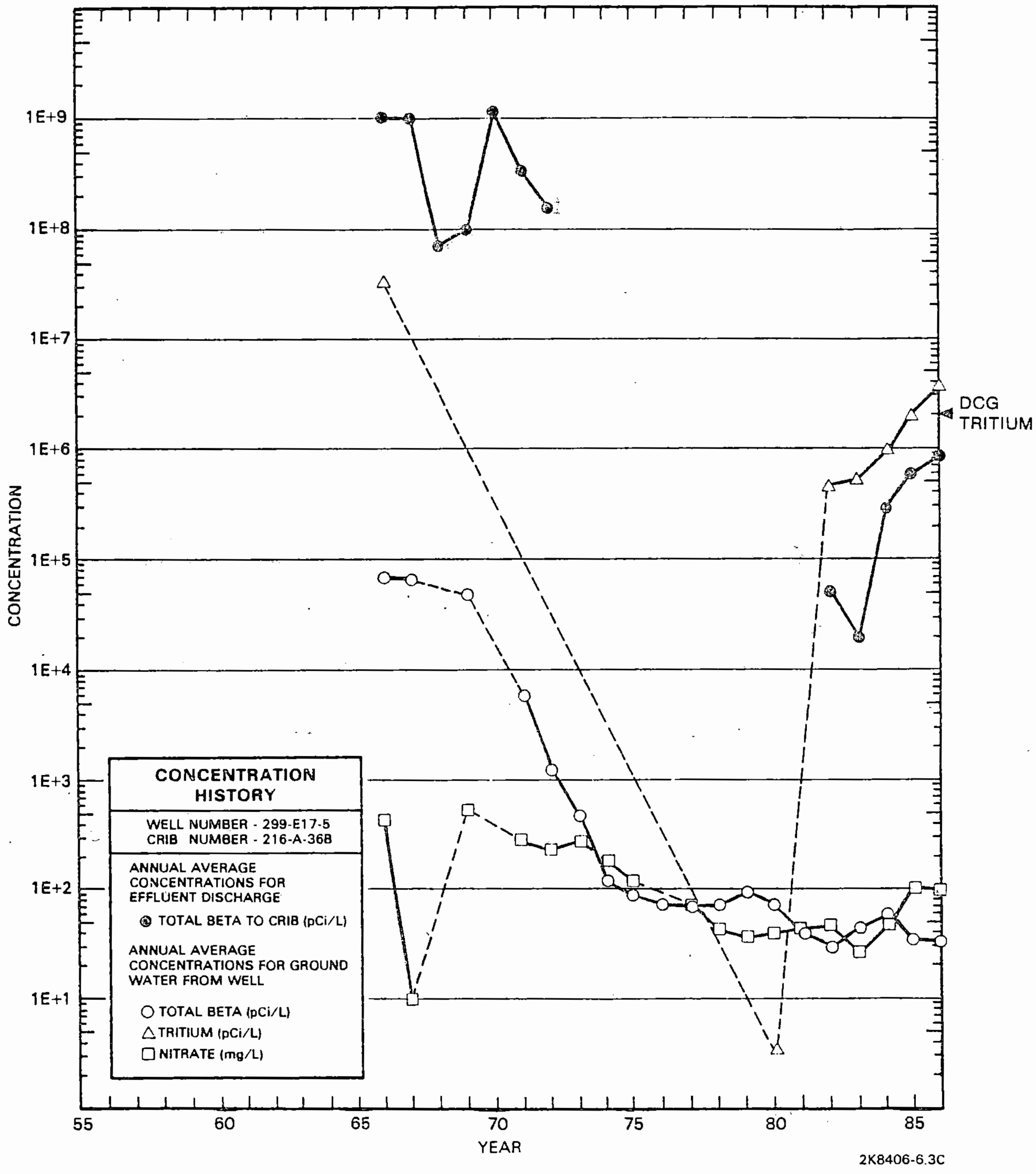
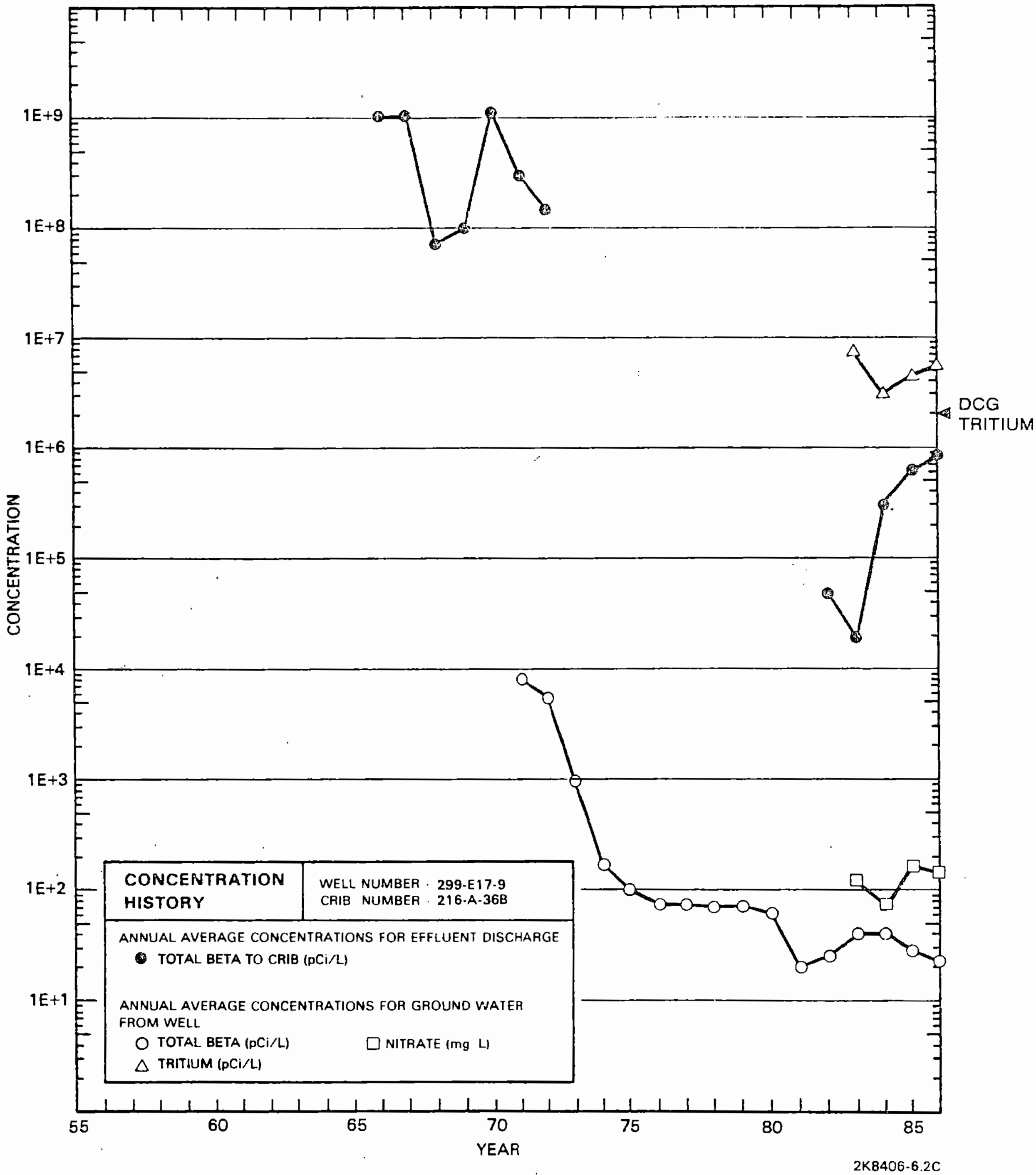


Well 299-E25-11, Crib 216-A-30



