0010881

START

DOE/RL-90-23
Draft A

RCRA Facility Investigation/ Corrective Measures Study Work Plan for the 100-NR-3 Operable Unit, Hanford Site, Richland, Washington

Date Published
September 1990

OCT 1990
RECEIVED
EDMC

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

Approved for Public Release

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

PREFACE

This document constitutes the Resource Conservation and Recovery Act (RCRA) facility investigation/corrective measures study (RFI/CMS) work plan for the 100-NR-3 operable unit which is mandated by the Hanford Federal Facility Agreement and Consent Order (referred to herein as the Tri-Party Agreement). In accordance with the Tri-Party Agreement, the U.S. Environmental Protection Agency (EPA) and the Washington Department of Ecology (Ecology) have agreed that the 100-NR-3 operable unit will be addressed under RCRA corrective action authority, with Ecology in the role of lead regulating agency.

Although RCRA terminology will be used where appropriate, the content and format of the work plan will conform to EPA guidance for CERCLA activities, including the Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA 1988). The work plan has been designed to comply with all relevant articles of Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), RCRA, the Washington Dangerous Waste Regulations, appropriate DOE Orders and guidelines provided by the Westinghouse Hanford Company.

The 100-NR-3 operable unit has been defined as a source operable unit associated with the 100-NR-1 aggregate source/groundwater operable unit. The RFI/CMS to be conducted at 100-NR-3 will therefore address characterization and remediation of hazardous, radioactive and mixed waste releases to air, vadose zone sediments and terrestrial biota. Characterization of releases to groundwater, surface water and river sediments, and riparian/aquatic biota for the entire 100-N Area will be conducted in the RFI/CMS for 100-NR-1. The work plans for both units are designed to closely coordinate RFI/CMS activities during each program.

ACRONYMS AND ABBREVIATIONS

ACL	alternative concentration limit
amsl	above mean sea level
ANSI/ASME	American National Standards Institute/American Society of Mechanical Engineers
ARAR	applicable, or relevant and appropriate, requirements
BOD	biochemical oxidation demand
BTDS	Basalt Waste Isolation Project Technical Data System
BWIP	Basalt Waste Isolation Project
CAR	corrective action requirement
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLP	contract laboratory program
CMS	corrective measure study
CPM	counts per minute
CRP	community relations plan
DMP	data management plan
DMS	data management system
DNAPL	dense, nonaqueous phase liquid
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy-Richland Operations Office
DQO	data quality objective
Ecology	State of Washington Department of Ecology
ECCS	emergency core cooling system
ECTS	Environmental Compliance Tracking System
EDB	emergency dump basin
EDT	emergency dump tank
EII	environmental investigations instructions
EIS	environmental impact statement
EM	electromagnetic
ENU	elementary neutralization unit
EPA	U.S. Environmental Protection Agency
FR	Federal Register
FS	feasibility study
FSP	field sampling plan
GPM	gallons per minute
HECR	Hanford Environmental Compliance Report
HEX	Flow Gemini--Environmental Information System
HGP	Hanford Generating Plant
HGWDB	Hanford Groundwater Data Base
HISS	Hanford Inactive Site Survey
HMS	Hanford Meteorological Station
HP	Health Physics
HPP	Health Physics Procedures
HPT	Health Physics Technician
HSP	health and safety plan
HWMA	Washington Hazardous Waste Management Act
IRA	interim remedial action

ACRONYMS AND ABBREVIATIONS (cont.)

LWDF	Liquid Waste Disposal Facility
MCL	maximum contaminant level
MCLG	maximum contaminant level goals
mpn	most probable number
MSDS	material safety data sheet
msl	mean sea level
MTCA	Washington Model Toxics Control Act
MWE	megawatts electricity
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1978
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NR	not reported
NTU	nephthelometric turbidity unit
PARCC	precision, accuracy, representativeness, completeness, comparability
PCB	polychlorinated biphenyl
ORE	occupational radiation exposure
OVA	organic vapor analyzer
PDMS	Program Data and Management System
PJSP	prejob safety plan
PMP	project management plan
PNL	Pacific Northwest Laboratory
PVC	polyvinyl chloride
QAPP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act of 1976
RCW	Revised Code of Washington
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	remedial investigation
ROD	record of decision
RQ	reportable quantity
RWP	radiation work permit
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
SCBA	self-contained breathing apparatus
SPS	Sample Preparation System
SS	Supply System
TLV	threshold limit value
TOC	total organic carbon
TOX	total organic halogen
TRIS	Training Records Information System
TSD	treatment, storage, and disposal
UPR	unplanned release
WAC	Washington Administrative Code
WIDS	Waste Information Data System
WIMS	Waste Information Management System

THIS PAGE INTENTIONALLY
LEFT BLANK

CONTENTS

1.0 Introduction WP-1
1.1 Overview WP-1
1.1.1 Tri-Party Agreement WP-3
1.1.2 RCRA/CERCLA Remediation Program WP-3
1.2 Purpose of Work Plan WP-4
1.3 Scope of Work WP-7
1.3.1 Operable Units at 100-N WP-7
1.3.2 RFI/CMS Strategy WP-7
1.4 Project Goals WP-10
1.5 Quality Assurance WP-10
1.6 Organization of Work Plan WP-12

2.0 Operable Unit Background and Setting WP-15
2.1 Operable Unit Site Description WP-15
2.1.1 Location WP-15
2.1.2 History of Operations WP-15
2.1.3 Facility Characteristics WP-17
2.1.4 Primary Effluent Generation Processes . WP-22
2.1.5 RCRA/CERCLA Interrelationships WP-24
2.2 Physical Setting WP-26
2.2.1 Topography WP-26
2.2.2 Geology WP-26
2.2.3 Hydrogeology WP-38
2.2.4 Surface Hydrology WP-39
2.2.5 Meteorology WP-42
2.2.6 Environmental Resources WP-44
2.2.7 Human Resources WP-48

3.0 Initial Evaluation WP-51
3.1 Known and Suspected Contamination WP-51
3.1.1 Sources WP-51
3.1.2 Contaminant Occurrence in Environmental Media WP-98
3.1.3 Contaminant Occurrence in Biological Media WP-105
3.1.4 Interactions Between Operable Units . . WP-109
3.1.5 Quality of Existing Data WP-109
3.2 Potential Corrective Action Requirements . . . WP-110
3.2.1 Identification of CAR WP-110
3.2.2 Point of Applicability of CAR WP-118
3.2.3 Evaluation of CAR During Remedial Action WP-118
3.3 Preliminary Assessment of Potential Health Impacts WP-119
3.3.1 Objectives WP-119
3.3.2 Potential Contaminants WP-120
3.3.3 Imminent and Substantial Endangerment . WP-122
3.3.4 Potential Impacts WP-123
3.3.5 Conclusions WP-125

CONTENTS (cont.)

3.4 Preliminary Corrective Action Objectives and Alternatives WP-125
3.4.1 Corrective Action Objectives WP-126
3.4.2 Preliminary Corrective Action Technologies WP-126
3.4.3 Preliminary Corrective Action Alternatives WP-129

4.0 Work Plan Rationale WP-130
4.1 Decision Types WP-130
4.1.1 Data Users WP-131
4.1.2 Available Information WP-132
4.1.3 Conceptual Models WP-132
4.1.4 RFI/CMS Objectives and Decisions . . . WP-132
4.2 Data Uses and Needs WP-133
4.2.1 Data Uses WP-134
4.2.2 Data Types WP-135
4.2.3 Data Quality Needs WP-135
4.2.4 Data Quantity Needs WP-140
4.2.5 Sampling and Analyses Options WP-140
4.2.6 PARCC Parameters WP-141
4.3 Data Collection Program WP-141
4.3.1 General Rationale WP-141
4.3.2 General Strategy WP-142
4.3.3 Investigation Methodology WP-154
4.3.4 Phase I Field Activities at 100-NR-3 Groupings WP-150
4.3.5 Data Evaluation and Decision Making . . WP-150

5.0 Facility Investigation/Corrective Measures Tasks . . WP-154
5.1 Project Management WP-154
5.1.1 Project Management WP-154
5.1.2 Meetings WP-155
5.1.3 Cost and Schedule Control WP-155
5.1.4 Data Management WP-155
5.1.5 Progress Reports WP-155
5.2 Interim Corrective Measures WP-156
5.2.1 Deciding on Interim Measures WP-156
5.2.2 Selection of Interim Measures WP-160
5.3 RFI Phase I: Operable Unit Characterization . WP-162
5.3.1 Task 1 - Project Management WP-163
5.3.2 Task 2 - Source Characterization . . . WP-163
5.3.3 Task 3 - Geologic Investigations . . . WP-183
5.3.4 Task 4 - Surface Water and Sediment Investigation WP-185
5.3.5 Task 5 - Vadose Zone Investigation . . WP-185
5.3.6 Task 6 - Groundwater Investigation . . WP-185
5.3.7 Task 7 - Air Investigation WP-185
5.3.8 Task 8 - Ecological Investigation . . . WP-185

CONTENTS (cont.)

5.3.9 Task 9 - Cultural Resource Investigation WP-187
5.3.10 Task 10 - Data Evaluation WP-188
5.3.11 Task 11 - Baseline Risk Assessment . . WP-188
5.3.12 Task 12 - RFI Phase I Report WP-193
5.4 Corrective Measures Study Phase I/II: Remedial Alternatives Development and Screening WP-194
5.4.1 Task 1 - Project Management WP-194
5.4.2 Task 2 - CMS Phase I - Alternatives Development WP-194
5.4.3 Task 3 - CMS Phase II - Corrective Measure - Alternatives Screening . . . WP-198
5.4.4 Task 4 - CMS Phase I/II Report: Alternatives and Screening WP-202
5.5 RFI Phase II: Treatability Investigation . . . WP-203
5.5.1 Task 1 - Project Management WP-204
5.5.2 Task 2 - Source Investigations WP-204
5.5.3 Task 3 - Geologic Investigations . . . WP-205
5.5.4 Task 4 - Surface Water and Sediments Investigations WP-205
5.5.5 Task 5 - Vadose Zone Investigations . . WP-205
5.5.6 Task 6 - Groundwater Investigation . . WP-206
5.5.7 Task 7 - Air Investigations WP-206
5.5.8 Task 8 - Ecological Investigations . . WP-207
5.5.9 Task 9 - Treatability Investigation Work Plan Development WP-207
5.5.10 Task 10 - Treatability Investigation Implementation WP-211
5.5.11 Task 11 - Other Activities WP-213
5.5.12 Task 12 - Data Evaluation WP-213
5.5.13 Task 13 - Phase II Risk Assessment . . WP-213
5.5.14 Task 14 - RFI Phase II Report WP-214
5.6 Corrective Measures Study Phase III: Detailed Analysis of Remedial Alternatives WP-215
5.6.1 Task 1 - Definition of Corrective Measure Alternatives WP-216
5.6.2 Task 2 - Detailed Analysis of Alternatives WP-216
5.6.3 Task 3 - Comparison of Corrective Measure Alternatives WP-219
5.6.4 Task 4 - Corrective Measures Study Phase III Report WP-219
5.6.5 Task 5 - Corrective Action Plan WP-220
5.7 National Environmental Policy Act (NEPA) . . . WP-220
5.7.1 Task 1 - Analyze Impacts WP-220
5.7.2 Task 2 - Prepare Impact Statement . . . WP-221
5.7.3 Task 3 - Review and Approval WP-221
5.8 Closure Plans and Post-Closure Permits WP-221
5.8.1 Task 1 - Prepare Closure Plans WP-221
5.8.2 Task 2 - Review and Approval WP-221

CONTENTS (cont.)

6.0 Project Schedule WP-223

7.0 References WP-227

FIGURES:

1 Location and Plan of the Hanford Site WP-2
2 RCRA Corrective Action Process WP-5
3 CERCLA RI/FS Process WP-6
4 Operable Units at the 100-N Area WP-8
5 Location of the 100-N Area WP-16
6 Generalized Floor Plan of the 163-N Facility WP-20
7 Flow Diagram of the 163-N Demineralization Plant Waste Stream WP-23
8 Topography of the 100-N Area WP-27
9 Structure of the Pasco Basin WP-29
10 Hanford Site Stratigraphic Column WP-30
11 Conceptual Geologic and Hydrogeologic Column for 100-N WP-32
12 Location of Monitoring Wells and Geologic Borings in 100-N Area WP-33
13 Locations of Cross-Sections A-A', B-B' and C-C' . . WP-34
14 Cross-Section A-A' WP-35
15 Cross-Section B-B' WP-36
16 Cross Section C-C' WP-37
17 Water Levels at 100-N, June 24, 1988 . . . . . WP-40
18 Water Levels at 100-N, May 1990 . . . . . WP-41
19 Columbia River Flows at Priest Rapids Dam, 1960-1977 . . . . . WP-43
20 Wind Roses for the Hanford Telemetry Network, 1979-1982 . . . . . WP-45
21 Land Use Surrounding the Hanford Site WP-49
22 Source Unit Groupings in the 100-NR-3 Source Operable Unit WP-52
23 Source Units in the Outer Refuse Area Grouping . . . WP-59
24 Source Units in the 182-N High Lift Pumphouse Grouping WP-61
25 Source Units in the Acid/Caustic Storage and Transport System Grouping WP-63
26 Regeneration Waste Transport System Configuration, 1977-1983 . . . . . WP-68
27 Regeneration Waste Transport System, 1983-1986 . . . WP-69
28 Regeneration Waste Transport System, 1986-1988 . . . WP-71
29 Source Units in the 116-N-8 Mixed Waste Storage Area Grouping WP-73
30 Source Units in the 184-N Plant Service Powerhouse, Tanks, and Piping Systems Grouping WP-75

CONTENTS (cont.)

31 Source Units in the Decontamination Drain Line Leak Grouping WP-78
32 Source Units in the 120-N-4 Nonhazardous and Nonradioactive Storage Area Grouping WP-79
33 Source Units in the Regeneration/Filter Backwash Waste Disposal Area Grouping WP-81
34 120-N-1 Percolation Pond Area Configuration, 1977-1983 . . . . . WP-83
35 120-N-1 Percolation Pond/120-N-2 Surface Impoundment Configuration, 1986-1988 . . . . . WP-88
36 120-N-2 Surface Impoundment Physical Design WP-89
37 Source Units in the Office Septic Tank Area Grouping WP-92
38 Source Units in the N-17 Paint Shop Grouping WP-94
39 Source Units in the 124-N-9 Septic Tank Grouping . . WP-95
40 Source Units in the 100-N Sewer System Grouping . . WP-97
41 Areas of Inferred Soil Contamination at 100-NR-3 . . WP-104
42 Ambient Air Sampling Locations at 100-N Area WP-107
43 Conceptual Contaminant Exposure Path Model for the 100-NR-3 Operable Unit WP-121
44 Decision Tree for RFI/CMS Soil, Sediment, Air and Biota Sampling WP-153
45 Interim Corrective Measures Process WP-157
46 Components of Risk Assessment WP-190
47 Schedule for 100-NR-3 RFI Phase I - Operable Unit Characterization WP-224
48 Schedule for 100-NR-3 CMS Phase I and II - Corrective Measures Development and Screening . . . WP-225
49 Schedule for 100-NR-3 RFI Phase II - Treatability Study WP-226
50 Schedule for 100-NR-3 CMS Phase III - Analysis and Selection of Corrective Measures WP-227

TABLES:

1 Overview of Significant Dates for 100-N Area Operation WP-18
2 Waste Management Units and Unplanned Releases at the 100-NR-3 Operable Unit WP-53
3 163-N Demineralization Plant Regeneration Effluent Waste Analysis Cation Regeneration Cycle WP-84
4 163-N Demineralization Plant Regeneration Waste Analysis Anion Regeneration Cycle WP-85
5 183-N Filtered Water Plant Backwash Effluent Analysis WP-86
6 Summary Statistics - Background Samples (Soil - Metal) for the 120-N-1/120-N-2 Study WP-99

CONTENTS (cont.)

7 Summary Statistics - Background Samples (Soil - Non-Metal) for the 120-N-1/120-N-2 Study . . WP-100
8 Summary Statistics - Background Samples (Radiochemical) for the 120-N-1/120-N-2 Study . . . WP-101
9 Summary Statistics - Background Samples (Extraction) for the 120-N-1/120-N-2 Study WP-102
10 Nonradioactive Air Emissions from 100-N Area WP-106
11 Air Monitoring for Radionuclides at 100-N Area, 1981 - 1988 . . . . . WP-108
12 Potential Federal Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Operable Unit 100-NR-3 . . . . . WP-112
13 Potential State Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Operable Unit 100-NR-3 . . . . . WP-114
14 Potential Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Nonradioactive Contaminants at Operable Unit 100-NR-3 . . . . . WP-116
15 Potential Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Radionuclides at Operable Unit 100-NR-3 . . . . WP-118
16 Radionuclide Concentration (pCi/g) Detected in N Springs Vegetation Samples from 1980 through 1988 . . . . . WP-124
17 Preliminary Corrective Action Objectives and General Response Actions for Operable Unit 100-NR-3. WP-127
18 Preliminary Corrective Action Technologies for Operable Unit 100-NR-3 . . . . . WP-128
19 Data Collection Objectives for the 100-NR-3 Operable Unit WP-136
20 Analytical Levels for the 100-NR-3 Operable Unit Work Plan WP-137
21 Data Collection Types, Measurements, and Required Analytical Levels for the 100-NR-3 Operable Unit . . WP-138
22 Source Ranking and Rationale WP-145
23 Phase I RFI Field Activities at Operable Unit Groupings WP-151
24 Source Sampling at 100-NR-3 . . . . . WP-168
25 Comprehensive List of Analytes and Parameters . . . WP-175

1.0 INTRODUCTION

This work plan presents the basis for conducting a RCRA Facility Investigation/Corrective Measure Study (RFI/CMS) at the 100-NR-3 operable unit at the U.S. Department of Energy (DOE) Hanford Federal Facility Site in Washington State and describes the planned RFI/CMS activities. This introduction focuses on the overall scope of activities being performed at the Hanford Site and the regulatory framework under which these activities are being conducted. In addition, the scope, objectives and associated mechanisms for performance of the RFI/CMS activities at 100-NR-3 are briefly described. Finally, the organization of the remaining sections of the work plan are introduced and explained.

1.1 OVERVIEW

The Resource Conservation and Recovery Act of 1976 (RCRA) provides for corrective action at solid waste management units located at permitted RCRA facilities, regardless of when waste was received at a unit. The Comprehensive Environmental Resource Compensation and Liability Act of 1980 (CERCLA) focuses on waste site cleanups whenever there is a release or substantial threat of a release to the environment of a hazardous substance, pollutant, or contaminant. High priority sites are placed on the National Priorities List (NPL) by the U.S. Environmental Protection Agency (EPA) in accordance with CERCLA. CERCLA requires that federal facilities which qualify be placed on the NPL.

Statutes for the management and remediation of hazardous waste sites have been promulgated in the State of Washington as the Hazardous Waste Management Act (HWMA) of 1976 (70.105 RCW) and the Model Toxics Control Act (MTCA) of 1988 (70.105D RCW). HWMA codifies the state's program for managing the RCRA program in overseeing the permitting and operation of sites, while MTCA is broadly equivalent to CERCLA and the corrective action provisions of RCRA for cleanup of contaminated sites.

The Hanford Site is located in southeastern Washington. Figure 1 presents the location and plan of the site. Over 1,400 waste management units have been identified on the Hanford Site. These include active treatment, storage, and disposal (TSD) units, subject to permit application and/or closure requirements under RCRA and HWMA, as well as inactive units and unplanned

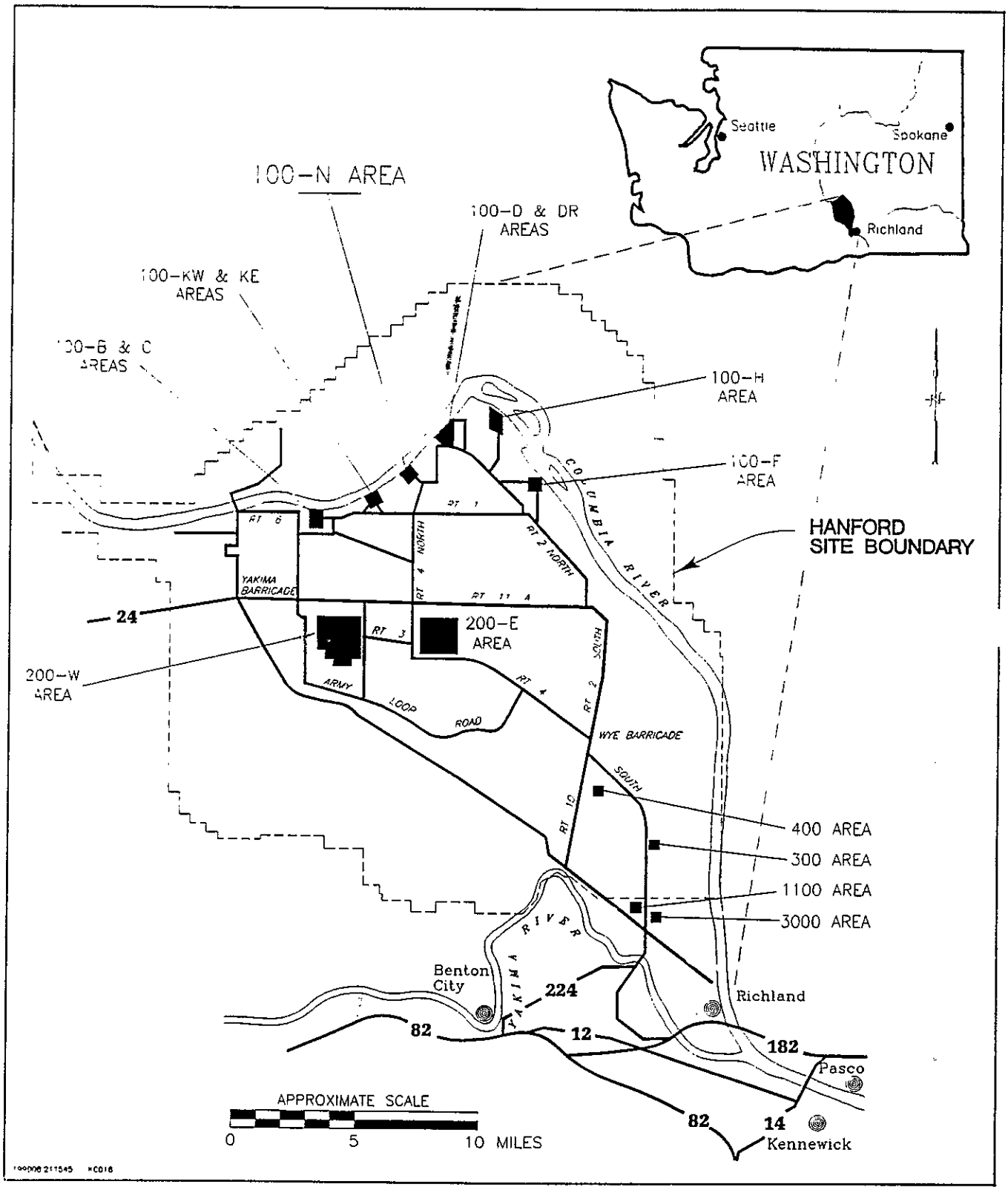


Figure 1. Location and Plan of the Hanford Site

release sites which are subject to "corrective" action under RCRA, or "remedial" action under CERCLA and the MTCA.

Most of the waste management units are located within four geographic areas that are referred to as the 100, 200, 300, and 1100 Areas (see Figure 1). Each of the four areas was listed on the NPL on November 3, 1989. The four areas are subdivided into 21 waste area groups on the basis of facility and type of operation. Each waste area group is further subdivided into operable units on the basis of waste disposal practices, geology, hydrogeology, and other pertinent characteristics. A total of 78 operable units have currently been identified. This document addresses the 100-NR-3 operable unit located at the 100-N Area in the northern portion of the Hanford Site.

1.1.1 Tri-Party Agreement

This work plan was developed in accordance with the Hanford Federal Facility Agreement and Consent Order (Ecology et al. 1989), referred to in this document as the Tri-Party Agreement. The Tri-Party Agreement was developed and signed by representatives of the State of Washington Department of Ecology (Ecology), EPA, and DOE in May 1989. The purpose of the Tri-Party Agreement is to provide a framework for coordination between these agencies to ensure the safe management and mitigation of environmental and public health hazards at the Hanford Site.

All work conducted under this plan will conform to the conditions set forth in the Tri-Party Agreement. Pursuant to the agreement, relevant EPA guidance documents were consulted in the preparation of this work plan, including:

- Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA 1988a)
- Data Quality Objectives for Remedial Response Activities (EPA 1987)
- Superfund Public Health Evaluation Manual (EPA 1986a)
- Superfund Exposure Assessment Manual (EPA 1988c)
- Interim Final RCRA Facility Investigation (RFI) Guidance (EPA 1989a).

1.1.2 RCRA/CERCLA Remediation Program

The potential for conflict between state and federal environmental cleanup requirements has been minimized by modifying standard RCRA and CERCLA procedures and regulated contaminant lists in the Tri-Party Agreement. The purpose of

these modifications is to ensure that investigations and remedial procedures will be similar, regardless of which agency is in charge of reviewing plans and making decisions at a particular operable unit.

The steps and objectives of the RCRA corrective action process, as implemented at the Hanford Site, are shown in Figure 2. A significant modification to the corrective action process is the concurrent rather than consecutive performance of the RFI and CMS. This approach is equivalent to the CERCLA remedial investigation/feasibility study (RI/FS) process shown in Figure 3. The concurrent RFI/CMS performance is discussed in Section 1.3.2 of this work plan.

Ecology and EPA have determined that the operable units at 100-N Area will be addressed under RCRA corrective action authority but that the EPA guidance for conducting a RI/FS under CERCLA will be used in the performance of RFI/CMS at the Hanford Site. Therefore, although RCRA terminology will be used where appropriate, the content and format of this work plan conform to EPA guidance for CERCLA activities.

Because the RFI/CMS is to be conducted as an equivalent process to RI/FS, cleanup requirements will be denied from CERCLA policy. CERCLA cleanup standards rely on health-based criteria determined from risk assessment, coupled with compliance with applicable or relevant and appropriate requirements (ARAR). It is the intent of the EPA, Ecology, and the DOE that the CERCLA ARARs process, which addresses all applicable RCRA standards, be used for this project. RCRA does not include ARARs, but because the operable unit is being addressed under RCRA authority, an equivalent process is being used. This process is specified in this work plan, designated corrective action requirements (CAR). Section 3.2 of this work plan addresses potential contaminant and location-specific CAR, which have been identified based on CERCLA guidance.

Because this operable unit is being addressed under RCRA corrective action authority, the corrective action decision will be made through modification of the Hanford Federal Facility RCRA permit, rather than a record of decision as required under CERCLA.

1.2 PURPOSE OF WORK PLAN

The purpose of this RFI/CMS work plan is to define specific strategies, procedures, and activities required for successful completion of the RFI/CMS at 100-NR-3. This entails identification and evaluation of all known operational and environmental information and development of plans for collection of additional data necessary to adequately characterize the

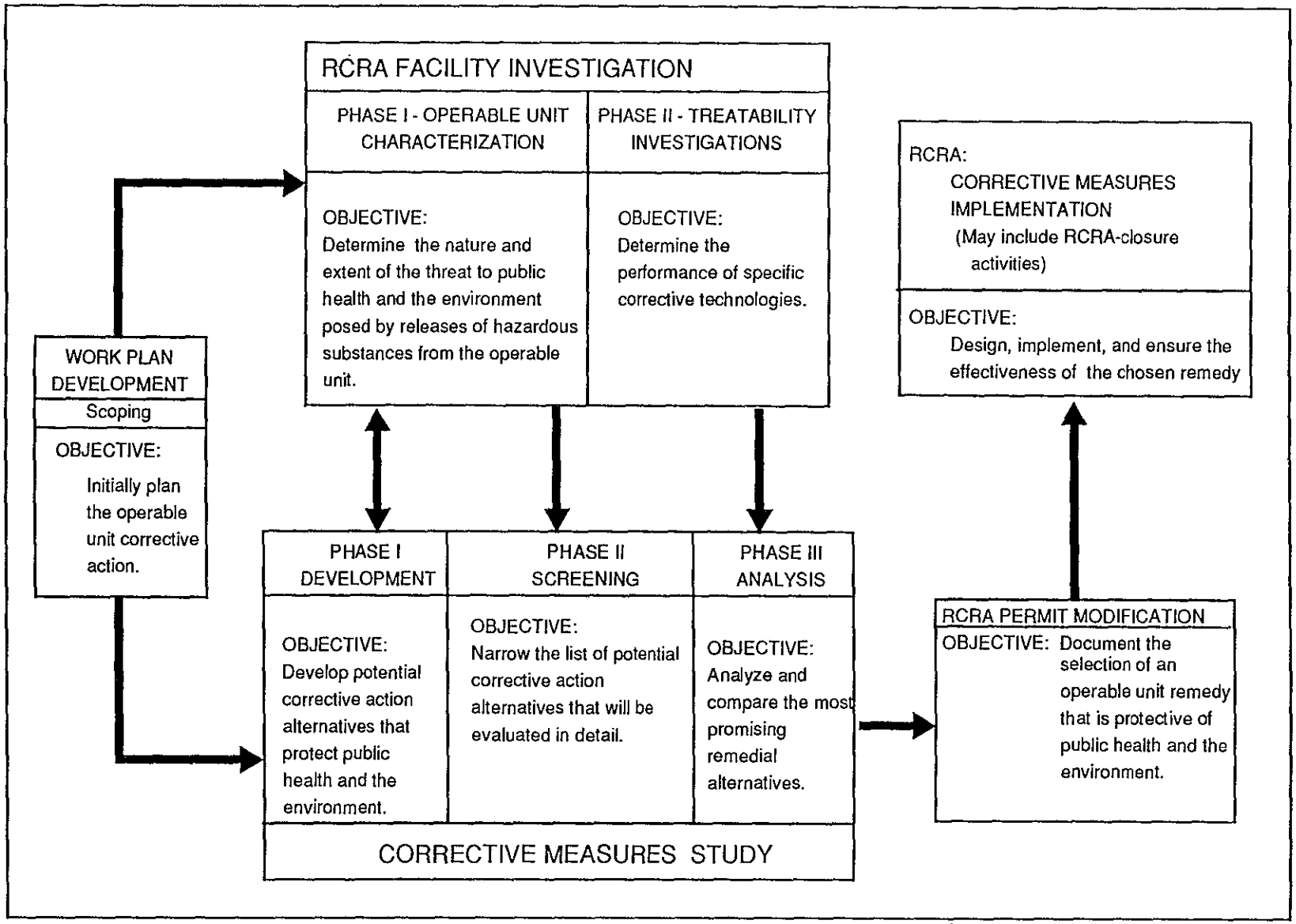


Figure 2. RCRA Corrective Action Process
Source: Ecology et al. 1989

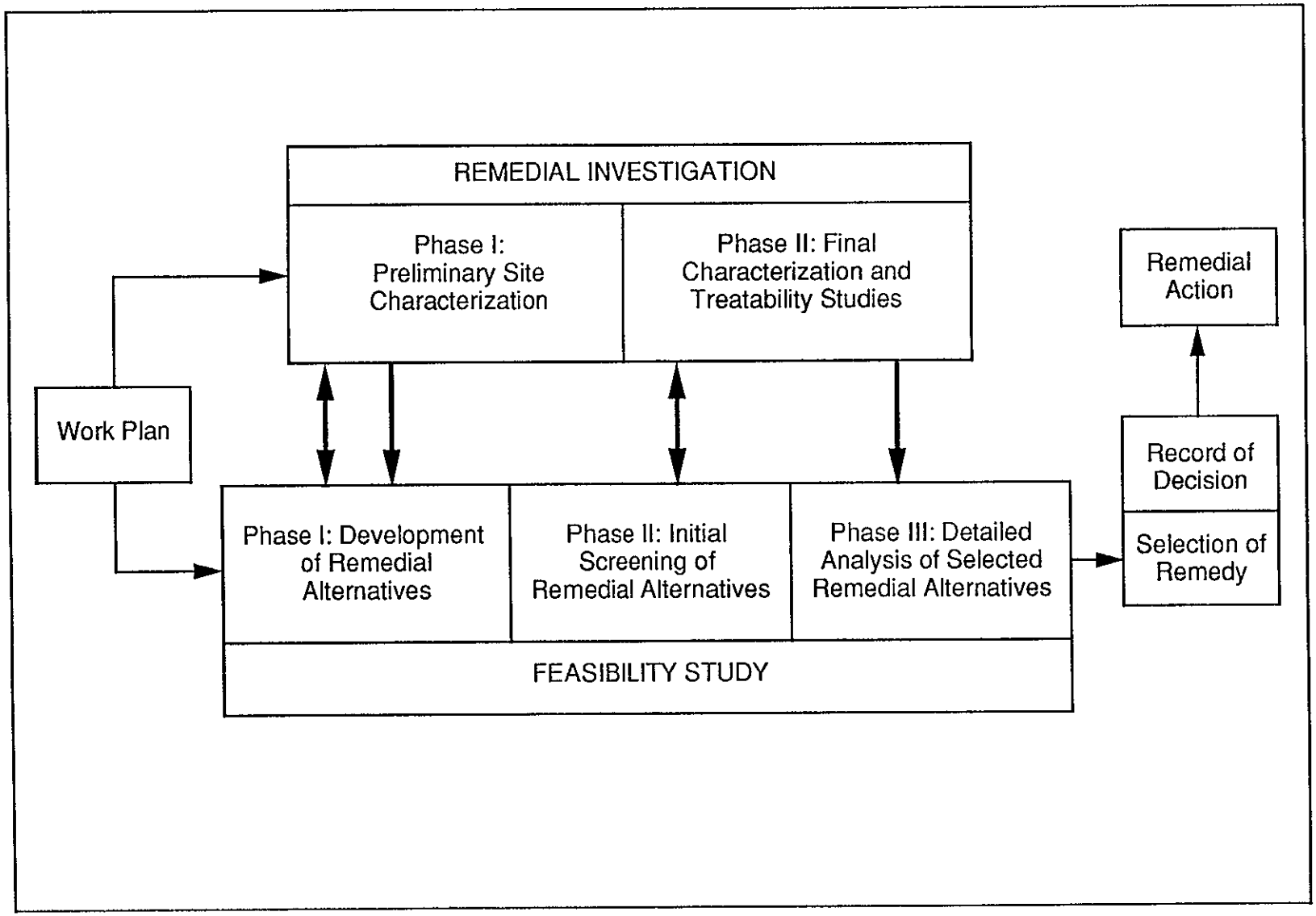


Figure 3. CERCLA RI/FS Process
Source: Ecology et al. 1989

nature, extent, and rate of migration of contamination at the site, and to develop meaningful corrective measures to mitigate identified hazards.

1.3 SCOPE OF WORK

Design of an appropriate RFI/CMS work plan for the 100-NR-3 operable unit must reflect the difficult technical and environmental issues regarding the operable unit's relationship to other operable units at the 100-N Area and the Hanford Site as a whole. In addition, the work plan must satisfy requirements set fourth in the Tri-Party Agreement regarding performance of characterization and remediation programs at the Hanford Site.

1.3.1 Operable Units at 100-N

The 100-N Area has been subdivided into three operable units which are shown in Figure 4. The 100-NR-3 operable unit has been designated a source operable unit. As such, the scope of this work plan includes waste sources, contaminated soils, air, and terrestrial biota within the surface boundaries of 100-NR-3. 100-NR-1 has been designated the aggregate source/groundwater operable unit for the 100-N Area. Releases of contaminants from 100-NR-3 to the groundwater, river water and sediments, and aquatic biota will be addressed in the 100-NR-1 RFI/CMS. Investigations related to releases from the Washington Public Power Supply System Hanford Generating Plant, which is located within the boundaries of 100-NR-3, are not addressed in the 100-NR-3 work plan, for institutional reasons. Also shown in Figure 4 are the boundaries of the 100-KR-4 and 100-HR-3 groundwater operable units. Because of the interconnection between these units and the 100-N Area, close communication will be held with preparers of the work plans for those operable units.

The 100-NR-1 RFI/CMS work plan is being prepared concurrently with this work plan. Preparation of the work plans and performance of the RFI/CMS for the two operable units will be closely coordinated. The 100-NR-2 work plan has been delayed until a later date, in accordance with the Tri-Party Agreement.

1.3.2 RFI/CMS Strategy

The typical strategy for performing RFI/CMS tasks is defined in EPA guidance (EPA 1989a). The strategy involves a sequential process including a regulatory-agency-conducted RCRA Facility Assessment (RFA), to assess the potential for the release of hazardous wastes or constituents to the environment, followed by the RFI and then the CMS. However, most Hanford Site waste management units have been initially analyzed and rated as part of the EPA hazard ranking system and development of the NPL

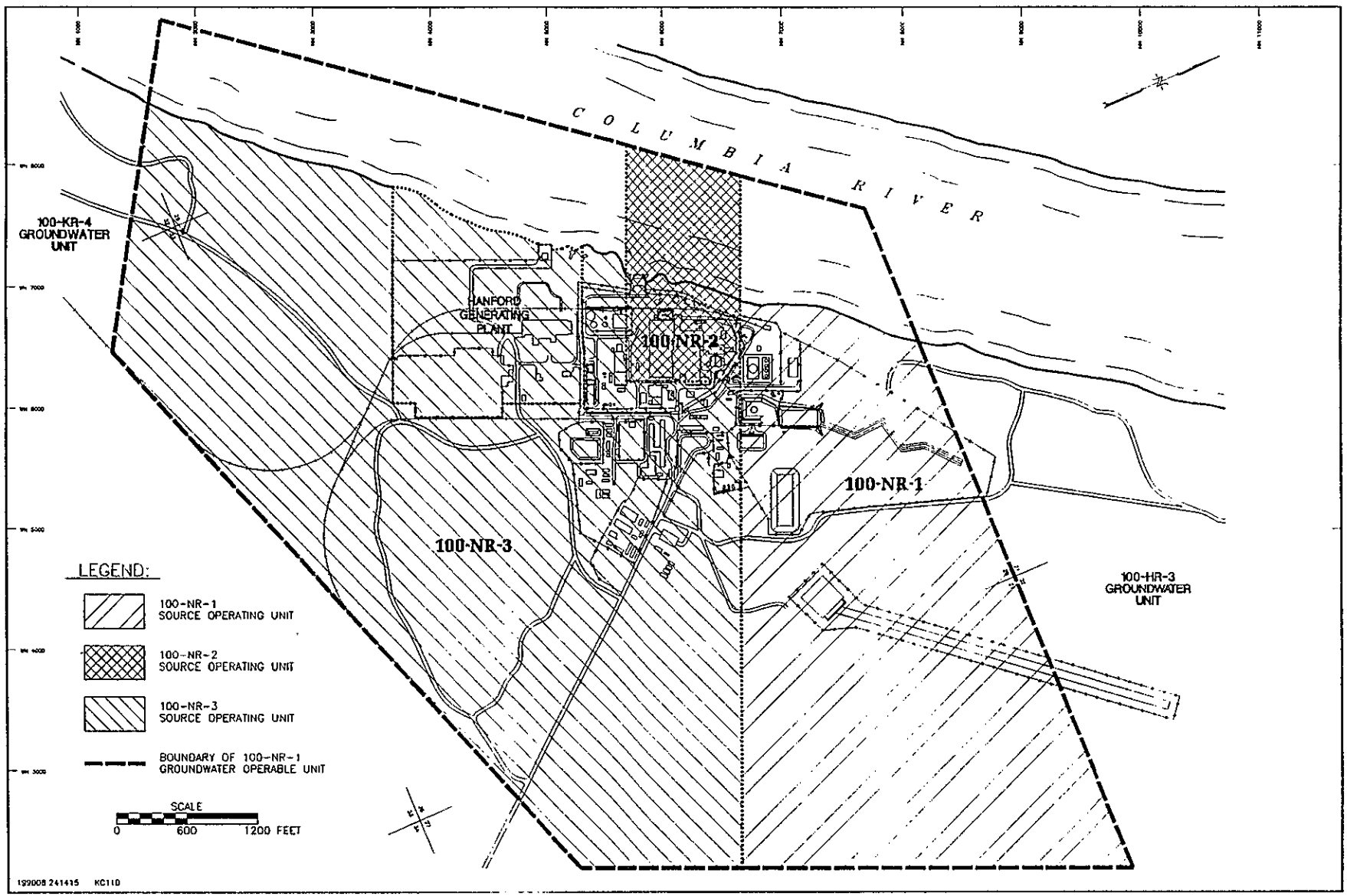


Figure 4. Operable Units at the 100-N Area

listing proposal. These units, rankings, and operable unit groupings are also included in the Tri-Party Agreement (Ecology et al. 1989) Action Plan (Action Plan), Appendixes C, Listing, and D, Work Schedule.

The Action Plan (Section 7.4.1) specifically acknowledges that sufficient information may already exist that indicates that further investigation will be required (e.g., a release of hazardous or dangerous wastes or substances can be documented). In these cases, including the identification of additional units or unplanned releases not noted in the Action Plan, the RFA process is to be bypassed and the units included in the RFI/CMS work plan. In preparation of RFI/CMS and RI/FS work plans at Hanford, the current strategy calls for performance of scoping studies to identify units prior to production of the work plan. Because of the recent adoption of this policy, the work plan for the 100-NR-3 RFI/CMS is being developed concurrently with the Westinghouse Hanford Company (Westinghouse Hanford) scoping study.

Preparation of this work plan involved preliminary evaluation and summarization of a large volume of existing documentation, visual inspection of the operable unit, and personal knowledge gathered from interviews with current and former Westinghouse Hanford and UNC, Nuclear Industries employees. This information is organized into Sections 1.0 through 4.0 of this work plan.

The typical sequential RFI/CMS process has been modified to match the typical concurrent CERCLA RI/FS procedures. This modification accelerates the overall corrective action process and allows development of a RFI/CMS work plan which is equivalent in format and function to RI/FS work plans, as required in the Tri-Party Agreement. This procedure also permits data collection to be focused on activities that facilitate selection of the optimal corrective action.

A preliminary evaluation of all identified sources in the area has been performed during development of the work plan. This has entailed examination of disposal, unplanned release, and environmental monitoring records for the 100-NR-3 operable unit.

The strategy for the performance of RFI/CMS activities at Hanford calls for a phased approach. Scoping studies and work plans are focused on the RFI Phase I, which consists of the initial characterization of the site. The purpose of this phase is to sufficiently characterize the operable unit to: (1) determine if any source or contamination poses imminent and substantial endangerment to human health or the environment, thus triggering interim corrective actions; (2) conduct a short-term risk assessment; and (3) define the scope of the Phase II RFI.

The development of corrective action alternatives (CMS Phases I and II) will be conducted concurrently with the RFI Phase I characterization so that the goals of the RFI/CMS process will be addressed throughout all stages in the project.

Phase I of the 100-NR-3 RFI will include more complete evaluation of additional existing information and close coordination with the 100-NR-1 RFI/CMS.

1.4 PROJECT GOALS

The goals and purposes of the 100-NR-3 RFI are to provide sufficient information needed to select the most appropriate corrective measure, by determining and/or evaluating:

- The nature and extent of the threat to public health and the environment posed by releases of dangerous, hazardous or radioactive substances from the operable unit facilities to the soil, air, and terrestrial biota within 100-NR-3 boundaries
- The potential performance of specific corrective measure technologies.

Such determinations will be carried out to the extent necessary and sufficient to allow for the evaluation of corrective measure alternatives during the CMS.

An additional purpose of the 100-NR-3 Phase I RFI will be to provide ancillary data for the groundwater investigation being conducted in the 100-NR-1 RFI.

The goal of the 100-NR-3 CMS is to evaluate potential corrective measures that encompass a range of appropriate waste management options by developing, screening, and analyzing corrective measure alternatives.

The ultimate goal of the RFI/CMS is to allow the selection, for subsequent implementation, of cost-effective corrective measures that ensure the protection of human health and the environment.

1.5 QUALITY ASSURANCE

A basic objective of the work plan and attachments is to ensure that the data obtained and the conclusions drawn in the RFI/CMS are sufficiently accurate and reliable to support decisions associated with site evaluation, risk assessment, and evaluation and selection of corrective measures. To help achieve this goal, all work on the Hanford Site is subject to the

9 1 1 3 5 7 0 7 3 1

requirements of DOE-RL Order 5700.6B, Quality Assurance (DOE-RL 1986), which establishes broadly applicable quality assurance (QA) program requirements in compliance with American National Standards Institute/American Society of Mechanical Engineers NQA-1 guidelines (ANSI/ASME 1986); the QA program requirements so defined apply to all types of project activities conducted on the Hanford Site.

To ensure that the objectives of the RFI/CMS are met in a manner consistent with DOE-RL Order 5700.6B (DOE-RL 1986), all work will be performed in compliance with Westinghouse Hanford Company's QA manual (WHC 1989e). The work plan will be reviewed by the appropriate Westinghouse Hanford staff to assure compliance with the QA manual. The work will also comply with procedures outlined in the QA program plan specific to CERCLA RI/FS activities (WHC 1990a). This QA program plan describes the various plans, procedures, and instructions that will be used by Westinghouse Hanford to implement the requirements of DOE-RL Order 5700.6B. The plan discusses areas such as:

- Management policies
- Organization charts and charters
- Management requirements and procedures
- Document clearance and information release
- Records management
- Quality audits and surveillance
- Health physics and radiological protection
- Emergency preparedness
- Standard engineering practices
- Radioactive and mixed solid waste packaging, storage, and disposal requirements
- Publication style
- Procurement.

Current EPA guidance for structure and content (EPA 1988a) has been followed in the preparation of the work plan and attachments. These plans have been prepared within the overall DOE-mandated QA program structure and will be supported and implemented through the use of standard operating procedures drawn from the overall program.

1.6 ORGANIZATION OF WORK PLAN

The work plan for the 100-NR-3 operable unit conforms with current draft guidance for RI/FS activities under CERCLA and pursuant to regulations in the National Contingency Plan (EPA 1988a). It is based on current knowledge of conditions at the operable unit.

The work plan is intended to be a document which will be amended, as necessary. In this manner, the work plan will provide efficient and effective directions consistent with project goals. A dynamic work plan will also serve to help document the rationale for project decisions and conclusions, and thereby provide assistance in making subsequent remediation decisions.

The RFI/CMS is divided into five interdependent phases--two RFI phases (operable unit characterization and treatability investigation) and three CMS phases (corrective alternatives development, screening, and analysis). The RFI and CMS are to be conducted concurrently. Existing data describing media contamination are adequate for preliminary identification of corrective measures options. However, the full extent of contamination and degree of mobility of contaminants must be determined before final corrective measures are chosen. The data collected in the RFI provide the information needed to evaluate alternatives in the CMS; the CMS, in turn, determines the corrective measure data collection objectives for the RFI. Figure 2 showed how the RFI/CMS fits into the overall corrective action process. Each phase of the RFI/CMS and its corresponding objective is indicated.

The work plan consists of seven sections. These sections include this Introduction (Section 1.0), the Operable Unit Background and Setting (Section 2.0), the Initial Evaluation (Section 3.0), the Work Plan Rationale (Section 4.0), the RFI/CMS Tasks (Section 5.0), the RFI/CMS Schedule (Section 6.0), and References (Section 7.0).

Section 2.0 presents the broad operable unit background setting. It includes a history and current understanding of the 100-N waste generation, transfer, storage, and disposal processes and facilities. The environmental setting for 100-NR-3 and its surroundings are also summarized, both from a historical and current perspective. This section points out the general impact of waste management activities on environmental setting and sets the stage for evaluating the impact of specific source units on the environmental setting presented in Section 3.0.

Available data are reviewed in Section 3.0. Potential sources, effluent quantities, and characteristics are identified, along with the current understanding of the impact on various

environmental media. Legal CAR for the various contaminants are identified, potential impacts to public health and the environment are assessed, and preliminary corrective action objectives are presented.

Section 4.0 provides the rationale and objectives for RFI/CMS activities. Data needs, data quality objectives, and the data collection strategies required to attain the objectives are discussed, based on data presented in Sections 2.0 and 3.0.

Section 5.0 presents the tasks necessary to conduct the phases of the RFI/CMS. Specific subtasks and activities for the treatability investigation and corrective alternatives analysis are not set forth, because such activities will be dependent on the information gathered during the operable unit characterization phase of the RFI and the results of the initial phases of the CMS.

A project schedule is presented in Section 6.0. Modifications to the schedule may be needed as information is obtained during project implementation.

References for literature cited in the work plan are provided in Section 7.0.

There are five attachments to the work plan. These are:

- Attachment I--Sampling and Analysis Plan
  - Ia--Field Sampling Plan
  - Ib--Quality Assurance Project Plan
- Attachment II--Health and Safety Plan
- Attachment III--Project Management Plan
- Attachment IV--Data Management Plan
- Attachment V--Community Relations Plan.

The sampling and analysis plan is composed of two subcomponent plans: Attachment Ia--field sampling plan, and Attachment Ib--quality assurance project plan. The field sampling plan specifies types of samples and sampling objectives needed to fulfill the objectives of the site characterization phase of the RFI. Sampling locations, frequencies, and sample designations are also specified in that plan. The quality assurance project plan specifies analytical objectives. Also specified are sampling and QA/quality control (QC) procedures needed to ensure that the project provides information of defendable quality.

The health and safety plan specifies occupational health and safety procedures to ensure the maintenance of personnel involved in RFI/CMS field activities. The project management plan defines the administrative and institutional tasks necessary to support RFI/CMS activities. The data management plan specifies data management procedures for the project. The community relations plan specifies activities that will be used to keep the potentially impacted and interested communities informed of project progress and results. The community relations plan also specifies activities needed to obtain and incorporate appropriate community feedback on the project.

9 1 1 0 3 7 1 7 3 5

2.0 OPERABLE UNIT BACKGROUND AND SETTING

Operational and environmental characteristics of a site need to be understood to assess the likelihood of contamination and the behavior of contaminants in the environment. Information describing the natural and manmade systems at the 100-N Area is presented in this section.

2.1 OPERABLE UNIT SITE DESCRIPTION

The following section briefly describes the physical and operational characteristics of the 100-N Area to provide information necessary for understanding the waste streams associated with contaminant sources addressed in Section 3.1.1.

2.1.1 Location

The Hanford Site is a 560-mi^2 tract of land located in Benton, Franklin, and Grant counties in south-central Washington. The 650-acre 100-N Area is situated along the Columbia River. Figure 5 shows the Hanford Site and the location of the 100-N Area. The 100-N Area is bounded on the northwest by the Columbia River, on the northeast by the 100-D Area, on the south and east by the 600 area; and on the southwest by the 100-K Area (Ecker et al. 1983, p. 3).

Three operable units are located in the 100-N Area. These are 100-NR-1, 100-NR-2, and 100-NR-3. The 100-NR-3 operable unit is composed of the physical structures present and potential sources within the boundaries of the 100-NR-3 area.

2.1.2 History of Operations

The N Reactor was the last reactor to be constructed as a major production reactor at the Hanford Site. It differs from the other reactors at Hanford in that it was designed as a dual-purpose reactor capable of producing special nuclear materials and electricity from steam production. The steam production of the N Reactor, produced from the core cooling systems, was piped to the Hanford Generating Plant, which began construction in September 1963. The N Reactor went into production in December 1963. The Hanford Generating Plant completed and producing electrical power by April 1966. Both systems operated continuously, except for periodic shutdowns for maintenance and repairs until December 1987, when N Reactor was placed in standdown (shut down with fuel in place) status. In

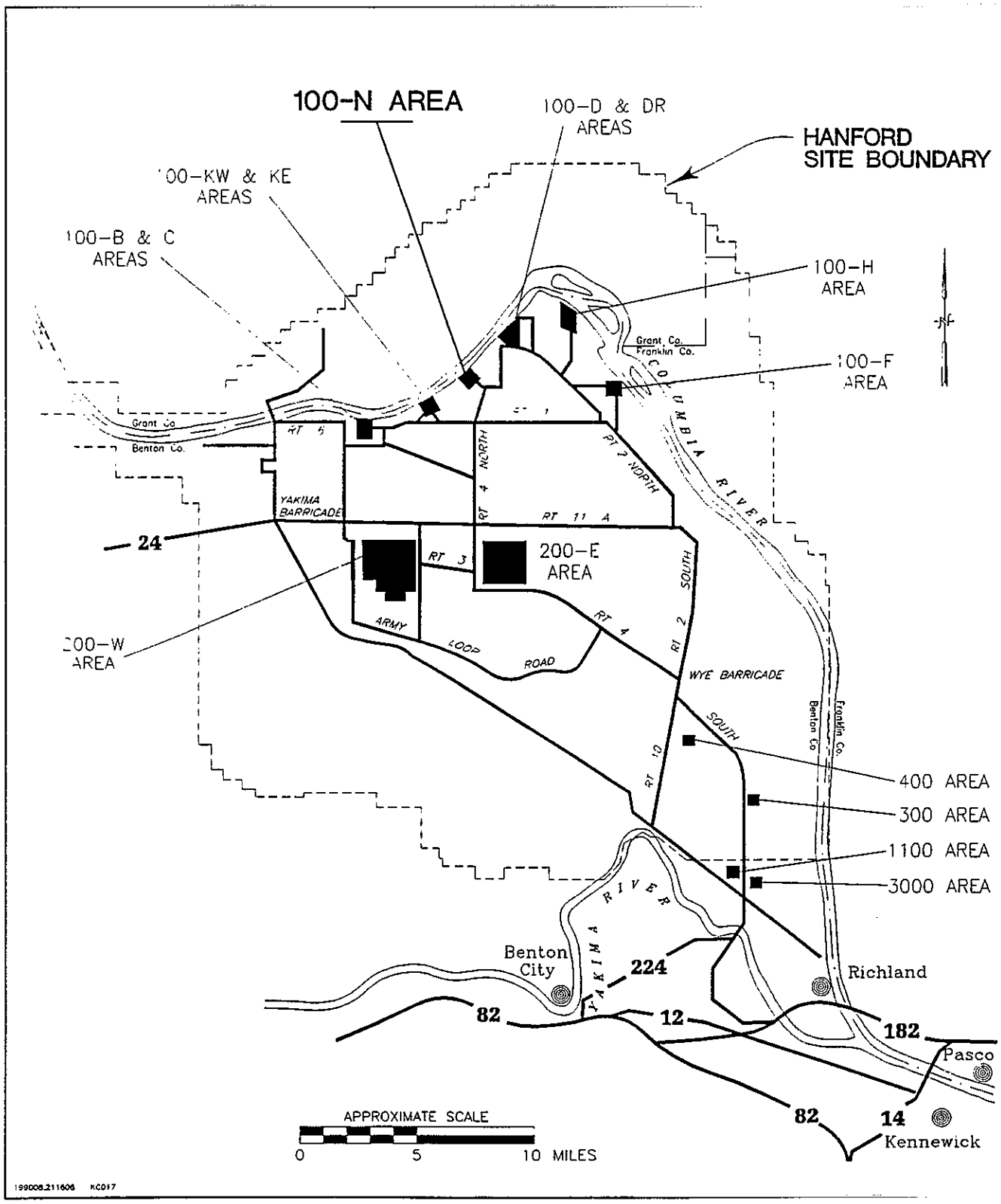


Figure 5. Location of the 100-N Area

February 1988, N Reactor was placed in cold standby (cooled down, short-term layup status) (WHC 1989b, pp. 1.1-2 and 1.1-3). Table 1 presents other significant dates for the 100-N Area.

2.1.3 Facility Characteristics

All activities at the 100-N Area are conducted in support of the N Reactor, located in the 100-NR-2 operable unit. Section 2.1.3 of the 100-NR-1 operable unit work plan (DOE-RL 1990a) describes the N Reactor, its design and operations, and support activities throughout the 100-N Area.

The three main operating systems specific to 100-NR-3 are the 183-N/163-N Water Treatment System, the 184-N Plant Service Power House, and the Hanford Generating Plant.

2.1.3.1 183-N/163-N Water Treatment System. The 183-N Filtration Plant supplies the filtered and potable water needs of the 100-N Area. Filtered water is used for producing demineralized water. Raw water from the Columbia River is treated with chlorine gas (a biocide) and alum (a coagulant) in a mixing tank. From there, it is piped to a coagulator, where a polyelectrolyte is added as a coagulation aid, and then piped to the sand filters where actual filtration takes place. The filtered water is pumped to the filtered water storage tank from a clearwell south of the 163-N facility (Tuck 1990, p. 2-6).

The 163-N plant produces high quality, demineralized makeup water from filtered river water for the major coolant systems at N Reactor. Demineralized water is used to prevent mineral deposits that would foul piping systems. It also limits the generation of radioactive waste during reactor operation. The dissolved and suspended matter can become radioactive through neutron activation. Demineralized water has virtually all dissolved and suspended matter removed by ion exchange (Tuck 1990, p. 2-2).

