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EXECUTIVE SUMMARY

This report fulfills Milestone M-17-13 of the Hanford Federal Facility Agreement and Consent Order (Agreement) (Ecology et al. 1989), as amended. Milestone M-17-13 specifically requires the following: Submit methodology for assessing impact of liquid discharge on groundwater at disposal sites to U.S. Environmental Protection Agency (EPA) and Washington Department of Ecology (Ecology) for approval -- October 1991.

Previous studies identified 33 waste streams which discharged to a total of 27 receiving sites having a potential to impact groundwater conditions (Figure ES-1). Current negotiations among Ecology, the EPA, and the U. S. Department of Energy, (DOE) have eliminated the need for groundwater assessments for 10 sites and delayed or potentially eliminated assessments for three other sites (Table ES-1). At present, continued disposal of liquid effluent past June 1992 is proposed for 14 receiving sites. The status of the other 10 facilities will be updated when negotiations are completed.

The impact assessment methodology addresses hydrologic and contaminant impacts associated with continued discharge to the soil column. The methodology is divided into two stages (Figure ES-2). Stage 1 serves as a scoping exercise for Stage 2 and allows resources to be efficiently directed. Categorization involves sorting the 14 liquid effluent receiving sites into three categories. Each category represents a preliminary evaluation of the level of additional information needed to conduct a credible impact assessment. A Level 1 category requires the least amount of new field data while a Level 3 category requires the most.

Stage 2 of the methodology describes the impact assessment criteria and task descriptions that will be used to conduct the individual receiving site assessments. Tasks include the assessment of hydrologic, geologic, and contaminant data, collection of new groundwater data, soil property, and geophysical data where needed, and impact analysis using analytical or numerical modeling techniques. Impact assessment portions of the approach are also directly applicable to the siting of new facilities discharging through the soil column to the groundwater.

As stated in the Agreement, DOE will submit a schedule for completion of the assessments within 30 days of approval of the methodology. Schedules for each receiving site and an integrated schedule will be developed using the assessment tasks described in the methodology.

To expedite preparation of the schedule to implement this methodology, the Stage 1 categorization process was applied to the 14 receiving sites. Table 5-1 presents the results. Site-specific information is found in the report and appendix.

Figure ES-1. Effluent Receiving Sites Location Map.

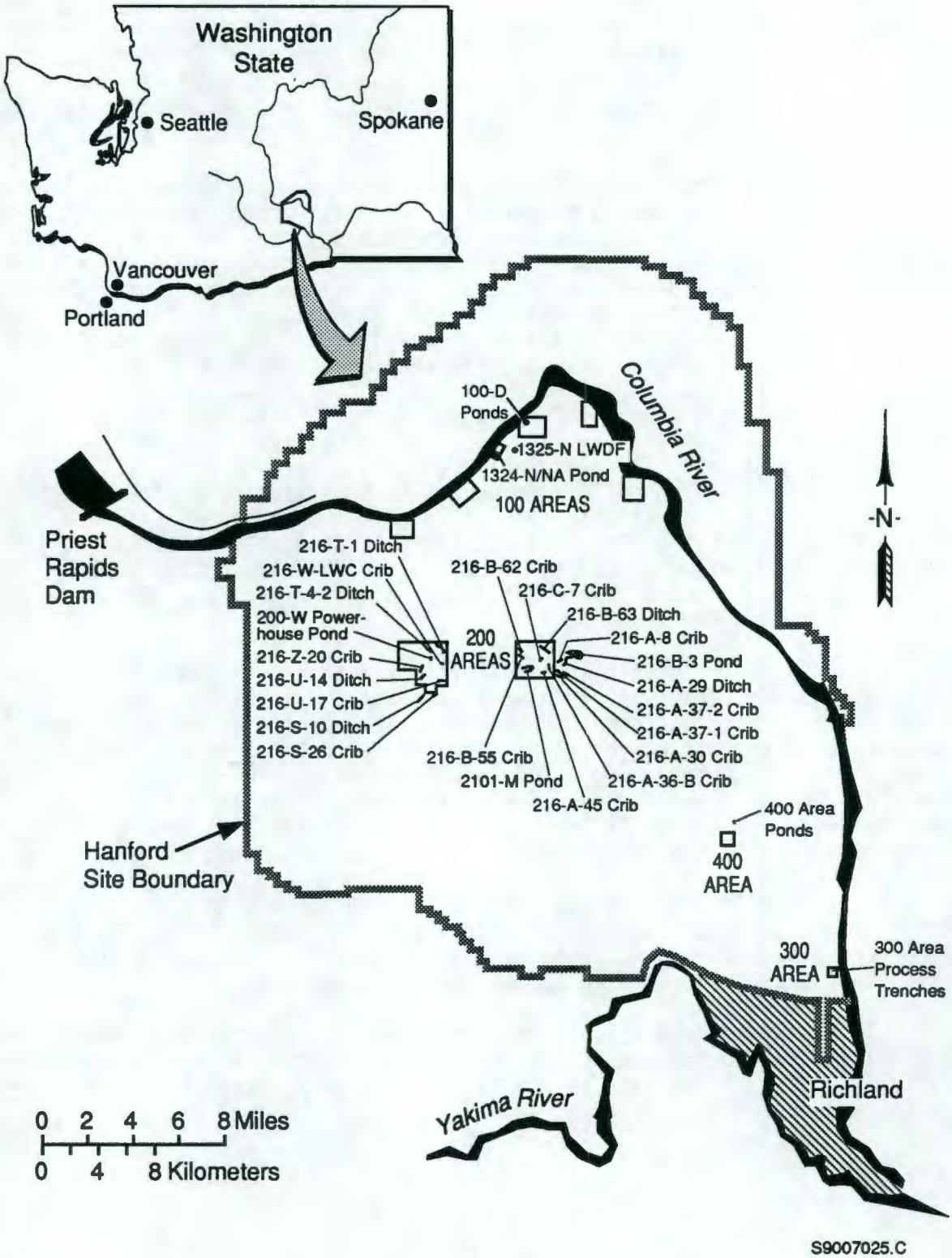

Table ES-1. Liquid Effluent Receiving Site Assessment Status.

Receiving Site	Associated Effluent Stream
TO BE ASSESSED:	
1. 216-U-14 Ditch	UO_3/U Plant wastewater
2. 216-B-3 Pond System	Multiple PUREX, B Plant and other cooling water
3. 100-D Ponds	183-D Filter backwash wastewater
4. 1325-N LWDF	N Reactor effluent
5. 216-W-LC Crib	2724-W Laundry wastewater
6. 216-Z-20 Crib	Plutonium Finishing Plant wastewater
7. 216-U-17 Crib	UO_3 Plant process condensate
8. 216-S-26 Crib	222-S laboratory wastewater
9. 216-T-1 Ditch	T Plant laboratory wastewater
10. 216-T-4-2 Ditch	T Plant wastewater
11. 284 West Powerhouse Pond	284-W Powerplant wastewater
12. 2101-M pond	2101-M laboratory wastewater
13. 300 Area Process Trenches	300 Area process wastewater
14. 400 Area Ponds	400 Area secondary cooling water
WITHHELD (Effluent discharge discontinued or to cease by June 1992)	
1. 1324-N/NA Pond	163-N Demineralization Plant Wastewater
2. 216-A-29 Ditch	PUREX Plant Chemical Sewer
3. 216-A-45 Crib	PUREX Plant Process Condensate
4. 216-A-36B Crib	PUREX Plant Ammonia Scrubber Condensate
5. 216-A-37-1 Crib	242-A Evaporator Process Condensate
6. 216-C-7 Crib	209-E Laboratory Reflector Water
7. 216-S-10 Ditch	S Plant Wastewater
8. 216-A-30 Crib	PUREX Plant Steam Condensate
9. 216-A-37-2 Crib	PUREX Plant Steam Condensate
10. 216-B-63 Ditch	B Plant Chemical Sewer
DELAYED:	
1. 216-A-8 Crib	241-AY/AZ Tank Farm Steam Condensate
2. 216-B-55 Crib	B Plant Steam Condensate
3. 216-B-62 Crib	B Plant Process Condensate

Figure ES-2. Outline of Groundwater Impact Assessment Methodology Development.

GROUNDWATER IMPACT ASSESSMENT METHODOLOGY

Effluent Discharged to 14 Receiving Sites after June 1992

Objectives - Determine for Each Receiving Site:

- Local Impacts to Groundwater System (Contaminant and Hydrologic)
- Extent of Contamination in Vadose Zone
- Contaminant Break Through to Groundwater and Adequacy of Monitoring System
- Incremental Impacts from Continued Use

A Two Stage Approach:

Stage 1. Categorize Sites - Scoping for Stage 2
Stage 2. Receiving Site Impact Assessments

STAGE 1 - CATEGORIZATION

Impact Assessment Categories Correspond to Data Collection Effort:

Level 1 - Use Existing Data
Level 2 - Limited Field Data Collection (sampling, surveys)
Level 3 - Extensive Field Data Collection (drilling)

Categorization of Receiving Sites Based on Evaluation of Factors:

- Potential for Impact - Effluent Constituents and Volume, Hydrogeology
- Schedule for Cessation of Effluent Discharges
- Adequacy of Existing Information

STAGE 2 - IMPACT ASSESSMENT OF RECEIVING SITES

Impact Assessment Plan for Each Receiving Site

Data Collection Activities

- According to Category and Impact Assessment Plan

Receiving Site Conceptual Model

- Hydrogeologic Framework and Contaminant Migration Processes

Impact Analysis to Satisfy Objectives:

- Analysis Techniques Appropriate for Data Available - Analytical Solutions, Numerical Modeling
- Assessment Criteria Used as Relative Measure of Impact

1.0 INTRODUCTION

1.1 BACKGROUND

In response to public comments received on the Hanford Federal Facility Agreement and Consent Order (Ecology et al. 1989) (hereinafter referred to as Agreement), and at the request of the Washington Department of Ecology (Ecology), the U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA), the DOE conducted a study to document the discharge history, characteristics of liquid discharges, assess groundwater contamination, and address the potential for movement of the contamination. The results of this study are documented in the *Liquid Effluent Study Final Project Report* (WHC 1990a).

The EPA and Ecology expressed several concerns regarding uncertainties in the analysis for the Liquid Effluent Study. Foremost among these concerns were the lack of site-specific data, need for a more rigorous simulation of physical transport processes, need to consider interactions from adjacent liquid discharge facilities, and establishment of credible parameters defining rates of flow and contaminant movement. As a result, DOE Richland Field Office (RL), Ecology, and EPA agreed to the following milestone as promulgated in the May 1991 amendment to the Agreement:

- M-17-13: Submit methodology for assessing impact of liquid discharge of groundwater at disposal sites to EPA and Ecology for approval -- October 1991.

1.2 PURPOSE

In fulfillment of Milestone M-17-13, this report presents a methodology for assessing impacts to groundwater from liquid effluent discharges to the soil. The methodology recognizes the major concerns of the past, incorporates current field data collection activities, and efficiently allocates resources to receiving sites based on an expectation of their impact to groundwater resources.

In addition, the first stage of the methodology was applied to the subject receiving sites. The results provide a basis for planning and scheduling assessment activities. On approval of this report by Ecology and EPA, RL will submit a schedule for the completion of the groundwater impact assessments for each of the 14 liquid effluent receiving sites listed in Table ES-1 within 30 calendar days. Site-specific impact assessments will be prioritized in the schedule. Priority will be based on consideration of the perceived magnitude and immediacy of potential groundwater impacts, scheduled Agreement milestones, and comments provided by the EPA and Ecology. Figure ES-2 outlines implementation of the methodology.

2.0 GROUNDWATER IMPACT ASSESSMENT METHODOLOGY

2.1 OBJECTIVE

The objective of this methodology is to establish a systematic, technically defensible approach to assessing the impact of continued discharge of liquid effluent to the soil column at the Hanford Site. For each liquid effluent receiving site included in the evaluation, an assessment will be performed to determine:

- the local impacts to the groundwater system due to the effluent discharge
- the extent of existing contamination in the vadose zone
- if and when contaminants might break through the soil column to groundwater, and the adequacy of the monitoring system to detect that event
- the incremental impacts to the vadose zone and groundwater system from continued use of the receiving site

2.2 SCOPE

The signatories of the Agreement have agreed that certain liquid discharges to the soil at Hanford are subject to the provisions of Washington Administrative Code (WAC) 173-216, *Washington State Waste Discharge Permit Program*, or, if applicable, WAC 173-218). This methodology not only addresses Milestone M-17-13, it also supports compliance with these regulations. Discharges under Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 are exempt from requirements under WAC 173-216 and -218.

There are two types of groundwater impacts to be assessed: contaminant and hydrologic. Contaminant impacts refer to the influence of liquid effluent discharges on the presence and migration of chemical and radioactive contaminants through the soil column and in groundwater. Hydrologic impacts refers to the influence of liquid effluent discharges on groundwater flow rates and direction under both unsaturated and saturated conditions. The relative significance of an impact to the groundwater is determined by comparison with impact assessment criteria. The impact assessment criteria are based on regulatory standards, guidelines, and professional judgement.

The more significant impacts are most likely to occur in the vicinity of the effluent receiving sites, in unsaturated soils above the water table referred to as the vadose zone, and in the unconfined aquifer. Accordingly, the assessments will focus on these local scale impacts. However, it is recognized that some effluent discharges may exert a far-reaching influence on groundwater quality and flow. Thus, some receiving site impact assessments may include an expansive geographic area and the confined aquifer system as well. Also, in recognition of operational factors such as spills, leaks, and infiltration, the assessment of a receiving site may include those areas through which pipelines and ditches transmit effluent wastestreams to a discharge point.

2.3 APPROACH

To focus the assessment on those receiving sites with the greatest potential impact to groundwater and to make efficient use of resources, the methodology is divided into two stages. The first stage is a scoping exercise. Receiving sites are categorized according to the information gathering and analysis activities considered necessary to perform a credible impact assessment. The second stage involves performing a detailed, multi-task impact assessment.

2.4 ASSUMPTIONS

The following assumptions influence the application of the methodology and the future development of schedules for implementation.

1. **Historical data are fully useable.** Groundwater systems generally respond slowly to changes. Current conditions are often the result of discharges occurring years in the past. As such, historic flow and loading data are required to evaluate current conditions.

2. **The degree of certainty of the hydrologic, chemical, and geologic regime needed to conduct a groundwater impact assessment for each site is directly related to the expected level of impact the receiving site has on its surroundings.** Site-specific data, though desirable, is not required to address every site.

3. **Modeling sophistication is tailored to the existing database and the expected level of impact a receiving site has on its surroundings.** This assumption states that there are limitations to data collection. Development of site-specific, hydrostratigraphically detailed models that require extensive data for calibration are beyond the scope of these assessments.

4. **New site-specific geologic, hydrologic, and groundwater data obtained through drilling requires 1.5 to 2 years to acquire.** Planning, drilling, well construction, well development, and collection of representative groundwater samples is approximately a 1.5- to 2-year effort. This assumption is based on extensive Resource Conservation and Recovery Act (RCRA) of 1976 experience on the Hanford Site.

5. **The existing purge water agreement (DOE 1990) severely limits the use of pumping tests to obtain aquifer properties.** Many parts of the unconfined aquifer are highly transmissive and will yield a high volume of water during pumping. The purge water agreement requires the containment of this water. Since most multiwell pumping tests require several hours, the amounts of water produced are beyond practical containment capacities. This assumption constrains the development of new aquifer hydrologic data.

6. **Data collection and modeling activities are integrated with other Agreement milestones.** In some cases (notably B Pond), an assessment of hydrologic and contaminant impacts from a facility may extend sitewide. The development of a modeling tool to conduct this assessment is being done under separate Agreement milestones. Modeling and data collection schedules will be integrated to the extent possible with ongoing programs and activities.

3.0 STAGE 1 - CATEGORIZATION OF RECEIVING SITES

3.1 RATIONALE

The first stage of the methodology, called categorization, serves as the scoping process for the second stage assessment process. Categorization provides:

- an indication of the scope of field activities and breadth of analysis necessary to conduct an assessment - so resources can be efficiently allocated and schedules established
- identification of the more significant receiving sites - data indicate that some sites have only limited additional impact on the groundwater while others affect entire flow systems
- an approximate timeframe to perform the assessment - time-consuming data collection activities must be balanced with the projected termination date for effluent discharge and with projected dates for submittal of permit applications.

3.2 DESCRIPTION OF CATEGORIES

There are three general categories, which represent an estimate of the level of field effort needed to perform an assessment. The higher the level selected, the greater the scope of the effort must be to result in a credible groundwater assessment.

Level 1: A receiving site placed in Level 1 is generally considered to have sufficient information to conduct a credible assessment in relation to projected period of time of continued discharge and potential impacts. A relatively simple modeling effort may be needed to quantify impacts.