Well 299-E17-5, Crib 216-A-36B



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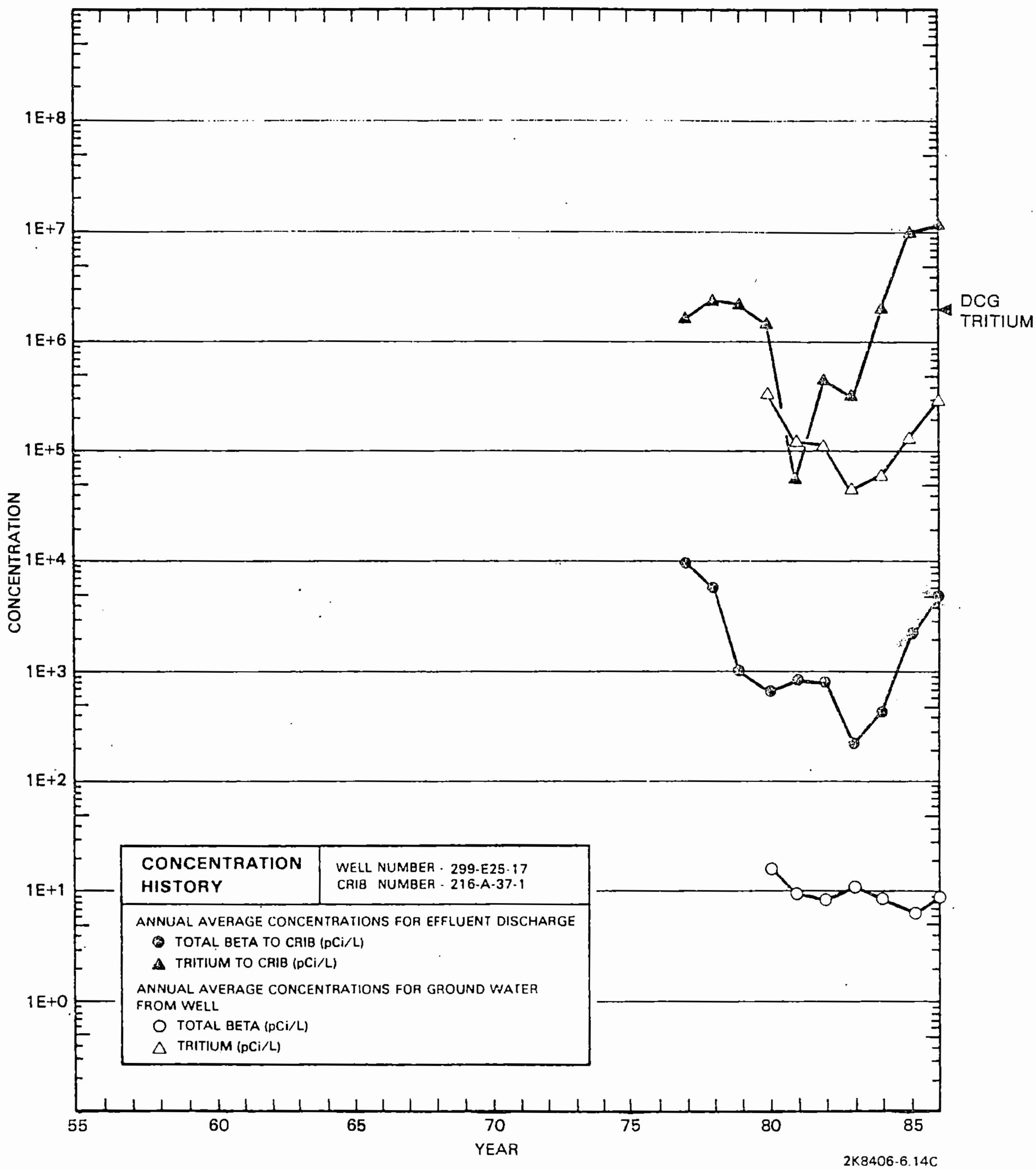