The physical layout of the 163-N facility is presented in Figure 6. The 163-N facility contains demineralization equipment, including ion exchange units, regeneration tanks, treatment tanks (for pH adjustment) that are part of the elementary neutralization unit (ENU), acid and caustic storage tanks, a heater, and a degasifier (Tuck 1990, p. 2-3). The basic components of the plant and the demineralization process are described in the following paragraphs.

2.1.3.1.1 Primary Cation Exchange Units. There are four primary cation exchange units, which are the top portions of four large tanks (or ion exchange columns) in the 163-N facility. They contain ion exchange resins saturated with hydrogen ions to displace cation impurities (e.g., calcium, sodium, manganese, iron) in the water. At the same time, the displaced cations

Table 1. Overview of Significant Dates for 100-N Area Operation.

Date	Activity
May 13, 1959	Construction of N Reactor begins
September 1963	Construction of HGP begins
December 1963	N Reactor goes into production
March 1964	Construction of N Reactor completed
November 1964	N Reactor reaches 4,000 MW (thermal)
April 1966	HGP construction completed
December 1966	N Reactor reaches 800 MW (electrical) (combined with HGP output)
1975	N Reactor irradiated fuel storage begins in 105-KE reactor basin
1981	N Reactor irradiated fuel storage begins in 105-KW reactor basin
December 1987	N Reactor placed in standdown status
February 1988	N Reactor placed in cold standby
1989	Shipment of N Reactor irradiated fuel to 100-K Area completed
1990	N Reactor dewatered

HGP = Hanford Generating Plant

Source: WHC 1989b, pp. 1.1-2 and 1.1-3

accumulate on the resins and the resins eventually become "exhausted," losing their capacity to absorb more cations. When this occurs, the resins are sent to a regeneration tank, where they are again saturated with hydrogen ions while the cation impurities are removed (Tuck 1990, p. 2-2).

2.1.3.1.2 Primary Anion Exchange Units. There are four primary anion exchange units, which are the bottom sections of the tanks that contain the primary cation exchange units. These primary anion units contain ion exchange resins saturated with hydroxide ions. The hydroxide ions displace anion impurities (e.g., chlorides, fluorides, sulfates) in the water. The resins eventually become exhausted in the process and require regeneration (Tuck 1990, p. 2-4).

2.1.3.1.3 Degasifier. Also referred to as the deaerator, this device uses heat and vacuum to remove noncondensible gases (e.g., nitrogen, oxygen) from the cation effluent water. The degasifier has two vacuum systems: a steam jet air ejector system that uses medium pressure steam to create a vacuum, and a system that consists of three vacuum pumps (Tuck 1990, p. 2-4).

2.1.3.1.4 Heater. Also referred to as the heat exchanger, this device uses medium-pressure steam to warm up the water after it exits the primary cation units. The water must be heated to reduce the solubility of gases and make the degasifier more efficient (Tuck 1990, p. 2-4).

2.1.3.1.5 Booster Pumps. There are four booster pumps, each rated at 600 gal/min, to increase the water pressure after it exits the degasifier (Tuck 1990, p. 2-4).

2.1.3.1.6 Secondary Cation and Anion Exchange Units. There are four secondary cation units and four secondary anion units. These units are in four tanks in the top and bottom sections, respectively, in a manner similar to the primary units. The secondary units contain the same ion exchange resins as the primary units. Their purpose is to remove any impurities remaining in the water following treatment in the primary units. Because the water treated in the secondary units has already been largely deionized in the primary units, the resins in the secondary units are exhausted and require regeneration less frequently (Tuck 1990, p. 2-4).

2.1.3.1.7 Resin Trap. The resin trap removes any resins that may have escaped from the cation and anion exchange units, and it prevents the resins from entering the 163-N facility wastewater. The resin trap is a series of screens through which the demineralized water flows (Tuck 1990, p. 2-4).

2.1.3.1.8 Demineralized Water Storage Tank. This tank stores water from the 163-N facility before the water is used at

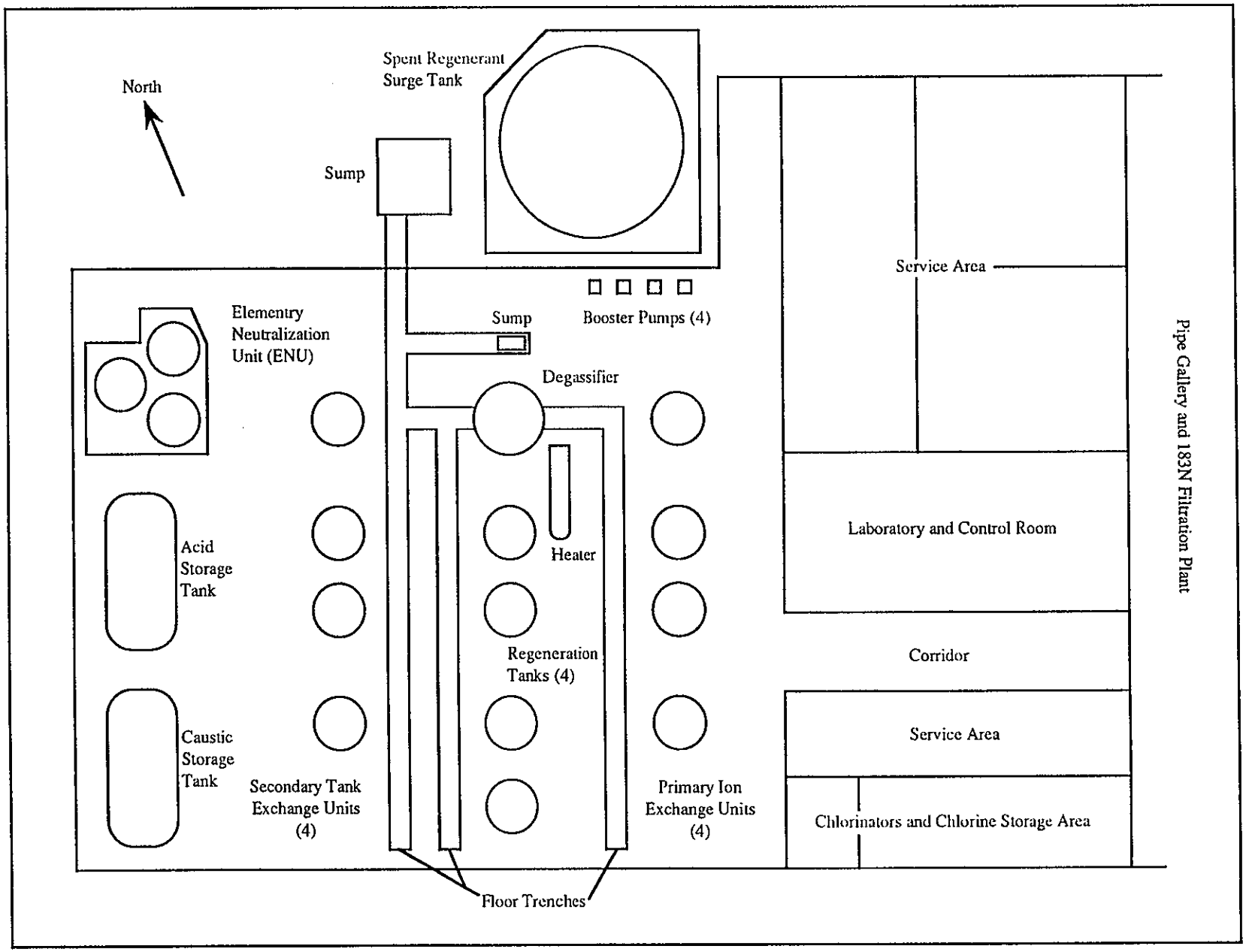


Figure 6. Generalized Floor Plan of the 163-N Facility

N Reactor. It is a 1 million-gal capacity tank, located along with other water storage tanks southwest of the 163-N facility (Tuck 1990, p. 2-4).

2.1.3.1.9 Regeneration Tanks. These are used to regenerate the cation and anion exchange resins when they become "exhausted" or saturated with ions and impurities. There are four regeneration tanks. The regeneration tank for the primary cation units and the regeneration tank for the primary anion units each have an upper compartment where regeneration occurs, and a lower compartment where a spare resin charge is stored. The spare resin is sent to the primary units at the same time as the depleted resin charge is sent to the regeneration tank, allowing near-continuous operation of the primary units (Tuck 1990, p. 2-4).

A sulfuric acid solution is used to regenerate cation resins, and a sodium hydroxide solution is used to regenerate the anion resins. The solutions are pumped through the resins in the regeneration tanks and drained to the spent regenerant surge tank (Tuck 1990, p. 2-5).

2.1.3.1.10 Acid and Caustic Storage Tanks. Located along the west inside wall of the 163-N facility, acid and caustic storage tanks contain solutions of sulfuric acid (H^2SO^4, 93% by weight) and sodium hydroxide (NaOH, 50% by weight), respectively. These solutions are used to regenerate the resins and to neutralize the spent regenerant (i.e., the wastewater from regeneration). The storage tanks are surrounded by curbs for spill control. The acid or caustic spills are recovered. The storage tanks are filled, as needed, through below-grade pipelines that run through concrete trenches from larger tanks located at the 108-N chemical unloading facility east of 163-N (Tuck 1990, p. 2-5).

2.1.3.1.11 Spent Regenerant Surge Tank. The spent regenerant surge tank is located outside the 163-N facility on its north side. It is designed to store spent regenerant until it can be neutralized in the elementary neutralization unit (ENU). During normal operation, the surge tank discharges to the ENU system (Tuck 1990, p. 2-5).

The effluent stream is then neutralized and discharged to the 120-N-1 (1324-NA) Percolation Pond. An alternate mode of operation allows the waste stream to be neutralized in the surge tanks by recirculation and pH adjustment. Upon reaching proper pH, the liquid is sent to the 120-N-1 Percolation Pond by an 8-in. chemical waste pipeline. After neutralization, the effluent stream contains no dangerous or radioactive constituents. The surge tank is surrounded by a concrete berm for spill control, capable of containing the entire volume of the tank (Tuck 1990, p. 2-5).

2.1.3.1.12 Elementary Neutralization Unit. The elementary neutralization unit (ENU) includes three upright tanks adjacent to the acid and caustic storage tanks inside 163-N. Spent regenerant is piped from the surge tank to the ENU. After adding the proper amount of acid or caustic solution, the tank contents are mechanically agitated to ensure mixing and pH neutralization. Neutralized spent regenerant is discharged from the ENU to 120-N-1 when its pH falls within the range from 6.0 to 9.0. Spent regenerant having a pH outside this range is piped back to the surge tank until it can receive additional treatment in the ENU. The ENU is surrounded by a curb, for spill control (Tuck 1990, p. 2-5).

2.1.3.2 184-N Plant Service Power House. During reactor shutdowns, startup, or during periods when offsite power was not available, the onsite 184-N plant service power house boilers provided steam for the reactor coolant pump drive turbines and for the onsite turbine generators Hanford Generating Plant to supply power. There are three boilers. Two boilers are located in the 184-N Building. These boilers can supply the approximately 340,000 lbs of steam per hour required following a reactor shutdown and during reactor startup periods (WHC 1989b, p. 1.2-18).

Fuel for the boilers is piped from the 166-N Tank Farm (located in 100-NR-1) to the 184-N Day Tanks, located north of the 184-N Building. There are two 35,000-gal No. 6 fuel oil tanks and one 8,000-gal No. 2 diesel oil tank which provide fuel to the boilers. Underground piping connects the 166-N Tank Farm, the 184-N Day Tanks and the 184-N Boilers.

2.1.3.3 Hanford Generating Plant. The Hanford Generating Plant is located within the geographical area of the 100-NR-3 operable unit and receives steam via the steam piping system from the N Reactor. The Hanford Generating Plant consists of two 430 MWe, low pressure turbine generator systems with associated auxiliary equipment normally found in a steam power station. The Hanford Generating Plant is operated by the Washington Public Power Supply System. The Hanford generating plant condensers and auxiliary cooling systems are supplied by raw water pumped from the Columbia River and discharged back to the river approximately 300 ft upstream from the N Reactor raw water intake structure.

2.1.4 Primary Effluent Generation Processes

The 163-N Demineralization Plant regeneration waste stream is the primary effluent generated at 100-NR-3. Figure 7 shows the 163-N waste stream flow. The demineralization process at 163-N is discussed in Section 2.1.3.1.

Before 1977, the nonneutralized spent regenerant was discharged from the 163-N facility to the Columbia River, as was

9 1 1 3 9 7 0 7 4 5

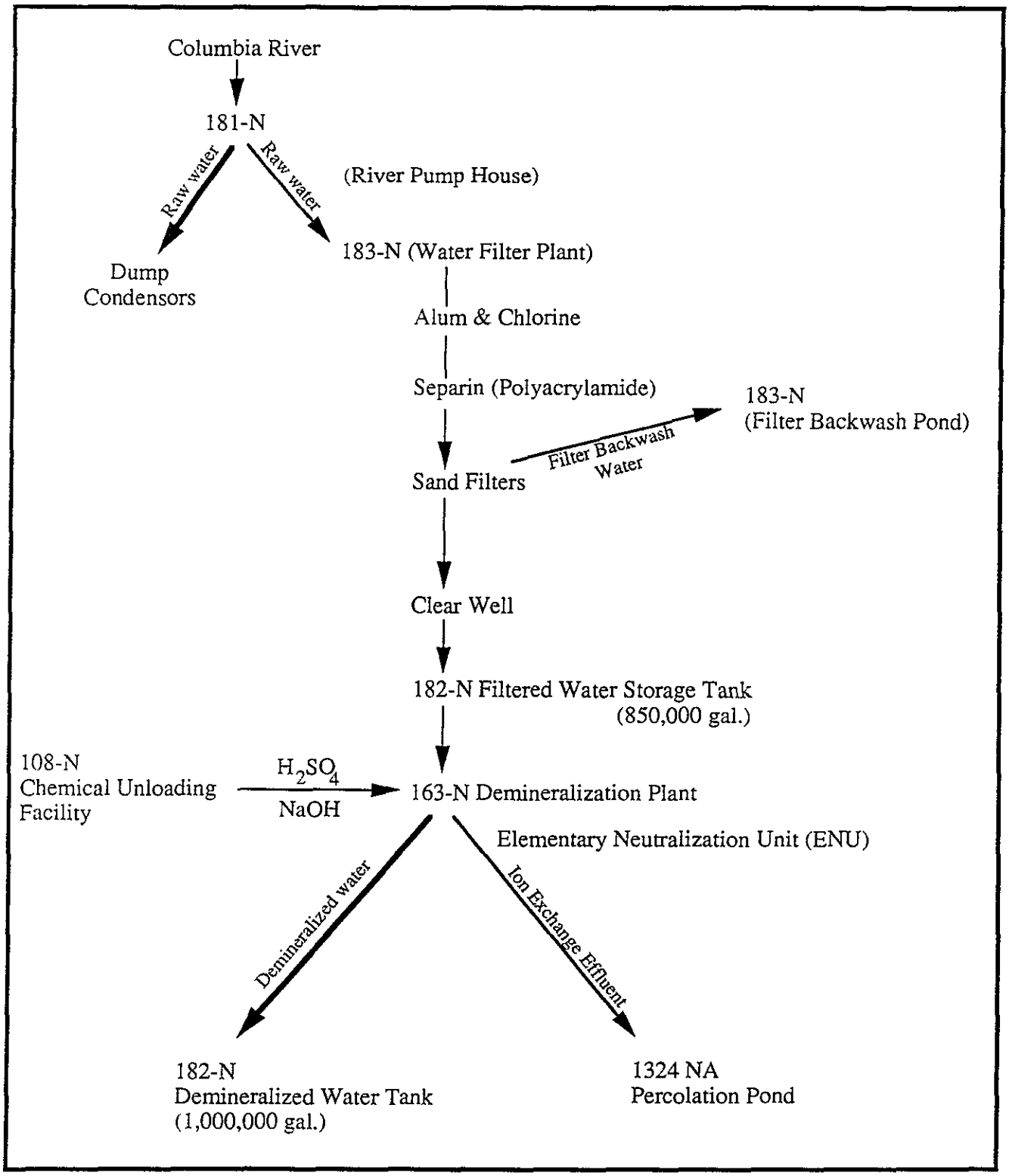


Figure 7. Flow Diagram of the 163-N Demineralization Plant Waste Stream

common practice of industry at the time. The resulting dilution was relied on to mitigate the corrosive nature of this wastewater. Beginning in 1977, spent regenerant from the 163-N facility was discharged to the unlined 120-N-1 Percolation Pond (1324-NA). The alternate addition of acidic cation regenerant and alkaline anion regenerant served to neutralize the pH of the pond contents over time. In addition, the buffering capacity of the calcareous soil underlying the pond assisted the neutralization process. Thus, waste from the 163-N facility was treated in situ at the 120-N-1 Percolation Pond by a combination of pH neutralization and eventual percolation or evaporation of the wastewater (Tuck 1990, p. 1-3).

Since early 1986, the 120-N-1 (1324-NA) Percolation Pond has received only neutralized wastewater because construction of the lined 120-N-2 (1324-N) Surface Impoundment in that year provided a means of neutralizing and mixing the spent regenerant (in batchwise fashion from successive regenerations) from the 163-N facility before discharging it to 120-N-1. The neutralization process involves treating individual batches with either sulfuric acid or sodium hydroxide, as appropriate. From 120-N-2, the neutralized wastewater was then piped to the 120-N-1 for disposal (Tuck 1990, p. 1-6).

In November 1988, use of the 120-N-2 (1324-N) Surface Impoundment was discontinued when the newly-constructed ENU was put on line inside the 163-N facility. The ENU neutralizes the spent regenerant before it leaves the plant, and does so with greater efficiency and operator control than had the 120-N-2 facility (Tuck 1990, p. 1-6).

2.1.5 RCRA/CERCLA Interrelationships

This section discusses the regulatory and physical interactions between RCRA and CERCLA requirements in the 100-NR-3 operable unit. The general approach to integrating RCRA and CERCLA rules (including state requirements) is described in the Tri-Party Agreement and Action Plan (Ecology et al. 1989), and discussed in the Introduction to this work plan (Sections 1.1.2 and 1.3.2).

2.1.5.1 RCRA Treatment, Storage, and Disposal Units. Active or recently active TSD units at 100-NR-3 which must be operated, permitted, and/or closed in compliance with RCRA and the state Dangerous Waste Program regulations are identified in Appendix B of the Tri-Party Agreement Action Plan. They include the 120-N-1 (1324-NA) Percolation Pond and the 120-N-2 (1324-N) Surface Impoundment.

A dangerous waste Part B permit application (WHC 1986a) for 120-N-2 was submitted to Ecology in 1986 by DOE-RL, in accordance

with RCRA. This submittal contains process information and proposed permit conditions for the facility.

The 120-N-2 (1324-N) Surface Impoundment was operated under RCRA interim status from 1986 through 1988. After construction of the ENU, the 120-N-2 facility has been inactive and is currently undergoing RCRA closure as part of the Tri-Party Agreement Milestone M-20-35 (Tuck 1990, p. 1-6).

More than one year of RCRA groundwater monitoring at the site has been completed. Since a significant statistical difference between the upgradient and downgradient water quality has been observed, monitoring of this site has advanced into a more detailed assessment program (Tuck 1990, p. 1-6).

On December 5, 1988, a Notice of Intent was submitted to EPA, Region X, with a request to reroute this neutralized waste stream back to the river outfall. A formal National Pollutant Discharge Elimination System (NPDES) permit application is in progress (Tuck 1990, p. 1-6).

As part of the 1989 Liquid Effluent Study Project, which characterizes 33 waste streams throughout the Hanford Site, the 163-N regeneration effluent stream was characterized. The characterization consisted of the following elements: a process description, sampling data, and a proposed waste stream designation based on dangerous waste regulations contained in Washington Administrative Code (WAC) 173-303. The characterization report (Tuck 1990) proposes that this effluent stream is not a dangerous waste pursuant to the above regulations, thus affecting the RCRA status of the 120-N-1 and 120-N-2 units.

2.1.5.2 Other RCRA Waste Management Units. Other 100-NR-3 locations where containerized dangerous or mixed wastes have been temporarily stored (less than 90 days), or waste management tanks in which elementary neutralization of corrosive dangerous wastes has been conducted in accordance with WAC 173-303, are not subject to closure plan requirements. The Mixed Waste Storage Pad (116-N-8) and the Nonhazardous and Nonradioactive Waste Storage Pad (120-N-4) are considered major temporary storage areas. The 163-N Demineralization Plant ENU has been in operation since 1988. These units and locations were reviewed, in accordance with CERCLA guidance, during development of this work plan to determine if releases have occurred or may have occurred.

2.1.5.3 RCRA Past Practice Units. Under the terms of the Tri-Party Agreement, all other "past practice" units in the 100-NR-3 operable unit are to be addressed under RCRA corrective action authority, and are therefore classified as RCRA past practice units. The RCRA past practice classification includes

sites where releases of hazardous, dangerous (including state-only) or mixed wastes, or CERCLA hazardous substances (including radioactive-only), have occurred or may have occurred, without regard to the date of the release.

2.1.5.4 RCRA/CERCLA Summary. Integration of RCRA (state and federal) and CERCLA requirements as specified in the Tri-Party Agreement provides a unified, comprehensive approach to assessment and eventual cleanup of radioactive and dangerous wastes which may pose a risk to public health or the environment.

2.2 PHYSICAL SETTING

Of critical importance in designing an effective program for site characterization is an understanding of the environmental media and pathways. Existing information on the environment is presented in this section. An evaluation of data gaps and uncertainties regarding the various media is included to help direct data-gathering activities in the Phase I characterization. Because the 100-NR-3 RFI/CMS will not directly investigate releases to groundwater or the river, geological and hydrological information is summarized only in this section. Reference is made to the 100-NR-1 RFI/CMS work plan, where the subsurface and hydrologic environment of the 100-N Area is discussed in more detail.

2.2.1 Topography

The topography of the 100-N Area is relatively flat with elevations ranging from approximately 390 ft above msl at the Columbia River to approximately 460 ft above msl on the east side of the area. Topography at the site is shown in Figure 8. Most of the area has been reworked as part of construction of the reactor building and related facilities. This area is relatively flat and overlooks the river, with an elevation approximating 450 ft above msl. The hummocky terrain surrounding the 100-N Area is perhaps the result of catastrophic flooding associated with Pleistocene glaciation.

2.2.2 Geology

The geology of the 100-N Area is summarized in this section, beginning with a discussion of the regional setting and followed by site-specific characteristics.

2.2.2.1 Regional Geology. The Hanford Site is located in the Pasco Basin, a subsection of the Columbia-Snake River Plateau physiographic province (WHC 1987a, p. 5-3). The Pasco Basin is a structural basin bounded on the north by Saddle Mountain; on the west by the Umtanum Ridge, Yakima Ridge, and the Rattlesnake Hills; on the south by a series of doubly plunging anticlines;

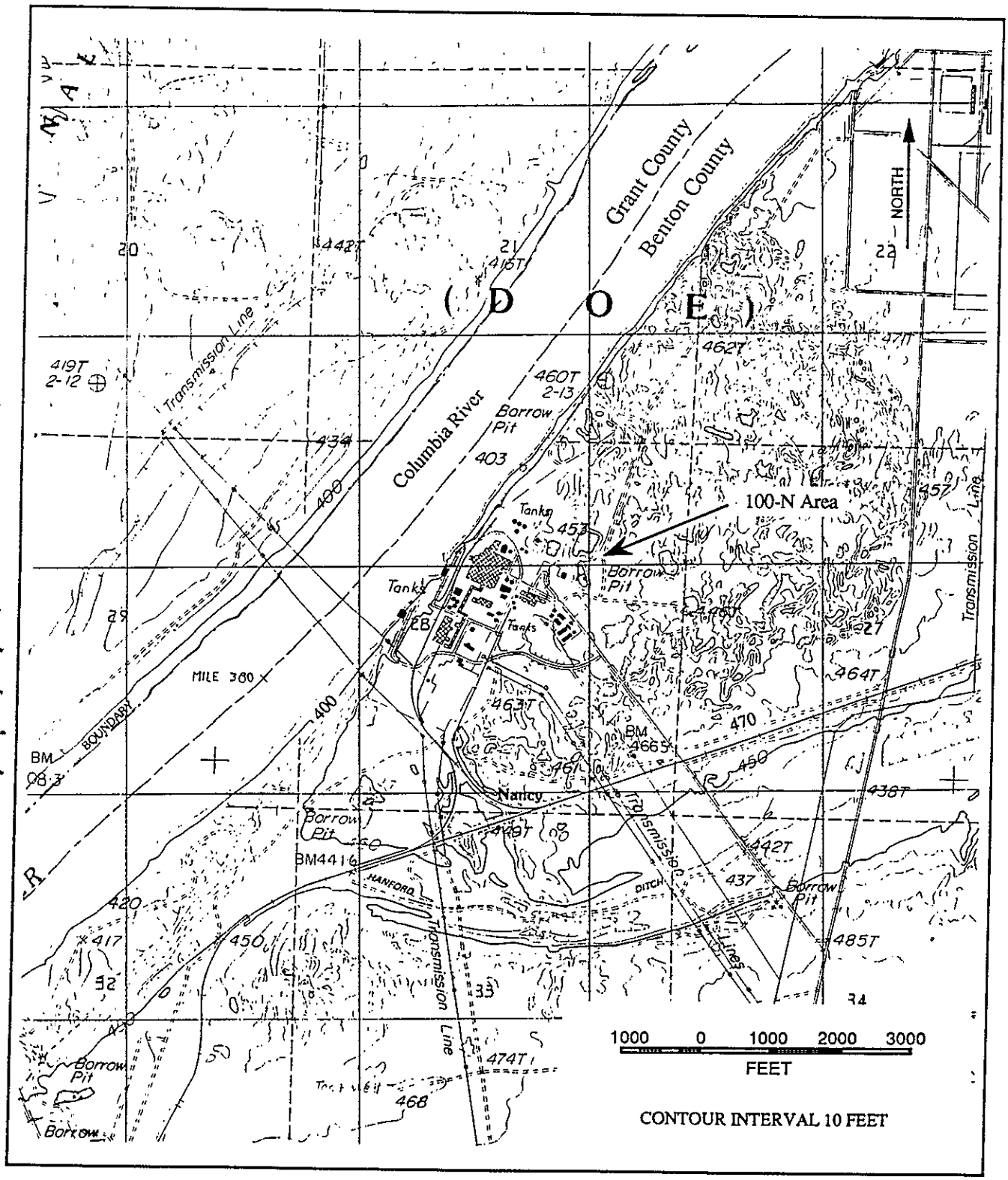


Figure 8. Topography of the 100-N Area
Source: Coyote Rapids Quadrangle-Washington
7.5 Minute Series (Topographic)

which merge with the Horse Heaven Hills; and on the east by a broad monocline, locally known as the Jackass Mountain Monocline. Structural features of the Pasco Basin are shown in Figure 9.

The stratigraphy underlying the Pasco Basin is typified by a great thickness of flood basalts overlain by up to 1,300 ft of clastic deposits divided into the Ringold Formation and the Hanford formation. Alluvium, colluvium and eolian sediments locally veneer the surface of the Pasco Basin. The stratigraphic column for the Hanford Site is presented in Figure 10.

The Columbia River Basalt Group consists of a 10,000-ft-thick series of five formations of tholeiitic flood basalts. These basalts are interbedded with sedimentary rocks of the Ellensburg Formation, which record fluvial deposition from the ancestral Columbia River. These units are described in more detail in Section 2.2.2.1.2 of the 100-NR-1 RFI/CMS work plan (DOE-RL 1990a).

The Ringold Formation occurs above the Columbia River Basalt, and consists of interbedded clays, silts, and sands (with some gravel) that were deposited in response to a period of uplift and erosion that occurred near the end of and after basalt eruption ceased. These sediments were deposited in association with fluvial systems. The Ringold Formation is up to 1,200 ft thick in some areas of the Pasco Basin (WHC 1987a, pp. 5-9 to 5-10).

The Hanford formation is composed of coarse sands and gravels as well as fine sands and silts. These sediments are essentially multiple flood deposits that were emplaced when the dams of Pleistocene glacial lakes failed, which caused flooding and associated deposition of glaciofluvial sediments. The coarser-grained sediments occur principally within the center of the Pasco Basin, and are high-energy (flood) deposits that are referred to as the Pasco gravels (WHC 1987a, p. 5-12). The finer sand and silt units, called the Touchet beds (WHC 1987a, p. 5-12), are representative of low-energy sediment deposition and occur principally along the margins of the basin. Lateral facies variation within the gravels is apparent and can be attributed to changes in energy regimes and water levels that occurred during floods. The thickness of the Hanford formation is quite variable and is thickest in the areas of paleochannel deposition (WHC 1987a, pp. 5-10 to 5-12).

2.2.2.2 Geology of the 100-N Area. While the deeper units described above are probably present below the 100-N Area, stratigraphic information is available only for upper units of the stratigraphic column. Stratigraphic units known to be present in the 100-N Area consist of the Saddle Mountain Basalt, the Ringold Formation, and the Hanford formation. Surficial eolian deposits are also present in the area. Because of the

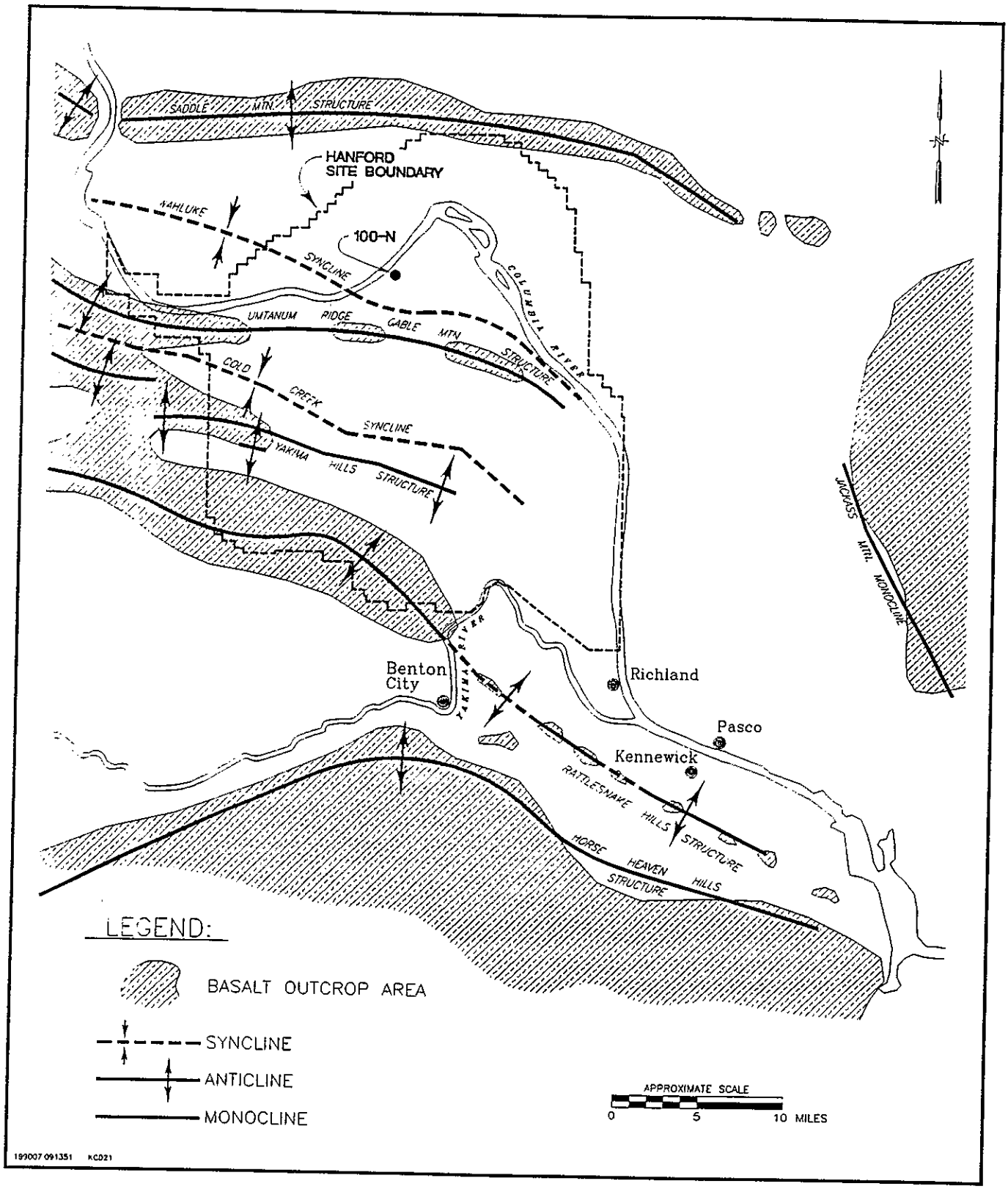
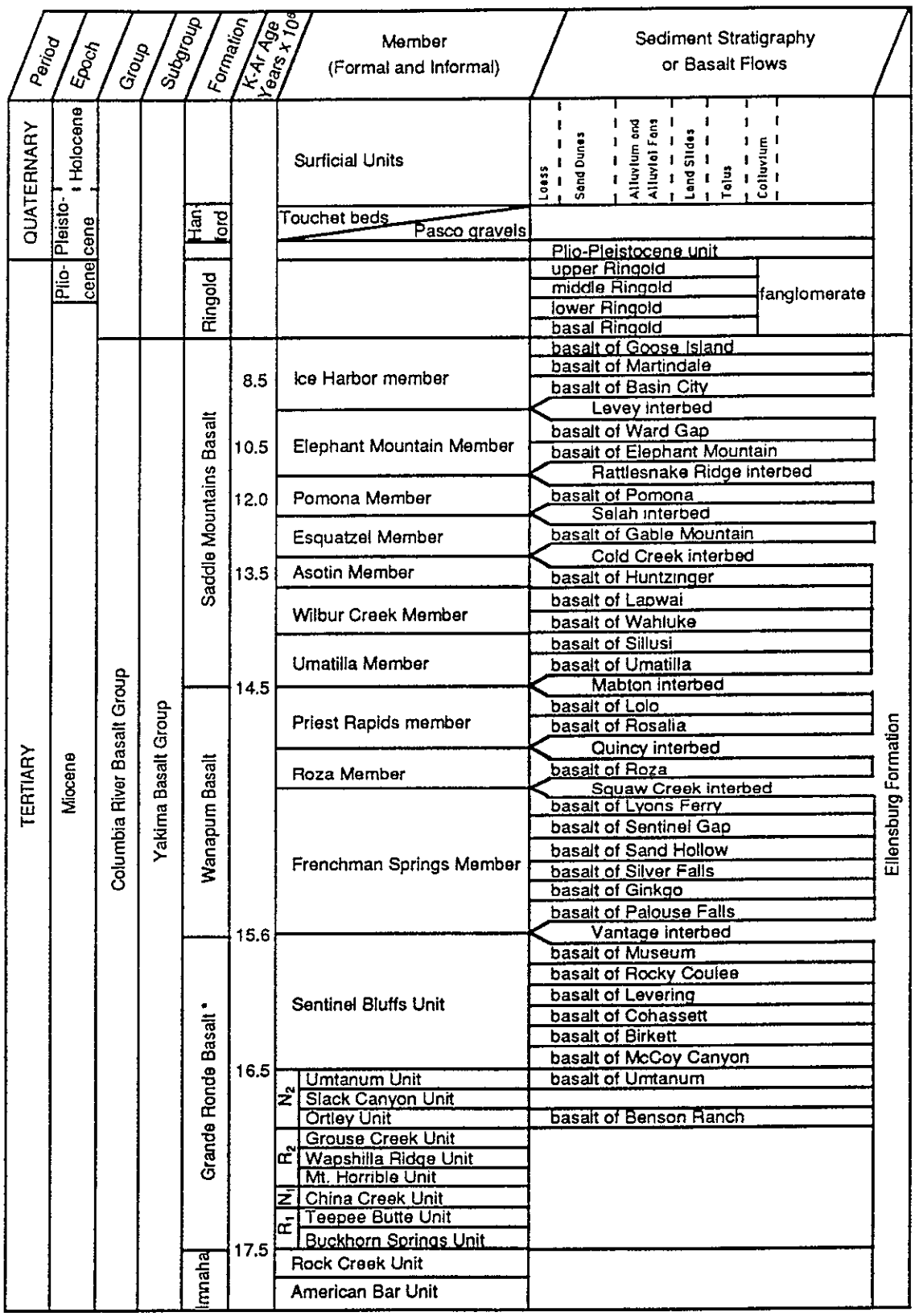


Figure 9. Structure of the Pasco Basin



* The Grande Ronde Basalt consists of at least 120 major basalt flows. Only a few flows have been named. N_2, R_2, N_1 and R_1 are magnetostratigraphic units.

Figure 10. Hanford Site Stratigraphic Column

institutional relationship between the 100-NR-3 and 100-NR-1, units underlying the Hanford formation are not described in detail in this work plan. Discussion of these units can be found in Section 2.2.2.2 of the 100-NR-1 operable unit RFI/CMS work plan (DOE-RL 1990a).

Logs from the installation of approximately 70 wells are available for characterization of the 100-N Area geology. Of these, seven wells are located in the 100-NR-3 operable unit. The majority of the wells at 100-N were completed within the uppermost portion of the Ringold Formation. Additionally, five borings (identified as "BH" borings) were drilled in 100-NR-3 in support of the HGP Nuclear Project No. 1 (WPPSS 1974). A geologic column based on both the wells and borings is presented in Figure 11. The location of the monitoring wells and the deeper borings in the 100-N Area is presented in Figure 12.

Data quality of geologic descriptions on boring logs is highly variable. The level of detail in the descriptions is dependent upon the person logging the hole, as well as the sampling methods. The majority of the shallow holes (N wells) were drilled using cable tool and samples for lithologic descriptions were collected by bailing the holes. Other wells were drilled using air rotary, and drill cuttings were used to log the holes. Further details on sampling methods in the wells and borings are discussed in Section 2.2.2.2.1 of the 100-NR-1 RFI/CMS work plan (DOE-RL 1990a).

Three cross sections for the 100-N Area have been developed from well data. The location of these cross sections is shown in Figure 13, and the cross sections in Figures 14, 15 and 16. These cross sections portray the uppermost portion of the Ringold Formation and the Hanford formation. Because the water table approximates the Ringold/Hanford contact, detailed descriptions of the Ringold Formation and underlying units are given in Section 2.2.2.2.3 of the 100-NR-1 RFI/CMS work plan (DOE-RL 1990a). Discussion of the Hanford formation is provided to describe the vadose zone at 100-NR-3.

Although the cross sections are primarily from wells in the 100-NR-1 and 100-NR-2 operable units, the southern portions of B-B' and C-C' show conditions in 100-NR-3. Examination shows the material to be similar across the 100-N Area. The following discussion is based on evaluation of the well logs and cross sections.

The Hanford formation at 100-N occurs above the Ringold Formation and is composed of interbedded sands, gravels and cobbles of the Pasco gravels. The finer-grained Touchet beds are not present in this area. The unit is described as gravelly sand to sandy gravel that is poorly sorted and composed of rounded basaltic clasts with caliche deposits. Coarser-grained material

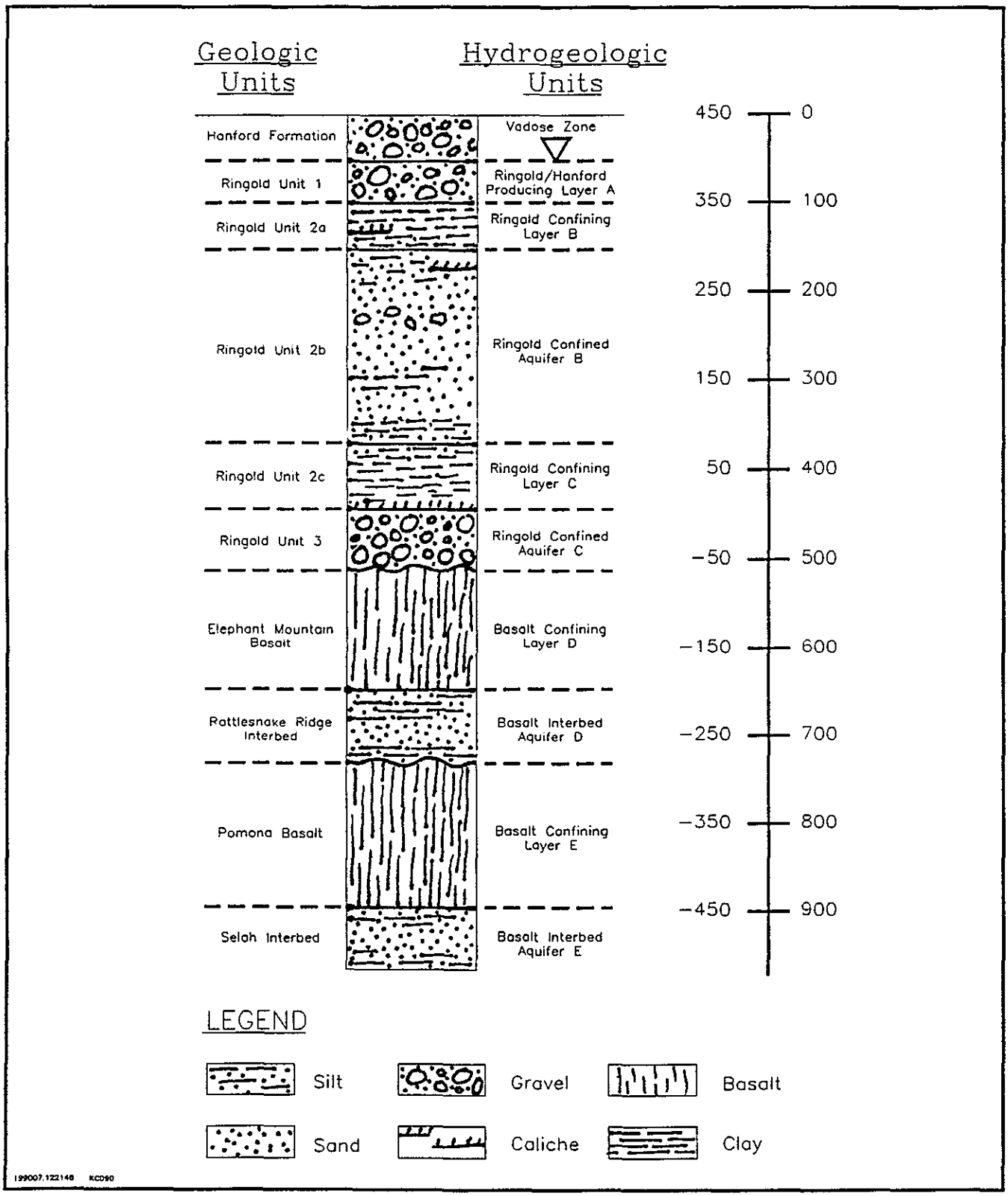


Figure 11. Conceptual Geologic and Hydrogeologic Column for 100-N

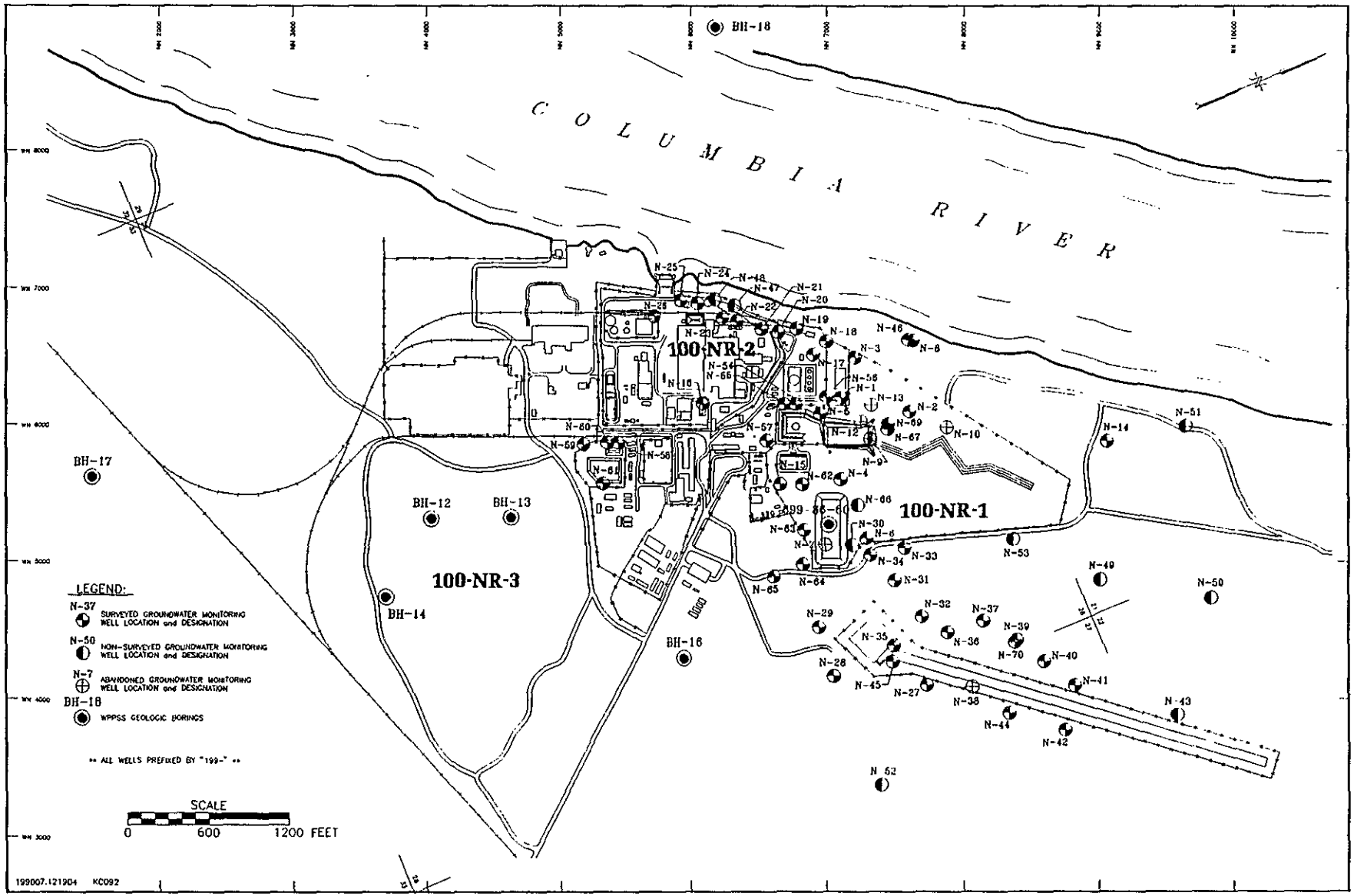


Figure 12. Location of Monitoring Wells and Geologic Borings in 100-N Area

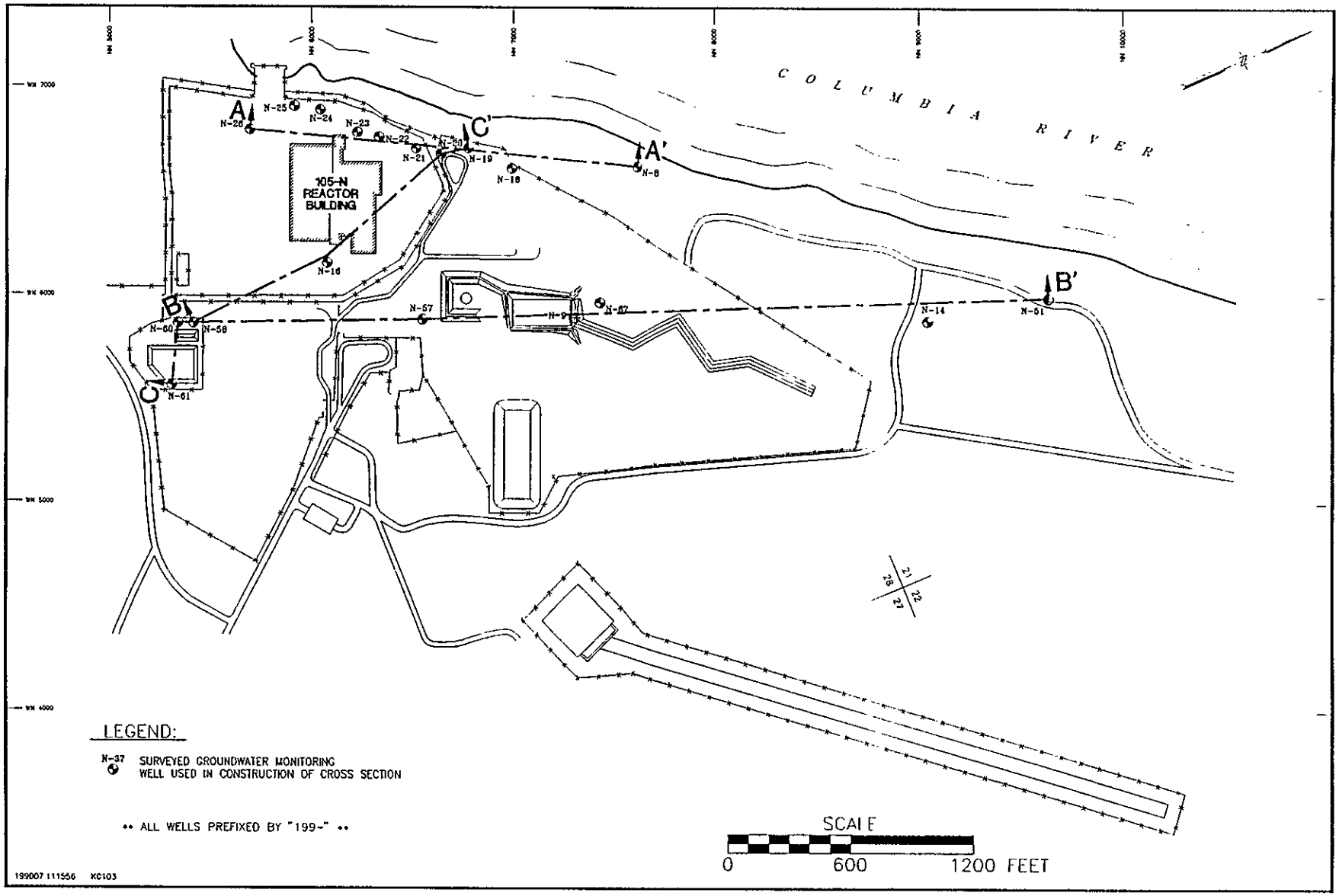


Figure 13. Locations of Cross-Sections A-A', B-B' and C-C'

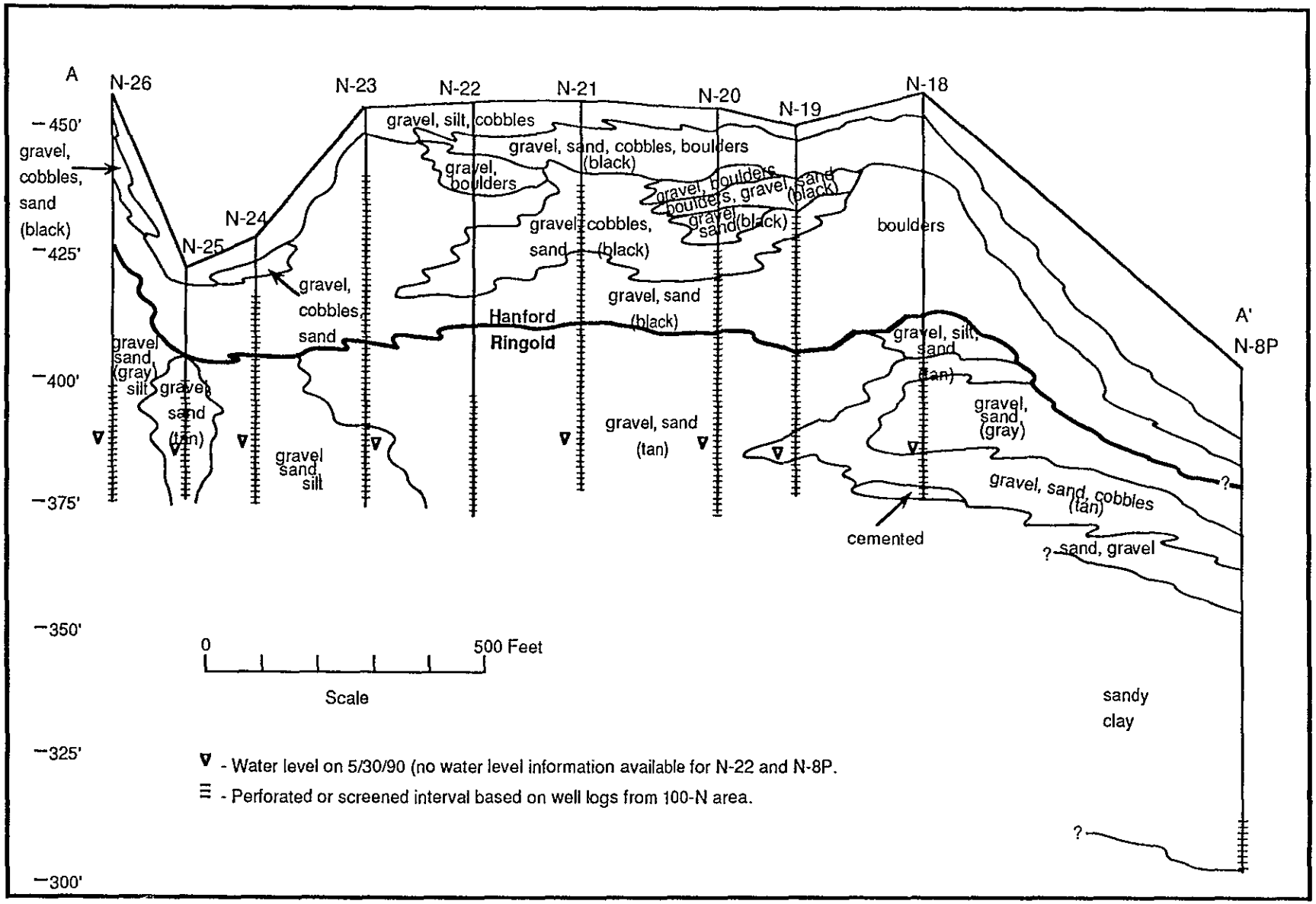


Figure 14. Cross-Section A-A'

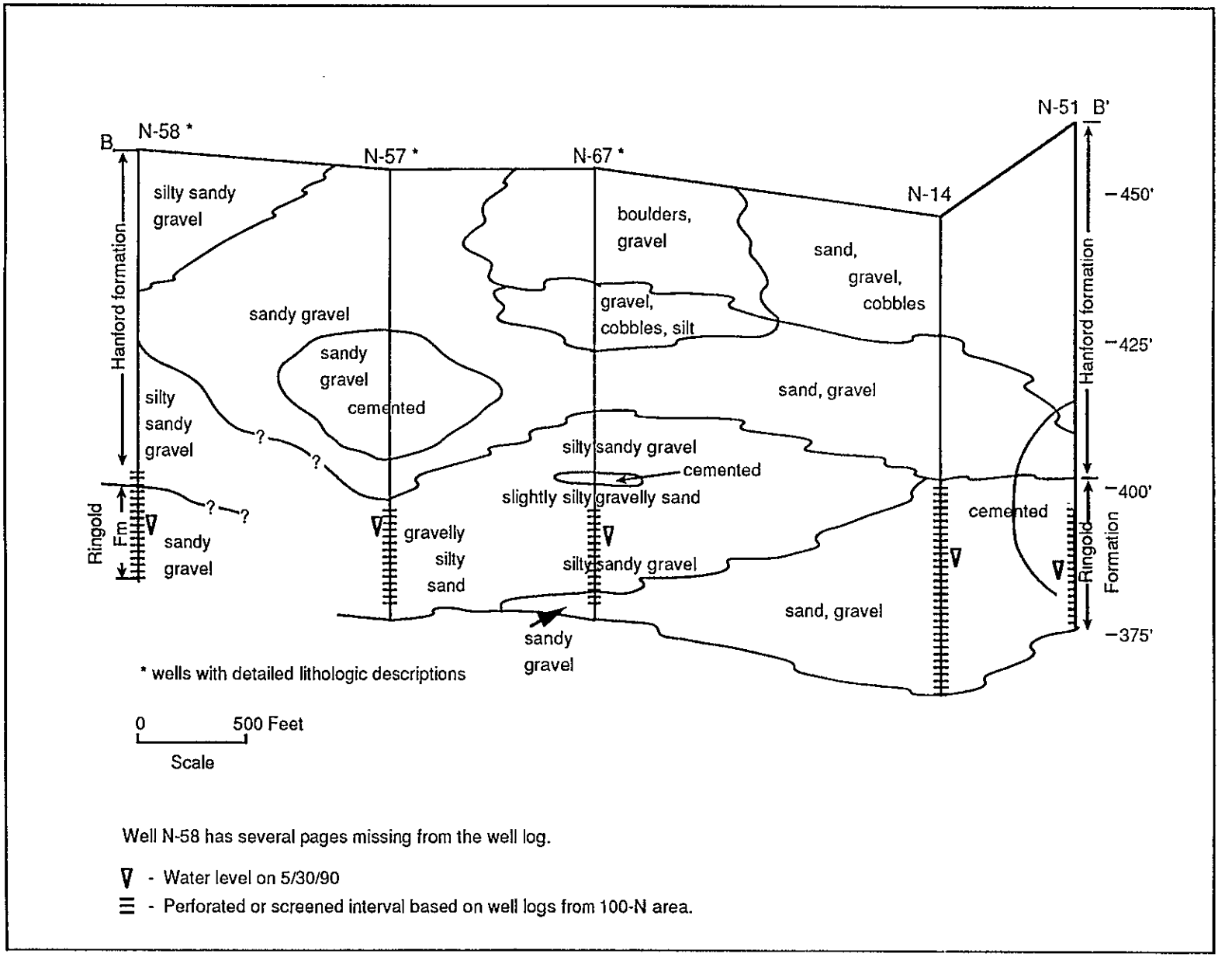
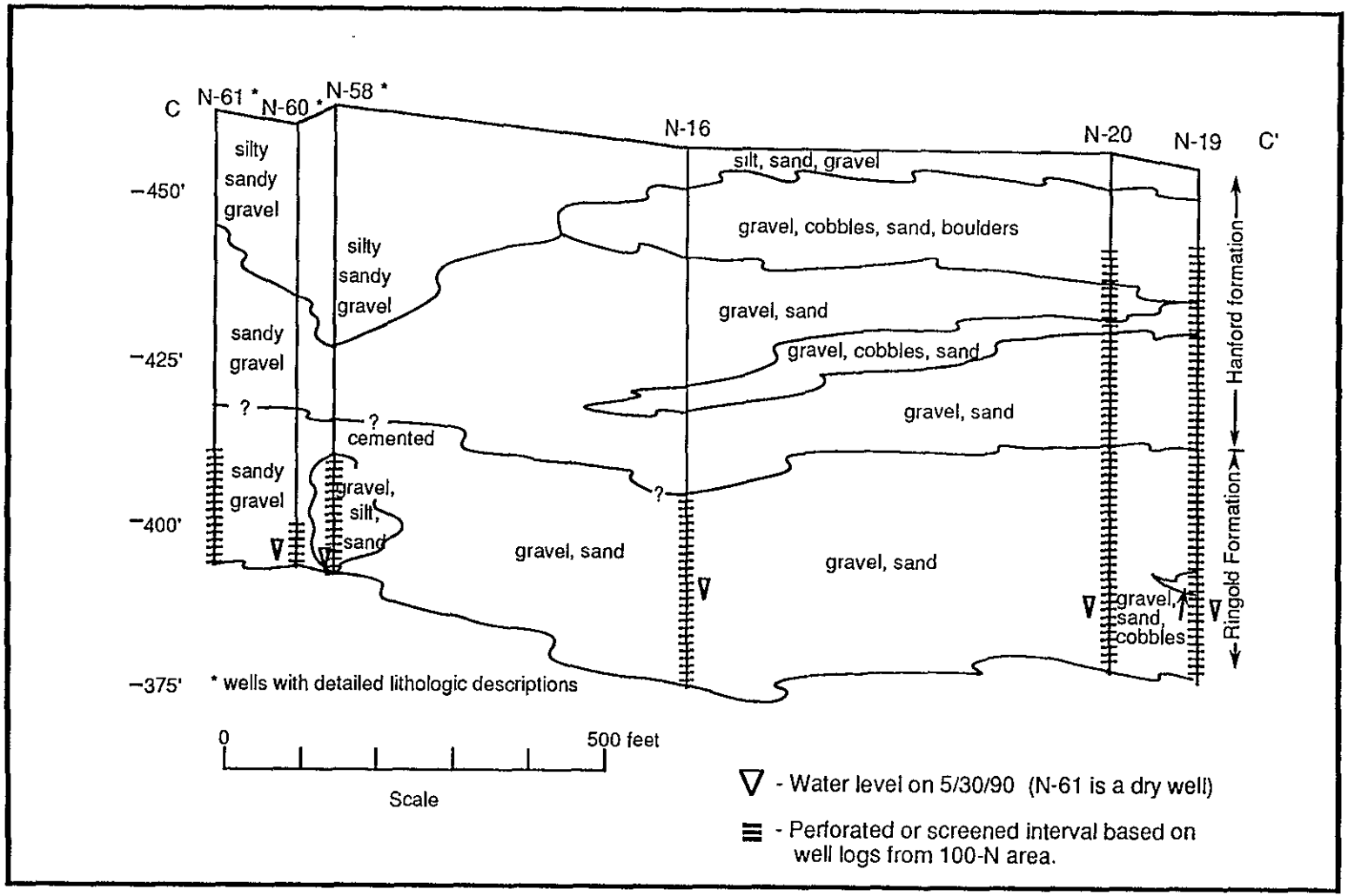


Figure 15. Cross-Section B-B'


C
N-61 *
N-60 *
N-58 *
N-16
N-20
N-19
C'
silty sandy gravel
silty sandy gravel
sandy gravel
sandy gravel
silt, sand, gravel
gravel, cobbles, sand, boulders
gravel, sand
gravel, cobbles, sand
gravel, sand
cemented
gravel, silt, sand
gravel, sand
gravel, sand
gravel, sand, cobbles
-450'
-425'
-400'
-375'
* wells with detailed lithologic descriptions
Hanford formation
Ringold Formation
0
500 feet
Scale
- Water level on 5/30/90 (N-61 is a dry well)
- Perforated or screened interval based on well logs from 100-N area.

such as cobbles appear to be present in upper portions of the unit, with sandy gravels and gravelly sands downsection. Occasional cemented zones occur with the gravels, but lateral continuity of these intervals in the 100-N Area is questionable. The Pasco gravels are approximately 50 to 60 ft thick in the 100-N Area.

