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Department of Energy
Richland Operations Office
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NOV 20 1991

91-ERB-214

Mr. Paul T. Day
Hanford Project Manager
U.S. Environmental Protection Agency
712 Swift Avenue, Suite 5
Richland, Washington 99352

Mr. Timothy L. Nord
Hanford Project Manager
State of Washington
Department of Ecology
Mail Stop PV-11
Olympia, Washington 98504-8711

Dear Messrs. Day and Nord:

TRANSMITTAL OF 200 AGGREGATE AREA MANAGEMENT STUDY (AAMS) SAMPLING AND ANALYSIS PLANS FOR "INFORMATION ONLY"

Enclosed are the sampling and analysis plans for the 200 AAMS Groundwater Field Activity and the 200 AAMS Borehole Geophysics Field Activity.

These plans serve as internal Westinghouse Hanford Company planning documents for outlining and implementing portions of the 200 AAMS field program.

As agreed to during the September 1991 and October 1991, unit manager meetings, these plans are to be transmitted by the U.S. Department of Energy, Richland Field Office to the U.S. Environmental Protection Agency and the State of Washington Department of Ecology for "information only" in advance of the November 1991, unit manager meeting.

If you have any questions, please contact Mr. A. C. Harris on (509) 376-4339.

Sincerely,

James E. Rasmussen
for Steven H. Wisness
Hanford Project Manager

ERD:ACH

Enclosures:
1. 200 AAMS Groundwater Field Activity
2. 200 AAMS Borehole Geophysics Field Activity

cc w/o encls:
T. B. Veneziano, WHC
R. D. Wojtasek, WHC

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200 Aggregate Area Management Study

Groundwater Field Activity
Sampling and Analysis Plan

November 8, 1991

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1.0 INTRODUCTION

1.1 PURPOSE

This sampling and analysis plan (SAP) provides the details for conducting groundwater sampling and analysis field activities in support of the 200 Aggregate Area Management Study (AAMS) program. Included within this SAP are the objectives of the field activity, data needs and data quality objectives, sampling and analysis task descriptions, analytical requirements, quality assurance objectives and quality control methods.

1.2 BACKGROUND

The Hanford Site is organized into numerically designated operational areas including the 100, 200, 300, 400, 600, and 1100 Areas (Figure 1). The 100, 200, 300, and 1100 Areas have been listed on the EPA's National Priorities List (NPL). The 200 Area, located near the center of the Hanford Site, encompasses the 200 West, East and North Areas which contain reactor fuel processing and waste management facilities.

Under the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), the 200 NPL Site is divided into 8 waste area groups largely corresponding to the major processing plants (e.g. B-Plant and T-Plant), and a number of isolated operable units located in the surrounding 600 Area. Each waste area group is further subdivided into one or more operable unit. The intent of defining operable units was to group associated waste management units together, such that they could be effectively characterized and remediated under one work plan. In addition to past practice units, RCRA TSD facilities are often associated with an operable unit for characterization and remediation purposes.

Recent proposed revisions to the Tri-Party Agreement require that an aggregate area approach be implemented in the 200 Area based on the "Hanford Past Practice Investigation Strategy" (HPPIS). The fundamental principal of the HPPIS is to streamline the existing RI/FS and RFI/CMS processes to provide a "bias for action" by maximizing the use of existing data, integrating past practice with RCRA TSD closure investigations, limiting and focusing the RI/FS process, and conducting expedited and interim actions where appropriate. The preferred path of the HPPIS is to achieve records of decisions through interim remedial actions for the initial stages of Hanford cleanup. The ultimate goal being the successful cleanup or closure of contaminated areas at the earliest possible date in the most effective manner.

Currently, ten AAMS are to be conducted for the 200 Area. Eight of the studies will focus on "source" areas. Source aggregate areas have been delineated so as to contain past-practice units that are associated with a major processing facility (e.g. PUREX, B-Plant, Z-Plant). Investigations of source areas will include evaluation of contamination from ground surface down to groundwater (the vadose zone). The remaining two AAMS are groundwater-based (200 East and 200 West).

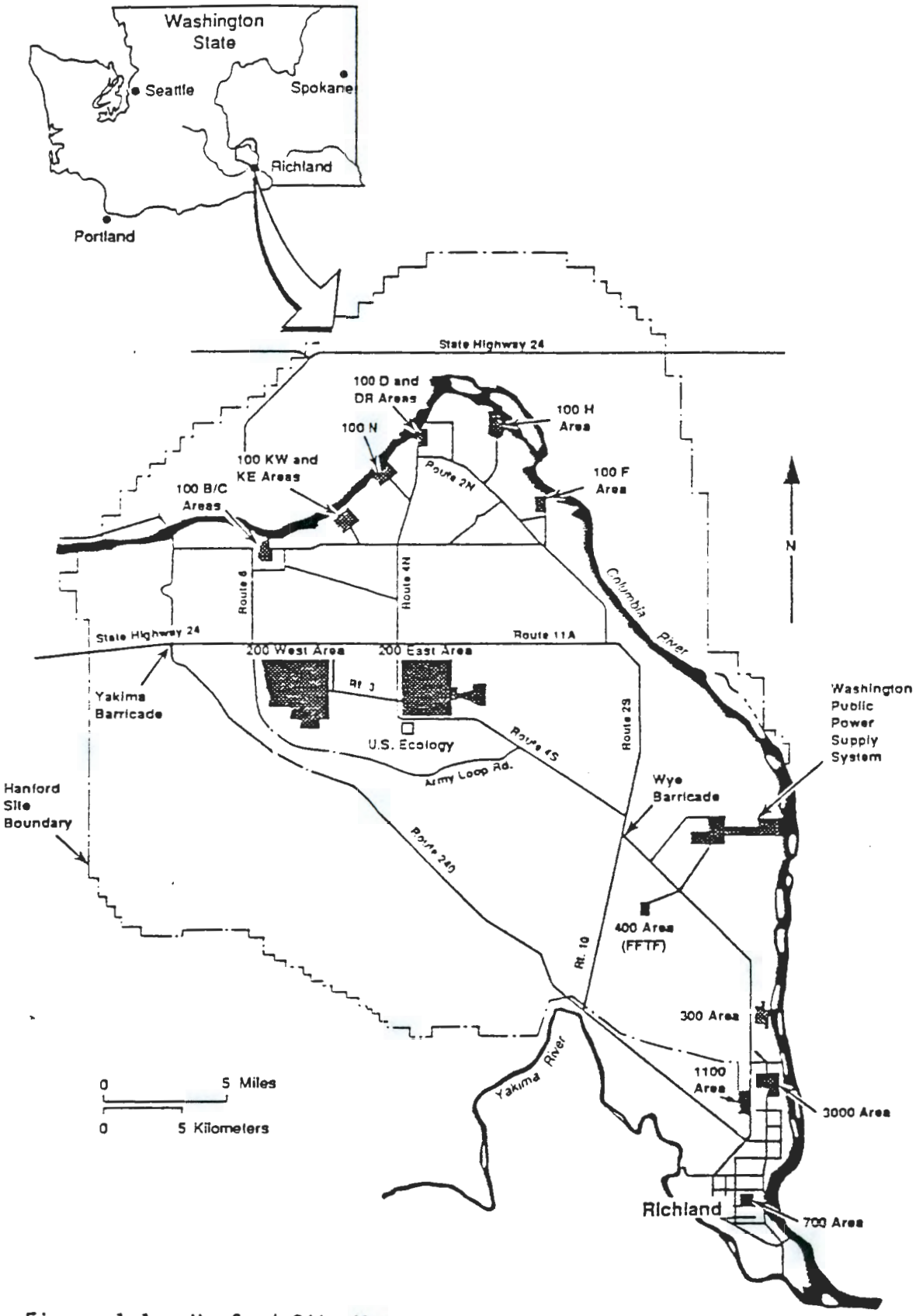


Figure 1-1. Hanford Site Map

Groundwater aggregate areas are delineated to encompass the geography necessary to define and understand the local hydrologic regime, and the distribution, migration and interaction of contaminants emanating from source sites which is considered an appropriate scale for developing conceptual and numerical groundwater models. As part of the 200 AAMS program, limited field activities are planned to help develop the area-wide conceptual models. Field activities will include groundwater sampling and analysis and borehole geophysical surveys. The groundwater sampling and analysis field activity is specifically directed toward refining the list of contaminants of concern and contaminant plume geometries. The goal is to supplement existing information to more accurately assess contaminant plume distributions.

2.0 SAMPLING AND ANALYSIS TASK DESCRIPTIONS

2.1 GENERAL APPROACH

The groundwater sampling and analysis activity has been structured into two phases (Table 2-1). The tasks associated with each phase of the activity are listed in the table as well as the section of the sampling and analysis plan that contains details for each task.

2.1.1 Phase I

Phase I (October-December, 1991) groundwater sampling and analysis will entail supplementing the sampling of wells that are already being sampled by other Hanford Site groundwater sampling programs (network wells). This approach has been chosen for the first quarter of sampling due to: 1) the limited amount of time available to evaluate contaminant plume distributions based on the most recent analytical data (since 1/1/88), 2) the possible need to select non-network wells, which may require remediation, which are more advantageously positioned for plume definition, and 3) the necessity of filing appropriate NEPA documentation for the sampling of non-network wells before they can be included in the AAMS sampling program.

The general approach for Phase I is to select wells and constituents which will provide an area-wide set of data which will complement the data set from 1/1/88. Wells that have been sampled and analyzed for a "long list" of constituents (>350) since 1/1/88 were not considered for resampling during Phase I so as to maximize the areal spread of information. Constituent lists of network wells selected for sampling during Phase I will be supplemented to include contaminants that have been detected in the 200 Area.

2.1.2 Phase II

The second phase of sampling and analysis will begin in January, 1992. Three quarters of sampling (January-March, April-June, and July-September) will be included under this phase. The primary objective of plume definition will govern the selection of wells. Well lists will likely be modified each quarter to achieve the primary objective of plume delineation.

2.2 DATA QUALITY OBJECTIVES

The EPA has devised a classification of analytical levels for contaminant data (EPA 1987). The classification provides for data of better quality as the ranking increases. Level I consists of field screening methods; Level II entails more advanced onsite analytical techniques; Level III pertains to standard laboratory program procedures; Level IV consists of EPA contract laboratory program procedures; and Level V pertains to specially developed procedures where standard methods are not available or where a high degree of analytical sensitivity is required.

TABLE 2-1. 200 AAMS Groundwater Sampling and Analysis Activity Tasks

	TASK	S&A PLAN SECTION	PHASE I	PHASE II
1	DATA COMPILATION AND REVIEW	2.3.1	X	X
2	CONTAMINANT DETERMINATION	2.3.2	X	X
3	EVALUATION OF EXISTING SAMPLING PROGRAMS	2.3.3	X	X
4	CONTAMINANT DETECTS PLUME MAPPING	2.3.4	X	X
5	EVALUATION OF EXISTING WELLS	2.3.5	X	X
6	DATABASE DEVELOPMENT	2.3.6	X	X
7	PHASE I WELL NETWORK SELECTION	2.3.7 APP. A	X	
8	PHASE I GROUNDWATER SAMPLING & ANALYSIS	2.3.8	X	
9	INITIATE NEPA DOCUMENTATION	2.3.9		X
10	PHASE II WELL NETWORK SELECTION	2.3.10 APP. B		X
11	NON-NETWORK WELL REMEDIATION	2.3.11		X
12	PHASE II GROUNDWATER SAMPLING & ANALYSIS	2.3.12		X
13	DATA EVALUATION	2.3.13	X	X

Westinghouse Hanford has developed a site-specific analytical classification that implements the EPA data quality objective (DQO) process but consists of two data quality levels: field or laboratory screening and validated laboratory analyses (McCain and Johnson, 1990). Field or laboratory screening is generally equivalent to EPA Levels I, II, and III; validated laboratory analyses are generally equivalent to EPA Levels IV and V, although some aspects of Level III are included.

The 200 AAMS groundwater sampling and analysis program is a screening activity and will follow WHC screening DQO protocols or EPA I, II, and III, dependent on the analysis performed. There is no intent to use the information in statistical analyses or to define "absolute" concentrations of contaminants at a well. Data quality objectives and analytical levels do not apply to compilation and evaluation of existing data. The Quality Assurance Plan for the 200 Area sampling and analysis activity is included in Attachment I.

2.3 TASK DESCRIPTIONS

2.3.1 Task 1 - Data Compilation and Review

The objective of this task is to assemble and evaluate existing data (electronic database and hardcopy) on 200 Area hydrogeology and groundwater contamination. Information sources include, but are not to be limited to, hydrogeologic and groundwater monitoring reports, monitoring well construction reports, groundwater quality data, and water level information.

2.3.2 Task 2 - Contaminant Determination

The purpose of this task is to query the Hanford Site Groundwater Database for all contaminants that have been detected in 200 Area groundwater samples analyzed since January 1, 1988. The term "contaminants" refers to any chemical or constituent that is listed in:

-40 CFR 141 and 143 - Primary and Secondary Drinking Water Regulations
-FR 54 22062 - Proposed Drinking Water MCL
-40 CFR 264 Appendix IV - the RCRA "Long List"
-WAC 173-200-040 - Model Toxics Control Act
-DOE Order 5400.5 - Derived Concentration Guides (DCG) for Radionuclides

A list of contaminant detections are contained in Appendix A and will be maintained in an electronic database for later evaluations such as contaminant plume mapping and comparisons with regulatory standards and background levels.

2.3.3 Task 3 - Evaluation of Existing Sampling Programs

The well networks and associated constituent lists for monitoring programs operating in the 200 Area will be compiled into an electronic database that identifies each well and the analyses scheduled for each month of the fiscal year, beginning in October, 1992.

Phase I sampling and analysis will be scheduled to supplement sampling schedules already defined by other Site groundwater programs. The contaminant detects identified in Task 2 will define the analyses requested for Phase I (Appendix A). Phase II sampling and analysis may also include wells that are scheduled for sampling under another Site program.

2.3.4 Task 4 - Contaminant Plume Mapping

The purpose of this task is to develop contaminant plume maps for use in the selection of well networks during Phase II. Maps will be generated for contaminant detections identified in Task 2. Each constituent will be plotted separately and contaminant plumes will be hand contoured. The plumes will then be digitized. Plume maps will continually be refined as additional analytical data is received and will be used as primary guides during Phase II well selection.

2.3.5 Task 5 - Evaluation of Existing Wells

The purpose of this task is to obtain information on the integrity, accessibility, construction quality, monitored interval, and sampling system employed by every well, network and non-network, within the study area. This evaluation will be based on the records review conducted in Task 1 and field inspections, as necessary. Wells will be categorized as either:

Category 1: This is the highest quality categorization, i.e. RCRA/CERCLA wells or equivalents. Wells must be constructed of stainless steel, have a screened interval of 20 feet or less with filter pack, have well completion information that is well documented, and be sampled by a positive-displacement or electric submersible pump. Water-level data and water chemistry are considered representative.

Category 2: These wells have a know screened or perforated interval of 30 feet or less, are sampled by a pump, and monitor the unconfined water table zone. Wells may or may not be constructed of stainless steel, have a filter pack, or documented borehole completion. Water-level data is representative. Chemistry data is representative in most cases but not regulation (RCRA) quality, i.e. adequate for screening purposes.