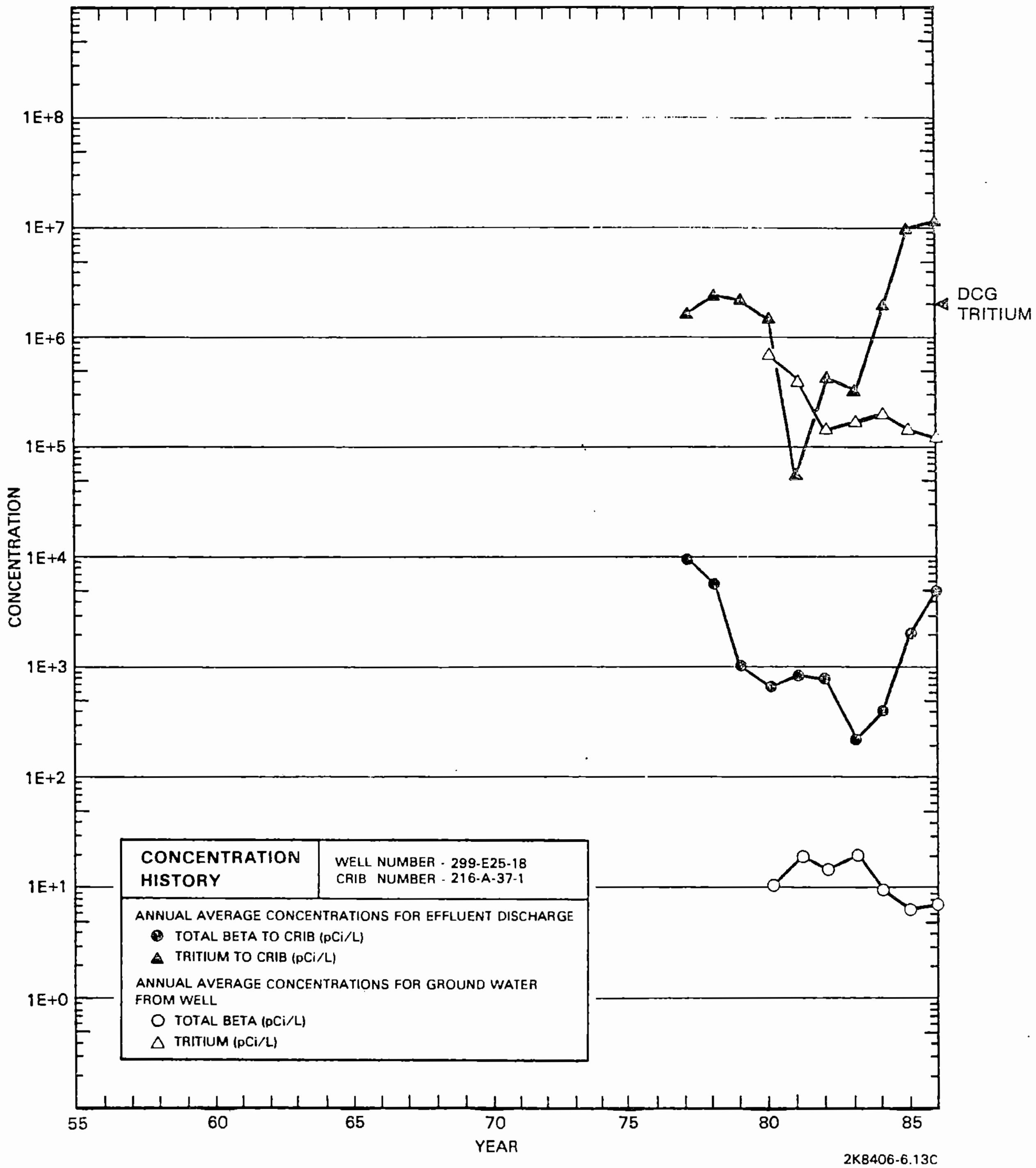


Well 299-E25-17, Crib 216-A-37-1



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