2.2.3 Hydrogeology

This section provides a brief summary of current knowledge of the groundwater regime at the site. A more complete discussion of the hydrogeology at 100-N is provided in Section 2.2.3 of the RFI/CMS work plan for the 100-NR-1 aggregate source/groundwater operable unit (DOE-RL 1990a).

Both unconfined and confined aquifers occur at the Hanford Site. Several confined aquifers are known to underlie the unconfined aquifer. The uppermost confined aquifer includes the permeable units within the lower Ringold Formation plus the interflow contacts and sedimentary interbeds within the Saddle Mountains Basalt down to the Mabton Interbed of the Ellensburg Formation. The dense columnar portions of each basalt flow act as aquitards surrounding the higher permeability interflow and interbed zones. Recharge to and discharge from these aquifers occurs within the Pasco Basin (Gephart et al. 1979, p. III-18).

Throughout the Hanford Site, the unconfined aquifer is located primarily in the sands and gravels of the Ringold Formation. However, the water table often extends upward into the bottom of the Hanford formation. Natural recharge to the unconfined aquifer occurs from rainfall, runoff from the higher bordering elevations, infiltration of water from small ephemeral streams and river water along influent reaches of the Columbia River. The unconfined groundwater flows from recharge areas in the west to the discharge areas of the Columbia River. Artificial recharge at the Hanford Site occurs primarily from the discharge of liquid waste in man-made surface impoundments (see Section 2.2.3.2.2 of the 100-NR-1 operable unit RFI/CMS work plan, DOE-RL 1990a) and subsequent leakage into the subsurface (DOE-RL 1988).

In the 100-N Area, the groundwater flow regime has been heavily influenced by artificial recharge and by river stage fluctuations. The recharge areas include the 120-N-1 (1324-NA) Percolation Pond, the 120-N-2 (1324-N) Surface Impoundment and the 130-N-1 Filter Backwash Discharge Pond in 100-NR-3. Recharge from these and other sources in the 100-N Area are discussed in the 100-NR-1 RFI/CMS work plan.

The 120-N-1 (1324-NA) Percolation Pond and the north and south settling ponds began receiving effluent discharge from the 163-N Demineralization Plant and 183-N Filtered Water Plant in

1977. From 1977 to 1983, these sources contributed approximately 450,000 gal/day of effluent (Krug 1989, p. 13). Mounding in the area is expected to have started at this time. However, groundwater monitoring wells were not installed in this area until 1987, so the extent of mounding cannot be confirmed.

In 1983, the north and south settling ponds stopped receiving effluents. Regeneration effluent continued to be discharged at 120-N-1 (1324-NA), while filter backwash effluent was discharged to the 130-N-1 Filter Backwash Discharge Pond. Approximately 450,000 gal/day were discharged to 120-N-1 and 300,000 gal/day were discharged to 130-N-1 (Krug 1989, p. 13).

From 1986 until 1990, 120-N-1 continued to receive approximately 430,000 gal/day of neutralized regeneration effluent from the lined 120-N-2 (1324-N) Surface Impoundment. The 130-N-1 Filter Backwash Discharge Pond also continued to receive approximately 300,000 gal/day of discharge until 1990 (Krug 1989, p. 13).

With the installation of groundwater monitoring wells in the 120-N-1/120-N-2 area in 1987, documentation of mounding was initiated. Figure 17 shows groundwater elevations in the area in June 1988, when levels of discharge to the ground were relatively high (approximately 430,000 gal/day at 120-N-1). Figure 18 depicts groundwater elevations in the area after discharge to the ground was discontinued.

The unsaturated sediments at the vadose zone at the 100-N Area occur in the Hanford formation and range up to 80 ft in thickness (Jensen 1987; Gilmore et al. 1989). The vadose zone has been reduced in thickness historically due to groundwater mounding. The sediments consist of poorly sorted boulders, cobbles, gravel, sand, and silt. The water content at depth in sediments at the Hanford Site is generally low, ranging from 2 to 7% in coarse and medium-grained soils and 7 to 15% in silts (Gee and Heller 1985, p. 35).

2.2.4 Surface Hydrology

The only permanently flowing surface water at the 100-N Area is the Columbia River. The Columbia River is the largest river in the Pacific Northwest and the fifth largest river (by volume) in North America. Its flow is regulated by 11 dams within the United States: seven upstream and four downstream of the Hanford Site. The nearest upstream dam is the Priest Rapids Dam which is located approximately 17 river miles from the 100-N Area. The nearest downstream dam is the McNary Dam which is located approximately 88 river miles downstream from the 100-N Area. The Hanford Reach of the Columbia River is the only stretch of the Columbia River within the United States that is not impounded by a dam. Hydrologic data regarding the Columbia

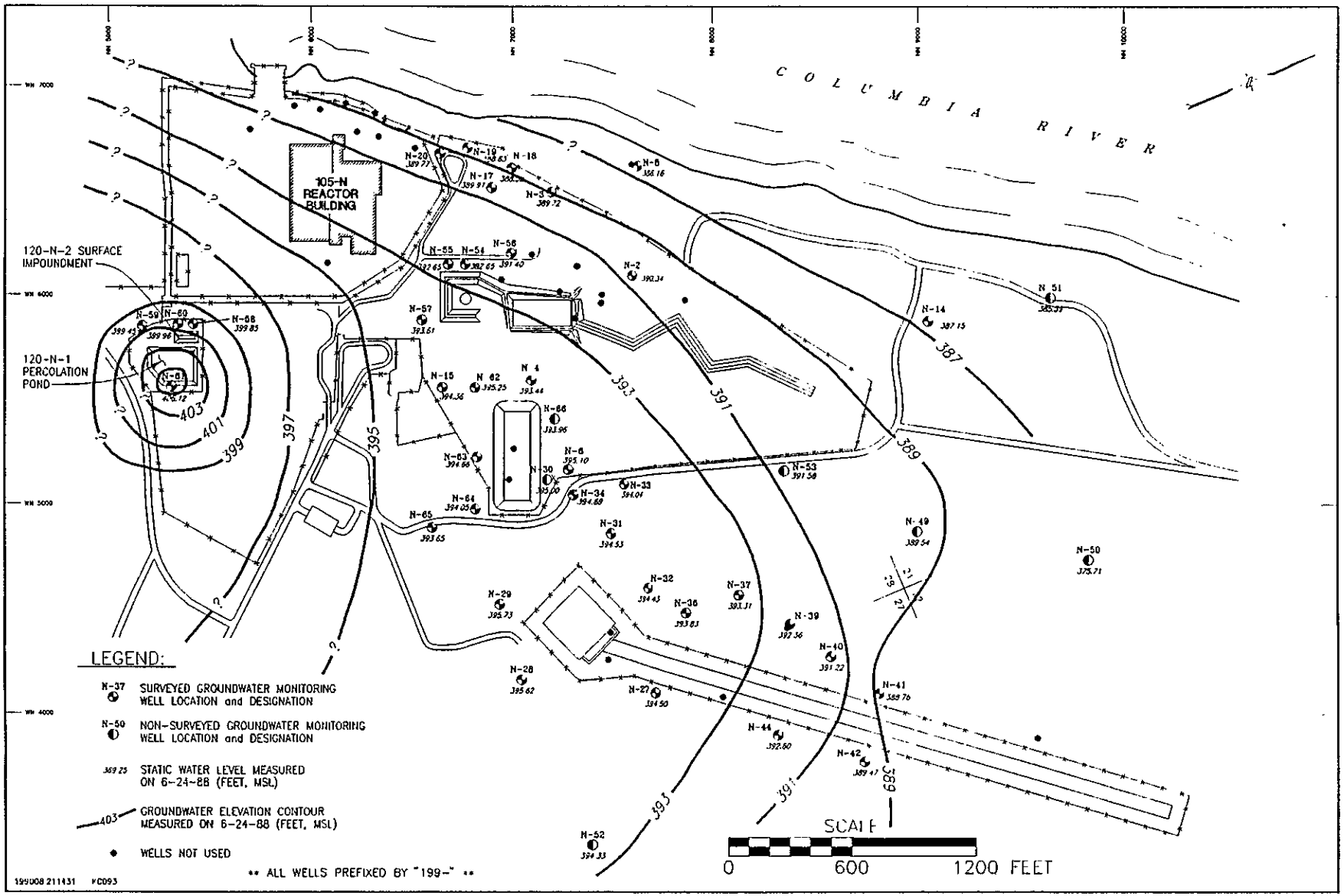


Figure 17. Water Levels at 100-N, June 24, 1988

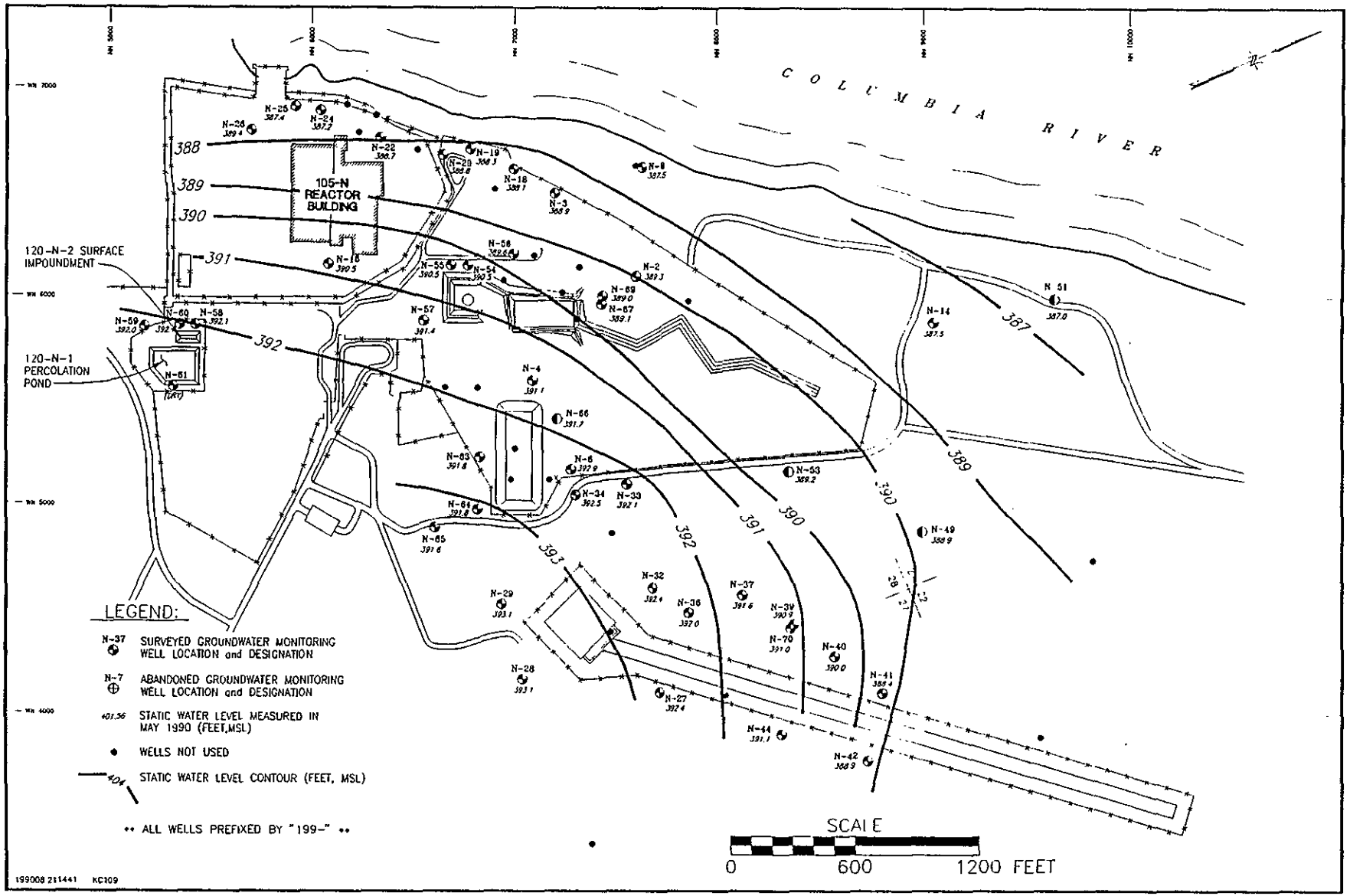


Figure 18. Water Levels at 100-N, May 1990

River at 100-N is presented in Section 2.2.4 of the 100-NR-1 RFI/CMS work plan (DOE-RL 1990a). Columbia River flow trends at Priest Rapids Dam from 1960 to 1977 are presented in Figure 19.

As a result of the relatively flat topography, no well-defined drainage channels exist within the 100-N Area. The soils of the 100-N Area consist primarily of coarse sands, pebbles, cobbles, and boulders that are highly permeable. Direct precipitation over the unit is essentially lost through evaporation and infiltration. Typically, there are only two occurrences per year with precipitation of 0.5 in. or more during a 24-h period (Stone et al. 1983, p. iii), which may result in some local puddling. However, no runoff from the operable unit is expected during these events. The lack of sufficient precipitation, high evaporation rates, and high soil infiltration capacities combine to keep surface runoff to a minimum.

2.2.5 Meteorology

Climatological data are available from the Hanford Meteorological Station (HMS) located between the 200 East and 200 West areas in the central portion of the Hanford Site. Since 1945, data have been collected at the HMS, located approximately 7 mi south of the 100-N Area. Climatological data from the HMS are assumed to be representative of conditions at the 100-N Area. Additionally, wind data have been collected at 13 other sites on the Hanford telemetry network. The precipitation, temperature, wind, and evapotranspiration summaries presented in the following sections were largely extracted from Stone et al. (1983).

2.2.5.1 Precipitation. The Hanford Site is located within a rain shadow formed by the Cascade Mountains 80 mi to the west. The area is considered a desert, with an average annual precipitation of 6.3 in. Most of the precipitation falls during the winter, with nearly half of the annual amount occurring from November through February. Average winter monthly snowfall ranges from 0.3 in. in March to 5.3 in. in January. The record snowfall of 24 in. occurred in February 1916, but the second highest recorded snowfall was less than half this amount.

Days with precipitation greater than 0.5 in. occur with a frequency of less than 1% during the year. Rainfall intensities of 0.5 in./h persisting for 1-h are expected once every 10-yr. Rainfall intensities of 1.0 in./h for 1-h are expected only once every 500-yr.

The average annual relative humidity is 54%. Humidity is higher in winter than in summer, averaging about 75% and 35%, respectively.

2.2.5.2 Temperature. Average monthly temperatures at the Hanford Site range from 29°F (-1.5°C) in January to 76°F (24.7°C)

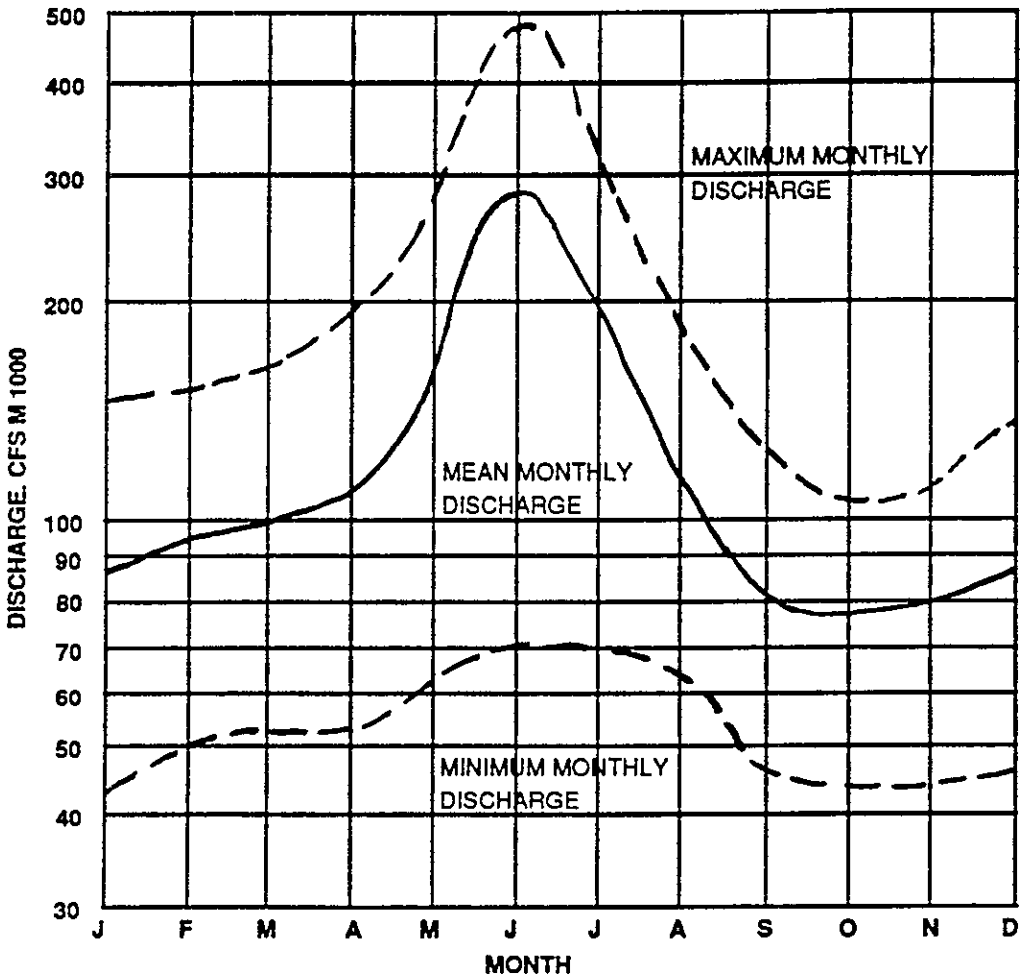


Figure 19. Columbia River Flows at Priest Rapids Dam, 1960-1977

in July. The lowest recorded monthly average winter temperature was 21°F (-5.9°C), and the highest recorded monthly average winter temperature was 44°F (6.0°C); both of these records were set during February. The highest recorded monthly average summer temperature was 82°F (27.7°C), which occurred during July. The coolest summer month on record was in June at 63°F (17.2°C).

2.2.5.3 Wind. Wind roses for 14 locations on the Hanford Site are displayed in Figure 20. Hanford telemetry network station 13 is located at the 100-N Area. The wind roses show prevailing winds from the northwest with a secondary maximum for southwesterly winds, except at the 100-N Area, where prevailing winds are from the west-southwest.

Winds from the northwest quadrant occur most often during the winter and summer. During the spring and fall, the frequency of southwesterly winds increase whereas winds blowing from other directions display minimal seasonal variation.

Monthly low average wind speeds are 6.2 to 6.8 mi/h. Monthly peak wind speeds average 8.7 to 9.9 mi/h in the summer. Winds are usually southwesterly and in the summer, the high-speed southwest winds are responsible for most of the region's dust storms. In addition, high-speed winds are associated with afternoon winds and thunderstorms. The summertime drainage winds are normally northwesterly with average wind speeds up to 31 mi/h. An average of 10 thunderstorms occur yearly, but the winds do not display a directional preference.

2.2.5.4 Evapotranspiration. Mean annual evapotranspiration for the area immediately southeast of the Hanford Site has been estimated to be about 29 in.

2.2.6 Environmental Resources

The Hanford Site, located in southeastern Washington, is characterized as a cool desert or a shrub-steppe, and supports a biological community typical to this environment.

2.2.6.1 Flora and Fauna. Over 240 species of plants have been identified on the Hanford Site (Cushing 1989, p. 4.57). Near the 100 Areas, cheatgrass and riparian plants are the most prevalent. Plants likely to be present at the 100-N Area include: the gray rabbitbrush (Chrysothamnus nauseosus); cheatgrass (Bromus tectorum); tumbleweed (Salsola kali); yarrow (Achillea millefolium); yellow salsify (Tragopogon dubius); false yarrow (Chaenactis douglasii); and tumble mustard (Sisymbrium altissimum).

More than 300 species of terrestrial and aquatic insects have been found on the Hanford Site. Specific insects likely to be found in fresh water in the 100-N Area include: water

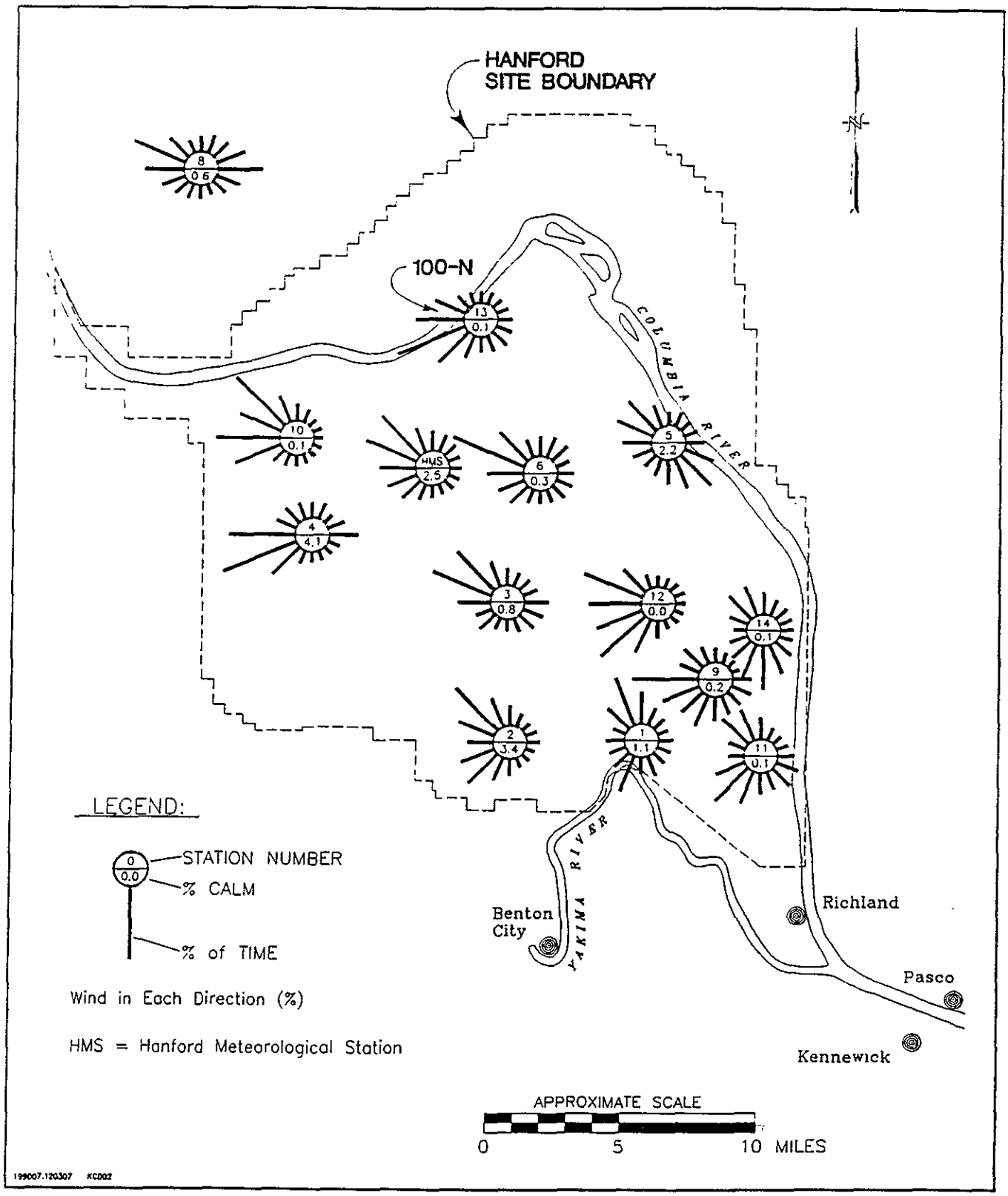


Figure 20. Wind Roses for the Hanford Telemetry Network, 1979-1982

striders (Gerridae); backswimmers (Notonectidae); water boatman (corixidae); and diving beetles (Dytiscidae). Seasonal inhabitants would include larvae of the cadisfly (Trichoptena); mosquito (culicidae), and manfly (Ephemeroptera) (Jacques 1985, p. 11).

Approximately 16 species of amphibians and reptile have been observed on the Hanford Site. Toads (family: Bufonidae) and frogs (family: Ranidae) are found along the Columbia River (Cushing 1989, p. 4.62).

Over 125 species of birds have been identified on the Hanford Site, the horned lark (family: Alaudidae) and western meadowlark (Sturnella neglecta) are the most abundant nesting birds. Wastewater ponds at the Hanford Site are important habitats for songbirds, shore birds, ducks, and geese. The most abundant nesting bird at these sites is the American coot (Fucila americana). Waterfowl frequently use the ponds during fall migration. The most important resident waterfowl is the Canada goose (Branta canadensis moffitti), whose nesting habitat is the islands in the Columbia River. The Hanford Site is located in the Pacific Flyway (Cushing 1989, p. 4.64). Birds identified at the 100-N Area include swallows (genus: Petrochelidon) and robins (Turdus migratorius) (Jacques 1985, p. 12).

Of the approximately 30 species of mammals that have been identified on the Hanford Site, most are small and nocturnal. Muskrats (Ondatra zibethica) and porcupines (genus: Erethizon) have been observed along the shorelines of the ponds and ditches, and beavers (Castor canadensis) are resident in the sloughs along the Columbia River. Mule deer (Odocoileus hemionus) are found mostly along the Columbia River and in the Rattlesnake Hills (Cushing 1989, pp. 4.65 - 4.67).

Two types of natural aquatic habitats are present at 100-N Area, the Columbia River and the artificial water bodies. The Columbia River supports a large diverse community of planktonic and benthic invertebrates, fish, and other communities. Phytoplankton and zooplankton populations in the river are largely transient, flowing from one area to another (Cushing 1989, p. 4.67).

Characteristic edemic groups of plankton generally have insufficient time to develop in the Hanford Reach. Phytoplankton and periphyton are abundant in the Columbia River (Cushing 1989, p. 4.68).

Forty-four species of fish have been identified in the Hanford Reach of the Columbia River. The chinook salmon (Oncorhynchus tshawytscha), sockeye salmon (Oncorhyncus nerka), coho salmon (Oncorhynchus kisutch), and steelhead trout (Salmon

9 1 1 3 8 7 9 7 3 7

gairdneri) use the river as a migration route (Cushing 1989, p. 4.71).

2.2.6.2 Threatened and Endangered Species. There are no known plants on the federal list of Endangered and Threatened Wildlife and Plants that are known to occur on the Hanford Site. Several species of plants are under consideration.

There are two species of plants which are found at the Hanford Site that are identified on the State of Washington list of threatened or endangered species. These are the Columbia milk-vetch (Astragalus columbianus Barneby), listed as threatened, and yellowcress (Rorippa columbiae Suksd), designated endangered. Columbia milk-vetch occurs on dry land benches of the Columbia River in the Priest Rapids Dam, Midway, and Vernita vicinity. Yellowcress occurs in the wetted zone of the water's edge along the Columbia River (Cushing 1989, p. 4.75). Both species may exist along the 100-N Area shore, but neither have been specifically identified.

The federal government lists the American peregrine falcon (Falco peregrinus anatum) as endangered and the bald eagle (Haliaeetus leucocephalus) as threatened. The State of Washington list includes these two birds and also identifies the white pelican (Pelecanus erythrorhynchos) and sandhill crane (Grus canadensis) as endangered, and the ferruginous hawk (Buteo regalis) as threatened. The peregrine falcon does not nest at the Hanford Site but is a casual migrant. The bald eagle is a regular winter resident in areas where it forages on dead salmon and waterfowl along the Columbia River. It does not nest on the Hanford Site. State of Washington Bald Eagle Protection Rules were issued in 1986 (WAC 232-12-292) which will require DOE to prepare a management plan to mitigate eagle disturbance. Increased use of power poles for nesting sites by the ferruginous hawk has been noted (Cushing 1989, pp. 4.75 to 4.77). Little is known about the visitation frequencies of the white pelican and sandhill crane. The frequencies of these birds visiting the 100-N Area are unpredictable, occurring primarily between October and March.

Three mammal species are listed as being endangered by the State of Washington: Merriam's shrew (Sorex merriami), the pallid bat (Antrozous pallidus), and the long-earned myotis (Myotis evotis). The pygmy rabbit (sylvilagus idahoensis) is identified as threatened. Only the pygmy rabbit is known to be present at the Hanford Site (Cushing 1989, pp. 4.77 to 4.78). Its occurrence at 100-N is unknown.

2.2.6.3 Critical Habitats. The roost trees and foraging areas of the bald eagle and ferruginous hawk are regarded as critical habitats and are required to be protected. The use of the 100-N Area by bald eagles and ferruginous hawk is not known. If any of

the threatened or endangered species are found in the 100-N Area, their location will constitute a critical habitat. Specific information as to the occurrence of these species within the project area has not been compiled.

2.2.6.4 Land Use. The nearest structures to the 100-N Area are those which are present on the Hanford Site. The 100-D Area is located about 1.0 mi northeast, and the 100-K Area is located about 1.5 mi southwest of the 100-N Area. The land immediately north of the 100-N Area, across the Columbia River, is the Saddle Mountain National Wildlife Refuge, a federally-operated refuge. Figure 21 shows the use of lands surrounding the Hanford Site.

2.2.6.5 Surface Water Use. The Columbia River forms the northern boundary of the 100-N Area. The portion of the Columbia River that flows through the Hanford Site is known as the Hanford Reach. The entire Hanford Reach is used for boating, fishing, and hunting. River water is used onsite and at downstream communities for drinking water.

Columbia River water has been used as the source of cooling water for the N Reactor. Water for the heat dissipation system is drawn from the river through a shoreline intake system, circulated through various condensers and heat exchangers, and discharged to the center of the river (102-in. discharge line). The normal pumping rate was 290,000 gal/min (Ecker et al. 1983, p. 5).

2.2.6.6 Groundwater Use. No production wells exist at the 100-N Area. The nearest reported domestic groundwater well is located near Vernita Bridge, over 10 mi west (upgradient) of the 100-N Area.

2.2.7 Human Resources

The potential effects of the environmental conditions at the Hanford Site on the surrounding population centers are of primary concern to DOE-RL. A very brief summary appears below.

2.2.7.1 Demography. There are no residences on the Hanford Site. The nearest inhabited residences are farm homes on land 6 mi north of the 100-N Area. There are approximately 258,000 people living within a 50 mi radius of the 100-N Area. The primary population centers are the cities of Richland, Kennewick, and Pasco, located southeast of the Hanford Site.

2.2.7.2 Archaeology. Within 1.5 mi of the 100-N Area are eight archaeological sites. Three of the sites are located north of the Columbia River. Knowledge about the archaeology of the 100-N Area is largely based on reconnaissance-level archaeological surveys. Three of the sites situated on the south shore comprise the Ryegrass Archaeological District. One of the sites at the

9 1 1 3 3 7 5 7 5 9

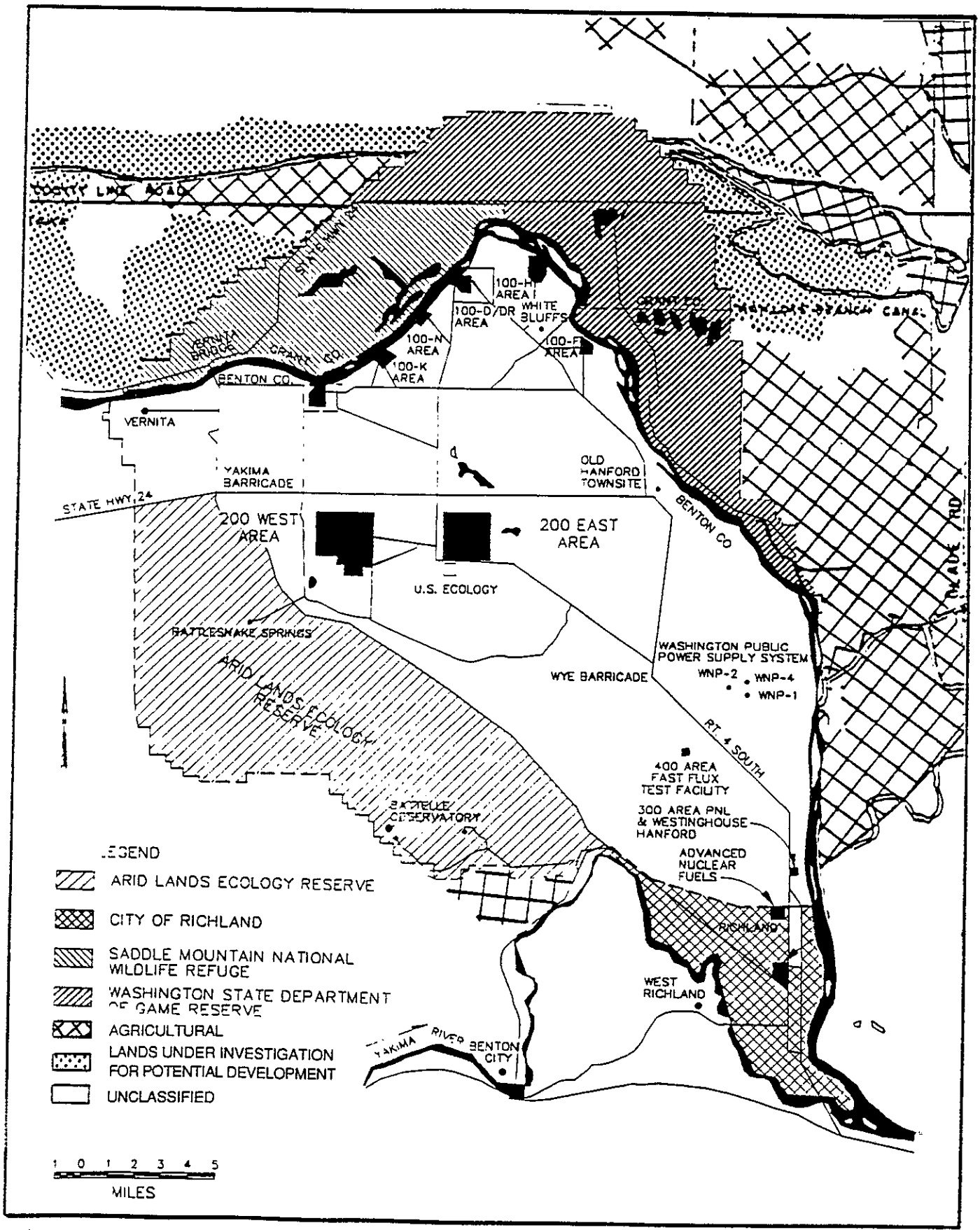


Figure 21. Land Use Surrounding the Hanford Site

100-N Area, known as the Hanford Generating Plant site (45BN179) has been test-excavated. It has been nominated for the National Register of Historic Places (Cushing 1989, p. 4.81). No known sites of religious importance actually lie within the 100-N Area.

2.2.7.3 Historical. The most common evidence of historic activity now found near the 100-N Area is gold mine tailings on river banks and archaeological sites where homesteads once stood. Few of these vestiges of the early years remain. The double-faced compound of the 100-N Area has been cleared of cultural resource concerns (Cushing 1989, p. 4.89).

2.2.7.4 Community Involvement. The involvement of the potentially affected community with respect to the RFI/CMS for the 100-NR-1 operable unit is encompassed in the community relations plan (CRP) that has been developed for the Hanford Site Environmental Restoration Program. The community relations plan includes a discussion and analysis of key community concerns and perceptions regarding the project, along with a list of all interested parties.

9 1 1 1 3 3 7 9 7 7 1

3.0 INITIAL EVALUATION

To properly justify a proposed RFI/CMS work plan, information must be provided regarding contaminant source units, evidence of contamination, legal and regulatory requirements for the program, toxicological parameters, and preliminary objectives of the program. The following section provides justification for the 100-NR-3 RFI/CMS work plan.

3.1 KNOWN AND SUSPECTED CONTAMINATION

Evidence for the release of hazardous and mixed waste constituents to the environment is presented in the following section. A description of sources of contamination in the 100-NR-3 operable unit is followed by discussions of monitoring results for environmental and biological media.

Following the source, environmental media, and biological media discussions is a brief discussion of environmental and process interactions between the 100-NR-3 operable unit and the 100-NR-1 and 100-NR-2 operable units. Finally, the quality of the existing data is discussed. The emphasis of the discussion is the determination of whether the existing data meets the specific QA/QC requirements outlined in the Tri-Party Agreement.

3.1.1 Sources

There are 49 discrete potential source units at 100-NR-3. These include waste management units and unplanned releases. Sources have been placed together into logical groupings, either according to geographical location or process and waste-handling similarities. The grouping concept will permit an efficient site characterization program. Phase I characterization activities will address these groupings and Phase II characterization will address specific sources which require further characterization. Figure 22 depicts the 100-NR-3 operable unit and shows the 12 groupings located within 100-NR-3. The location of all potential source units is shown in Plate 1. Table 2 lists and summarizes each potential source unit in 100-NR-3.

3.1.1.1 Grouping 1: Outer Refuse Area. The outer refuse area grouping consists of three waste management units located near the southern periphery of 100-NR-3. These three potential sources have been grouped together because of their isolated location away from the main 100-N Area. Figure 23 shows the grouping and

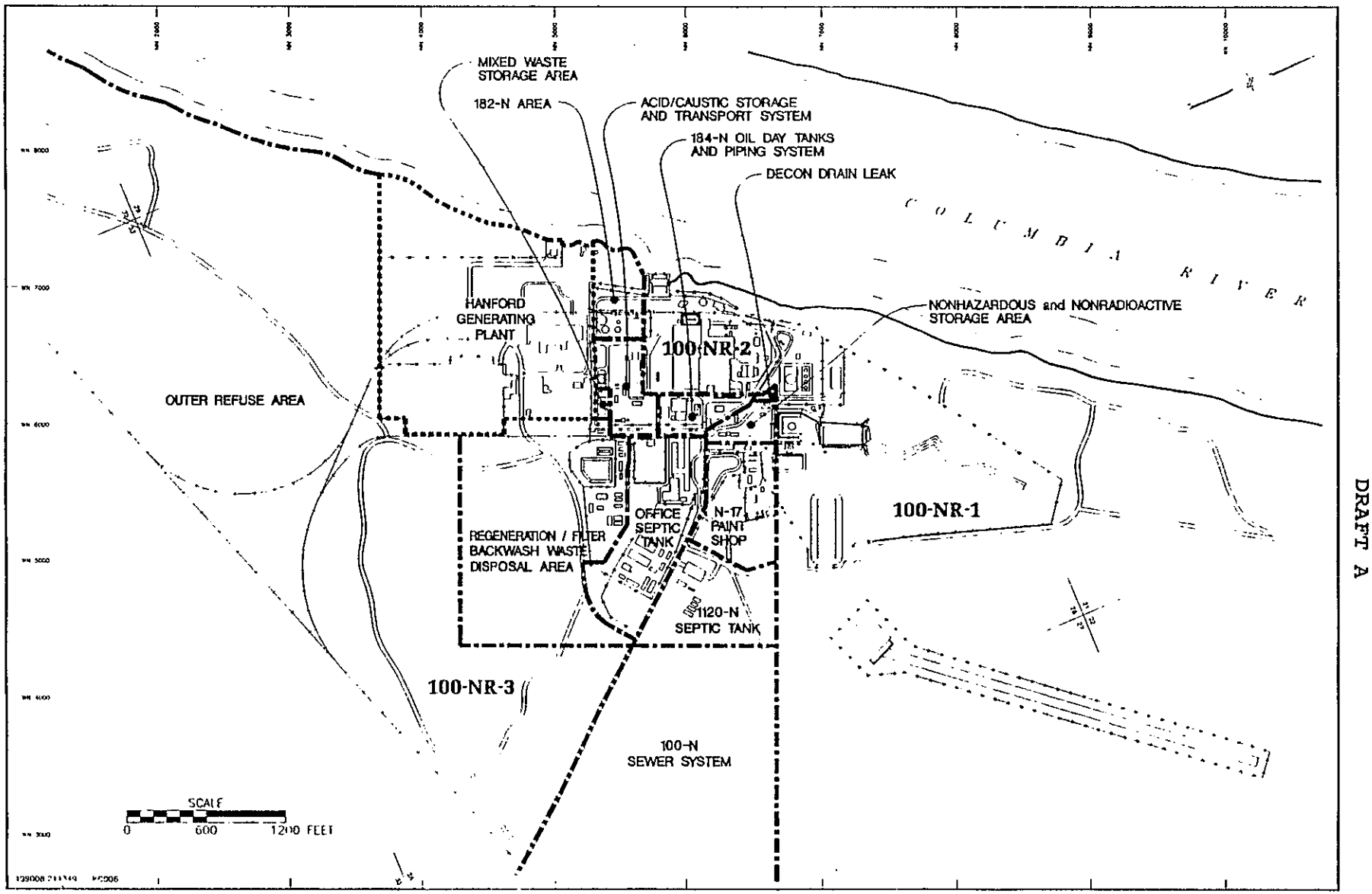


Figure 22. Source Unit Groupings in the 100-NR-3 Source Operable Unit

Table 2. Waste Management Units and Unplanned Releases at 100-NR-3. (sheet 1 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
1. Outer Refuse Area Grouping				
---	HGP Burn Pit	Unknown	Trash.	Pit used for burning of trash. Unknown if flammable solvents were burned.
---	Grass Dump	Unknown	Grass; unknown if other wastes were disposed.	Pit for storage of grass clippings.
---	Construction Debris Dump	Unknown	Construction debris of unknown nature.	Used by J.A. Jones Construction Co. for disposal of construction rubble (e.g., dirt, cement, asphalt, metal, and wood)
2. 182-N High Lift Pumphouse Grouping				
124-N-2	182-N Septic Tank	1963-present	Sanitary sewage.	Serves personnel from 182-N Building.
---	182-N Tank Farm Overflow	Unknown-present	Overflow water analyzed for temperature, pH, total suspended solids, oil and grease, and chlorine per NPDES permit.	NPDES Discharge Point Number 005 via a 36-inch raw water return line.
---	182-N Drain System	Unknown-present	Primarily water analyzed for temperature, pH, total suspended solids, and oil and grease per NPDES permit.	NPDES Discharge Permit Number 006 via a 42-inch raw water return line.
---	Lube Oil Line Leak	2/6/87	5 gal of turbine oil.	Pinhole leak in lube oil line allowed oil to enter secondary steam system. Discharged to river with steam condensate.
3. Acid/Caustic Storage and Transport System Grouping				
---	108-N Chemical Unloading Facility	1963-present	93% sulfuric acid and 50% sodium hydroxide.	Unloading area for trucks or railcars. Has three above ground sulfuric acid tanks and one aboveground sodium hydroxide tank.

Table 2. Waste Management Units and Unplanned Releases at 100 NR-3. (sheet 2 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
3. Acid/Caustic Storage and Transport System Grouping (cont.)				
120-N-7	Unloading Station French Drain	1963-3/87	93% sulfuric acid and 50% sodium hydroxide.	French drain for receiving incidental spills during railcar or tank truck unloading.
120-N-6	Sulfuric Acid Tank French Drains (5)	1963-3/87	93% sulfuric acid.	French drains surrounding acid tanks for containment of incidental spills.
---	108-N Neutralization Pit	1983-present	Waste sulfuric acid.	The unit was used to neutralize waste sulfuric from 108-N floor drains and acid transfer tank drainage.
UN-100-N-15	108-N Unloading Facility	3/20/81	Unknown amount of sulfuric acid and rinsewater.	Transfer line leak during pumping of liquid from 108-N to french drain.
UN-100-N-33	108-N Unloading Facility	11/9/81	Approximately 1,000 gal of sulfuric acid.	Spilled to ground during transfer from railcar to storage tank.
---	108-N Unloading Facility Spill	12/26/87	Approximately 10 gal of sodium hydroxide.	Spilled during transfer from railcar to storage tank.
120-N-5	Acid/Caustic Transfer French and Neutralization Unit	1963-present	Sulfuric acid and sodium hydroxide	Piping trench between 108-N and 163-N and containment vaults.
UN-100-N-34	Acid/Caustic Transfer French and Neutralization Unit	5/12/80	Approximately 3,400 gallons of sulfuric acid.	Pipeline rupture filled containment vaults and spilled to ground. Acid was neutralized.
---	Acid/Caustic Transfer Trench	8/7/87	Unknown amount of sulfuric acid.	Acid had corroded away exposed trench area releasing to the soil.
---	Acid/Caustic Transfer Trench	9/2/87	Unknown amount of sodium hydroxide.	Leak in piping was contained in trench.

Table 2. Waste Management Units and Unplanned Releases at 100 NR-3. (sheet 3 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
3. Acid/Caustic Storage and Transport System Grouping (cont.)				
---	Acid/Caustic Transfer Trench	11/9/87	Approximately 200 gal of sulfuric acid spilled and approximately 15 to 30 gal released to ground.	Leak in piping escaped trench through a dry well. Contaminated soil was removed.
120-N-3	163-N Neutralization Pit and French Drain	12/63-3/87	Sulfuric acid and sodium hydroxide.	French drain and vault receiving drainage from 163-N Acid and Caustic Day Tank Area.
120-N-8	163-N Sulfuric Acid Day Tank Vent French Drain	12/63-5/13/88	Sulfuric acid.	Tank overflows are vented to the french drain.
---	Regeneration Waste Transport System	1977-present	Acid and caustic regeneration wastes.	Sump and pipeline delivering wastes from 163-N to 1324-N.
---	Regeneration Waste Transport System	6/14/86	Approximately 6,500 gal of acidic regeneration wastes.	Pipeline leak during transfer. Spill was neutralized and contaminated soil was removed.
---	Regeneration Waste Transport System	6/30/86	Approximately 1,000 gal of acidic regeneration wastes.	Pipeline leak during transfer. Spill was neutralized and contaminated soil was removed.
124-N-1	163-N Septic Tank	1963-present	Sanitary sewage.	Serving 163-N, 183-N, 1127-N, and 1128-N buildings.
4. Mixed Waste Storage Area Grouping				
116-N-8	Mixed Waste Storage Pad	12/86-present	Radioactively contaminated oil and miscellaneous dangerous process chemicals.	Paved and curbed concrete pad for mixed waste storage in drums and miscellaneous containers.

Table 2. Waste Management Units and Unplanned Releases at 100 NR-3. (sheet 4 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
5. 184-N Plant Service Power House				
---	184-N Plant Service Power House	1963-Present	Hydrocarbons, particulates, sulfur dioxide, sulfur trioxide, carbon monoxide, nitrogen oxide, and aldehydes.	Routine and systematic releases from boiler stacks.
---	184-N Day Tanks	1963-Present	No. 6 (Bunker C) fuel oil and diesel oil.	Two 350,000-gal fuel oil tanks and one 8,000-gal diesel oil tank surrounded by a containment wall.
UN-100-N-19	Fuel Oil Day Tank at 184-N	4/84	Approximately 2,000 gal of fuel oil.	Tank overflowed during filling. Oil contained within walls and removed.
UN-100-N-21	Diesel Oil Day Tank at 184-N	4/25/86	Approximately 800 gal of diesel oil.	Tank overflowed during filling. Oil removed from containment area.
---	Diesel Oil Day Tank at 184-N	10/9/87	Unknown amount of diesel oil.	Tank overflowed during filling. Oil was removed.
---	166-N - 184-N Piping	1963-present	No. 6 fuel oil and No. 2 diesel oi.	Underground fuel supply piping.
UN-100-N-18	Diesel oil supply line between 166-N and 184-N	8/73	Approximately 200 gal of diesel oil.	Line leak caused by external corrosion.
UN-100-N-22	Diesel oil supply line near 184-N	6/23/86	Approximately 1,000 gal of diesel oil.	Line leak caused by external corrosion. Contaminated soil removed. Oil detected in groundwater.
UN-100-N-23	Diesel oil supply line near 184-N	1/10/87	Approximately 200 gal of diesel oil.	Line leak caused by external corrosion. Oil detected in groundwater.
---	Fuel oil pipe fitting at 184-N Annex	10/14/87	Unknown amount of fuel oil.	Oil leaked from loose pipe fitting during transfer to boiler. Oil contained and removed.
---	Diesel oil supply line between 166-N and 184-N	4/26/89	A minimum of 300 gal of diesel oil.	Line leak in three places. 46 drums of contaminated soil removed.

Table 2. Waste Management Units and Unplanned Releases at 100 NR-3. (sheet 5 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
6. Decon Drain Line Leak Grouping				
UN-100-N-6	1-1/2-Inch, Chemical Decontamination Waste Drain Line between 105-N and 1310-N	9/10/85	Approximately 1,800 gal of irradiated wastewater with 0.2 Ci - Co-60, 0.04 Ci - Mn-54, 0.003 Ci - Ru-103, and 0.003 Ci - Cs-137.	Four locations along line passing through 100-NR-3. Contaminated soil removed.
7. Nonhazardous and Nonradioactive Storage Area				
120-N-4	Nonhazardous and nonradioative storage area	11/85-present	Nonhazardous and nonradioactive oils and aqueous liquid.	Curbed concrete pad for container storage.
100-N-SS-27 100-N-SS-28	1716-N Service Station Underground Storage Tanks	100-N-SS-27 1967-present; 100-N-SS-28 1976-present	Unleaded gasoline.	Two 1,000 to 4,000 gal underground storage tanks associated with service station.
8. Regeneration/Filter Backwash Waste Disposal Area Grouping				
120-N-2	1324-N Surface Impoundment (formerly North Settling Pond)	1977-1988	Corrosive regeneration wastes and filter backwash water.	1977-1983 unlined settling pond; 1983-1986 out of service; 1986-1988 lined surface impoundment.
---	South Settling Pond	1977-1983	Corrosive regeneration wastes and filter backwash water. Unlined settling pond.	
120-N-1	1324-NA Percolation Pond	1977-present	Corrosive regeneration wastes and filter backwash water. Currently receives nonregulated neutralized regeneration wastewater.	Unlined percolation pond.
130-N-1 (formerly 126-N-1)	Filter Backwash Discharge Pond	1983-present	Filter backwash water.	Unlined percolation basin.
---	1143-N Paint Shop	Unknown-present	Paint wastes and associated water, spent thinner, spent garnet sand and paint chips.	Paint shops with water scrubber in the paint booth, a solvent accumulation drum, and an outdoor sandblasting area.