Category 3: This is the lowest quality well type. These wells have longer than 30 foot perforated intervals or unknown intervals and/or are sampled by bailer. These wells may be used for water levels if the monitoring interval is known and appropriate. Chemistry data from these wells may be representative, but can not be proven to be unbiased and may represent groundwater quality averaged over a large vertical distance in the aquifer.

This information will be used to evaluate the suitability of available wells as part of the well selection process.

2.3.6 Task 6 - Database Development

Information compiled in Tasks 2, 3, and 5 will be maintained in an electronic database for later data evaluation and inclusion in required reports. The database will have the capability of being expanded to include analytical results from Phase I and Phase II samplings.

2.3.7 Task 7 - Phase I Well Network Selection

Task Objective: The purpose of this task is to select a network of wells for sampling during October-December, 1991 which will provide a broad base of information on contaminant distribution in the 200 Area.

Task Description: Well selection for Phase I sampling and analysis is based on the following criteria: (1) only existing network wells may be considered, (2) wells should be chosen to provide the best areal coverage, and (3) wells that have had a "long list" (>350) constituents run since 1/1/88 are not to be considered. The wells chosen for sampling will have their

analytical constituent lists supplemented by analytical methods containing contaminant detects identified in Task 2.

Sample Locations, Frequencies, and Analyses: Wells selected for sampling during Phase I and the analyses requested are included in Appendix A. Appendix C contains a list of analytical procedures with applicable detection limits (hazardous constituents) or minimum detectable concentrations (radioactive constituents).

2.3.8 Task 8 - Phase I Groundwater Sampling and Analysis

Task Objective: This task objective is to sample monitoring wells chosen under Task 7 and analyze the groundwater collected for the constituents identified in Appendix A.

Task Description: Groundwater samples will be obtained by onsite organizations from Task 7 wells. Purgewater will be managed as prescribed in the purgewater strategy document (DOE 1990). Quality assurance requirements specified in Attachment I will be met.

2.3.9 Task 9 - Initiate NEPA Documentation for Non-Network Wells

Task Objective: The purpose of this activity is to prepare and submit for approval the necessary NEPA documentation to allow for the remediation and use of non-network wells in Phase II sampling (Task 12).

Task Description: A determination has been made that an Information Bulletin, as required by NEPA regulations, must be submitted in order that non-network wells may be remediated and sampled during Phase II.

2.3.10 Task 10 - Phase II Well Network Selection

Task Objective: The general objective of this task is to select wells for sampling during the three quarters of sampling scheduled for Phase II. The wells will be chosen to meet the specific objective of delineating and refining contaminant plume geometries.

Task Description: Using contaminant plume maps created in Task 4, well networks will be chosen on a quarterly basis. Wells chosen for sampling may be network or non-network wells, with the understanding that non-network wells may require limited remediation (Task 11) to provide representative groundwater samples.

Sampling Locations, Frequencies, and Analyses: Wells selected for sampling during Phase II and the analyses requested are included in Appendix B. Appendix C contains a list of analytical procedures with applicable detection limits (hazardous constituents) or minimum detectable concentrations (radioactive constituents).

2.3.11 Task 11 - Non-Network Well Remediation

Task Objective: The purpose of this task is to remediate non-network wells selected for sampling during Phase II of the field activity.

Task Description: As this activity is being implemented as a screening activity, remediation of non-network wells will be the minimum necessary to assure sample representativeness. At a minimum, the wells selected for remediation will be (1) backplugged with sand and grout-sealed to provide for a 20-foot or less sampling interval, (2) redeveloped, and (3) outfitted with an electric submersible or Hydrostar pump. Additional remediation measures will be evaluated on a well-by-well basis however it is intended that only those wells requiring minimal remediation will be scheduled.

2.3.12 Task 12 - Phase II Groundwater Sampling and Analysis

Task Objective: The objective of Task 12 is to sample monitoring wells chosen under Task 10 and analyze the groundwater collected for the constituents identified in Appendix B. Data will be used to delineate and refine contaminant plume geometries in the 200 Area.

Task Description: Groundwater samples will be obtained by onsite organizations from wells selected during Task 10 and sent to an offsite laboratory for analysis. Purgewater will be managed as prescribed in the purgewater strategy document (DOE 1990). Quality assurance requirements specified in Attachment I will be met.

2.3.13 Task 13 - Data Evaluation and Reporting

Task Objective: The purpose of this task is to compile and integrate the results of the Phase I and II sampling and analysis activities with existing data to provide improved contaminant plume geometry information.

Task Description: Analytical results from the quarterly samplings will be incorporated, as received, into the 200 Area database developed in Task 6. Contaminant plume geometries will be modified as data are received. The data and resultant plume geometry maps will be incorporated into the following reports. The reports that have been identified for data inclusion are:

- 200 West Groundwater Aggregate Area Management Study Report (September, 1992)
- 200 East Groundwater Aggregate Area Management Study Report (September, 1992)
- 200 Aggregate Area Management Study Final Groundwater Field Activity Report (November, 1992)

It is expected that only the first two or three quarters of analytical data will be available for inclusion in the 200 East and 200 West Groundwater Aggregate Area Management Study Reports. The Final report will summarize all four quarters of information.

3.0 REFERENCES

DOE, 1990, Letter, R. D. Izatt, DOE to President, HEHF; General Manager, KEH; Director, PNL; and President, WHC, "Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington", ERD:KMT, 90-ERB-076, dated August 21, 1990.

EPA, 1987, *Data Quality Objectives for Remedial Response Activities*, Vol. 1, Development Process, EPA-540/6-87-003, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, U.S. Environmental Protection Agency, Washington, D.C.

McCain, R. G., W. L. Johnson, 1990, *A Proposed Data Quality Strategy for Hanford Site Characterization*, WHC-SD-EN-023, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

PHASE I CONTAMINANT DETECTIONS, WELL NETWORK AND ANALYTICAL REQUIREMENTS

APPENDIX A

This appendix contains a listing the 200 Area contaminant detections identified in Task 2 (Table A-1), the Phase I (October-December 1991) sampling network and analytical requirements (Table A-2), and a sampling network location map (Figure A-1).

Table A-1. 200 Area Contaminant Detections (by Analytical Method) Since 1/1/88

ANALYTICAL METHOD	CONTAMINANT DETECT
AA Metals SW-846 7060	Arsenic
SW-846 7470	Mercury
SW-846 7421	Lead
SW-846 7471	Selenium
ICP Metals SW-846 6010	Barium
	Chromium
	Copper
	Iron
	Manganese
	Zinc
Volatile Organics SW-846 8240	Carbon Tetrachloride
	Chloroform
	Trichloroethylene
	1,1-Dichloroethane
	1,1,1-Trichloroethane
	1,2-Dichloroethane
Anions ASTM D4327-88 OR EPA 300.2	Chloride
	Fluoride
	Nitrate
	Sulfate
Pesticide SW-846 8080	DDT (a)
Hydrazine ASTM D1385	Hydrazine
Semi-Volatile SW-846 8270	Bis(2-ethylhexyl)phthalate (a)
Coliform SW-846 9131/9132	Coliform

ANALYTICAL METHOD	CONTAMINANT DETECT
Cyanide SW-846 9010	Cyanide
Radiochemistry SW-846 9310	Gross Alpha
SW-846 9310	Gross Beta
	Co-60 (b)
	I-129 (b)
	Pu-239/40 (b)
	Radium (b)
	Strontium-90 (b)
	Technetium-99
	Tritium
	Uranium

(a) This contaminant is suspected of being a spurious detect.

(b) Due to the limited extent of presently known plume geometry, this contaminant will be evaluated in detail during Phase II (except for peak information derived from gamma scan analysis, where appropriate).

TABLE A-2. 200 AGGREGATE AREA MANAGEMENT STUDY
SAMPLING NETWORK AND ANALYTICAL REQUIREMENTS
OCTOBER-DECEMBER, 1991

Well	VOAs	ICP	As	SVol	Anion	Colif	Cn	Pest	Hyd	Pb	Hg	Se	TDS	Gross Alpha	Gross Beta	Gamma Scan	Tc 99	Trit	U Chem
Z PLANT AGGREGATE AREA																			
2-W6-2	*	*	*	*	*	*	*	*	X	*	*	*	X	*	*	*	*	*	*
2-W7-6	*	*	*	*	*	*	*	*	X	*	*	*	X	*	*	*	*	*	*
2-W15-7	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2-W15-8	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2-W15-19	*	*	*	*	*	*	*	*	X	*	*	*	X	*	*	*	*	*	*
2-W15-24	*	*	*	*	*	*	*	*	X	*	*	*	X	*	*	*	*	*	*
U PLANT AGGREGATE AREA																			
2-W18-25	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	X	X	X
2-W19-18	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	X	X
2-W19-29	*	*	X	X	*	X	X	X	X	X	X	X	X	*	*	X	*	*	*
2-W19-31	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-W22-40	*	*	*	X	*	*	X	*	X	*	*	*	X	*	*	X	*	*	*
S PLANT AGGREGATE AREA																			
2-W22-20	*	*	X	X	X	X	X	X	X	X	X	X	X	*	*	*	X	*	*
2-W22-21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2-W22-39	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-W23-11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	X	X
2-W23-14	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-W26-6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	X	X
2-W26-11	*	*	*	X	*	*	X	*	X	*	*	*	X	*	*	X	X	X	*

Well	VOAs	ICP	As	SVol	Anion	Colif	Cn	Pest	Hyd	Pb	Hg	Se	TDS	Gross Alpha	Gross Beta	Gamma Scan	Tc 99	Trit	U Chem
T PLANT AGGREGATE AREA																			
2-W10-16	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-W11-23	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-W14-2	X	*	X	X	X	X	*	X	X	X	X	X	X	X	X	X	X	*	X
2-W15-12	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	X
2-W15-22	*	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
B PLANT AGGREGATE AREA																			
2-E26-9	X	*	*	X	*	*	X	*	X	*	*	*	X	*	*	X	X	*	X
2-E26-11	X	*	*	X	*	*	X	*	X	*	*	*	X	*	*	X	X	*	X
2-E32-5	*	*	*	*	*	*	*	*	X	*	*	*	X	*	*	*	*	*	*
2-E33-37	*	*	*	X	*	*	X	*	X	*	*	*	X	*	*	*	X	*	*
2-E34-8	*	*	*	X	*	*	X	*	X	*	*	*	X	*	*	*	X	*	*
PUREX AGGREGATE AREA																			
2-E24-19	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-E25-33	*	*	*	*	*	*	X	*	X	*	*	*	X	*	*	X	*	*	
2-E25-37	*	*	*	*	*	*	X	*	X	*	*	*	X	*	*	X	*	*	X
2-E25-39	*	*	*	*	*	*	X	*	X	*	*	*	X	*	*	X	*	*	X
2-E25-41	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-E27-14	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-E27-15	X	*	*	X	*	*	*	*	*	*	*	*	X	*	*	*	*	*	*
2-E34-7	*	*	*	*	*	*	*	*	X	*	*	*	X	*	*	*	*	*	*
600 AREA																			
6-34-42	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	X
6-35-70	X	*	X	X	X	X	X	X	X	X	X	X	X	*	*	*	X	*	X

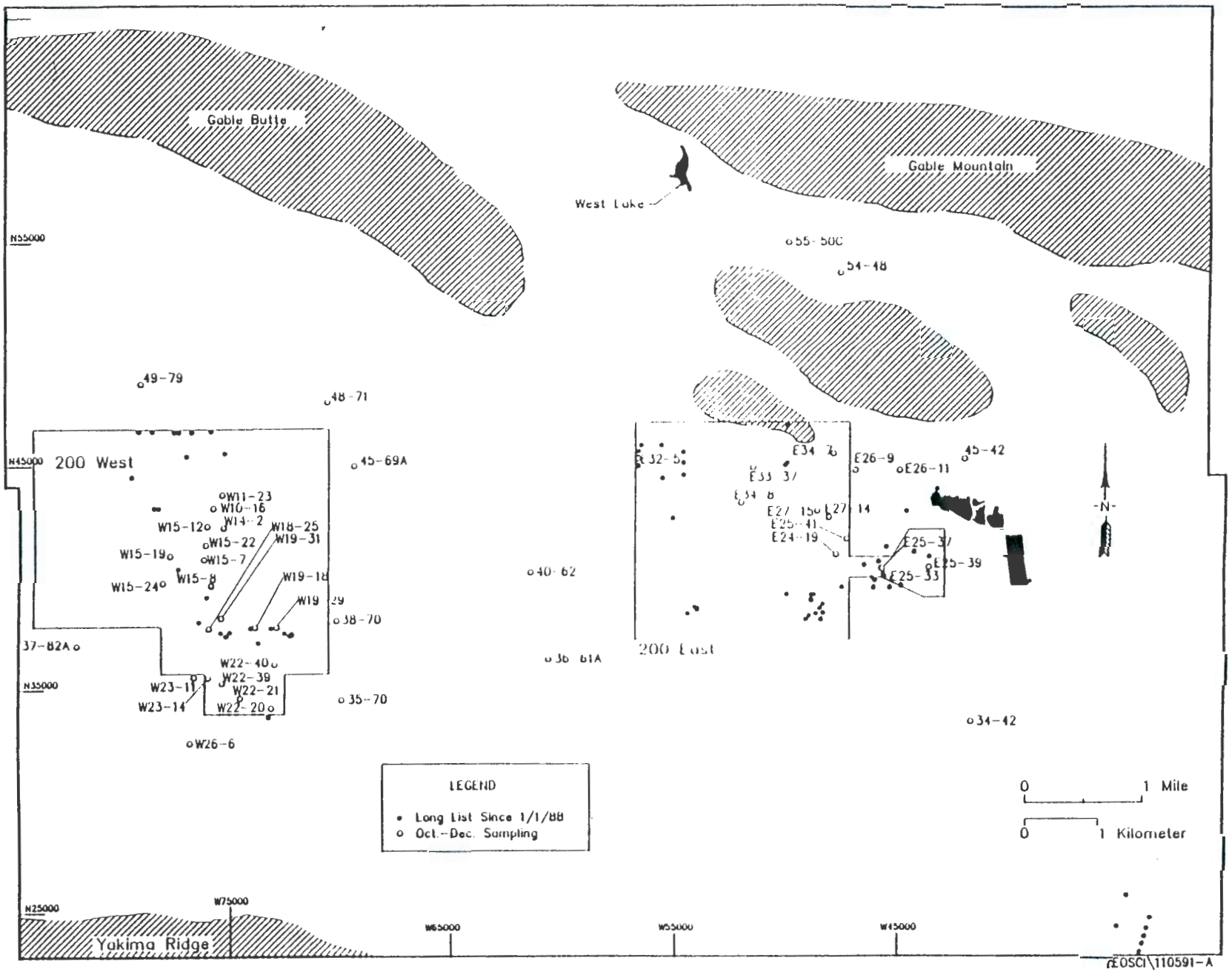
Well	VOAs	ICP	As	SVol	Anion	Colif	Cn	Pest	Hyd	Pb	Hg	Se	TDS	Gross Alpha	Gross Beta	Gamma Scan	Tc 99	Trit	U Chem
6-36-61A	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	*	X
6-37-82A	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	X
6-38-70	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6-40-62	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	X
6-45-42	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	*	X
6-45-69A	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	*	X
6-48-71	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*	X
6-49-79	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6-54-48	X	X	X	X	*	X	X	X	X	X	X	X	X	*	*	X	X	*	X
6-55-50C	X	*	X	X	*	X	X	X	X	X	X	X	X	*	*	X	X	*	X

NOTE:

* - Indicates that this analysis has been requested by another Hanford Site groundwater monitoring program.