Level 2: A Level 2 facility is evaluated similarly to the Level 1, but with the need to verify by nonintrusive means the extent of existing contamination movement in the soil. Nonintrusive data collection may include, but not be limited to, some of the following: groundwater sampling, surface and borehole geophysics, remote sensing, soil surface sampling and radioactivity surveys, well remediation, and water level measurements. A more sophisticated modeling effort may be needed to evaluate future rates of movement and potential contaminant breakthrough.

Level 3: Level 3 is reserved for those facilities where significant additional field work is needed due to the lack of existing data, potential magnitude of the impact, or expected long-term discharge to the site. Soil borings and drilling to construct monitoring wells are examples of intensive data collection efforts that distinguish Level 3 from Level 2 data collection. Analysis techniques and modeling may require greater sophistication than Levels 1 and 2.

Some receiving sites may not fit into any single category or, through the course of the assessment, it may become apparent that more or less data and analyses are needed. Impact assessment plans will be flexible to accommodate such situations.

3.3 CATEGORIZATION PROCESS

The categorization process involves a qualitative examination of site-specific information by a group of individuals familiar with both the hydrogeology and nature of effluent disposal practices for each receiving site. Primary sources of information on each receiving site are listed below:

- *Liquid Effluent Study Final Project Report*, WHC-EP-0367 (WHC 1990a)
- *Waste Stream Characterization Report*, WHC-EP-0287, Vols. 1-4, (WHC 1989)
- *Hanford Site Stream-Specific Reports*, WHC-EP-0342 (WHC 1990b)
- *Liquid Effluent Study: Groundwater Characterization Data*, WHC-EP-0366 (WHC 1990c)

For most receiving sites, the information contained in these reports is the most current collection of data and information available. Other sources of information included an evaluation of both EPA's and Ecology's comments and conclusions to the entire collection of reports listed above.

Based on consideration of the set of factors listed below, each receiving site is categorized by group consensus:

<u>Categorization Factors</u>

- wastestream composition
- curie inventory discharged to receiving site
- past effluent discharge volume and peak rate
- present contaminant load in soil column and potential for breakthrough to groundwater
- evidence of groundwater contamination
- proximity to contaminant pathways - exposure to health and environment
- operational history of receiving site and planned future discharge
- process knowledge
- scheduled termination date for effluent discharge
- adequacy of existing hydrogeologic data and groundwater monitoring
- ongoing and planned data collection activities under other programs
- comments and concerns of regulators regarding specific receiving sites.

Results of the Stage 1 categorization process are provided in Chapter 5.

4.0 STAGE 2 - GROUNDWATER IMPACT ASSESSMENT

4.1 RATIONALE

All three categories for assessing groundwater impacts rely on development of a conceptual model for each receiving site. The conceptual model describes the contaminant migration processes and hydraulic effects of effluent disposal within a site-specific hydrogeologic framework.

A combination of new and existing data will form the basis for the assessment. The scope of this effort is in part determined by the category or level ascribed to each site in Stage 1. A broad range of data collection techniques are available to characterize the receiving site geology, hydrology, and contaminants. Some of these techniques are mentioned in the outline of impact assessment tasks below. Data collection activities will be detailed in impact assessment plans to be prepared for each receiving site.

Various impact analysis techniques can be used in context with the conceptual model and quality of data available. Simplified or numerical modeling may be necessary to evaluate flow rate and contaminant transport through the vadose and saturated zone. Model selection and associated data needs will be commensurate with the category assigned a receiving site level and significance of potential impacts.

Contaminant impact assessment includes an evaluation of past, present, and expected changes in effluent discharge quality, rates of movement, and adsorption/desorption mechanisms. Hydrologic impact assessment includes an evaluation of past, present, and expected changes in the surrounding groundwater table; local flow rate; and direction. Impact assessment criteria are applied to analysis results as an approximate measure of impact significance.

4.2 IMPACT ASSESSMENT CRITERIA

Quantitative contaminant assessment criteria provide *a relative measure of the significance* of an impact. Qualitative criteria may be appropriate under some circumstances. For example, no quantitative criteria are proposed for evaluating hydrologic impacts. Hydrologic impacts will be qualita-tively determined. Criteria may be selected or modified as needed, with the concurrence of Ecology and EPA.

Criteria for contaminant impacts to groundwater are based on: (1) WAC 173-200-040, Table 1, Ground Water Quality Criteria (Table 4-1), and (2) DOE derived concentration guides (DCG) for those radioisotopes (Table 4-2) not addressed in WAC 173-200-040.

Each disposal site assessment will include analysis of: (1) the negotiated wastestream analyte list (i.e., from the effluent sampling and analysis plans, and (2) other chemical and radiological constituents as indicated from discharge records and/or historical data/process information. The significance of contaminant concentrations will be judged with respect to standards and guidelines in Tables 4-1 and 4-2.

Table 4-1. Groundwater Quality Criteria. (Page 1 of 2)

CONTAMINANT	CRITERION	
I. PRIMARY AND SECONDARY CONTAMINANTS AND RADIONUCLIDES		
A. PRIMARY CONTAMINANTS		
Barium*	1.0	milligrams/ liter (mg/l
Cadmium*	0.01	mg/l
Chromium*	0.05	mg/l
Lead*	0.05	mg/l
Mercury*	0.002	mg/l
Selenium*	0.01	mg/l
Silver*	0.05	mg/l
Fluoride	4	mg/l
Nitrate (as N)	10	mg/l
Endrin	0.0002	mg/l
Methoxychlor	0.1	mg/l
1,1,1-Trichloroethane	0.20	mg/l
2-4 D	0.10	mg/l
2,4,5-TP Silvex	0.01	mg/l
Total Coliform Bacteria	1/100	ml
B. SECONDARY CONTAMINANTS		
Copper*	1.0	mg/l
Iron*	0.30	mg/l
Manganese*	0.05	mg/l
Zinc*	5.0	mg/l
Chloride	250	mg/l
Sulfate	250	mg/l
Total Dissolved Solids	500	mg/l
Foaming Agents	0.5	mg/l
pH	6.5–8.5	
Corrosivity	noncorrosive	
Color	15 color units	
Odor	3 threshold odor units	
C. RADIONUCLIDES		
Gross Alpha Particle Activity	15	pico Curie/ liter (pCi/l
Gross Beta Particle Radioactivity		
Gross Beta Activity	50	pCi/l
Tritium	20,000	pCi/l
Strontium-90	8	pCi/l
Radium 226 & 228	5	pCi/l
Radium -226	3	pCi/l
II. CARCINOGENS		
Acrylamide	0.02	micrograms/ liter ug/l
Acrylonitrile	0.07	ug/l
Aldrin	0.005	ug/l
Aniline	14	ug/l
Aramite	3	ug/l
Arsenic*	0.05	(ug/l)
Azobenzene	0.7	ug/l
Benzene	1.0	ug/l
Benzidine	0.0004	ug/l
Benzo(a)pyrene	0.008	ug/l
Benzotrichloride	0.007	ug/l
Benzyl chloride	0.5	ug/l
Bis(chloroethyl)ether	0.07	ug/l
Bis(chloromethyl)ether	0.0004	ug/l
Bis(2-ethylhexyl) phthalate	6.0	ug/l
Bromodichloromethane	0.3	ug/l
Bromoform	5	ug/l
Carbazole	5	ug/l
Carbon tetrachloride	0.3	ug/l
Chlordane	0.06	ug/l
Chlorodibromomethane	0.5	ug/l
Chloroform	7.0	ug/l
4 Chloro-2-methyl aniline	0.1	ug/l
4 Chloro-2-methyl analine hydrochloride	0.2	ug/l
o-Chloronitrobenzene	3	ug/l
p-Chloronitrobenzene	5	ug/l
Chlorthalonil	30	ug/l
Diallate	1	ug/l

Table 4-1. Groundwater Quality Criteria. (Page 2 of 2)

CONTAMINANT	CRITERION	
DDT (includes DDE and DDD)	0.3	ug/l
1,2 Dibromoethane	0.001	ug/l
1,4 Dichlorobenzene	4	ug/l
3,3' Dichlorobenzidine	0.2	ug/l
1,1 Dichloroethane	1.0	ug/l
1,2 Dichloroethane (ethylene chloride)	0.5	ug/l
1,2 Dichloropropane	0.6	ug/l
1,3 Dichloropropene	0.2	ug/l
Dichlorvos	0.3	ug/l
Dieldrin	0.005	ug/l
3,3' Dimethoxybenzidine	6	ug/l
3,3 Dimethylbenzidine	0.007	
1,2 Dimethylhydrazine	60	ug/l
2,4 Dinitrotoluene	0.1	ug/l
2,6 Dinitrotoluene	0.1	ug/l
1,4 Dioxane	7.6	ug/l
1,2 Diphenylhydrazine	0.09	ug/l
Direct Black 38	0.009	ug/l
Direct Blue 6	0.009	ug/l
Direct Brown 95	0.009	ug/l
Epichlorohydrin	8	ug/l
Ethyl acrylate	2	ug/l
Ethylene dibromide	0.001	ug/l
Ethylene thiourea	1	ug/l
Folpet	20	ug/l
Furazolidone	0.02	ug/l
Furium	0.002	ug/l
Furmecyclox	3	ug/l
Heptachlor	0.02	ug/l
Heptachlor Epoxide	0.009	ug/l
Hexachlorobenzene	0.05	ug/l
Hexachlorocyclohexane (alpha)	0.001	ug/l
Hexachlorocyclohexane (technical)	0.05	ug/l
Hexachlorodibenzo-p-dioxin, mix	0.000001	ug/l
Hydrazine/Hydrazine sulfate	0.05	ug/l
Lindane	0.06	ug/l
2 Methoxy-5-nitroaniline	2	ug/l
2 Methylaniline	0.2	ug/l
2 Methylaniline hydrochloride	0.5	ug/l
4,4' Methylene bis(N,N'-dimethyl) aniline	2	ug/l
Methylene chloride (dichloromethane)	5	ug/l
Mirex	0.05	ug/l
Nitrofurazone	0.06	ug/l
N-Nitrosodiethanolamine	0.03	ug/l
N-Nitrosodiethylamine	0.00005	ug/l
N-Nitrosodimethylamine	0.002	ug/l
N-Nitrosodiphenylamine	17	ug/l
N-Nitroso-di-n-propylamine	0.01	ug/l
N-Nitrosopyrrolidine	0.04	ug/l
N-Nitroso-di-n-butylamine	0.02	ug/l
N-Nitroso-N-methylethylamine	0.004	ug/l
PAH	0.01	ug/l
PBBs	0.01	ug/l
PCBs	0.01	ug/l
o-Phenylenediamine	0.005	ug/l
Propylene oxide	0.01	ug/l
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.0000006	ug/l
Tetrachloroethylene (perchloroethylene)	0.8	ug/l
p,α,α,α-Tetrachlorotoluene	0.004	ug/l
2,4 Toluenediamine	0.002	ug/l
o-Toluidine	0.2	ug/l
Toxaphene	0.08	ug/l
Trichloroethylene	3	ug/l
2,4,6-Trichlorophenol	4	ug/l
Trimethyl phosphate	2	ug/l
Vinyl chloride	0.02	ug/l

*metals are measured as total metals

Table 4-2. Effluent Study Guidelines. (Page 1 of 2)

Group A: MCL, proposed MCL, and DCG

Reference	Constituent	Guideline Limit	Units	Source of Guideline
DOE 5400.5 DCG, Adjusted to 4 mrem/yr allowable dose per primary drinking water standards	Americium-241	1.2	pCi/L	1/25 DCG
	Antimony-124	400	pCi/L	1/25 DCG
	Antimony-125	2,000	pCi/L	1/25 DCG
	Barium-140	800	pCi/L	1/25 DCG
	Carbon-14	2,800	pCi/L	1/25 DCG
	Cerium-141	2,000	pCi/L	1/25 DCG
	Cerium-144	280	pCi/L	1/25 DCG
	Cesium-134	80	pCi/L	1/25 DCG
	Cesium-137	120	pCi/L	1/25 DCG
	Cobalt-58	1,600	pCi/L	1/25 DCG
	Cobalt-60	200	pCi/L	1/25 DCG
	Curium-242	40	pCi/L	1/25 DCG
	Curium-244	2.4	pCi/L	1/25 DCG
	Europium-154	800	pCi/L	1/25 DCG
	Europium-155	4,000	pCi/L	1/25 DCG
	Iodine-129, low detec. level	20	pCi/L	1/25 DCG
	Iodine-131	120	pCi/L	1/25 DCG
	Iron-59	800	pCi/L	1/25 DCG
	Lanthanum-140	800	pCi/L	1/25 DCG
	Lead-210	1.2	pCi/L	1/25 DCG
	Manganese-54	2,000	pCi/L	1/25 DCG
	Molybdenum-99	1,200	pCi/L	1/25 DCG
	Nickel-63	12,000	pCi/L	1/25 DCG
	Niobium-95	2,400	pCi/L	1/25 DCG
	Phosphorus-32	800	pCi/L	1/25 DCG
	Plutonium-238	1.6	pCi/L	1/25 DCG
	Plutonium-239/40	1.2	pCi/L	1/25 DCG
	Plutonium-241	80	pCi/L	1/25 DCG
	Praseodymium-144	280	pCi/L	1/25 DCG
	Promethium-147	4,000	pCi/L	1/25 DCG
	Radium-228	4	pCi/L	1/25 DCG
	Ruthenium-103	2,000	pCi/L	1/25 DCG
	Ruthenium-106	240	pCi/L	1/25 DCG
	Silver-110 mestable	400	pCi/L	1/25 DCG
	Sodium-22	400	pCi/L	1/25 DCG
	Strontium-89	800	pCi/L	1/25 DCG
	Strontium-90	40	pCi/L	1/25 DCG
	Strontium-90, low detec. level	40	pCi/L	1/25 DCG
	Technetium-99	4,000	pCi/L	1/25 DCG
	Tin-113 daughter	2,000	pCi/L	1/25 DCG
	Tritium (Hydrogen-3)	80,000	pCi/L	1/25 DCG
	Uranium-234	20	pCi/L	1/25 DCG

Table 4-2. Effluent Study Guidelines. (Page 2 of 2)

Group A: MCL, proposed MCL, and DCG

Reference	Constituent	Guideline Limit	Units	Source of Guideline
DOE 5400.5 (Contd)	Uranium-235	24	pCi/L	1/25 DCG
	Uranium-236	20	pCi/L	1/25 DCG
	Uranium-238	24	pCi/L	1/25 DCG
	Zinc-65	360	pCi/L	1/25 DCG
	Zirconium-95	1,600	pCi/L	1/25 DCG

[a]This value represents a screening value for assumed compliance with the 4 mrem/yr MCL (WAC 248-54-185).

[b]These parameters not used to select key constituents since they are indicator parameters and not actual discrete chemical or radiological constituents.

ABN = acid-based neutrals
BHC = benezine hexachloride
MCLG = maximum contamination level goal
MPN = most probable number
NTU = nephelometric turbidity unit
SMCL = secondary maximum contamination level.

For those contaminants with standards below a practical analytical detection limits, the practical quantitation limit (PQL) as defined by EPA (1986) will be used. For any contaminant that falls outside of the above described methods, a criteria will be proposed to Ecology and EPA that meets the same assessment purposes as other defined criteria.

No generally acceptable quantitative criteria for contaminants in unsaturated soils is known to exist. A study of background values for Hanford soils and groundwater is under way, but that information will not be available in time for use in the first assessments. Literature values, existing, and/or new site data may be used for this purpose. Application of such data will be consistent with the approach defined by Hoover and Legore (1991).

4.3 IMPACT ASSESSMENT TASKS

The impact assessment tasks described below will serve as an outline for preparation of impact assessment plans. Level 2 and Level 3 assessments begin with similar data collection tasks as the Level 1 assessment, but also include up-front planning for acquisition of field data used to refine the conceptual model and in application of analytical techniques such as modeling.

LEVEL 1 TASKS

TASK 1: Organize and plan facility-specific assessment

Subtasks

A. Review facility categorization information and develop assessment scope of work

B. Identify available resources - personnel, budget, etc.

C. Prepare impact assesment plan, obtain assent of regulators, and initiate Assessment

TASK 2: Characterize effluent using existing data

Subtasks

A. Review Liquid Effluent Study data

B. Obtain recent data (post Liquid Effluent Study), e.g., facility effluent monitoring plans

C. Establish quantities and loading rates for constituent inventory

D. Identify effluent constituents of concern (present in concentrations that pose a health and environmental concern, subsurface mobility, source-specific indicators, etc.)