Table 2. Waste Management Units and Unplanned Releases at 100 NR 3. (sheet 6 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
9. Office Septic Tank Area Grouping				
124-N-5	1117-N Septic Tank (Sewer System V)	1981-2/87	Sanitary sewage.	Septic tank and drainfield.
124-N-6	1113-N Septic Tank (Sewer System VI)	1979/80-2/87	Sanitary sewage.	Septic tank and drainfield.
124-N-7	1115-N Septic Tank (Sewer System VII)	1984-2/87	Sanitary sewage.	Septic tank and drainfield.
124-N-8	1134-N Septic Tank (Sewer System VIII)	1983-present	Sanitary sewage.	Septic tank and drainfield.
10. N-17 Paint Shop Area Grouping				
---	N-17 Paint Shop	Unknown-present	Waste paint, solvents, and oils.	Two waste accumulation drums (one for waste paint, the other for waste oil); sandblasting area.
11. 1120-N Septic Tank Grouping				
124-N-9	1120-N Septic Tank	1985-present	Sanitary sewage.	Septic tank and drainfield
12. 100-N Sewer System Grouping				
124-N-10	100-N Sewer System	2/87-present	Sanitary sewage.	Central sewer system with three lagoons, sewer trunk line and other pipelines, and lift stations.
UN-100-N-11	Corner of Route 4 north and access road	10/2/75	Radioactive soil and asphalt.	Valve bonnet fell from truck onto road and rolled into adjacent field. Valve bonnet, asphalt, and soil removed.

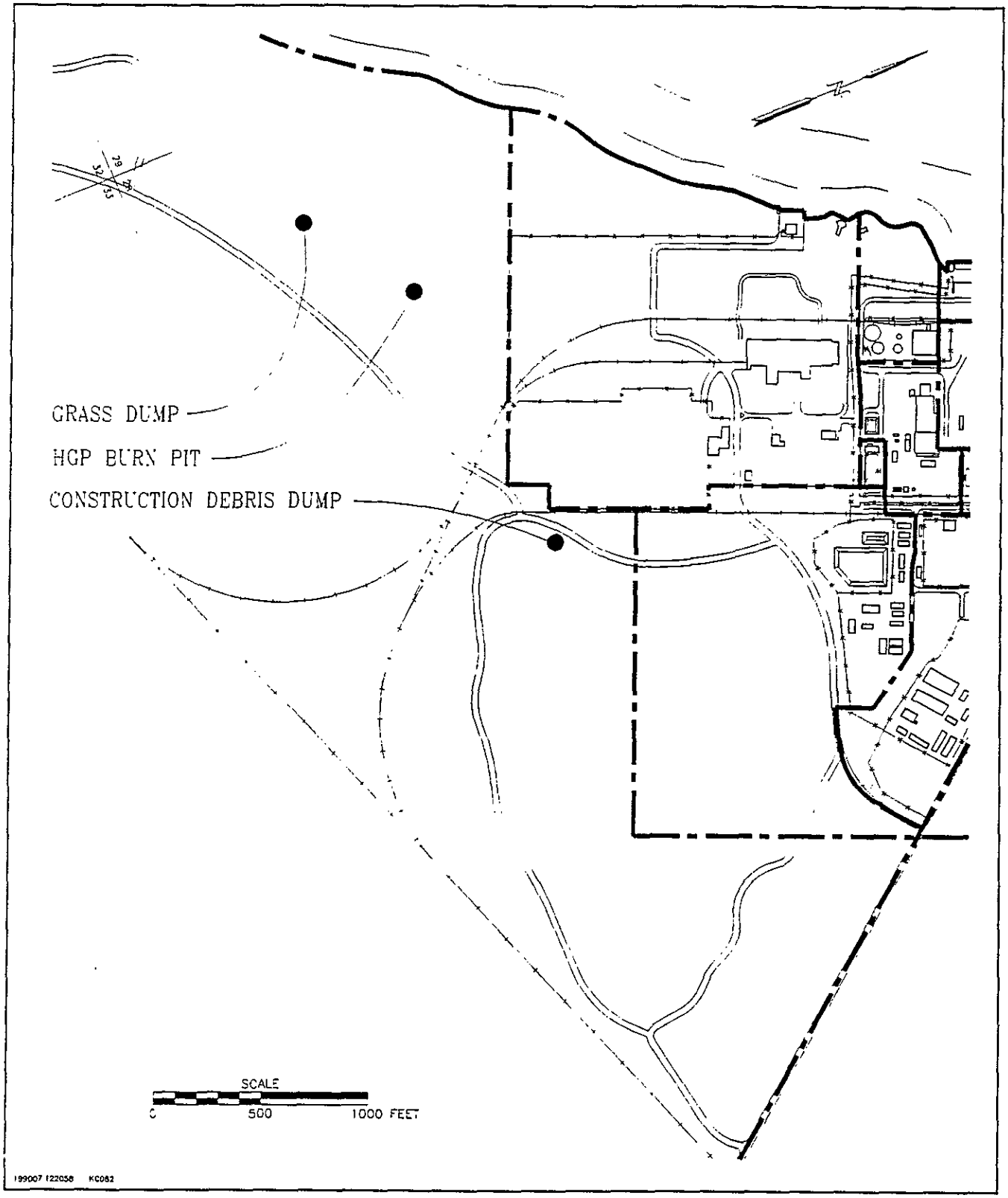


Figure 23. Source Units in the Outer Refuse Area Grouping

the locations of the potential sources. The grouping consists of the following potential sources:

1. HGP Burn Pit
2. Grass Dump
3. Construction Debris Dump.

3.1.1.1.1 **HGP Burn Pit.** The HGP burn pit is located south of the Hanford generating plant area. Burning takes place in a pit on open ground. It has been used to burn paper and wood. Dates of use of the pit are unknown, but inspection of the area on May 5, 1990, indicated recent use of the pit.

3.1.1.1.2 **Grass Dump.** The grass dump is located south of the Hanford generating plant area. The unit has been used as a grass dump for an unknown period of time. It is unknown if other wastes have been placed in the unit.

3.1.1.1.3 **Construction Debris Dump.** The construction debris dump is located south of the Hanford generating plant area. This dump was used by J.A. Jones Construction Company during past construction work. Debris dumped at the site consisted of dirt, rocks, asphalt, concrete, metal, and wood. No sign of hazardous or radioactive disposal has been documented. A practice at 100-N has been to survey materials for radioactivity before disposal. According to Westinghouse Hanford personnel, materials disposed here have been released.

3.1.1.2 **Grouping 2: 182-N High Lift Pumphouse.** The 182-N high lift pumphouse grouping consists of four potential sources within the area surrounding the 182-N high lift pumphouse. This includes the Water Supply Tank Farm and extends to the Columbia River. Figure 24 shows the grouping and the locations of the potential sources. The four potential sources within this grouping include:

1. 124-N-2 Septic Tank
2. 182-N Tank Farm Overflow (NPDES Outfall No. 005)
3. 182-N Drain Outfall (NPDES Outfall No. 006)
4. February 6, 1987 unplanned release.

3.1.1.2.1 **124-N-2 Septic Tank.** The septic tank and seepage pit making up sewer system II are located southeast of the 182-N Building and were installed in 1963 (Gydesen 1985, p. 13); the system is still operating. The unit receives sanitary sewage. The seepage pit for this system provides about 200 ft^2 of infiltration surface area and 2,256 gal of fluid storage. In 1985, the system served 10 personnel and the calculated daily flow was 200 gal/day (Gydesen 1985, pp. 6 and 13). The sewer system is still in place. No remedial activities have taken place.

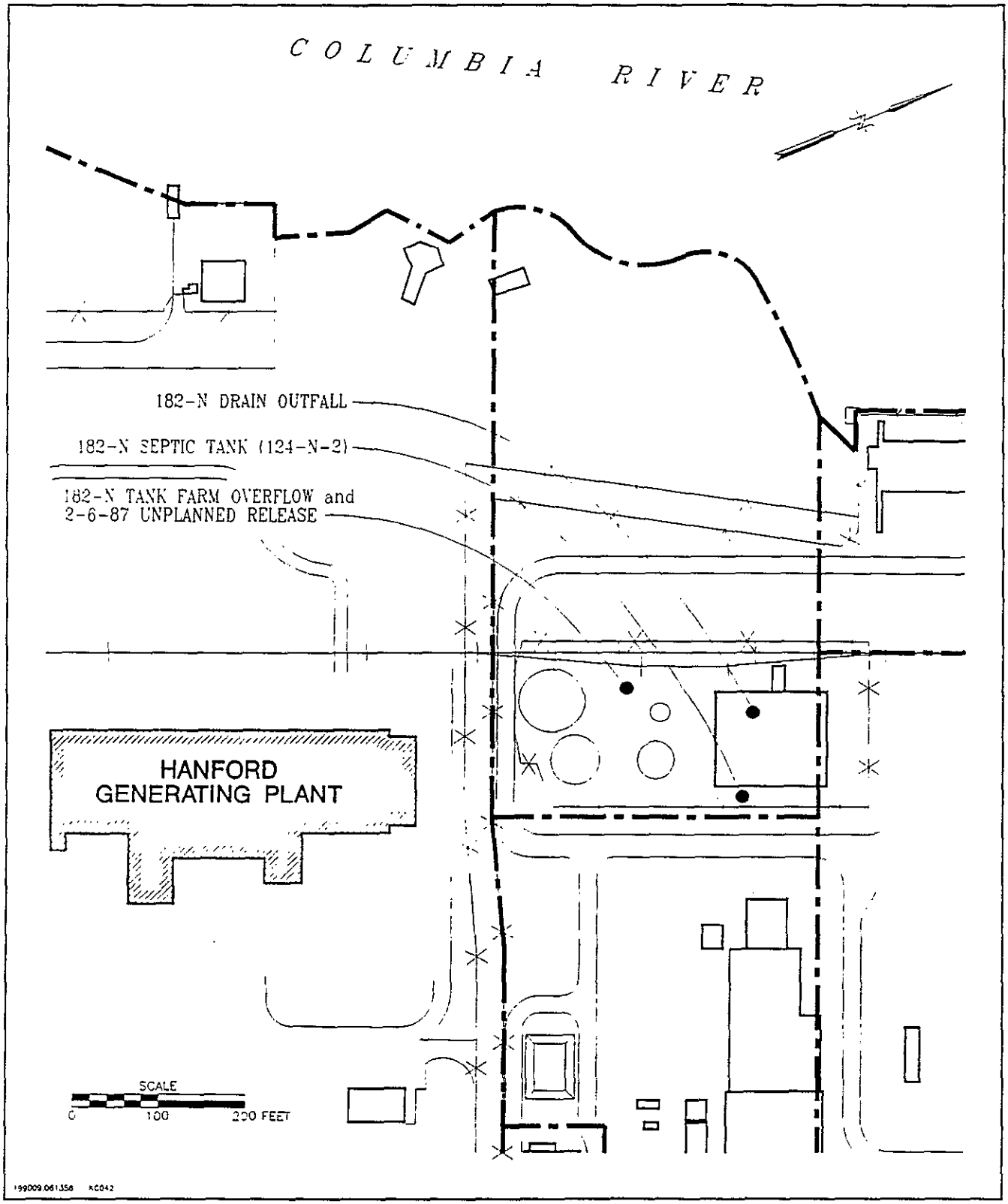


Figure 24. Source Units in the 182-N High Lift Pumphouse Grouping

3.1.1.2.2 182-N Tank Farm Overflow. This unit is a NPDES-permitted discharge point (Source No. 005) to the Columbia River. It contains drainage from the 182-N Tank Farm Area. The area discharges to the river by a 36-in. raw water return line. The discharge point is located 200 ft upstream of 181-N. In 1987, the average daily discharge to the river via this point was 2.7 million gal (Rokkan 1988, p. 15). Currently, discharges from this point are minimal. The startup date for the discharge was 1964. It is currently in use. There are no documented dangerous or radioactive releases to the river via this discharge point.

3.1.1.2.3 182-N Drain System. This unit is a NPDES-permitted discharge point (Source No. 006) to the Columbia River. Drainage from the 182-N High Lift Pumphouse is discharged to the river by a 42-in. raw water return line. Raw and filter water from pump seal leakage is discharged from this point. Westinghouse Hanford personnel have indicated that low-level radionuclides have been released from emergency core cooling system pumps for the reactor. When the reactor was operating, small amounts of irradiated water was released through the seals and drained to the river. The discharge point is 100 ft upstream of 181-N. In 1987, the average daily discharge to the river via this point was 270,000 gal (Rokkan 1988, p. 15). The startup date for the discharge was 1964. It is currently in use.

3.1.1.2.4 Oil Release to the Columbia River. On February 6, 1987, approximately 5 gal of turbine oil was discharged to the Columbia River near the 182-N tank farm raw water return. A small (pinhole size) leak in a lube oil line in the No. 2 drive turbine allowed oil to enter the secondary steam system. Steam condensate from this system returns to the 100-N steam condensate system that drains to the river. The leak in the lube line was repaired (Rokkan 1988, p. 23).

3.1.1.3 Grouping 3: Acid/Caustic Storage and Transport System. The acid/caustic storage and transport system grouping includes all of the process units, waste management units, and pipelines associated with the storage and transport of acids and caustics used in the 163-N Demineralization Plant. There are both waste management units and unplanned releases in the grouping. Due to its location, the 163-N Septic Tank was also placed in this grouping. Figure 25 shows the grouping and the locations of the potential sources. The potential sources include:

1. 108-N Chemical Unloading Facility
2. 120-N-7 Unloading Station French Drain
3. 120-N-6 Sulfuric Acid Tank French Drains
4. 108-N Neutralization Pit
5. UN-100-N-15 unplanned release
6. UN-100-N-33 unplanned release
7. December 26, 1987 unplanned release
8. 120-N-5 Acid/Caustic Trench and Neutralization Unit

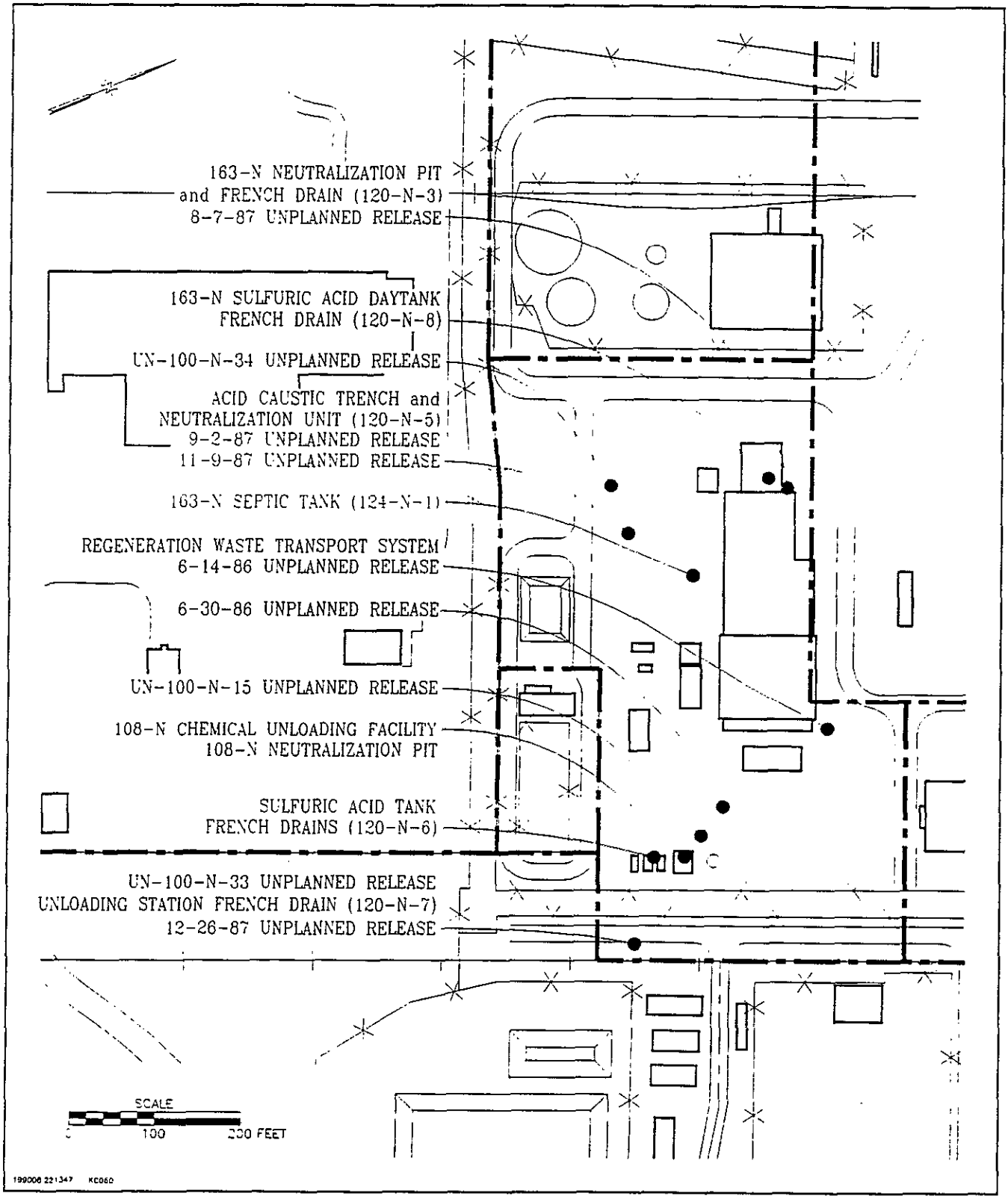


Figure 25. Source Units in the Acid/Caustic Storage and Transport System Grouping

9. UN-100-N-34 unplanned release
10. August 7, 1987 unplanned release
11. September 2, 1987 unplanned release
12. November 9, 1987 unplanned release
13. 120-N-3 (163-N) Neutralization Pit and French Drain
14. 120-N-8 (163-N) Sulfuric Acid Day Tank French Drain
15. Regeneration Waste Transport System
16. June 14, 1986 unplanned release
17. June 30, 1986 unplanned release
18. 124-N-1 Septic Tank.

3.1.1.3.1 108-N Chemical Unloading Facility. The 108-N chemical unloading facility is used for receiving, storage, and transfer of 93% sulfuric acid and 50% sodium hydroxide. Shipments are received by railroad tank car or tank trucks (Chien 1989, p. 11). The unloading station has a french drain (120-N-7) for small releases from the overhead transfer boom. The french drain was used from 1963 until March 1987 (WHC 1989c). The french drain is 3 ft in diameter by 4 ft deep. It is made of clay pipe and is filled with lime.

There are three 10,000-gal above-ground steel sulfuric acid storage tanks and one 76,800-gal sodium hydroxide tank located at the 108-N facility. The tanks began operating in 1964. Adjacent to the sulfuric acid tanks are five french drains (120-N-6) where the overflows from these tanks are vented. The french drains are approximately 2 ft in diameter. They consist of a clay pipe packed with lime to neutralize the acid. The french drains operated from 1963 until March 1987 (WHC 1989c). The acid transfer system uses a 1,000-gal steel transfer tank of unknown construction located in a pit west of the 108-N building. The tank is filled with acid via gravity flow from the storage tanks. Air pressure is used to transfer the acid by way of piping through the trench to the 163-N Day Tank. There are no french drains associated with the sodium hydroxide tank. Transfer pumps located in the 108-N building transfer the sodium hydroxide directly to the 163-N Day Tank from the storage tank via piping through the trench (Chien 1989, p. 11).

A brick-lined neutralization pit is located outside the 108-N building. This received drainage from the 108-N floor drains and from the acid transfer tank. The pit was used to manually neutralize waste acid. The neutralized waste was sent via a water jet pump to the 183-N facility where it was then discharged to the river by way of the 102-in. outfall. The unit has been in operation since 1963. According to Westinghouse Hanford personnel, the unit is 6 ft wide by 4 ft long by 6 ft deep. The brick lining has been replaced on at least one occasion. Currently, the unit contains water, apparently from wash down of facilities at shutdown in 1990.

Various small, intermittent spills have occurred over the years at the 108-N facility associated with unloading or transfer operations. Several larger spills have been documented and are described below:

- March 20, 1981 (UN-100-N-15) - Sulfuric acid and rinsewater were spilled inside the 108-N building. The unknown amount of liquid was transferred to the acid tank french drains for neutralization. The transfer line developed a leak and released to the ground. The affected area was estimated to be less than 50 ft^2 (WHC 1989c). Remedial measures that were instituted have not been documented.

- November 9, 1981 (UN-100-N-33) - Approximately 1,000 gal of sulfuric acid were spilled during an acid transfer from a rail car to an acid storage tank (WHC 1989c).

- December 26, 1987 - Approximately 10 gal of sodium hydroxide were spilled to the ground during caustic transfer from a rail car to the caustic storage tank. Difficulties in transfer prompted the operator to disconnect the transfer line and set it on the ground while investigating the problem. At that time, the sodium hydroxide leaked from the transfer line. The spill was cleaned up on December 31, 1987 (WHC 1988a). The extent of remediation is unknown.

3.1.1.3.2 120-N-5 Acid/Caustic Transfer Trench and Neutralization Unit. The unit is a polymer concrete-lined neutralization pit and acid/caustic transfer trench between the 163-N Demineralization Plant and the 108-N Chemical Unloading Facility. The neutralization unit consists of two containment vaults - one for sulfuric acid and one for sodium hydroxide. Each containment vault is approximately 6 ft long by 6 ft wide by 10 ft deep. The trench, containing both acid and caustic piping, slopes toward the neutralization unit so that spills can be contained within the vaults. The polymer concrete lining was installed in parts of the trench in 1986. According to Westinghouse Hanford personnel, the unit was unlined from 1983 to 1986.

Intermittent small releases have occurred over the years. In January 1976, the pit sealed itself and liquid backed up to the piping level, subsequently corroding the caustic and acid lines (WHC 1989c). Several documented releases associated with the unit have occurred. These releases are described below:

- May 12, 1980 (UN-100-N-34) - During the weekly transfer of sulfuric acid from the 108-N Storage Tank to the 163-N Day Tank, a rupture in the pipeline occurred.

Approximately 3,400 gal of sulfuric acid spilled into the containment vault and overflowed to the ground. The acid in the containment vault was neutralized with 50% sodium hydroxide and pumped to the clearwell overflow (located south of the unit). The unknown amount of acid that overflowed to the ground was neutralized with soda ash and liquid sodium hydroxide (WHC 1989c). No further remediation has been documented.

- August 7, 1987 - Water was found leaking outside the 163-N building north wall. It was found that an area of the trench had not been treated with polymer cement due to clearance restrictions. Sulfuric acid had corroded away the exposed concrete (WHC 1987b). The extent of contamination, amount of sulfuric acid released, and the extent of remediation is unknown.

- September 2, 1987 - During caustic transfer from the 108-N Caustic Storage Tank to the 163-N Caustic Day Tank, a leak was noted in the piping and caustic collected in the trench. Transfer was stopped and a patch was installed (WHC 1987c). The amount of caustic released into the trench is unknown. There is no documentation of caustic reaching the soil.

- November 9, 1987 - A leak of approximately 200 gal of sulfuric acid occurred during transfer operations. This was cleaned up at the time. On December 4, 1987, it was noticed that the trench was open to the soil at the location where the leak occurred. This open area was found to be a dry well installed in 1986 during upgrading of the trench. The dry well was installed for steam trap drainage, not for containment of acid spills. An estimated 15 to 30 gal of sulfuric acid was released to the ground (WHC 1987d). An unknown amount of contaminated soil was removed.

3.1.1.3.3 120-N-3 (163-N) Neutralization Pit and French Drain. The unit is a french drain and vault located immediately west of the 163-N Demineralization Plant. The unit was constructed in 1963 and is still in place (WHC 1989c). It serves as a spill containment unit for the two 10,000 gal acid and caustic day tanks located immediately inside the 163-N Building. A drain in the tank area leads to the unit. The vault is approximately 8 ft by 25 ft in size and approximately 8 ft deep. The walls of the vault are constructed of concrete and the floor is unlined, earthen material. Located in the vault is a 4- to 6-ft diameter french drain made of clay. The depth of the french drain is unknown.

9 1 1 3 3 7 0 7 3 7

Small, intermittent releases of sulfuric acid or sodium hydroxide occurred during transfer operations to or from the 163-N Day Tanks (WHC 1989c). No releases other than the small releases described above have been documented.

3.1.1.3.4 120-N-8 (163-N) Day Tank Vent French Drain. The unit is a french drain used to receive overflow of sulfuric acid from the 163-N Demineralization Plant Sulfuric Acid Day Tank. Overflows were vented to this french drain. The unit is 4 to 6 ft in diameter and consists of a clay pipe filled with lime to neutralize any sulfuric acid releases. It is located on the north side of the 163-N building. The unit was installed in 1963 and taken out of service on May 13, 1988 (WHC 1989c).

The unit received unknown amounts of sulfuric acid in intermittent discharges. Each discharge is estimated to have averaged less than 1 gal of liquid (WHC 1989c). There are no specific documented releases associated with the unit.

3.1.1.3.5 Regeneration Waste Transport System. The regeneration waste transport system includes the storage and piping systems which managed spent regeneration effluent (either acid, caustic or neutralized) from the 163-N Demineralization Plant and routed this effluent to the 120-N-1 (1324-NA) Percolation Pond and the 120-N-2 (1324-N) Surface Impoundment area. The system took on various configurations from 1977 until 1990. Prior to 1977, the spent regeneration waste was discharged to the Columbia River (Krug 1989, p. 5).

From 1977 until 1983, regeneration effluents flowed through lined concrete trenches, 1 ft deep by 2 ft wide, in the 163-N Demineralization Plant. The trenches were covered with a metal grating. The trenches carried the effluent to a sump located near the northwest corner of the 163-N building. The sump pumps delivered the effluent to an underground 8-in. epoxy resin waste transfer line. The 8-in. waste-transfer line historically carried the acid and/or caustic regeneration effluent as well as filter backwash water effluent from the 183-N Water Filter Plant approximately 1,300 ft to the north and south settling ponds and subsequently the 120-N-1 (1324-NA) Percolation Pond (WHC 1987a). Figure 26 shows the regeneration waste transfer system configuration from 1977 until 1983.

In 1983, the piping was modified to deliver the acid and/or caustic effluent from 163-N directly to the 120-N-1 (1324-NA) Percolation Pond, bypassing the closed settling ponds. In addition, the filter backwash water was no longer combined with the regeneration effluent, but was piped to the new 130-N-1 Filter Backwash Discharge Pond. The Regeneration Waste Transport System operated in this configuration from 1983 until 1986 (WHC 1987a, p. 4-5). Figure 27 shows the design of this system for that time period.

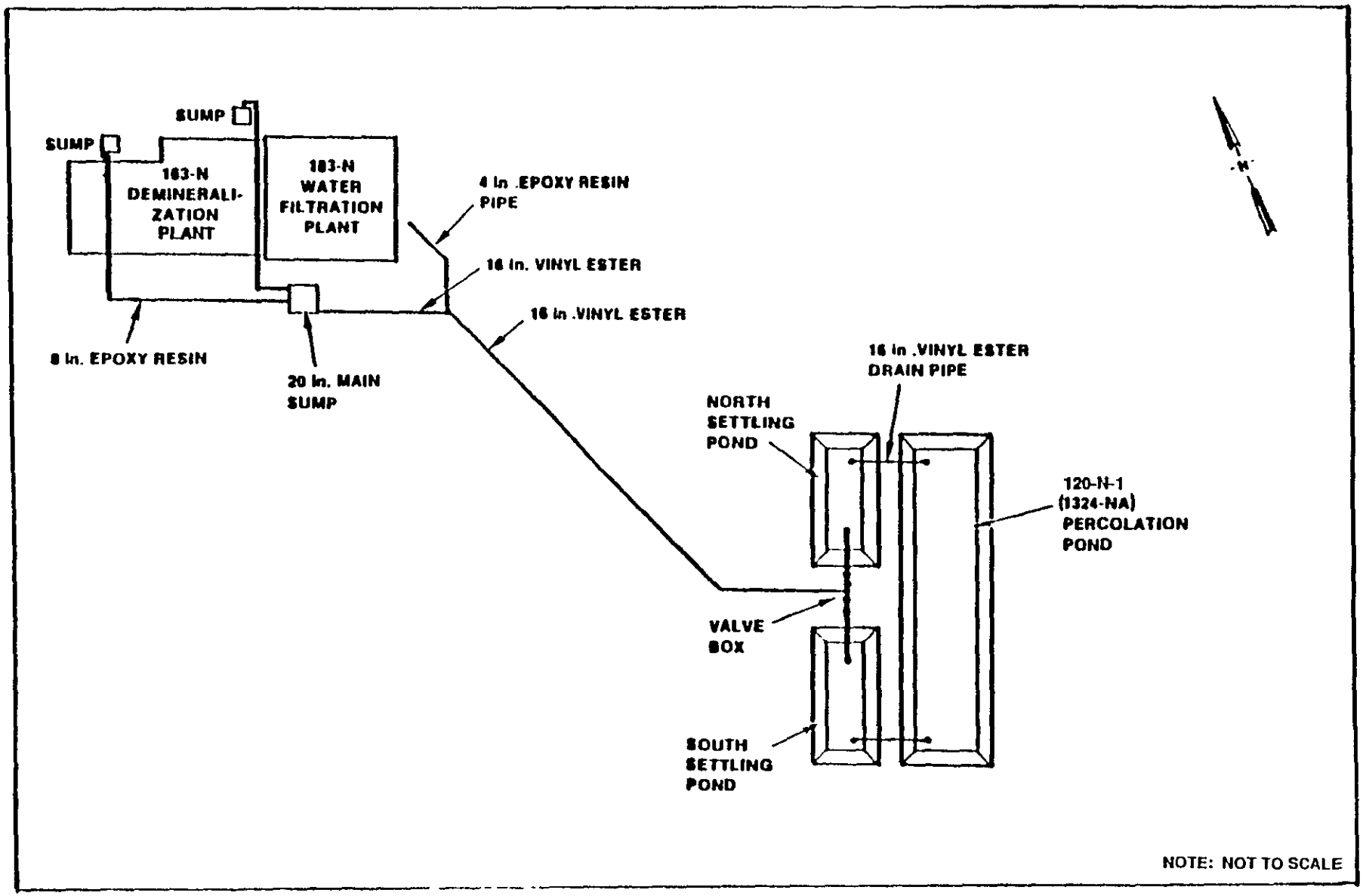


Figure 26. Regeneration Waste Transport System Configuration, 1977-1983
Source: WHC 1987a, p. 4-3

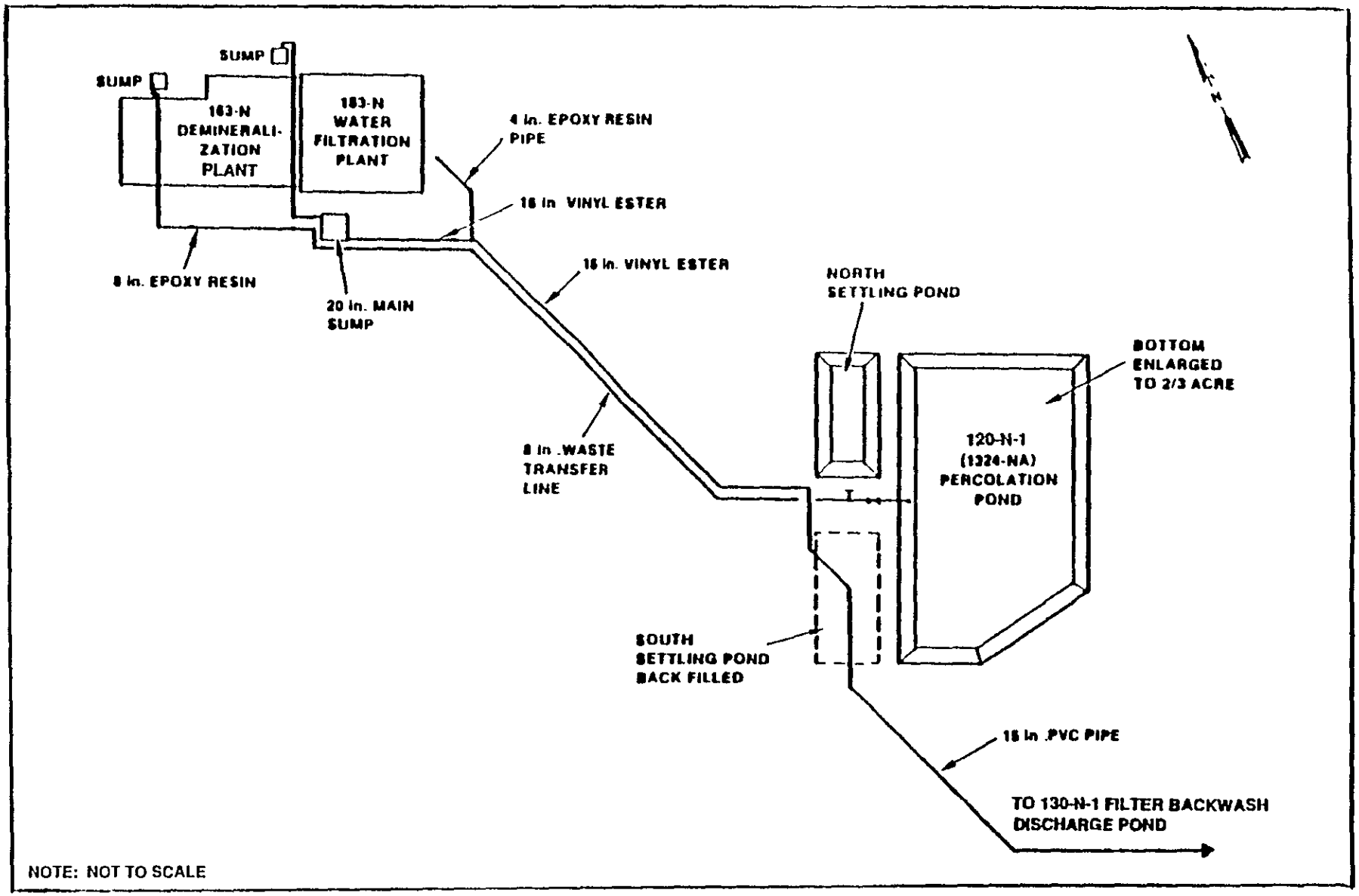


Figure 27. Regeneration Waste Transport System, 1983-1986
Source: WHC 1987a, p. 4-6

In 1986, the 120-N-2 (1324-N) Surface Impoundment was put into service. At that time, the acid and/or caustic regeneration effluent was routed directly to this unit, where the effluent was neutralized. The neutralized effluent was then piped to the 120-N-1 (1324-NA) Percolation Pond (WHC 1987a, p. 4-5). Figure 28 shows the design of the Regeneration Waste Transport System between 1986 and 1988.

In 1988, an elementary neutralization unit (ENU) was installed within the 163-N Demineralization Plant. At that point, the 120-N-2 (1324-N) Surface Impoundment was taken out of service. From 1988 until 1990, spent regeneration effluent was routed via the same trenches mentioned previously to the spent regeneration surge tank, located on the north exterior of 163-N. The tank discharged to the ENU, located inside the north wall of 163-N. After adding the proper amount of acid or caustic solution, the contents were mechanically agitated. When the pH was within the range of 6.0 to 9.0, the neutralized effluent was then piped via the 8-in. waste transfer line to the 120-N-1 (1324-NA) Percolation Pond (Tuck 1990, p. 2-5). Figure 6 shows the 163-N layout from 1988 until 1990.

Westinghouse Hanford personnel have indicated that low levels of radionuclides have been found in the piping. Based on analyses of piping scale, the material was determined to be naturally occurring and not associated with reactor operations.

There have been two documented releases associated with the regeneration waste transport system. These releases are described below:

- June 14, 1986 - A leak was detected in the waste transport pipe while wastes from the anion and cation regeneration process were being routed to 120-N-2. Once the leak was discovered, the regeneration processes were shut down. A sample was collected at the point of the leak and found to be at a pH level of 1.4. It was estimated that approximately 6,500 gal of acidic regeneration waste had leaked to the ground and formed a pond in an area south of the 163-N building. It was decided to continue pumping caustic regeneration waste and allow it to leak into the acidic pond so that it could neutralize the spilled material. This continued for several hours until the pH of the spilled material reached 6.9 units. The neutralized liquid was then pumped to the 102-Inch NPDES outfall for release to the Columbia River. An unknown amount of soil around the leak was excavated and disposed. The pipe was repaired (WHC 1986c).

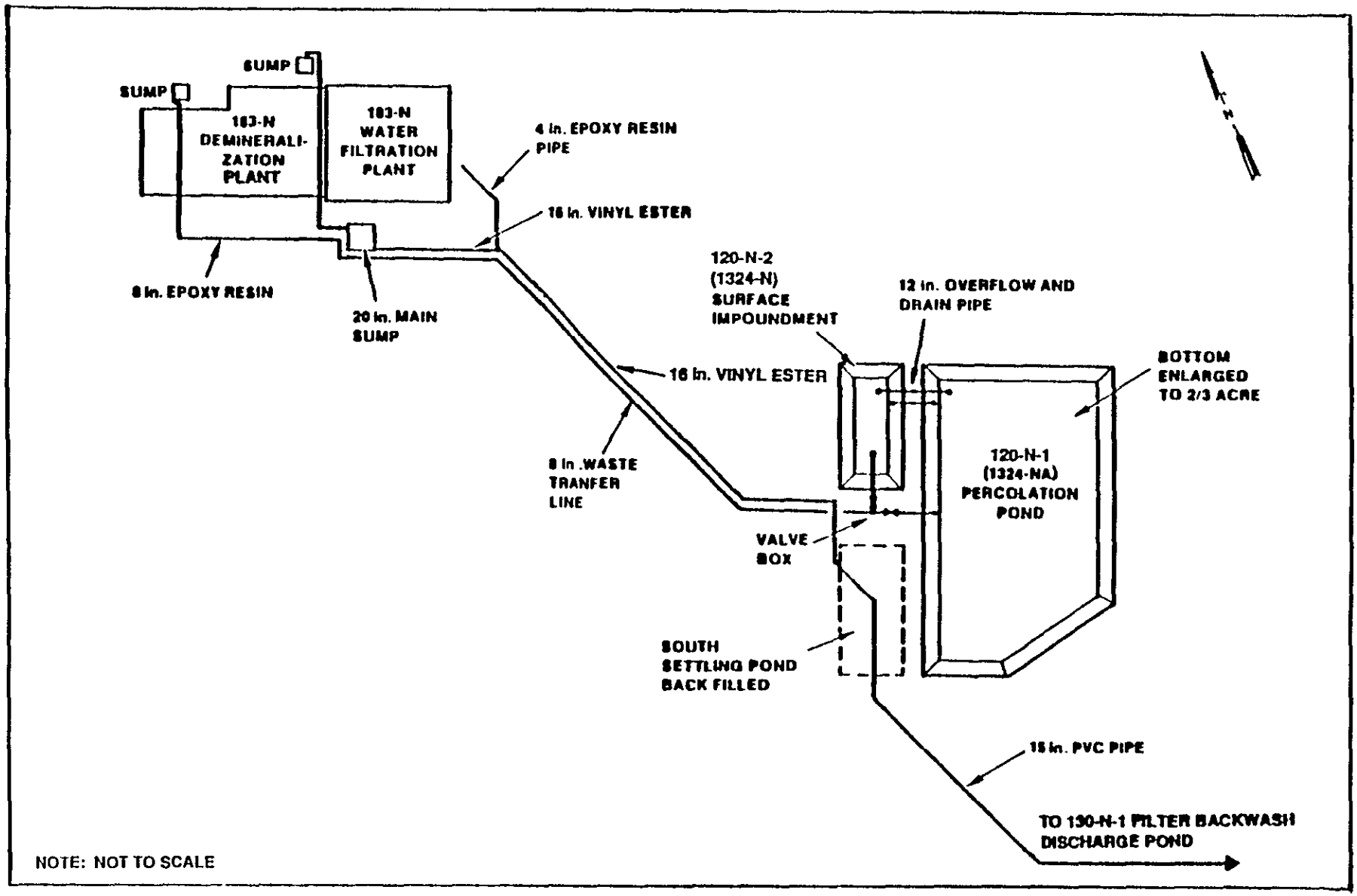


Figure 28. Regeneration Waste Transport System, 1986-1988
Source: WHC 1987a, p. 4-7

- June 30, 1986 - Approximately 1,000 gal of acidic (pH of 1.1) cation regeneration waste spilled to the ground in the area of sump No. 1 when a temporary transport line became momentarily dislodged from the sump. When this was discovered, the regeneration process was stopped and the hose was placed back in the sump and secured. One hundred and eighty lbs of caustic soda ash was added to the spilled waste to adjust the pH (WHC 1986c). The extent of remediation associated with this release is unknown.

3.1.1.3.6 124-N-1 Septic Tank. The septic tank and seepage pit making up sewer system I are located south of the 163-N Building and were installed in 1963 (Gydesen 1985, p. 7); the system is still operating (WHC 1989c). This unit receives sanitary sewage. It was originally designed to serve only personnel in the 163-N/183-N Building. The seepage pit for this system provides about 200 ft^2 of infiltration surface area and 2,256 gal of fluid storage. In about 1982, two bathroom utility trailers were hooked up to this sewer system to serve the personnel in the 1127-N and 1128-N Buildings. In 1985, the unit served 50 personnel and calculated daily flow was 1,420 gal/day (Gydesen 1985, pp. 6-7). The sewer system is still in place. The number of personnel at N Area has declined since 1987, when N Reactor was placed in standdown status. No remedial activities have taken place. There are no documented dangerous or radioactive releases associated with the unit.

3.1.1.4 Grouping 4: 116-N-8 Mixed Waste Storage Area. The Mixed Waste Storage Area is distinctly different than the surrounding source unit areas due to the type of waste managed. It includes only one source, the 116-N-8 Mixed Waste Storage Pad. Figure 29 shows the location of the Mixed Waste Storage Pad. The unit is a concrete-paved mixed waste container storage area. The pad is curbed and surrounded by a wire mesh fence. The pad is 60 ft by 152 ft in size. It is located inside the double-fenced reactor area at the southern corner of the fence. The pad is covered by a roof and is walled on two sides. The unit has been in operation since December 1986 (WHC 1989c).

Wastes are stored in drums and containers and include radioactively contaminated oil and miscellaneous hazardous process chemicals (WHC 1989c). Hazardous and radioactive mixed wastes from satellite collection areas and from other points of generation at 100-N and K Areas are stored at the unit (ICF Technology, Inc. and Ebasco Services, Inc. 1988, p. 2-6). There are no documented releases to the soil from this unit. Prior to 1986, the area was used as a maintenance storage area. There are no documented dangerous or radioactive releases from the unit.

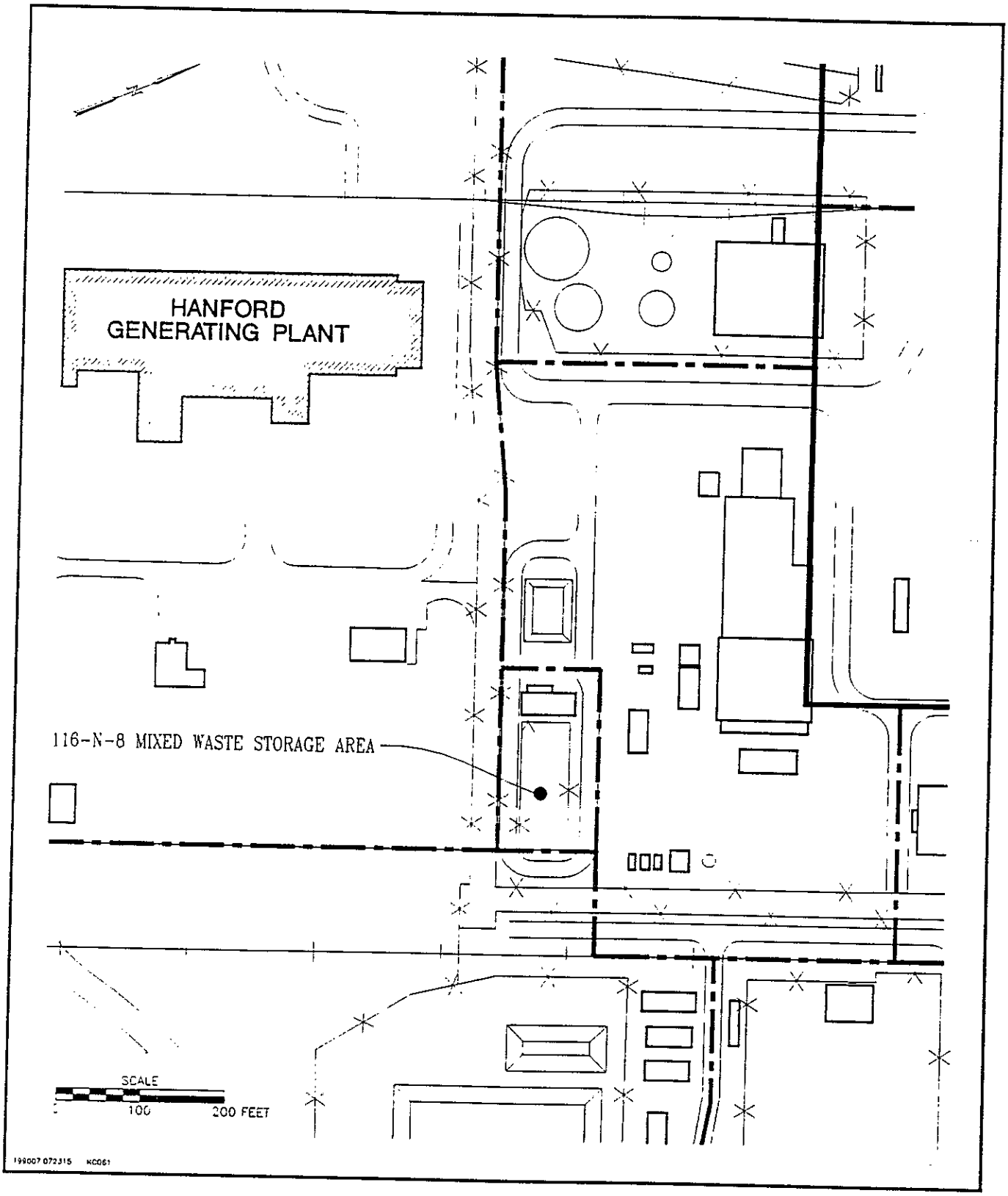


Figure 29. Source Units in the 116-N Mixed Waste Storage Area Grouping

3.1.1.5 Grouping 5: 184-N Plant Service Power House, Tanks, and Piping Systems. This area is distinguished by the significant number of releases of hydrocarbon products to the environment. Figure 30 shows the grouping and potential sources. The grouping consists of:

1. 184-N Plant Service Power House
2. 184-N Day Tank Area
3. UN-100-N-19 unplanned release
4. UN-100-N-21 unplanned release
5. October 9, 1987 unplanned release
6. 166-N-184-N Piping
7. UN-101-N-18 unplanned release
8. UN-100-N-22 unplanned release
9. UN-100-N-23 unplanned release
10. October 14, 1987 unplanned release
11. April 26, 1989 unplanned release.

3.1.1.5.1 184-N Plant Service Power House. The 184-N Plant Service Power House consists of three boilers located in the 184-N Building and the 184-N Annex. The boiler system provides oil-fired boiler-generated steam to the main steam supply system during reactor startup and shutdown periods (WHC 1989b, p. 10.4-22). The 184-N Stack released a variety of constituents to the air from 1963 until 1987. The known chemicals emitted from the stack include sulfur dioxide, nitrogen oxide, sulfur trioxide, carbon monoxide, aldehydes, hydrocarbons, and various particulates.

3.1.1.5.2 184-N Day Tank Area. The 184-N Plant Service Power House has three above-ground oil day tanks located outside the building on the north side. These include two 35,000-gal No. 6 (Bunker C) fuel oil day tanks and one 8,000-gal diesel oil day tank. The day tanks are surrounded by a concrete retaining wall (Zoric 1989, pp. 2-9).

Several documented unplanned releases are associated with the 184-N Day Tank Area. These are described below:

- <u>April, 1984</u> (UN-100-N-19) - Approximately 2,000 gal of No. 6 fuel oil spilled to the ground when the day tank overflowed during filling. All of the fuel oil was contained within the surrounding retaining walls and did not penetrate the hard sand floor of the containment structure. The waste oil was removed and disposed (Zoric 1989, p. 6).

- <u>April 25, 1986</u> (UN-100-N-21) - Approximately 800 gal of diesel oil was released to the ground when the day tank overflowed during filling. This was attributed to a failure of the tank-level annunciator. The annunciator was repaired and the oil was removed from the tank

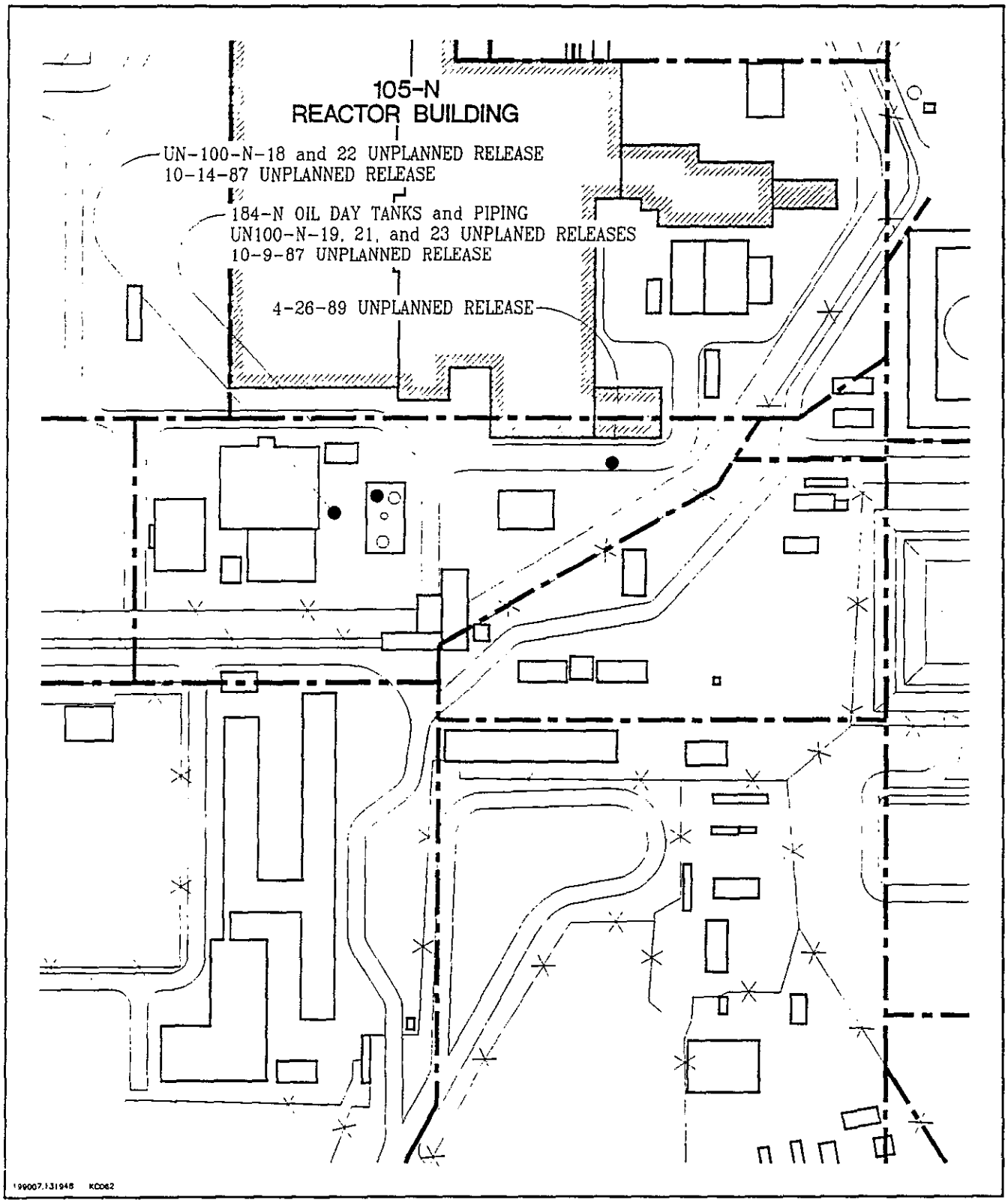


Figure 30. Source Units in the 184-N Plant Service Powerhouse,Tanks, and Piping Systems Grouping

impoundment area. Groundwater monitoring wells at 100-N were sampled and no oil was detected (Zoric 1989, p. 1).

- October 9, 1987 - The diesel oil day tank overflowed during filling operations due to a level indicator which was not reading the correct oil level. The unknown amount of oil was cleaned up (Zimmerman 1987, p. 1).

3.1.1.5.3 166-N - 184-N Piping. The 184-N Fuel Oil Day Tanks are connected to the oil storage tank at 166-N by an 8-in. underground supply line. The 184-N Diesel Oil Day Tank is connected to the storage tanks at 166-N by a 4-in. underground supply line (Zoric 1989, pp. 2-4). Several unplanned releases from the pipelines have been documented. They are described below:

- August 1973 (UN-100-N-18) - A leak caused by external corrosion occurred in the 4-in. diesel oil supply line between the 166-N storage tanks and the day tank. The leak was detected by a pressure test after approximately 200 gal of diesel oil had been spilled to the ground (Zoric 1989, p. 5). The line was excavated and repaired (WHC 1989c). There is no documentation regarding the specific location of the leak or of removal of contaminated soil.

- June 23, 1986 (UN-100-N-22) - External corrosion of the diesel oil supply line caused a 1,000 gal leak of diesel oil just outside the 184-N tank area. The line was excavated and rerouted. An unknown amount of contaminated soil was removed. Groundwater monitoring Well N-16 was sampled and oil was detected in July 1986. Well N-16 is located approximately 30 ft west of the 184-N Building. An unknown amount of residual oil was recovered from the groundwater through Well N-16 (Zoric 1989, p. 5).

- January 10, 1987 (UN-100-N-23) - External corrosion caused a leak in the diesel oil supply line. Approximately 200 gal of diesel oil were released to the soil. The line was isolated, excavated, and repaired. Groundwater monitoring Well N-16 was sampled and oil was found. Residual oil was recovered from the well (Zoric 1989, p. 6). There is no documentation regarding soil remediation that occurred.

- October 14, 1987 - An unknown amount of fuel oil leaked from a loose pipe fitting at the 184-N Annex. Oil was being transferred from the day tank to the

No. 2 boiler. Oil was contained in the 184-N Annex drain trench and cleaned up (Tallent 1988, pp. 1-2).

- April 26, 1989 - The diesel oil supply pipeline developed leaks in three places between 166-N and the 184-N Day Tanks. The specific cause of the leak was unknown. A minimum of 300 gal of diesel oil was released to the soil along the pipeline. Monitoring wells N-16 and N-17 were sampled (WHC 1990b, pp. 1-2). Westinghouse Hanford personnel indicated that oil was detected in these samples. A total of 46 drums and eight dump trucks of contaminated soil were removed.

3.1.1.6 Grouping 6: Decontamination Drain Line Leak. This small area is distinguished from the surrounding source unit areas due to a mixed waste leak from the decontamination drain line between 105-N Reactor and the 116-N-2 (1310-N) Radioactive Chemical Waste Treatment and Storage Facility. Decontamination of the N Reactor occurred on a semiannual basis. The decontamination solution generally contained phosphoric acid and diethylthiourea, but small-scale decontaminations occurred which contained a variety of cleaning solutions. Generally, the 1 1/2-in. chemical decontamination waste drain line transported these smaller-scale decon solutions to the 116-N-2 (1310-N) Storage Tank.

On September 10, 1985, a leak of radiologically contaminated water occurred at four locations along the 1 1/2-in. Chemical Decontamination Waste Drain Line (UN-100-N-6). This occurred near the N-29 Craft Shop. Figure 31 shows the location of the unplanned release. The drain line transfers irradiated decontamination wastes from the 105-N Reactor Building to the 116-N-2 (1310-N) Storage Tank. Approximately 1,800 gal of irradiated water was released. The spilled water contained an estimated 0.2 Ci of Co-60, 0.04 Ci of Mn-54, 0.003 Ci of Ru-103, and 0.003 Ci of Cs-137. Five-hundred and ninety ft^3 of contaminated soil reading between 7,000 and 25,000 counts per minute was removed and drummed for disposal. The area was backfilled with clean fill (WHC 1989c).

3.1.1.7 Grouping 7: 120-N-4 Nonhazardous and Nonradioactive Storage Area. This grouping consists of two potential sources in an area southwest of the 116-N-2 (1310-N) Radioactive Chemical Waste Treatment and Storage Facility. These potential sources are the 120-N-4 Nonhazardous and Nonradioactive Storage Area and the 1716-N Service Station Underground Storage Tanks. Figure 32 shows the grouping and the locations of the potential sources.