X - Indicates that this analysis is supplemental to other program requirements and is to be collected for the 200 Aggregate Area Project.

Figure A-1. 200 Area Phase I Sampling Network



APPENDIX B

PHASE II CONTAMINANT PLUME MAPS, WELL NETWORKS, AND ANALYTICAL REQUIREMENTS

APPENDIX B

(To be provided separately)

APPENDIX C

ANALYTICAL PROCEDURES

ANALYTICAL PROCEDURES AND DETECTION LIMITS (DLs) FOR HAZARDOUS CHEMISTRY ANALYTES

METHOD	ANALYTE	DL ppb	PRESERVE
ICP METALS	ANTIMONY	300	HNO3
SW-846 6010	BARIUM	20	"
	BERYLLIUM	3	"
	CADMIUM	10	"
	CALCIUM	100	"
	CHROMIUM	50	"
	COBALT	70	"
	COPPER	60	"
	IRON	300	"
	MAGNESIUM	100	"
	MANGANESE	50	"
	NICKEL	50	"
	POTASSIUM	300	"
	SILVER	50	"
	SODIUM	300	"
	TIN	100	"
	VANADIUM	80	"
	ZINC	20	"
AA METALS			
SW-846 7060	ARSENIC	10	HNO3
SW-846 7421	LEAD	10	"
SW-846 7470	MERCURY	2	"
SW-846 7471	SELENIUM	10	"
SW-846 7841	THALLIUM	10	"
ANIONS			
ASTM D4327-88	CHLORIDE	200	H2SO4
OR EPA 300.2	NITRITE	200	"
	NITRATE	200	"
	PHOSPHATE	400	"
	BROMIDE	500	NONE
	CHLORIDE	250000	"
	FLUORIDE	4000	"
	PHOSPHATE	400	"
	SULFATE	250000	"
	NITRATE	10000	"

METHOD	ANALYTE	DL ppb	PRESERVE
INDIVIDUAL INORGANIC ANALYTICAL PROCEDURES			
ASTM D 1426-D	AMMONIUM	100	H2SO4
SW-846 9010	CYANIDE	40	NaOH
SW-846 9030	SULFIDE	10000	NaOH/ZnAc
ASTM D1385	HYDRAZINE	30	HCL
PHYSICAL CHARACTERISTICS			
ASTM D1067 A/B	ALKALINITY	50 MG/L	NONE
SM 214 A	CONDUCTIVITY	N/A	"
SM 209 B	TDS	500 MG/L	"
PESTICIDES AND PCBs			
SW-846 8080	ALDRIN	0.05	NONE
	A - BHC	0.05	"
	B - BHC	0.05	"
	D - BHC	0.1	"
	G - BHC	0.05	"
	CHLORDANE	0.1	"
	4,4'-DDD	0.1	"
	4,4'-DDE	0.05	"
	4,4'-DDT	0.1	"
	DIELDRIN	0.05	"
	ENDOSULFAN I	0.1	
	ENDOSULFAN II	0.05	"
	ENDOSULFAN SO4	0.5	"
	ENDRIN	0.1	"
	ENDRIN ALDEHYDE	0.2	"
	HEPTACHLOR	0.05	"
	HEPTACHLOR EPOXIDE	1	"
	METHYOXYCHLOR	2	"
	TOXAPHENE	2	"
	PCBs	50	"
	AROCLOR 1016	1	
	AROCLOR 1221	1	"
	AROCLOR 1232	1	"
	AROCLOR 1242	1	"
	AROCLOR 1248	1	"
	AROCLOR 1254	1	"
	AROCLOR 1260	1	"
			"

METHOD	ANALYTE	DL ppb	PRESERVE
CHLORINATED HERBICIDES SW-846 8150	2,4-D	100	NONE
	DINOSEB; DNBP	1	"
	SILVEX; 2,4,5-TP	10	"
	2,4,5-T	2	"
ORGANOPHOSPHORUS PESTICIDES SW-846 8140	DISULFOTON	2	NONE
	METHYL PARATHION	0.5	"
	PHORATE	2	
VOLATILE ORGANICS BY GC SW-846 8010/8020	BENZENE	1	HCl
	CARBON TETRACHLORIDE	1	"
	CHLOROFORM	0.5	"
	p-DICHLOROBENZENE	2	"
	1,1-DICHLOROETHANE	1	"
	1,2-DICHLOROETHANE	0.5	"
	cis-1,2-DICHLOROETHLYLENE	1	"
	trans-1,2-DICHLOROETHYLENE	1	"
	ETHYLBENZENE	2	"
	METHYLENE CHLORIDE	5	"
	TETRACHLOROETHYLENE	0.5	"
	TOLUENE	2	"
	1,1,2-TRICHLOROETHANE	0.2	"
	THRICHLOROETHYLENE	1	"
	VINYL CHLORIDE	2	"
	XYLENE (TOTAL)	5	"

METHOD	ANALYTE	DL ppb	PRESERVE
VOLATILE ORGANICS FOR GC/MS			
SW-846 8240	ACETONE	100	HCl
	BENZENE	5	"
	CARBON TETRACHLORIDE	5	"
	CHLOROFORM	5	"
	p-DICHLOROBENZENE	5	"
	1,1-DICHLOROETHANE	5	"
	1,2-DICHLOROETHANE	5	"
	trans-1,2-DICHLOROETHYLENE	5	"
	METHYLENE CHLORIDE	5	"
	METHYL ETHYL KETONE	100	"
	4-METHYL-2-PENTANONE	50	"
	TETRACHLOROETHYLENE	5	"
	TETRAHYDORFURAN	10	"
	TOLUENE	5	"
	1,1,1-TRICHLOROETHANE	5	"
	1,1,2-TRICHLOROETHANE	5	"
	TRICHLOROETHYLENE	5	"
	VINYL CHLORIDE	10	"
	XYLENE (m)	5	"
	XYLENE (o,p)	5	"

METHOD	ANALYTE	DL ppb	PRESERVE
APPENDIX IX ADDITIONS			
SW-846 8240	CHLOROPRENE	5	HCl
	METHYLENE BROMIDE	5	"
	METHYL IODIDE	5	"
	METHYL METHACRYLATE	5	"
	TICs		"
	ACETONITRILE	200	"
	ACROLEIN	5	"
	ACRYLONITRILE	5	"
	ALLYL CHLORIDE	100	"
	BROMODICHLOROMETHANE	5	"
	BROMOFORM	5	"
	CARBON DISULFIDE	5	"
	CHLOROBENZENE	5	"
	CHLOROETHANE	10	"
	DIBROMOCHLOROMETHANE	5	"
	1,2-DIBROMO-3-CHLOROPROPANE	5	"
	1,2-DIBROMOMETHANE	5	"
	trans-1,4-DIRCHLORO-2-BUTENE	5	"
	DICHLORODIFLUOROMETHANE	5	"
	1,1-DICHLOROETHYLENE	5	"
	1,2-DICHLOROPROPANE	5	"
	cis-1,2-DICHLOROPROPENE	5	"
	trans-1,3-DICHLOROPROPENE	5	"
	1,4-DIOXANE	5	"
	ETHYLBENZENE	200	"
	ETHYL METHACRYLATE	5	"
	2-HEXANONE	5	"
	ISOBUTYL ALCOHOL	50	"
	METHACRYLONITRILE	200	"
	METHYL BROMIDE	5	"
	METHYL CHLORIDE	10	"
	PROPIONITRILE	10	"
	STYRENE	5	"
	1,1,1,2-TETRACHLOROETHANE	5	"
	1,1,2,2-TETRACHLOROETHANE	5	"
	TRICHLOROFLUOROMETHANE	5	"
	1,2,3-TRICHLOROPROPANE	5	"
	VINYL ACETATE	5	"
		5	"
PHENOLS			
SW-846 8040	PHENOL	1	NONE

METHOD	ANALYTE	DL ppb	PRESERVE
SEMIVOLATILE ORGANICS			
SW-846 8270	o-CRESOL	10	NONE
	m-CRESOL	10	"
	p-CRESOL	10	"
	DECANE	10	"
	DODECANE	10	"
	NAPHTHALENE	10	"
	PENTACHLOROPHENOL	50	"
	PHENOL	10	"
	TETRADECANE	10	"
	TRIBUTYL PHOSPHATE	10	"
	TICs		

METHOD	ANALYTE	DL ppb	PRESERVE
APPENDIX IV LIST FOR SEMI-VOA'S			
SW-846 8270	o-CRESOL	10	NONE
	m-CRESOL	10	"
	p-CRESOL	10	"
	KEROSENE	10000	"
	NAPHTHALENE	10	"
	PENTACHLOROPHENOL	50	"
	PHENOL	10	"
	TRIBUTYL PHOSPHATE	10	"
	TICs		"
	ACENAPHTHENE	10	"
	ACENAPHTHYLENE	10	"
	ACETOPHENONE	10	"
	2-ACETYLAMINOFLUORENE	10	"
	4-AMINOBIPHENYL	10	"
	ANILINE	14	"
	ANTRACENE	10	"
	ARAMITE	3	"
	BENZO[A]ANTHRACENE	10	"
	BENZO[B]FLUORANTHENE	10	"
	BENZO[K]FLUORANTHENE	10	"
	BENZO[GHI]PERYLENE	10	"
	BENZO[A]PYRENE	10	"
	BENZYL ALCOHOL	20	"
	BIS(2-CHLOROETHOXY)METHANE	10	"
	BIS(2-CHLOROETHYL)ETHER	10	"
	BIS(2-CHLORO-1-METHYLETHYL)ETHER	10	"
	BIS(2-ETHYLHEXYL)PHTHALATE	10	"
	4-BROMOPHENYL PHENYL ETHER	10	"
	BUTYL BENZYL PHTHALATE	10	"
	p-CHLOROANILINE	20	"
	CHLOROBENZILATE	10	"
	p-CHLORO-m-CRESOL	20	"
	2-CHLORONAPHTHALENE	10	"
	2-CHLOROPHENOL	10	"
	4-CHLOROPHENYL PHENYL ETHER	10	"
	CHRYSENE	10	"
	DIALLATE	10	"
	DIBENZ[A,H]ANTHRACENE	10	"
	DIBENZOFURAN	10	"
	DI-n-BUTYL PHTHALATE	10	"
	o-DICHLOROBENZENE	10	"
	m-DICHLOROBENZENE	10	"
	p-DICHLOROBENZENE	10	"
	3,3'-DICHLOROBENZIDINE	20	"
	2,4-DICHLOROPHENOL	10	"
	2,6-DICHLOROPHENOL	10	"

METHOD	ANALYTE	DL ppb	PRESERVE
APPENDIX IV LIST FOR SEMI-VOA'S CONT.	0,0-DIETHYL 0-2-PYRAZINYL PHOSPHOROTHIOATE	10	NONE
SW-846 8270	DIMETHOATE	10	"
	p-(DIMETHYLAMINO)AZOBENZENE	10	"
	7,12-DIMETHYLBENZ[a]ANTHRACENE	10	"
	3,3'-DIMETHYLBENZIDINE	10	"
	a,a-DIMEHTYLPHENETHYLAMINE	10	"
	2,4-DIMETHYLPHENOL	10	"
	DIMETHYL PHTHALATE	10	"
	m-DINITROBENZENE	10	"
	4,6-DINITRO-o-CRESOL	50	"
	2,4-DINITROPHENOL	50	"
	2,4-DINITROTOLUENE	10	"
	2,6-DINITROTOLUENE	10	"
	DI-n-OCTYL PHTHALATE	10	"
	DIPHENYLAMINE	10	"
	ETHYL METHANESULFONATE	10	"
	FAMPHUR	10	"
	FLUORANTHENE	10	"
	FLUORENE	10	"
	HEXACHLOROBENZENE	10	"
	HEXACHLOROBUTADIENE	10	"
	HEXACHLOROCYCLOPENTADIENE	10	"
	HEXACHLOROETHANE	10	"
	HEXACHLOROPHENE	10	"
	HEXACHLOROPROPENE	10	"
	INDENO[1,2,3-cd]PYRENE	10	"
	ISODRIN	10	"
	ISOPHORONE	10	"
	ISOSAFROLE	10	"
	KEPONE	10	"
	METHAPYRILENE	10	"
	3-METHYLCHOLANTHRENE	10	"
	METHYL METHANESULFONATE	10	"
	2-METHYLNAPHTHALENE	10	"
	1,4-NAPHTHOQUINONE	10	"
	1-NAPHTHYLAMINE	10	"
	2-NAPHTHYLAMINE	10	"
	o-NITROANILINE	50	"

METHOD	ANALYTE	DL ppb	PRESERVE
APPENDIX IV LIST FOR SEMI-VOA'S CONT. SW-846 8270	m-NITROANILINE	50	NONE
	p-NITROANILINE	50	"
	NITROBENZENE	10	"
	o-NITROPHENOL	10	"
	p-NITROPHENOL	50	"
	4-NITROQUINOLINE-1-OXIDE	10	"
	N-NITROSODI-n-BUTYLAMINE	10	"
	N-NITROSODIETHYLAMINE	10	"
	N-NITROSODIMETHYLAMINE	10	"
	N-NITROSODIPHENYLAMINE	10	"
	DI-n-PROPYLNITROAMINE	10	"
	N-NITROSOMETHYLETHYLAMINE	10	"
	N-NITROSOMORPHOLINE	10	"
	N-NITROSPIPERIDINE	10	"
	N-NITROSOPYRROLIDINE	10	"
	5-NITRO-o-TOLUIDINE	10	"
	PARATHION	10	"
	PENTACHLOROBENZENE	10	"
	PENTACHLOROETHANE	10	"
	PENTACHLORONITROBENZENE	10	"
	PHENACETIN	10	"
	PHENANTHRENE	10	"
	p-PHENYLENEDIAMINE	10	"
	2-PICOLINE	10	"
	PRONAMIDE	10	"
	PYRENE	10	"
	PYRIDINE	10	"
	SAFROLE	10	"
	1,2,4,5-TETRACHLOROBENZENE	10	"
	2,3,4,6-TETRACHLOROPHENOL	10	"
	TETRAETHYL DITHIOPYROPHOSPHATE	10	"
	o-TOLUIDINE	10	"
	1,2,4-TRICHLOROBENZENE	10	"
	2,4,5-TRICHLOROPHENOL	10	"
	2,4,6-TRICHLOROPHENOL	10	"
	0,0,0-TRIETHYL PHOSPHOROTHIOATE	10	"
	SYM-TRINITROBENZENE	10	"
DIOXIN AND DIBENZOFURANS SW-846 8280	PCDDs	0.01	NONE
	PCDFs	0.01	"
	2,3,7,8-TCDD	0.005	"

METHOD	ANALYTE	DL ppb	PRESERVE
INDICATOR PARAMETERS			
ASTM D2579 A/B	TOTAL CARBON	2000	NONE
SW-846 9060	TOTAL ORGANIC CARBON	1000	H2SO4
SW-846 9020	TOTAL ORGANIC HALIDES	10	H2SO4
TOTAL COLIFORM BACTERIA			
SW-846 9131/9132	COLIFORM	1/100 ML	Na2S2O3

MINIMUM DETECTABLE CONCENTRATIONS (MDCs) FOR RADIOCHEMICAL CHEMISTRY ANALYTES

METHOD	ANALYSIS	MDC(pCi/l)
SW-846 9310	GROSS ALPHA GROSS BETA	15 50
SW-846 9315A	RADIUM	5
	TRITIUM	20,000
	STRONTIUM-89, 90	8
	TECHNETIUM-99	15
	GAMMA SCAN (including: Cs-137, Co-60, C-14)	20
	RUTHENIUM-106	20
	IODINE-129	1
	PLUTONIUM-238, 239, 240	0.1
	URANIUM-NATURAL	0.5
	URANIUM-ISOTOPIC	0.1
	AMERICIUM-241	0.015

ATTACHMENT 1

QUALITY ASSURANCE PLAN

ACTIVITY DESCRIPTION

The primary objective of this field activity is to collect groundwater samples from wells in the 200 Area and analyze them for contaminants of concern and to use the resultant data to refine and delineate contaminant plume maps for the area. The requirement for this work is given in Section 1.2, Background. Specific tasks associated with the conduct of the investigation are described in Section 2.3, Task Descriptions.