E. Identify operational discharge factors pertinent to character of effluent (such as slug loads, variable physical and chemical properties)

TASK 3: Develop conceptual model of hydrologic responses and contaminant migration using existing data

Subtasks

A. Collect and review available geologic data - borehole and well drilling logs, core samples and outcrop analogs, soil texture analyses, geophysical logs, stratigraphic interpretations

B. Collect and review available hydrologic data - water level data, soil moisture analyses, permeameter and hydraulic conductivity analyses, pumping test data

C. Synthesize hydrologic and geologic data, and interpret hydrostratigraphic relationships - aquifers, aquitards, perched groundwater, preferential flowpaths and barriers, hydraulic communication between aquifers, water level trends

D. Describe hydrologic responses with regard to past effluent disposal practices - mounding, gradient effects

E. Review water chemistry data and describe local groundwater quality conditions - likely contaminant sources, plume movement

F. Describe soil column geochemical factors relative to contaminant mobility

TASK 4: Assess groundwater impacts and identify additional information needs

Subtasks

A. Apply analytical techniques within the context of the conceptual model and limitations due to the quality and quantity of data to:
   - Predict time to breakthrough (if this has not yet occurred)
   - Assess extent of contamination (existing)
   - Assess impact on groundwater system
   - Assess impact from continued use

B. Identify additional data needs if further information is determined necessary to adequately assess impacts

C. Evaluate adequacy of existing monitoring well network to detect potential hydrologic and contaminant impacts to groundwater

TASK 5: Prepare and distribute report

Subtasks

A. Document reference materials and data sources

B. Summarize performance of the preceding tasks and resultant conclusions

C. Issue report through DOE.

LEVELS 2 AND 3 TASKS

TASK 1: Organize and plan facility-specific assessment
(Same as Level 1 outline)

TASK 2: Characterize effluent using existing data
(Same as Level 1 outline)

TASK 3: Develop a preliminary conceptual model of hydrologic responses and contaminant migration

This task is similar to Task 4 of the Level 1 outline, except a preliminary conceptual model is developed. The preliminary conceptual model aids identification of that information necessary to refine the conceptual model and support assessment techniques that may have more rigorous data requirements.

TASK 4: Identify additional information needs and plan data collection

Levels 2 and 3 involve collection of field data and laboratory analyses. Level 2 data acquisition may include water chemistry sampling, shallow soil samples, remote sensing, geophysical surveys, water level measurements, some types of aquifer tests (no large volumes of purge water), and physical and chemical analysis of archived soil samples.

Level 3 data collection may include borehole drilling and sampling, monitoring well construction (RCRA standard), aquifer testing, and more extensive data collection for activities listed in Level 2.

Subtasks

A. Identify additional information needs

B. Establish data quality objectives according to model input needs, regulations, and procedural requirements

C. Prepare data collection plans and associated documentation

TASK 5: Collect field data

Subtasks

A. Collect samples for analyses, according to established data collection plans and sampling protocols.

TASK 6: Analyze and interpret data to refine conceptual model

Subtasks

A. Analyze data

B. Interpret data and refine conceptual model

TASK 7: Assess groundwater impacts and identify additional information needs

Level 2 and 3 assessments may include unsaturated and saturated flow and contaminant transport modeling. Level 2 assessment may use simple numerical modeling. A Level 3 assessment may involve more sophisticated numerical modeling.

Subtasks

A. Apply analytical and modeling techniques consistent with the conceptual model and limitations due to the quality and quantity of data to:
   - Predict time to breakthrough (if this has not yet occurred)
   - Assess extent of contamination (existing)
   - Assess impact on groundwater system
   - Assess impact from continued use

B. Identify additional data needs if further information is determined necessary to adequately assess impacts

C. Evaluate the adequacy of the existing monitoring well network to detect potential hydrologic and contaminant impacts to the groundwater

TASK 8: Prepare and distribute report

Subtasks

A. Document reference materials and data sources

B. Summarize performance of the preceding tasks and resultant conclusions

C. Issue report through DOE.

5.0 APPLICATION OF METHODOLOGY: STAGE 1 - CATEGORIZATION OF RECEIVING SITES

Ongoing discussions with EPA and Ecology indicate that a number of receiving sites will not require a groundwater assessment due to expected or current changes in their status. Table ES-2 reflects the current status of these negotiations as of October 4, 1991. Changes that result from further negotiations will be incorporated as they become known. Prior to resuming use of any of the "temporarily discontinued" receiving sites, DOE will conduct a groundwater impact assessment.

The remaining 14 receiving sites were categorized into one of three levels, using the methodology previously described. Table 5-1 summarizes the key factors that influenced assignment to a particular category. The appendix contains information used to aid categorization and includes:

- a summary table (Table A-1) derived from the Liquid Effluent Study
- generalized site location maps
- a set of worksheets for each receiving site with data derived from the Liquid Effluent Study, the Wastestream Characterization Report, and the Waste Information Data System (WIDS)
- available curie inventory data
- projected effluent discharge rates and schedules (Table A-2) per TPA Milestone M-17, Liquid Effluents, Final Draft, October 21, 1991.

No single factor dominated the categorization process. Basic quantitative information used included the reported curie inventory, rates of flow, contaminant concentrations in the effluent stream, and noted impacts from effluent disposal at the site to the groundwater. A major concern was the lack of site-specific data on which to base a decision.

Expected longevity of the facility was also considered. An important consideration that it would require approximately 1.5 to 2 years to construct additional groundwater wells and to collect representative data. Some receiving sites are scheduled to be taken out of service shortly after the minimum period of time that it would take to drill new monitoring wells and collect data. In these instances, a Level 3 rating would not be appropriate.

Field data being collected under CERCLA and RCRA programs were factored into the selected categorization level. Both programs represent extensive drilling and data collection programs currently under way on the Hanford Site.

It should be noted that operating conditions and/or the status of some of the facilities listed in Table 5-1 have changed since issuance of the final report of the Liquid Effluent Study (WHC 1990a). For example, discharges to the 1325-N Liquid Waste Disposal Facility are now much lower than the average flow rate used in the evaluation for the Liquid Effluent Study (300 gal/min versus current discharge rate of 2 gal/min). If average annual flow rates in the future are only a few gallons per minute, contaminant movement in the soil

column is likely insignificant. The rating for the 1325-N Liquid Waste Disposal Facility in Table 5-1 is based on recent change to a substantially lower discharge rate. Otherwise, the high radionuclide inventory, shallow vadose thickness, historically high discharge rates, and dearth of soil chemistry data would place this facility in a Level 3 assessment category.

Table 5-1. Summary of Category Assignments and Basis for Rating.

Receiving Site	Category	Basis
1. 216-U-14 Ditch	3	Soil borings and new upgradient well needed to assess status of soil column contaminants (uranium spill)
2. 216-B-3 Pond System	3	Groundwater mound has major impact on movement of contaminant plumes; requires additional wells to assess areal extent of influence
3. 100-D Ponds	3	New RCRA wells currently under construction to provide necessary additional data
4. 1325-N LWDF	1	Discharge substantially reduced (2 gal/min) so contaminant driving force is effectively eliminated
5. 216-W-LC Crib	2	Low potential for soil column loading; well remediation needed
6. 216-Z-20 Crib	2	Adequate existing soil column data and recent spectral gamma logging results; new perched water well combined with existing wells that are easily rehabilitated; intensive expedited response action investigation of adjacent area (Z cribs) provides supporting data
7. 216-U-17 Crib	1	New crib with low soil column inventory, low discharge rate and adequate RCRA equivalent monitoring wells
8. 216-S-26 Crib	1	Low soil column loading potential, moderate discharge, adequate monitoring well data
9. 216-T-1 Ditch	1	Low reported curie inventory, moderate discharge
10. 216 T-4-2 Ditch	1	Low discharge compared to historical; low reported curie inventory record

Table 5-1. Cont.

Receiving Site	Category	Basis
11. 284-W Powerhouse Pond	1	Low hazard potential of wastewater; improved modelling of impacts should be adequate for assessment
12. 2101-M Pond	1	Existing data adequate; proposed for clean closure
13. 300 Area Process Trenches	1	Impact assessment/mitigation work already under way
14. 400 Area Ponds	1	Low hazard potential; existing and ongoing monitoring data adequate for assessment

The ratings assigned for the 216-T-1 and 216-T-4-2 ditches are based on the assumption that an enhanced assessment for these facilities can be accomplished using nearby lithologic data; i.e., there are no wells in the immediate vicinity from which to obtain site-specific lithologic data. If this assumption is unacceptable, these facilities would be upgraded to Level 3 (e.g., soil borings and/or monitoring wells required).

The rating for the 284-W Powerhouse Pond is based primarily on the low hazard potential of the liquid wastestream (high salt or demineralizer type wastewater). The assigned rating assumes that modeling efforts can be used to assess the groundwater concentrations resulting from this input. Monitoring wells, however, would be required to confirm such calculations. If this is deemed necessary for the impact assessment, this facility would be upgraded to a Level 3.

6.0 REFERENCES

DOE, 1990, *Strategy for Handling and Disposing of Purgewater at the Hanford Site*, DOE-RL, 90-ERB-0761, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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Delaney, C. D., K. A. Lindsey, and S. P. Reidel, 1991, *Geology and Hydrology of the Hanford Site: A Standardized Text for use in Westinghouse Hanford Company Documents and Reports*, WHC-SD-ER-TI-003, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Hoover, J. D., and T. Legore, 1991, *Characterization and Use of Soil and Groundwater Background for the Hanford Site*, WHC-MR-0246, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989a, *Waste Stream Characterization Report*, WHC-EP-0287, Vols. 1-4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989b, *Environmental Compliance Manual*, WHC-CM-7-5, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Liquid Effluent Study Final Project Report*, WHC-EP-0367, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *Hanford Site Stream-Specific Reports*, WHC-EP-0342, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990c, *Liquid Effluent Study: Groundwater Characterization Data*, WHC-EP-0366, Westinghouse Hanford Company, Richland, Washington.

APPENDIX
RECEIVING SITE CATEGORIZATION WORKSHEET

This appendix is organized by receiving site with the following provided for each site: a generalized site location map, a categorization worksheet for each effluent stream discharged at that site, and effluent stream sampling data. In addition, curie inventory data are provided for several of the receiving sites. The primary source of information was the *Liquid Effluent Study Final Project Report*, WHC-EP-0367 (WHC 1990a). The curie inventory data were reproduced from tables included in the *Waste Stream Characterization Report*, WHC-EP-0287, Vol. 3 (WHC 1989). A summary table (Table A-1) derived from the Liquid Effluent Study is provided. Projected effluent discharge rates and schedules are provided in Table A-2.

Categorization worksheets were generated to summarize the pertinent information necessary to categorize each receiving site. As discussed in the main text of this document, the purpose of the categorization was to determine an appropriate level of effort necessary to obtain data for the groundwater impact assessments. The following is a description of the information used in the categorization and the sources of that information.

Effluent Constituents of Concern. Reported values were selected from the *Liquid Effluent Study Final Project Report*, Tables 2.xx-2. These values represent the upper 90% confidence interval concentration (abbreviated "90%C-Int" on the worksheets) from either the old or new data set. When multiple data points were provided in the 2.xx-2 tables, the maximum value was selected for the worksheets. The maximum was reported on the worksheets to indicate a potential, worst case loading of the soil column from previous discharges.

The list of constituents is not a verbatim reproduction of the 2.xx-2 tables, i.e., not all constituents that exceeded a study guideline were included on the worksheets. The list of constituents of concern was selected with an emphasis on human health; therefore, radionuclides, volatile organic compounds, and heavy metals were typically included in the lists, while common ions were typically excluded. In other words, constituents which exceeded the primary maximum contaminant levels (MCL) or 1/25 derived concentration guides (DCG) were included, whereas exceedances of secondary MCL were typically omitted. An exception is the 284-W Powerplant wastewater effluent stream, where chloride concentrations greatly exceeded the guideline.

Along with the highest reported 90% confidence interval concentration, the study guideline has been provided on the worksheet for comparison purposes. The guidelines were taken from WHC (1990a), Table 2-1, specifically Group A and Group C. No regulatory requirement or policy is intended or implied by these guidelines. The guidelines were included on the worksheets to provide a perspective as to the relative magnitude of the exceedance.

Effluent Designation. Effluent streams were designated in WHC (1990a) as being either dangerous or nondangerous and as either radioactive or nonradioactive. The designation was based on what was referred to as the new data set. The designation provided on the worksheets was copied from WHC (1990a, Table 3-1).

Effluent Volume. The total volume of effluent discharged to the receiving site, as reported in WHC (1990a, Table 2.xx-1), was provided on the worksheets.

Peak Effluent Flowrate. The greatest flowrate reported by WHC (1990a, Table 2.xx-1) was included in the worksheets. The greatest flowrate, although not representative of current discharge conditions, was selected to indicate a potential, worst-case hydrologic impact and loading from previous discharges. All flowrates were converted to units of liters per month for standardization, assuming continuous flow for the entire month.

Receiving Site Location. The location of the receiving site, by Hanford operational area, was identified. The location is pertinent when considering the general proximity to the Columbia River and/or the depth to groundwater. Receiving sites in the 200 Areas can be considered to be more remote with respect to hypothetical public receptors than those sites in the 100 or 300 Areas, based on distance to the river and/or depth to groundwater.

LES Final Report Conclusions and Recommendations. Conclusions and recommendations, as identified by WHC (1990a), were extracted and included in the worksheets as an indication of the need for further site-specific data collection activities.

EPA Priority Classification. The EPA, in their review and comment on *Liquid Effluent Study Final Project Report* (WHC 1990a), identified four priority classes for effluent streams. The four classes are defined as follows.

> **High** - Those streams for which "continued discharge of liquid effluents, as currently allowed in Milestone M-17 of the Tri-Party Agreement, will, in some cases, cause a significant increased loading of contaminants in the environment, and continued discharges will result in further releases of radionuclides and/or hazardous substances requiring future cleanup.
>
> "In other instances, continued discharge of certain of these effluents to their respective highly contaminated sites will provide a driving head that will tend to spread contamination, even with the proposed treatment or discharge controls, thereby exacerbating the cleanup problem."

9 2 1 2 4 6 8 1 5 7 0

Negotiations Required for Restart - Pertains to effluent discharges from the PUREX Plant, should the plant be restarted.

Lower Priority Streams - Streams which require little additional activity other than that described in the future activities section of the stream-specific addenda.

Negotiations Complete - Current Agreement milestones and schedules are appropriate.

Termination Date. Reported dates are the result of negotiations on interim operating restrictions for the particular effluent streams.

Categorization. Level-of-effort categories were defined in Chapter 3. As previously stated, Category 3 represents the greatest level of effort (e.g., drilling) and Category 1 represents the least level of effort (e.g., existing data are sufficient) necessary to conduct the groundwater impact assessments.

Table A-1. TPA Milestone M-17 Schedule for Reduction and Cessation of Liquid Effluent Discharge to Receiving Sites.

Receiving Site	Associated Effluent Stream	Milestone	Date	Discharge (gal/min)[a]
216-U-14 Ditch	UO_3/U Plant Wastewater (during stabilization run)	M-17-17A	09/91	450
				750
		M-17-17D	12/92	250
		M-17-17	06/95	0
	Surface Contamination Control Water	M-17-17B	During stabiliz-ation run	300
		M-17-17B	02/92	0
	242-S Evaporator Steam Condensate	M-17-18A	09/91	50
		M-17-18	06/95	0
216-B-3 Ponds	PUREX Steam Condensate	M-17-22	06/95	0
	PUREX Cooling Water	M-17-23	06/95	0
	Decon Laundry Wastewater	M-17-35	06/95	0
	Other Waste Streams	NA	NA	NA
100-D Ponds	183-D Filter Backwash	NA	NA	NA
1325-N LWDF	N Reactor Effluent	M-17-15A	09/91	2
		M-17-151	06/95	0
216-W-LWC Crib	2724 W Laundry Wastewater	M-17-34	06/95	0
216-Z-20 Crib	PFP Wastewater	M-17-16A	09/91	160
		M-17-16D	01/94	75
		M-17-16	06/95	0
216-U-17 Crib	UO_3 Plant Process Condensate	M-17-19A	09/91	10
		M-17-19	06/95	0
216-S-26 Crib	222 S Laboratory Wastewater	M-17-29	06/95	0
216-T-1 Ditch	T Plant Laboratory Wastewater	M-17-42	06/95	0
216-T-4-2 Ditch	T Plant Wastewater	M-17-41	06/95	0
284-W Powerplant Pond	284-W Powerplant Wastewater	M-17-38	06/95	0
2101-M Pond	2101 M Laboratory Wastewater	M-17-43	06/95	0
300 Area Process Trenches	300 Area Process Wastewater	NA	NA	NA
400 Area Ponds	400 Area Secondary Cooling	NA	NA	NA

[a]Maximum allowed flow rate (in gal/min) averaged over a calendar month.