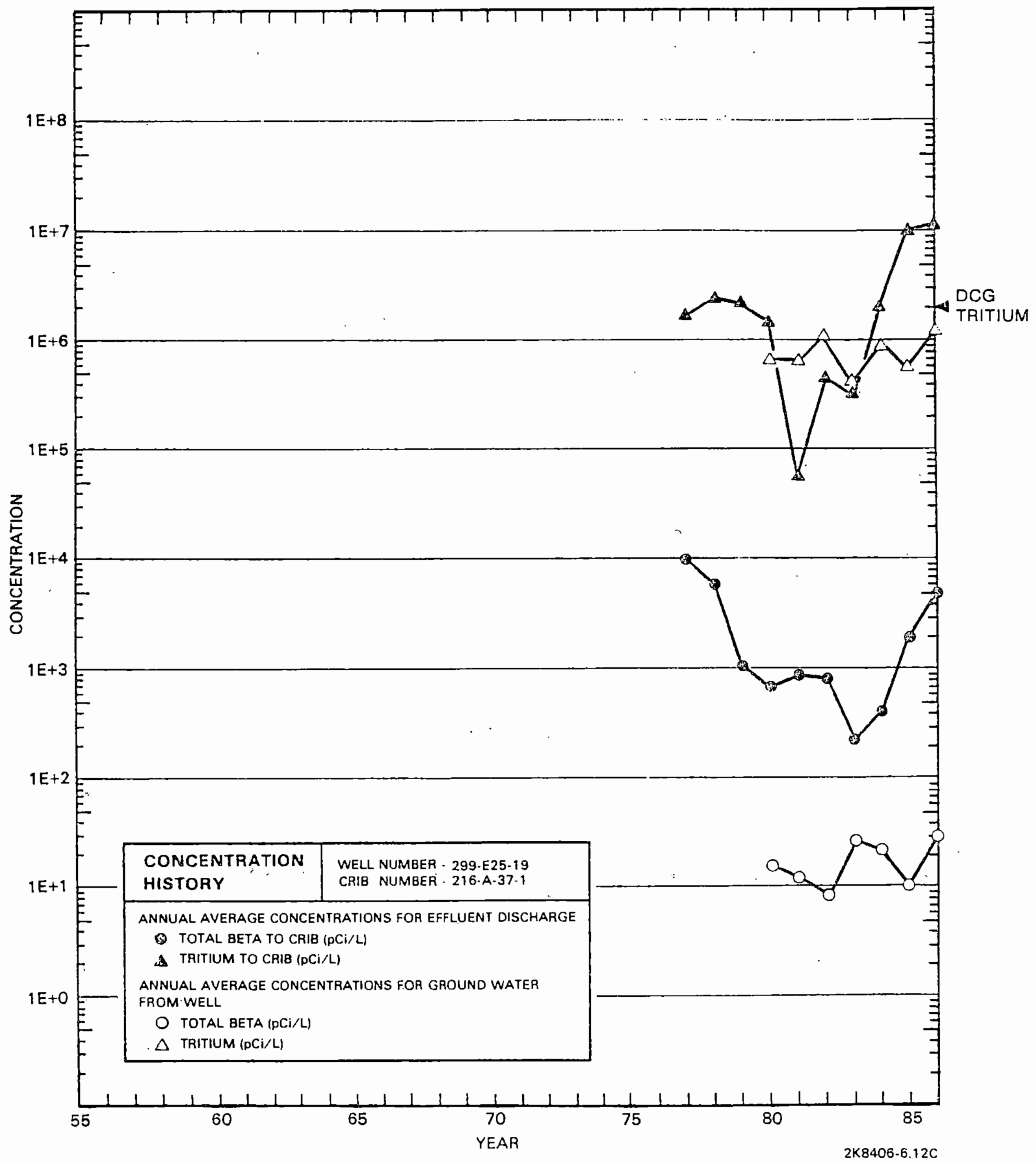

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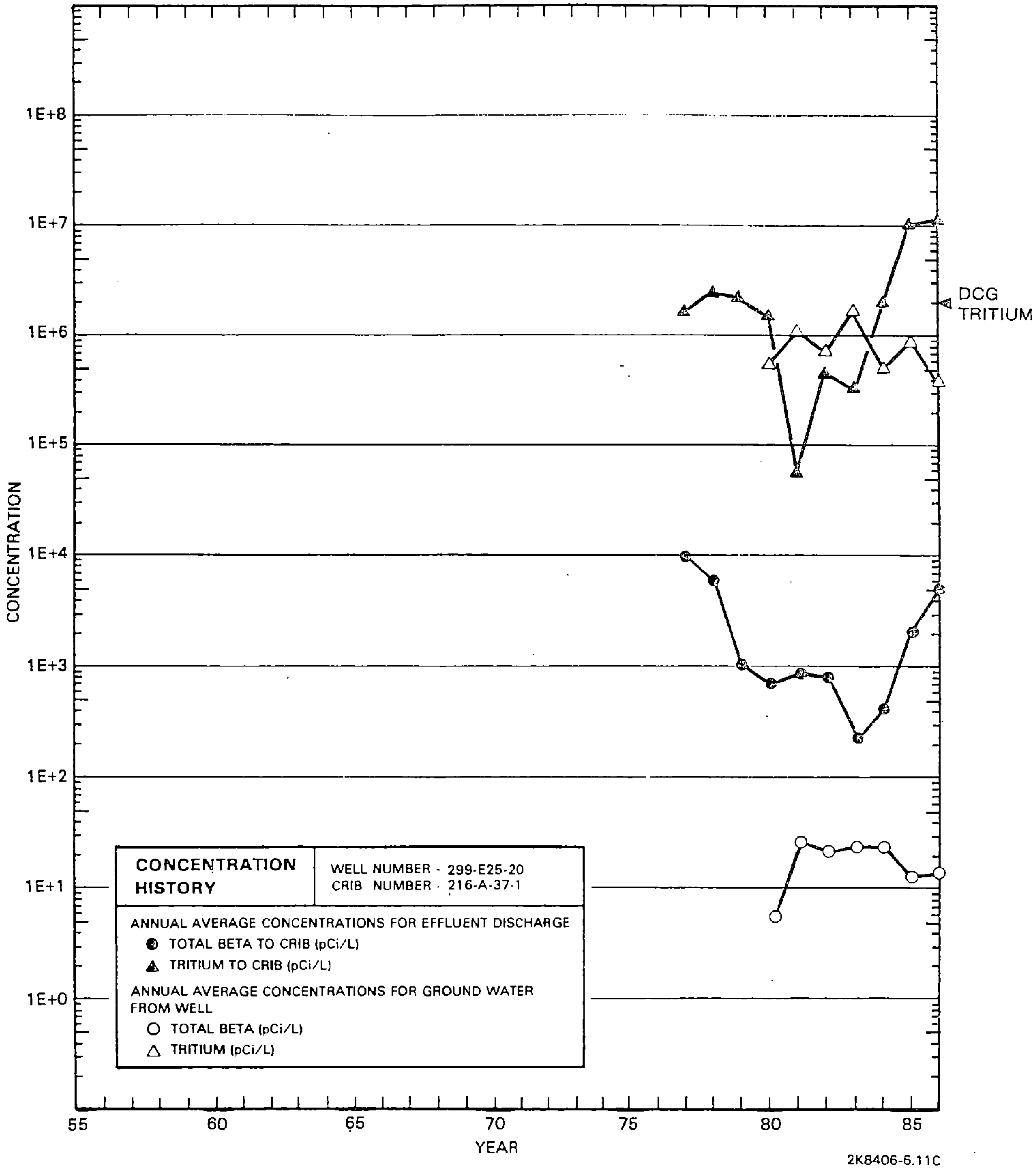