QUALITY ASSURANCE (QA) OBJECTIVES FOR MEASUREMENT

The data quality objectives (DQOs), which are the data quantity and data quality levels required to support the data interpretation requirements for this activity, are explained in Section 2.2. Most samples will be analyzed at EPA Levels I and III (EPA 1987). Field screening will be done with a calibrated instrument. Laboratory screening will be technically correct using a calibrated instrument and documented. Groundwater samples submitted for laboratory analysis will be analyzed according to applicable procedures defined in a statement of work to the laboratory which will be equivalent to, or more stringent, procedures listed in Appendix C.

PROCEDURES

Phase I sampling and analysis activities will be conducted as an add-on program to other Hanford Site groundwater monitoring networks. Field sampling for these programs will be conducted by PNL and the analytical work will be conducted through laboratories under contract to PNL. A Statement of Work (SOW) for FY 1992 has been transmitted from Westinghouse Hanford to PNL to establish the requirements and sampling schedules for groundwater sampling and analysis activities (WHC 1990a). The QA/QC section of the SOW contains requirements (1) for the preparation of a QA project plan (QAPP) that meets the requirements of QAMS-0005/80, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA 1983) and pertinent U.S. Department of Energy (DOE) orders, and (2) that all activities (i.e. procedures) are consistent with protocols and recommendations provided in U.S. Environmental Protection Agency"s (EPA) *RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (EPA 1986a) and *Test Methods for Evaluating Solid Waste* (EPA 1986b). Sampling and analysis activities conducted during Phase I will be performed under a supplemental work order to PNL and will meet the same requirements as are specified in the FY 1992 SOW.

Phase II sampling and analysis activities will be directly managed and conducted by Westinghouse Hanford personnel. The Westinghouse Hanford procedures that will be used to support the sampling plan have been selected form the *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990b), which will be included in the Westinghouse Hanford QA program plan for Comprehensive Environmental Response, Compensation, and Liability Act of 1980 remedial investigation/feasibility

study activities. Selected procedures include Environmental Investigations Instructions (EIIs) from the *Environmental Investigations and Site Characterization Manual* (WHC 1988a), and Quality Requirements (QR) and Quality Instructions (QI) from the Westinghouse Hanford *Quality Assurance Manual* (WHC 1988b).

The tasks associated with Phase II are discussed in Sections 2.3.9 through 2.3.12. The EII will govern these tasks as applicable. Tasks performed by subcontractors or participant contractors will comply with applicable portions of the EII (WHC 1988a) and/or with Westinghouse Hanford-approved contractor or participant contractor procedures.

Procedural approval, revision, and distribution control requirements applicable to EIIs are addressed in EII 1.2, "Preparation and Revision of Environmental Investigations Instructions". Deviations from established EIIs that may be required in response to unforseen field situations may be authorized in compliance with EII 1.4, "Deviation from Environmental Investigations Instructions". In the event of a time constraint, deviations from procedures may be documented in, for example, field logbooks.

Sampling locations, frequencies, and analyses are described in Section 2.3.

SAMPLE CUSTODY

Sample custody will be maintained if sample analysis does not immediately follow sample collection. Results of analyses shall be traceable to original samples through the unique code or identifier assigned to the sample in the field. Results of field investigations will be controlled according to applicable EIIs.

CALIBRATION PROCEDURES

Calibration of measuring equipment will be done according to procedures in manuals governing its use. Calibration of Westinghouse Hanford, participant contractor, or subcontractor analytical equipment shall be as defined by applicable standard analytical methods, subject to Westinghouse Hanford review and approval.

ANALYTICAL PROCEDURES

Analytical methods are identified in Appendix D. Procedures based on these methods will be selected or developed and approved prior to use in compliance with Westinghouse Hanford procedure and/or procurement control requirements.

DATA REDUCTION, VALIDATION, AND REPORTING

The cognizant engineer for 200 Area sampling and analysis field activities will be responsible for preparing a report summarizing the results of analyses and for preparing a detailed data package that includes all information necessary to perform data validation as required.

INTERNAL QUALITY CONTROL

Internal quality control methods, such as the use of field duplicate samples and field blanks will be used. The type and frequency of Phase I quality control samples are defined in the FY 1992 SOW to PNL. Phase II quality control will be equivalent to what is defined for Phase I.

PERFORMANCE AND SYSTEMS AUDITS

Audits in environmental investigations are considered to be systematic checks that verify the quality of operation of one or more elements of the total measurement system. Performance audit requirements will be met by the use of internal quality control methods. Systems audits will be scheduled if so requested by the Project Lead, Project Scientist, or U.S. Department of Energy-Richland Operations Office (DOE-RL).

PREVENTIVE MAINTENANCE

All measurement and testing equipment used in the field that directly affects the quality of the analytical data shall be subject to preventive maintenance to ensure minimization of measurement system downtime. Field equipment maintenance instructions shall be as defined by the approved procedures governing their use.

CORRECTIVE ACTIONS

In the context of QA, corrective actions are procedures that might be implemented on samples that do not meet QA specifications. A corrective action request might be generated, for example, by an audit. Corrective actions may include resampling or reanalyzing samples, if feasible. The primary responsibility for corrective action resolution is assigned to the Project Scientist and Project lead.

QUALITY ASSURANCE REPORT

Copies of all QA documentation, such as audits and corrective action resolutions, will be routed to the project QA records upon completion of the sampling and analysis activities. Summaries of the data quality information related to the field sampling and analysis activities will be included in reports specified in Section 2.3.13, Task 13 - Data Evaluation and Reporting.

REFERENCES

EPA, 1983, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, EPA-600/4-83-004, Office of Exploratory Research, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1986a, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, Office of Waste Programs Enforcement and Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1986b, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, 3rd edition, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1987, *Data Quality Objectives for Remedial Response Activities, Vol. 1, Development Process*, EPA-540/6-87-003, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, U.S. Environmental Protection Agency, Washington, D.C.

WHC, 1988a, *Environmental Investigations and Site Characterization Manual*, Westinghouse Hanford Company, Richland, Washington

WHC, 1988b, *Quality Assurance Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Fiscal Year 1991 Sampling and Analysis Statement of Work*, K. R. Fecht, Westinghouse Hanford Company to M. A. Neely, Pacific Northwest Laboratory, letter 9057081 dtd October 1, 1990, Richland, Washington.

WHC, 1990b, *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan*, Westinghouse Hanford Company, Richland, Washington.

ATTACHMENT
9158383D

200 Aggregate Area Management Study

Borehole Geophysics Field Activity
Sampling and Analysis Plan

November 8, 1991

NOV 1991
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1.0 Introduction

1.1 Purpose

This sampling and analysis plan (SAP) provides the details for conducting borehole geophysical surveys with the Radionuclide Logging System (RLS) in support of the 200 Aggregate Area Management Study (AAMS) program. Included within this SAP are the objectives of the field activity, data needs and data quality objectives, sampling and analysis task descriptions, analytical requirements, quality assurance objectives and quality control methods.

1.2 Background

Recent revisions to the Hanford Federal Facility Agreement and Consent Order require that an aggregate area approach be implemented in the 200 Area based on the Hanford Past Practice Investigation Strategy (HPPIS). The fundamental principal of the HPPIS is to streamline the existing RI/FS and RFI/CMS processes to provide a "bias for action" by maximizing the use of existing data, integrating past practice with RCRA TSD closure investigations, limiting and focusing the RI/FS process, and conducting expedited and interim actions where appropriate. The preferred path of the HPPIS is to achieve records of decision through interim remedial actions for the initial stages of Hanford cleanup or closure of contaminated areas at the earliest possible date and in the most effective manner.

Borehole geophysics activities are focusing on the collection of data from existing boreholes and wells within each of the eight plant areas in the 200 AAMS. The data will be used to help define and understand the distribution, migration and interaction of specific radiocontaminants emanating from source sites. The data will be integrated with other types of geohydrologic sites. The data will be integrated with other types of geohydrologic and geochemical data to develop 200 AAMS conceptual models.

The specific objectives of the geophysical activities in the 200 AAMS are to log selected boreholes with the RLS. The RLS surveys will identify radionuclide species, the maximum depth of migration of each species and their relative concentrations.

2.0 Sampling and Analysis Task Descriptions

2.1 General Approach

The geophysical logging program has been structured into two principal tasks for the RLS surveys. The first task is to define the data quality objectives for the logging which are defined in Section 2.2. The other task is data evaluation and logging activities which are described in Section 2.3. In addition, a summary of the activities for identifying wells to be logged in the RLS survey for each plant area are described in appendices.

2.2 Data Quality Objectives

The 200 AAMS geophysical logging program is a screening activity. The EPA does not specify DQO protocols for geophysical logging. Therefore, actual calibration, logging and data handling will be in accordance with WHC requirements. Data quality objectives do not apply to the compilation and evaluation of existing data. Data objectives include logging in areas of maximum vertical extent of contaminant waste plumes to:

- Identify specific radioactive species (through defined energy levels)
- Identify the maximum number of radioactive species at waste management facilities
- Determine vertical distribution of radioactive species within the borehole to within about 1 ft at 1/2 intervals
- Log at facilities with high probability of the existence of a significant waste plume (i.e., exclude low activity sites such as french drains or storage sites such as catch tanks from logging).

2.3 Task Descriptions

2.3.1 Task 1 - Existing Data Compilation and Evaluation

The objective of this task is to assemble and evaluate existing geophysical data and general waste site data in each of the eight plant areas of the 200 AAMS to determine the waste storage and disposal sites that will be selected for RLS survey. Selected total gamma ray logs for each plant area will be reviewed and about 10 wells will be selected from each plant area for RLS survey. In general, the most recent total gamma-ray log will be used. Total gamma-ray logs from well construction are preferred over bentonite-sealed wells due to some interference from the bentonite seal. The review of total gamma-ray logs will include categorizing log response as natural or contamination. The results of this effort are documented in plant area specific attachments to this SAP.

2.3.2 Task 2 - RLS Logging

The purpose of this task is to log wells selected in task-1 with the RLS system. The system will be calibrated prior to logging. Secondary standards such as the calibration models at Grand Junction, Colorado or Spokane, Washington are acceptable for calibration since the geophysical logging program is a screening activity. (The Spokane calibration models are being stored for installation at Hanford). Calibration to the secondary standards will be in accordance with the American Petroleum Institute spectral gamma calibration procedure where appropriate. Field calibration checks will be performed during logging in accordance with WHC procedures. Also RLS well surveys will be conducted in accordance with WHC procedures and to the 200 AAMS schedule.

The survey will identify radionuclide species, will define depth ranges of the radionuclides, and will acquire data to compute relative concentrations along the full length of each borehole. Data will be acquired at 0.5-ft intervals at a logging speed of 40 ft per hour.

Gamma-ray energy spectra will be recorded on a 4000 channel analyzer. Each original and uncorrected spectra will be permanently recorded on optical disk.

2.3.3 Task 3 - Data Analysis

Existing radionuclide species will be identified by the presence of full energy gamma-ray photo peaks in the multi-channel analyzer spectra. The intensity of the gamma-ray peaks must agree with published values and gamma-ray yield intensity for positive radionuclide identification.

Maximum depth ranges will be determined by the presence of gamma-ray photo peaks. Radionuclides will not be reported if the gamma-ray photo peak is not above the Compton continuum background.

Radionuclide concentrations will be computed from the net count rate observed in the full energy gamma-ray photo peaks. The net count rates will be corrected for borehole fluids and steel casing in accordance with WHC procedures. The RLS and analysis tools are not currently able to correct for all borehole conditions, so the calculated concentration values will be conservative.

2.3.4 Task 4 - RLS Data Reporting

The purpose of this task is to compile and integrate the results of the RLS survey. A report will consist of a series of plots and associated explanatory text for each logged well including:

- The gamma-ray spectra for each logged interval
- Distribution of each detected natural and contaminant radionuclide
- Relative concentration of each detected natural and contaminant radionuclide
- Quality assurance calibration data (field calibration check data).

3.0 Quality Assurance

The DQO, which are the data quantity and data quality levels required to support data interpretation requirements for this activity, are explained in Section 2.2. Logging is to be performed after the RLS is calibrated to at least secondary standards and will be supported by calibration check data. Calibration checks will be performed by approved WHC procedures. Logging will be conducted in accordance with internal WHC procedures. All calibration, logging and data reduction will be performed by or under the direction of a qualified geophysist. The logging data will be stored on optical disk.

Optical disks will be backed up to assure no data loss. Summaries of the data quality calibrations will be documented in the reports specified in Section 2.3.4.

Appendix A

Well Selection for RLS Surveys in the U-Plant Area

This appendix presents the results of the borehole and facility evaluation that were used to select boreholes for RLS logging in the U-Plant Area. The facility data and total gamma-ray logs were reviewed by an environmental geologist and borehole geophysist. The outcome of the evaluation process was selection of wells for the RLS survey. Since the existing data was collected under differing quality requirements, the facility and well selection was based heavily on professional judgement.

Facilities disposal or storage data and well locations were reviewed to determine if contaminant plumes existed beneath a facility and should those plumes be logged. Two criteria were used: (1) the facility should have wells that are of sufficient depth (i.e., about 100 ft) to penetrate the waste plume, and (2) the facility should have a high activity inventory relative to other facilities in the plant area. The results of this screening are presented in Table A.1.

Total gamma-ray logs for boreholes and wells in the plant area were reviewed by a logging geophysist and radioactivity categorized into five types. The categories are: natural, probably natural, transfer line (tank farms only), possible contamination and contamination. The categorization is tabulated in Table A.2.