		Waste Stream	Receiving Site					
Receiving Site	Associated Effluent Stream	1 Effluent Determined Radioactive [a,b]	2 Presence of Key Chem./Rad. Constituents [c,d]	3 Presence of Key Chem./Rad. Constituents in Groundwater [d,e]	4 Breakthrough of Other Key Chem./Rad. Constituents [c,d,f]	5 Use of at Least an Additional 10% of Remaining Soil Column [g]	6 Volume Impact on Groundwater Flow Regime [h]	7 Further Evaluation Priority – U.S. EPA [i]
1. 100-D Ponds [j]	183-D Filter Backwash Wastewater	No	Yes	N/D [k]	Yes	No	No	Low
2. 1325N Crib [j]	N Reactor Effluent	Yes	Yes	Yes	Yes	No [m]	No	Hi
3. 216-B-3 Pond System [j]	PUREX Plant Chemical Sewer [n]	No	Yes	No	No	No	Yes	–
	PUREX Plant Cooling Water	No	Yes					
	242-A Evaporator Cooling Water [p]	Yes	Yes					
	B Plant Cooling Water	No	Yes					
	241-A Tank Farm Cooling Water	No	Yes					
	284-E Powerplant Wastewater	No	Yes					
	244-AR Vault Cooling Water	No	Yes					
	242-A Evaporator Steam Condensate	No	Yes					
4. 216-S-26 Crib	222-S Laboratory Wastewater	Yes	Yes	No	No	No	No	Low
5. 216-T-1 Ditch	T Plant Laboratory Wastewater	No	Yes	N/D [k]	No	No	No	Low
6. 216-T-4-2 Ditch	T Plant Wastewater	No	Yes	N/D [k]	No	No	No	Low
7. 216-U-14 Ditch	UO_3/U Plant Wastewater	No	Yes	No	Yes	No	No	Hi
	242-S Evaporator Steam Condensate	No	Yes					
8. 216-U-17 Crib	UO_3 Plant Process Condensate [p]	Yes	Yes	No	No	No	No	Hi
9. 216-W-LC Crib	2724-W Laundry Wastewater	Yes	Yes	N/D [k]	No	No	No	Low
10. 216-Z-20 Crib	Plutonium Finishing Plant Wastewater	Yes	Yes	No	No	No	No	Low
11. 200-W Powerhouse Pond	284-W Powerplant Wastewater	No	Yes	N/D [k]	Yes	No	No	Low
12. 2101-M Pond [j]	2101-M Laboratory Wastewater [p]	No	Yes	No	No	No	No	Low
13. 300 Area Process Trenches [j]	300 Area Process Wastewater	No	Yes	Yes	No	No	No	Low
14. 400 Area Ponds	400 Area Secondary Cooling Water	No	No	No	No	No	No	Low

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FOOTNOTES

a) Based on effluent sampling data collected from October 1989 to March 1990 as part of Liquid Effluent Study or on sampling data collected from 1985 to October 1989 for wastestreams identified in footnote p.

b) For this study, wastestreams are radioactive if any constituent exceeds concentration standards in Westinghouse Environmental Compliance Manual (1989b), Part N, Groundwater Protection.

c) Based on effluent sampling data collected from 1985 to March 1990.

d) Key constituents are effluent constituents that exceed study guidelines in Liquid Effluent Study Final Project Report (WHC 1990a, Table 2-1). (No regulatory requirement or policy is intended or implied by these guidelines.)

e) Key effluent constituents present in the groundwater that exceed Group A study guidelines in Table 2-1 of WHC document (1990a) and have resulted from discharges to the receiving site. (No regulatory requirement or policy is intended by these guidelines.) Based on groundwater sampling data collected from January 1989 to May 1990.

f) Movement of other key effluent constituents from the vadose zone into the groundwater based on average discharge rates and one-dimensional flow and transport analyses (WHC 1990a, Appendix B).

g) Based on average discharge rates and one-dimensional flow and transport analyses (WHC 1990a, Appendix B).

h) Based on an effluent discharge rate greater than the natural recharge rate from Cold Creek/Dry Creek recharge area for 200 Area sites. Groundwater patterns at sites along the Columbia River are important only when associated with groundwater mounds due to artificial recharge and mounts not masked by fluctuations of the river.

i) EPA response to Liquid Effluent Study correspondence.

j) Regulated units based on previous identification as RCRA disposal TSD facility.

k) No wells at receiving site to sample groundwater; well at 216-W-LC Crib requires rehabilitation to collect representative groundwater sample.

m) Based on current discharge rates to the soil column and/or water quality.

n) PUREX Chemical Sewer discharges to 216-A-29 Ditch which flows into the 216-B-3 Pond System.

p) Wastestream not sampled as part of Liquid Effluent Study.

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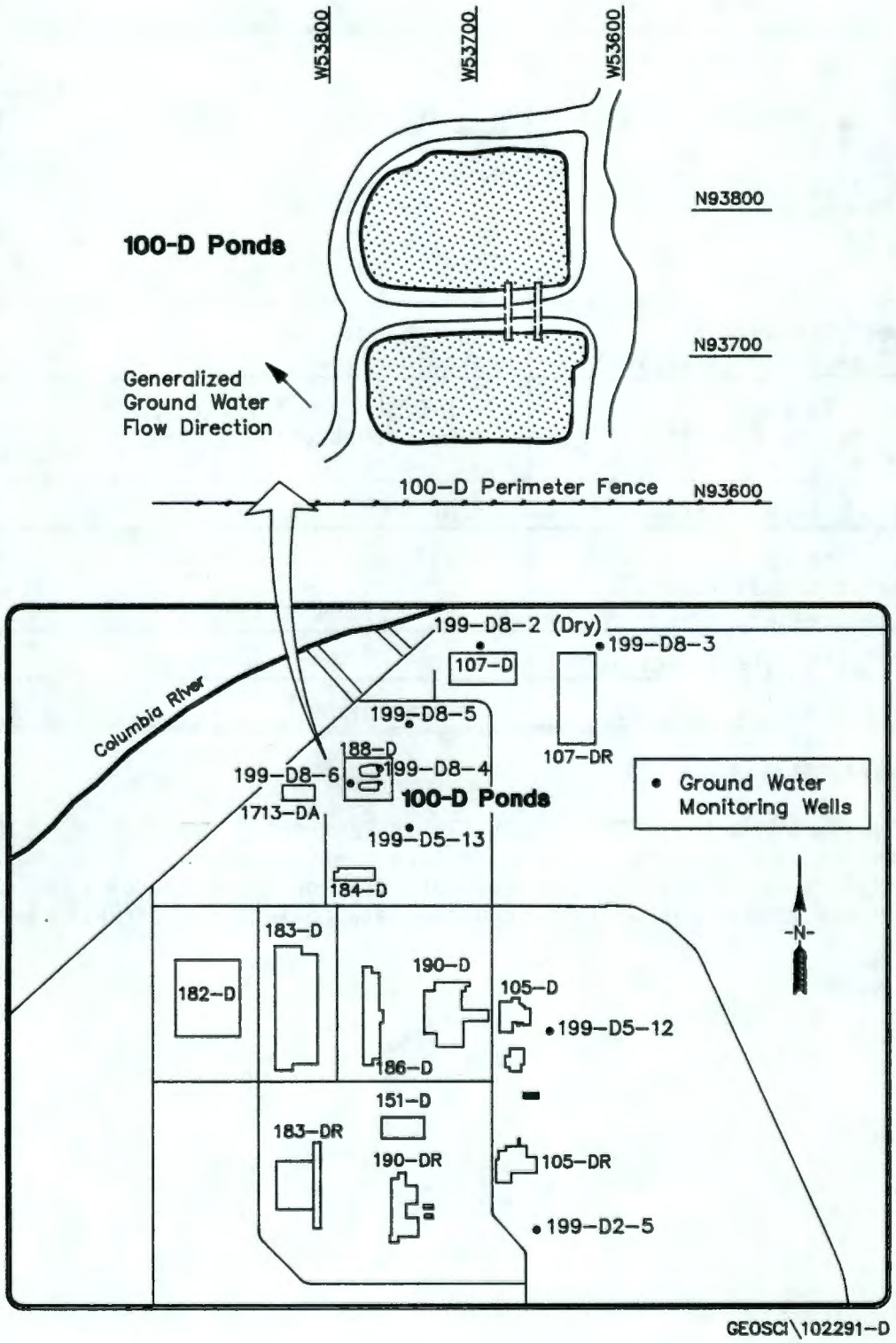
Figure A-1. Well Location and Site Map for 100-D Ponds.



RECEIVING SITE CATEGORIZATION WORKSHEET
100-D PONDS

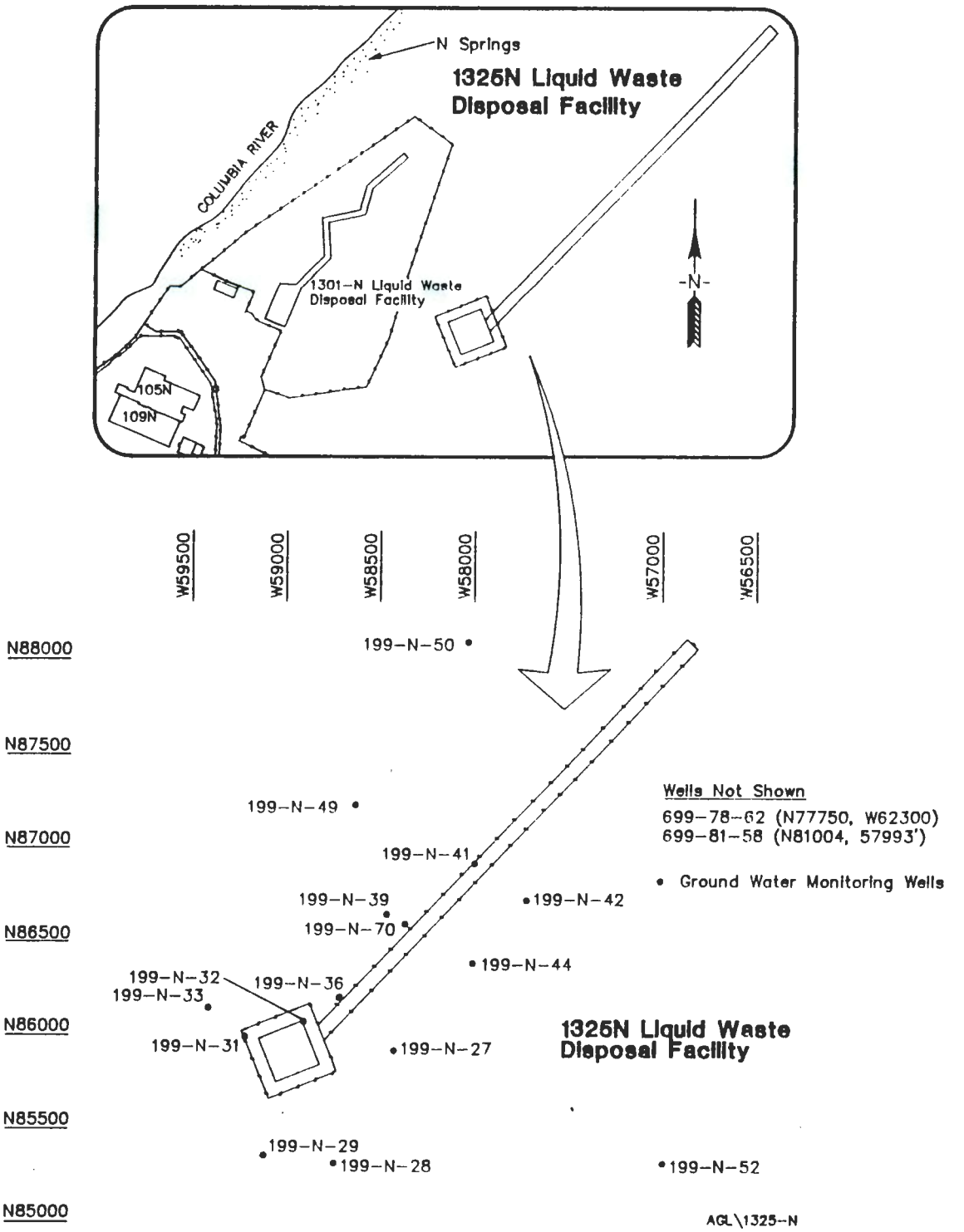
Effluent Stream Name: 183-D Filter Backwash Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.1-2)	Constituent	Maximum 90%C-Int, ppb	Guideline, ppb
	chromium	220	50
	lead	120	50
	mercury	10	2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.1-1)	3.1 E+07 L from 1/77 to 7/90 ponds constructed in 1977 1.89 E+05 L/mo		
Receiving Site Location:	100 Area		
Conclusions and Recommendations: (WHC-EP-0367)	install monitoring wells		
EPA Priority Classification:	low		
Termination Date:	to be continued		

CATEGORIZATION: 3

Four groundwater monitoring wells are currently being constructed at this site in accordance with an Agreement milestone, to be completed by 12/91. Ponds are a RCRA treatment, storage, or disposal (TSD) facility. Impact assessment will incorporate data collected under RCRA program.

Figure A-2. 1325-N Liquid Waste Disposal Facility.



RECEIVING SITE CATEGORIZATION WORKSHEET
1325-N LIQUID WASTE DISPOSAL FACILITY (Crib)

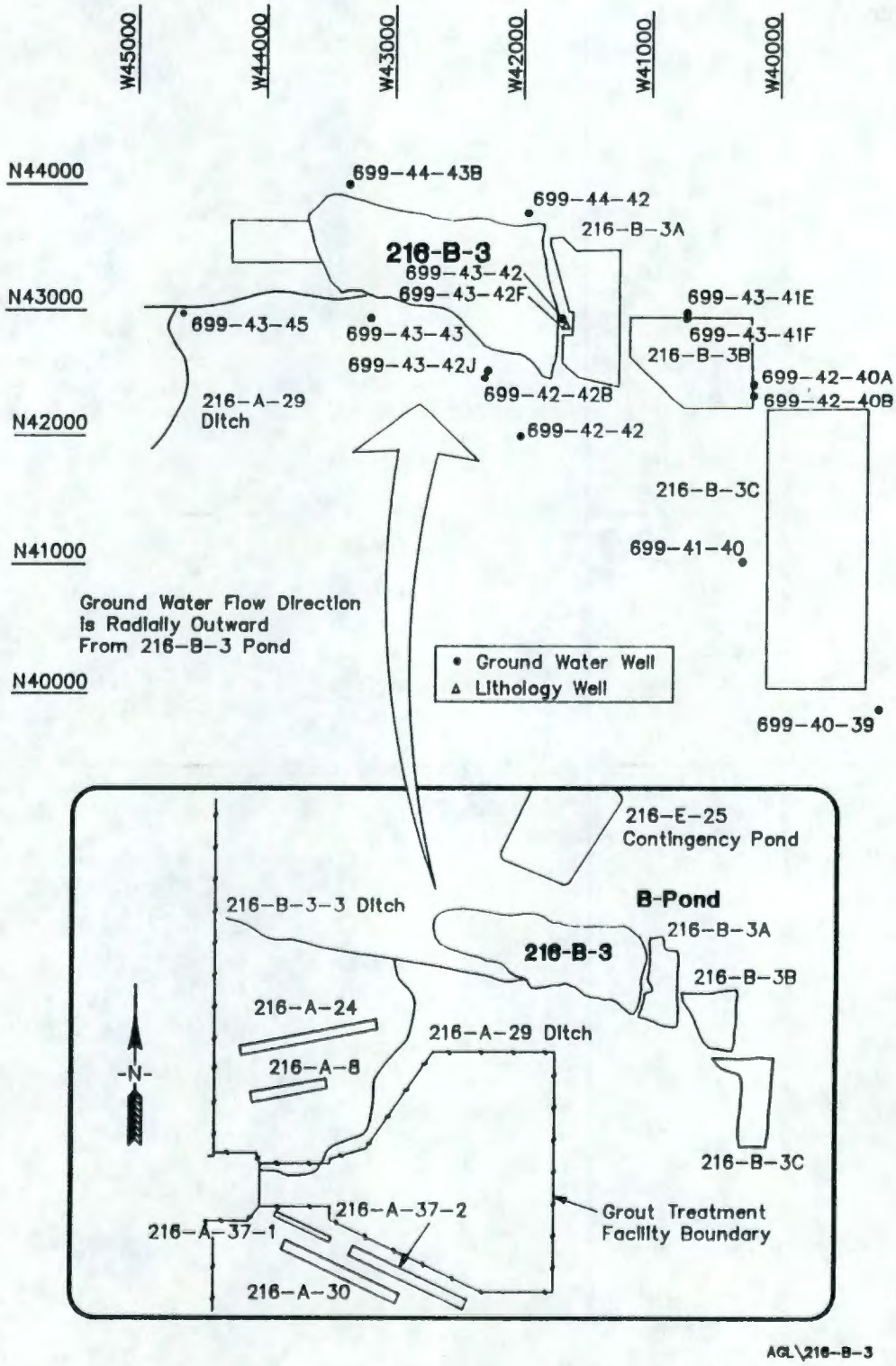
Effluent Stream Name: N Reactor Effluent

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.3-2)	Constituent	Maximum 90%C-Int, pCi/L	Guideline, Pci/L
	hydrogen-3	198,000	80,000
	manganese-54	64,000	2,000
	iron-59	22,000	800
	cobalt-60	41,000	200
	zinc-65	2,500	360
	strontium-89	74,000	800
	strontium-90	176,000	40
	ruthenium-106	31,000	240
	iodine-131	160,000	120
	cesium-134	1,500	80
	cesium-137	47,000	120
	lanthanum-140	910,000	800
	plutonium-239	420	1.2
	americium-241	70	1.2
	phosphorus-32	4,500	800
	cobalt-58	3,300	1,600
	zirconium-95	11,000	1,600
	niobium-95	23,000	2,400
	molybdenum-99	400,000	1,200
	ruthenium-103	7,600	2,000
	antimony-124	1,600	400
	antimony-125	5,000	2,000
	barium-140	48,000	800
	cerium-141	15,000	2,000
	cerium-144	39,000	280
	plutonium-238	64	1.6
	lead-210	3	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous radioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.3-1)	7.15 E+09 L from 1/83 to 4/90 Crib received effluent since 1983, trench added in 1986. 2.13 E+08 L/mo 1985 - 7/87		
Receiving Site Location:	100 Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	Site-specific evaluation recommended prior to future use of receiving site. (footnote w)		
EPA Priority Classification:	HIGH		
Termination Date:	6/95		

CATEGORIZATION: 3

Categorization based on potential radionuclide loading of soil column. A site-specific evaluation is recommended prior to future use of receiving site (WHC 1990a, Table 3-1, footnote w). Impact assessment activities will incorporate ongoing activities managed under other programs.