3.1.1.7.1 120-N-4 Nonhazardous and Nonradioactive Storage Area. The unit is currently a nonhazardous and hazardous waste storage pad. It is a 100 ft by 75 ft curbed concrete pad located

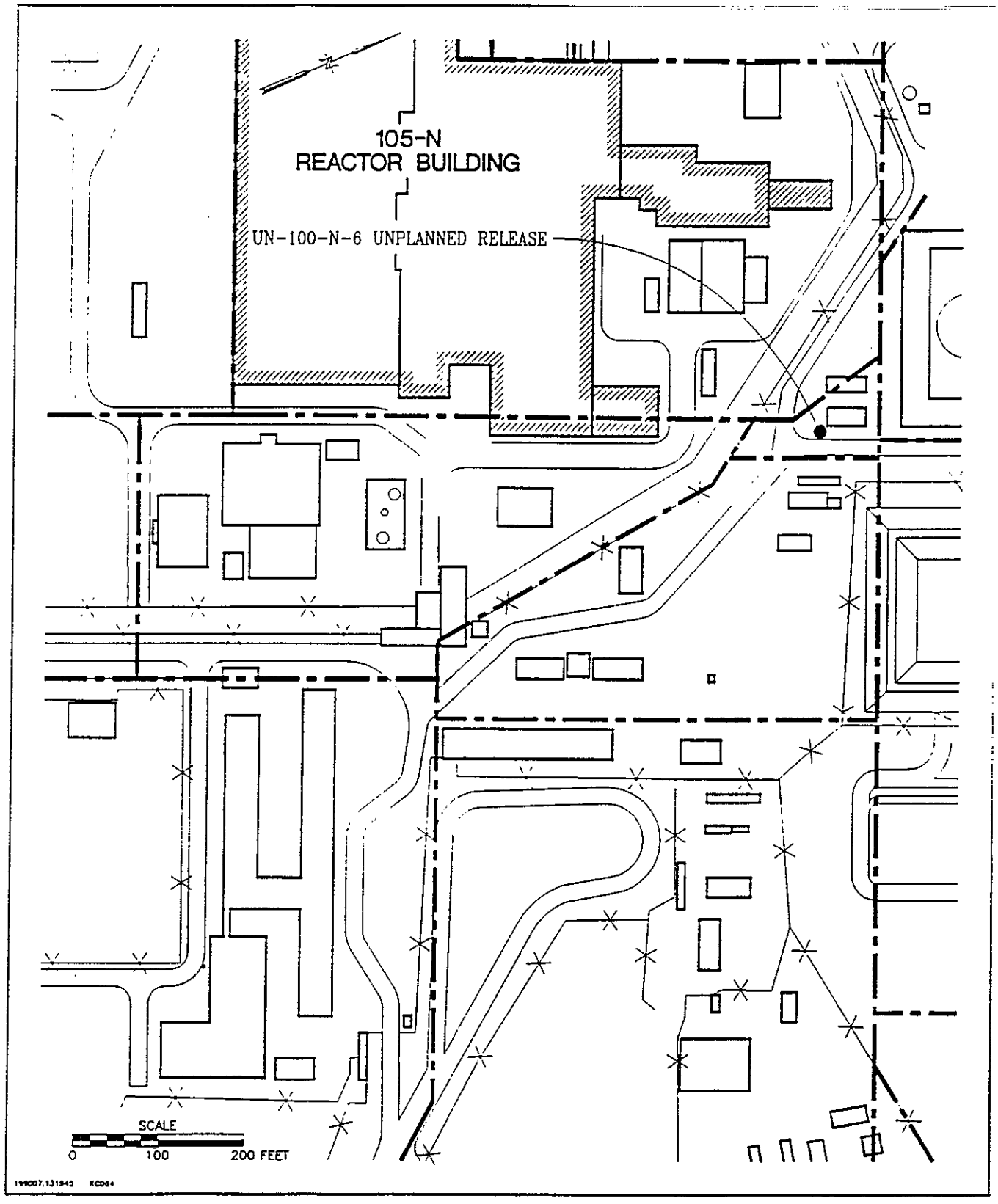


Figure 31. Source Units in the Decontamination Drain Line Leak Grouping

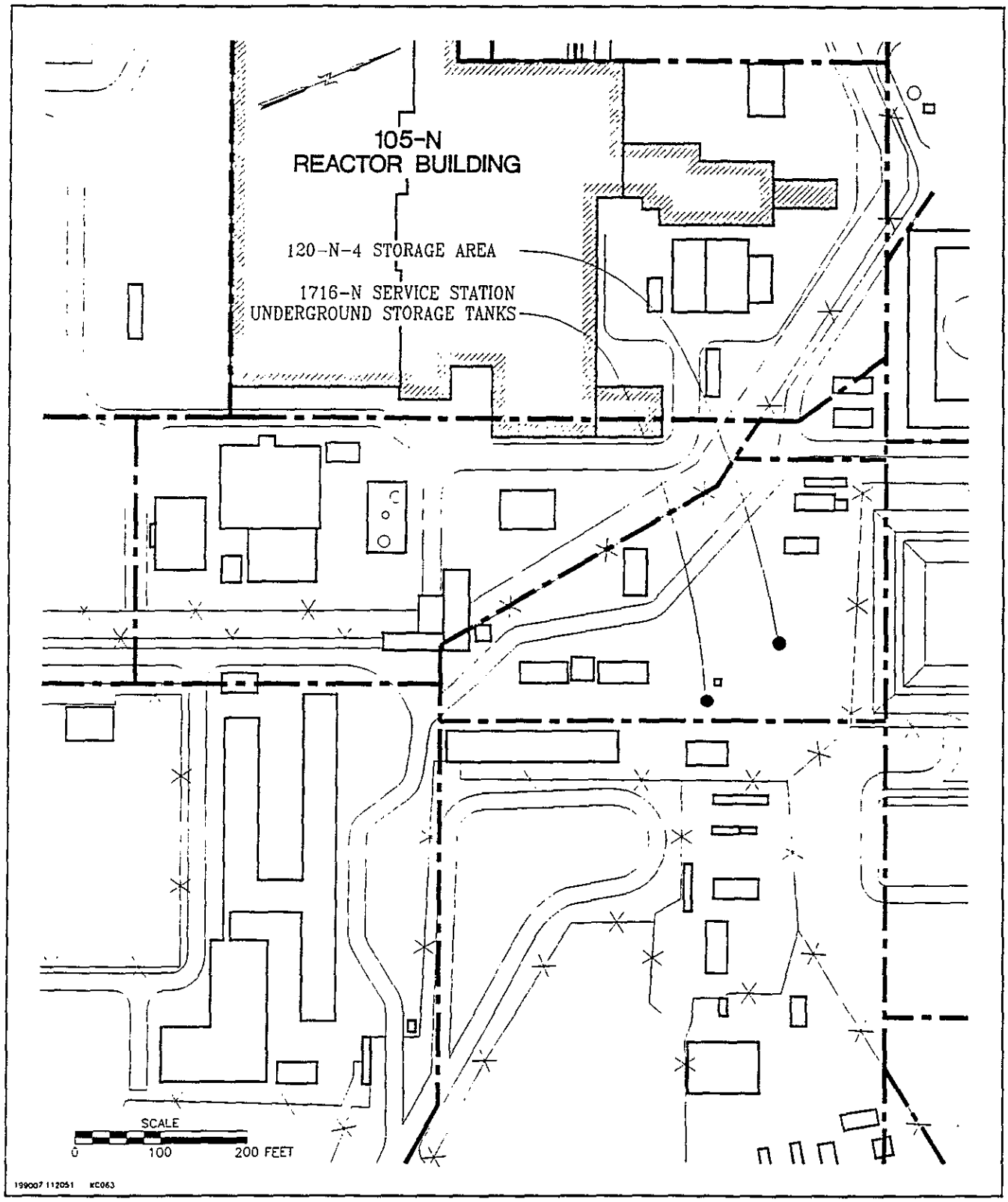


Figure 32. Source Units in the 120-N-4 Nonhazardous and Nonradioactive Storage Area Grouping

immediately southwest of the berm surrounding the 1310-N Radioactive Chemical Waste Treatment and Storage Facility. The unit has been in its current configuration since November 1985. It stores nonradioactive and nonhazardous oils and aqueous liquids.

Prior to 1985, the unit was unpaved and used as a laydown yard for radioactive-contaminated equipment as well as for storage of radioactive-contaminated oils. Information regarding types and amounts of wastes stored in this area is unavailable. Aerial photographs from prior to 1985, indicate storage of unknown materials in the area immediately southeast of the current pad. There are no documented releases to the soil from this unit.

3.1.1.7.2 1716-N Service Station Underground Storage Tanks. Two underground storage tanks are located at the 1716-N Service Station, located south of the 120-N-4 Nonhazardous and Nonradioactive Storage Area. The tanks are identified as 100-N-SS-27 and 100-N-SS-28. Both tanks contain unleaded gasoline and are approximately 1,000 to 4,000 gal in capacity. The tanks are constructed of single-wall carbon steel and neither have cathodic or interior protection. Tank 100-N-SS-27 was installed in 1967 and Tank 100-N-SS-28 was installed in 1976 (DOE-RL 1989, p. 3). The tanks are scheduled to be tightness-tested and provided with leak-detection equipment by December 1991 (Stupka 1989, p. 1-5). There is no documentation regarding releases from the tanks.

3.1.1.8 Grouping 8: Regeneration/Filter Backwash Waste Disposal Area. The Regeneration/Filter Backwash Waste Disposal Area grouping includes those units which have received corrosive regeneration wastes from the 163-N Demineralization Plant and filter backwash water from the 183-N Filtered Water Plant. There are five potential sources in this area, including:

1. 120-N-1 (1324-NA) Percolation Pond
2. South Settling Pond
3. 120-N-2 (1324-N) Surface Impoundment
4. 130-N-1 Filter Backwash Discharge Pond
5. 1143-N Paint Shop.

The 1143-N Paint Shop is included in this area since it is located in close proximity to the 120-N-1 and 120-N-2 facilities. Figure 33 shows the grouping and the locations of the potential sources.

3.1.1.8.1 120-N-1 (1324-NA) Percolation Pond. The 120-N-1 (1324-NA) Percolation Pond is a large unlined pond that was historically used to treat corrosive regeneration effluent. It is located approximately 1,000 yd southeast of the 105-N Reactor building. The pond was placed in service in August 1977, and was

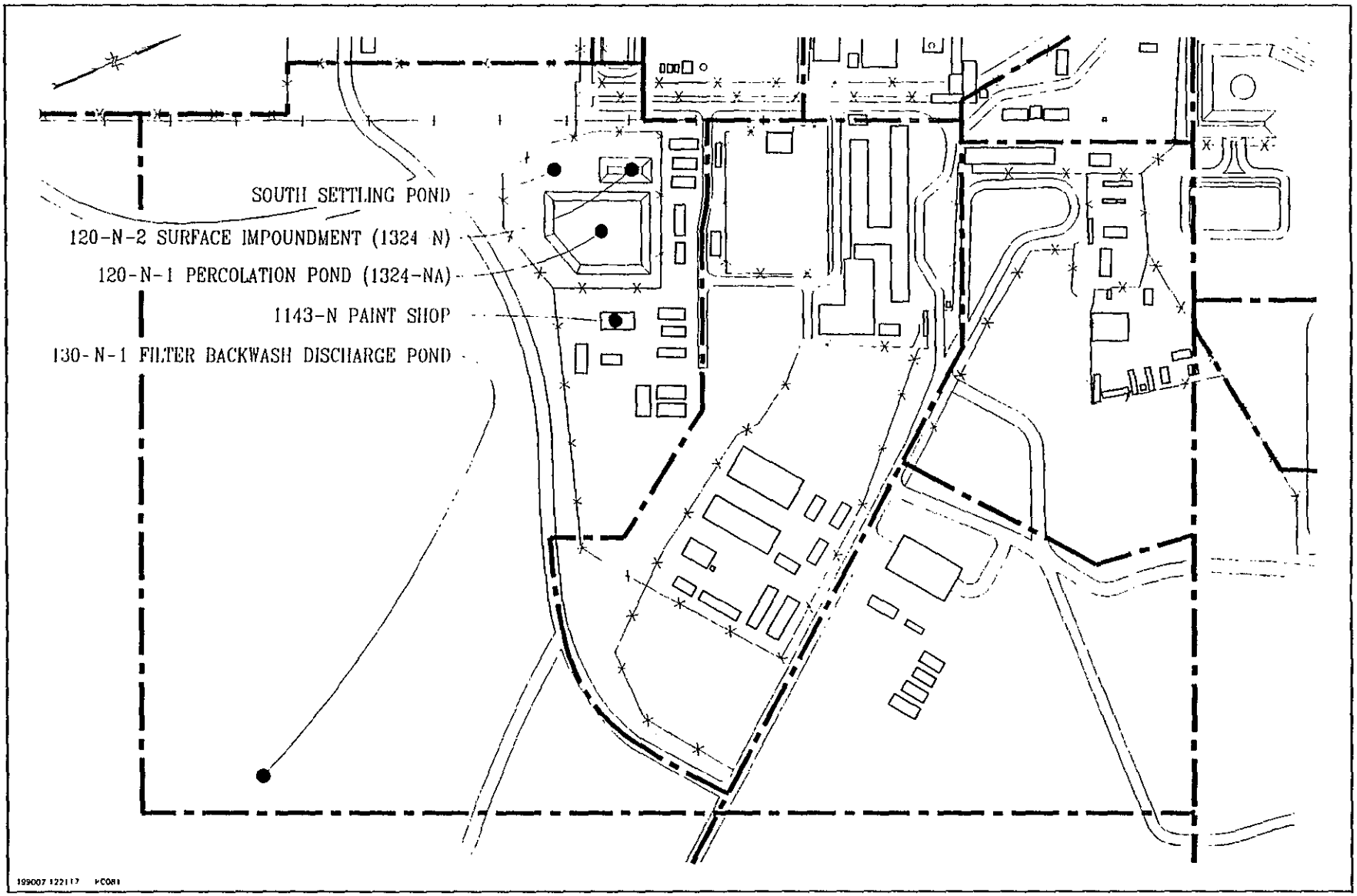


Figure 33. Source Units in the Regeneration/Filter Backwash Waste Disposal Area Grouping

used to treat corrosive regeneration effluent from the 163-N Demineralization Plant and filter backwash water from the 183-N Filtered Water Plant. The effluent was treated in the 120-N-1 Percolation Pond by the alternate addition to the pond of acidic cation column regeneration effluent and alkaline anion column regeneration effluent. This alternate addition of low and high pH effluent served to neutralize the effluents in the 120-N-1 Percolation Pond. The 120-N-1 Percolation Pond also made use of the buffering capacity and calcareous nature of the soil underlying the pond to neutralize the corrosive wastes. The effluents which were treated in the 120-N-1 Percolation Pond were first transferred to the north and south settling ponds located directly west of 120-N-1. These settling ponds were used to settle out the solids in the filter backwash water waste stream. The settling ponds were removed from service in early 1983. The 120-N-1 Percolation Pond managed an average of 160,000 gal/day of corrosive regeneration effluent and 300,000 gal/day of filter backwash water (WHC 1987a). Figure 34 shows the configuration of the 120-N-1 Percolation Pond area from 1977 to 1983. Tables 3 and 4 show representative analyses of cation and anion regeneration effluent cycles, respectively, which were discharged to 120-N-1. Table 5 shows representative analyses of the filter backwash effluent discharged to 120-N-1.

Westinghouse Hanford personnel indicated that low levels of naturally occurring radionuclides may have been disposed in this unit. These radionuclides have been found in the piping and may have been retained in the soil column.

In the spring of 1983, the 120-N-1 Percolation Pond was enlarged from a bottom area of 9,200 ft^2 with a volume of approximately 1,200,000 gal to a bottom area of 29,000 ft^2. This enlarged pond was designed to contain up to 3,000,000 gal of corrosive wastes from the regeneration of ion exchange columns in the 163-N Demineralization Plant. The entire bottom area of the pond has not been covered with wastes since the enlargement of the pond. The filter backwash water was routed to the 130-N-1 Filter Backwash Discharge Pond at this time, and the south settling pond was backfilled to grade (WHC 1987a, p. 2-3).

Use of the 120-N-1 (1324-NA) Percolation Pond to treat dangerous wastes was discontinued by May 13, 1986, when the 120-N-2 (1324-N) Surface Impoundment was put into service to treat the corrosive regeneration effluents. The 120-N-2 (1324-N) Surface Impoundment is a double-lined pond with a leachate collection system which was used to neutralize the wastes prior to their discharge to the percolation pond (WHC 1987a, p. 2-3). This unit was used from 1986 until 1988, when it was replaced by an elementary neutralization unit (ENU) located at the 163-N Demineralization Plant. The 120-N-1 Percolation Pond continued to receive neutralized regeneration effluent from 1986 until

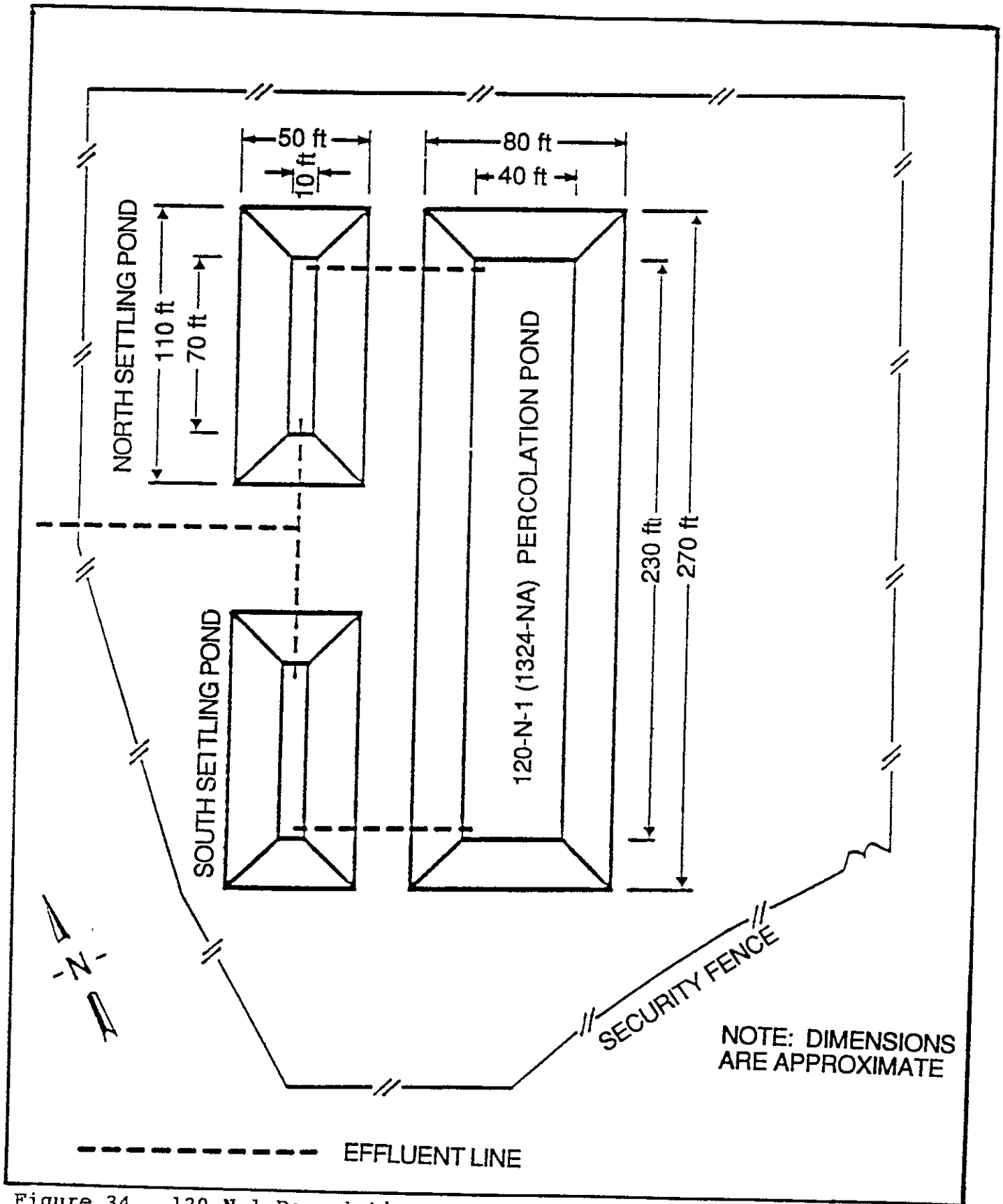


Figure 34. 120-N-1 Percolation Pond Area Configuration, 1977-1983
Source: Krug 1989, p. 7

Table 3. 163-N Demineralization Plant Regeneration Effluent Waste Analysis Cation Regeneration Cycle.

Parameters (MDL)	Sample 1	2	3	Average
pH (standard units)	0.894	0.936	0.922	0.917
Conductivity (μmhos)	37,000	40,100	35,000	37,367
Mercury (0.0001 p/m)	LD	LD	LD	LD
Ethylene glycol (10 p/m)	LD	LD	LD	LD
Enhanced thiourea (0.2 p/m)	LD	LD	LD	LD
TOC (1 p/m)	0.0013	0.0019	0.0018	0.0016
Cyanide (0.01 p/m)	LD	LD	LD	LD
Barium (0.006 p/m)	0.030	0.023	0.020	0.024
Cadmium (0.002 p/m)	0.003	0.002	0.003	0.003
Chromium (0.01 p/m)	LD	LD	LD	LD
Lead (0.03 p/m)	LD	LD	LD	LD
Silver (0.01 p/m)	LD	LD	LD	LD
Sodium (0.1 p/m)	12.2	16.5	9.6	12.8
Nickel (0.01 p/m)	LD	LD	LD	LD
Copper (0.01 p/m)	LD	LD	LD	LD
Vanadium (0.005 p/m)	0.025	0.027	0.020	0.024
Antimony (0.1 p/m)	LD	LD	LD	LD
Aluminum (0.15 p/m)	0.725	0.842	0.655	0.741
Manganese (0.005 p/m)	0.027	0.035	0.027	0.030
Potassium (0.1 p/m)	12.2	15.5	14.8	14.2
Iron (0.05 p/m)	1.1	1.2	1.0	1.1
Beryllium (0.005 p/m)	LD	LD	LD	LD
Osmium (0.3 p/m)	LD	LD	LD	LD
Strontium (0.3 p/m)	1.3	1.4	1.2	1.3
Zinc (0.005 p/m)	0.016	0.024	0.067	0.036
Calcium (0.05 p/m)	282.6	347.4	324.9	318.3
Nitrate (0.5 p/m)	1.0	0.5	0.8	0.8
Sulphate (0.5 p/m)	2,310	4,271	2,952	3,201
Fluoride (0.5 p/m)	LD	LD	LD	LD
Chloride (0.5 p/m)	2.0	1.8	1.9	1.9
Phosphate (1 p/m)	LD	LD	LD	LD
Phosphorus Pesticides (0.005 p/m)	LD	LD	LD	LD
Chlorinated Pesticides (0.001 p/m)	LD	LD	LD	LD
Enhanced ABN List	LD	LD	LD	LD
Citrus Red (1 p/m)	LD	LD	LD	LD
Arsenic (0.005 p/m)	LD	LD	LD	LD
Ammoniun Ion (0.05 p/m)	LD	LD	LD	LD
Coliform (3 MPN)	LD	LD	LD	LD
Selenium (0.005 p/m)	LD	LD	LD	LD
Thallium (0.01 p/m)	LD	LD	LD	LD
Enhanced VOA (10 p/m)	26	28	26	27

LD = less than detectable
MDL = minimum detection limit
MPN = most probable number.

Data obtained from samples taken August 1985.

Source: WHC 1987a, p. 3-3

Table 4. 163-N Demineralization Plant Regeneration Waste Analysis
Anion Regeneration Cycle.

Parameters (MDL)	Sample 1	2	3	Average
pH (standard units)	13.72	13.74	13.77	13.74
Conductivity (μmhos)	62,000	60,000	70,000	64,000
Mercury (0.0001 p/m)	0.00018	0.00013	0.00019	0.00017
Ethylene glycol (10 p/m)	LD	LD	LD	LD
Enhanced thiourea (0.2 p/m)	LD	LD	LD	LD
TOC (1 p/m)	462	499	456	472
Cyanide (0.01 p/m)	0.010	0.015	LD	0.013
Barium (0.6 p/m)	LD	LD	LD	LD
Cadmium (0.2 p/m)	LD	LD	LD	LD
Chromium (1 p/m)	LD	LD	LD	LD
Lead (0.2 p/m)	LD	LD	LD	LD
Silver (1 p/m)	LD	LD	LD	LD
Sodium (0.1 p/m)	26,910	28,200	26,330	27,150
Nickel (1 p/m)	LD	LD	LD	LD
Copper (1 p/m)	LD	LD	LD	LD
Vanadium (0.5 p/m)	LD	LD	LD	LD
Antimony (10 p/m)	LD	LD	LD	LD
Aluminum (15 p/m)	LD	LD	LD	LD
Manganese (0.5 p/m)	LD	LD	LD	LD
Magnesium (5 p/m)	LD	LD	LD	LD
Potassium (10 p/m)	26.5	27.2	26.3	26.7
Iron (5 p/m)	LD	LD	LD	LD
Beryllium (0.5 p/m)	LD	LD	LD	LD
Osmium (30 p/m)	LD	LD	LD	LD
Strontium (30 p/m)	LD	LD	LD	LD
Zinc (0.5 p/m)	LD	LD	LD	LD
Calcium (5 p/m)	LD	LD	LD	LD
Nitrate (0.5 p/m)	1.0	1.4	0.9	1.1
Sulphate (0.5 p/m)	30.9	30.6	30.6	30.7
Fluoride (0.5 p/m)	LD	LD	LD	LD
Chloride (0.5 p/m)	2.5	2.3	2.3	2.4
Phosphate (1 p/m)	LD	LD	LD	LD
Phosphorus Pesticides (0.005 p/m)	LD	LD	LD	LD
Chlorinated Pesticides (0.001 p/m)	LD	LD	LD	LD
Enhanced ABN List	LD	LD	LD	LD
Citrus Red (1 p/m)	LD	LD	LD	LD
Arsenic (0.2 p/m)	LD	LD	LD	LD
Ammoniun Ion (0.05 p/m)	2.3	2.7	2.8	2.6
Coliform (2.2 MPN)	LD	LD	LD	LD
Selenium (0.002 p/m)	LD	LD	LD	LD
Thallium (0.4 p/m)	LD	LD	LD	LD
Enhanced VOA (10 p/m)	26	28	26	27

LD = less than detectable
MDL = minimum detection limit
MPN = most probable number.

Data obtained from samples taken August 1985.

Source: WHC 1987a, p. 3-4

Table 5. 183-N Filtered Water Plant Backwash Effluent Analysis.

Parameters (MDL)	Sample 1	2	3	Average
pH (standard units)	7.08	7.65	7.64	7.46
Conductivity (μmhos)	160	150	150	153
Mercury (0.001 p/m)	LD	LD	LD	LD
Ethylene glycol (10 p/m)	LD	LD	LD	LD
Enhanced thiourea (0.2 p/m)	LD	LD	LD	LD
TOC (1 p/m)	0.00277	.002175	0.002257	0.002404
Cyanide (0.01 p/m)	LD	LD	LD	LD
Barium (0.006 p/m)	0.030	0.031	0.030	0.030
Cadmium (0.002 p/m)	0.004	0.002	0.002	0.003
Chromium (0.01 p/m)	LD	LD	LD	LD
Lead (0.03 p/m)	LD	LD	LD	LD
Silver (0.01 p/m)	LD	LD	LD	LD
Sodium (0.1 p/m)	2.202	2.287	2.186	2.225
Nickel (0.01 p/m)	LD	LD	LD	LD
Copper (0.01 p/m)	LD	LD	LD	LD
Vanadium (0.005 p/m)	LD	LD	LD	LD
Antimony (0.1 p/m)	LD	LD	LD	LD
Aluminum (0.15 p/m)	0.392	0.389	0.376	0.386
Manganese (0.005 p/m)	0.020	0.015	0.014	0.016
Potassium (0.1 p/m)	0.799	0.814	0.762	0.792
Iron (0.05 p/m)	LD	LD	LD	LD
Beryllium (0.005 p/m)	LD	LD	LD	LD
Osmium (0.3 p/m)	LD	LD	LD	LD
Strontium (0.3 p/m)	LD	LD	LD	LD
Zinc (0.005 p/m)	LD	LD	LD	LD
Calcium (0.05 p/m)	17.340	17.720	17.020	17.360
Nitrate (0.5 p/m)	0.789	0.500	0.500	0.596
Sulphate (0.5 p/m)	18.900	20.980	19.110	19.663
Fluoride (0.5 p/m)	LD	LD	LD	LD
Chloride (0.5 p/m)	2.846	2.671	2.901	0.2806
Phosphate (1 p/m)	LD	LD	LD	LD
Phosphorus Pesticides (0.005 p/m)	LD	LD	LD	LD
Chlorinated Pesticides (0.001 p/m)	LD	LD	LD	LD
Enhanced ABN List	LD	LD	LD	LD
Citrus Red (1 p/m)	LD	LD	LD	LD
Arsenic (0.005 p/m)	LD	LD	LD	LD
Ammoniun Ion (0.05 p/m)	LD	LD	LD	LD
Coliform (3 MPN)	0.240	2.400	0.2400	1.680
Selenium (0.005 p/m)	LD	LD	LD	LD
Thallium (0.01 p/m)	LD	LD	LD	LD
Enhanced VOA (10 p/m)	---	0.024	0.025	0.025

LD = less than detectable
MDL = minimum detection limit
MPN = most probable number.

Data obtained from samples taken August 1985.

Source: WHC 1987a, p. 3-6

1990. The enlarged 120-N-1 Percolation Pond and the 120-N-2 Surface Impoundment are shown in Figure 35.

3.1.1.8.2 South Settling Pond. The south settling pond, in conjunction with the north settling pond (described in Section 3.1.1.8.3), received corrosive regeneration effluent and process and cooling water from the 163-N Demineralization Plant and filter backwash water from the 183-N Filtered Water Plant from 1977 until 1983. Volumes of effluent to these ponds is the same as for the 120-N-1 Percolation Pond, described in Section 3.1.1.8.1. Representative analyses of effluents discharged to the south settling pond are presented in Tables 3, 4, and 5. As indicated by Westinghouse Hanford personnel, low levels of naturally occurring radionuclides may be present.

The south settling pond was a rectangular, unlined basin constructed below grade. The dimensions of the pond were approximately 110 ft by 50 ft at grade; the sides sloped to a bottom measuring approximately 70 ft by 10 ft. Depth is estimated to have been approximately 15 ft. After settling out of solids primarily from the filter backwash effluent, the contents of the settling ponds were transferred to the 120-N-1 Percolation Pond. Between 1983 and 1986, the north and south settling ponds were closed. The regeneration effluent was then discharged directly to the 120-N-1 Percolation Pond and the filter backwash effluent was then discharged to the 130-N-1 Filter Backwash Disposal Pond. The south settling pond was backfilled. As part of closure activities for the entire 120-N-1 and 120-N-2 area, soil sampling is to be conducted at the former south settling pond location as outlined by Krug (1989) pp. 8-12; (WHC 1987a, pp. 4-2 to 4-5).

3.1.1.8.3 120-N-2 (1324-N) Surface Impoundment. The 120-N-2 (1324-N) Surface Impoundment was constructed and placed in service in 1986 and operated until 1988. It is located approximately 1,000 yd southeast of the 105-N Reactor building in the former location of the north settling pond (WHC 1986a, p. 8-2). The operating history for the north settling pond is the same as the south settling pond, described in Section 3.1.1.8.2.

The 120-N-2 unit is a double-lined surface impoundment equipped with a leak detection system. The unit is approximately 140 ft by 75 ft at grade sloping to 80 ft by 15 ft at approximately 15 ft below grade. The impoundment was designed to contain a volume of 424,000 gal (WHC 1986a, pp. D-6 and A-8). Figure 36 shows the physical design of the unit.

Acid and caustic regeneration effluent from the 163-N Demineralization Plant was neutralized in the 120-N-1 Surface Impoundment. Approximately 430,000 gal/day were neutralized (Krug 1989, p. 13). Tables 3 and 4 show representative analyses

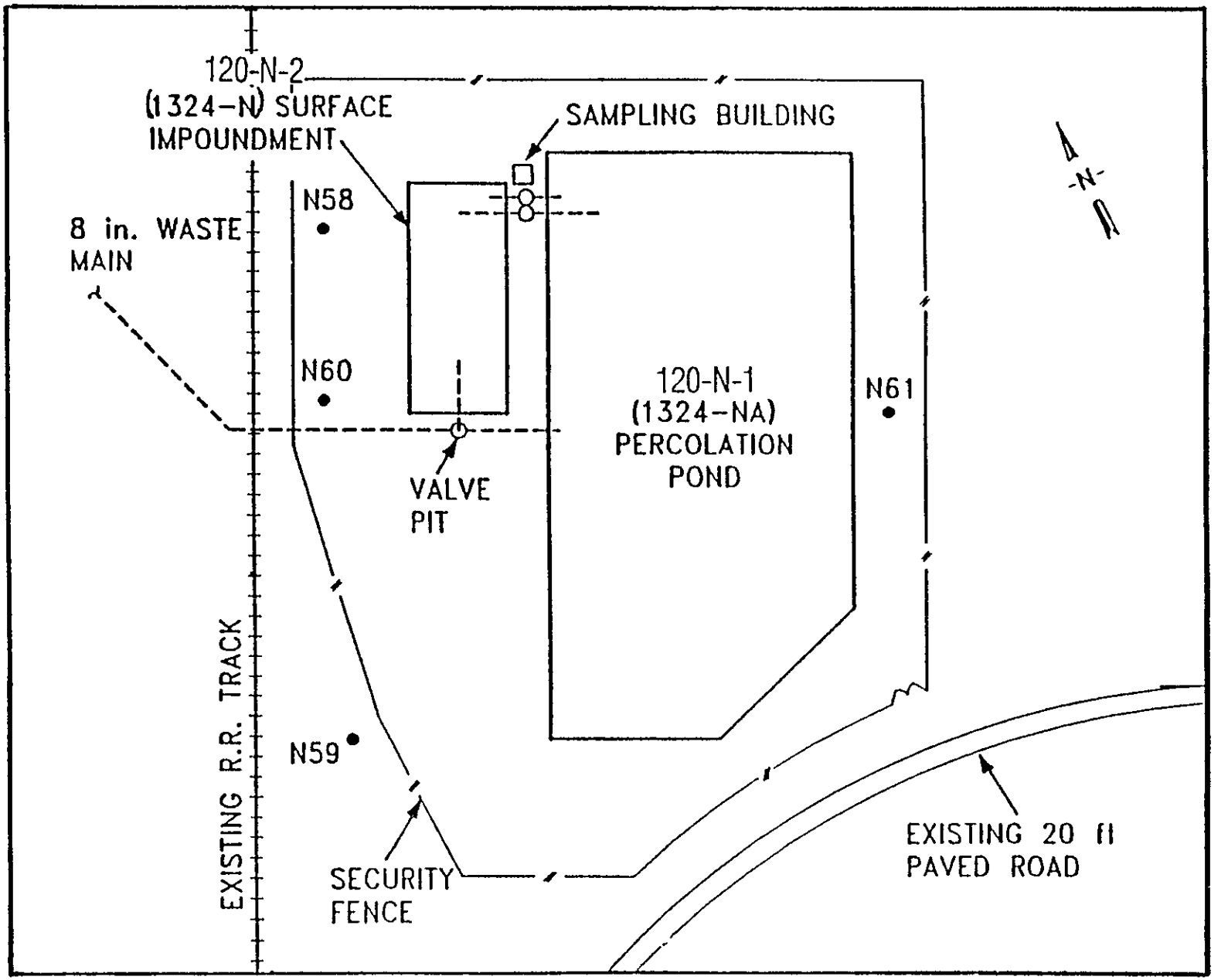


Figure 35. 120-N-1 Percolation Pond/120-N-2 Surface Impoundment Configuration, 1986-1988

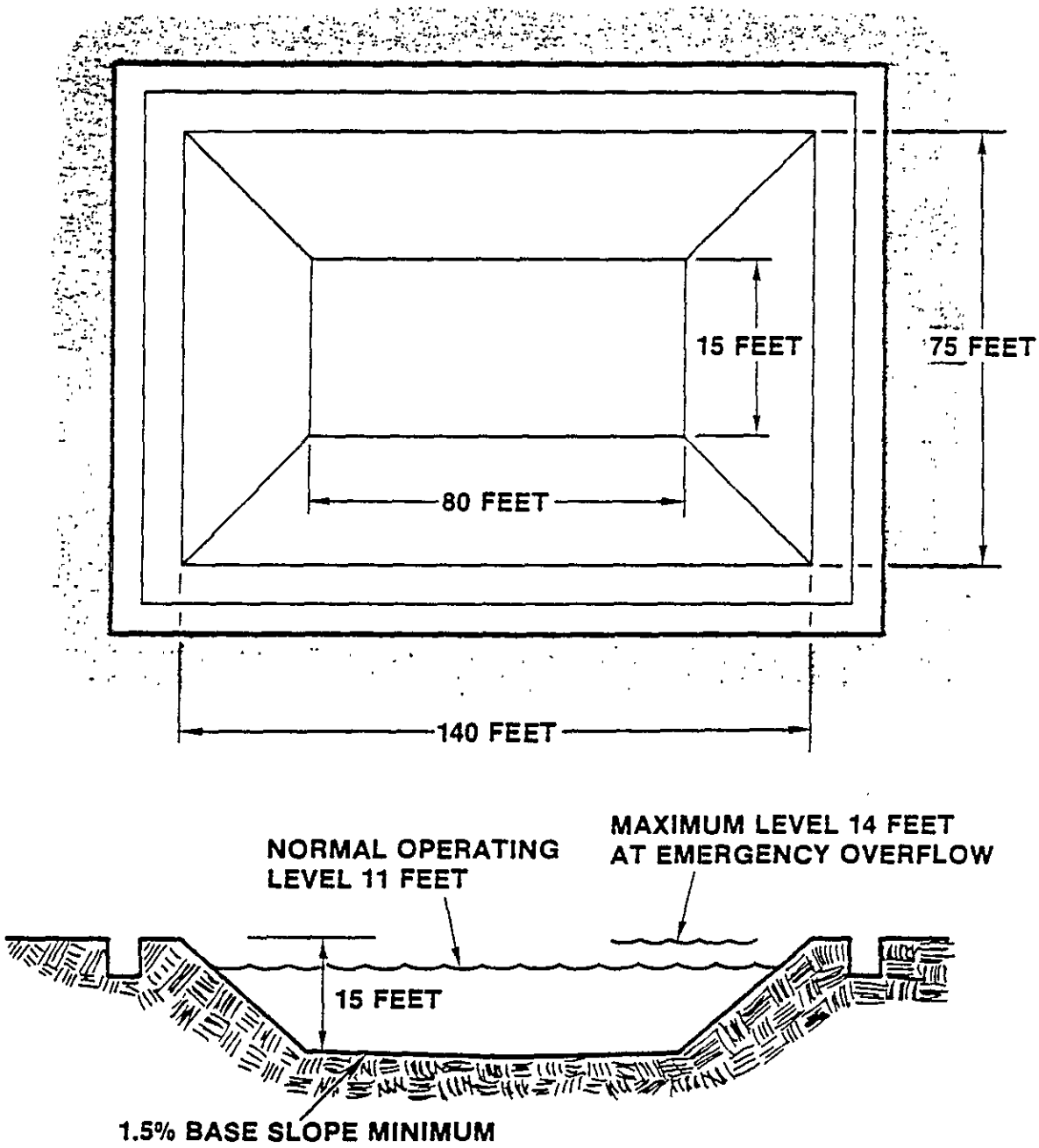


Figure 36. 120-N-2 Surface Impoundment Physical Design
Source: WHC 1986a, p. D-19

of cation and anion regeneration effluents, respectively. The caustic anion regeneration effluent was generally neutralized in the surface impoundment by the addition of the acidic cation regeneration effluent. Acid cation regeneration effluent was thus similarly neutralized by the addition of caustic anion regeneration effluent. Once neutralization was complete, the neutralized effluent was discharged to the 120-N-1 Percolation Pond via a 12-in. drain line and 12-in. overflow line (WHC 1986a, p. D-4).

In 1988, the 120-N-2 Surface Impoundment was taken out of service and replaced by the elementary neutralization unit located at the 163-N Demineralization Plant. As part of closure activities at the 120-N-1/120-N-2 area, sampling is schedule to be performed at the 120-N-2 unit as part of the site characterization program outlined by Krug (1989). In addition, five groundwater monitoring wells were installed in the area in 1988. These wells have been sampled regularly. The 100-NR-1 RFI/CMS work plan discusses analytical results from these wells.

3.1.1.8.4 130-N-1 Filter Backwash Discharge Pond. The 130-N-1 Filter Backwash Discharge Pond is a percolation pond used for disposal of effluents generated during backwash of the filters in the 183-N Filtered Water Plant. The pond is a natural basin, marsh-like in appearance, located about 0.5 mi southeast of the 105-N Reactor Facility.

The 130-N-1 Filter Backwash Discharge Pond was placed in service in early 1983 following reconstruction of the 120-N-1 (1324-NA) Percolation Pond, which was formerly used for disposal of the backwash effluent. The pond is fed via a 10- to 12-in buried line from the 183-N Filtered Water Plant. Approximately 300,000 gal/day of backwash effluent were disposed at the unit. The 183-N filter backwash effluent has a neutral pH and contains low concentrations of several anions and cations (Krug 1989). Aluminum sulfate (alum) is used as a flocculent and polyacrylamide is used as a filter aid/coagulant in filtered water production (Greager 1979, pp. 9-10). Analysis of the filter backwash effluent indicates that it does not contain any listed dangerous wastes or dangerous waste sources, or exhibit any dangerous waste characteristics or criteria (Krug 1989, pp. 7-8). Table 5 shows representative analyses of the filter backwash effluent.

3.1.1.8.5 1143-N Paint Shop. The 1143-N Paint Shop has three waste management units, including a water scrubber in the paint booth, a 55-gal solvent accumulation drum, and an associated outdoor sandblasting area, the 1143-N Blast Yard. Specific design details for the paint shop, water scrubber, and paint booth are unknown.

The water scrubber manages paint wastes and associated water. Spent thinner is accumulated in the solvent drum. The Blast Yard manages spent garnet sand and paint chips. These waste management units are still active and no remedial activities have taken place.

3.1.1.9 Grouping 9: Office Septic Tank Area. The only known waste managed in this area is sanitary sewage. There is no documented information that any other wastes were released into the septic systems. The four septic systems in this grouping are located in the office area. Figure 37 shows the grouping area and the locations of the septic systems. The source units include:

1. 124-N-5 Septic Tank
2. 124-N-6 Septic Tank
3. 124-N-7 Septic Tank
4. 124-N-8 Septic Tank.

3.1.1.9.1 124-N-5 Septic Tank. The septic tank and drainfield making up sewer system V are located south of Building 1117-N and were installed in 1981 (Gydesen 1985, p. 32); the system was taken out of service in February 1987 (WHC 1989c). This unit received sanitary sewage. The septic tank has a fluid capacity of 3,677 gal and a drainfield providing approximately 960 ft^2 of infiltrative surface area. Fill dirt was placed over the drainfield to a depth of 2 ft or more in the early 1980s. Sewer system V serves Buildings 1111-N, 1116-N, 1117-N, 1118-N, 1123-N, 1124-N, 1125-N, and 1131-N. In 1985, the unit served 210 personnel and the calculated daily flow was 3,780 gal/day (Gydesen 1985, pp. 6 and 32). There is no documented information regarding disposal of any other wastes to the unit. The sewer system is still in place. The number of personnel at the 100-N Area has declined since 1987, when N Reactor was placed in standdown status. No documented remedial activities have taken place.

3.1.1.9.2 124-N-6 Septic Tank. The septic tank and drainfield making up sewer system VI are located south of Building 1113-N and were installed in 1979-80 (Gydesen 1985, p. 38); the system was taken out of service in February 1987 (WHC 1989c). This unit received sanitary sewage. The septic tank has a fluid capacity of 2,000 gal and the drainfield has an infiltrative surface area of 800 ft^2 (Gydesen 1985). This system is directly hooked up to sewer system VII just upstream of the septic tank. Sewer system VI serves Buildings 1113-N, 1114-N, and 1115-N. In 1984, irreparable damage was done to the septic tank after it was pumped out and the system was abandoned (Gydesen 1985, pp. 6 and 38). There is no documented information regarding disposal of any other wastes to the unit. The sewer system is still in place. No documented remedial activities have taken place.

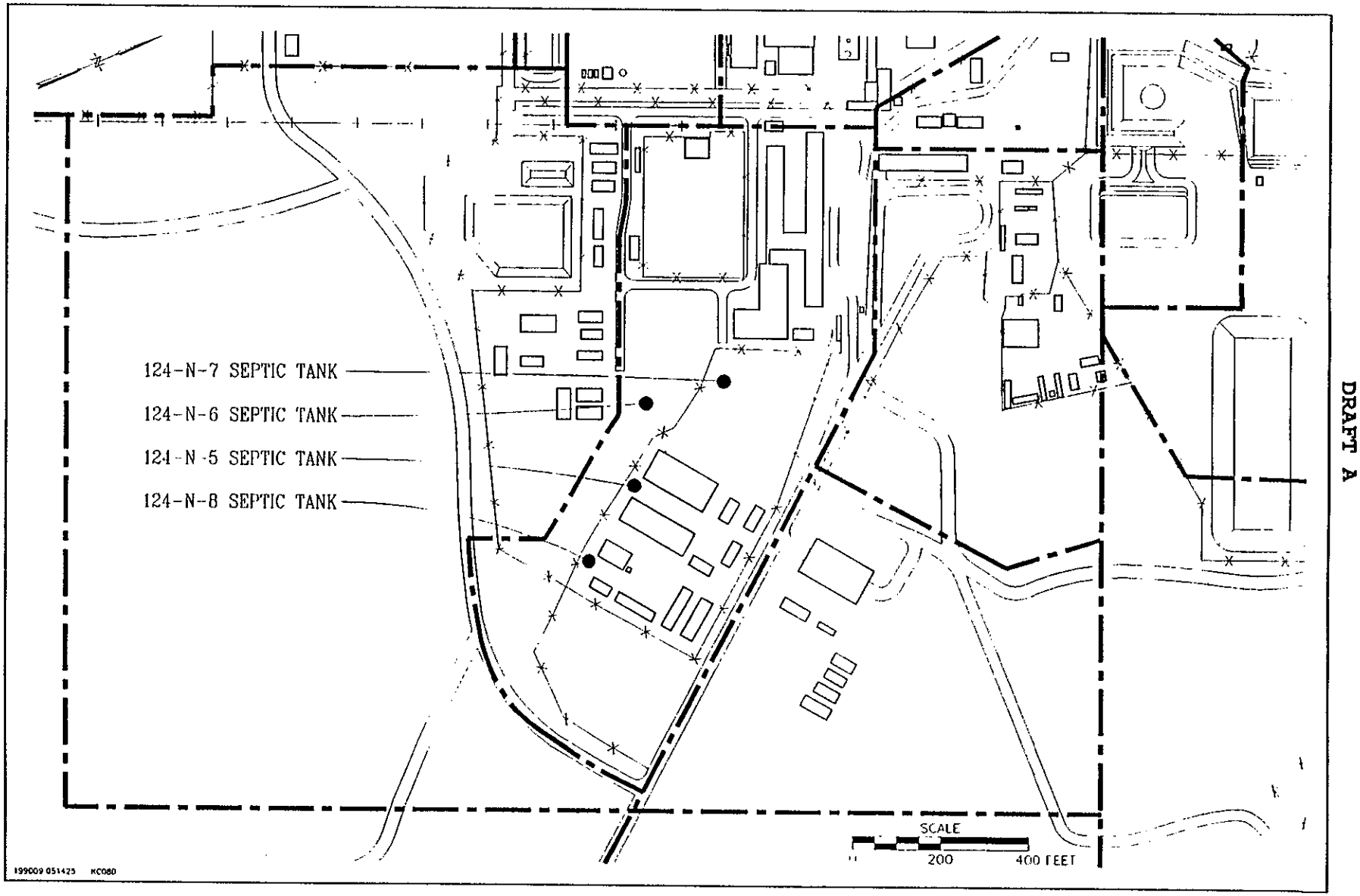


Figure 37. Source Units in the Office Septic Tank Area Grouping

3.1.1.9.3 124-N-7 Septic Tank. The septic tank and drainfield making up sewer system VII are located south of Building 1115-N under the high-voltage power lines and were installed in 1984 (Gydesen 1985, p. 6); the system was taken out of service in February 1987 (WHC 1989c). This unit received sanitary sewage. The septic tank has a fluid capacity of 7,500 gal. Sewer system VII serves Buildings 1103-N, 1104-N, and 1145-N. In 1985, the unit served 290 personnel and the calculated daily flow was 5,220 gal/day (Gydesen 1985, pp. 6 and 39). There is no documented information regarding disposal of any other wastes to the unit. The sewer system is still in place. No documented remedial activities have taken place.

3.1.1.9.4 124-N-8 Septic Tank. The septic tank and drainfield making up sewer system VIII are located south of Building 1134-N and were installed in 1983. This unit receives sanitary sewage. The septic tank has a fluid capacity of 5,000 gal and the drainfield has an infiltrative surface area of 1,650 ft^2. Sewer system VIII serves Buildings 1132-N, 1133-N, 1134-N, and 1135-N. In 1985, the unit served 51 personnel and the calculated daily flow was 915 gal/day (Gydesen 1985, pp. 6 and 39). There is no documented information regarding disposal of any other wastes to the unit. The sewer system is still in place. No documented remedial activities have taken place.

3.1.1.10 Grouping 10: N-17 Paint Shop. This grouping includes the entire 100-NR-3 Craft Shop Area. Figure 38 shows the grouping areas and the N-17 Paint Shop. The N-17 Paint Shop is the only craft shop within the area with a known release to the environment. A minor oil leak from the air compressor serving the N-17 Paint Shop has stained the surrounding soil.

The N-17 Paint Shop has two waste accumulation drums, one for waste paint and the other for waste oil. There is also an associated sandblasting area. The paint shop is located about 1,000 ft west of the 105-N Reactor. Design details of the paint shop and associated units are unknown.

This unit is presently active. The startup date is unknown. Paints, solvents, and oils are managed at Building N-17. An air compressor located east of the paint shop has leaked nonhazardous lubrication oil over the years; the surrounding soil is oil stained. The extent of contamination is unknown. Remedial activities have been initiated.

3.1.1.11 Grouping 11: 124-N-9 Septic Tank. The only known source unit in this grouping is the 124-N-9 Septic Tank, which manages sanitary sewage. Figure 39 shows the grouping area and the location of the 124-N-9 Septic Tank.

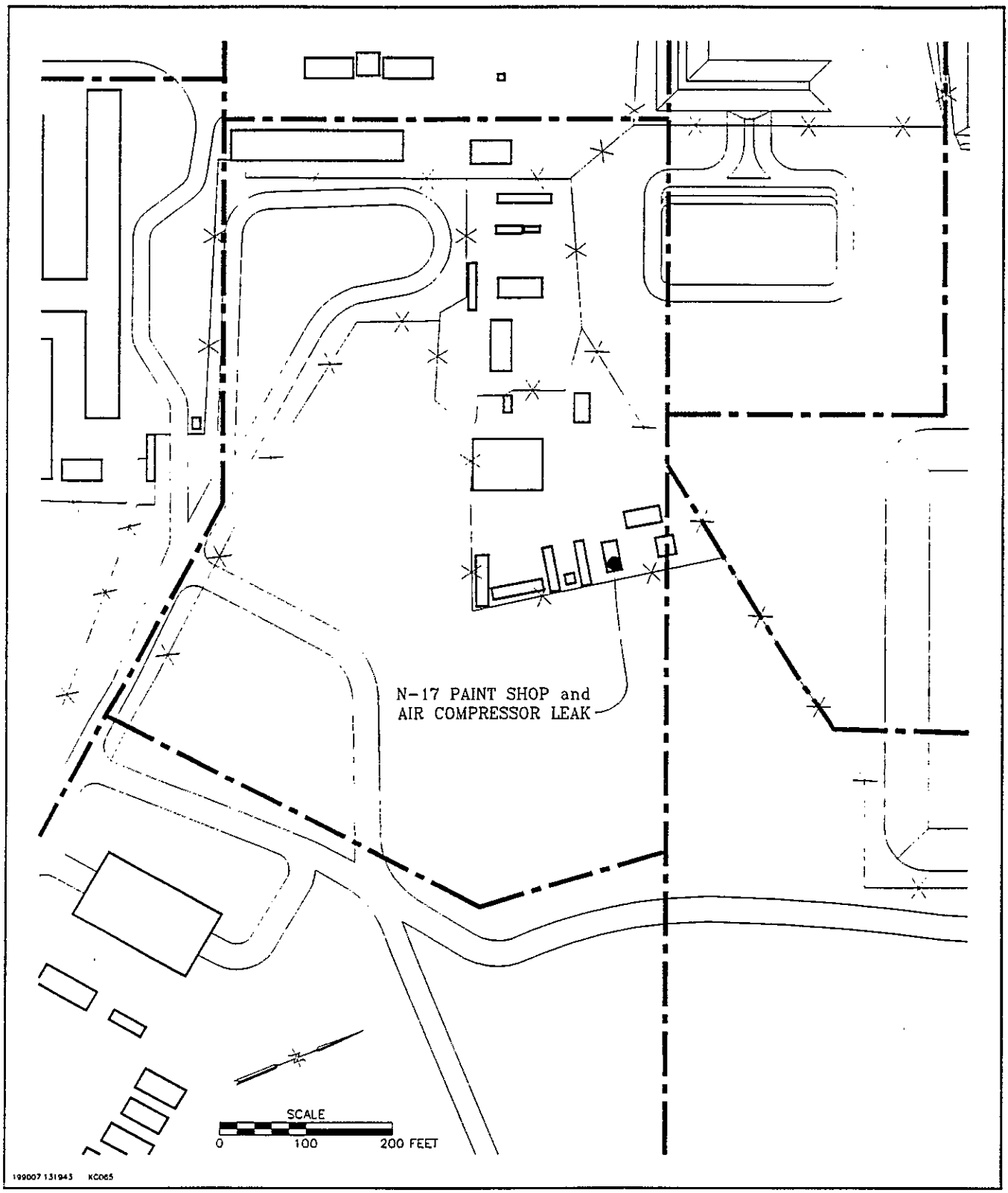


Figure 38. Source Units in the N-17 Paint Shop Grouping

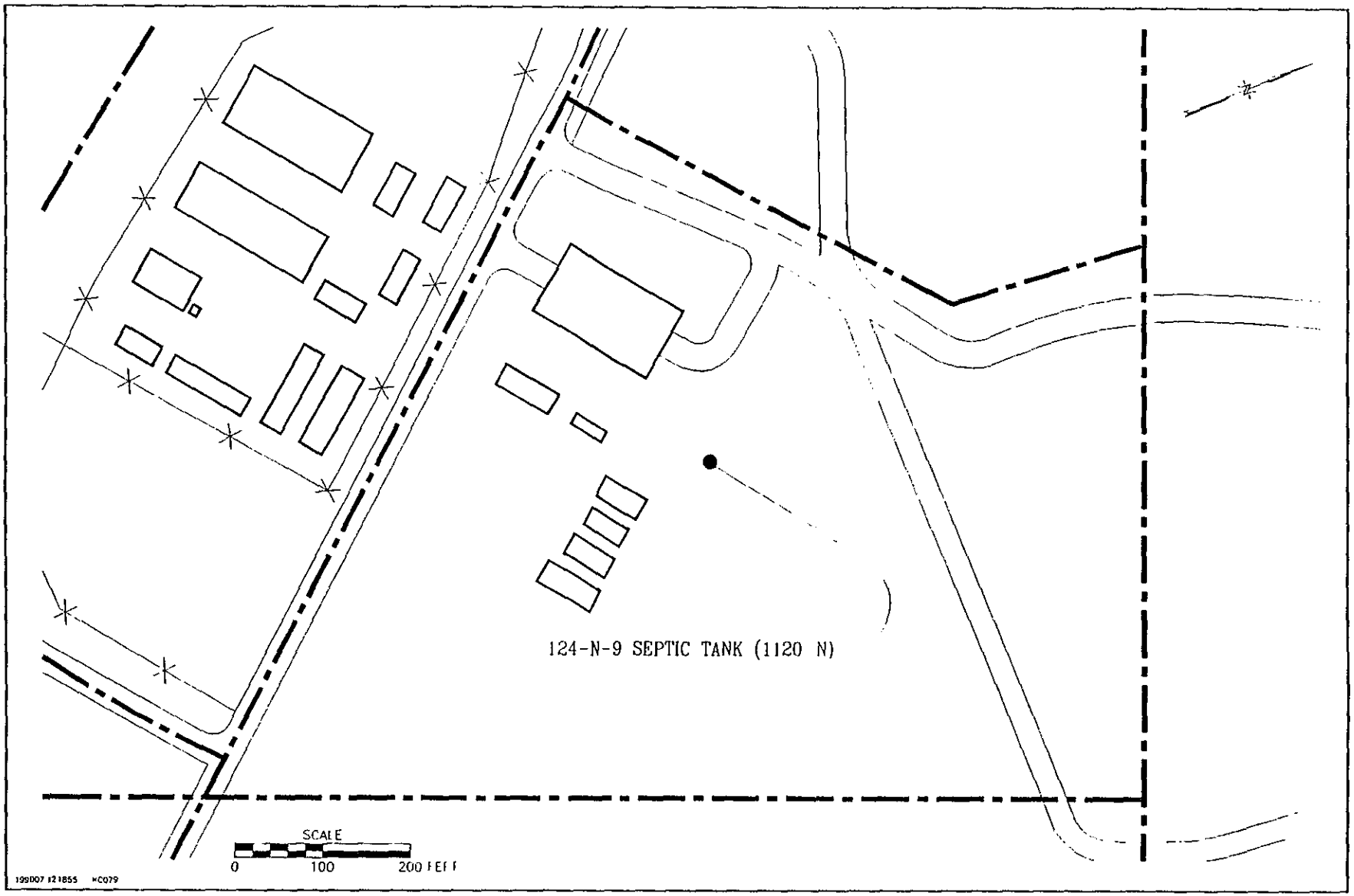


Figure 39. Source Units in the 124-N-9 Septic Tank Grouping

The septic tank and drainfield making up this sewer system are located northeast of Building 1120-N and were installed in 1985. The septic tank has a fluid capacity of 3,000 gal and the drainfield has an infiltrative surface area of 3,500 ft^2. This unit receives 2,200 gal/day of sanitary sewage (WHC 1989c). There is no documented information regarding disposal of any other wastes to the unit. The sewer system is still in place. No documented remedial activities have taken place.