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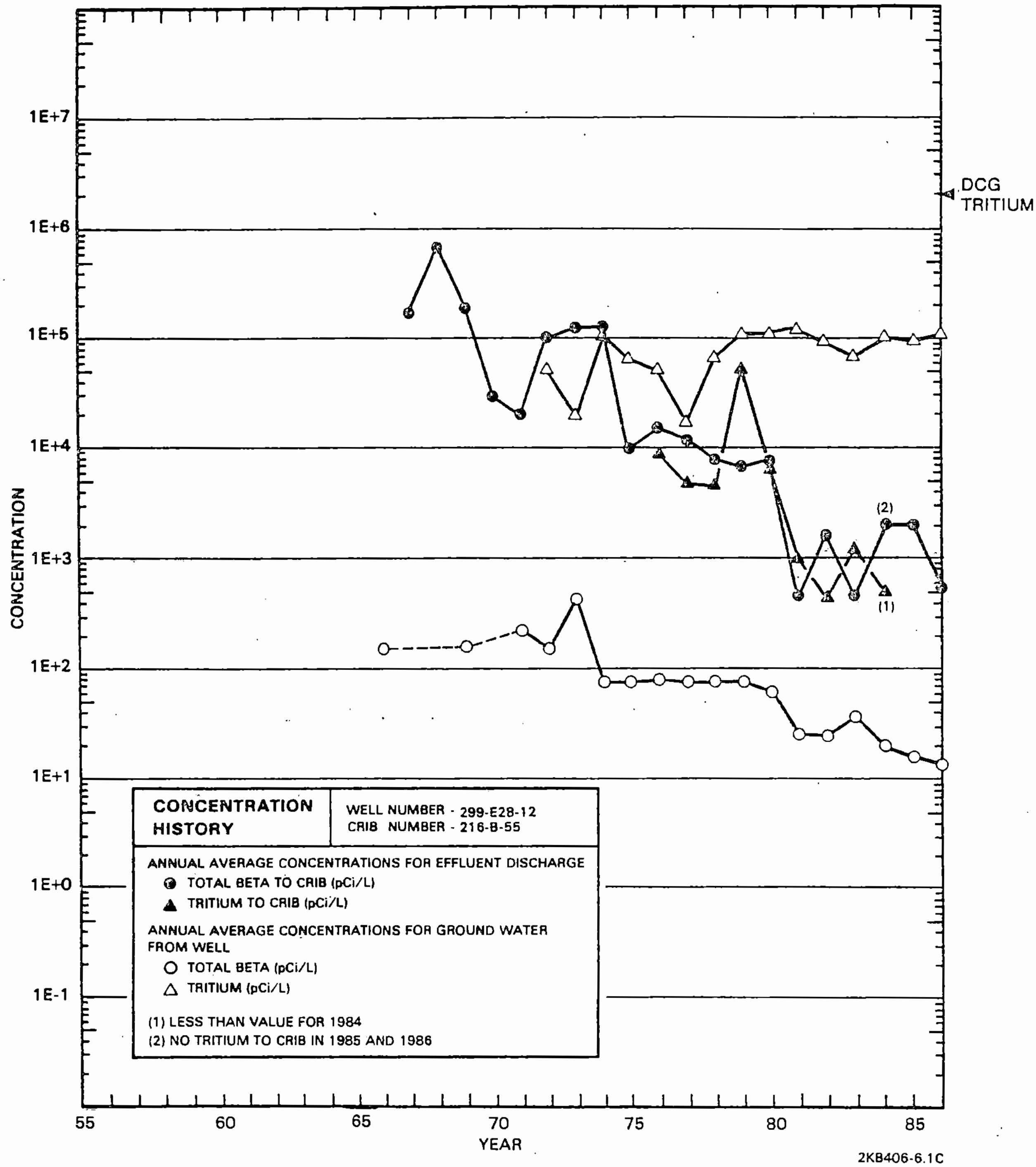

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