Figure A-3. Well Location and Site Map for 216-B-3 Pond System.



RECEIVING SITE CATEGORIZATION WORKSHEET (a)
216-B-3 POND

Effluent Stream Name: PUREX Chemical Sewer

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.11-2a)	Constituent	Maximum 90%C-Int, ppb	Guideline,
	acetone	340	50
	nitrate	70,300	45,000
	sulfate	1,470,000	250,000
		Pci/L	Pci/L
	strontium-90	150	40
	cesium-137	330	120
	americium-241	48	1.2
	promethium-147	4,300	4,000
	uranium (isotopes)	150	20
	plutonium-239	6	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.11-1a)	1.04 E+10 L from 1/76 to 12/88 lobe B-3 placed into service 1945 B-3A 1983 B-3B 1984 B-3C 1985 2.0 E+08 L/mo		
Receiving Site Location:	200 E Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	groundwater impact evaluation recommended (footnote s)		
EPA Priority Classification:	to be negotiated		
Termination Date:	6/95		

9 2 1 2 4 6 8 1 5 8 0

RECEIVING SITE CATEGORIZATION WORKSHEET (b)
216-B-3 POND (continued)

Effluent Stream Name: PUREX Cooling Water

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.11-2b)	Constituent	Maximum 90%C-Int, pCi/L	Guideline, pCi/L
	cesium-137	260	120
	uranium (isotopes)	62	20
	plutonium-239	10	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.11-1b)	8.07 E+10 L from 1/76 to 12/88 lobe B-3 placed into service 1945 B-3A 1983 B-3B 1984 B-3C 1985 1.14 E+09 L/mo		
Receiving Site Location:	200 E Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	groundwater impact evaluation recommended (footnote s)		
EPA Priority Classification:	to be negotiated		
Termination Date:	6/95		

RECEIVING SITE CATEGORIZATION WORKSHEET (c)
216-B-3 POND (continued)

Effluent Stream Name: 242-A Evaporator Cooling Water

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.11-2c)	Constituent / Maximum 90%C-Int, pCi/L / Guideline, pCi/L strontium-90 190 40 cesium-137 160 120 uranium (isotopes) 140 20
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous radioactive
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.11-1c)	3.61 E+10 L from 3/77 to 12/88 lobe B-3 placed into service 1945 B-3A 1983 B-3B 1984 B-3C 1985 6.0 E+08 L/mo
Receiving Site Location:	200 E Area
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	groundwater impact evaluation recommended (footnote s)
EPA Priority Classification:	low
Termination Date:	to be continued

RECEIVING SITE CATEGORIZATION WORKSHEET (d)
216-B-3 POND (continued)

Effluent Stream Name: B-Plant Cooling Water

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.11-2d)	Constituent	Maximum 90%C-Int, pCi/L	Guideline, pCi/L
	americium-241	540	1.2
	cobalt-60	700	200
	cesium-137	960	120
	strontium-90	97	40
	uranium (isotopes)	380	20
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.11-1d)	6.3 E+10 L from 1/68 to 12/87 lobe B-3 placed into service 1945 B-3A 1983 B-3B 1984 B-3C 1985 2.77 E+08 L/mo		
Receiving Site Location:	200 E Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	groundwater impact evaluation recommended (footnote s)		
EPA Priority Classification:	low		
Termination Date:	to be continued		

RECEIVING SITE CATEGORIZATION WORKSHEET (e)
216-B-3 POND (continued)

Effluent Stream Name: 241-A Tank Farm Cooling Water

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.11-2e)	Constituent	Maximum 90%C-Int, ppb	Guideline, ppb
	lead	110	50
		pCi/L	pCi/L
	cesium-137	1,100	120
	uranium (isotopes)	340	20
	plutonium-239	3.5	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous radioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.11-1e)	1.75 E+10 L from 1/76 to 12/88 lobe B-3 placed into service 1945 B-3A 1983 B-3B 1984 B-3C 1985 7.29 E+07 L/mo		
Receiving Site Location:	200 E Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	groundwater impact evaluation recommended (footnote s)		
EPA Priority Classification:	low		
Termination Date:	to be continued		

RECEIVING SITE CATEGORIZATION WORKSHEET (f)
216-B-3 POND (continued)

Effluent Stream Name: 284-E Powerplant Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.11-2f)	Constituent	Maximum 90%C-Int, ppb	Guideline, ppb
	aluminum	3,500	50
	barium	14,000	1,000
	chloride	7.1E+07	250,000
	fluoride	160,000	4,000
	sulfate	1.2E+06	250,000
	zinc	13,000	5,000
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.11-1f)	data not available lobe B-3 placed into service 1945 B-3A 1983 B-3B 1984 B-3C 1985 1.23 E+07 L/mo		
Receiving Site Location:	200 E Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	groundwater impact evaluation recommended (footnote s)		
EPA Priority Classification:	low		
Termination Date:	to be continued		

RECEIVING SITE CATEGORIZATION WORKSHEET (g)
216-B-3 POND (continued)

Effluent Stream Name: 244-AR Vault Cooling Water

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.11-2g)	Constituent	Maximum 90%C-Int, pCi/L	Guideline, pCi/L
	strontium-90	16,000	40
	cesium-137	200	120
	uranium (isotopes)	54	20
	plutonium-239	8.7	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.11-1g)	1.26 E+09 L from 1/76 to 12/88 lobe B-3 placed into service 1945 B-3A 1983 B-3B 1984 B-3C 1985 6.88 E+06 L/mo		
Receiving Site Location:	200 E Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	groundwater impact evaluation recommended (footnote s)		
EPA Priority Classification:	low		
Termination Date:	to be continued		

RECEIVING SITE CATEGORIZATION WORKSHEET (h)
216-B-3 POND (continued)

Effluent Stream Name: 242-A Evaporator Steam Condensate

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.11-2h)	Constituent — Maximum 90%C-Int, pCi/L — Guideline, pCi/L strontium-90 — 48 — 40 cesium-137 — 200 — 120 hydrogen-3 — 95,000 — 80,000 americium-241 — 100 — 1.2 plutonium-239 — 4.5 — 1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.11-1h)	5.18 E+08 L from 3/77 to 12/88 lobe B-3 placed into service 1945 B-3A 1983 B-3B 1984 B-3C 1985 2.45 E+05 L/mo
Receiving Site Location:	200 E Area
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	groundwater impact evaluation recommended (footnote s)
EPA Priority Classification:	low
Termination Date:	to be continued

Categorization: 3

High effluent volume and known hydrologic impact (i.e., potentiometric mounding). Footnote "s" of Table 3-1, "A groundwater evaluation to be initiated to more accurately asses impacts of continued use of receiving site."

Impact assessment will incorporate data obtained under other ongoing programs.

Curie Inventory Data for 216-B-3 Pond System.

Waste Information Data System
Radionuclide Inventory
(In Curies)

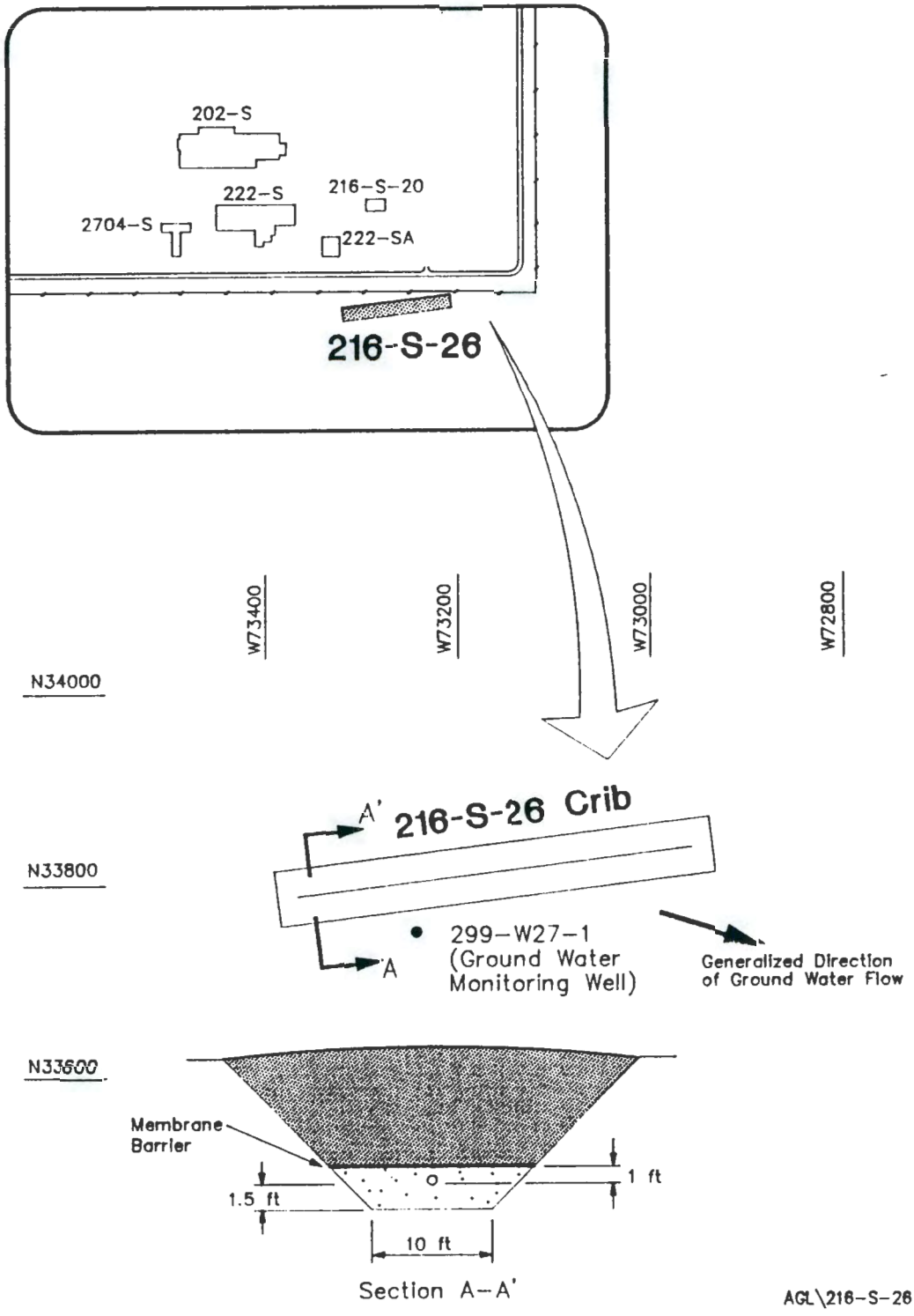
These Values Are Decayed Thru: 12/31/88

Site Name: 216-B-3

H-3:	829.00000	Ru-103:		Th-232:	
C-14:		Ru-106:	.00013	U-233:	
Na-22:		Sn-113:		U-234:	
Mn-54:		Sb-125:		U-235:	
Co-58:		I-129:		U-238:	
Fe-59:		Cs-134:		Np-237:	
Co-60:		Cs-137:	94.90000	Pu-238:	
Ni-63:		Ce-141:		Pu-239:	.55200
Kr-85:		Ce-144:		Pu-240:	
Sr-90:	103.00000	Pr-144:		Pu-241:	
Y-91:		Pm-147:	1.03000	Pu-242:	
Nb-95:		Eu-152:		Am-241:	3.52000
Zr-95:		Eu-154:		Am-243:	
Tc-99:		Eu-155:		Cm-245:	

Inventory Total U:		Total Reported Alpha:	16.00000
Inventory Total Pu:		Total Reported Beta:	393.00000
Site Reported Total:		Total Reported Gamma:	
Total Volume Disposed:	199000000000	Last Updated:	July 30, 1987

Figure A-4. Well Location and Site Map for 216-S-26 Crib.



RECEIVING SITE CATEGORIZATION WORKSHEET
216-S-26 CRIB

Effluent Stream Name: 222-S Laboratory Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.17-2)	Constituent	Maximum 90%C-Int, pCi/L	Guideline, pCi/L
	americium-241	63	1.2
	cobalt-60	280	200
	cesium-137	360	120
	manganese-54	1,900	2,000
	strontium-90	82	40
	uranium (isotopes)	670	20
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous radioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.17-1)	1.51 E+08 L, from 10/84 to 12/88 crib constructed in 1984 2.34 E+06 L/mo		
Receiving Site Location:	200 W Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	none		
EPA Priority Classification:	low		
Termination Date:	6/95		

CATEGORIZATION: 1

Categorization based on WHC (1990a) of no adverse impact, and based on EPA's low priority classification. Existing data are sufficient to conduct impact assessment.

9 2 1 2 4 6 8 1 5 9 0

Curie Inventory Data for 216-S-25 Crib.