3.1.1.12 Grouping 12: 100-N Sewer System. This grouping includes the recently constructed centralized 100-N Sewer System (124-N-10) and an unplanned release (UN-100-N-11). Both potential sources are located approximately 1 mi east of 100-N. Figure 40 shows the approximate location of the grouping. There are no known releases from the Sewer System. The unplanned release involved a radioactively-contaminated piece of equipment that rolled off of a truck onto the ground.

3.1.1.12.1 124-N-10 Sewer System. The 100-N Sewer System was constructed to replace five existing and potentially unsafe 100-N Area sewer systems. This centralized sewer system is located 1 mi east of the 105-N Reactor Facility. The system includes a three-pond lagoon facility, a sewer trunk line and other pipelines, two lift stations, new manholes, and associated sewer system instrumentation and annunciation capability. The five sewer systems that were replaced include:

- Sewer system IV, which served the 105-N, 109-N, 184-N, 1100-N, 1101-N, 1102-N, 1107-N, 1112-N, 1119-N, and 1126-N Buildings and contractor construction buildings.
- Sewer system V, which served the 1111-N, 1116-N, 1117-N, 1118-N, 1123-N, 1124-N, 1125-N, and 1131-N buildings.
- Sewer system VI, which served the 1113-N, 1114-N, and 1115-N buildings and was abandoned.
- Sewer system VII, which served the 1103-N and 1104-N Buildings, and 1113-N, 1114-N, 1115-N, and 1146-N Buildings. The 1152-N, 1153-N, and 1154-N Buildings were also connected to this system.
- Sewer system VIII, which served the 1132-N, 1133-N, 1134-N, and 1135-N Buildings (Hughes 1985, pp. 1 and 6).

This unit has been operational since February 1987 and receives 50,000 gal/day of sanitary sewage (WHC 1989c). There is no documented information regarding disposal of any other wastes to the unit. The central sewer system is still in place. No remedial activities have taken place.

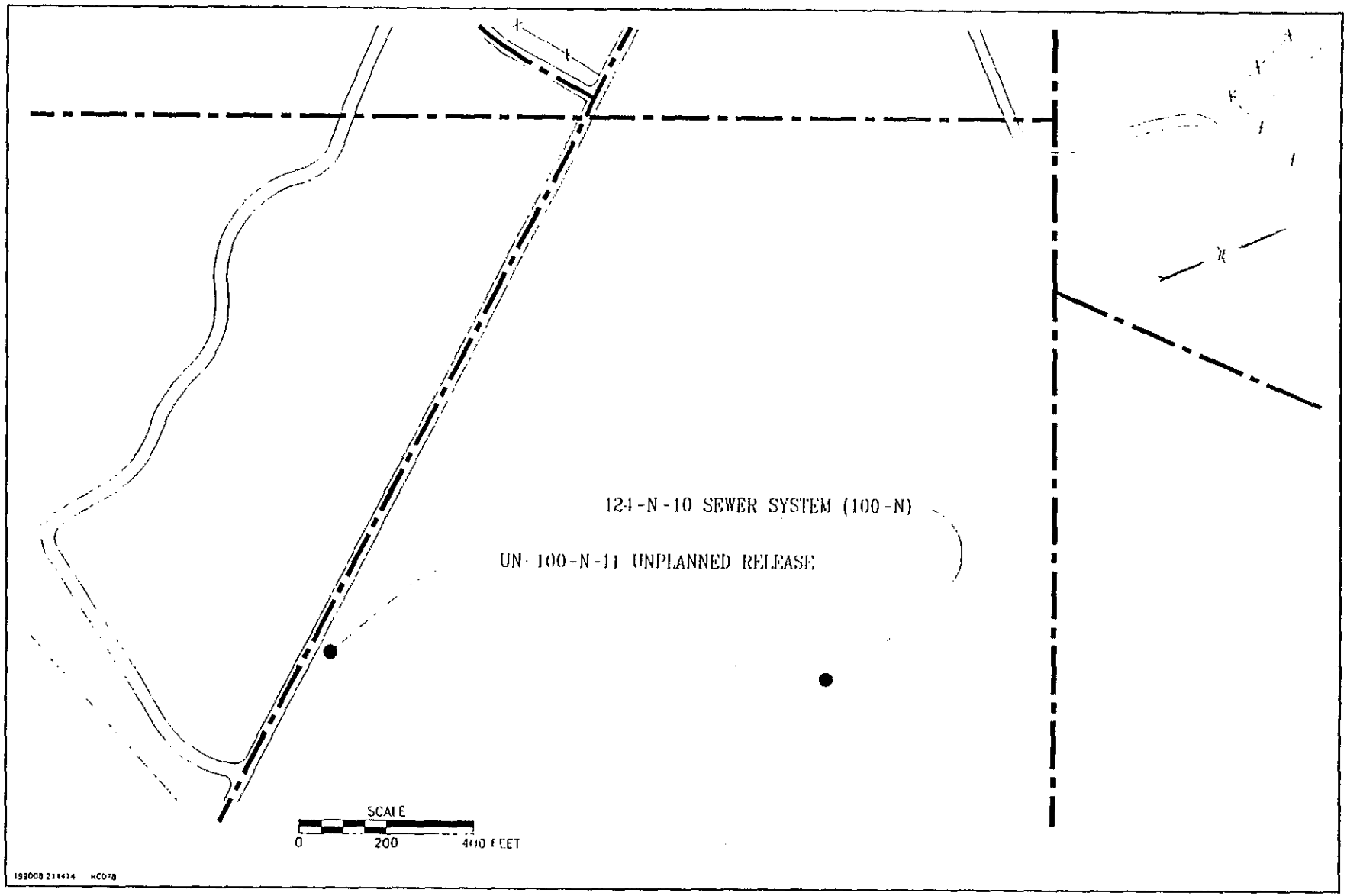


Figure 40. Source Units in the 100-N Sewer System Grouping

3.1.1.12.2 UN-100-N-11 Unplanned Release. On October 2, 1975, a radioactively-contaminated 500-lb valve bonnet fell from a truck onto the road and into the adjacent field (WHC 1989c). This occurred at the corner of Route 4 North and the 100-N access road. Eight cubic yards of contaminated soil and asphalt were removed and disposed.

3.1.2 Contaminant Occurrence in Environmental Media

The following section primarily discusses data on contamination in soils and in the air as a result of releases from 100-NR-3. Detailed discussion of contamination data in groundwater and surface water in the 100-N Area are presented in the 100-NR-1 RFI/CMS work plan (DOE-RL 1990a).

3.1.2.1 Soil. As described in previous sections, a number of potential sources of contamination have been identified at the 100-N Area. The 100-NR-3 operable unit includes 12 waste management groupings. Of these groupings, the only soil-sampling data that were examined in 100-NR-3 was background soil data in the area of the 120-N-1 and 120-N-2 Ponds.

3.1.2.1.1 Soil Data from 120-N-1 and 120-N-2 Area. Seventeen background soil samples were collected from a location south of the 120-N-1 (1324-NA) Percolation Pond, and were taken from 1 ft below the surface of a 10-ft-deep trench that was used as access to the sampled horizon. Thirteen of the 17 background samples were used for soil chemical analyses; the results of metals analyses and non-metal analyses are presented in Tables 6 and 7, respectively (Sada 1989).

Radiochemical analyses of soils, presented in Table 8, indicate that most radionuclides are below detection limit (BDL), except for beta, uranium, potassium-40, lead-212, and lead-214. These data appear to be normally distributed. Soil extraction test results are presented in Table 9. Five of the samples were analyzed for volatile organics, dichlorobenzene, acetone, and diethylether. No semivolatile compounds were detected; only concentrations at or below the detection limit were apparent (Sada 1989).

These data indicate that background soils contain metals with little background volatiles and no semivolatiles. Several anomalies in the sampling data have been identified, included exceedance of holding times as an indirect result of inconsistencies in the chain of custody/sample request forms. Overall, the QC data was good, except results from some analyses for anions and cations were questionable (Sada 1989).

3.1.2.1.2 Inferred Soil Contamination. Most of the unplanned release locations in the 100-NR-3 operable unit have not been

Table 6. Summary Statistics - Background Samples (Soil - Metal) for the 120-N-1/120-N-2 Study.

Analyte	No. of GT DL Values	No. of LT DL Values	Mean (p/m)	Median (p/m)	Std Dev (p/m)	CV (%)	Minimum (p/m)	Maximum (p/m)
Aluminum	13	0	4,902.31	4,870	581.165	11.85	3,720	6,240
Antimony	0	13	BDL	BDL	NA	NA	BDL	BDL
Arsenic	13	0	0.99	0.88	0.302	30.51	0.69	1.78
Barium	13	0	50.22	49.40	4.737	9.43	44.10	58.20
Beryllium	2	11	0.07	BDL	0.419	98.57	BDL	0.80
Calcium	13	0	7,060.77	7,230	911.212	12.91	5,440	8,120
Chromium	13	0	3.57	3.50	0.891	24.96	2.30	5.00
Cobalt	13	0	8.97	9.10	0.646	7.20	8.00	9.70
Cadmium	13	0	7.03	7.10	0.571	8.12	6.10	7.90
Copper	13	0	16.69	16.50	1.019	6.11	15.10	19.10
Iron	13	0	2,6346.20	27,200	2,174.710	8.25	21,900	29,000
Lead	6	0	2.83	2.84	0.200	7.07	2.58	3.15
Lithium	0	13	BDL	BDL	NA	NA	BDL	BDL
Magnesium	13	0	5,085.38	5,020	348.033	6.84	4,590	5,700
Manganese	13	0	284.54	290	36.477	12.82	227	350
Mercury	0	13	BDL	BDL	NA	NA	BDL	BDL
Molybdenum	0	13	BDL	BDL	NA	NA	BDL	BDL
Nickel	13	0	7.41	7.30	1.059	14.29	5.70	8.80
Potassium	13	0	681.62	675	128.674	18.88	455	931
Silver	0	13	BDL	BDL	NA	NA	BDL	BDL
Sodium	13	0	298.46	298	46.157	15.47	226	370
Strontium	13	0	20.95	20.00	3.963	18.92	16.30	27.40
Tin	0	13	BDL	BDL	NA	NA	BDL	BDL
Titanium	13	0	2,139.23	2,270	289.150	13.52	1,700	2,540
Vanadium	13	0	52.46	56.60	8.487	16.18	41.70	64.60
Zinc	13	0	38.16	38.20	3.305	8.66	33.40	44.80
Zirconium	13	0	27.35	27.70	2.274	8.31	24.20	31.00

GT = greater than; LT = less than; DL = detection limit.
BDL = below detection limit.
NA = not available.
CV = coefficient of variation.

Source: Sada 1989

Table 7. Summary Statistics - Background Samples (Soil - Non-Metal) for the 120-N-1/120-N-2 Study.

Analyte	No. of GT DL Values	No. of LT DL Values	Mean (p/m)	Median (p/m)	Std Dev (p/m)	CV (%)	Minimum (p/m)	Maximum (p/m)
Ammonium	4	7	0	BDL	1.386	NA	BDL	2.50
Boron	0	13	BDL	BDL	NA	NA	BDL	BDL
Bromide	0	13	BDL	BDL	NA	NA	BDL	BDL
Chloride	0	13	BDL	BDL	NA	NA	BDL	BDL
Conductivity	4	0	21.25	21	3.775	17.76	17	26
Cyanide	0	16	BDL	BDL	NA	NA	BDL	BDL
EOX	0	12	BDL	BDL	NA	NA	BDL	BDL
Fluoride	0	17	BDL	BDL	NA	NA	BDL	BDL
Nitrate	0	17	BDL	BDL	NA	NA	BDL	BDL
Nitrite	0	17	BDL	BDL	NA	NA	BDL	BDL
pH	11	0	8.38	8.40	0.108	1.29	8.20	8.60
Phosphate	0	17	BDL	BDL	NA	NA	BDL	BDL
Selenium	0	6	BDL	BDL	NA	NA	BDL	BDL
Silicon	13	0	638.62	647	169.228	26.50	439	1040
Sulfate	1	16	BDL	BDL	NA	NA	BDL	2.51
Sulfide	0	11	BDL	BDL	NA	NA	BDL	BDL
TOC	0	3	BDL	BDL	NA	NA	BDL	BDL

GT = greater than; LT = less than; DL = detection limit.
BDL = below detection limit.
NA = not available.
CV = coefficient of variation.

Source: Sada 1989

Table 8. Summary Statistics - Background Samples (Radiochemical) for the 120-N-1/120-N-2 Study.

Analyte	No of GT DL Values	No of LT DL Values	Mean (pCi/g)	Median (pCi/g)	Std Dev (pCi/g)	CV (%)	Minimum (pCi/g)	Maximum (pCi/g)
Lo-Alpha	3	14	NA	BDL	NA	NA	BDL	1.89
Beta	17	0	6.861	6.800	0.891	12.99	5.520	8.870
Co-60	0	14	BDL	BDL	NA	NA	BDL	BDL
Cs-134	0	14	BDL	BDL	NA	NA	BDL	BDL
Cs-137DA	1	13	NA	BDL	NA	NA	BDL	0.0238
Eu-154	0	14	BDL	BDL	NA	NA	BDL	BDL
Eu-155	1	13	NA	BDL	NA	NA	BDL	0.205
K-40	14	0	9.256	9.355	1.029	11.12	6.800	11.300
Pb-212	14	0	0.480	0.490	0.066	13.75	0.316	0.595
Pb-214	14	0	0.375	0.382	0.047	12.53	0.282	0.443
Ru-106DA	0	14	BDL	BDL	NA	NA	BDL	BDL
ZnNb-95	0	14	BDL	BDL	NA	NA	BDL	BDL
U-Chem (Ug/g)	3	0	0.447	0.444	0.025	5.59	0.424	0.473

GT = greater than; LT = less than; DL = detection limit.
BDL = below detection limit.
NA = not available.
CV = coefficient of variation.

Source: Sada 1989

Table 9. Summary Statistics - Background Samples (Extraction) for the 120-N-1/120-N-2 Study.

Analyte	No of GT DT Values	No of LT DL Values	Mean (p/b)	Median (p/b)	Std Dev (p/b)	CV (%)	Minimum (p/b)	Maximum (p/b)
Aluminum	0	17	BDL	BDL	NA	NA	BDL	BDL
Antimony	0	17	BDL	BDL	NA	NA	BDL	BDL
Beryllium	0	17	BDL	BDL	NA	NA	BDL	BDL
Boron	0	17	BDL	BDL	NA	NA	BDL	BDL
Calcium	17	0	43,964.7	44,200	10,447.1	23.76	25,000	62,500
Cobalt	0	17	BDL	BDL	NA	NA	BDL	BDL
Copper	0	17	BDL	BDL	NA	NA	BDL	BDL
EPTARS	0	17	BDL	BDL	NA	NA	BDL	BDL
EPTBAR	0	17	BDL	BDL	NA	NA	BDL	BDL
EPTCAD	0	17	BDL	BDL	NA	NA	BDL	BDL
EPTCHR	0	17	BDL	BDL	NA	NA	BDL	BDL
EPTLEA	0	17	BDL	BDL	NA	NA	BDL	BDL
EPTMER	0	17	BDL	BDL	NA	NA	BDL	BDL
EPTSEL	0	17	BDL	BDL	NA	NA	BDL	BDL
EPTSIL	0	17	BDL	BDL	NA	NA	BDL	BDL
Iron	0	17	BDL	BDL	NA	NA	BDL	BDL
Lithium	0	17	BDL	BDL	NA	NA	BDL	BDL
Magnesium	17	0	7,315.29	6,920	1,663.83	22.75	5,000	10,600
Manganese	17	0	221.65	199	82.29	37.13	140	407
Molybdenum	0	17	BDL	BDL	NA	NA	BDL	BDL
Nickel	0	17	BDL	BDL	NA	NA	BDL	BDL
Potassium	17	0	3,342.35	3,290	694.95	20.79	2,550	4,850
Silicon	17	0	4,768.24	4,020	1,533.44	32.16	3,480	7,700
Sodium	13	4	2,458.04	2,340	775.57	31.55	BDL	3,710
Strontium	15	2	158.92	128	72.38	45.54	BDL	285
Tin	0	17	BDL	BDL	NA	NA	BDL	BDL
Titanium	0	17	BDL	BDL	NA	NA	BDL	BDL
Vanadium	0	17	BDL	BDL	NA	NA	BDL	BDL
Zinc	1	16	BDL	BDL	NA	NA	BDL	BDL
Zirconium	0	17	BDL	BDL	NA	NA	BDL	BDL

GT = greater than; LT = less than; DL = detection limit.
NA = not available.
BDL = below detection limit.
CV = coefficient of variation.

Source: Sada 1989

sampled to determine extent of contamination. Although screening sampling or radiation surveys were usually performed, and exposed surface contamination was excavated, quantitative radionuclide- and/or chemical-specific analyses were not performed.

Based on the areas of known and inferred releases discussed in Section 3.1.1, inferred areas of soil contamination have been identified in Figure 41.

3.1.2.2 Groundwater. A considerable amount of groundwater data is available for the 100-N Area, collected primarily in 100-NR-1. The 120-N-1 and 120-N-2 Ponds are undergoing continued RCRA groundwater monitoring. Because the groundwater investigation for sources in 100-NR-3 will be conducted as part of the 100-NR-1 RFI/CMS, a detailed discussion of groundwater quality and contamination at 100-N is not presented in this work plan.

3.1.2.3 Surface Water. Specific information on Columbia River water quality and river sediments in the immediate 100-N Area is sparse. The majority of studies conducted in the past focused on the water quality and river sediments above Priest Rapids Dam and immediately above McNary Dam or the pumphouse located downriver. The effect the 100-N Area may have had on river water quality or river sediments is almost impossible to determine at such a distance from the 100-N Area. Any degradation of water quality or sediment contamination may have resulted from the operation of any of the other reactor areas or disposal areas. Therefore, presented here are that data found to be of immediate significance to the 100-N Area.

All source units in 100-NR-3 which are known to have discharged to the soil or suspected to have discharged to the soil may have impacted surface water. If contamination from any unit or unplanned release migrated through the soil column to groundwater, it may have ultimately reached the Columbia River. The interaction between source units in the 100-N Area and groundwater discharge to the river is addressed in the 100-NR-1 RFI/CMS work plan (DOE-RL 1990a).

Surface runoff is not well defined at the 100-N due to lack of rainfall in the area. The 100-N Area is elevated from the river, having a bluff separating the area from the river. No mention of drainage ditches or erosion along the bank, indicating surface runoff to the river has been noted. Heavy rains which would result in surface runoff occur infrequently. Engineered surface runoff features, such as the 182-N surface runoff flume, have been designed to contain runoff, but have not been used extensively.

3.1.2.4 Air. Atmospheric releases of radioactive and nonradioactive materials from the 100-N Area represent a possible direct pathway to human exposure. Air monitoring data for the

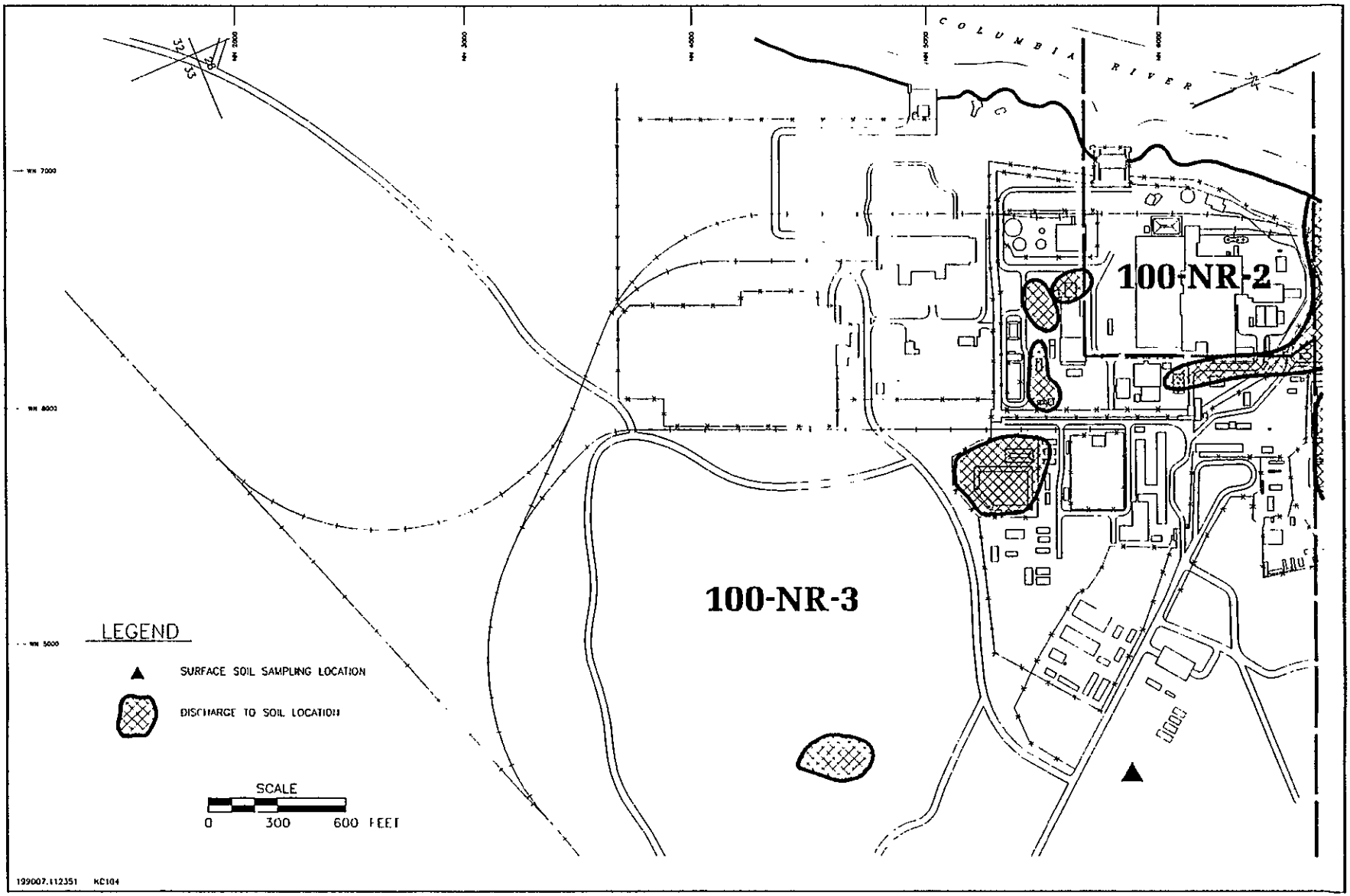


Figure 41. Areas of Inferred Soil Contamination at 100-NR-3

Hanford Site is available for onsite and offsite monitoring locations. Due to the numerous emission sources at the Hanford Site, it is nearly impossible to separate or interpret the impact the 100-N Area may have had at each of the monitoring stations.

Table 10 lists the amounts of nonradioactive air emissions from the 100-N Area, primarily flow from the 184-N Stack. Past releases may have been of gaseous-phase radionuclides and radioactive or nonradioactive particulates emitted to the atmosphere which may settle on land or water and eventually enter the food chain.

In 1975, the monitoring of radionuclides increased to include particulate releases as well as gaseous releases. The list of radionuclides monitored also expanded over time. A review of the data indicates that only trace amounts of radionuclides were emitted each year. The primary sources for air release of radionuclides include the 109-N Roof Vents and the 116-N Stack.

The Environmental Surveillance Program, which was begun in 1980, included air sampling for radionuclides at the 100-N Area. There are no data for 1980, as the air monitoring stations were not fully operational.

From 1981 through 1988, four continuous air sampling stations were used, located as depicted in Figure 42. These stations were labelled A1, located at the west side of the 116-N-1 1301-N Crib and Trench; A2, located at the 120-N-2 (1324-N) Sample Shed; A3, located near the 1900-N Water Supply Tanks; and A4, located at 151-N. The sampling train consisted of an air mover and an air filter system. The collection device used was a standard cartridge sampler. The cartridge contained an engineered flow-limiting 1 ft^3/min orifice, particulate filtration, and a charcoal absorber for halogens. A continuous-duty low volume vacuum air pump was installed, along with the cartridge in a weather proof enclosure. Samples were collected monthly and analyzed for gamma emitters. The particulate filters were also analyzed for gross alpha and beta. Table 11 presents the average data per sampling location for the years 1981-1988. These data provide no direct evidence for air releases from 100-NR-3.

3.1.3 Contaminant Occurrence in Biological Media

As stated in previous sections, the impact of the 100-N Area on plants and animals outside the Hanford site or outside the 100-N Area are almost impossible to distinguish from the effects of other reactor areas within the Hanford Site. Plants and animals which occur at the 100-N Area are described in Section 2.2.6.1. No documented plant or animal sampling programs in 100-NR-3 were reviewed during preparation of this work plan.

Table 10. Nonradioactive Air Emissions from 100-N Area.

	Particulates (lb)	Sulfur Dioxide (lb)	Sulfur Trioxide (lb)	Carbon Monoxide (lb)	Hydrocarbons (lb)	Nitrogen Oxide (lbs)	Aldehydes (lbs)
1971[a]	NR	1,000,000	NR	NR	NR	1,000,000	NR
1972[a]	NR	900,000	NR	NR	NR	900,000	NR
1973[a]	NR	1,500,000	NR	NR	NR	NR	NR
1974[a]	NR	1,600,000	NR	NR	NR	NR	NR
1975[b] (Total Released from 184-N Oil Fire Boilers)	110,000	1,000,000	13,000	20,000	15,000	400,000	5,000
1962[b] (Total Released from 184-N Oil Fire Boilers)	110,000	1,000,000	13,000	19,000	14,000	380,000	4,800
1977[b] (184-N Oil Fire Boilers)	100,000	950,000	12,000	18,000	13,000	360,000	4,700
1978[c]	99,400	1,102,000	14,460	18,000	13,500	360,000	5,000
1979[c]	93,500	1,039,500	3,890	16,900	12,700	336,700	4,640
1980[b]	72,900	814,000	10,270	13,200	9,780	261,400	3,490
1981[b]	130,000	1,530,000	19,400	22,900	17,300	460,000	5,990
1982[b]	100,600	1,168,000	14,960	17,800	13,460	358,000	4,770
1983[b]	114,000	1,320,000	16,800	20,600	15,400	410,000	5,600
1984[b]	92,400	1,032,000	13,460	17,000	12,500	340,000	4,690
1985[b]	82,300	1,142,000	14,590	23,200	4,650	254,000	NR
1986[b]	120,000	16,000,000	21,000	31,000	6,100	360,000	NR
1987[b]	42,100	587,000	7,620	12,800	2,570	132,000	NR

[a] Identified as chemicals to atmosphere, source unknown.
[b] Source is identified at 184-N oil-fired boilers.
[c] Does not specify 184-N oil-fired boilers, states airborne emissions at the 100-N Area resultant from combustion of No. 6 Fuel Oil and No. 2 Diesel Oil.

NR = Not reported or not measured.

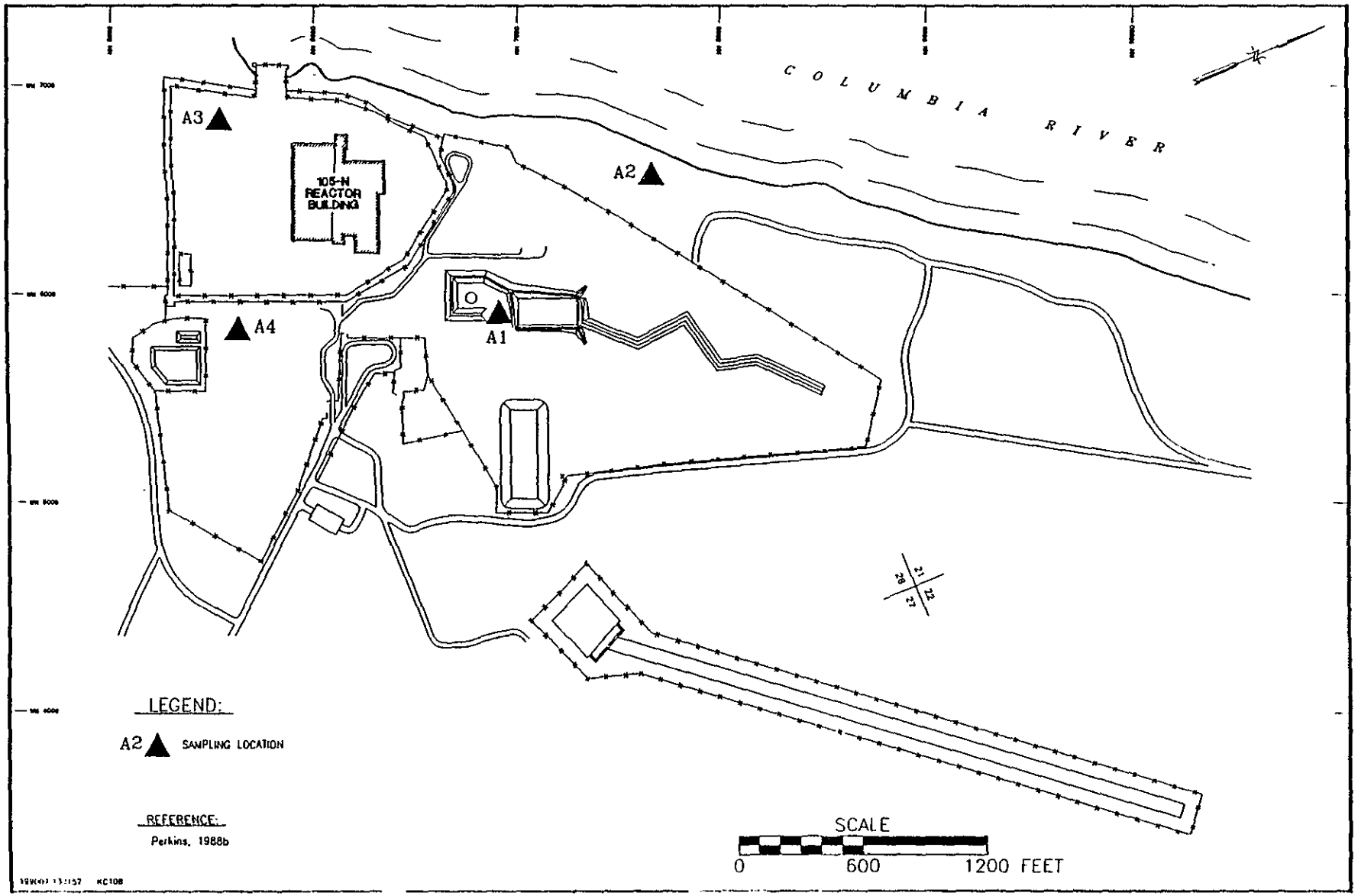


Figure 42. Ambient Air Sampling Locations at 100-N Area
Source: Perkins 1990

Table 11. Air Monitoring Results for Radionuclides at 100-N Area, 1981 - 1988.

	Mn-54	Fe-59	Co-60	As-76	Nb-95	Ru-103	I-131	Cs-137	Ce141	Ce144	I-133	Eu-155
Station A1												
1981	NR	NR	ND	9.0E-2	NR	NR	2.0E-4	NR	NR	NR	3.0E-3	NR
1982	NR	NR	1.1E-4	4.9E-2	NR	NR	2.1E-4	NR	NR	NR	1.8E-3	NR
1983	2.7E-5	NR	6.8E-5	NR	NR	NR	1.5E-4	NR	NR	NR	NR	1.8E-5
1984	6.1E-5	--	1.7E-4	--	4.8E-5	2.7E-5	2.7E-4	NR	3.8E-5	6.3E-5		
1985	OOS	OOS	OOS	OOS	OOS	OOS	OOS	OOS	OOS	OOS		
1986	0.39	0.081	0.16	NR	0.056	0.024	0.22	NR	NR	0.063		
1987	5.2E-2	NR	2.8E-1	NR	NR	<2.7E-2	1.7E-2	2.6E-2	--	--		
1988	<2.1E-2	NR	7.1E-1	NR	NR	<1.7E-2	<1.8E-2	<2.1E-2	--	--		
Station A2												
1981	NR	NR	3.1E-4	ND	NR	NR	6.8E-5	NR	NR	NR	ND	NR
1982	NR	NR	2.8E-5	NR	NR	NR	8.5E 5	NR	NR	NR	NR	NR
1983	NR	NR	2.5-E5	NR	NR	NR	1.1E-4	NR	NR	NR	NR	1.5E-5
1984	ND	ND	7.1E-5	ND	ND	ND	ND	NR	--	ND		
1985	0.052	ND	0.19	ND	0.043	ND	0.068	NR	ND	0.027		
1986	0.021	NR	0.055	NR	NR	ND	0.067	0.017	NR	NR		
1987	ND	NR	1.3E-1	NR	NR	ND	ND	ND	NR	NR		
1988	ND	NR	6.0E-2	NR	NR	NR	ND	ND	NR	NR		
Station A3												
1981	NR	NR	ND	ND	NR	NR	NR	NR	NR	NR	ND	NR
1982	NR	NR	3.6E-5	NR	NR	NR	NR	NR	NR	NR	NR	NR
1983	NR	NR	5.3E-5	NR	NR	NR	NR	NR	NR	NR	NR	NR
1984	OOS	OOS	OOS	OOS	OOS	OOS	OOS	OOS	OOS	OOS		
1985	0.040	ND	0.21	ND	ND	ND	ND	ND	NR	ND		
1986	0.020	NR	0.078	NR	NR	0.017	0.054	0.019	NR	NR		
1987	ND	NR	1.0E-1	NR	NR	ND	ND	ND	NR	NR		
1988	ND	NR	4.6E-2	NR	NR	ND	ND	ND	NR	NR		
Station A4												
1981	NR	NR	ND	ND	NR	NR	ND	NR	NR	NR	ND	NR
1982	NR	NR	1.3E-4	NR	NR	NR	ND	NR	NR	NR	NR	NR
1983	NR	NR	5.5E-5	NR	NR	NR	ND	NR	NR	NR	NR	NR
1984	ND	ND	4.1E-5	ND	ND	ND	ND	NR	ND	ND		
1985	0.024	ND	0.056	ND	ND	0.011	0.048	NR	ND	ND		
1986	0.017	NR	0.062	NR	NR	0.017	0.046	0.019	NR	NR		
1987	ND	NR	1.2E-1	NR	NR	ND	ND	2.4E-2	NR	NR		
1988	ND	NR	9.1E-2	NR	NR	ND	ND	ND	NR	NR		

All measurements in picocuries per liter (pC/L)
OOS = Station out of service
ND = Not detected
NR = Not reported or not measured

Extensive radiological monitoring of plants and animals has been conducted in the 100-NR-1 operable unit. The results of these surveys are discussed in the 100-NR-1 RFI/CMS work plan (DOE-RL 1990a).

3.1.4 Interactions Between Operable Units

As illustrated in Figure 4, the 100-N Area is divided into three operable units. The 100-NR-3 operable unit is bordered on the north by both the 100-NR-1 and 100-NR-2 operable units.

Generally, 100-NR-3 activities supported the reactor operation at 100-NR-2. The extent of process interactions between 100-NR-3 and 100-NR-1 is limited. A significant interaction between 100-NR-3 and 100-NR-1 is the piping system which delivers No. 6 fuel oil and No. 2 diesel oil from the 166-N Tank Farm at 100-NR-1 to the 184-N Day Tanks at 100-NR-3. This system is discussed in Sections 2.1.3.9, 2.1.3.10, and 3.1.1.5.

Specific sources within 100-NR-3 are known to have released to the groundwater, most notably the 120-N-1 (1324-NA) Percolation Pond.

In addition, documented releases to groundwater from the above-mentioned oil transfer piping system have occurred. Specifically, the UN-100-N-22, UN-100-N-23, and potentially the April 26, 1989, unplanned releases reached the groundwater and were detected in monitoring wells. Section 3.1.1.5 provides information on these unplanned releases. Close coordination is required during performance of the 100-NR-3 and 100-NR-1 RFIs.

3.1.5 Quality of Existing Data

Most of the data in the references reviewed in the development of this work plan are adequate for initial screening and preliminary evaluation of environmental contamination and health hazards at the 100-NR-3 operable unit. These data have been acquired according to DOE procedures and quality assurance requirements, especially in recent years.

However, the available 100-NR-3 air and soil analyses have not been performed, supported and validated according the EPA-approved methods and quality assurance procedures. The Tri-Party Agreement (Ecology et al. 1989) specifies (Article XXX) that all sampling and analyses conducted according to this work plan must follow EPA and Ecology-approved procedures, as discussed in Section 1.5.

It may be possible to upgrade some existing data by extracting additional information from laboratory and field notebooks, instrument calibration data, and related records. However, the available information may be difficult to obtain and

may not significantly improve the validation status of the data in question. For example, most existing reports of 100-N Area soil, air and water analyses do not include sample chain-of-custody documentation, reports of blank or spiked sample analyses, analytical methods, or descriptions of sample collection procedures. This information is necessary to support decisions regarding assessment of health risks and corrective action requirements.

Existing data are also potentially incomplete. Some parameters of significance to assessment of public and environmental health risks are not included in previous analyses. For example, while 100-NR-3 soil samples were analyzed for ten radionuclides, total alpha, and total beta, the data do not include plutonium, americium, or CERCLA hazardous substances.

In summary, this work plan contains sampling and analysis plans which are intended to confirm and expand on previous data using EPA-approved procedures. Emphasis is placed on areas where threats to the environment or public health are most likely. These locations include the acid/caustic storage grouping, and the regeneration/filter backwash disposal area grouping.

3.2 POTENTIAL CORRECTIVE ACTION REQUIREMENTS

Section 121(d) of CERCLA requires that remedial actions at NPL sites comply with federal and state environmental laws, promulgated standards, requirements, criteria, and limitations that are legally applicable or relevant and appropriate under the circumstances presented by the release or threatened release of hazardous substances, pollutants, or contaminants at the site. These applicable and/or relevant and appropriate requirements (ARAR) are not definitively mandated in RCRA. However, because Ecology wishes a full regulatory and technical approach to the 100-NR-3 RFI/CMS, an equivalent process has been designated corrective action requirements (CAR).

3.2.1 Identification of CAR

CAR can be grouped into three types: chemical-specific, location-specific, and action-specific:

- Chemical-specific CAR are usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.

- Action-specific CAR are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes.

- Location-specific CAR are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations (e.g., floodplains) (EPA 1988b).

Included in Table 12 is a list and assessment of potential federal CAR for 100-NR-3. Potential Washington State CAR are included in Table 13. Based on the evaluation of site background information, chemical-specific and location-specific CAR have been preliminarily identified. Potential action-specific CAR have been identified to the extent possible based on preliminary development of corrective measures.

Also included in these tables is an assessment of whether the requirement is applicable, potentially relevant and appropriate, or to be considered. Applicable requirements are defined as those that would be legally applicable to a remedial action if that action were not taken pursuant to CERCLA. Relevant and appropriate requirements are those that apply in circumstances similar to those encountered at NPL sites, where their applications would be appropriate, although not legally required.

To-be-Considered (TBC) Materials are nonpromulgated advisories or guidance issued by Federal or State government that are not legally binding and do not have the status of potential CAR. However, in many circumstances, TBC will be considered along with CAR as part of the site risk assessment and may be used in determining the necessary level of cleanup for protection of health or the environment.

Although the 100-NR-3 operable unit does not include the groundwater and saturated soils below this area, groundwater CAR may drive the final corrective action decision(s) for 100-NR-3. Therefore, the groundwater CAR discussed in the 100-NR-1 RFI/CMS work plan may be applied indirectly to 100-NR-3 soils.

Tables 14 and 15 include lists of probable waste constituents with chemical-specific CAR for chemical and radiological contaminants, respectively.

EPA is currently developing regulations for corrective action requirements imposed by RCRA sections 3004(u) and (v). These requirements were added by the Hazardous and Solid Waste Amendments (to RCRA) which became law in November 1984. The new requirements regulate releases of hazardous constituents to the environment from solid waste management units at RCRA facilities, regardless of the date on which the waste was received. In

Table 12. Potential Federal Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Operable Unit 100-NR-3. (sheet 1 of 2).

Requirements	Applicable	Potentially Relevant and Appropriate	To Be Considered	Rationale
1. Contaminant Specific				
1.1 Safe Drinking Water Act - Maximum contaminant levels (MCL) - Maximum contaminant level goals (MCLG)		X X		Groundwater is not used for drinking and institutional controls can prevent future use. However, contaminated groundwater is discharged to the Columbia River which is used for drinking water.
1.2 Health advisories, EPA Office of Drinking Water			X	Chemicals identified for which health advisories are listed.
1.3 Clean Water Act (PL 92-500) - Federal Water Quality Criteria	X			Contaminated groundwater discharges to the Columbia River.
1.4 RCRA Groundwater Protection Standards (40 CFR 264 Subpart F) - Alternate concentration limits (ACL)		X		ACLs may be relevant and appropriate in accordance with CERCLA 12(d)(2)(B)(ii).
1.5 RCRA Amendments of 1984 (42 USC 6401, Section 3019) - Exposure Information and Health Assessment)		X	X	Baseline risk assessment will be conducted for contaminants of concern by all routes of exposure.
1.6 Clean Air Act (41 USC 7401) - Standards for Protection Against Radiation (10 CFR Parts 20 and 61) - National Emission Standard for Hazardous Air Pollutants for Radionuclides (40 CFR Part 61)	X X			Remedial alternatives may result in air emissions.
1.7 Environmental Radiation Protection Standards (DOE Order 5400.3 and 40 CFR Part 191 Subpart F)	X			Radiation standards for protection of the public in the vicinity of DOE facilities.
1.8 Toxic Substance Control Act (15 USC 2601)	X			Polychlorinated biphenyls (PCB) may be detected in contaminated soils.

Table 12. Potential Federal Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Operable Unit 100-NR-3. (sheet 2 of 2).

Requirements	Applicable	Potentially Relevant and Appropriate	To Be Considered	Rationale
2. Location Specific				
2.1 Historic Sites, Buildings, and Antiquities Act (16 USC 461)	X			Applicability will be determined during Remedial Investigation and in evaluation of remedial alternatives.
2.2 National Historic Preservation Act (16 USC 470) - Protection of Archaeological Resources	X			Applicability will be determined during Remedial Investigation and in evaluation of remedial alternatives.
2.3 Endangered Species Act of 1973 (16 USC 1531)		X		Considered in the baseline risk assessment.
2.4 Fish and Wildlife Coordination Act (16 USC 661)	X			Applicable if remedial alternatives affect wetlands and protected habitats.
2.5 Fish and Wildlife Improvement Act (16 USC 742)	X			Applicable if remedial alternatives affect wetlands and protected habitats.
2.6 Fish and Wildlife Conservation Act (16 USC 2901)	X			Applicable if remedial alternatives affect wetlands and protected habitats.
3. Action-Specific				
3.1 Hazardous Waste Requirements (RCRA Subtitle C, 40 CFR, Part 264)	X	X		May be applicable for remedial alternatives involving the generation, transportation, storage, containment, and offsite disposal of waste.
3.2 Clean Water Act of 1977 (PL 92-500)				
- National Pollutant Discharge Elimination System (NPDES) permit	X			Remedial actions may include discharge to the Columbia River.
- Underground Injection Control Regulations (40 CFR 144-147)	X			Remedial actions may include injection of treated groundwater.
3.3 Occupational Safety and Health Act (29 USC 651)				Occupational health and safety requirements.
- Occupational Safety and Health Administration (OSHA) Standards (29 CFR Part 1910)	X			

Table 13. Potential State Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Operable Unit 100-NR-3. (sheet 1 of 2).

Requirements	Applicable	Potentially Relevant and Appropriate	To Be Considered	Rationale
1. Contaminant-Specific				
1.1 Water Pollution Laws and Regulations				
- Water Pollution Control Act (Ch. 90.46 RCW)	X	X		Do not contain numeric standards. Require surface and groundwaters of the state to be protected to maximize beneficial uses. Require all known available and reasonable treatment for discharges.
- Regulation of Public Groundwaters (Ch. 90.44 RCW)		X		
- Water Resources (Ch. 90.54 RCW)		X		
- Water Quality Standards for Waters of the State of Washington (Ch. 173-201 WAC)	X			Contain water quality standards for the Hanford Reach of the Columbia River.
- Public Water Supplies (Ch. 248-54 WAC)	X			Contain standards for public drinking water.
1.2 Solid and Hazardous Waste Laws and Regulations				Require remedial actions to attain a degree of cleanup protective of human health and the environment. Regulations on cleanup levels in preparation.
- Hazardous Waste Cleanup Model Toxics Control Act (Ch. 70.105D RCW)	X	X		
- Model Toxics Control Act-Cleanup Regulation (Ch. 173-340 WAC)	X	X		Proposed rule (Jan. 1990) establishes standards for investigations, liability, etc. Cleanup standards in draft.
- Department of Ecology Final Cleanup Policy-Technical (July 10, 1984) (Ch. 173-303 WAC)			X	Non promulgated policy to be considered. New policy in draft.
- Dangerous Waste Regulations (Ch. 173-303 WAC)	X	X		Contain requirements equivalent to RCRA for groundwater protection standards.
1.3 State Radiation Standards (Ch. 70.98 RCW and WAC Title 402)		X		Contain state radiation standards.
2. Location-Specific				
2.1 Washington Shoreline Management Act (Ch. 90.58 RCW)	X			Controls the development of riparian habitat.
3. Action-Specific				
3.1 Washington Clean Air Act (Ch. 70.94 RCW and Ch. 173-480 WAC)	X	X		Contain air emissions standards. Applicable to the extent federal laws are applicable. May be relevant and appropriate to the extent they are more stringent than federal law.

Table 13. Potential State Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Operable Unit 100-NR-3. (sheet 2 of 2).

Requirements	Applicable	Potentially Relevant and Appropriate	To Be Considered	Rationale
3.2 Hazardous Waste Management Act (Ch. 70.105 RCW) and Dangerous Waste Regulations (Ch. 173-303 WAC)	X	X		Establish priorities for hazardous waste management. May be applicable to alternatives that include generation, treatment, storage or disposal of waste. May be relevant and appropriate for containment alternatives.
3.3 Hazardous Waste Cleanup-Model Toxics Control Act (Ch. 70.105 DRCW) and draft Model Toxics Control Act Cleanup Regulation (Ch. 173-340 WAC)	X	X		Establishes enforcement powers, liability, and remedial action requirements. Regulation proposed, not yet in effect.
3.4 Solid Waste Management Recovery and Recycling Act (Ch. 70.95 RCW) and Minimum Functional Standards for Solid Waste Handling (Ch. 173-304 WAC)	X	X		May be applicable for alternatives requiring management of solid waste. To extent they are more stringent than federal law, may be relevant and appropriate.
3.5 Washington State Water Code (Ch. 90.03 RCW)		X		Water rights law. May be relevant and appropriate for alternatives that include extraction and treatment of groundwater.
3.6 Minimum Standards for Construction and Maintenance of Water Wells (Ch. 173-160 WAC)		X		May be relevant and appropriate for monitoring wells during RI and alternatives that include extraction wells.
3.7 State Waste Discharge Program (Ch. 173-216 WAC)		X		May be relevant and appropriate to alternatives that include discharges to ground.
3.8 Underground Injection Control Program (Ch. 173-218 WAC)	X	X		May be applicable to alternatives that include underground injection to the extent federal laws are applicable. May be relevant and appropriate to the extent they are more stringent than federal law.
3.9 National Pollution Discharge Elimination System Permit Program (Ch. 173-220 WAC)	X	X		May be applicable to alternatives which include discharges to the Columbia River to the extent federal laws are applicable. May be relevant and appropriate to the extent they are more stringent than federal law.

Table 14. Potential Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Nonradioactive Contaminants at Operable Unit 100-NR-3 (ug/L)*.

Contaminant	1-MCL[a]	2-MCL[b]	MCLG[c]	QCFW-A[d]	QCFW-C[e]	QCHH-W/F[f]	QCHH-F[g]
Arsenic	50	-	-	360	-	-	-
Barium	1,000	-	-	-	-	-	-
Cadmium	10	-	-	2.4[h]	0.81[h]	10	-
Chromium	50	-	-	16[i]	11[i]	50[i]	-
Copper	-	1,000	-	12[h]	8.2[h]	-	-
Iron	-	300	-	-	1,000	300	-
Lead	50	-	-	47[h]	1.8[h]	50	-
Manganese	-	50	-	-	-	50	100
Nickel	-	-	-	1,300[h]	69[h]	13.4	100
Zinc	-	5,000	-	220[h]	47	-	-
Chloride	-	250,000	-	-	-	-	-
Cyanide	-	-	-	22	5.2	200	-
Fluoride	4,000	2,000	-	-	-	-	-
Nitrate	45,000	-	-	-	-	45,000	-
Sulfate	-	250,000	-	-	-	-	-
pH	-	6.5-8.5	-	-	6.5-9.0	-	-
Chloroform	100	-	-	-	-	-	-
Trichloro-ethylene	5	-	-	-	-	-	-

[a] Primary maximum contaminant level for drinking water to protect public health (40 CFR 141 and WAC 248).
[b] Secondary maximum contaminant level for drinking water to protect public welfare (40 CFR 143 and WAC 248).
[c] Maximum contaminant level goal for drinking water to protect public health (50 FR 46936, November 13, 1985.
[d] Quality criterion for ambient surface water to protect freshwater aquatic life (acute).
[e] Quality criterion for ambient surface water to protect freshwater aquatic life (chronic).
[f] Quality criterion for ambient surface water to protect human health (ingestion of water and aquatic organisms [FISH]).
[g] Quality criterion for ambient surface water to protect human health (ingestion of aquatic organisms only).
[h] Hardness-dependent criterion, the average value of 65 mg/L for the Columbia River is used.
[i] Value for chromium(IV), corresponding values for chromium(III) are 1,200,150,170,000, and 3,433,000 ug/L, respectively.

* The 100-NR-3 operable unit does not include groundwater, but may impact groundwater by infiltration or leaching of unsaturated soil. Decisions concerning the groundwater (part of the 100-NR-1 RFI/CMS) may impact soil cleanup requirements in 100-NR-3.

9 1 1 3 7 0 3 7

Table 15. Potential Legal Corrective Action Environmental Standards, Requirements, Criteria, and Limitations for Radionuclides at Operable Unit 100-NR-3.

Contaminant	Federal and State Drinking Water Standards (MCL) (pCi/L)	Federal Air Quality Standards	Environmental Radiation: 10 CFR 20[a] emission limits: Air Soluble (pCi/mL)	Air Insoluble (pCi/mL)	Water Soluble (pCi/mL)	Water Insoluble (pCi/mL)	Protection standards for radioactive waste disposal (all pathways): 40 CFR 191[b] (Ci/unit of waste)	40 CFR 193	Concentration Guides (DCG): Water (pCi/L)	Air (pCi/m³)
Gross alpha	15[c]	-	-	-	-	-	-	-	-	-
Gross beta and gross gamma	50[d]	-	-	-	-	-	-	-	-	-
Celsium-137	200[d]	-	2E09	5E10	2E05	4E05	1,000	-	3,000	400
Cobalt-60	100[d]	-	1E08	3E10	5E05	3E05	-	-	5,000	80
Ruthenium-106	30[d]	-	-	-	-	-	-	-	-	-
Strontium-90	8[d]	-	3E11	2E10	3E7	4E05	1,000	-	1,000	9
Technetium-99	900[d]	-	-	-	-	-	-	-	-	-
Tritium	20,000[d]	-	-	-	-	-	-	-	-	-
Uranium (natural)	-	-	2E11	4E12	3E05	3E05	100	-	600	0.1
Uranium	-	-	3E12	5E12	4E05	4E05	100	-	600	0.1
All radionuclides	4 mrem/yr[d]	whole body: 25 mrem/yr critical organ: 75 mrem/yr alternate standards continuous exposure: 100 mrem/yr noncontinuous exposure: 500 mrem/yr					whole body: 25 mrem/yr critical organ: 75 mrem/yr alternate standards continuous exposure: 100 mrem/yr noncontinuous exposure: 500 mrem/yr			

[a] NRC radiation protection standards at boundary of restricted area.
[b] 40 CFR 191 has been invalidated by the courts and remanded back to EPA on groundwater protection issues. Release limits for radionuclides may be deleted from these regulations.
[c] 40 CFR 141.15-141.116 excludes radon and uraniums. The WAC 248-54-375(B) excludes uranium only.
[d] Annual average concentration shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 mrem/yr. For known mixture of radionuclides, the sum of the ratios of the observed concentrations of each radionuclide and its corresponding MCL must not exceed 1.0.

addition, the State of Washington has proposed new water cleanup regulations. These new regulations, when promulgated, are expected to be applicable or relevant and appropriate to the 100-NR-3 operable unit investigation and cleanup. The regulations were not promulgated or proposed in final form at the time that this work plan was developed. If the new regulations are promulgated before final corrective measures are decided, they will have to be taken into account.

3.2.2 Point of Applicability of CAR

A significant factor for evaluation of remedial alternatives at the Hanford Site will be determining the point of applicability for the compliance with the CAR. Points of applicability are the boundaries that will be used to assess the effectiveness of remedial alternatives.

Surficial soil and sediment CAR will probably apply regardless of location, since the conservative exposure assumption is that the soil can be directly ingested or inhaled as dust. Deep soil (below approximately 2 ft from the surface) is not readily accessible for direct exposure, and may be subject to less conservative CAR. RCRA RFI guidelines suggest that the solubility and leachability of waste constituents, and the potential impact of leached waste constituents on groundwater quality, will be key criteria for determining deep soil corrective action requirements. Therefore, the point of applicability for deep soil CAR would be at the groundwater surface below 100-NR-3. This is also the administrative boundary of the 100-NR-3 and 100-NR-1 operable units. Leachability testing of contaminated 100-NR-1 soils may be necessary in later phases of the RFI, but the determination of limitations on groundwater impact (and therefore soil cleanup requirements) will depend on the groundwater CAR conclusions developed as part of the 100-NR-1 RFI/CMS.

3.2.3 Evaluation of CAR During Remedial Action

Evaluation of CAR is an iterative process that will be conducted at multiple points throughout the RFI/CMS, namely:

- During the RFI, when the baseline risk assessment is conducted, chemical-specific CAR, TBC, and location-specific CAR will be identified more comprehensively.

- During development of corrective action alternatives in Phase I of the CMS, action-specific CAR will be identified for each of the proposed alternatives and considered along with other CAR and advisories.

- During the detailed analysis of alternatives in the Phase II CMS, all the CAR and advisories for each alternative will be examined as a package to determine what is needed to comply with other laws and be protective of human health and the environment.

The corrective action alternatives analyzed during the CMS must be able to attain all CAR unless a no-migration variance petition, or some other form of statutory waivers, can be invoked. The five reasons CAR could be waived at the Hanford Site are as follows:

- The remedy is an interim measure where the final remedy will attain CAR upon completion (particularly relevant when a site has been divided into operable units).
- Compliance will result in greater risk to human health and the environment than other options.
- Compliance is technically impractical.
- The remedy selected will attain a standard of performance equivalent to that required under a CAR.
- For state CAR, the state has not consistently applied (or demonstrated the intention to consistently apply) the CAR in similar circumstances.