Radioactive contaminated intervals were tabulated by facility and included depths to the top and bottom of the interval and the average gamma-ray activity. The results are presented in Table A.3.

The contaminated interval data and average gamma-ray activity (Table A.3) and well construction data were used with the following criteria to select wells for RLS logging in the plant area:

- Wells should be fully penetrating or a minimum depth of about 100 ft
- Wells selected should not have a bentonite seal (i.e., select wells drilled prior to 1986)
- Wells should be limited to one per facility or unit (i.e., trench, tank, etc.) for a total in the plant area of no more than 10
- Wells should be in close proximity to crib distribution system or storage tank
- Wells should have contaminated interval if previously logged with total gamma-ray.

Table A-4 lists the wells selected for RLS logging and the U-Plant Area to support the 200 AAMS.

Table A-1: U-Plant aggregate area disposal facilities and RLS logging recommendations.

U-PLANT

DISPOSAL FACILITY	LOG WITH RLS	COMMENTS
216-U-1 CRIB	YES	URANIUM ACTIVITY
216-U-2 CRIB	YES	URANIUM ACTIVITY
216-U-3 CRIB	NO	NO ACTIVITY
216-U-4 REVERSE WELL	NO	NO MONITORING WELLS
216-U-4A/B FRENCH DRAIN	NO	NO MONITORING WELLS
216-U-5 TRENCH	NO	NO MONITORING WELLS
216-U-6 TRENCH	NO	NO MONITORING WELLS
216-U-7 FRENCH DRAIN	NO	NO MONITORING WELLS
216-U-8 CRIB	YES	POTENTIAL URANIUM ACTIVITY
216-U-10 POND	NO	LOW ACTIVITY
216-U-11 TRENCH	NO	NO MONITORING WELLS
216-U-12 CRIB	YES	ACTIVITY
216-U-13 TRENCH	NO	NO MONITORING WELLS
216-U-14 DITCH	NO	LOW URANIUM ACTIVITY
216-U-15 TRENCH	NO	NO MONITORING WELLS
216-U-16 CRIB	NO	LOW ACTIVITY
216-U-17 CRIB	NO	LOW ACTIVITY
241-U TANK FARM	YES	CONTAMINATION ASSOCIATED WITH LEAKING TANKS/LINES
216-Z-10 DITCH	NO	NO MONITORING WELLS
216-Z-11 DITCH	NO	NO PREVIOUS LOGGING DATA
216-Z-19 DITCH	NO	NO PREVIOUS LOGGING DATA
216-Z-20 CRIB	NO	LOW ACTIVITY
216-S-21 CRIB	YES	ACTIVITY
216-S-4 FRENCH DRAIN	NO	LOW ACTIVITY

Table A-2: U Plant Aggregate Area Radioacivity
Categorized by Facility and Well

Well	Tankfarm	Facility	Log Date	Category	E	N
2-W18-176					-75698	38074
2-W21-51					-71500	36500
2-W21-52					-71486	36534
2-W21-53					-71474	36526
2-W21-54					-71466	36514
2-W21-55					-71463	36500
2-W21-56					-71466	36486
2-W21-57					-71474	36474
2-W21-58					-71486	36466
2-W21-59					-71500	36463
2-W21-60					-71514	36466
2-W21-61					-71526	36474
2-W21-62					-71534	36486
2-W21-63					-71537	36500
2-W21-64					-71534	36514
2-W21-65					-71526	36526
2-W21-66					-71514	36534
2-W21-67					-71500	36537
2-W21-68					-71462	36537
2-W21-69					-71552	36500
2-W21-70					-71470	36470
2-W21-71					-71500	36447
2-W21-72					-71530	36469
2-W21-73					-71548	36500
2-W21-74					-71538	36537
2-W21-75					-71500	36543
2-W21-76					-71434	36569
2-W21-77					-71406	36500
2-W21-78					-71434	36434
2-W21-79					-71500	36406
2-W21-80					-71566	36434
2-W21-81					-71594	36500
2-W21-82					-71569	36566
2-W21-83					-71500	36594
2-W14-07		None			-75002	40003
2-W14-63		None			-74725	41090
2-W19-04		None	5/06/63	Natural	-71999	39000
2-W23-013		S Tank farm	11/30/90	Natural	-76067	36040
2-W23-004		S-21 Crib	2/23/76	Contamination	-76335	35861
2-W23-063		S-21 Crib			-76400	35925
2-W23-071		S-21 Crib			-76300	35800
2-W19-07		S-23 Crib	5/13/76	Natural	-74125	37000

Table A-2: U Plant Aggregate Area Radioacivity
Categorized by Facility and Well

Well	Tankfarm	Facility	Log Date	Category	E	N
2-W19-10		S23:U16:Retn			-75000	37201
2-W19-91		U Basin:U-14			-75269	37617
2-W19-08		U Plant	4/05/85	Possible Contamination	-73268	38574
2-W19-28		U Plant	6/06/89	Natural	-73184	37823
2-W19-29		U Plant	6/08/89	Natural	-72940	37849
2-W19-51		U Plant			-73500	38160
2-W19-52		U Plant			-73285	38410
2-W19-55		U Plant			-73218	38210
2-W19-90		U Plant:U-3	2/05/87	Natural	-73341	37553
2-W18-015		U Pond	9/23/86	Possible Contamiation	-77152	36990
2-W19-21		U Ret. Basin	7/08/86	Natural	-75273	37462
2-W19-22		U Ret. Basin	6/17/86	Probably Natural	-74796	37628
2-W19-27		U Ret. Basin	4/24/87	Natural	-75072	37629
2-W19-01		U TF : Basin	5/19/87	Probably Natural	-75491	37613
2-W19-12		U TF : Basin			-75456	38052
2-W19-31		U TF: Basin	12/06/90	Natural	-75457	38275
2-W19-32		U TF: Basin	10/17/90	Probably Natural	-75459	37887
2-W18-025		U Tank farm	11/29/90	Natural	-76034	37786
2-W18-051	60-00-06	U Tank farm	5/08/63	Probably Natural	-75700	37822
2-W18-052	60-00-11	U Tank farm	5/08/63	Probably Natural	-75837	38262
2-W18-053	60-00-10	U Tank farm	5/08/63	Probably Natural	-75908	38135
2-W18-054	60-08-10	U Tank farm	10/21/91	Natural	-75775	38035
2-W18-055	60-00-08	U Tank farm	5/08/63	Probably Natural	-75908	37935
2-W18-090	60-12-07	U Tank farm			-75860	37857
2-W18-091	60-12-10	U Tank farm			-75876	37920
2-W18-092	60-12-05	U Tank farm			-75820	37855
2-W18-100	60-10-01	U Tank farm	10/08/91	Natural	-75616	37942
2-W18-101	60-11-06	U Tank farm	10/21/91	Natural	-75737	37860
2-W18-102	60-11-03	U Tank farm	10/15/91	Transfer line	-75686	37901
2-W18-103	60-12-03	U Tank farm	10/21/91	Natural	-75786	37900
2-W18-104	60-10-05	U Tank farm	10/08/91	Natural	-75612	37857
2-W18-105	60-11-12	U Tank farm	10/15/91	Transfer line	-75737	37947
2-W18-109	60-11-05	U Tank farm	10/15/91	Natural	-75717	37857

Table A-2: U Plant Aggregate Area Radioacivity
Categorized by Facility and Well

Well	Tankfarm	Facility	Log Date	Category	E	N
2-W18-110	60-11-07	U Tank farm	10/15/91	Natural	-75763	37857
2-W18-113	60-12-01	U Tank farm	10/21/91	Contamination	-75817	37940
2-W18-114	60-07-01	U Tank farm	10/15/91	Contamination	-75617	38043
2-W18-115	60-08-04	U Tank farm	10/21/91	Transfer line	-75692	37976
2-W18-116	60-07-10	U Tank farm	10/15/91	Contamination	-75678	38017
2-W18-117	60-07-11	U Tank farm	10/15/91	Contamination	-75657	38043
2-W18-118	60-08-08	U Tank farm	10/15/91	Natural	-75787	37977
2-W18-119	60-08-09	U Tank farm	10/15/91	Natural	-75787	38017
2-W18-120	60-09-01	U Tank farm	10/15/91	Natural	-75818	38041
2-W18-121	60-09-07	U Tank farm	10/15/91	Natural	-75862	37956
2-W18-122	60-09-08	U Tank farm	10/21/91	Natural	-75887	37977
2-W18-123	60-09-10	U Tank farm	10/21/91	Natural	-75887	38017
2-W18-124	60-04-08	U Tank farm	10/08/91	Contamination	-75687	38077
2-W18-125	60-04-10	U Tank farm	10/15/91	Possible contamination	-75687	38117
2-W18-126	60-04-12	U Tank farm			-75637	38143
2-W18-127	60-05-05	U Tank farm	10/21/91	Natural	-75722	38047
2-W18-128	60-05-07	U Tank farm	10/21/91	Natural	-75757	38047
2-W18-129	60-05-08	U Tank farm	10/21/91	Natural	-75787	38077
2-W18-130	60-05-10	U Tank farm	10/21/91	Natural	-75787	38117
2-W18-131	60-06-07	U Tank farm	10/15/91	Natural	-75857	38051
2-W18-132	60-06-08	U Tank farm	10/15/91	Transfer line	-75885	38077
2-W18-133	60-06-10	U Tank farm	10/15/91	Natural	-75885	38117
2-W18-134	60-06-11	U Tank farm	10/15/91	Natural	-75857	38141
2-W18-135	60-01-08	U Tank farm	10/15/91	Natural	-75690	38177
2-W18-136	60-01-10	U Tank farm	10/21/91	Natural	-75687	38217
2-W18-137	60-02-01	U Tank farm	10/21/91	Transfer line	-75717	38244
2-W18-138	60-02-05	U Tank farm	10/21/91	Natural	-75707	38164
2-W18-139	60-02-07	U Tank farm	10/21/91	Natural	-75757	38151
2-W18-140	60-02-08	U Tank farm	10/21/91	Natural	-75778	38186
2-W18-141	60-02-10	U Tank farm	10/15/91	Natural	-75787	38217
2-W18-142	60-02-11	U Tank farm	10/21/91	Natural	-75757	38244
2-W18-143	60-03-01	U Tank farm	10/15/91	Natural	-75817	38244
2-W18-144	60-03-05	U Tank farm	10/15/91	Natural	-75822	38151
2-W18-145	60-03-08	U Tank farm	10/15/91	Transfer line	-75885	38177
2-W18-146	60-03-10	U Tank farm	10/15/91	Natural	-75885	38217
2-W18-147	60-03-11	U Tank farm	10/15/91	Natural	-75857	38244
2-W18-148	60-10-07	U Tank farm	10/09/91	Contamination	-75657	37857
2-W19-53	60-00-05	U Tank farm	10/08/91	Natural	-75577	37898
2-W19-54	60-00-02	U Tank farm	5/08/63	Natural	-75577	38197
2-W19-74	60-07-02	U Tank farm	10/15/91	Probably Natural	-75594	38017
2-W19-75	60-10-02	U Tank farm	10/08/91	Natural	-75600	37920
2-W19-76	60-04-03	U Tank farm			-75593	38095
2-W19-03		U-1 Crib	4/18/85	Contamination	-74098	37819
2-W19-11		U-1 Crib	4/18/85	Contamination	-74210	37860
2-W19-16		U-1 Crib	6/12/85	Natural	-74230	37950
2-W19-17		U-1 Crib	12/10/85	Natural	-74175	37895
2-W19-18		U-1 Crib	11/27/85	Natural	-73936	37895

Table A-2: U Plant Aggregate Area Radioacivity
Categorized by Facility and Well

Well	Tankfarm	Facility	Log Date	Category	E	N
2-W22-28		U-12 : S-9	2/23/68	Contamination	-73770	36150
2-W22-22		U-12 Crib	9/29/82	Natural	-73098	36094
2-W22-23		U-12 Crib	8/25/82	Natural	-73198	36030
2-W22-40		U-12 Crib	3/30/90	Natural	-73042	36242
2-W22-41		U-12 Crib	3/05/90	Natural	-73034	36142
2-W22-42		U-12 Crib	3/05/90	Natural	-73080	36053
2-W22-43		U-12 Crib	3/30/90	Natural	-73377	36339
2-W22-60		U-12 Crib	2/23/68	Natural	-73150	36125
2-W22-73		U-12 Crib	8/25/82	Contamination	-73120	36339
2-W22-75		U-12 Crib	8/25/82	Contamination	-73145	36255
2-W19-92		U-14 Ditch	4/07/87	Probably Natural	-75319	37492
2-W19-93		U-14 Ditch	5/19/87	Possible Contamination	-75431	37299
2-W23-210		U-14 Ditch			-76120	36322
2-W19-13		U-16 Crib	3/14/85	Natural	-74180	37510
2-W19-14		U-16 Crib	3/14/85	Natural	-74240	37300
2-W19-19		U-17 Crib	1/26/87	Probably Natural	-72406	37569
2-W19-20		U-17 Crib	6/02/86	Probably Natural	-72252	37525
2-W19-23		U-17 Crib	3/05/87	Natural	-72587	37499
2-W19-24		U-17 Crib	3/12/87	Natural	-72588	37613
2-W19-25		U-17 Crib	4/16/87	Natural	-72250	37575
2-W19-26		U-17 Crib	4/16/87	Possible Contamination	-72345	37504
2-W19-89		U-17 Crib	2/05/87	Natural	-72390	37520
2-W19-09		U-2 Crib	5/09/85	Contamination	-74225	37895
2-W19-15		U-2 Crib	5/24/85	Natural	-74285	37775
2-W19-72		U-2 Crib			-74247	37859
2-W19-73		U-2 Crib			-74322	37859
2-W18-177		U-3 Crib	9/16/87	Natural	-75500	37680
2-W19-02		U-8 Crib	5/13/76	Possible Contamination	-73000	36849
2-W19-69		U-8 Crib			-73100	36920
2-W19-70		U-8 Crib	12/03/76	Contamination	-73100	36860
2-W19-71		U-8 Crib	12/03/76	Contamination	-73100	36800
2-W19-30		U-8:U Plant	4/27/90	Natural	-72935	37603
2-W18-196		Z-1 Ditch			-77065	36880

Table A-2: U Plant Aggregate Area Radioacivity
Categorized by Facility and Well

Well	Tankfarm	Facility	Log Date	Category	E	N
2-W18-178		Z-11 Ditch			-76240	38610
2-W18-186		Z-11 Ditch			-76685	37270
2-W18-188		Z-11 Ditch			-76413	38065
2-W18-199		Z-11 Ditch			-76335	38366
2-W18-187		Z-19 Ditch			-76535	37425
2-W18-195		Z-19 Ditch			-76710	37275
2-W18-018		Z-20 Crib	6/27/91	Natural	-76270	38903
2-W18-019		Z-20 Crib	5/31/91	Natural	-76403	38503
2-W18-020		Z-20 Crib	5/29/91	Natural	-76477	38103
2-W18-207		Z-20 Crib			-76148	39145
2-W18-208		Z-20 Crib			-76207	39032
2-W18-209		Z-20 Crib			-76270	38898
2-W18-210		Z-20 Crib			-76319	38798
2-W18-211		Z-20 Crib			-76338	38715
2-W18-212		Z-20 Crib			-76355	38645
2-W18-213		Z-20 Crib			-76373	38564
2-W18-214		Z-20 Crib			-76395	38473
2-W18-215		Z-20 Crib			-76422	38370
2-W18-217		Z-20 Crib			-76459	38140
2-W18-218		Z-20 Crib			-76462	38058
2-W18-219		Z-20 Crib			-76470	37940
2-W18-220		Z-20 Crib			-76471	37840