Waste Information Data System
Radionuclide Inventory
(In Curies)

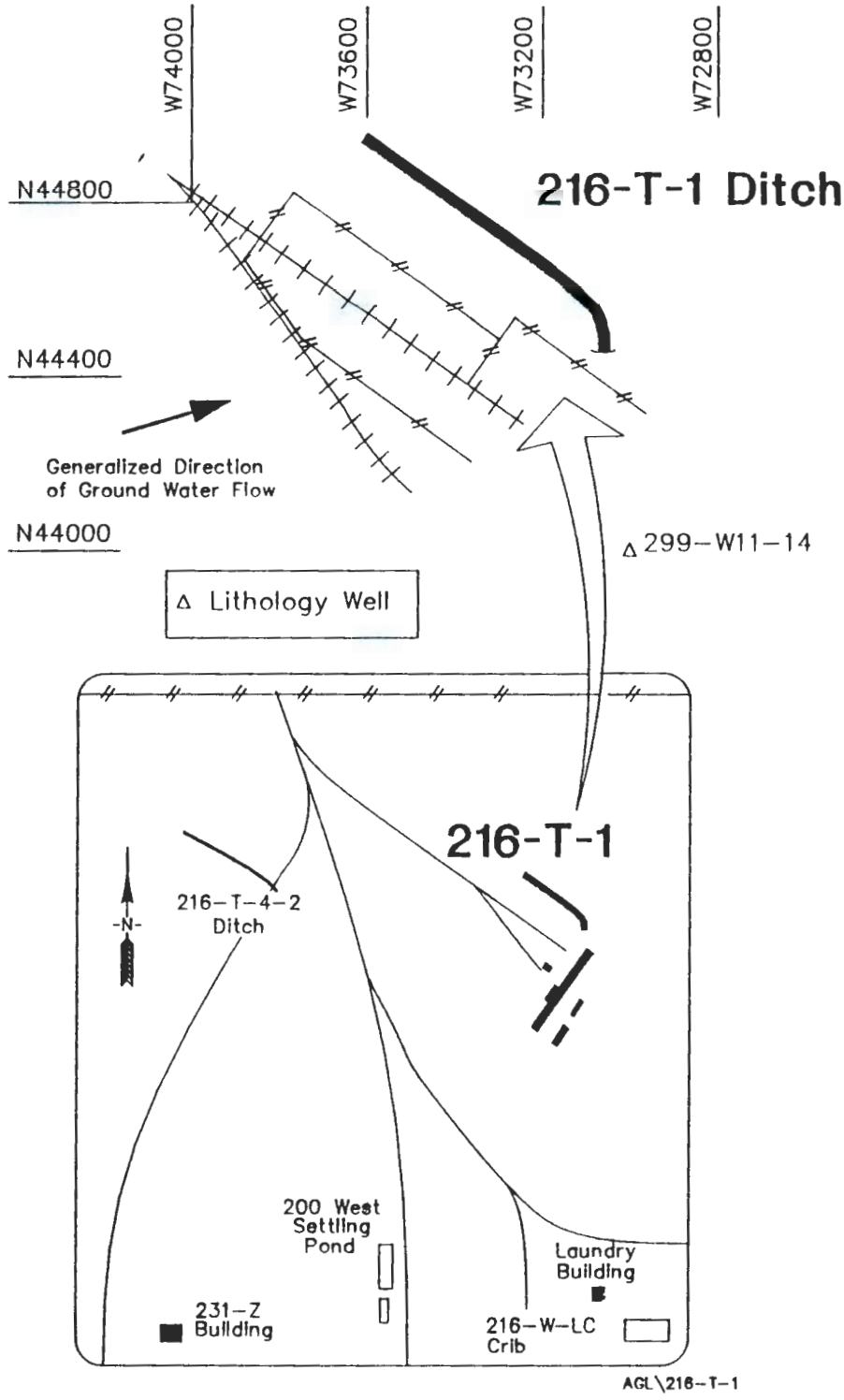
These Values Are Decayed Thru: 12/31/88

Site Name: 216-S-26

H-3:		Ru-103:		Th-232:	
C-14:		Ru-106:		U-233:	
Na-22:		Sn-113:		U-234:	
Mn-54:		Sb-125:		U-235:	
Co-58:		I-129:		U-238:	
Fe-59:		Cs-134:		Np-237:	
Co-60:		Cs-137:	.00235	Pu-238:	
Ni-63:		Ce-141:		Pu-239:	.00009
Kr-85:		Ce-144:		Pu-240:	
Sr-90:	.00175	Pr-144:		Pu-241:	
Y-91:		Pm-147:		Pu-242:	
Nb-95:		Eu-152:		Am-241:	.00045
Zr-95:		Eu-154:		Am-243:	
Tc-99:		Eu-155:		Cm-245:	

Inventory Total U:		Total Reported Alpha:	.00074
Inventory Total Pu:		Total Reported Beta:	.00909
Site Reported Total:		Total Reported Gamma:	
Total Volume Disposed:	132000000	Last Updated:	July 30, 1987

Figure A-5. Well Location and Site Map for 216-T-1 Ditch.



RECEIVING SITE CATEGORIZATION WORKSHEET
216-T-1 DITCH

Effluent Stream Name: T-Plant Laboratory Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.18-2)	Constituent	Maximum 90%C-Int, ppb	Guideline, ppb
	lead	160	50
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.18-1)	1.77 E+08 L, from 1944 to 1975 ditch constructed in 1944 1.08 E+07 L/mo		
Receiving Site Location:	200 W Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	none		
EPA Priority Classification:	low		
Termination Date:	6/95		

CATEGORIZATION: 1

Categorization based on EPA's low priority classification and few constituents of concern. Existing data are sufficient to conduct impact assessment.

9 2 1 2 4 6 8 1 5 9 3

Curie Inventory Data for 216-T-1 Ditch.

Waste Information Data System
Radionuclide Inventory
(In Curies)

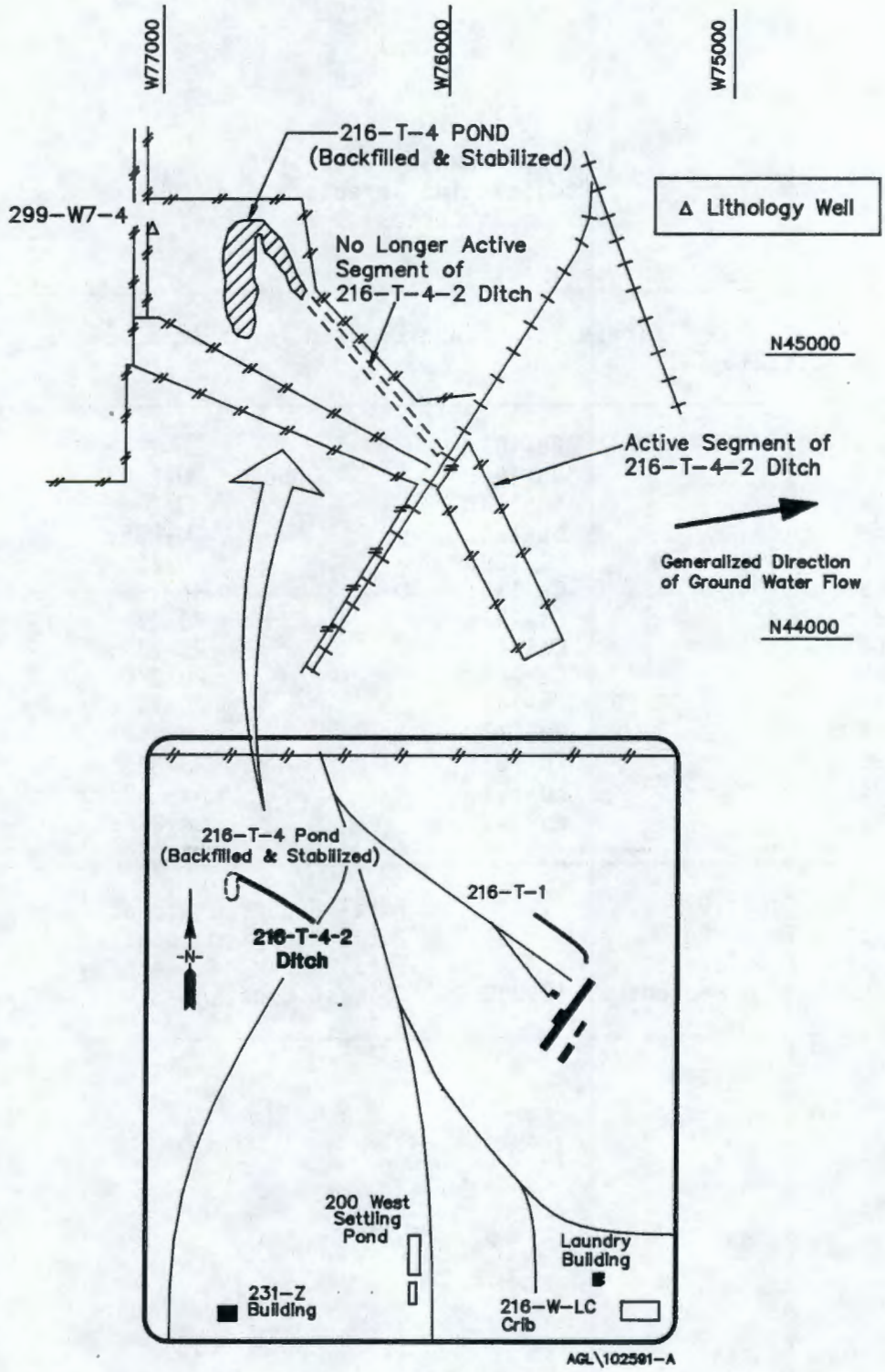
These Values Are Decayed Thru: 12/31/88

Site Name: 216-T-1

H-3:		Ru-103:		Th-232:	
C-14:		Ru-106:	.00000	U-233:	
Na-22:		Sn-113:		U-234:	
Mn-54:		Sb-125:		U-235:	
Co-58:		I-129:		U-238:	
Fe-59:		Cs-134:		Np-237:	
Co-60:		Cs-137:	.03960	Pu-238:	
Ni-63:		Ce-141:		Pu-239:	
Kr-85:		Ce-144:		Pu-240:	
Sr-90:	.03720	Pr-144:		Pu-241:	
Y-91:		Pm-147:		Pu-242:	
Nb-95:		Eu-152:		Am-241:	
Zr-95:		Eu-154:		Am-243:	
Tc-99:		Eu-155:		Cm-245:	

Inventory Total U:		Total Reported Alpha:	.00614
Inventory Total Pu:		Total Reported Beta:	.15100
Site Reported Total:		Total Reported Gamma:	
Total Volume Disposed:	177000000	Last Updated:	July 30, 1987

Figure A-6. Well Location and Site Map for 216-T-4-2 Ditch.



RECEIVING SITE CATEGORIZATION WORKSHEET
216-T-4-2 DITCH

Effluent Stream Name: T-Plant Wastewater

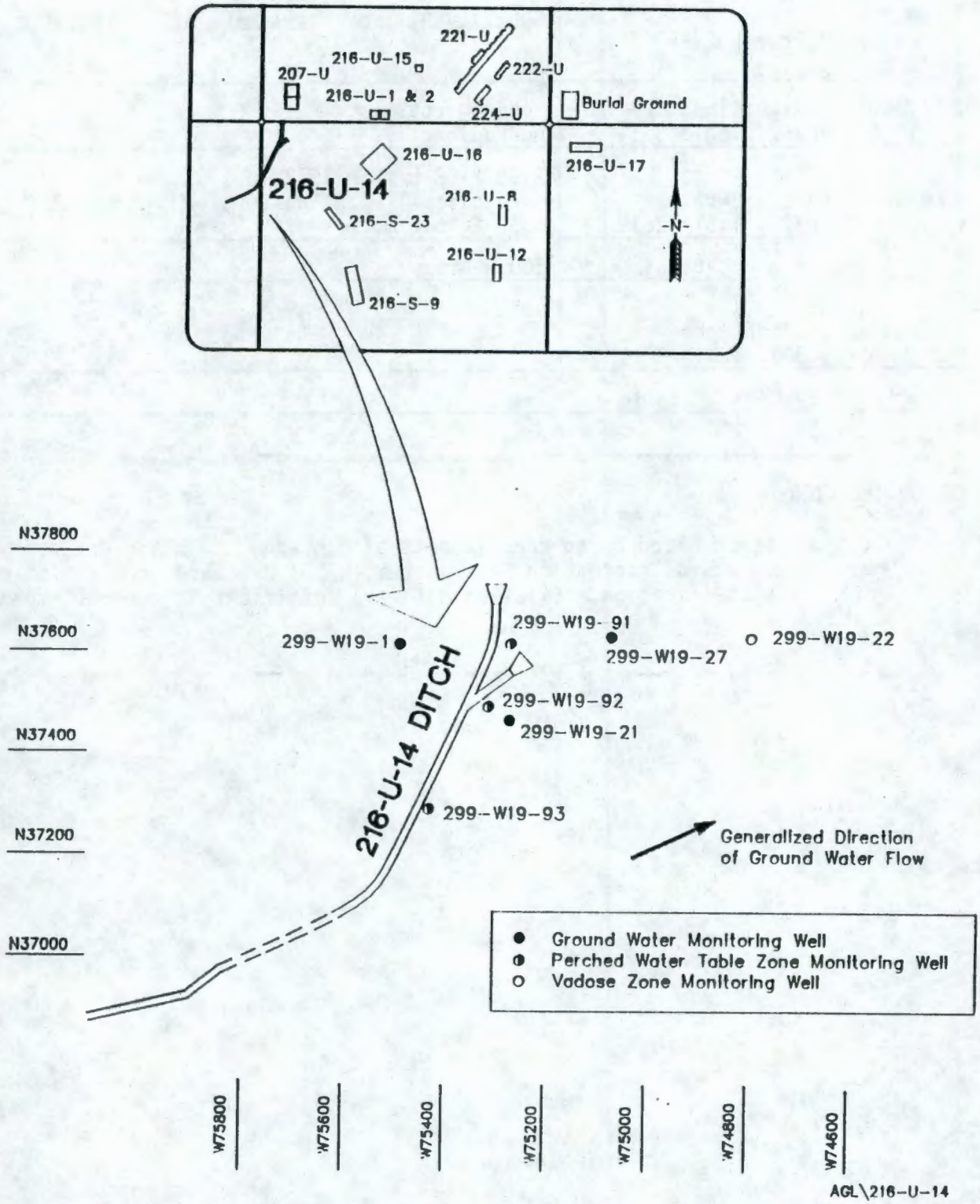
Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.19-2)	Constituent / Maximum 90%C-Int / Guideline none
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.19-1)	2.98 E+08 L from 1972 to 1987 received T-Plant wastewater since 1972 1.60 E+06 L/mo
Receiving Site Location:	200 W Area
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	none
EPA Priority Classification:	low
Termination Date:	6/95

CATEGORIZATION: 1

Categorization based on no constituents of concern, low curie inventory reported in Waste Information Data System (WIDS) database, and EPA's low priority classification. Existing data are sufficient to conduct impact assessment.

9 2 1 2 4 6 8 1 5 9 6

Figure A-7. Well Location and Site Map for 216-U-14 Ditch.



RECEIVING SITE CATEGORIZATION WORKSHEET (a)
216-U-14 DITCH

Effluent Stream Name: UO_3/U Plant Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.20-2a)	Constituent	Maximum 90%C-Int, pCi/L	Guideline, pCi/L
	strontium-90	1,800	40
	plutonium-239	17	1.2
	uranium (isotopes)	41	20
	americium-241	260	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.20-1a)	2.30 E+09 L from 1/84 - 12/88 ditch constructed in 1944 1.64 E+08 L/mo (operating)		
Receiving Site Location:	200 W Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	breakthrough predicted groundwater evaluation recommended (footnote s)		
EPA Priority Classification:	HIGH		
Termination Date:	6/95		

9 2 1 2 4 6 8 1 5 9 8

RECEIVING SITE CATEGORIZATION WORKSHEET (b)
216-U-14 DITCH (continued)

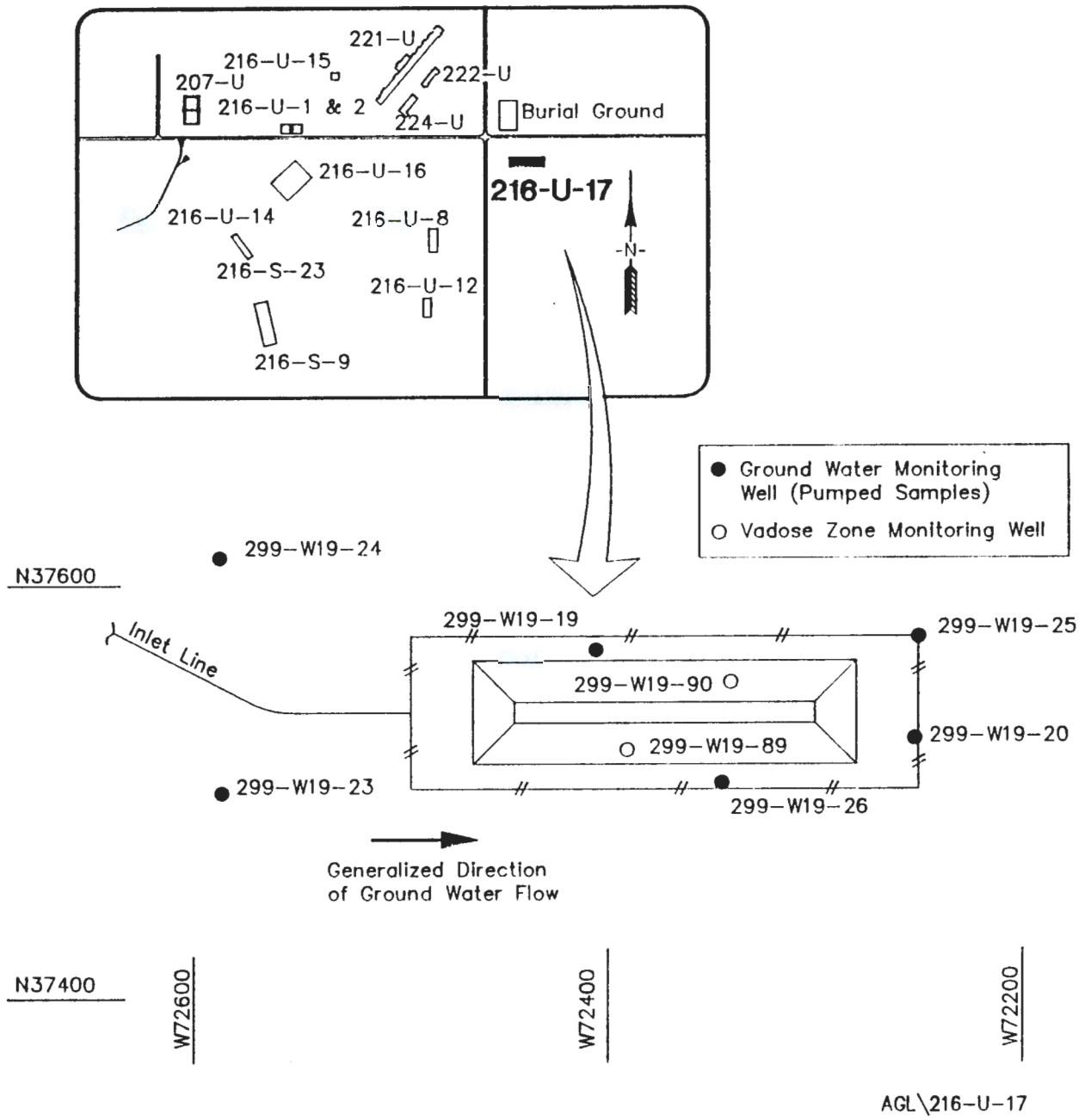
Effluent Stream Name: 242-S Evaporator Steam Condensate

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.20-2b)	Constituent	Maximum 90%C-Int, pCi/L	Guideline, pCi/L
	cesium-137	150	120
	strontium-90	72	40
	ruthenium-106	820	240
	cerium-144	920	280
	uranium (isotopes)	110	20
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.20-1b)	4.39 E+08 L, 1/76 - 12/81 7.57 E+07 L, 10/84 - 9/89 ditch constructed in 1944 5.36 E+06 L/mo (operating		
Receiving Site Location:	200 W Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	breakthrough predicted groundwater evaluation recommended (footnote s)		
EPA Priority Classification:	low		
Termination Date:	6/95		

CATEGORIZATION: 3

Categorization based on WHC (1990a) conclusions that breakthrough is predicted. Also based on EPA's classification of UO_3/U Plant wastewater effluent stream as a HIGH priority stream. Construction or rehabilitation of an upgradient well and subsurface sampling are recommended to confirm report conclusions.