During the design phase of the corrective action, the technical specifications of construction must ensure attainment of CAR. Environmental monitoring during and after implementation of the selected remedy will also help to ensure CAR compliance.

3.3 PRELIMINARY ASSESSMENT OF POTENTIAL HEALTH IMPACTS

Both RCRA corrective action and CERCLA RI/FS guidance require a preliminary risk assessment to be a part of the planning process for contaminant-mitigation programs. This section assesses the potential impacts to human health and the environment as a result of activities at 100-NR-3, based on the information provided above.

3.3.1 Objectives

This preliminary assessment is intended to provide initial direction to the RFI/CMS work plan and a starting point for the baseline (no-action) risk assessment which will be developed during implementation of the work plan. It includes preliminary determination of the major contaminant sources and migration paths, the degree of toxic hazard posed by each known contaminant, identification of highest hazard contaminants, human

and other environmental receptors, and a preliminary decision as to the need for interim corrective measures.

3.3.1.1 Conceptual Exposure Pathway Model. Based on information presented thus far, a conceptual model of contaminant exposure pathways for 100-NR-3 was developed. The model is presented in Figure 43. The purpose of the conceptual model is to present hypotheses of unit-specific contaminant exposure pathways. Each exposure pathway must contain the following (EPA 1986b):

- A contaminant source
- A contaminant release mechanism
- An environmental transport medium
- An exposure route
- A receptor.

During the RFI, the conceptual model hypotheses are tested and refined in an iterative manner until the understanding of the operable unit is sufficient to support subsequent decisions regarding remediation. By conducting the RFI in this manner, the project becomes more efficient as the investigation is kept focused on unit-specific objectives.

3.3.2 Potential Contaminants

The compounds which may be present in the 100-NR-3 operable unit include a very wide range of organic and inorganic compounds, elements, and radionuclides. The 100-NR-3 operable unit includes 12 waste management groupings. Of these groupings, only background soils in the vicinity of the 120-N-1 (1324-NA) Percolation Pond have been sampled and analyzed. These data indicate that background soils contain metals, with little background radionuclides or volatiles and no semivolatiles. The results are presented in Tables 6 through 9 in Section 3.1.2.1.1. However, it is important to note that some potential contaminants may not have been detected because analyses have not been performed to determine their presence. In addition, the adequacy of QC and QA procedures for some historical analyses is acknowledged to be open to question. These considerations form the basis for several of the RFI sampling and analysis tasks.

There are 49 potential sources at 100-NR-3. These include waste management units and unplanned releases. Each of these 49 sources has been placed in one of twelve groupings. Figure 22 in Section 3.1.1 depicts the 100-NR-3 operable unit and shows the 12 groupings located within 100-NR-3.

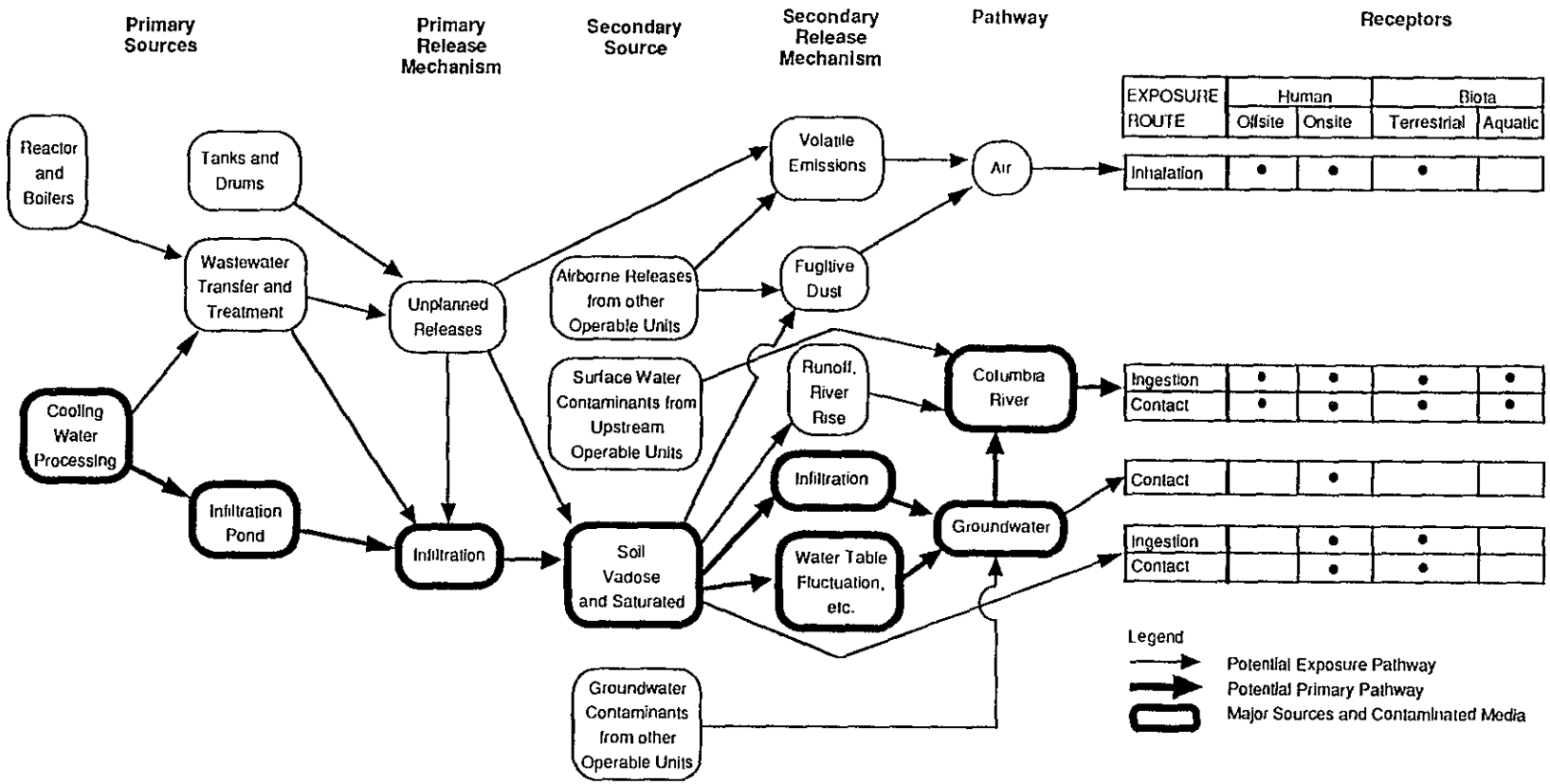


Figure 43. Conceptual Contaminant Exposure Path Model for the 100-NR-3 Operable Unit

3.3.2.1 Preliminary Toxicity Assessment. The preliminary toxicity assessment is performed to further focus attention on those parameters that are most toxic to human and environmental receptors. The assessment compares critical toxicity values for each parameter, where available, to the levels found within the environment. Those parameters that meet or exceed their critical levels will be focused on during the RFI/CMS. The assessment also provides a means by which to select the level of analytical quality needed for the RFI--the lower the parameter's critical toxicity value, the more sensitive the analytical method must be to provide meaningful data for the baseline risk assessment.

3.3.2.2 Contaminants of Concern. The contaminants of concern at 100-NR-3 are those known to have been released to soil at 100-NR-3 and are the following:

- pH - There have been several reported releases of corrosive waste at 100-NR-3, either highly acidic or highly caustic. This may increase the mobility of metals and other contaminants.

- Diesel Oil - There have been several unplanned releases of various oils to the ground at 100-NR-3. Many of these releases were 1,000 gal or greater. This may migrate to the groundwater or be a toxic threat to ecological organisms.

- Cs-137, Co-60, Mn-54, Ru-103 - These radionuclides were released during a process line leak between the 105-N Reactor facility and the 1310-N Radioactive Chemical Waste Treatment Storage Facility.

The appropriate CAR for the above should be background, since all of these contaminants may migrate to groundwater and eventually reach human receptors via the Columbia River. At 100-NR-3, they may pose a threat to ecological organisms which live in the soil and then to other organisms through the food chain.

Air release of contaminants does not appear to pose a health threat to the public. Table 10 in Section 3.1.2 shows that air emissions from the 184-N Power Plant have been reduced considerably and are not a health threat due to this reduction and to the distance to the nearest residential area.

3.3.3 Imminent and Substantial Endangerment

Based on the environmental data available, the 100-NR-3 operable unit does not appear to pose an imminent or substantial threat to public health or the environment. Background sample results presented in Section 3.1.2.1.1 show low radionuclides,

volatiles and no semivolatiles, and the metal concentrations are below EPA reference dose values (RFDs) (EPA 1989a).

3.3.4 Potential Impacts

The potential future adverse impacts from 100-NR-3 relate to possible discharges to groundwater, or resulting from uncontrolled access to the 100-NR-3 operable unit.

Although there are no reported hazardous or radioactive releases to groundwater from 100-NR-3, it is recognized that sufficient data are not available for clearly establishing background groundwater quality in the 100-N Area.

Groundwater releases could have reached the Columbia River via the N Springs in the riverbank. Although the dilution provided by the Columbia River is very large, there are several possible points of exposure where the N Springs discharge from the bank, above the river elevation for much of each year. This allows direct access by animals to the relatively high activity groundwater (average 353 pCi/L in 1988).

Comprehensive radionuclide-specific analyses of groundwater and internal dose calculations for direct ingestion of N Springs discharges have not been performed. Consumption of vegetation growing in the N Springs area would deliver additional doses. Fish and other aquatic biota living along the riverbank adjacent to and immediately downstream from the N Springs receive continuous, only partially diluted exposures.

A backup drinking water supply pumphouse is located in the 100-D Area, approximately 2 mi downstream from the N area. The intake configuration for this pump station is unknown, but could conceivably take in a significant portion of the N Spring discharge.

Average radionuclide concentrations detected in N Springs vegetation from 1980 through 1988 are presented in Table 16. The table shows a decrease in radionuclide concentrations for the time period shown. This should be indicative of the radionuclide concentration of the springs.

The changes in groundwater flow patterns below the 100-N Area resulting from shutdown of the facility systems and termination of major discharges in the 100-NR-1 operable unit may result in movement of sodium and sulfate from the 120-N-1 (1324-NA) and 120-N-2 (1324-N) area into soils which are holding large amounts (several thousand curies) of radionuclides deposited during operation of the 116-N-1 (1301-N), 116-N-2 (1310-N), and 116-N-3 (1325-N) facilities (Golder Associates, Inc. 1990). The potential remobilization of these radionuclides

Table 16. Radionuclide Concentration (pCi/g) Detected in N Springs Vegetation Samples from 1980 through 1988

Year	MN-54	Co-60	Sr-90	Cs-137	Pu-238	Pu-239,240
1980	1.5E-01	5.6E+00	NR	4.4E-01	NR	3.7E-03
1981	NR	3.3E+00	2.0E+02	NR	NR	3.7E-03
1982	1.5E-0.1	2.8E+00	4.8E+02	NR	NR	8.3E-03
1983	7.0E-02	3.0E+00	3.3E+02	4.0E-02	NR	8.0E-03
1984	NR	NR	NR	NR	NR	NR
1985	7.6E-02	1.2E+00	4.2E+02	1.7E-01	NR	4.4E-04
1986	1.6E-01	1.1E+00	2.2E+02	2.1E-01	NR	4.2E-04
1987	2.0E-01	9.0E-01	2.9E+02	1.1E-01	<1.3E-04	7.6E-04
1988	2.4E-01	1.4E+00	1.2E+02	2.0E-01	8.5E-05	2.0E-04

NR = Not reported.

as a result of sodium exchange is a serious concern. These issues are addressed in the 100-NR-1 RFI/CMS work plan.

3.3.5 Conclusions

An imminent and substantial hazard does not appear to exist at the 100-NR-3 operable unit. However, the uncertainties in actual soil contamination and the extent of discharge to groundwater, groundwater flow paths, the influence of river surface elevation variations and sodium exchange, does not allow a quantitative risk assessment at this time.

The most significant current contaminant release mechanism is water infiltration through contaminants in the unsaturated zone. Rainwater and snowmelt infiltrating from the ground surface transport contaminants in the unsaturated zone to the groundwater. Although the average annual water infiltration in the 100-NR-3 operable unit is low, unusually heavy rainfall may cause contaminant movement in the unsaturated zone. Contaminants can eventually reach the groundwater and be discharged to the Columbia River, where sediments and aquatic organisms may be exposed. Future human exposures may result if the area returns to private use after institutional control is lost.

Humans may be exposed under both current and future use conditions. The extent and magnitude of contamination at 100-NR-3 is not completely known; therefore a quantitative risk assessment is not possible at this time. However, what monitoring data exist for 100-NR-3 does not indicate an imminent or substantial health or environmental hazard.

3.4 PRELIMINARY CORRECTIVE ACTION OBJECTIVES AND ALTERNATIVES

Corrective action at 100-NR-3 will address only surface and subsurface soil because of the dual source unit/groundwater focus of the RFI/CMS to be conducted at the 100-NR-3 operable unit. The 100-NR-3 RFI will characterize air, soil, vadose zone sediments and biota associated with source units within the surface confines of 100-NR-3. The 100-NR-1 RFI will characterize groundwater, river water and sediments, and subriparian biota for releases from source units located in 100-NR-1, 100-NR-2, 100-NR-3 and the Hanford Generating Plant. A range of approaches to manage/mitigate contaminated media in the 100-NR-3 unit will be developed. Presented here are preliminary corrective action objectives, technologies, and alternatives.

Corrective action objectives for 100-NR-3 soils have been developed based on the preliminary data regarding the contaminants present, potential exposure pathways, and remediation goals. General response actions have been developed for each that will be evaluated and implemented to satisfy the

corrective action objectives. Technologies applicable to each general response action have been considered for preliminary screening based on available data. These technologies have been assembled into alternatives for soil remediation at 100-NR-3.

Preliminary corrective action alternatives have been developed to address soil contamination associated with the use of process liquid effluent disposal facilities, one radioactive liquid waste transfer pipeline and hazardous product (acid/caustic) waste storage facilities. Information regarding historical treatment and disposal activities has been used to determine possible waste constituents in the soils, sediments, surface water, and groundwater. Additional data will be developed during the RFI that may impact the technologies and alternatives that are considered for both the 100-NR-3 and 100-NR-1 operable units.

3.4.1 Corrective Action Objectives

The contaminants determined to be present and of interest in the operable unit include metals, corrosives, hydrocarbons, and radionuclides. Additional environmental data gathered during the RFI may expand the list of contaminant types.

Corrective action objectives and general response actions developed for screening are presented in Table 17. The general response actions are developed to provide for human health and environmental protection. The media of concern for the operable unit include: soils beneath and near the radioactive and mixed liquid waste transfer pipeline and the dangerous waste and hazardous substance storage facilities, air, and terrestrial biota.

3.4.2 Preliminary Corrective Action Technologies

General corrective action technologies included for preliminary screening for 100-NR-3 are presented in Table 18. These technologies address the waste constituents expected to be present in soils. Applicable technologies will be better defined as additional RFI data are obtained.

Although corrective action response objectives were developed for surface water, air, and biota, no specific corrective action technologies and subsequent corrective action alternatives have been identified for these media. If the N Reactor is permanently shut down, the source of any substantial air or biota impact would be either the soils and sediments in 100-NR-3 or from external sources. In the first case, remediation of the soil would achieve the response objectives for the air and biota.

9 1 1 3 7 0 3 4 7

Table 17. Preliminary Corrective Action Objectives and General Response Actions for Operable Unit 100-NR-3.

Environmental Medium	Corrective Action Objectives	General Response Actions
Soil	For human health: Prevent ingestion, inhalation, or direct contact with contaminated soils. For environmental protection: Prevent migration of soil contaminants that would result in groundwater or surface water contamination, or which may have significant adverse impact on adjacent operable units (100-NR-1 and 100-NR-2).	No action: No action with institutional action, such as deed restriction, for land use. Additional site access restrictions. Long-term monitoring. Containment action: Place soil or other cover over contaminated soil. Excavation: Physically remove soil. Vitrification: Solidify in place.
Air	For human health: Prevent inhalation of airborne contaminants, and exposure to external radiation.	No action: No action with institutional actions, such as deed and access restrictions. Containment action: Cap or cover spills and/or sediments to prevent airborne migration and volatilization of constituents.
Biota	For human health: Prevent ingestion of contaminated biota (e.g., asparagus or other vegetation; deer; whitefish). For environmental protection: Prevent adverse impacts on local biota.	No action: No action with monitoring. Institutional actions: Physically restrict access and/or prohibit harvesting contaminated vegetation, animals, fish, etc. Institutional controls: Fencing and/or eradication of vegetation. Containment action: Capping of contaminated soil/sediment areas to prevent biota exposure to wastes.

Table 18. Preliminary Corrective Action Technologies for Operable Unit 100-NR-3.

Environmental Medium	General Response Actions	Corrective Action Technologies
Soils/ Sediments	Excavation	Physical removal of waste material for treatment or disposal.
	Capping	Barrier placed on top of waste materials.
	Chemical stabilization/ solidification	Process to mix chemical wastes with materials (e.g., cement, lime kiln dust, cement kiln dust, fly ash, or proprietary agents) to limit the waste solubility and leachability in a dry aggregate or solid material.
	Landfill	Waste materials are disposed of in an area designed to receive the wastes. Materials may be drummed or disposed of in bulk form.
	Incineration	Combustion/oxidation of organic waste materials at high temperatures.
	Biodegradation	Onsite or in situ treatment of wastes by enhancing the growth of microbes specially adapted to degradation of polychlorinated biphenyls (PCBs) and waste constituents.
	In situ steam stripping	Removes volatile organic constituents from contaminated soils and waste. Dissolved gases are transferred to air streams. Steam is used as the stripping gas.
	Vapor extraction	Removes volatile organic constituents from contaminated soils and wastes. Dissolved gases are transferred to air streams.
	Flushing	Use of water and/or surfactants to enhance elutriation of organic or inorganic contaminants from soil. Used in conjunction with other treatment steps.
	Vitrification	Incorporation of waste materials into a glass matrix by the introduction of electric currents.

3.4.3 Preliminary Corrective Action Alternatives

Potential treatment technologies identified in Table 18 will be linked to form several corrective measure alternatives that could meet corrective action objectives. These corrective measure alternatives will address contaminated soils and the secondary wastes that result from the recovery and/or treatment of contaminated soil. Corrective measure alternatives include no action, containment, treatment and disposal, and possible combinations of containment, treatment, and disposal. Treatment alternatives may include in situ treatment technologies. Treated water will be reused, discharged to the ground, discharged to the Columbia River, or evaporated, depending on the volumes of water requiring treatment and the quality of water that results after treatment. Any new discharges to the Columbia River will be subject to NPDES permit limitations.

New closure plans for the 120-N-1 (1324-NA) and 120-N-2 (1324-N) RCRA TSD units (see Section 2.1.5.1) are required to be submitted to Ecology in 1994 in accordance with Agreement Milestone M-20-35 (Ecology et al. 1989). Data from samples collected from or in the vicinity of these units during the RFI work may be initiated or completed (possibly as part of the RCRA corrective action permit modification) by the time the closure plans are submitted.

Nonradioactive secondary wastes from water treatment and recovered sediments will be stabilized and disposed onsite or offsite. Engineered barriers and leachate collection systems also may be used as part of the overall disposal scheme for recovered and stabilized wastes.

4.0 WORK PLAN RATIONALE

This section provides the rationale and framework for conducting the Phase I RFI for the 100-NR-3 operable unit. Data uses and data users, data needs, and the data quality objectives (DQOs) for the sources, vadose zone and biota are defined. The methodology for obtaining and evaluating data is outlined for the RFI Phase I and a preview of needed tasks is provided.

The DQOs are specific qualitative and quantitative statements designed to ensure that data of known and appropriate quality are obtained during the remedial response process. DQOs are developed for each data collection activity in the corrective action process (RFI, CMS, and corrective measures implementation). A three-stage process is used to develop DQOs:

- Stage 1 - Identify decision types
- Stage 2 - Identify data uses and needs
- Stage 3 - Design a data collection program.

For the efficient use of resources, an RFI is best approached as an iterative process. After each stage of the RFI, existing data will be evaluated to assess any gaps that must be addressed in the next stage of the data collection effort. DQOs will be revised accordingly. Data gaps will decrease as the overall understanding of site conditions improve and the range of potential corrective action alternatives is narrowed.

4.1 DECISION TYPES

Stage 1 of the DQO process is undertaken to identify the decision makers and the data users, and to define the types of decisions that will be made as part of the RFI/CMS. The major elements of Stage 1 include:

- Identifying and involving data users
- Evaluating available information
- Developing a conceptual model
- Specifying RFI/CMS objectives and decisions.

4.1.1 Data Users

Data users can be subdivided into primary and secondary categories. Primary data users are those individuals or organizations directly involved in ongoing RFI/CMS activities. Primary data users for the 100-NR-3 operable unit include:

- Managers from DOE, Westinghouse Hanford, EPA, and Ecology
- The DOE, EPA, and Ecology unit managers
- Unit manager contractor representatives
- Technical contributors and other involved DOE contractors
- Decision makers.

Secondary data users are those individuals or organizations who rely mainly on outputs from the RFI/CMS studies to support their activities. Secondary data users include the following:

- The DOE headquarters staff and Secretary
- The EPA Regional Administrator
- The Ecology Director
- The Director of the State Department of Health
- Other federal and state agencies
- The general public
- Special interest groups.

Most data needs are defined by primary data users. Secondary data users may also provide inputs to the decision makers and primary data users by communicating generic or site-specific data needs or regulatory requirements, or by comment or question during the review process.

Information obtained during the RFI Phase I for the 100-NR-3 operable unit will be managed in accordance with the data management plan found in Attachment 4. Public participation in the RFI/CMS will be solicited as stated in the community relations plan (Attachment 5). Implementation of these two plans will ensure that the data needs of both the primary and secondary data users will be met.

4.1.2 Available Information

Available information is reviewed and evaluated as the initial step in the RFI/CMS process. This review provides the foundation for additional onsite activities and serves as the database for scoping studies. Available information for this operable unit was reviewed and evaluated by the project team to determine the adequacy of existing information so that data needs could be identified. The physical setting of 100-NR-3 is summarized in Section 2.0, and the existing data that were evaluated to guide the development of the RFI Phase I are presented and summarized in Section 3.0. Information source documents referenced in the text are listed in Section 7.0.

4.1.3 Conceptual Models

Conceptual models describe a site and its environments and present hypotheses regarding the contaminants present, their routes of migration, and their potential impacts on sensitive receptors. The hypotheses are tested, refined and modified throughout the RFI/CMS process. Based on the data reviewed by the project team, a conceptual site model was developed for the 100-NR-3 operable unit and is presented in Section 3.0.

4.1.4 RFI/CMS Objectives and Decisions

In a broad sense, the objective of a corrective action program is to determine the nature and extent of releases or threat of releases of hazardous substances and to select a cost-effective corrective action to mitigate that threat. Achieving this broad objective requires that several interrelated activities be performed. Each activity must have objectives, acceptable levels of uncertainty, and attendant data quality requirements. The first step toward the development of a cost-effective data collection program is to develop clear, precise decision statements (EPA 1987). The decision framework for developing the data collection program for the RFI Phase I can be summarized in the following questions.

- Where are the contaminants located?
- What contaminants are present?
- What are the concentrations of these contaminants in the environment?
- What is the potential for the contaminants to move within the environment?
- What are the risks to people and the environment if these contaminants are not separated from the environment?

- If the risks from the contaminants are unacceptable, then how can the risks be reduced to acceptable levels?

- If the risks can be reduced, what is the most cost-effective way to reduce the risks?

The activities that provide answers to the first four questions are classified as site characterization activities. A baseline risk assessment is performed to determine the risks to people and the environment. The CMS determines how risks can be reduced to acceptable levels, and the most cost-effective way to accomplish the task.

Existing data for the 100-NR-3 operable unit (as presented in Section 3.0) are insufficient to adequately identify which contaminants are present, their locations, and their potential to migrate in the environment. Therefore, RFI Phase I activities are proposed in each of the media at the operable unit to answer these questions with data of appropriate quantity and quality.

Following the completion of RFI Phase I data development activities, a baseline risk assessment will be performed to estimate the short-term risks to humans and the environment from the contaminants that are found. The risk assessment will become one mechanism for identifying potential interim response actions that may be needed at the 100-N Area. The risk assessment will be revised and updated following Phase II data collection activities to estimate the long-term risks to humans and the environment, and to identify any additional short-term risks which may require interim action.

Questions regarding acceptable levels of contaminants and cost-effective methods of reducing risk are answered by the CMS. These studies will be performed concurrently with the RFI, with alternative identification and preliminary screening beginning early in the process. Alternative selection will take place once the contaminants have been identified and their locations and concentrations established.

4.2 DATA USES AND NEEDS

Stage 2 of the DQO development process defines data uses and specifies the types of data needed to meet the project objectives. Although data needs are identified generally during Stage 1, it is in Stage 2 where specific data uses are defined (EPA 1987). The major elements of DQO Stage 2 are described in this section:

- Identifying data uses (per Section 4.2.1)

- Identifying data types (per Section 4.2.2)

- Identifying data quality/quantity needs (per Section 4.2.3)
- Evaluating sampling/analysis options (per Section 4.2.5)
- Reviewing data quality parameters (per Section 4.2.6).

4.2.1 Data Uses

During the RFI/CMS, most data uses fall into one or more of four general categories: (1) site characterization, (2) public health evaluation and risk assessment, (3) evaluation of corrective action alternatives, and (4) worker health and safety.

Site characterization refers to a process that includes determination and evaluation of the physical and chemical properties of any wastes and contaminated media present at a site, and an evaluation of the nature and extent of contamination. This process involves the collection of necessary geologic, hydrologic, and meteorologic data as well as data on specific contaminants and sources.

Data required to conduct a public health evaluation and risk assessment at the 100-NR-3 operable unit include the following: input parameters for various performance assessment models, site characteristics, and contaminant data required to evaluate the threat to public health and welfare through exposure to the various media. These needs usually overlap with site characterization needs, but higher-level quality control is often needed for risk assessment purposes and potential CAR identification.

Data collected to support evaluation of the 100-NR-3 operable unit corrective action alternatives include site characteristics and engineering data required for initial screening of alternatives, feasibility-level design, and preliminary cost estimates. Once an alternative is selected for implementation, much of the data collected during the RFI/CMS can be used for the final engineering design. Generally, collection of information during the RFI for use in the final design is not cost effective. It is preferable to gather such specific information during a separate predesign investigation.

The worker health and safety category includes data collected to establish the required level of protection for workers during various RFI activities. These data are used to determine if there is concern for the personnel working in the vicinity of the operable unit.

4.2.2 Data Types

Data use categories described in Section 4.2.1 define the general purpose and intent for collecting additional data. Based on the intended uses, a concise statement regarding the data types needed can be developed. Data types specified at this stage should not be limited to chemical parameters, but should also include necessary physical parameters such as bulk density, viscosity, etc. Since environmental media and source materials are interrelated, data types used to evaluate one media may also be useful to characterize another media. Identifying data types by media exposes overlapping data needs. Data objectives, needs, and types to be collected in the RFI Phase I are identified in Table 19. These are discussed below in Section 4.3 to provide focus to the RFI/CMS tasks discussed in Section 5.0 and the sampling and analysis plan (Attachment 1).

4.2.3 Data Quality Needs

The various tasks and phases of a RCRA facility investigation may require different levels of data quality. Important factors in defining data quality include selecting appropriate analytical levels and validation and identifying contaminant levels of concern as described below. The Westinghouse Hanford document, A Proposed Data Quality Strategy for Hanford Site Characterization will be used to help define these levels (McCain and Johnson 1990).

In general, increasing accuracy and precision are obtained with increasing cost and time. Therefore, the analytical level used to obtain data should be commensurate with the intended use. Table 20 defines five analytical levels based on overall data quality. Individual DQOs and the appropriate analytical levels associated with each data need are given in Table 21.

Before laboratory and field data can be used in the RFI/CMS process, it must first be validated. Exceptions are made for initial evaluation of the site, using available data, which may not be validatable. Other screening data (e.g., estimates of contaminant concentration inferred from field analyses) may also be excepted). Validation involves determining the usability and quality of the data. Once data are validated, they can be used to successfully complete the RFI/CMS process. Activities involved in the data validation process include the following:

- Confirm that laboratory data meet QA/QC criteria
- Document and manage data properly so that they are usable.

To address the first objective, all RFI laboratory data must meet the requirements of the specific QA/QC parameters as

Table 19. Data Collection Objectives for the 100-NR-3 Operable Unit.

Data Objectives	Data Needs	Data Types
Sources		
Refine understanding of facility characteristics	Locations of contaminant source	- Site geodetic survey - Source data compilation and evalvation
Determine waste characteristics and spatial distribution of contaminants	Physical, chemical and radiological characterization of the sources	- Chemical and radiological properties - Soil gas survey - Geophysical properties
Geologic		
Identify pathways for contaminant migration	Stratigraphy, structure	- Lithology - Soil/sediment type
Surface Soil		
Determine presence of absence of contaminants	Contaminant characterization	- Concentrations - Physiochemical and radiological properties
Vadose Zone		
Determine presence or absence and spatial distribution of contamination	Contaminant characterization of the soil column	- Chemical and radiological properties
Refine concepts of unsaturated flow and recharge	Soil physiochemical properties	- Physiochemical properties - Lysimeter data
Air		
Determine presence or absence of contaminants around field activities	Air quality	- Physical properties - Chemical and radiological concentrations
Biota		
Determine the biotic communities present	Identification of critical habitats Identification of ecological processes	- Literature review - Field observations
Determine presence or absence of contaminants	Contaminant characterization of the biota	- Literature review - Chemical and radiological concentrations
Cultural Resources		
Identify archaeological or historic sites	- Literature review - Field survey	- Locations - Site protection requirements
Topography	- Topographic base map development	- Ground and well casing elevations - Facility locations

Table 20. Analytical Levels for the 100-NR-3 Operable Unit.

Level[a]	Description
LEVEL I	Field screening. This level is characterized by the use of portable instruments which can provide real-time data to assist in the optimization of sampling point locations and for health and safety support. Data can be generated regarding the presence or absence of certain contaminants (especially volatiles) at sampling locations.
LEVEL II	Field analysis. This level is characterized by the use of portable analytical instruments which can be used onsite, or in mobile laboratories stationed near a site (close-support laboratories). Depending on the types of contaminants, sample matrix, and personnel skill, qualitative and quantitative data can be obtained.
LEVEL III	Laboratory analysis using methods other than the Contract Laboratory Program Routine Analytical Services. This level is used primarily in support of engineering studies using standard EPA-approved procedures. Some procedures may be equivalent to Contract Laboratory Program Routine Analytical Services without the Contract Laboratory Program requirements for documentation.
LEVEL IV	Contract Laboratory Program Routine Analytical Services. This level is characterized by rigorous QA/QC protocols and documentation and provides qualitative and quantitative analytical data. Some regions have obtained similar support via their own regional laboratories, university laboratories, or other commercial laboratories.
LEVEL V	Nonstandard methods. Analyses which may require method modification and/or development are considered Level V by Contract Laboratory Program Special Analytical Services.

[a] Per McCain and Johnson 1990, Levels I and II are equivalent to field or laboratory screening and Levels III, IV and V are equivalent to validated laboratory analyses.

Table 21. Data Collection Types, Measurements and Required Analytical Levels for the 100-NR-3 Operable Unit. (sheet 1 of 2).

Data Types	Measurements	Analytical Method	Required Analytical Level	Data Use
Sources				
Data Review	Plans and specifications monitoring data analytical data	N/A	N/A	SC, EA, ED
Geodetic	Surveying map construction	N/A	N/A	SC, EA, ED
Topographic Mapping	2-ft contours	SOP	I	SC, EA, ED
Radiological survey	Beta/gamma activity of area	OHP	I, II	SC
Geophysical	Electromagnetic induction magnetometry and ground penetrating radar for physical properties	EII	I	SC
	soil gas monitoring	EII	I	SC
Source Samples	Radionuclides	OHP/LAP	III/IV	
	Organics	SW846/CLP	III/IV	
	Inorganics	SW846/CLP	III/IV	
	Herbicides/ Pesticides	SW846/CLP	III/IV	
	PCBs	SW846/CLP	III/IV	
Geologic				
Lithology	Geologic log	SOP	I	SC, EA, ED
Soil/sediment type	Soil/sediment classification	SOP	I	SC, EA, ED
Physical properties	Porosity	ASTM	III	SC, EA, ED
	Bulk density	ASTM	III	SC, EA, ED
	Particle size distribution	ASTM	III	SC, EA, ED
	Moisture content	ASTM	III	SC, EA, ED
	Permeability	ASTM	III	SC, EA, ED, RA
Geochemical properties	Cation exchange capacity	MOSA	III	SC, EA, ED
	Total organic carbon	MOSA	III	SC, EA, ED
	pH	SOP	III	SC, EA, ED
	XRF analysis of basalt			
	$CaCO_3$ content			

Table 21. Data Collection Types, Measurements and Required Analytical Levels for the 100-NR-3 Operable Unit. (sheet 2 of 2).

Data Types	Measurements	Analytical Method	Required Analytical Level	Data Use
Biota				
Literature review				
	Biota uptake of radionuclides and inorganics	N/A	I	SC, EA, ED, AC
	Presence of critical habitats	N/A	I	AC
Cultural Resources				
Literature search	Location of surficial archaeological sites	N/A	N/A	AC
Field survey	Presence of historic or archaeological sites that may be eligible for the National Register of Historic Places	N/A	N/A	AC

EEI = Environmental Investingation Instruction
OHP = Operational Health Physics Procedures
SOP = Standard operating procedures
CLP = Contract laboratory program
LAP = Laboratory analytical protocol
N/A = Not applicable
ASTM = American Society of Testing and Materials
SC = Site characterization
EA = Evaluation of alternatives
ED = Engineering design
RA = Risk assessment
WS = Worker safety
AC = Address CAR
SW846 = EPA 1986c

set up in the QAPP (Attachment 1b) before it can be considered usable. The QA/QC parameters include laboratory precision and accuracy, method blanks, instrument calibration, and holding times.

The usability of field data must be assessed by a trained and qualified person. Senior technical reviews will be conducted periodically throughout the project.

Consistent data management procedures are also necessary for validated data. Data management includes proper documentation of field activities, sample management and tracking, and document and inventory control. Specific procedures are discussed in the data management plan (Attachment 4).

4.2.4 Data Quantity Needs

The number of samples that need to be collected during an RFI/CMS can be determined by using several approaches. In instances where data are lacking or are limited, a phased sampling approach may be useful. In the absence of available data, an approach or rationale will need to be developed to justify the sampling locations and the numbers of samples selected. In situations where data are available, statistical techniques may be useful in determining the number of additional data required.

4.2.5 Sampling and Analyses Options

The resources available for performing a RCRA facility investigation need to be evaluated during RFI/CMS planning. Data collection activities can then be structured to obtain the needed data in a cost-effective manner. Developing a sampling and analysis approach which ensures that appropriate data quality and quantity are obtained with the resources available may be accomplished by using a phased RFI approach and field screening techniques.

The RFI/CMS for the 100-NR-3 operable unit will take advantage of both approaches. Additional scoping studies conducted either prior to or in conjunction with the RFI Phase I activities, followed by a more detailed RFI Phase II, will provide for a comprehensive characterization of the site in a cost-effective manner.

Another important aspect of planning the data collection program is determination of the quantity of high level analytical data required to support RFI/CMS objectives. In order to obtain needed data in a cost-effective manner, and still support RFI/CMS

objectives, a combination of lower level analytical data (Levels I, II, and III) and higher level analytical data (Levels IV and V) will be collected. The initial round of source samples will be analyzed by CLP procedures. Subsequently, samples will be analyzed for a short list of analytes, depending upon the results of the initial analyses. Appropriate QC procedures will be used to support analytical data, including data validation procedures where necessary.

4.2.6 PARCC Parameters

Precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters are indicators of data quality. Ideally, the end use of the data collected should define the necessary PARCC parameters. Once the PARCC requirements have been identified, then appropriate analytical methods can be chosen to meet established goals and requirements. A complete discussion of the PARCC requirements for the RFI Phase I appears in the QAPP.

4.3 DATA COLLECTION PROGRAM

Conducting an RFI in phases is a common method for optimizing the quantity and quality of the data collected. It would be very inefficient and overly expensive to specify beforehand all the types of samples and analyses that will yield the most complete and accurate understanding of the contamination and physical behavior of the site. Data adequate to achieve RFI/CMS goals and objectives are obtained at a lower cost by using the information obtained in each step to focus the investigation in succeeding steps. Phased investigations are encouraged by EPA's current RI/FS guidance document, which was used in developing this work plan (EPA 1988a).

The first phase of the RFI for the 100-NR-3 operable unit will continue the gathering and analysis of existing information and collect new data believed necessary to confirm and refine the conceptual model. Subsequent phases may be needed to further reduce uncertainty, to fill in remaining data gaps, to collect more detailed information for certain points where such information is required, and to conduct any needed treatability studies. The need for subsequent investigation phases will be assessed early in the RFI Phase I investigation and as data become available.

4.3.1 General Rationale

The general rationale for undertaking an RFI of the operable unit is to develop needed data that is not available. Because of the size of the operable unit, the complexity of past operations, and the number of releases and waste management

units, a large amount of new information will be required. A fairly large amount of relevant information is already available, but has not been fully evaluated.

The following general rationale and corresponding technical work plan approach or strategy will be used to evaluate existing data and to collect additional data for the 100-NR-3 operable unit:

- Existing data will be used to the maximum extent possible. Although existing data may not be validated to current standards, the data are still useful in developing the site model and helping to focus and guide the investigations.

- Additional validated data will be collected to obtain the maximum amount of useful information for the amount of time and resources invested in the investigation.

- Data will be collected, as needed, to support the intended data uses identified in Section 4.2.1.

- Nonintrusive sampling (e.g., geophysical testing, radiological surveys, soil gas monitoring will be conducted early in the RFI Phase I to identify necessary interim response actions.

- Phase I data will be collected to confirm and refine the conceptual model, refine the analyte list for any subsequent investigations, and provide information to conduct a short-term risk assessment.

- The RFI Phase II for the 100-NR-3 operable unit will support long-term risk assessments for final cleanup actions.

- Investigations for the 100-NR-3 and 100-NR-1 operable units will be coordinated to reduce overall costs and maximize the usefulness of data obtained.

- Field investigation techniques will be used to minimize the amount of hazardous waste generated; however, any waste generated will be contained in drums in accordance with "Interim Control of Unknown Suspected Hazardous and Mixed Waste," EII 4.2 (WHC 1989d). Drums will be designated according to the parameters of interest.

4.3.2 General Strategy

The objective of the RFI is to gather additional information to support a baseline risk assessment and CMS. The

9 1 1 3 3 7 0 8 3 3

general approach or strategy for obtaining additional information is presented below.

4.3.2.1 Operable Unit Investigation Strategy. Several strategies have been developed and will be used during data collection activities at 100-NR-3 operable unit.

- Locations and types of sources that exist in 100-NR-3 will be identified and evaluated as possible contributors to groundwater contamination in the 100-NR-1 operable unit.

- All proposed groundwater investigations for the 100-N Area will be conducted as part of the 100-NR-1 RFI.

- The 100-NR-1 operable unit groundwater investigation will begin at the same time as the 100-NR-3 operable unit investigation. By designing two investigations in an integrated manner, costs of information obtained will be reduced, and value of the information will be increased.

- Riverbank seeps, soils, sediments, and aquatic biota investigations will be coordinated with groundwater investigations to provide information on contaminant movement and fate. These investigations will be conducted as part of the 100-NR-1 RFI.

- All similar field work for the 100-NR-3 and the 100-NR-1 operable units will, to the maximum extent possible, be conducted at the same time.

4.3.2.2 Source Grouping and Unit Investigation Strategy. In order to focus the Phase I RFI on the stated goals, performance of the short-term risk assesment and design the Phase II investigation, potential source units have been prioritized and assigned numerical rankings. The rankings are based on the apparent probability of having released dangerous or radioactive wastes to the environment and specifically, whether these releases have resulted in dangerous or radioactive materials at the surface or in the groundwater or river.

Both source groupings and source units have been assigned numerical values from "1" to "3", with "1" being the most serious and "3" being the least serious. These numerical ratings are discussed below:

1. Source locations were given a ranking of "1" where documented releases of dangerous or radioactive wastes to soil, groundwater, or surface water occurred. Characterization of source by soil or sediment sampling is indicated as part of the 100-NR-3 RFI. In addition,

field sampling to determine extent of groundwater and/or surface water contamination will be conducted as part of the 100-NR-1 RFI.

2. Source locations were given a "2" ranking where documented or potential release of dangerous or radioactive wastes to soil have occurred. Characterization of the source by soil or sediment verification sampling is indicated.

3. Potential source locations were given a "3" ranking where no documented releases to environmental media have occurred. Current information indicates that no imminent hazard exists at these units. The Phase I characterization will consist of nonintrusive methods only.

Table 22 shows the source groupings, sources and their associated ranking. Evidence of discharge associated with each unit and constituents in the release(s) are also presented. It should be noted that results of Phase I activities may alter the rankings of the sources, prioritizing some and showing that others are not contaminated.

Other strategies developed for the source unit and grouping investigations are discussed below:

- Analytical parameter selection will be based on verifying overall conditions and then narrowed to specific contaminants of concern. Periodic analyses of A full list of chemical parameters will be conducted to verify that the list of contaminants of concern has not changed.

- A minimum of dangerous and radioactive wastes will be generated during the field investigation. Any waste generated will be contained in drums in accordance with "Interim Control of Unknown Waste," EII 4.2 (WHC 1989d).

4.3.3 Investigation Methodology

The initial phase of the RFI will include the following integrated tasks:

- Source investigation

- Geological investigation

- Surface water and sediment investigation (100-NR-1 RFI)

- Vadose investigation

Table 22. Source Ranking and Rationale. (sheet 1 of 3).

Source	Work Plan Section	Ranking	Evidence of Discharge	Constituents
100-NR-3				
Grouping 1	**3.1.1.1**	**3**		
HGP Burn Pit	3.1.1.1.1	3	No evidence of release.	Nonhazardous solids
Grass Dump	3.1.1.1.2	3	No evidence of release.	Nonhazardous solids
Construction Debris Dump	3.1.1.1.3	3	No evidence of release.	Nonhazardous solids
Grouping 2	**3.1.1.2**	**2**		
124-N-2 Septic Tank	3.1.1.2.1	2	Discharge of sanitary sewage.	Sanitary sewage
182-N Tank Farm Overflow	3.1.1.2.2	3	No evidence of release.	Water
182-N Drain System - 2/6/87 UPR	3.1.1.2.3 3.1.1.2.4	3	No evidence of dangerous release.	Water, oil
Grouping 3	**3.1.1.3**	**2**		
Unloading Station French Drain (120-N-7) - UN-100-N-33 - 12/26/87 UPR	3.1.1.3.1	2	Systematic releases to french drain usually small (<1 gal); two documented unplanned releases with unknown remediation.	Sulfuric acid, sodium hydroxide
108-N Chemical Unloading Facility 108-N Neutralization Pit Sulfuric Acid Tank French Drains (120-N-6) - UN-100-N-15	3.1.1.3.1 3.1.1.3.1	2	Systematic releases to french drains and neutralization pit usually small (<1 gal).	Sulfuric acid, sodium hydroxide
Acid/Caustic Transfer Trench (120-N-5) - UN-100-N-34 - 8/7/87 UPR - 9/2/87 UPR - 11/9/87 UPR	3.1.1.3.2	2	Intermittent discharges; four documented unplanned releases with varied remediation.	Sulfuric acid, sodium hydroxide
Neutralization Pit and French Drain (120-N-3)	3.1.1.3.3	2	Systematic small releases to french drain.	Sulfuric acid, sodium hydroxide
163-N Day Tank French Drain (120-N-8)	3.1.1.3.4	2	Systematic small releases to french drain.	Sulfuric acid

Table 22. Source Ranking and Rationale. (sheet 2 of 3).

Source	Work Plan Section	Ranking	Evidence of Discharge	Constituents
100-NR-3, Grouping 3 (cont)				
Regeneration Waste Transport System - 6/14/86 UPR - 6/30/86 UPR	3.1.1.3.5	2	Two documented large unplanned releases to soil which were apparently cleaned up.	Acidic and caustic regeneration waste
124-N-1 Septic Tank	3.1.1.3.6	3	Releases of sanitary sewage.	Sanitary sewage
Grouping 4	**3.1.1.4**	**2**		
116-N-8 Mixed Waste Storage Area		2	No documented releases. Historical storage of wastes on nonpaved area indicates potential for spillage.	Unknown
Grouping 5	**3.1.1.5**	**2**		
184-N Power House Stack	3.1.1.5.1	2	Systematic releases to air.	Hydrocarbons, particulates, sulfur dioxide, nitrogen oxide, sulfur trioxide, carbon monoxide, and aldehydes
184-N Day Tank Area - UN-100-N-19 - UN-100-N-21 - UN-100-N-23 - 10/9/87 UPR	3.1.1.5.2	2	Several unplanned releases from day tank area; apparently cleaned up.	Diesel oil, No. 6 fuel oil
184-N Piping - UN-100-N-18 - UN-100-N-22 - 10/14/87 UPR - 4/26/89 UPR	3.1.1.5.3	2	Several unplanned releases of oil from transfer piping.	Diesel oil, No. 6 fuel oil
Grouping 6	**3.1.1.6**	**2**		
UN-100-N-6		2	Release to soil of irradiated decon wastewater. Cleaned up.	Various radionuclides, phosphoric acid, diethyliourea
Grouping 7	**3.1.1.7**	**3**		
120-N-4 Nonhazardous and Nonradioactive Storage Area	3.1.1.7.1	3	Current storage of non-radioactive chemicals. Previous radioactive waste storage area. No documented releases.	Non-radioactive chemicals
1716-N USTs	3.1.1.7.2	3	No documented releases.	Gasoline

Table 22. Source Ranking and Rationale. (sheet 3 of 3).

Source	Work Plan Section	Ranking	Evidence of Discharge	Constituents
Grouping 8	3.1.1.8	1		
120-N-1 Percolation Pond (1324-NA)	3.1.1.8.1	1	Documented releases of corrosives to soil and groundwater from 1977-1983.	Corrosive regeneration wastes
South Settling Pond	3.1.1.8.2	1	Documented releases of corrosives to soil and groundwater from 1977-1983.	Corrosive regeneration wastes
120-N-2 Surface Impoundment (1324-N)	3.1.1.8.3	2	Managed high volume of corrosive wastes. No documented releases.	Corrosive ion exchange column regeneration wastes
130-N-1 Filter Backwash Discharge Pond	3.1.1.8.4	2	No evidence of dangerous releases.	Non-hazardous filter backwash water
1143-N Paint Shop	3.1.1.8.5	3	No evidence of release.	Solvents, sandblasting grit, wastewater
Grouping 9	3.1.1.9	2		
124-N-5 Septic Tank	3.1.1.9.1	2	No evidence of release.	Sanitary sewage
124-N-6 Septic Tank	3.1.1.9.2	2	No evidence of release.	Sanitary sewage
124-N-7 Septic Tank	3.1.1.9.3	2	No evidence of release.	Sanitary sewage
124-N-8 Septic Tank	3.1.1.9.4	2	No evidence of release.	Sanitary sewage
Grouping 10	3.1.1.10	3		
N-17 Paint Shop		3	Release of oil to be remediated.	Oil, waste paint
Grouping 11	3.1.1.11	2		
124-N-9 Septic Tank		2	No evidence of release.	Sanitary sewage
Grouping 12	3.1.1.12	2		
124-N-10 Sewer System	3.1.1.12.1	2	No evidence of release.	Sanitary sewage
UN-100-N-11	3.1.1.12.2	3	Release of radioactive waste to soil was cleaned up, contaminated valve bonnet removed.	Unknown radionuclides

- Groundwater investigation (100-NR-1 RFI)
- Air investigation
- Ecological investigation
- Cultural resource investigation.

Each task is briefly outlined in the following sections; more detailed descriptions are contained in Section 5.0.

4.3.3.1 Source Investigation. The purpose of the source investigation for the 100-NR-3 operable unit is to characterize locations and types of sources that may have contributed radioactive or hazardous contaminants to the environment. Source sampling may be conducted at units or groupings where the available data indicates that dangerous or radioactive wastes may be present. In some cases, available data is complete enough that source sampling can be bypassed and media characterization will be conducted. Activities to be performed during the source investigation include the following:

- Compile and evaluate additional data for the purpose of: verifying locations and specifications of engineered facilities, pipelines, and other source units; waste stream characteristics; evaluating additional reports and raw data regarding radiological and hazardous substances monitoring; and integrating additional environmental modeling data into the 100-NR-3 conceptual site model.

- Conduct a concurrent geodetic and radiological survey of 100-NR-3 to verify location of units and accurately locate areas of surface and subsurface radiological contamination. This subtask will produce a surveyed base map to normalize all RFI/CMS activities to the 100-N grid coordinates. Conditions at specific sources will also be noted in order to plan sampling activities.

- Conduct nonintrusive geophysical techniques at specific groupings to verify locations and physical characteristics of subsurface source units, pipelines, and other relevant engineered structures; determine if drums or other solid objects are buried at burial grounds; and detect surface evidence of organic contamination. Specific techniques to be conducted include electromagnetic induction, magnetometer, ground-penetrating radar and soil-gas monitoring surveys. Data generated from these activities will be used in planning intrusive source sampling activities.

9 1 1 3 7 0 3 9

- Conduct surface and subsurface source sampling of contaminated soils and/or waste materials at selected locations, if necessary.

4.3.3.2 Geologic Investigation. A geologic investigation for the 100-NR-3 operable unit will be performed to determine physical and chemical properties of the subsurface regime that are relevant to understanding source/subsurface relationships in 100-NR-3. The majority of this task will involve data collected in field activities in the 100-NR-1 RFI which will then be evaluated regarding 100-NR-3 source units. The geologic investigation will include the following tasks:

- Compilation and review of additional existing and new data to further the understanding of geologic conditions at the 100-N Area.

- An area walkover to develop preliminary sitewide geologic and soil maps of the surficial sediments, evaluate access for drilling equipment, and locate surface utilities.

- Geologic data collected during field mapping and during the groundwater investigation conducted in the 100-NR-1 RFI Phase I (e.g., geologic and geophysical logs) will be evaluated to determine relevance to 100-NR-3 field activities.

4.3.3.3 Surface Water and Sediment Investigation. A surface water and sediment investigation will be conducted during the 100-NR-1 RFI. Although it is not expected that units in 100-NR-3 have impacted the river, any data that suggests 100-NR-3 input will be evaluated.

4.3.3.4 Vadose Investigation. The purpose of vadose zone investigations is to determine physical and chemical properties of the soil and to determine the extent of soil contamination associated with sources and source groupings. Field activities will be performed during source sampling. The vadose investigation will be partially integrated with the 100-NR-1 Phase I groundwater investigation. During monitoring well installation in 100-NR-3, vadose zone samples will be collected and radiation monitoring will be performed.

4.3.3.5 Groundwater Investigation. No field activities are to be conducted in this task. The ground water investigation will be conducted in the 100-NR-1 Phase I investigation. Groundwater data related to source units in 100-NR-3 will be evaluated and integrated in this task.

4.3.3.6 Air Investigation. The 100-NR-3 air investigation will consist of onsite particulate sampling as part of the health and safety program.

4.3.3.7 Ecological Investigation. The ecological investigation for the 100-NR-3 operable unit will consist of a review of biological data developed and evaluated at other areas on the Hanford Site, supplemented by a focused, onsite terrestrial biota survey. The objectives of this survey will be restricted to determining whether any critical habitat exists within the operable unit, refining the contaminant pathways model, and deciding whether sampling of biota is necessary or justified during later phases of the RFI.

4.3.3.8 Cultural Resource Investigation. A cultural resource investigation will be conducted at 100-NR-3 to verify the locations of known archaeological sites by reviewing data and conducting a field survey. The focus of the investigation will be to determine whether archaeological resources are present at proposed drilling sites.

4.3.4 Phase I Field Activities at 100-NR-3 Groupings

The field activities described above are discussed in more detail in Section 5.3. As discussed in Section 1.0, releases to groundwater, surface water, river sediments and aquatic biota from 100-NR-3 source units will be investigated in the Phase I RFI of 100-NR-1.

Table 23 illustrates field activities to be conducted at source unit groupings in the 100-NR-3 area. Air, ecological and cultural investigations at 100-NR-3 are not present in this table because they are not grouping- or source-specific during the Phase I RFI. Field activities of Phase I at groupings and source units are elaborated on in Section 5.3.

4.3.5 Data Evaluation and Decision Making

During the RFI Phase I for the 100-NR-3 operable unit, data will be evaluated as soon as they become available, for use in restructuring and focusing the RFI/CMS. Data reports will be developed that summarize and interpret new data. Data will be used to refine the conceptual model, further assess potential contaminant-specific CAR, develop the baseline risk assessment, begin development of the CMS, and complete the RFI report.

The objectives of data evaluation are to:

- Reduce and integrate data to ensure that data gaps are identified and that the goals and objectives of the RFI/CMS are met.

9 1 1 3 7 0 9 7 1

Table 23. Phase I RFI Field Activities at Operable Unit Groupings.

Grouping	Geodetic	Radiological	Geophysical	Sampling
1	X	X	X	
2	X	X	X	X
3	X	X	X	X
4	X	X	X	
5	X	X	X	X
6	X	X	X	X
7	X	X	X	
8	X	X	X	X
9	X	X	X	X
10	X	X	X	X
11	X	X	X	X
12	X	X	X	X

9 1 1 3 3 7 5 8 7 8

- Confirm that data are representative of the media sampled and that QA/QC criteria have been met.

Decisions to be made upon completion of the 100-NR-1 RFI Phase I investigations will be primarily to determine the needs for additional data collection, and to decide if an interim response action is necessary. Figure 44 illustrates the decision-making process that will be used during the RFI Phase I for source, soils and sediments, air, and biological sampling activities.

9 1 1 1 3 3 7 9 9 7 5

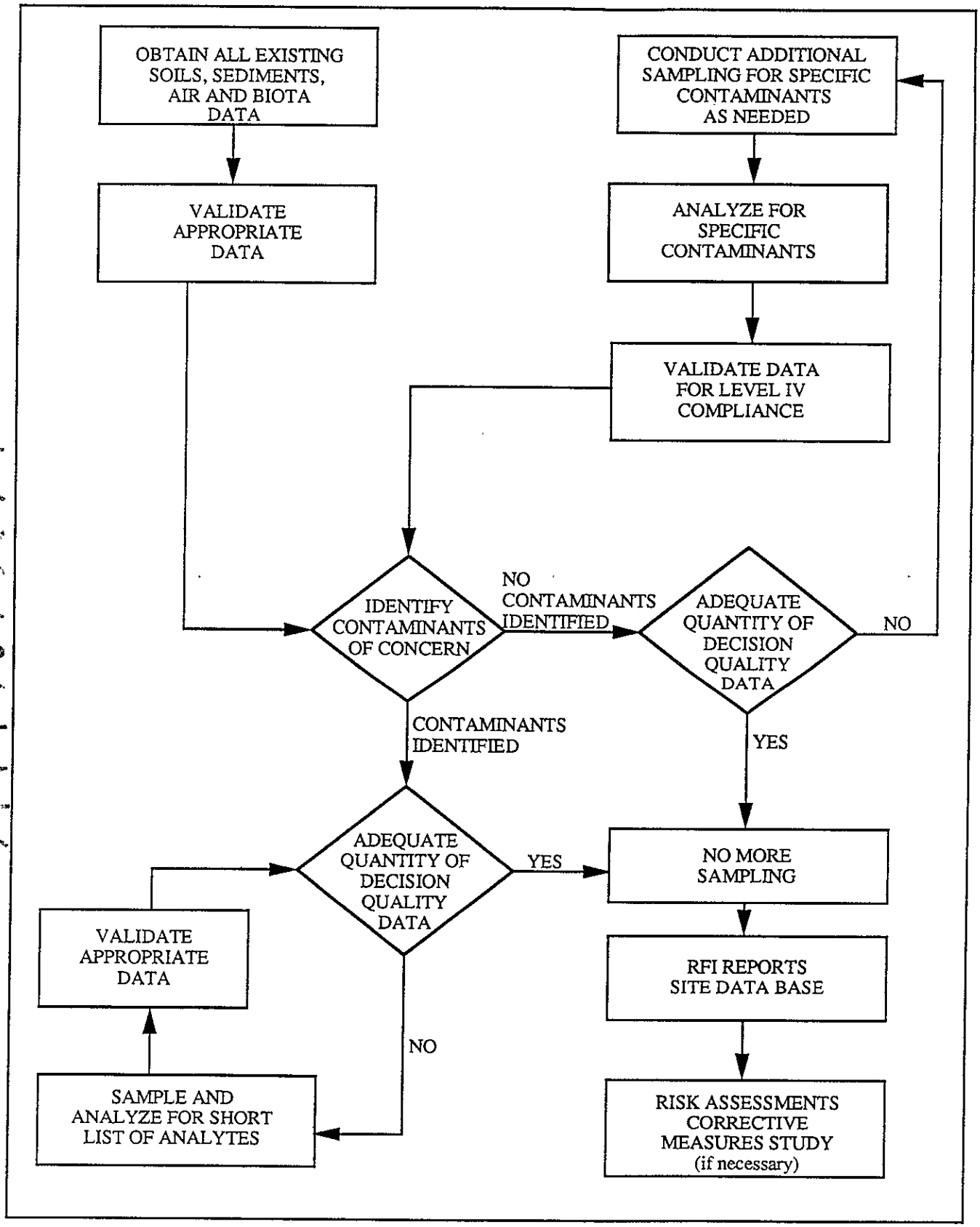


Figure 44. Decision Tree for RFI/CMS Soil, Sediment, Air and Biota Sampling

5.0 RCRA FACILITY INVESTIGATION/CORRECTIVE MEASURES TASKS

This section describes the various tasks to be implemented during the course of the project. The specified tasks are designed to provide information to meet the DQOs identified in Section 4.0.