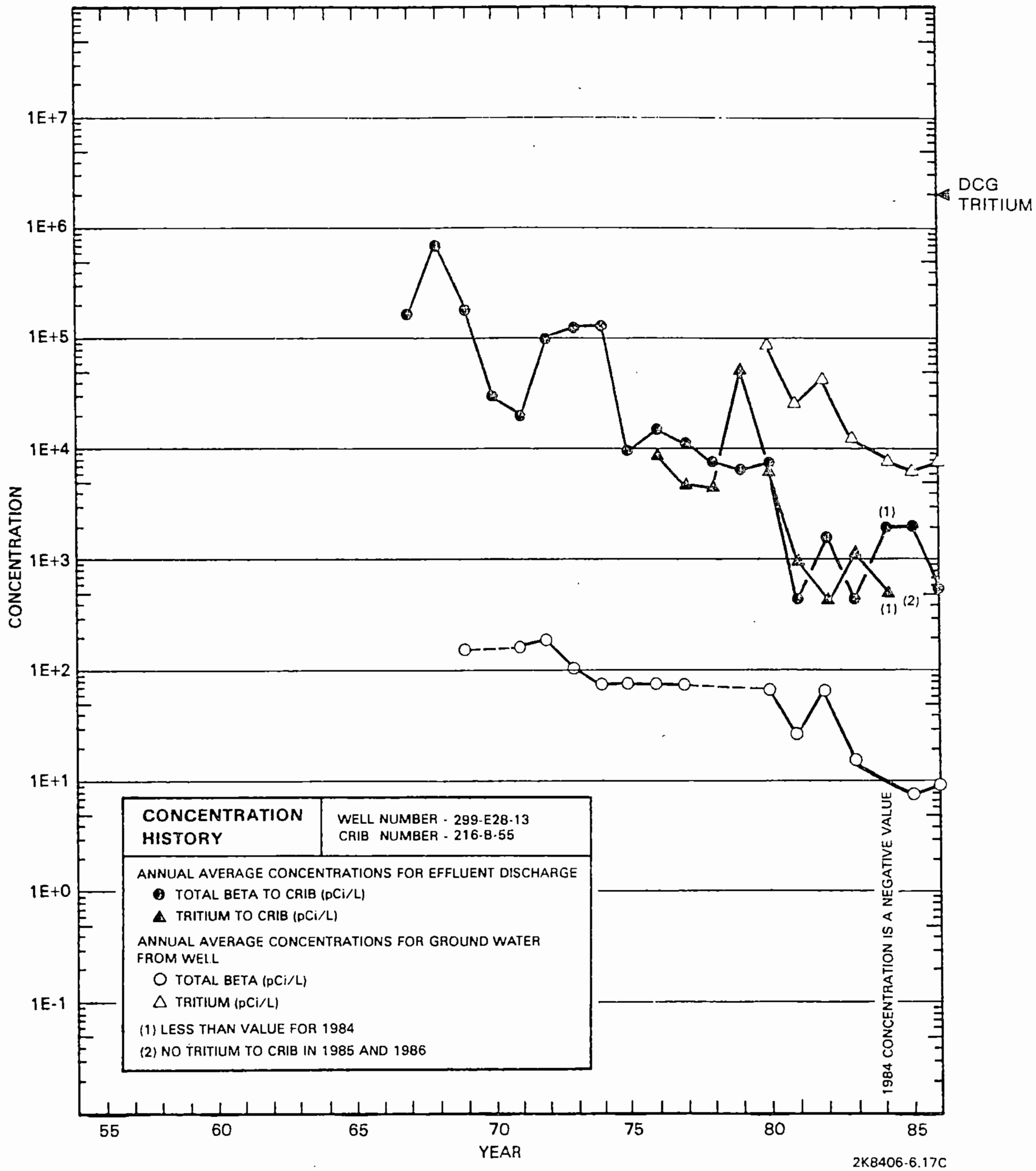

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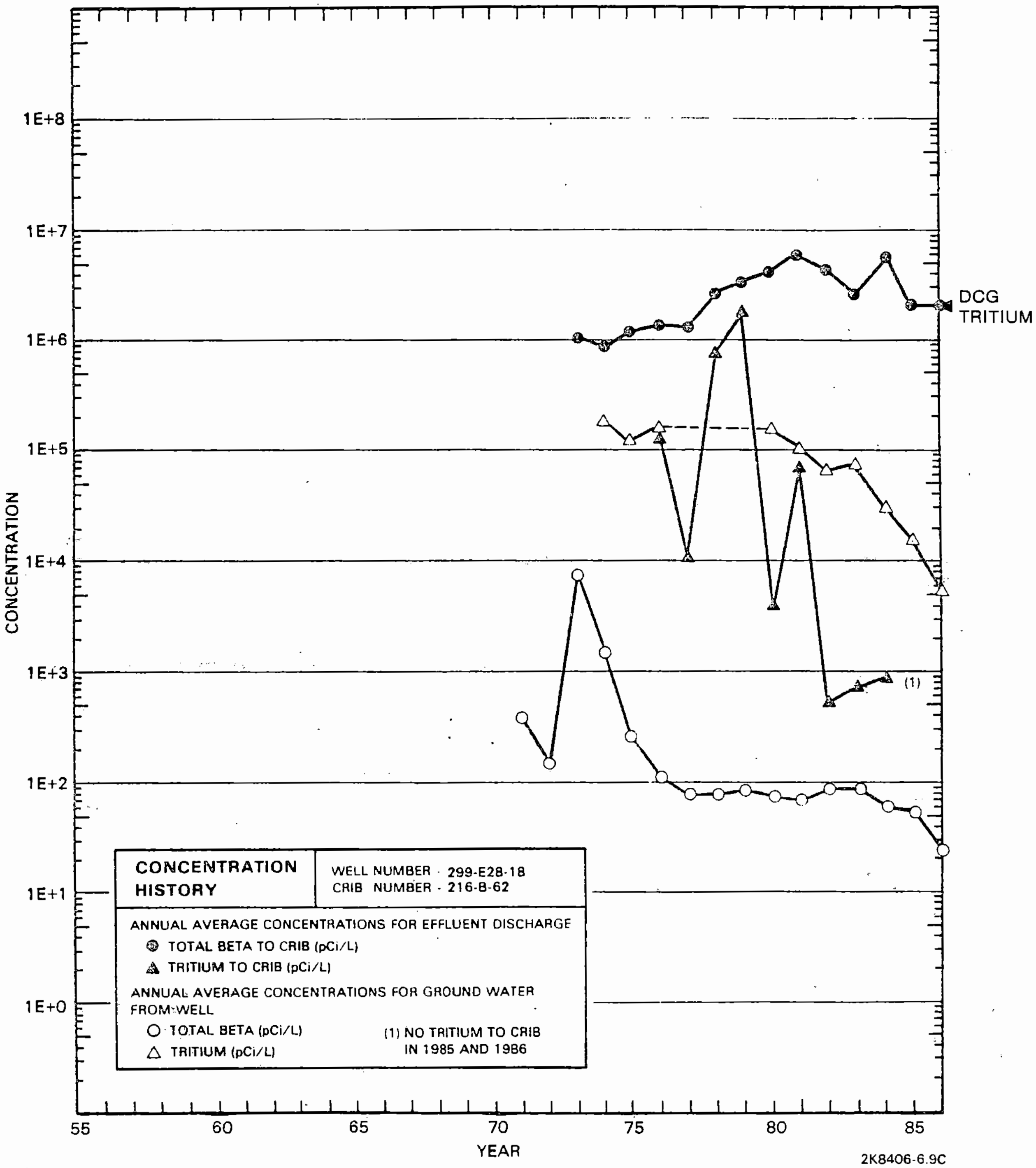