Figure A-8. Well Location and Site Map for 216-U-17 Crib.



RECEIVING SITE CATEGORIZATION WORKSHEET
216-U-17 CRIB

Effluent Stream Name: UO_3 Plant Process Condensate

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.21-2) Note: Reported data include pre-1988 samples. Data therefore may overstate effluent characteristics at time of discharge to 216-U-17 Crib.	Constituent	Maximum 90%C-Int, ppb	Guideline, ppb
	chromium	108	50
	mercury	4	2
	nitrate	15,200,000	45,000
	acetone	273	50
		pCi/L	pCi/L
	hydrogen-3	7,500,000	80,000
	strontium-90	210	40
	uranium (isotopes)	280,000	20
	americium-241	280	1.2
	cesium-137	330	120
	cobalt-60	420	200
	plutonium-239	13	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous radioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.21-1)	7.2 E+05 L, from 1/88 to 12/88 crib placed in service in 1988 9.18 E+05 L/mo (calcination)		
Receiving Site Location:	200 W Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	no impact		
EPA Priority Classification:	HIGH		
Termination Date:	6/95		

CATEGORIZATION: 1

Categorization based on low curie inventory, low effluent volume, and short duration of use of receiving site. Existing data are sufficient to conduct impact assessment.

Curie Inventory Data for 216-U-17 Crib.

Waste Information Data System
Radionuclide Inventory
(In Curies)

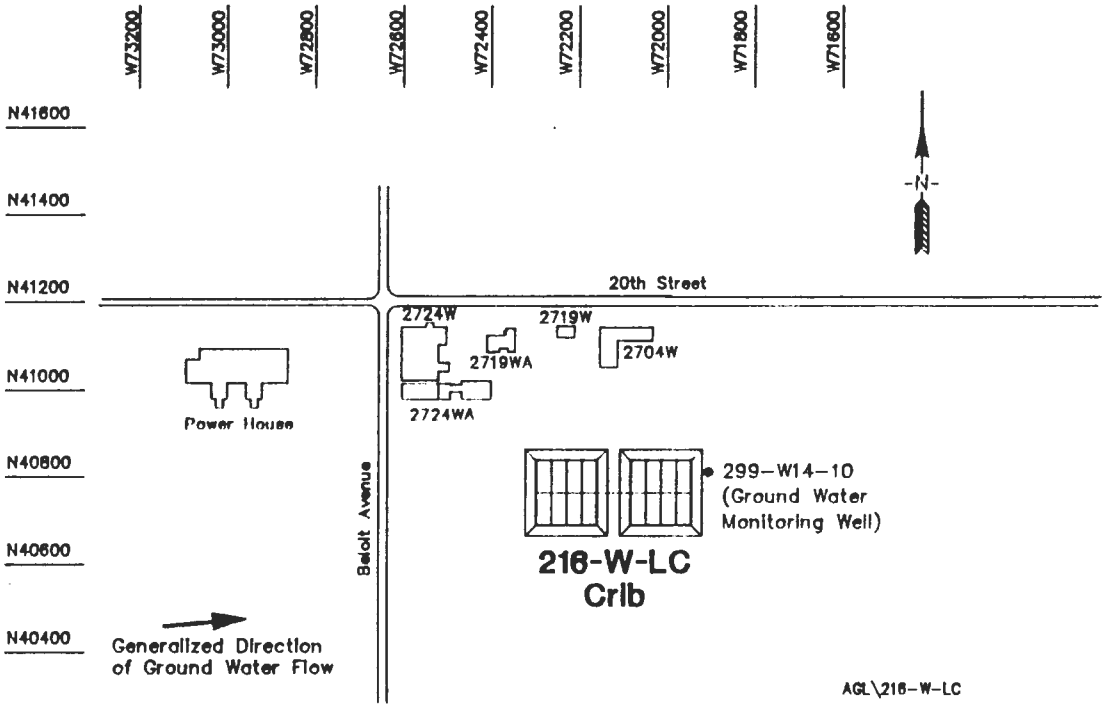
These Values Are Decayed Thru: 12/31/88

Site Name: 216-U-17

H-3:	10.50000	Ru-103:		Th-232:	
C-14:		Ru-106:		U-233:	
Na-22:		Sn-113:		U-234:	
Mn-54:		Sb-125:		U-235:	
Co-58:		I-129:		U-238:	
Fe-59:		Cs-134:		Np-237:	
Co-60:		Cs-137:		Pu-238:	
Ni-63:		Ce-141:		Pu-239:	
Kr-85:		Ce-144:		Pu-240:	
Sr-90:		Pr-144:		Pu-241:	
Y-91:		Pm-147:		Pu-242:	
Nb-95:		Eu-152:		Am-241:	
Zr-95:		Eu-154:		Am-243:	
Tc-99:		Eu-155:		Cm-245:	

Inventory Total U:		Total Reported Alpha:	.00011
Inventory Total Pu:		Total Reported Beta:	
Site Reported Total:		Total Reported Gamma:	
Total Volume Disposed:	722000	Last Updated:	July 30, 1987

Figure A-9. Well Location and Site Map for 216-W-LC Crib.



RECEIVING SITE CATEGORIZATION WORKSHEET
216-W-LC CRIB

Effluent Stream Name: 2724-W Laundry Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.22-2)	Constituent	Maximum 90%C-Int, ppb	Guideline, ppb
	barium	1,260	1,000
	chromium	64	50
	cadmium	22	10
	chloroform	140	100
	lead	226	50
		pCi/L	pCi/L
	cobalt-60	1,200	200
	cesium-137	590	120
	plutonium-239,240	395	1.2
	radium-228	250	4
	strontium-90	3,220	40
	uranium (isotopes)	320	20
	americium-241	116	1.2
	plutonium-238	34	1.6
	lead-210	2	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous radioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.22-1)	1.58 E+09 L, 1/76 - 12/88 crib constructed in 1981 3.60 E+06 L/mo, 1981 - 1989		
Receiving Site Location:	200 W Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	Well rehabilitation is recommended.		
EPA Priority Classification:	low		
Termination Date:	1/95		

CATEGORIZATION: 2

Categorization based on WHC (1990a) recommendation for well rehabilitation (page 2.22-2) to confirm conclusion of "no impact".

Curie Inventory Data for 216-W-LC Crib.

Waste Information Data System
Radionuclide Inventory
(In Curies)

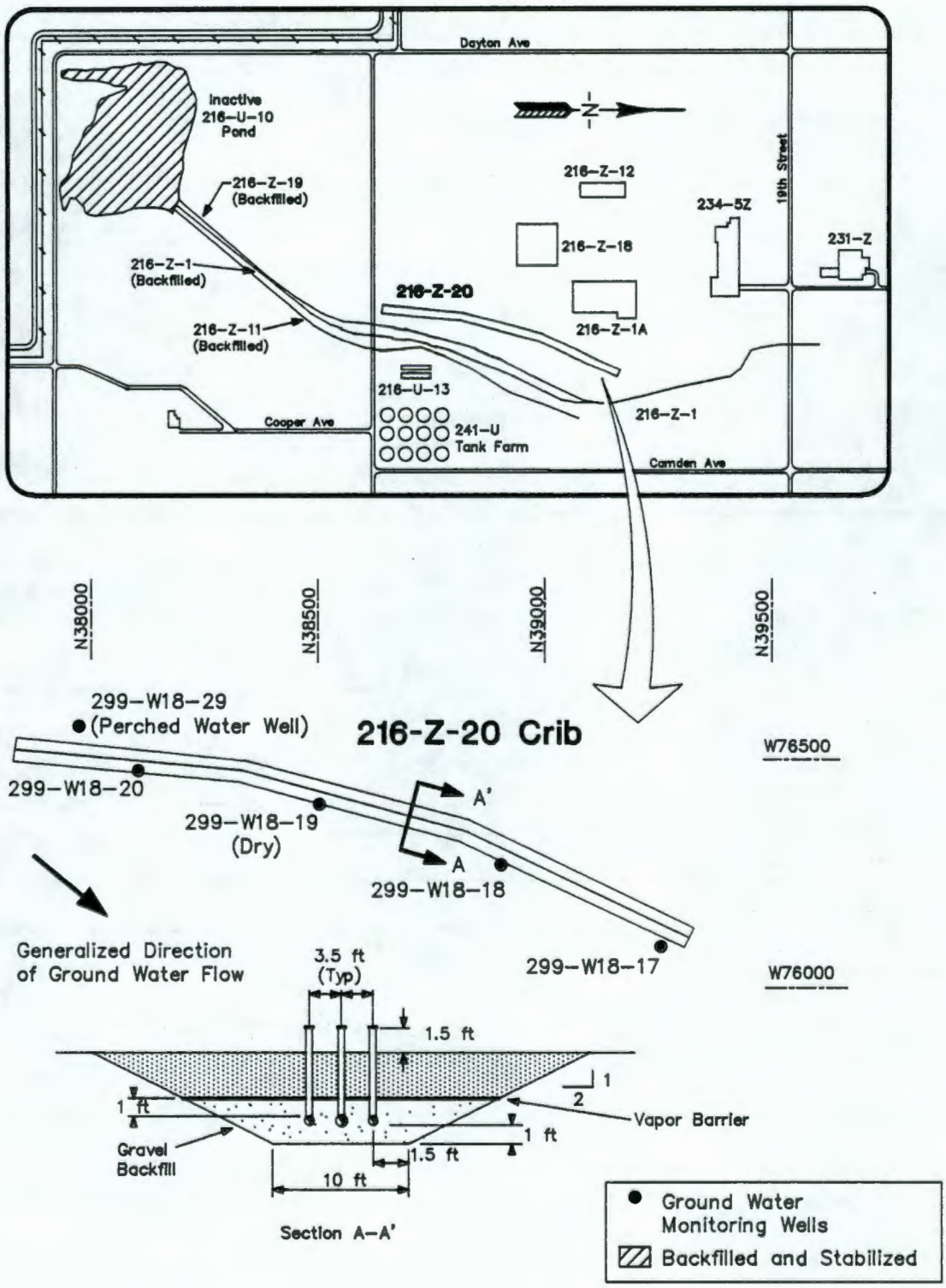
These Values Are Decayed Thru: 12/31/88

Site Name: 216-W-LC

H-3:	.00001	Ru-103:		Th-232:	
C-14:		Ru-106:		U-233:	
Na-22:		Sn-113:		U-234:	
Mn-54:		Sb-125:		U-235:	
Co-58:		I-129:		U-238:	
Fe-59:		Cs-134:		Np-237:	
Co-60:		Cs-137:	.24700	Pu-238:	
Ni-63:		Ce-141:		Pu-239:	.00022
Kr-85:		Ce-144:		Pu-240:	
Sr-90:	.16500	Pr-144:		Pu-241:	
Y-91:		Pm-147:		Pu-242:	
Nb-95:		Eu-152:		Am-241:	.03560
Zr-95:		Eu-154:		Am-243:	
Tc-99:		Eu-155:		Cm-245:	

Inventory Total U:		Total Reported Alpha:	.16200
Inventory Total Pu:		Total Reported Beta:	1.24000
Site Reported Total:		Total Reported Gamma:	
Total Volume Disposed:	1160000000	Last Updated:	July 30, 1987

Figure A-10. Well Location and Site Map for 216-Z-20 Crib.



RECEIVING SITE CATEGORIZATION WORKSHEET
216-Z-20 CRIB

Effluent Stream Name: Plutonium Finishing Plant Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.23-2)	Constituent	Maximum 90%C-Int, ppb	Guideline, ppb
	acetone	1,100	50
		pCi/L	pCi/L
	cobalt-60	4,300	200
	strontium-90	2,600	40
	cesium-134	16,000	80
	cesium-137	4,100	120
	americium-241	2,000	1.2
	plutonium-241	3,200	80
	plutonium-238	37	1.6
	uranium (isotopes)	110	20
	plutonium-239	340	1.2
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous radioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.23-1)	2.81 E+09, 9/81 - 12/88 crib constructed in 1981 4.12 E+07 L/mo (PRF)		
Receiving Site Location:	200 W Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	no impact		
EPA Priority Classification:	HIGH		
Termination Date:	6/95		

CATEGORIZATION: 2

Well remediation is recommended. Impact assessment will incorporate data obtained under other ongoing programs.

9 2 1 2 4 6 8 1 6 0 7

Curie Inventory Data for 216-Z-20 Crib.

Waste Information Data System
Radionuclide Inventory
(In Curies)

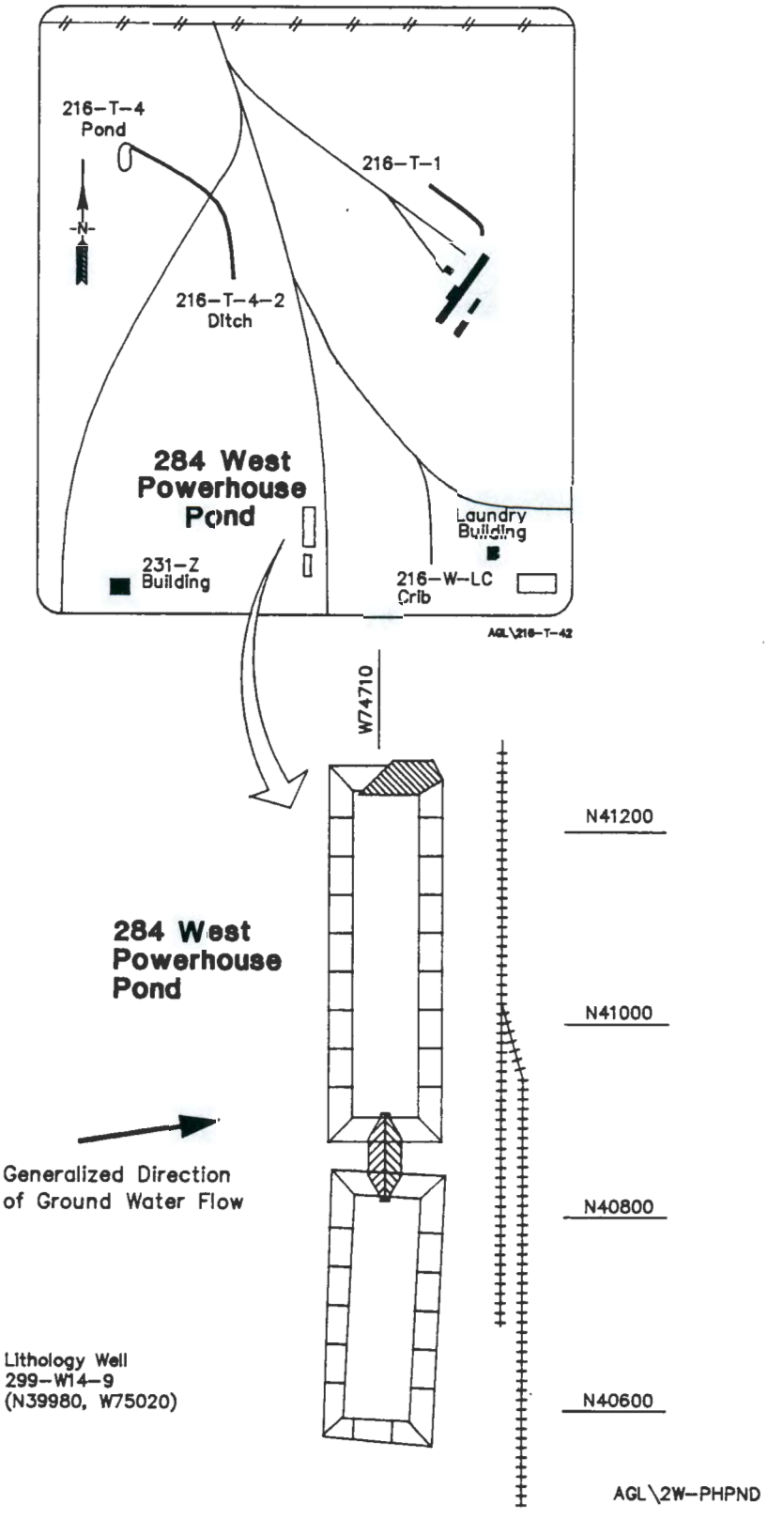
These Values Are Decayed Thru: 12/31/88

Site Name: 216-Z-20

H-3:		Ru-103:		Th-232:	
C-14:		Ru-106:	.00021	U-233:	
Na-22:		Sn-113:		U-234:	
Mn-54:		Sb-125:		U-235:	
Co-58:		I-129:		U-238:	
Fe-59:		Cs-134:		Np-237:	
Co-60:		Cs-137:	.06720	Pu-238:	.00889
Ni-63:		Ce-141:		Pu-239:	.69000
Kr-85:		Ce-144:		Pu-240:	
Sr-90:	.05930	Pr-144:		Pu-241:	2.57000
Y-91:		Pm-147:		Pu-242:	
Nb-95:		Eu-152:		Am-241:	.99600
Zr-95:		Eu-154:		Am-243:	
Tc-99:		Eu-155:		Cm-245:	

Inventory Total U:		Total Reported Alpha:	2.22000
Inventory Total Pu:		Total Reported Beta:	.37700
Site Reported Total:		Total Reported Gamma:	
Total Volume Disposed:	2810000000	Last Updated:	July 30, 1987

Figure A-11. Well Location and Site Map for 284-W Powerhouse Pond.