Table A-3: U Plant Contamination Intervals and Average Gamma Activity

Well	Site	Category	Top1	Base	Value1	Top2	Base	Value2	Top3	Base	Value3	Top4	Base	Value4	Top5	Base	Value5	Top6	Base	Value6
2-W23-004	S-21 Crib	Contamination	4	38	35	38	60	3200	60	170	45	170	257	25						
2-W19-08	U Plant	Possible Contamination	5	16	75	18	20	185	27	130	80	177	180	120	190	240	70	250	348	55
2-W18-015	U Pond	Possible Contamination	3	25	95	20	25	165	25	120	100	120	130	147	130	244	75			
2-W18-113	U Tank farm	Contamination	0	39	60	39	50	1000	50	70	21000	71	84	200	84	96	300	96	102	50
2-W18-114	U Tank farm	Contamination	3	47	19	47	58	60	58	97	34									
2-W18-116	U Tank farm	Contamination	3	54	19	53	67	300	67	97	31									
2-W18-117	U Tank farm	Contamination	3	52	23	52	75	200	75	122	38									
2-W18-124	U Tank farm	Contamination	2	53	19	53	68	200	66	117	29									
2-W18-125	U Tank farm	Possible contamination	3	7	38	7	49	22	49	57	48	57	115	32						
2-W18-148	U Tank farm	Contamination	2	18	50	18	48	5	48	61	20000	61	121	3						
2-W19-03	U-1 Crib	Contamination	2	9	430	10	72	35	73	80	145	80	92	95	94	101	220	102	240	55
2-W19-11	U-1 Crib	Contamination	4	30	30	30	80	20000	80		35		248	65	248	250	140			
2-W22-28	U-12 : S-9	Contamination	0	40	100	40	150	130	150	178	160	178	217	130	217	230	13000			
2-W22-73	U-12 Crib	Contamination	5	20	90	21	25	1800	26	59	95									
2-W22-75	U-12 Crib	Contamination	5	20	90	21	27	29000	29	38	3900	38	46	300	46	59	2650	59	95	85
2-W19-93	U-14 Ditch	Possible Contamination	2	12	75	12	39	150	39	112	90									

Table A-3: U Plant Contamination Intervals and Average Gamma Activity

Well	Site	Category	Top1	Base	Value1	Top2	Base	Value2	Top3	Base	Value3	Top4	Base	Value4	Top5	Base	Value5	Top6	Base	Value6
2-W19-26	U-17 Crib	Possible Contamination	2	18	90	18	30	295	30	99	195	99	130	250	130	213	195	215	248	120
2-W19-09	U-2 Crib	Contamination	5	8	175	11	13	1300	14	284	35									
2-W19-02	U-8 Crib	Possible Contamination		40	100	40	44	185	44		125		89	115	89	103	173	103		120
2-W19-70	U-8 Crib	Contamination	4	26	85	26	40	40000	40	52	10000	52	70	3000	70	82	2000			
2-W19-71	U-8 Crib	Contamination	5	30	75	30	42	40000	42	62	500	62	65	1000	65	82	250			

TABLE A-4. Selected RLS Survey Wells for U Plant

Well	Tank farm Well	Disposal Site	Drill Date	Drill Depth
299-W23-004		S-21 Crib	6/30/57	253
299-W18-113	60-12-01	U Tank farm	7/31/74	124
299-W18-117	60-07-11	U Tank farm	5/31/74	123
299-W18-148	60-10-07	U Tank farm	2/28/74	121
299-W19-011		U-1 Crib	4/30/83	250
299-W22-075		U-12 Crib	4/30/82	171
299-W19-009		U-2 Crib	8/31/44	284
299-W19-070		U-3 Crib	1/31/51	105

Appendix B

Well Selection for RLS Surveys in the Z-Plant Area

This appendix presents the results of the borehole and facility evaluation that were used to select boreholes for RLS logging in the Z-Plant Area. The facility data and total gamma-ray logs were reviewed by an environmental geologist and borehole geophysist. The outcome of the evaluation process was selection of wells for the RLS survey. Since the existing data was collected under differing quality requirements, the facility and well selection was based heavily on professional judgement.

Facilities disposal or storage data and well locations were reviewed to determine if contaminant plumes existed beneath a facility and should those plumes be logged. Two criteria were used: (1) the facility should have wells that are of sufficient depth (i.e., about 100 ft) to penetrate the waste plume, and (2) the facility should have a high activity inventory relative to other facilities in the plant area. The results of this screening are presented in Table B.1.

Total gamma-ray logs for boreholes and wells in the plant area were reviewed by a logging geophysist and radioactivity categorized into five types. The categories are: natural, probably natural, transfer line (tank farms only), possible contamination and contamination. The categorization is tabulated in Table B.2.

Radioactive contaminated intervals were tabulated by facility and included depths to the top and bottom of the interval and the average gamma-ray activity. The results are presented in Table B.3.

The contaminated interval data and average gamma-ray activity (Table B.3) and well construction data were used with the following criteria to select wells for RLS logging in the plant area:

- Wells should be fully penetrating or a minimum depth of about 100 ft
- Wells selected should not have a bentonite seal (i.e., select wells drilled prior to 1986)
- Wells should be limited to one per facility or unit (i.e., trench, tank, etc.) for a total in the plant area of no more than 10
- Wells should be in close proximity to crib distribution system or storage tank
- Wells should have contaminated interval if previously logged with total gamma-ray.

Table B-4 lists the wells selected for RLS logging and the Z-Plant Area to support the 200 AAMS.

Table B-1: Z-Plant aggregate area disposal facilities and RLS logging recommendations.

Z-PLANT

DISPOSAL FACILITY	LOG WITH RLS	COMMENTS
216-Z-1A TILE FIELD	YES	ACTIVITY
216-Z-1, -2 CRIBS	YES	ACTIVITY
216-Z-3 CRIB	NO	LOW ACTIVITY
216-Z-4 TRENCH	NO	NO MONITORING WELLS
216-Z-5 CRIB	YES	ACTIVITY
216-Z-6 CRIB	NO	NO MONITORING WELLS
216-Z-7 CRIB	YES	ACTIVITY
216-Z-8 FRENCH DRAIN	NO	NO MONITORING WELLS
216-Z-9 TRENCH	YES	ACTIVITY
216-Z-12 CRIB	YES	ACTIVITY
216-Z-13 FRENCH DRAIN	NO	NO MONITORING WELLS
216-Z-14 FRENCH DRAIN	NO	NO MONITORING WELLS
216-Z-15 FRENCH DRAIN	NO	NO MONITORING WELLS
216-Z-18 CRIB	YES	ACTIVITY

Table B-2: Z Plant Aggregate Area Radioactivity
Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W15-005O				-75984	39537
2-W15-005P				-75984	39537
2-W15-005Q				-75984	39537
2-W15-005R				-75984	39537
2-W15-005S				-75984	39537
2-W15-051				-76535	40804
2-W15-052				-76648	40920
2-W15-053				-76576	40878
2-W15-054				-76628	40920
2-W15-055				-76591	40904
2-W15-056				-76618	40920
2-W15-057				-76591	40936
2-W15-058				-76678	40920
2-W15-059				-76522	40811
2-W15-060				-76535	40788
2-W15-061				-76548	40811
2-W15-198				-76333	39995
2-W15-199				-76315	39991
2-W15-200				-76300	39991
2-W15-201				-76282	39995
2-W15-202				-76250	39995
2-W15-203				-76100	39873
2-W15-204				-76373	40673
2-W15-205				-76388	40180
2-W15-206				-76104	39873
2-W15-207				-77736	40732
2-W15-208				-75650	39600
2-W15-213				-76250	39999
2-W15-214				-76252	40000
2-W15-215				-76254	39996
2-W18-013				-77250	39370
2-W18-014				-77210	39370
2-W18-017				-76091	39256
2-W18-067				-76534	39399
2-W18-068				-76506	39371
2-W18-070				-77235	39395
2-W18-077				-76608	39273
2-W18-079				-76594	39274
2-W18-080				-76596	39246
2-W18-149				-76602	39329
2-W18-156				-77216	39475
2-W18-162				-77202	39392
2-W18-179				-77202	39432
2-W18-180				-77225	39367
2-W18-181				-77202	39367
2-W18-182				-77202	39285
2-W18-183				-77204	39190
2-W18-184				-77213	39366
2-W18-185				-77191	39367
2-W18-205				-76051	39348

Table B-2: Z Plant Aggregate Area Radioactivity
Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W18-206				-76096	39256
2-W18-243				-77212	39255
2-W6-1		4/25/63	Probably Natural	-74396	46090
6-46-79				-78900	45750
2-W15-212	T-25 Crib	6/24/86	Contamination	-76600	41190
2-W15-019	W-2 : W-4B	8/21/89	Natural	-77772	41041
2-W15-020	W-2 LLBG	8/12/89	Natural	-78120	41028
2-W10-179	W-3A LLBG			-77597	44420
2-W7-02	W-3A LLBG	7/10/87	Natural	-77385	46519
2-W7-03	W-3A LLBG	10/28/87	Natural	-77420	46520
2-W7-09	W-3A LLBG	11/10/89	Natural	-78889	46549
2-W6-2	W-3AE LLBG	10/29/87	Natural	-75302	45571
2-W7-04	W-3AE LLBG	11/05/87	Natural	-77040	45435
2-W7-05	W-3AE LLBG	11/14/87	Natural	-76816	46509
2-W7-06	W-3AE LLBG	10/09/87	Natural	-76219	46509
2-W7-07	W-3AE LLBG	11/17/89	Natural	-76519	46509
2-W7-08	W-3AE LLBG	11/17/89	Natural	-75880	46510
2-W7-10	W-3AE LLBG	1/25/90	Natural	-75564	45921
2-W15-002	W-4A LLBG	11/12/76	Probably Natural	-78082	42251
2-W15-015	W-4B LLBG	8/18/87	Natural	-78103	40330
2-W15-016	W-4B LLBG	8/18/87	Natural	-77387	40259
2-W15-017	W-4B LLBG	9/17/87	Natural	-77387	40221
2-W15-023	W-4B LLBG	1/16/90	Natural	-78119	40680
2-W15-014	W-4C LLBG			-78089	39990
2-W15-018	W-4C LLBG	7/08/87	Possible Contamination	-77383	39705
2-W15-024	W-4C LLBG	12/05/89	Probably Natural	-78096	39851
2-W18-003	W-4C LLBG	5/02/73	Natural	-77700	39600
2-W18-021	W-4C LLBG	7/08/87	Natural	-78080	37794
2-W18-022	W-4C LLBG	8/13/87	Natural	-78109	37831
2-W18-023	W-4C LLBG	6/15/87	Natural	-78120	38987
2-W18-024	W-4C LLBG	7/09/87	Natural	-77180	38998
2-W18-026	W-4C LLBG	9/27/89	Natural	-78097	39477
2-W18-084	W-4C LLBG	5/02/73	Natural	-77386	38249

Table 3-2: Z Plant Aggregate Area Radioactivity Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W18-064	Z-1 Crib	9/22/67	Contamination	-76614	39373
2-W18-065	Z-1 Crib	7/22/86	Contamination	-76589	39373
2-W15-005	Z-1 Ditch	5/02/63	Natural	-75984	39537
2-W15-102	Z-1 Ditch	4/27/73	Probably Natural	-76180	39702
2-W18-001	Z-12 : Z-1A	4/27/73	Natural	-77013	39388
2-W18-002	Z-12 Crib	7/22/87	Natural	-77150	39120
2-W18-004	Z-12 Crib	7/22/87	Natural	-77375	39150
2-W18-005	Z-12 Crib	5/02/73	Contamination	-77250	39350
2-W18-008	Z-12 Crib	5/19/76	Contamination	-77221	39327
2-W18-069	Z-12 Crib	2/23/68	Contamination	-77241	39350
2-W18-071	Z-12 Crib	8/20/87	Contamination	-77208	39347
2-W18-072	Z-12 Crib	8/20/87	Contamination	-77208	39298
2-W18-073	Z-12 Crib	8/20/87	Natural	-77205	39201
2-W18-074	Z-12 Crib	8/20/87	Natural	-77196	39111
2-W18-075	Z-12 Crib	7/08/86	Contamination	-77211	39371
2-W18-151	Z-12 Crib	7/15/86	Natural	-77194	39438
2-W18-152	Z-12 Crib	7/08/86	Contamination	-77247	39368
2-W18-153	Z-12 Crib	7/15/86	Contamination	-77154	39365
2-W18-154	Z-12 Crib	7/15/86	Contamination	-77184	39438
2-W18-155	Z-12 Crib	7/15/86	Natural	-77185	39458
2-W18-157	Z-12 Crib	7/15/86	Natural	-77223	39070
2-W15-010	Z-16 Crib	5/07/76	Natural	-76920	41080
2-W15-011	Z-16 Crib	5/07/76	Probably Natural	-77040	41145
2-W18-009	Z-18 Crib	7/23/87	Contamination	-76846	38852
2-W18-010	Z-18 Crib	5/13/76	Contamination	-76803	38847
2-W18-011	Z-18 Crib	7/23/87	Natural	-76955	38735
2-W18-012	Z-18 Crib	5/13/76	Natural	-76955	38850
2-W18-082	Z-18 Crib	7/23/87	Natural	-77101	38570
2-W18-083	Z-18 Crib	7/23/87	Natural	-77240	38409
2-W18-093	Z-18 Crib	7/23/87	Possible Contamination	-76905	38744
2-W18-094	Z-18 Crib	7/23/87	Contamination	-76880	38662
2-W18-095	Z-18 Crib	7/23/87	Natural	-76970	38665
2-W18-096	Z-18 Crib	7/23/87	Contamination	-76790	38825
2-W18-097	Z-18 Crib	7/23/87	Natural	-76790	38745
2-W18-098	Z-18 Crib	7/22/87	Natural	-76880	38940
2-W18-099	Z-18 Crib	7/22/87	Natural	-76768	38949
2-W18-006	Z-1A Crib	2/12/87	Natural	-76706	39212
2-W18-007	Z-1A Crib	7/21/87	Natural	-76491	39204
2-W18-056	Z-1A Crib	5/01/73	Contamination	-76615	39301