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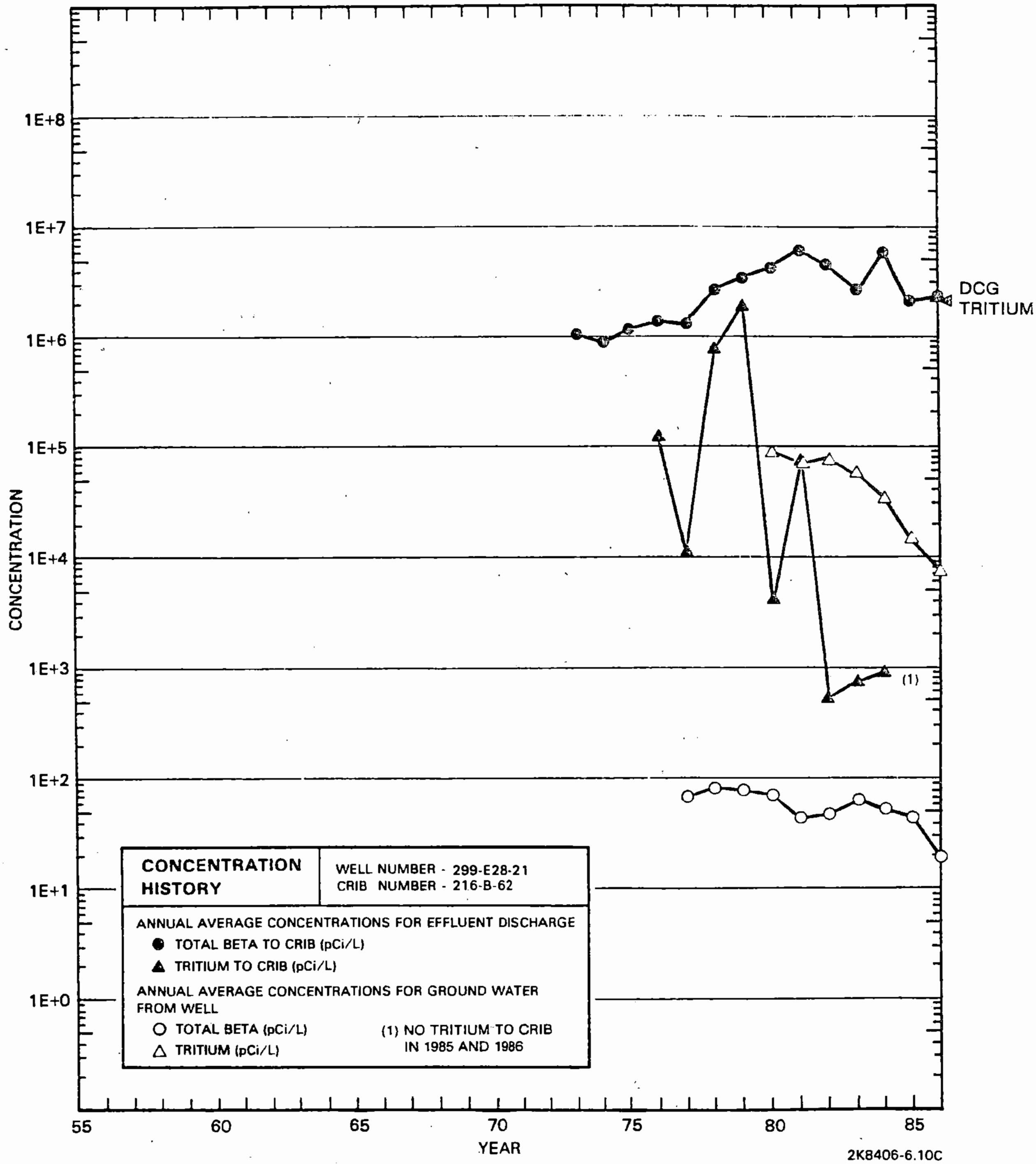