RECEIVING SITE CATEGORIZATION WORKSHEET
284-W POWERHOUSE POND

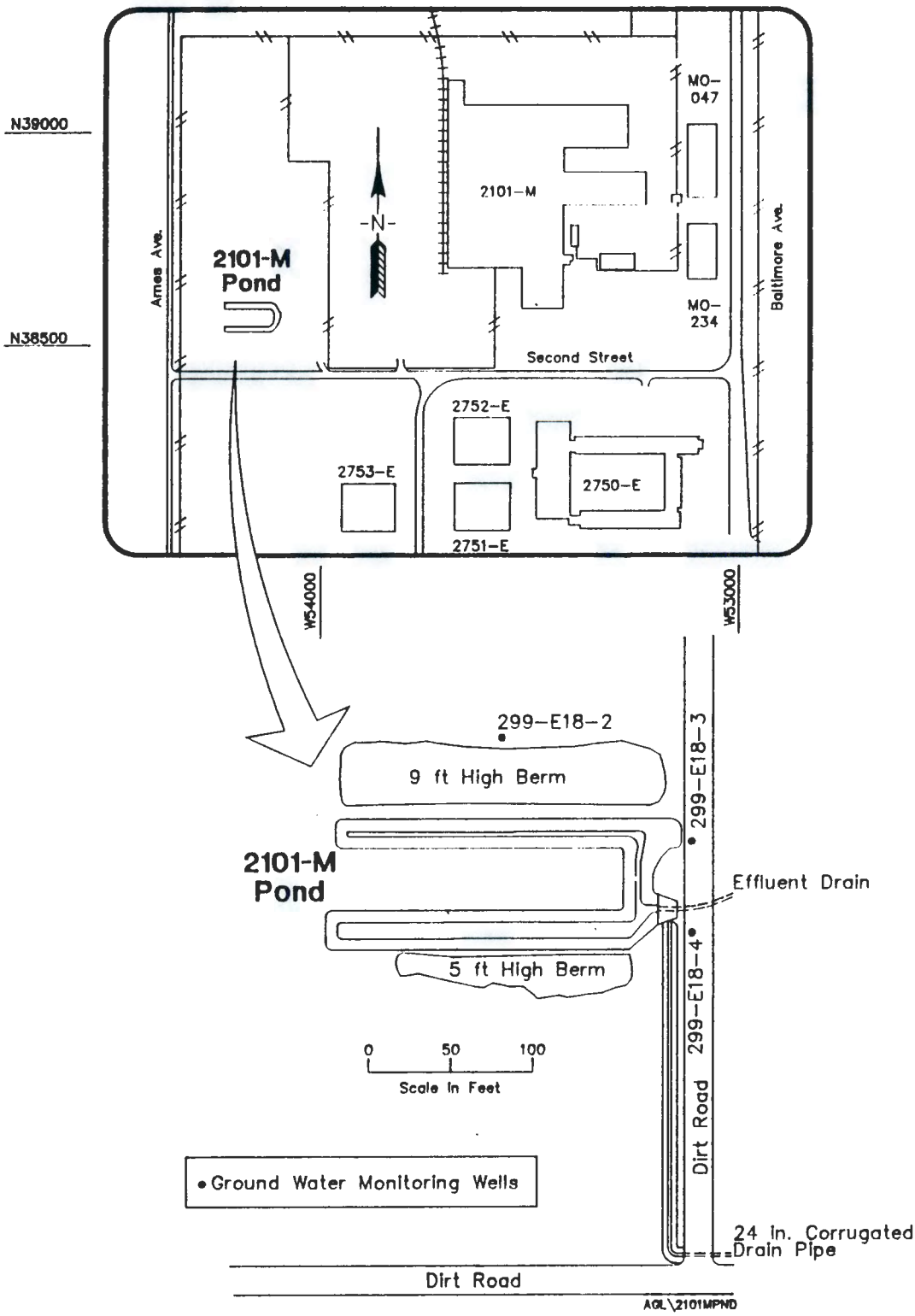
Effluent Stream Name: 284-W Powerplant Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.24-2)	Constituent	Maximum 90%C-Int, ppb	Guideline, ppb
	barium	75,000	1,000
	lead	170	50
	chloride	61,000,000	250,000
	fluoride	150,000	4,000
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.24-1)	total volume data not available received Powerplant Wastewater since 1984 1.23 E+07 L/mo (routine)		
Receiving Site Location:	200 W Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	breakthrough predicted		
EPA Priority Classification:	low		
Termination Date:	6/95		

CATEGORIZATION: 1

Existing data are sufficient to conduct improved modeling. Impacts are relatively well known; therefore, additional field investigations are not necessary.

Figure A-12. Well Location and Site Map for 2101-M Pond.



RECEIVING SITE CATEGORIZATION WORKSHEET
2101-M POND

Effluent Stream Name: 2101-M Laboratory Wastewater

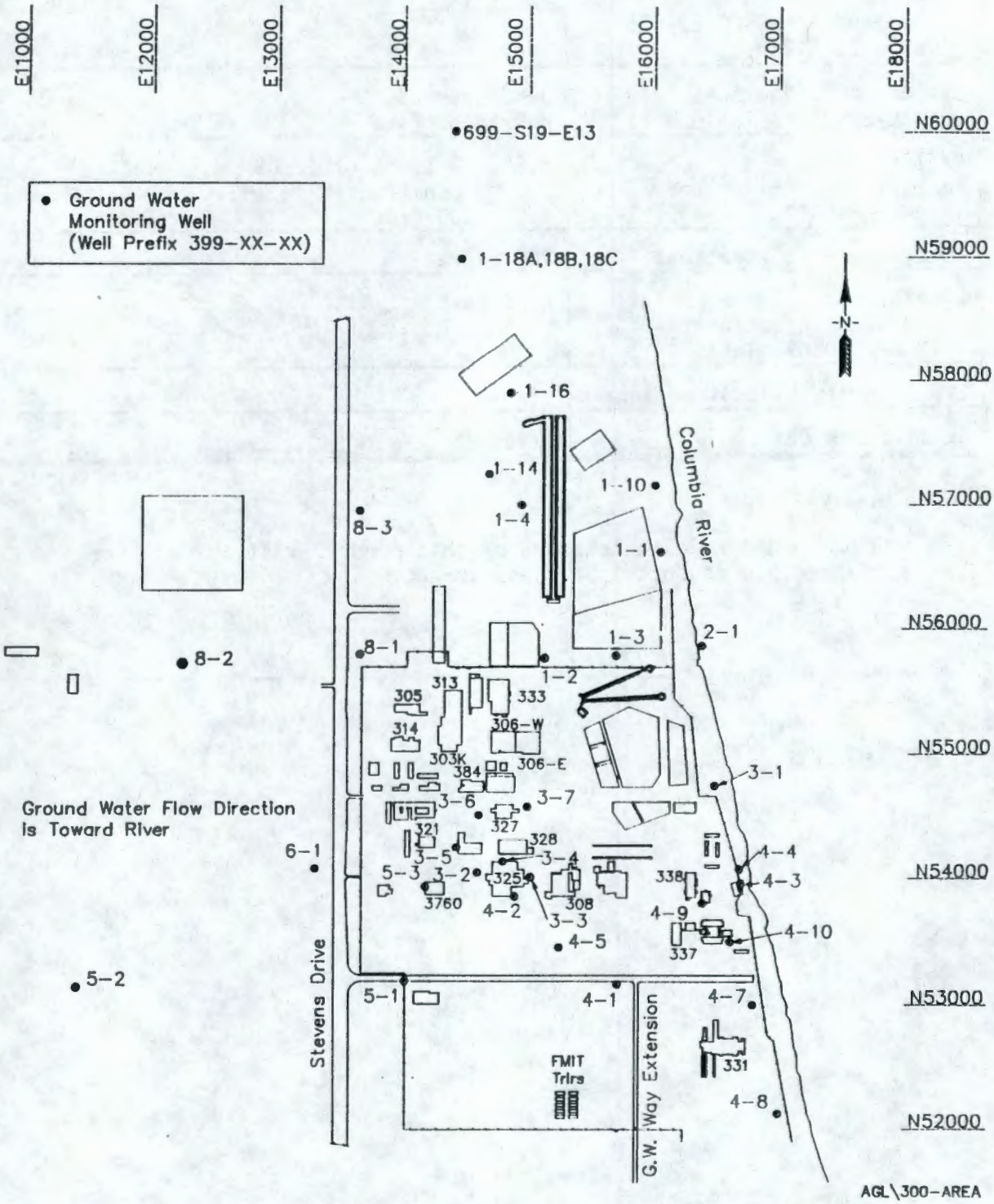
Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.25-2)	Constituent / Maximum 90%C-Int / Guideline none
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.25-1)	5.5 E+08 L, as of 12/88 pond constructed in 1953 2.27 E+06 L/mo
Receiving Site Location:	200 E Area
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	no impact
EPA Priority Classification:	low
Termination Date:	6/95

CATEGORIZATION: 1

WHC has proposed clean closure of this pond. Existing data are sufficient to conduct impact assessment.

9 2 1 2 4 6 8 1 6 1 2

Figure A-13. Well Location and Site Map for 300 Area Process Trenches.



RECEIVING SITE CATEGORIZATION WORKSHEET
300 AREA PROCESS TRENCHES

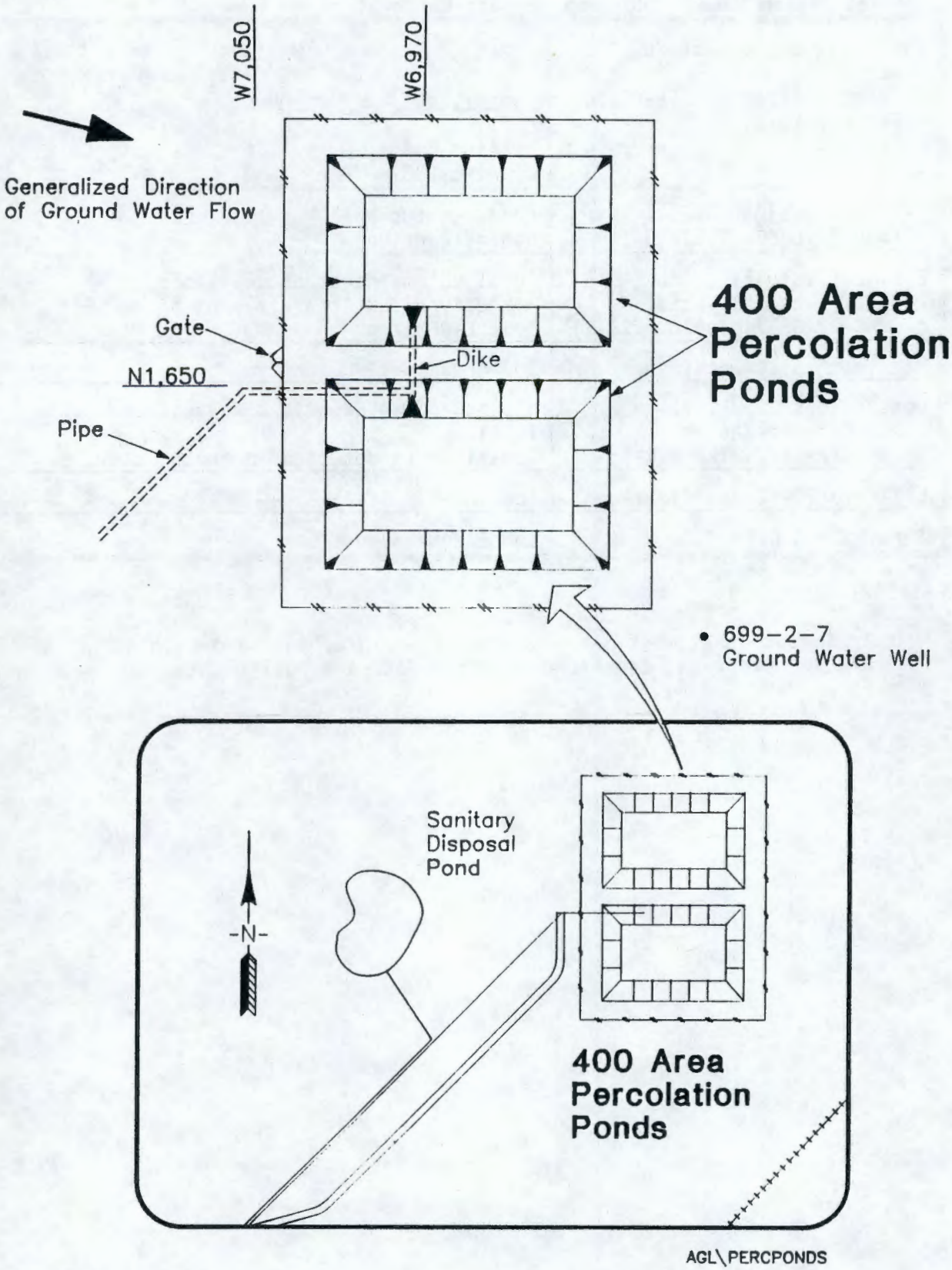
Effluent Stream Name: 300 Area Process Wastewater

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.26-2)	Constituent	Maximum 90%C-Int, pCi/L	Guideline, pCi/L
	uranium-234	36	20
	uranium-238	30	24
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive		
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.26-1)	total volume data not available received 300 Area effluent since 1975 1.52 E+08 L/mo		
Receiving Site Location:	300 Area		
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	Subject of an Expedited Response Action (ERA). Constituents detected in groundwater.		
EPA Priority Classification:	low		
Termination Date:	to be continued		

CATEGORIZATION: 1

An impact assessment has been completed in conjunction with other ongoing programs, therefore existing data are sufficient.

Figure A-14. Well Location and Site Map for 400 Area Ponds.



RECEIVING SITE CATEGORIZATION WORKSHEET
400 AREA PONDS

Effluent Stream Name: 400 Area Secondary Cooling Water

Effluent Constituents of Concern: (adapted from WHC-EP-0367, Table 2.27-2)	Constituent / Maximum 90%C-Int / Guideline none
Effluent Designation: (WHC-EP-0367, Table 3-1)	nondangerous nonradioactive
Effluent Volume: Peak Effluent Flowrate: (WHC-EP-0367, Table 2.27-1)	4.0 E+08 L, from 1979 to 1990 ponds in operation since 1979 2.98 E+06 L/mo
Receiving Site Location:	600 Area, immediately north of 400 Area
Conclusions and Recommendations: (WHC-EP-0367, Table 3-1)	no impact
EPA Priority Classification:	low
Termination Date:	to be continued

CATEGORIZATION: 1

No constituents of concern. Existing data are sufficient to conduct impact assessment.

9 2 1 2 4 6 8 1 6 1 6