Table B-2: Z Plant Aggregate Area Radioactivity Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W18-057	Z-1A Crib	1/31/66	Contamination	-76587	39309
2-W18-058	Z-1A Crib	9/15/67	Contamination	-76651	39161
2-W18-059	Z-1A Crib	5/01/73	Natural	-76552	39161
2-W18-066	Z-1A Crib	7/21/86	Contamination	-76601	39063
2-W18-076	Z-1A Crib	5/01/73	Natural	-76610	39318
2-W18-078	Z-1A Crib	5/01/73	Natural	-76600	39308
2-W18-081	Z-1A Crib	5/01/73	Contamination	-76605	39283
2-W18-085	Z-1A Crib	7/22/87	Natural	-76717	38989
2-W18-086	Z-1A Crib	7/22/87	Natural	-76742	39106
2-W18-087	Z-1A Crib	7/23/87	Natural	-76604	38980
2-W18-089	Z-1A Crib	7/22/87	Natural	-76752	39360
2-W18-150	Z-1A Crib	7/21/86	Contamination	-76601	39075
2-W18-158	Z-1A Crib	7/21/86	Possible Contamination	-76650	39266
2-W18-159	Z-1A Crib	7/21/86	Contamination	-76602	39228
2-W18-163	Z-1A Crib	7/21/86	Contamination	-76552	39284
2-W18-164	Z-1A Crib		Possible Contamination	-76602	39040
2-W18-165	Z-1A Crib	7/21/86	Contamination	-76650	39180
2-W18-166	Z-1A Crib	7/21/86	Possible Contamination	-76650	39108
2-W18-167	Z-1A Crib	7/22/86	Contamination	-76552	39214
2-W18-168	Z-1A Crib	7/22/86	Contamination	-76552	39043
2-W18-169	Z-1A Crib	7/21/86	Natural	-76552	39073
2-W18-170	Z-1A Crib	7/21/86	Contamination	-76602	39154
2-W18-171	Z-1A Crib	7/23/86	Natural	-76604	39010
2-W18-172	Z-1A Crib	7/22/86	Natural	-76595	39435
2-W18-173	Z-1A Crib	7/21/86	Possible Contamination	-76574	39307
2-W18-174	Z-1A Crib	7/21/86	Contamination	-76565	39296
2-W18-175	Z-1A Crib	7/21/86	Contamination	-76600	39117
2-W18-061	Z-2 Crib	7/22/86	Possible Contamination	-76589	39424
2-W18-062	Z-2 Crib	7/22/86	Natural	-76614	39398
2-W18-063	Z-2 Crib	7/22/86	Contamination	-76589	39398
2-W18-088	Z-3 Crib	9/23/86	Natural	-76432	39298
2-W15-001	Z-5 : Z-4	5/03/63	Probably Natural	-76576	40962
2-W15-062	Z-5 Crib	7/03/86	Contamination	-76150	40975
2-W15-063	Z-5 Crib	7/08/86	Contamination	-76100	40975
2-W15-064	Z-5 Crib	7/03/86	Natural	-75965	40900
2-W15-007	Z-7 Crib	5/12/76	Contamination	-76180	40880
2-W15-076	Z-7 Crib	7/08/86	Contamination	-76229	40878
2-W15-077	Z-7 Crib	7/08/86	Contamination	-76170	40824
2-W15-078	Z-7 Crib	7/08/86	Contamination	-76100	40824

Table B-2: Z Plant Aggregate Area Radioactivity Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W15-006	Z-9 Crib	3/23/87	Possible Contamination	-75765	40005
2-W15-008	Z-9 Crib	3/23/87	Contamination	-75910	39740
2-W15-009	Z-9 Crib	3/23/87	Probably Natural	-75890	39930
2-W15-082	Z-9 Crib	2/26/87	Natural	-75810	39860
2-W15-084	Z-9 Crib	3/05/87	Probably Natural	-76000	39860
2-W15-085	Z-9 Crib	2/26/87	Probably Natural	-75910	39970
2-W15-086	Z-9 Crib	3/23/87	Contamination	-75958	39790
2-W15-094	Z-9 Crib	5/03/63	Natural	-75890	39930
2-W15-095	Z-9 Crib	2/26/87	Natural	-75925	39930
2-W15-101	Z-9 Crib	4/30/73	Natural	-75860	39890

Table B-3: Z Plant Contamination Intervals and Average Gamma Activity

Well	Site	Category	Top1	Base	Value1	Top2	Base	Value2	Top3	Base	Value3	Top4	Base	Value4	Top5	Base	Value5	Top6	Base	Value6
2-W15-212	T-25 Crib	Contamination	2	26	105	26	30	20000	30	72	5000	72	97	100						
2-W15-018	W-4C LLBG	Possible Contamination	3	63	45	63	181	65	181	189	115	190	242	70						
2-W18-064	Z-1 Crib	Contamination	0	18	110	19	34	3500	34	36	380	36	64	150						
2-W18-065	Z-1 Crib	Contamination	3	22	125	22	50	3300	50	61	450	61	139	145						
2-W18-005	Z-12 Crib	Contamination	0	23	240	23	30	1800	30	274	250									
2-W18-008	Z-12 Crib	Contamination	4	24	75	24	30	135	30	76	75									
2-W18-069	Z-12 Crib	Contamination	0	21	80	21	29	220	29	47	70									
2-W18-071	Z-12 Crib	Contamination	4	17	65	17	20	8000												
2-W18-072	Z-12 Crib	Contamination	2	17	60	17	20	1500												
2-W18-075	Z-12 Crib	Contamination	4	16	95	16	24	5700	24	39	125									
2-W18-152	Z-12 Crib	Contamination	1	22	110	22	26	200	26	113	130									
2-W18-153	Z-12 Crib	Contamination	2	22	100	22	25	220	25	104	125									
2-W18-154	Z-12 Crib	Contamination	3	14	90	14	18	1600												
2-W18-009	Z-18 Crib	Contamination	2	21	70	21	27	380	27	67	130	67	212	80						
2-W18-010	Z-18 Crib	Contamination	2	36	80	27	47	160	48	52	400	52	214	90						
2-W18-093	Z-18 Crib	Possible Contamination	2	25	75	25	37	160	37	56	145	56	123	95	123	141	115			
2-W18-094	Z-18 Crib	Contamination	3	32	70	32	36	170	36	83	75									
2-W18-096	Z-18 Crib	Contamination	2	32	65	32	36	700	36	77	80									
2-W18-056	Z-1A Crib	Contamination	0	41	160	41	49	1800	49	69	800	69	94	300	94	149	240			
2-W18-057	Z-1A Crib	Contamination	0	20	110	20	44	18000	44	54	2000	54	123	120						
2-W18-058	Z-1A Crib	Contamination	0	43	120	44	58	20000	58	70	340	70	99	1400						
2-W18-066	Z-1A Crib	Contamination	5	17	100	17	52	1000	52	82	350	82	149	155						
2-W18-081	Z-1A Crib	Contamination	0	15	200	15	32	600	32	38	340									

Table B-3: Z Plant Contamination Intervals and Average Gamma Activity

Well	Site	Category	Top1	Base	Value1	Top2	Base	Value2	Top3	Base	Value3	Top4	Base	Value4	Top5	Base	Value5	Top6	Base	Value6
2-W18-150	Z-1A Crib	Contamination	3	8	85	8	15	2300	15	51	1000	51	53	150	53	78	310	78	117	150
2-W18-158	Z-1A Crib	Possible Contamination	1	48	80	48	58	140	58	107	100									
2-W18-159	Z-1A Crib	Contamination	4	12	21000	12	58	1500	58	119	110									
2-W18-163	Z-1A Crib	Contamination	2	41	95	41	45	240	45	127	145									
2-W18-164	Z-1A Crib	Possible Contamination	1	79	95	79	98	190	98	109	90									
2-W18-165	Z-1A Crib	Contamination	1	89	90	89	93	180	93	111	90									
2-W18-166	Z-1A Crib	Possible Contamination	1	88	80	88	91	145	91	112	80									
2-W18-167	Z-1A Crib	Contamination	1	52	100	52	56	280	56	124	145									
2-W18-168	Z-1A Crib	Contamination	1	45	105	45	61	240	61	223	150									
2-W18-170	Z-1A Crib	Contamination	1	22	6000															
2-W18-173	Z-1A Crib	Possible Contamination	2	10	120	10	16	190	16	26	110	26	36	180						
2-W18-174	Z-1A Crib	Contamination	2	13	125	13	18	165	18	32	120	32	42	300						
2-W18-175	Z-1A Crib	Contamination	3	22	9000	22	96	500	96	120	160									
2-W18-061	Z-2 Crib	Possible Contamination	2	22	105	22	69	250	69	110	105	110	130	150	130	147	100			
2-W18-063	Z-2 Crib	Contamination	4	23	110	24	54	430	54	111	110	111	134	165						
2-W15-062	Z-5 Crib	Contamination	1	96	95	96	108	700	108	139	190	139	151	700	151	190	105			
2-W15-063	Z-5 Crib	Contamination	3	39	100	39	90	145	90	143	1700	143	147	125						
2-W15-007	Z-7 Crib	Contamination	4	23	105	23	32	400	32	45	800	45	64	4000	64	82	1000	82	130	4500
2-W15-076	Z-7 Crib	Contamination	2	10	120	10	42	95	42	64	220	64	73	700	73	98	150	98	101	650
2-W15-077	Z-7 Crib	Contamination	2	8	120	8	41	100	41	66	145	66	68	265						
2-W15-078	Z-7 Crib	Contamination	2	39	95	40	61	950	61	69	360									
2-W15-006	Z-9 Crib	Possible Contamination	0	47	60	47	110	70	110	151	50	151	160	110	160	172	70	172	185	105
2-W15-008	Z-9 Crib	Contamination	3	48	55	48	56	450	56	70	180	70	104	120	104	120	290	120	136	65
2-W15-086	Z-9 Crib	Contamination	1	48	65	48	61	145	61	104	85	104	112	260	112	136	95			

TABLE B-4. Selected RLS Survey Wells for Z Plant

Well	Disposal Site	Drill Date	Drill Depth
299-W18-065	Z-1 Crib	4/30/49	140
299-W18-005	Z-12 Crib	11/30/58	272
299-W18-010	Z-18 Crib	12/31/68	212
299-W18-150	Z-1A Crib	6/30/73	128
299-W15-063	Z-5 Crib	10/31/47	200
299-W15-007	Z-7 Crib	3/31/66	325
299-W15-008	Z-9 Crib	11/30/66	203

Records indicate both potential boreholes for the Z-2 Crib have been destroyed.

Appendix B

Well Selection for RLS Surveys in the Z-Plant Area

This appendix presents the results of the borehole and facility evaluation that were used to select boreholes for RLS logging in the Z-Plant Area. The facility data and total gamma-ray logs were reviewed by an environmental geologist and borehole geophysist. The outcome of the evaluation process was selection of wells for the RLS survey. Since the existing data was collected under differing quality requirements, the facility and well selection was based heavily on professional judgement.

Facilities disposal or storage data and well locations were reviewed to determine if contaminant plumes existed beneath a facility and should those plumes be logged. Two criteria were used: (1) the facility should have wells that are of sufficient depth (i.e., about 100 ft) to penetrate the waste plume, and (2) the facility should have a high activity inventory relative to other facilities in the plant area. The results of this screening are presented in Table B.1.

Total gamma-ray logs for boreholes and wells in the plant area were reviewed by a logging geophysist and radioactivity categorized into five types. The categories are: natural, probably natural, transfer line (tank farms only), possible contamination and contamination. The categorization is tabulated in Table B.2.

Radioactive contaminated intervals were tabulated by facility and included depths to the top and bottom of the interval and the average gamma-ray activity. The results are presented in Table B.3.

The contaminated interval data and average gamma-ray activity (Table B.3) and well construction data were used with the following criteria to select wells for RLS logging in the plant area:

- Wells should be fully penetrating or a minimum depth of about 100 ft
- Wells selected should not have a bentonite seal (i.e., select wells drilled prior to 1986)
- Wells should be limited to one per facility or unit (i.e., trench, tank, etc.) for a total in the plant area of no more than 10
- Wells should be in close proximity to crib distribution system or storage tank
- Wells should have contaminated interval if previously logged with total gamma-ray.

Table B-4 lists the wells selected for RLS logging and the Z-Plant Area to support the 200 AAMS.

Table B-1: Z-Plant aggregate area disposal facilities and RLS logging recommendations.

Z-PLANT

DISPOSAL FACILITY	LOG WITH RLS	COMMENTS
216-Z-1A TILE FIELD	YES	ACTIVITY
216-Z-1, -2 CRIBS	YES	ACTIVITY
216-Z-3 CRIB	NO	LOW ACTIVITY
216-Z-4 TRENCH	NO	NO MONITORING WELLS
216-Z-5 CRIB	YES	ACTIVITY
216-Z-6 CRIB	NO	NO MONITORING WELLS
216-Z-7 CRIB	YES	ACTIVITY
216-Z-8 FRENCH DRAIN	NO	NO MONITORING WELLS
216-Z-9 TRENCH	YES	ACTIVITY
216-Z-12 CRIB	YES	ACTIVITY
216-Z-13 FRENCH DRAIN	NO	NO MONITORING WELLS
216-Z-14 FRENCH DRAIN	NO	NO MONITORING WELLS
216-Z-15 FRENCH DRAIN	NO	NO MONITORING WELLS
216-Z-18 CRIB	YES	ACTIVITY

Table B-2: Z Plant Aggregate Area Radioactivity
Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W18-206				-76096	39256
2-W18-243				-77212	39255
2-W6-1		4/25/63	Probably Natural	-74396	46090
6-46-79				-78900	45750
2-W15-212	T-25 Crib	6/24/86	Contamination	-76600	41190
2-W15-019	W-2 : W-4B	8/21/89	Natural	-77772	41041
2-W15-020	W-2 LLBG	8/12/89	Natural	-78120	41028
2-W10-179	W-3A LLBG			-77597	44420
2-W7-02	W-3A LLBG	7/10/87	Natural	-77385	46519
2-W7-03	W-3A LLBG	10/28/87	Natural	-77420	46520
2-W7-09	W-3A LLBG	11/10/89	Natural	-78889	46549
2-W6-2	W-3AE LLBG	10/29/87	Natural	-75302	45571
2-W7-04	W-3AE LLBG	11/05/87	Natural	-77040	45435
2-W7-05	W-3AE LLBG	11/14/87	Natural	-76816	46509
2-W7-06	W-3AE LLBG	10/09/87	Natural	-76219	46509
2-W7-07	W-3AE LLBG	11/17/89	Natural	-76519	46509
2-W7-08	W-3AE LLBG	11/17/89	Natural	-75880	46510
2-W7-10	W-3AE LLBG	1/25/90	Natural	-75564	45921
2-W15-002	W-4A LLBG	11/12/76	Probably Natural	-78082	42251
2-W15-015	W-4B LLBG	8/18/87	Natural	-78103	40330
2-W15-016	W-4B LLBG	8/18/87	Natural	-77387	40269
2-W15-017	W-4B LLBG	9/17/87	Natural	-77387	40221
2-W15-023	W-4B LLBG	1/16/90	Natural	-78119	40680
2-W15-014	W-4C LLBG			-78089	39990
2-W15-018	W-4C LLBG	7/08/87	Possible Contamination	-77383	39705
2-W15-024	W-4C LLBG	12/05/89	Probably Natural	-78096	39851
2-W18-003	W-4C LLBG	5/02/73	Natural	-77700	39600
2-W18-021	W-4C LLBG	7/08/87	Natural	-78080	37794
2-W18-022	W-4C LLBG	8/13/87	Natural	-78109	37831
2-W18-023	W-4C LLBG	6/15/87	Natural	-78120	38987
2-W18-024	W-4C LLBG	7/09/87	Natural	-77180	38998
2-W18-026	W-4C LLBG	9/27/89	Natural	-78097	39477
2-W18-084	W-4C LLBG	5/02/73	Natural	-77386	38249