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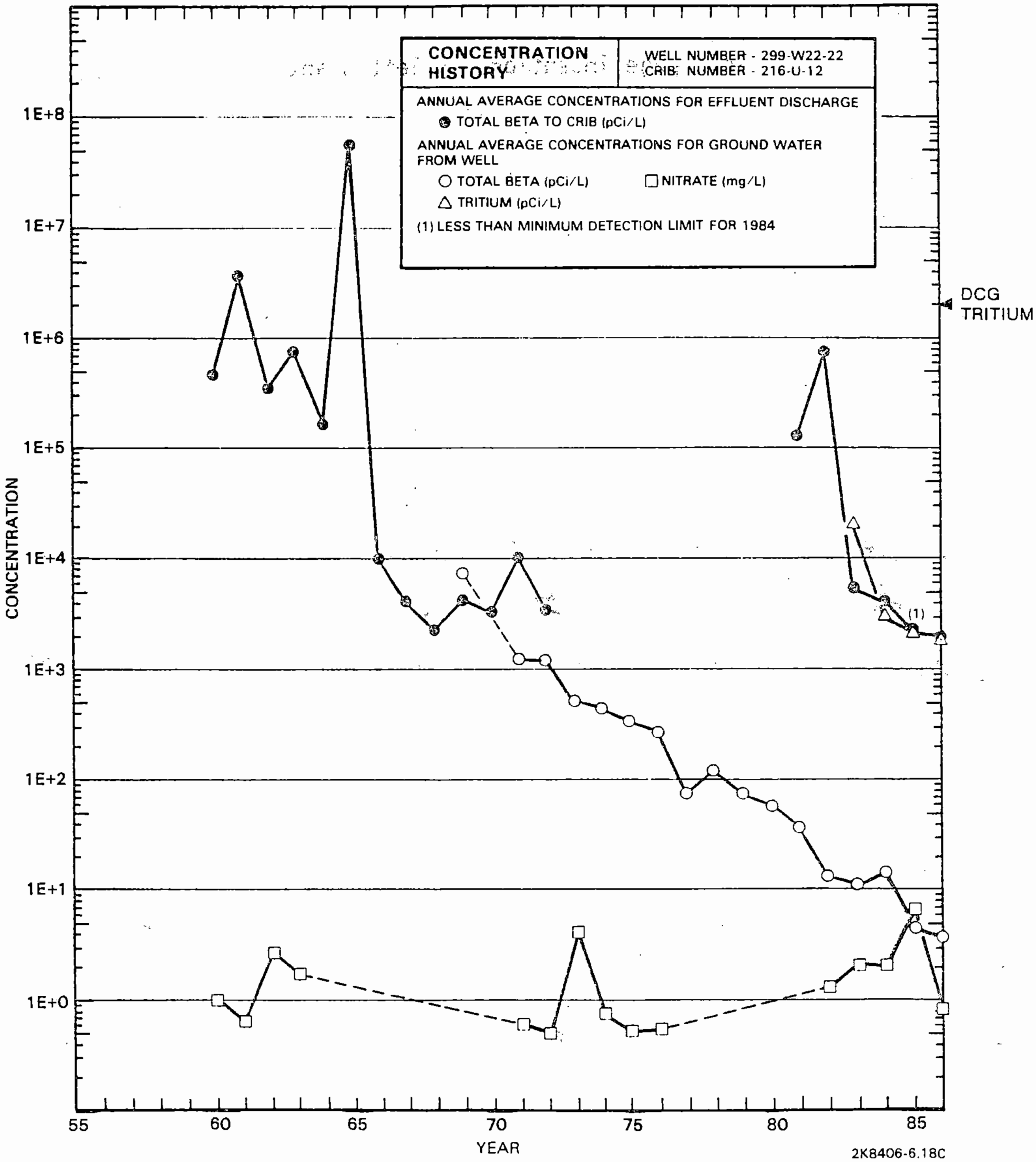

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