Table B-2: Z Plant Aggregate Area Radioactivity Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W18-064	Z-1 Crib	9/22/67	Contamination	-76614	39373
2-W18-065	Z-1 Crib	7/22/86	Contamination	-76589	39373
2-W15-005	Z-1 Ditch	5/02/63	Natural	-75984	39537
2-W15-102	Z-1 Ditch	4/27/73	Probably Natural	-76180	39702
2-W18-001	Z-12 : Z-1A	4/27/73	Natural	-77013	39388
2-W18-002	Z-12 Crib	7/22/87	Natural	-77150	39120
2-W18-004	Z-12 Crib	7/22/87	Natural	-77375	39150
2-W18-005	Z-12 Crib	5/02/73	Contamination	-77250	39350
2-W18-008	Z-12 Crib	5/19/76	Contamination	-77221	39327
2-W18-069	Z-12 Crib	2/23/68	Contamination	-77241	39350
2-W18-071	Z-12 Crib	3/20/87	Contamination	-77208	39347
2-W18-072	Z-12 Crib	3/20/87	Contamination	-77208	39298
2-W18-073	Z-12 Crib	3/20/87	Natural	-77205	39201
2-W18-074	Z-12 Crib	3/20/87	Natural	-77196	39111
2-W18-075	Z-12 Crib	7/08/86	Contamination	-77211	39371
2-W18-151	Z-12 Crib	7/15/86	Natural	-77194	39438
2-W18-152	Z-12 Crib	7/08/86	Contamination	-77247	39368
2-W18-153	Z-12 Crib	7/15/86	Contamination	-77154	39365
2-W18-154	Z-12 Crib	7/15/86	Contamination	-77184	39438
2-W18-155	Z-12 Crib	7/15/86	Natural	-77185	39458
2-W18-157	Z-12 Crib	7/15/86	Natural	-77223	39070
2-W15-010	Z-16 Crib	5/07/76	Natural	-76920	41080
2-W15-011	Z-16 Crib	5/07/76	Probably Natural	-77040	41145
2-W18-009	Z-18 Crib	7/23/87	Contamination	-76846	38852
2-W18-010	Z-18 Crib	5/13/76	Contamination	-76803	38847
2-W18-011	Z-18 Crib	7/23/87	Natural	-76955	38735
2-W18-012	Z-18 Crib	5/13/76	Natural	-76955	38850
2-W18-082	Z-18 Crib	7/23/87	Natural	-77101	38570
2-W18-083	Z-18 Crib	7/23/87	Natural	-77240	38409
2-W18-093	Z-18 Crib	7/23/87	Possible Contamination	-76905	38744
2-W18-094	Z-18 Crib	7/23/87	Contamination	-76880	38662
2-W18-095	Z-18 Crib	7/23/87	Natural	-76970	38665
2-W18-096	Z-18 Crib	7/23/87	Contamination	-76790	38825
2-W18-097	Z-18 Crib	7/23/87	Natural	-76790	38745
2-W18-098	Z-18 Crib	7/22/87	Natural	-76880	38940
2-W18-099	Z-18 Crib	7/22/87	Natural	-76768	38949
2-W18-006	Z-1A Crib	2/12/87	Natural	-76706	39212
2-W18-007	Z-1A Crib	7/21/87	Natural	-76491	39204
2-W18-056	Z-1A Crib	5/01/73	Contamination	-76615	39301

Table B-2: Z Plant Aggregate Area Radioactivity
Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W18-057	Z-1A Crib	1/31/66	Contamination	-76587	39309
2-W18-058	Z-1A Crib	9/15/67	Contamination	-76651	39161
2-W18-059	Z-1A Crib	5/01/73	Natural	-76552	39161
2-W18-066	Z-1A Crib	7/21/86	Contamination	-76601	39063
2-W18-076	Z-1A Crib	5/01/73	Natural	-76610	39318
2-W18-078	Z-1A Crib	5/01/73	Natural	-76600	39308
2-W18-081	Z-1A Crib	5/01/73	Contamination	-76605	39283
2-W18-085	Z-1A Crib	7/22/87	Natural	-76717	38989
2-W18-086	Z-1A Crib	7/22/87	Natural	-76742	39106
2-W18-087	Z-1A Crib	7/23/87	Natural	-76604	38980
2-W18-089	Z-1A Crib	7/22/87	Natural	-76752	39360
2-W18-150	Z-1A Crib	7/21/86	Contamination	-76601	39075
2-W18-158	Z-1A Crib	7/21/86	Possible Contamination	-76650	39266
2-W18-159	Z-1A Crib	7/21/86	Contamination	-76602	39228
2-W18-163	Z-1A Crib	7/21/86	Contamination	-76552	39284
2-W18-164	Z-1A Crib		Possible Contamination	-76602	39040
2-W18-165	Z-1A Crib	7/21/86	Contamination	-76650	39180
2-W18-166	Z-1A Crib	7/21/86	Possible Contamination	-76650	39108
2-W18-167	Z-1A Crib	7/22/86	Contamination	-76552	39214
2-W18-168	Z-1A Crib	7/22/86	Contamination	-76552	39043
2-W18-169	Z-1A Crib	7/21/86	Natural	-76552	39073
2-W18-170	Z-1A Crib	7/21/86	Contamination	-76602	39154
2-W18-171	Z-1A Crib	7/23/86	Natural	-76604	39010
2-W18-172	Z-1A Crib	7/22/86	Natural	-76595	39435
2-W18-173	Z-1A Crib	7/21/86	Possible Contamination	-76574	39307
2-W18-174	Z-1A Crib	7/21/86	Contamination	-76565	39296
2-W18-175	Z-1A Crib	7/21/86	Contamination	-76600	39117
2-W18-061	Z-2 Crib	7/22/86	Possible Contamination	-76589	39424
2-W18-062	Z-2 Crib	7/22/86	Natural	-76614	39398
2-W18-063	Z-2 Crib	7/22/86	Contamination	-76589	39398
2-W18-088	Z-3 Crib	9/23/86	Natural	-76432	39298
2-W15-001	Z-5 : Z-4	5/03/63	Probably Natural	-76576	40962
2-W15-062	Z-5 Crib	7/03/86	Contamination	-76150	40975
2-W15-063	Z-5 Crib	7/08/86	Contamination	-76100	40975
2-W15-064	Z-5 Crib	7/03/86	Natural	-75965	40900
2-W15-007	Z-7 Crib	5/12/76	Contamination	-76180	40880
2-W15-076	Z-7 Crib	7/08/86	Contamination	-76229	40878
2-W15-077	Z-7 Crib	7/08/86	Contamination	-76170	40824
2-W15-078	Z-7 Crib	7/08/86	Contamination	-76100	40824

Table B-2: Z Plant Aggregate Area Radioactivity Categorized by Facility and Well

Well	Facility	Log Date	Category	E	N
2-W15-006	Z-9 Crib	3/23/87	Possible Contamination	-75765	40005
2-W15-008	Z-9 Crib	3/23/87	Contamination	-75910	39740
2-W15-009	Z-9 Crib	3/23/87	Probably Natural	-75890	39930
2-W15-082	Z-9 Crib	2/26/87	Natural	-75810	39860
2-W15-084	Z-9 Crib	3/05/87	Probably Natural	-76000	39860
2-W15-085	Z-9 Crib	2/26/87	Probably Natural	-75910	39970
2-W15-086	Z-9 Crib	3/23/87	Contamination	-75958	39790
2-W15-094	Z-9 Crib	5/03/63	Natural	-75890	39930
2-W15-095	Z-9 Crib	2/26/87	Natural	-75925	39930
2-W15-101	Z-9 Crib	4/30/73	Natural	-75860	39890

Table B-3: Z Plant Contamination Intervals and Average Gamma Activity

Well	Site	Category	Top1	Base	Value1	Top2	Base	Value2	Top3	Base	Value3	Top4	Base	Value4	Top5	Base	Value5	Top6	Base	Value6
2-W15-212	T-25 Crib	Contamination	2	26	105	26	30	20000	30	72	5000	72	97	100						
2-W15-018	W-4C LLBG	Possible Contamination	3	63	45	63	181	65	181	189	115	190	242	70						
2-W18-064	Z-1 Crib	Contamination	0	18	110	19	34	3500	34	36	380	36	64	150						
2-W18-065	Z-1 Crib	Contamination	3	22	125	22	50	3300	50	61	450	61	139	145						
2-W18-005	Z-12 Crib	Contamination	0	23	240	23	30	1800	30	274	250									
2-W18-008	Z-12 Crib	Contamination	4	24	75	24	30	135	30	76	75									
2-W18-069	Z-12 Crib	Contamination	0	21	80	21	29	220	29	47	70									
2-W18-071	Z-12 Crib	Contamination	4	17	65	17	20	8000												
2-W18-072	Z-12 Crib	Contamination	2	17	60	17	20	1500												
2-W18-075	Z-12 Crib	Contamination	4	16	95	16	24	5700	24	39	125									
2-W18-152	Z-12 Crib	Contamination	1	22	110	22	26	200	26	113	130									
2-W18-153	Z-12 Crib	Contamination	2	22	100	22	25	220	25	104	125									
2-W18-154	Z-12 Crib	Contamination	3	14	90	14	18	1600												
2-W18-009	Z-18 Crib	Contamination	2	21	70	21	27	380	27	67	130	67	212	80						
2-W18-010	Z-18 Crib	Contamination	2	36	80	27	47	160	48	52	400	52	214	90						
2-W18-093	Z-18 Crib	Possible Contamination	2	25	75	25	37	160	37	56	145	56	123	95	123	141	115			
2-W18-094	Z-18 Crib	Contamination	3	32	70	32	36	170	36	83	75									
2-W18-096	Z-18 Crib	Contamination	2	32	65	32	36	700	36	77	80									
2-W18-056	Z-1A Crib	Contamination	0	41	160	41	49	1800	49	69	800	69	94	300	94	149	240			
2-W18-057	Z-1A Crib	Contamination	0	20	110	20	44	18000	44	54	2000	54	123	120						
2-W18-058	Z-1A Crib	Contamination	0	43	120	44	58	20000	58	70	340	70	99	1400						
2-W18-066	Z-1A Crib	Contamination	5	17	100	17	52	1000	52	82	350	82	149	155						
2-W18-081	Z-1A Crib	Contamination	0	15	200	15	32	600	32	38	340									

Table B-3: Z Plant Contamination Intervals and Average Gamma Activity

Well	Site	Category	Top1	Base	Value1	Top2	Base	Value2	Top3	Base	Value3	Top4	Base	Value4	Top5	Base	Value5	Top6	Base	Value6
2-W18-150	Z-1A Crib	Contamination	3	8	85	8	15	2300	15	51	1000	51	53	150	53	78	310	78	117	150
2-W18-158	Z-1A Crib	Possible Contamination	1	48	80	48	58	140	58	107	100									
2-W18-159	Z-1A Crib	Contamination	4	12	21000	12	58	1500	58	119	110									
2-W18-163	Z-1A Crib	Contamination	2	41	95	41	45	240	45	127	145									
2-W18-164	Z-1A Crib	Possible Contamination	1	79	95	79	98	190	98	109	90									
2-W18-165	Z-1A Crib	Contamination	1	89	90	89	93	180	93	111	90									
2-W18-166	Z-1A Crib	Possible Contamination	1	88	80	88	91	145	91	112	80									
2-W18-167	Z-1A Crib	Contamination	1	52	100	52	56	280	56	124	145									
2-W18-168	Z-1A Crib	Contamination	1	45	105	45	61	240	61	223	150									
2-W18-170	Z-1A Crib	Contamination	1	22	6000															
2-W18-173	Z-1A Crib	Possible Contamination	2	10	120	10	16	190	16	26	110	26	36	180						
2-W18-174	Z-1A Crib	Contamination	2	13	125	13	18	165	18	32	120	32	42	300						
2-W18-175	Z-1A Crib	Contamination	3	22	9000	22	96	500	96	120	160									
2-W18-061	Z-2 Crib	Possible Contamination	2	22	105	22	69	250	69	110	105	110	130	150	130	147	100			
2-W18-063	Z-2 Crib	Contamination	4	23	110	24	54	430	54	111	110	111	134	165						
2-W15-062	Z-5 Crib	Contamination	1	96	95	96	108	700	108	139	190	139	151	700	151	190	105			
2-W15-063	Z-5 Crib	Contamination	3	39	100	39	90	145	90	143	1700	143	147	125						
2-W15-007	Z-7 Crib	Contamination	4	23	105	23	32	400	32	45	800	45	64	4000	64	82	1000	82	130	4500
2-W15-076	Z-7 Crib	Contamination	2	10	120	10	42	95	42	64	220	64	73	700	73	98	150	98	101	650
2-W15-077	Z-7 Crib	Contamination	2	8	120	8	41	100	41	66	145	66	68	265						
2-W15-078	Z-7 Crib	Contamination	2	39	95	40	61	950	61	69	360									
2-W15-006	Z-9 Crib	Possible Contamination	0	47	60	47	110	70	110	151	50	151	160	110	160	172	70	172	185	105
2-W15-008	Z-9 Crib	Contamination	3	48	55	48	56	450	56	70	180	70	104	120	104	120	290	120	136	65
2-W15-086	Z-9 Crib	Contamination	1	48	65	48	61	145	61	104	85	104	112	260	112	136	95			

TABLE B-4. Selected RLS Survey Wells for Z Plant

Well	Disposal Site	Drill Date	Drill Depth
299-W18-065	Z-1 Crib	4/30/49	140
299-W18-005	Z-12 Crib	11/30/58	272
299-W18-010	Z-18 Crib	12/31/68	212
299-W18-150	Z-1A Crib	6/30/73	128
299-W15-063	Z-5 Crib	10/31/47	200
299-W15-007	Z-7 Crib	3/31/66	325
299-W15-008	Z-9 Crib	11/30/66	203

Records indicate both potential boreholes for the Z-2 Crib have been destroyed.

CORRESPONDENCE DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
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Subject: TRANSMITTAL OF 200 AGGREGATE AREA MANAGEMENT STUDY SAMPLING AND ANALYSIS PLANS FOR "INFORMATION ONLY"

INTERNAL DISTRIBUTION

Approval	Date	Name	Location	w/att
		Correspondence Control	A3-01	
		M. R. Adams	H4-55	
		R. J. Bliss (Level 1)	B3-04	
		L. C. Brown	H4-51	
		R. A. Carlson	H4-55	
		G. D. Carpenter	B2-16	
		C. K. DiSibio	B3-03	
		R. E. Lerch, Assignee	B2-35	
		H. E. McGuire	B3-63	
		P. J. Mackey	B3-15	
		T. B. Veneziano	B2-35	
		T. M. Wintczak	L4-92	
		C. D. Wittreich	H4-55	
		R. D. Wojtasek	L4-92	
		EDMC	H4-22	

ldp, 6-7049