Detailed information on field sampling is presented in the sampling and analysis plan (Attachment 1). Environmental monitoring requirements during the field investigations of 100-NR-3 are described in the health and safety plan (Attachment 2). The project management plan (Attachment 3) describes the organizational structure, responsibilities, and procedures for the overall management of the RFI/CMS. The data management plan (Attachment 4) describes procedures for data management. The community relations plan (Attachment 5) introduces the relationships between the Hanford Site and the community.

5.1 PROJECT MANAGEMENT

The objectives of project management during the performance of the 100-NR-3 RFI/CMS are to direct and document project activities to assure that data and evaluations generated meet the goals and objectives of the work plan, and to administer the project within budget and schedule. The initial project management activity will be to assign individuals to roles established in the project management plan. Specific activities that will occur throughout the RFI/CMS include:

- Project management
- Meetings
- Cost control
- Schedule control
- Data management
- Progress reports.

5.1.1 Project Management

Project management includes the day-to-day supervision of, and communication with, project staff and subcontractors.

Throughout the project, daily communications between office and field personnel will be maintained, along with periodic communications with subcontractors. This constant and continual exchange of information will be necessary to assess progress, to identify potential problems quickly enough to make necessary corrections, and to keep the project focused on the objectives, the schedule, and within the budget.

5.1.2 Meetings

Meetings will be held, as necessary, with members of the project staff, subcontractors, regulatory agencies, and other appropriate entities to communicate information, assess project status, and resolve problems.

A kickoff meeting will be held with designated project personnel, and project staff meetings should be held weekly. The 100-NR-3 operable unit project coordinators for this and other operable units will meet on a weekly basis to share information and to discuss progress and problems. The frequency of other meetings will be determined based on need and on schedules in the Hanford Federal Facility Agreement and Consent Order (Ecology et al. 1989).

5.1.3 Cost and Schedule Control

Project costs, including labor, other direct costs, and subcontractor expenses, will be tracked monthly. The budget for tracking activities will be computerized and will provide the basis for invoice preparation and review and for preparation of progress reports. Scheduled milestones will be tracked monthly for each task of each project phase. This will be done in conjunction with cost tracking.

5.1.4 Data Management

The project file for the 100-NR-3 operable unit will be kept organized, secured, and accessible to project personnel. All field reports, field logs, health and safety documents, QA/QC documents, laboratory data, memoranda, correspondence, and reports will be logged into the file upon receipt or transmittal. This task is also the mechanism for ensuring that data management procedures documented in the data management plan (Attachment 4) are carried out.

5.1.5 Progress Reports

Quarterly progress reports will be prepared, distributed to project personnel and entities (project and unit managers, coordinators, contractors, subcontractors, etc.), and entered into the 100-NR-3 operable unit project file. The reports will summarize the work completed, present data generated, and provide

evaluations of the data as they become available. Progress, anticipated problems and recommended solutions, upcoming activities, key personnel changes, status of deliverables, and budget and schedule information will be included in the reports.

5.2 INTERIM CORRECTIVE MEASURES

Interim corrective measures are actions initiated where a response to a release is appropriate prior to the completion of an RFI/CMS. As 100-N data become available and are evaluated, it should be compared to applicable health and environmental criteria to determine the need for interim corrective measures. There is also a continuing responsibility to identify and respond to emergency situations and to defuse priority situations that may warrant interim corrective measures. For these situations, the owner is required to institute the interim corrective measures process. A decision diagram illustrating the interim corrective measures process is shown in Figure 45.

The following will be included as health and environmental criteria:

- Maximum contaminant levels (MCLs) for drinking water
- State of Washington cleanup standards
- EPA risk-specific doses (RSD) for carcinogens
- EPA reference doses (RFD) for systemic toxicants.

Staff will continually review pertinent facts such as monitoring data about the source and nature of releases or potential threat of releases. To decide whether an interim measure is appropriate, both technical engineering judgment and an evaluation of potential threat to human health or the environment will be considered. The decision for an interim measure will be made on the immediacy and magnitude of the potential threat to human health or environment, the nature of appropriate corrective action, and the implications of deferring the corrective action until the RFI/CMS is completed.

When it is determined that interim corrective measures may be necessary, the Washington Department of Ecology will be notified. Implementation of any interim measures will be consistent with Ecology priorities and related to protection of human health and/or the environment.

5.2.1 Deciding On Interim Measures

In considering a release and potential threat to human health or the environment, consideration will be given to such

9 1 1 3 3 7 0 3 7 7

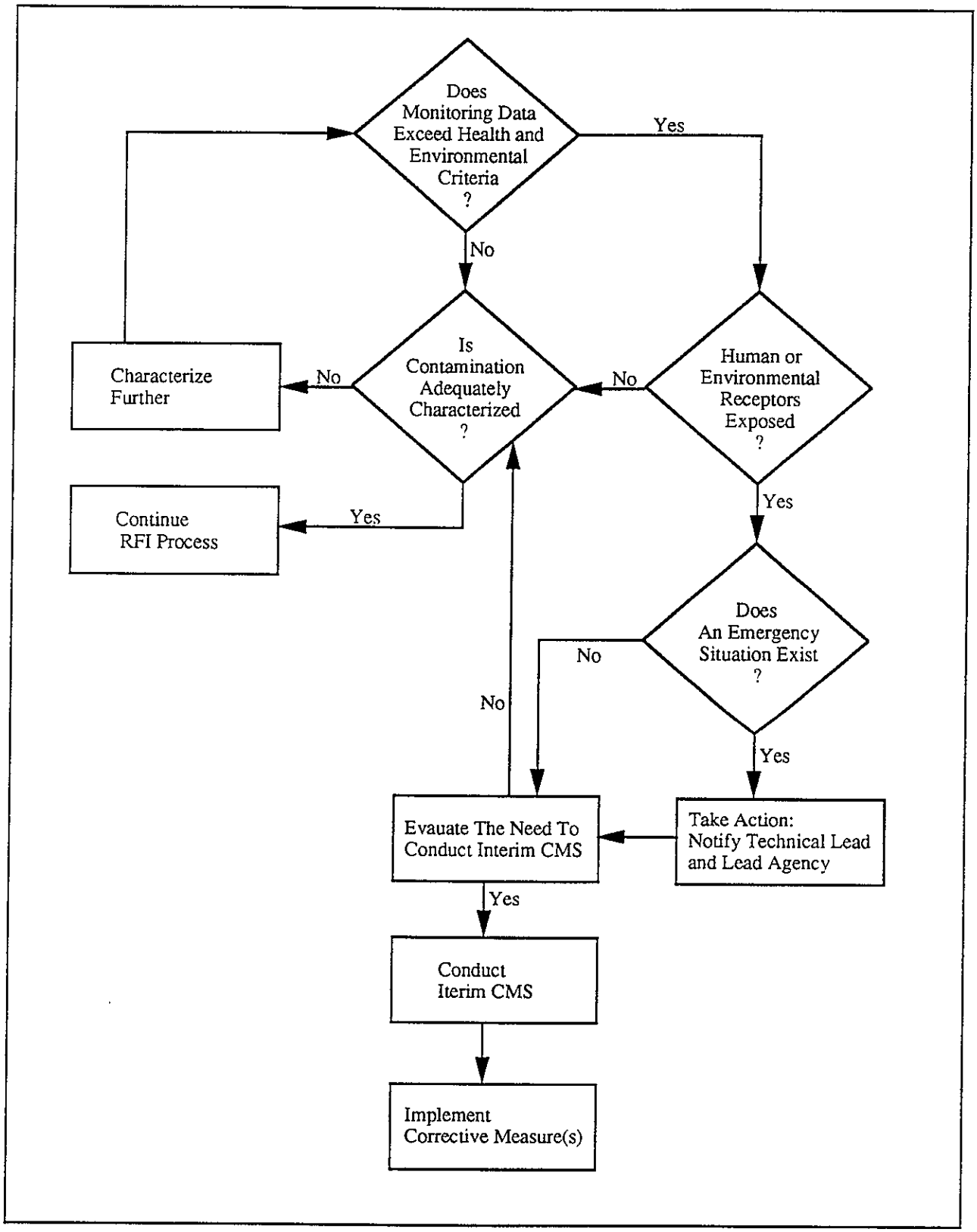


Figure 45. Interim Corrective Measures Process

factors as type of release, its scope and potential receptors. The following questions help in evaluating these factors.

A. Release Characterization

1. What is the source(s)? (Nature, size (area, depth), amount, location(s))

2. Regarding radioactive wastes or constituents at the source(s):

   a. What wastes (listed, characteristic radiologically surveyed) and constituents are present?

   b. At what concentrations or activities?

   c. What is the background level of each waste or constituent?

3. What are the known pathways through which the contamination is migrating or may migrate and the extent of contamination?

   a. By what media is it spreading or likely to spread? In what direction? At what rate?

   b. How far have the contaminants migrated? At what concentrations or activities?

   c. How mobile is the constituent?

   d. What are the estimated quantities and/or volumes released?

4. What is the projected fate and transport to the extent known?

B. Potential Human Exposure

1. What is or will be the exposure pathway(s) (e.g., air, groundwater, surface water, contact, ingestion)?

2. What are the location and demographics of populations potentially at risk from exposure (e.g., residential area, schools, drinking water supply, sole source aquifer near vital ecology or protected natural resource)?

3. What are the potential effects of human exposure (short and long-term)?

9 1 1 3 7 5 6 7 9

4. Has human exposure actually occurred? When may human exposure occur?

   a. What kind (e.g., inhalation, ingestion, skin contact)?

   b. Are there reports of illness, injury, death?

   c. May people be affected?

   d. What are the characteristics of the exposed population(s) (how many, infants, nursing home residents)?

5. If response is delayed, how will the situation change?

C. Potential Environmental Exposure and Threats

1. What media have been and may be contaminated (e.g., groundwater, air, surface water)?

2. What are the likely short-term and long-term threats and effects on the environment of the released waste or constituent?

3. What natural resource and environmental effects have occurred or are possible (terrestrial; aquatic organisms; aquifers whether or not used for drinking water purposes)?

4. What are the known or projected ecological effects?

5. When is this threat likely to materialize (days, weeks, months)?

6. What are the projected long-term effects?

7. If response is delayed, how will the situation change?

D. Notifications

If the answers to these questions indicate that there is an imminent threat to human health or the environment, or that an interim measure may prevent further significant environmental damage, then the appropriate Technical Lead should notify the Project Manager, who should notify the Washington Department of Ecology.

5.2.2 Selection of Interim Measures

Once a decision is made that interim measures are appropriate, then the next decision is what interim measures are required for the particular situation. Examples of interim measures for various unit and release types are listed below.

Containers

1. Overpack/Re-drum
2. Construct Storage Area/Move to Storage Area
3. Segregation
4. Sampling and Analysis
5. Treatment, Storage and/or Disposal
6. Temporary Cover

Tanks

1. Overflow/Secondary Containment
2. Leak Detection/Repair/Partial or Complete Removal

Surface Impoundments

1. Reduce Head
2. Remove Free Liquids and Highly Mobile Wastes
3. Stabilize/Repair Side Walls, Dikes or Liner(s)
4. Temporary Cover
5. Run-off/Run-on Control (Diversion or Collection Devices)
6. Sample and Analysis to Document the Concentration of Constituents Left in Place When a Surface Impoundment Handling Characteristic Wastes is Clean Closed.
7. Interim Groundwater Measures (See Groundwater Section)

Landfill or Burial Grounds

1. Run-off/Run-on Control (Diversion or Collection Devices)
2. Reduce Head on Liner and/or in Leachate Collection System
3. Inspect Leachate Collection/Removal System or French Drain
4. Repair Leachate Collection/Removal System or French Drain
5. Temporary Cap
6. Waste Removal (See Soils Section)
7. Interim Groundwater Measures (See Groundwater Section)

Waste Pile

1. Run-off/Run-on Control (Diversion or Collection Devices)
2. Temporary Cover
3. Waste Removal (See Soils Section)
4. Interim Groundwater Measures (See Groundwater Section)

Soils

1. Sampling/Analysis/Disposal
2. Run-off/Run-on Control (Diversion or Collection Devices)
3. Temporary Cap/Cover
4. Removal

Groundwater

1. Delineation/Verification of Gross Contamination
2. Sampling and Analysis
3. Interceptor Trench/Sump/Subsurface Drain
4. Pump and Treat/In-situ Treatment
5. Temporary Cap/Cover

Surface Water Release (Point and Nonpoint)

1. Overflow/Underflow Dams
2. Filter Fences
3. Run-off/Run-on Control (Diversion or Collection Devices)
4. Regrading/Revegetation
5. Sample and Analyze Surface Waters and Sediments or Point Source Discharges
6. Restrict Access

Gas Migration Control

1. Barriers/Collection/Treatment/Monitoring

Particulate Emissions

1. Truck Wash (Decontamination Unit)
2. Re-vegetation
3. Application of Dust Suppressant

Other Types of Actions

1. Fencing to Prevent Direct Contact
2. Extend contamination Studies to Offsite Areas if Permission is obtained as Required Under Section 3004(v)
3. Alternate Water Supply to Replace Contaminated Drinking Water
4. Temporary Relocation of Exposed Population
5. Temporary or Permanent Injunction
6. Suspend or Revoke Authorization to Operate Under Interim Status

The decision to apply interim corrective measures may involve estimates of the rate of release migration and an assessment of potential human or environmental receptors. Estimates of the rate of release migration will generally be based on simple calculations, analytical models, or well-understood numerical models. For example, the rate of contaminant migration in groundwater is likely to be based on time of travel calculations or other simple methods for estimating migration rate. Additional information on determining media-specific migration and the characterization of exposed populations is provided in the Superfund Public Health Evaluation Manual (EPA 1986a) and the Draft Superfund Exposure Assessment Manual (EPA 1988c). In addition, information describing data requirements for exposure related measurements is published in Risk Assessment Guidance for Superfund, Vols. 1 and 2 (EPA 1989b and c). The EPA interim final RFI guidance document (EPA 1989a) also provided additional information concerning RFI requirements.

As discussed above, the determination of the type and magnitude of the potential hazard posed by most contaminant releases will be accomplished as part of the assessment, including the comparison of projected or actual exposure concentrations to human health and/or the environment.

5.3 RFI PHASE I: OPERABLE UNIT CHARACTERIZATION

Sections 2.0 and 3.0 provide discussions about the current knowledge of the environmental characteristics and distributions of contaminants in the 100-NR-3 operable unit. These discussions provide the basis for identifying additional data needed to evaluate hazards associated with the 100-NR-3 operable unit and to design and implement remedial and corrective actions. Section 4.0 presented these needs in the form of 12 specific tasks. These tasks are discussed individually in this section. The data needed, techniques for collecting the data, and data uses are presented.

A ranking system for source units and groupings is also presented in Section 4.0. The ranking system categorizes the units by the activities to be conducted during the Phase I investigation. Table 22 lists the rankings of source-unit groupings. Table 23 shows which of the Phase I tasks will be performed in each grouping. Specific activities at source units within the groupings are described in the sections for the Phase I tasks.

5.3.1 Task 1 - Project Management

This task is necessary to meet the goals and objectives of the RFI/CMS, and it is discussed in Section 5.1 and Attachment 3, project management plan (PMP).

5.3.2 Task 2 - Source Characterization

The purpose of the Phase I RFI source characterization is to (1) determine exact locations for the source units, (2) conduct document reviews, surveys and sampling of source units to verify the presence of dangerous, radioactive or mixed-waste contamination, and (3) collect surface-media information for determination in the baseline risk assessment if an imminent hazard is present at the unit. This will be accomplished by conducting six subtasks:

- Subtask 2a - Data Compilation and Review
- Subtask 2b - Nonintrusive Field Investigations
- Subtask 2c - Source Sampling
- Subtask 2d - Laboratory Analysis
- Subtask 2e - Data Evaluation.

5.3.2.1 Subtask 2a - Data Compilation and Review. An extensive literature review concerning 100-N contaminant sources was conducted during development of this work plan. This comprehensive review has reduced much of the data compilation effort specified in work plans for other operable units at the Hanford Site.

Types of data to be collected include:

- Current reports of ongoing Hanford monitoring programs, such as radiological surveys, groundwater monitoring, ecological monitoring
- Activities and results of other RFI/CMS and RI/FS programs, especially for coordination with activities at 100-NR-1, 100-KR-4, and 100-HR-3

- Construction and engineering drawings to help determine the location and purposes of buried sewer lines, septic tanks and pipelines.

5.3.2.2 Subtask 2b - Nonintrusive Field Investigations. Prior to sampling activities, nonintrusive investigations will be implemented. These include site geodetic, radiological verification and geophysical surveys. The data from these investigations may be used to modify further site investigations.

5.3.2.2.1 Site Geodetic and Radiological Verification Surveys. Maps currently available for the 100-N Area are contradictory in some locations. Additionally, close physical inspection of the site is required to select and justify locations of specific activities. A survey of the site will be conducted to:

- verify location of all source units with regard to both topographic map and 100-N coordinates

- update and verify topography on topographic maps and resolve with 100-N coordinates.

These activities will be done to prepare a base topographic map overlaid by the 100-N grid. All source units, structures and monitoring wells will be correctly located on this map. All future sampling, well locations, or any other activities will be surveyed and located on this map. The N-grid system will therefore be the matrix on which all RFI activities will be located.

In conjunction with the geodetic verification survey, a radiological survey of the 100-N Area will be performed to accurately locate areas of surface and potential subsurface contamination. This survey will be performed in accordance with procedures set forth in the Health Physics Procedures Manual (WHC 1990b).

5.3.2.2.1.1 Map Construction. A topographical base will be developed at a scale that will allow the precision to show elevation contours at 2 ft intervals, at a scale of 1:2000. The map will identify the types and areal extent of surficial deposits within the operable unit, include dune and sheet sand, alluvium, colluvium and loess, as well as backfill and fly ash materials. The mapping will include the large areas of artificial backfill and unnatural features. The 100-N grid coordinates will be the primary reference grid with the Hanford Site grid referenced.

The map will be constructed to allow overlays of individual investigation or sampling regimes.

5.3.2.2.1.2 Radiological Survey. A radiological survey of the 100-N Area will be performed in conjunction with the geodetic verification survey. This survey will be performed in accordance with the Health Physics Procedures Manual (WHC 1990c). The results of this survey shall be plotted on grid map of the 100-N Area to be constructed in Section 5.3.2.2.1.1 - Map Construction, and used during data evaluation of the 100-N Area.

5.3.2.2.1.3 Data Evaluation. The geodetic and radiological data acquired during these activities will be assembled to generate interpretations of sources listed in Section 3.1.1 of this work plan.

This evaluation will serve as the basis for further nonintrusive testing as described in this subtask.

5.3.2.2.2 Geophysical Surveys

5.3.2.2.2.1 Electromagnetic Induction/Magnetometer Surveys. The electromagnetic induction (EMI)/magnetometer (MAG) surveys will consist of two activities:

- electromagnetic induction survey
- magnetometer survey.

The electromagnetic induction (EMI) survey measures the electrical conductivity of subsurface materials. Variations in conductivity maybe caused by changes in soil moisture content, the presence of ionic species or the presence of metallic objects below the surface. Filtering of the EMI signal allows screening of the EMI readout to remove or account for most above-ground interferences which tend to mimic subsurface features. The EMI Survey will be used to screen large areas for possible contamination or metallic objects below the surface. Areas identified as potentially contaminated will be marked for further investigation during Phase III.

Magnetometer (MAG) surveys are designed to detect ferro-nickel metallic objects beneath the surface. MAG surveys are used in conjunction with EMI surveys to add further definition to buried objects located during initial surveys; e.g., septic tank drain fields will often show up in an EMI survey but, be absent in a MAG survey. Buried aluminum or other nonferrous materials can also be determined by comparing the results of both surveys. Screening surveys using both EMI and MAG techniques are cost-effective methods for reducing and defining areas for further investigation.

5.3.2.2.2.2. Ground-Penetrating Radar Survey. Ground-penetrating radar is an effective tool for detecting subsurface irregularities such as buried objects. The ground penetrating

radar survey will be conducted on grids established for the EMI and MAG surveys to confirm and detect the following types of facilities:

- septic tanks and drain fields
- piping systems
- burial sites
- buried drums or objects.

This information combined with the EMI and MAG Surveys will be used to identify areas for additional investigation during source sampling.

5.3.2.2.3 Soil Gas Survey. A soil gas survey will be conducted in areas of the operable unit grids where petroleum products or solvents have been used, stored or released to the environment through unplanned releases. The area of coverage will include any associated areas where these products have flowed through either underground or above-ground piping systems. The survey will test for both halogenated and nonhalogenated volatile organic compounds. The extent of contamination will be determined by installing additional probes until no detectable contamination is found in two adjacent probes bonding the area.

Areas of contamination detected during the soil gas survey will be logged on the operational survey grid for sampling as required to determine the vertical extent of the contamination.

5.3.2.2.4 Data Evaluation. The nonintrusive data acquired in this subtask will be assembled to generate operable unit interpretations. These data will be evaluated to determine the location and condition of known and additional source units, and provide current baseline environmental conditions at units to be characterized. The data will also be used to assess the planned source sampling locations.

5.3.2.3 Subtask 2c - Source Sampling. Source sampling will be conducted to determine the types and concentrations of dangerous and radiological constituents managed or contained at the various source units in 100-NR-3. The purpose of source sampling is only to verify the existence and concentration of potential contaminants, not to determine the extent of contamination. Therefore, a minimum number of samples will be collected. Additional samples may need to be collected to statistically characterize the extent of contamination from those sources indicating the presence of contamination. This further characterization will be conducted either as part of the Task 5 - Vadose Zone Investigation, or the RFI Phase II: Treatability Investigation.

Discussed below are the sample types and methodologies as well as the anticipated sampling program to be conducted at the various source units. The results of the above subtasks, 2a-Data Compilation and Review and 2b-Nonintrusive Field Investigation, will be used to further develop and refine the source sampling program. The results of subtasks 2a and 2b will be documented and information pertinent to source sampling (e.g., revised sampling locations) will be made available to field personnel. If warranted, a revised field sampling plan will be prepared.

5.3.2.3.1 Sample Types and Methods. A variety of sample types and sampling methods will be used in the source sampling program. These are briefly discussed below. Attachment 1 - sampling and analysis plan provides more detail on the specific sampling methodologies.

5.3.2.3.1.1 Physical Sample Types. Liquid, sludge, and/or soil samples may be collected dependent upon the nature of the source units. Each of these media have specific field and analytical procedures associated with them. These are discussed in Attachment 1 - sampling and analysis plan.

If the nature of the source unit does not warrant sampling of its contents, the soil near the unit will be sampled at or below the surface. Where releases to the soil have occurred, the area of the release will be considered the source area, and will be sampled. If a spill is known to have been cleaned up, soil will be collected from below the replacement fill area to determine if any contaminants remain in the soil.

Based upon the results of the nonintrusive field investigation, further subsurface soil sampling may be necessary. In addition, the field team leader may determine that further sampling is necessary based on conditions observed in the field or high field instrument readings.

All sampling methods will be in accordance with the appropriate Environmental investigations instructions (EII) outlined in Attachment 1 - sampling and analysis plan.

5.3.2.3.1.2 Sample Handling. All sample handling procedures are outlined in Attachment 1 - sampling and analysis plan. Established protocol for sample collection, preservation, field measurements, chain of custody, transportation, and decontamination will be followed as described in accepted Westinghouse EII (WHC 1989d).

5.3.2.3.2 Sampling of Specific Sources at 100-NR-3. Table 24 presents the source sampling to be conducted at each source unit within 100-NR-3. Section 3.1.1 provides known background information in each of these units. This information was used to determine the source sampling locations. Subtasks 2a

Table 24. Source Sampling at 100-NR-3. (sheet 1 of 3).

Designation Number	Alias/ Location	Work Plan Section	Contents	Sample Type and Number: Surface Soil	Sample Type and Number: Subsurface Soil	Comments
---	HGP Burn Pit	3.1.1.1.1				No samples planned. Non-intrusive investigation will address these sources.
---	Grass Dump	3.1.1.1.2				
---	Construction Debris Dump	3.1.1.1.3				
124-N-2	Septic Tank	3.1.1.2.1	1			Contents of septic tank only.
---	184-N Overflow	3.1.1.2.2				No samples planned.
---	182-N Drain Outfall	3.1.1.2.3				
---	September 1986 UPR	3.1.1.2.4				
---	108-N Chemical Unloading Facility	3.1.1.3.1				Contents of french drains will be sampled. Surface and subsurface samples will be collected at areas of unplanned releases.
120-N-7	Unloading Station French Drain		1			
UN-100-N-33	UPR			1	1	
---	December 26, 1987 UPR			1	1	
---	108-N Neutralization Pit	3.1.1.3.1	1			Contents of neutralization pit and french drains will be sampled. Surface and subsurface samples will be collected in the area of the unplanned release.
120-N-6	Sulfuric Acid Tank French Drains		5			
UN-100-N-15	UPR			1	1	
120-N-5	Neutralization Unit and French Drains	3.1.1.3.2	2			Content samples from the containment vaults. Surface and subsurface soil samples at areas of unplanned releases.
UN-100-N-34	UPR			1	1	
---	August 7, 1987 UPR			1	1	
---	September 2, 1987 UPR			1	1	
---	November 9, 1987 UPR			1	1	
120-N-3	163-N Neutralization Pit and French Drain	3.1.1.3.3	1			Content samples of the french drain.
120-N-8	163-N Sulfuric Acid Day Tank Vent French Drain	3.1.1.3.4	1			Content samples from the french drain.

Table 24. Source Sampling at 100-NR-3. (sheet 2 of 3).

Designation Number	Alias/ Location	Work Plan Section	Contents	Sample Type and Number: Surface Soil	Sample Type and Number: Subsurface Soil	Comments
---	Regeneration Waste Transport System	3.1.1.3.5	1			Content samples from sump. Surface and subsurface samples from locations of unplanned releases.
---	June 14, 1986 UPR			1	1	
---	June 30, 1986 UPR			1	1	
124-N-1	Septic Tank	3.1.1.3.6	1			Content sample from septic tank.
116-N-8	Mixed Waste Storage Pad	3.1.1.4				No source samples planned. Nonintrusive investigation will address this source.
---	184-N Plant Service Power House	3.1.1.5.1				No source sampling planned.
---	184-N Day Tanks	3.1.1.5.2				Two surface and subsurface soil samples from within day tank containment area.
UN-100-N-19	UPR			1	1	
UN-100-N-21	UPR			1	1	
---	September 9, 1987 UPR					
---	166-N to 184-N Piping	3.1.1.5.3				Surface and subsurface soil samples from locations of unplanned releases.
UN-100-N-18	UPR			1	1	
UN-100-N-22	UPR			1	1	
UN-100-N-23	UPR			1	1	
---	October 14, 1987 UPR			1	1	
---	April 26, 1989 UPR			1	1	
UN-100-N-6	UPR	3.1.1.6		1	1	Surface and subsurface soil sample from location of unplanned release.
120-N-4	Nonhazardous Nonradioactive Storage Pad	3.1.1.7.1				No source sampling planned. Nonintrusive investigation will address this source unit.
---	1716-N Service Station USTs	3.1.1.7.2				No source sampling planned. Nonintrusive investigation will address this source unit.

Table 24. Source Sampling at 100-NR-3. (sheet 3 of 3).

Designation Number	Alias/ Location	Work Plan Section	Contents	Sample Type and Number: Surface Soil	Sample Type and Number: Subsurface Soil	Comments
120-N-1	1324-NA	3.1.1.8.1				No source samples planned. Nonintrusive, vadose zone, and groundwater investigations will address this unit.
---	South Settling Pond	3.1.1.8.2				No source samples planned. Nonintrusive, vadose zone, and groundwater investigations will address this unit.
120-N-2	1324-N	3.1.1.8.3				No source samples planned. Nonintrusive, vadose zone, and groundwater investigations will address this unit.
130-N-1	Filter Backwash Pond	3.1.1.8.4	1	1		One liquid and one sediment sample from this source unit.
---	1143-N Paint Shop	3.1.1.8.5				No source samples planned. Nonintrusive investigations will address this source unit.
124-N-5	1117-N Septic Tank	3.1.1.9.1	1			Content sample from septic tank.
124-N-6	1113-N Septic Tank	3.1.1.9.2	1			Content sample from septic tank.
124-N-7	1115-N Septic Tank	3.1.1.9.3	1			Content sample from septic tank.
124-N-8	1134-N Septic Tank	3.1.1.9.4	1			Content sample from septic tank.
---	N-17 Paint Shop	3.1.1.10		1	1	Surface and subsurface soil sample in area of compressor leak.
124-N-9	1120-N Septic Tank	3.1.1.11	1			Content sample from septic tank.
124-N-10	100-N Sewer System	3.1.1.12.1	3			Content samples from each lagoon.
UN-100-N-11	UPR	3.1.1.12.2				No source sample planned. Nonintrusive investigation will address this unit.

(Data Review and Evaluation) and 2b (Nonintrusive Field Investigations) results may affect the number and location of source samples.

5.3.2.3.2.1 Outer Refuse Area Grouping. No source samples are planned for this area. The nonintrusive investigation will address these units.

5.3.2.3.2.2 182-N High Lift Pumphouse Grouping. The contents of the 124-N-2 Septic Tank will be sampled with a ponar grab sampler or similar device. Access to the septic tank will be determined in the field.

The other sources within the 182-N High Lift Pumphouse Grouping will not be sampled. These sources will be addressed in the nonintrusive and surface water investigations.

5.3.2.3.2.3 Acid/Caustic Storage and Transport System Grouping. The contents of the 120-N-7 Unloading Station French Drain will be sampled with a ponar grab sampler or similar device. In addition, two surface and subsurface samples will be collected in the unloading area where two documented unplanned releases (UN-100-N-33 and December 26, 1987) occurred. Sample locations will be determined in the field based upon data review and evaluation. The subsurface samples will be collected from a depth of 4 ft with a sampling scoop after excavation with a backhoe.

A sample will be collected from the contents of the 108-N Neutralization Pit. The contents may either be standing liquid or sludges remaining in the bottom of the pit. A sample will be collected of the contents of each of the five 120-N-6 Sulfuric Acid Tank French Drains. A ponar grab sampler or similar device will be used for the pit and the french drains. In addition, surface and subsurface samples will be collected in the area of the March 20, 1981, unplanned release (UN-100-N-15). The area of the spill was between the 108-N Building and the sulfuric acid tank. The specific sample location will be determined in the field based on data review and evaluation. The subsurface sample will be collected from a depth of 4 ft with a sampling scoop after excavation with a backhoe.

Two contents samples will be collected from the 120-N-5 Neutralization Unit. One sample will be collected from the bottom of each of the two containment vaults associated with the unit. A ponar grab sampler or similar device will be used. In addition, four surface and subsurface samples will be collected. Each set of surface and subsurface samples will be placed near the area of one of the four documented unplanned releases associated with this unit. These are UN-100-N-34, August 7, 1987, September 2, 1987, and November 9, 1987, unplanned releases. UN-100-N-34 occurred at the containment vaults. The

August 7, 1987, unplanned release occurred in an unlined portion of the trench north of the 163-N Building. The specific location of the September 2, 1987, unplanned release is unknown. The November 9, 1987, unplanned release occurred in a dry well within the trench. All subsurface samples will be collected from a depth of 4 ft using a sampling scoop after excavation with a backhoe.

The contents of the 120-N-3 Neutralization Pit and French Drain will be sampled. A ponar grab sampler or similar device will be used to retrieve a sample from the french drain.

The contents of the 120-N-8 Sulfuric Acid Sump Tank Vent French Drain will be sampled. A ponar grab sampler or similar device will be used to retrieve a sample from the french drain.

A contents sample will be collected from the sump associated with the Regeneration Waste Transport System. The sump is located on the north side of the 163-N Building. A ponar grab sampler or similar device will be used to obtain the sample. In addition, two sets of surface and subsurface samples will be collected in the areas where the two documented unplanned releases occurred. The June 14, 1986, release occurred south of the 163-N Building. The June 30, 1986, release occurred near the above-mentioned sump. Specific sampling locations will be determined based upon data review and evaluation and nonintrusive investigations. The subsurface samples will be collected from a depth of 4 ft with a sampling scoop after excavation with a backhoe.

The contents of the 124-N-1 Septic Tank will be sampled with a ponar grab sampler or similar device. Access to the septic tank will be determined in the field.

5.3.2.3.2.4 116-N-8 Mixed Waste Storage Pad Grouping. No source sampling is planned for this unit. The nonintrusive field investigation will address potential releases from this source.

5.3.2.3.2.5 184-N Plant Service Power House Grouping. Two surface and subsurface sets of samples are planned for the 184-N Day Tank Containment Area. One sample location will be placed in the area where the fuel oil day tank overflowed in April 1984 (UN-100-N-19). The other sample location will be placed in the area where the diesel oil day tanks overflowed on April 25, 1986 (UN-100-N-21) and October 9, 1987. The specific sample locations will be determined in the field based on data review and evaluation. The subsurface samples will be collected from a depth of 4 ft with a sampling scoop after excavation with a backhoe.

A maximum of five sets of surface and subsurface samples will be collected along the 166-N to 184-N piping area. One

surface and subsurface sample will be collected from the area outside the day tank area where the June 23, 1986, unplanned release (UN-100-N-22) occurred. One surface and subsurface sample will be collected in the area of the August 1973 unplanned release (UN-100-N-18). One surface and subsurface sample will be collected from an area where a ruptured diesel line released on January 10, 1987 (UN-100-N-23). A surface and subsurface soil sample will be collected near the 184-N Annex where a fuel oil leak occurred on October 14, 1987. One surface and subsurface soil sample will be collected in the area of the April 26, 1989, release of diesel oil from the 4-in. pipe between 166-N and 184-N. The specific locations of these samples will be determined based upon further data review and evaluation and the nonintrusive investigation. All subsurface samples will be collected from a depth of 4 ft using a sampling scoop after excavation with a backhoe.

No source sampling is planned for the 184-N Plant Service Power House boiler.

5.3.2.3.2.6 Decontamination Drain Line Leak Grouping. One surface and subsurface soil sample is planned for the area where the September 10, 1985, unplanned release (UN-100-N-6) from the 1 1/2-in chemical decontamination waste drain line between 105-N and the 1310-N Silo. The specific sample location will be determined in the field based upon further data review and evaluation and the nonintrusive investigation. The subsurface sample will be collected from a depth of 4 ft using a sampling scoop after excavation with a backhoe.

5.3.2.3.2.7 Nonhazardous and Nonradioactive Storage Area Grouping. No source sampling is planned for the source units within this grouping. The Data Review and Evaluation and Nonintrusive Field Investigations subtasks (2a and 2b, respectively) will address these units.

5.3.2.3.2.8 Regeneration/Filter Backwash Disposal Area Grouping. A surface water and sediment sample will be collected from the 130-N-1 Filter Backwash Discharge Pond. The sample locations will be placed near the discharge point from the 183-N Building to the pond. Surface water samples will be collected by lowering a clean container into the water and filling the appropriate sample containers. The sediment sample will be collected using a ponar grab sampler or similar device.

The 120-N-1, 120-N-2, and south settling pond units have no planned source sampling associated with them. These units will be addressed in the nonintrusive investigation in this work plan. The vadose zone and groundwater investigations of the 100-NR-1 work plan will also address these units. In addition, soil sampling activities are planned, which are associated with closure activities, for these units. Krug (1989) is the

characterization plan for soil sampling activities. Likewise, no source sampling is planned for the 1143-N Paint Shop. The nonintrusive investigation will address this unit.

5.3.2.3.2.9 Office Septic Tank Area Grouping. Each of the four septic tanks (124-N-5, 124-N-6, 124-N-7, and 124-N-8) will be sampled. The contents of each septic tank will be sampled using a ponar grab sampler or similar device. Access to each of the tanks will be determined in the field.

5.3.2.3.2.10 N-17 Paint Shop Grouping. One surface and subsurface soil sample will be collected in the area of the compressor oil leak near the N-17 Paint Shop. The exact sampling location will be determined in the field based upon data review and evaluation and the nonintrusive investigation. The subsurface soil sample will be collected from a depth of 4 ft using a sampling scoop after excavation with a backhoe.

5.3.2.3.2.11 1120-N Septic Tank Grouping. The contents of the 124-N-9 Septic Tank will be sampled using a ponar grab sampler or similar device. Access to the septic tank will be determined in the field.

5.3.2.3.2.12 100-N Sewer System (124-N-10) Grouping. One sediment/sludge sample will be collected from each of the three lagoons located at the 100-N Central Sewage Plant (124-N-10) located east of the main 100-N Area. The samples will be collected near the inlet point at each of the lagoons. Samples will be collected using a ponar grab sampler or similar device.

No source sampling is to be done at the location of the October 2, 1975, unplanned release (UN-100-N-11). Westinghouse Hanford personnel have indicated that the area was remediated and cleared by radiation survey. The nonintrusive investigation will address this area.

5.3.2.3.3 Data Evaluation. Source sample data obtained in subtask 2c will be used to determine if the materials sampled are classified as dangerous waste under WAC 173-303-100. The data will also be used to determine the necessity and extent of further investigation in Phase II of the RFI.

5.3.2.4 Subtask 2d - Laboratory Analysis. Laboratory analysis will be conducted on all source samples (soil, water, and sludge). The analysis of samples will include determination of chemical and radiological properties. Table 25 shows the list of parameters for analysis.

Once the particular contaminants present at a unit have been defined, a shorter list of indicator parameters will be developed. Further, necessary characterization will address only those contaminants on the short list.

Table 25. Comprehensive List of Analytes and Parameters. (sheet 1 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Radionuclide	Strontium-90	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Tritium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Uranium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Plutonium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Cobalt-60	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Technetium-99	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Cesium-137	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Americium-241	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Carbon-14	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-152	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-154	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-155	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gamma Scan	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gross beta	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gross alpha	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Iodine-129	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Nickel-63	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
Inorganic	Aluminum	CLP[e]	40 mg/kg	±20	±25	200 µg/L	±10	±20
	Antimony	CLP[e]	12 mg/kg	±20	±25	60 µg/L	±10	±20
	Barium	CLP[e]	40 mg/kg	±20	±25	200 µg/L	±10	±20
	Beryllium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Cadmium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Chromium Hexavalent	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Chromium Total	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20

Table 25. Comprehensive List of Analytes and Parameters. (sheet 2 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Inorganic (cont.)	Cobalt	CLP[e]	10 mg/kg	±20	±25	50 µg/L	±10	±20
	Copper	CLP[e]	5 mg/kg	±20	±25	25 µg/L	±10	±20
	Iron	CLP[e]	20 mg/kg	±20	±25	100 µg/L	±10	±20
	Magnesium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Manganese	CLP[e]	3 mg/kg	±20	±25	15 µg/L	±10	±20
	Nickel	CLP[e]	8 mg/kg	±20	±25	40 µg/L	±10	±20
	Potassium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Silver	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Sodium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Vanadium	CLP[e]	10 mg/kg	±20	±25	50 µg/L	±10	±20
	Zinc	CLP[e]	4 mg/kg	±20	±25	20 µg/L	±10	±20
	Arsenic	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Lead	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Mercury	CLP[e]	0.04 mg/kg	±20	±25	0.2 µg/L	±10	±20
	Selenium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Thallium	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Total Cyanide	CLP	500 mg/kg	±20	±25	10 µg/L	±10	±20
	Free cyanide	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Zirconium	Westinghouse	Westinghouse	±20	±25	±20 µg/L	±10	±20
	Nitrate	ASTM D-4327[f]	500 mg/kg	±20	±25	2,500 µg/L	±10	±20
	Sulfate	ASTM D-4327[f]	100 mg/kg	±20	±25	500 µg/L	±10	±20
Volatile organic	Benzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Carbon tetrachloride	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chloroform	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25

Table 25. Comprehensive List of Analytes and Parameters. (sheet 3 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Volatile organic (cont.)	1,1-dichloroethene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1 dichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,2 dichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Methylene chloride	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Tetrachloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Tetrachloroethelene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Toluene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1,1-trichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Vinyl chloride	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Xylene (total)	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Bromodichloromethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Bromoform	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Carbon disulfide	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chlorobenzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chloroethane	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Chloromethane	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Dibromochloromethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,2-dichloropropane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Ethyl benzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	2-hexanone	CLP[e]	50 µg/L	±10	±25	50 µg/L	±20	±25
	2-butanone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Acetone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Cis-1,3-dichloropropene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Trans-1,3-dichloropropene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25

Table 25. Comprehensive List of Analytes and Parameters. (sheet 4 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Volatile organic (cont.)	Bromomethane	CLP[e]	µg/L	±10	±25	µg/L	±20	±25
	1,2-dichlorethene (total)	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1,2,2-tetrachloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	4-methyl-2-pentanone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Styrene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Vinyl acetate	CLP[e]	10 µg/L	±10	±25	5 µg/L	±20	±25
Semivolatile organic	Phenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Bis (2-chloroethyl) ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-chlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,3-dichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,4-dichorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzyl alcohol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,2-dichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-methylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-methylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	N-nitrosodipropylamine	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachloroethane	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Nitrobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Isophorone	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-nitrophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-dimethylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzoic acid	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Bis(2-chloroethoxy)methane	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-dichlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30

Table 25. Comprehensive List of Analytes and Parameters. (sheet 5 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Semivolatile organic (cont.)	1,2,4-trichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Naphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-chloroanaline	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorobutadiene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-chloro-3 methylphenol (para-chloro-metal-cresol)	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-methylnaphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorocyclopentadiene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4,6-trichlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4,5-trichlorophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	2-chloronaphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Dimethyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Acenaphthylene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	3-nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Acenaphthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-Dinitrophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	4-Nitrophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Dibenzofuran	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-Dinitrotoluene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,6-Dinitrotoluene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Diethylphthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Chlorophenyl phenyl ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Fluorene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30

Table 25. Comprehensive List of Analytes and Parameters. (sheet 6 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Semivolatile organic (cont.)	4,6-Dinitro-2-methylphenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	N-nitrodiphenylamine	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Bromophenyl phenyl ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Pentachlorophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Phenathrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Di-n-butylphthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Butyl benzyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	3,3'-Dichlorobenzidine	CLP[e]	0.66 mg/kg	±20	±25	20 µg/L	±30	±30
	Benzo(a)anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Bis (2-ethylhexyl) phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Chrysene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Di-n-octyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(b)Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(k)Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(a)pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
Semivolatile organic (cont.)	Indenol(1,2,3-cd)pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	DiBenz(a,h)anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(g,h,i)perylene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
Pesticides/PCBs	alpha-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	beta-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30

Table 25. Comprehensive List of Analytes and Parameters. (sheet 7 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Pesticides/PCBs	delta-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
(cont.)	gamma-BHC(lindane)	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Heptachlor	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Aldrin	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Heptachlor epoxide	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Endosulfan I	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Dieldrin	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDE	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endrin	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endosulfan II	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDD	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endosulfan sulfate	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDT	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Methoxychlor	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Endrin ketone	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	alpha-chlordane	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	gamma-chlordane	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Toxaphene	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	2,4,5-TP (Silvex)	CLP	80.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	2,4-D	CLP	80.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	Arochlor 1016	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1221	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1232	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1242	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30

Table 25. Comprehensive List of Analytes and Parameters. (sheet 8 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Pesticides/PCBs (cont.)	Arochlor 1248	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1254	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	Arochlor 1260	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
Ion	Chloride	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Fluoride	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Phosphate	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Ammonium	ASTM D-4327[f]	1 mg/kg	±15	±25	500 µg/L	±10	±20

[a] Analytical methods shall be approved by Westinghouse Hanford or Westinghouse-approved participant contractor or subcontractor procedures. All procedure reviews and approvals shall be in compliance with applicable Westinghouse Hanford procedure control or procurement procedures. Once laboratory methods are approved, this table shall be updated to provide appropriate method references.

[b] Values for detection limits, precision and accuracy are to be considered only as target values for initial procurement negotiations with the analytical laboratory. Precision is expressed as relative percentage difference (RPD); accuracy is expressed as percentage recovery. Target values for precision and accuracy do not apply to samples with greater than 200 counts per minute radioactivity. This table shall be updated to reflect negotiated contractual values as specified in the final procurement documents.

[c] MDC = minimum detectable concentration in soil.

[d] MDL = minimum detection limit in water.

[e] Standard methods shall be as specified in EPA Contract Laboratory Program Statement of Work for Organic Analysis (EPA 1988d) or EPA Contract Laboratory Program Statement of Work for Inorganic Analysis (EPA 1988e) as appropriate.

[f] Standard methods are from 1988 Annual Book of ASTM Standards (ASTM 1987).

5.3.2.5 Subtask 2e - Data Evaluation. Data collected in the source characterization activities will be evaluated to determine the usability and impact of the data for the purposes of the Phase I investigation. The information will be assembled and integrated with data and results from the scoping studies and work plan development, the further data compilation and evaluation (subtask 2a) and the nonintrusive investigation (subtask 2b).

Data will be statistically evaluated and validated, as described in Section 12 of the quality assurance project plan (Attachment 1b). The data will be compared with further Phase I tasks to determine if modification of those activities is warranted.

The data management plan (Attachment 4) describes the procedural system for accessing and tracking the receipt, storage, and control of data generated during source characterization. The data will be assembled in textual and graphic form for the Phase I RFI report. In coordination with the results of investigations on the geology, groundwater, surface water, etc. from the 100-NR-1 RFI/CMS, the data will be used to prepare the baseline risk assessment, to conduct the CMS, and to plan the Phase II RFI.

5.3.3 Task 3 - Geologic Investigations

The purpose of the geologic investigation in 100-NR-3 is to assess those geologic characteristics that are important to an understanding of contaminant occurrence, distribution, and migration in the subsurface. Geologic information will be acquired through surface mapping in this task and source sampling activities in Task 2. In addition, data collected during the groundwater investigation in the 100-NR-1 RFI will be evaluated for relevance to 100-NR-3 source and vadose zone characterization.

The objectives of the geologic investigation are presented below. These objectives may be modified, however, during implementation of the work plan:

- Characterize the geologic nature and extent of soils and other surficial material at ground surface at 100-NR-3 which could affect, among other things, infiltration of contaminants into the vadose zone.

- Assess the vertical and lateral soil and lithologic characteristics of the vadose zone, with particular attention to the nature and extent of low permeability zones (i.e., caliche, silty horizons) that could affect groundwater occurrence and movement. Additionally, a

determination of vadose zone thickness would provide additional understanding of the dimensions of the vadose zone.

The Phase I geologic investigation has three subtasks to accomplish project objectives:

- Subtask 3a - Data Compilation
- Subtask 3b - Field Activities
- Subtask 3c - Data Evaluation.

5.3.3.1 Subtask 3a - Data Compilation and Review. The purpose of this task is to refine the understanding of site geology in the 100-N Area using existing data. The preliminary review conducted as part of this work plan provided a good understanding of basic geologic conditions in the area, but more detailed investigation using available information could provide more detailed geologic interpretations. Data reviewed during development of the 100-NR-3 work plan will be supplemented with: site-specific information not reviewed during the preliminary review information collected during nonintrusive activities conducted in Task 2; soil and sediment sampling in Task 2; geologic data collected during the 100-NR-1 RFI; and information from relevant studies in the vicinity of the 100-N Area (i.e., other RFI studies in the 100-B/C, 100-D, 100-F, 100-H and 100-K Areas).

5.3.3.2 Subtask 3b - Field Investigations. The Phase I geologic investigation includes one field activity: geologic mapping. This will be conducted to determine distribution of geologic units and other materials at the surface that could impact downward migration of contaminants. The map will cover the 100-NR-3 operable unit. Site geologic mapping will be conducted at a scale of 1:500 on the topographic base map constructed in subtask 2b. Special emphasis will be placed on differentiating between fill and natural materials, and between types of fill, and site soil types.

5.3.3.3 Subtask 3c - Data Evaluation. Geologic data acquired in Phase I will be assembled and evaluated to generate geologic interpretations. This information will be used to assess characteristics of the surface and the unsaturated zone that may impact contaminant migration to groundwater or the Columbia River. It must be emphasized that the nature of geologic assessments will be flexible and will be a function of the data acquired and interpretive needs of the Phase I assessments.

5.3.4 Task 4 - Surface Water and Sediment Investigation

The goal of Task 4 is to evaluate the impact of facility operations on surface water and sediments of the Columbia River. No field activities will be conducted. Rather, data collected during the 100-NR-1 surface water investigation will be evaluated to determine if there is evidence of 100-NR-3 contribution to river contamination.

5.3.5 Task 5 - Vadose Zone Investigation

The purpose of the vadose zone investigation in the Phase I RFI for the 100-NR-3 operable unit is to provide information on source characterization in those areas where soil sampling data are unavailable, particularly in the area of known unplanned releases. In addition, information concerning soil chemical and physical properties as they relate to potential impacts on groundwater (release potential) will be acquired. In order to effectively integrate efforts and avoid duplication, sampling and analysis of the vadose zone materials will be conducted during the source sampling activities in subtask 2c and integrated with data collected in the 100-NR-1 groundwater investigation. Should results of the source investigation warrant further study, the vadose zone investigation may be expanded.

5.3.6 Task 6 - Groundwater Investigation

This task will integrate groundwater data collected during the 100-NR-1 groundwater investigation. These data will be assessed to determine if source units in 100-NR-3 impact groundwater. No field activities will be conducted.

5.3.7 Task 7 - Air Investigation

The air investigation for 100-NR-3 will be limited to monitoring for volatile organics and radiation during field drilling activities associated with the 100-NR-1 investigation. Should field monitoring indicate that additional monitoring of air quality be conducted, programs will be implemented. Monitoring procedures, instrumentation, and applicable standards and action levels are presented in the health and safety plan (Attachment 2).

5.3.8 Task 8 - Ecological Investigation

The biota investigation has the following objectives:

- Determine significant pathways and affected species
- Provide information necessary to complete the risk assessment

- Provide information necessary to evaluate the potential biological effects of proposed remediation alternatives.

The data required from the monitoring program include determination of significant potential pathways of contaminant movement to humans, determination of critical habitat for species of special concern, and determine conceptual models of human and environmental risk.

Sufficient data are currently available in existing studies to provide reasonably accurate descriptions of ecosystem structure, and to propose provisional estimates of pathways and potential risks. In order to provide the most efficient use of resources, the biological studies will proceed incrementally and in concert with the biologic studies planned for the 100-NR-3 operable unit. The approach produces several subtasks:

- Compile all existing data on the 100-NR-3 operable unit and related 100 Area sites
- Refine field investigation plan on the basis of identified data gaps
- Predict impacts to human health and the environment
- Conduct field investigations to determine the suitability of the compiled data for use in 100-NR-3 studies and to collect additional data needed to refine the site conceptual model and complete the risk assessment.

5.3.8.1 Subtask 8a - Data Compilation and Review. A description of the aquatic and terrestrial biota is given in Section 2.2.6. Existing regional and site-specific biological data will be collected. This task will focus on work performed as part of the ongoing Hanford environmental monitoring program, on special studies conducted at the Hanford Site, and on information available from the Washington Department of Wildlife and Natural Resources, as well as the Washington Natural Heritage Program. Emphasis will be placed on using data developed during investigations at other operable units in the 100-N Area.

Existing data will be used to identify terrestrial and aquatic species (aquatic species present in the 130-N-1 Filter Water Backwash Pond) with protected management status that occur at the site; species that are dominant in the community in terms of productivity, abundance, or biomass; and species whose removal from the ecosystem would result in a dramatic change in the characteristics of the system. Probable pathways of contaminant transfer in the environment will also be identified.

These data will give direction to the field monitoring program, and will provide information needed for other tasks in the study. The field investigation will concentrate on areas of known contamination in the operable unit, and on species within or closely surrounding these areas.

5.3.8.2 Subtask 8b - Field Activities. It is expected that transport of chemical contaminants from the operable unit via ground or surface water is low and that the uptake of these contaminants by plants will also be minimal. Therefore, biotic sampling under Phase I has not been proposed.

Field activities will be limited to a site walkover survey, which will be conducted to identify the general site terrestrial and aquatic inventory. Major species present will be confirmed, to the extent practicable under this task.

5.3.8.3 Subtask 8c - Data Evaluation. After completion of the data compilation and review and site walkover survey, data will be evaluated to see if the provisional understanding developed from the existing data is supported. In addition, any gaps in the data that remain, or that develop from the field studies, will be identified. If data gaps exist, or if anomalous results are obtained in initial field studies of biota, additional field studies of biota will be developed to attempt to resolve the uncertainty.

If provisional understanding is supported by the field data, and no data gaps are evident, no further field studies will be conducted for this portion of the work plan.

5.3.9 Task 9 - Cultural Resource Investigation

In addition to the above tasks, a cultural resource investigation will be conducted. Studies to determine the location of surficial archaeological and historical sites eligible for the National Register of Historic Places have been conducted at Hanford. However, additional archaeological sites may be present along the Columbia River adjacent to the 100-N Area, and must be investigated.

This study will involve verification of the locations of known archaeological sites by reviewing available data concerning historic land uses by Indians, pioneers, etc. The investigation will focus on determining whether any sites are present at proposed drilling locations. A Class 3 field survey will be conducted by a qualified archaeologist as part of initial RFI field activities. The Hanford Cultural Resource Management Plan will be followed during review processes. No intrusive RFI field work will be performed in areas of known sites.

5.3.10 Task 10 - Data Evaluation

This task consists of compiling and integrating the results from each of the data evaluation subtasks of each investigation (Tasks 2 through 9). A conceptual model will be constructed to describe: (1) the quantities and concentrations of specific contaminants at the operable unit, (2) the number, location, and types of nearby populations and activities, and (3) the potential transport mechanisms and the expected fate of the contaminants in the environment. Additional data needs for source or site characterization, or risk assessment support, will be assessed and documented.

5.3.11 Task 11 - Baseline Risk Assessment

The purpose of the baseline risk assessment is to provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action. It will provide the basis for determining whether or not remedial action is necessary and the justification for performing remedial actions. The baseline risk assessment is also used to support a finding of imminent and substantial endangerment if such a finding is required as part of an enforcement action. Detailed guidance on evaluating potential human health impacts as part of this baseline assessment is discussed in two EPA documents that outline in detail the two main areas of a baseline risk assessment. These areas are human health assessment, found in Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A) (EPA 1989b) and ecological assessment, found in Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual (EPA 1989c).

To achieve this objective, the following areas will be identified and characterized:

- Toxicity and concentrations of hazardous substances present in air, soil, groundwater, surface water, sediment, and biota
- Environmental fate and transport mechanisms within specified environmental media, such as physical, chemical, and biological degradation processes and geohydrologic conditions
- Potential exposure pathways and extent of actual or expected exposure
- Potential human and environmental receptors
- Extent of expected impacts and the potential for such impacts occurring (i.e., risk characterization)

- Acceptable levels of exposure based on regulatory and/or toxicological information
- Level(s) of uncertainty associated with the above items.

Factors that effect the level of effort of the baseline risk assessment are the following:

- The number, concentration, and types of chemicals present
- Areal extent of contamination
- The quality and quantity of available monitoring data
- The number and complexity of exposure pathways (including the complexity of release sources and transport media)
- The required precision of sample analyses, which in turn depends on site conditions such as the extent of contaminant migration and the proximity, characteristics, and size of potentially exposed population(s)
- The availability of appropriate standards and/or toxicity data.

The risk assessment process is composed of the following components that, collectively, address the areas identified:

- Contaminant identification
- Exposure assessment
- Toxicity assessment
- Risk characterization.

The relationship of these components is presented in Figure 46.

5.3.11.1 Contaminant Identification. The first component of the risk assessment process is to identify contaminants of concern. The objective of this component is to screen the field of contaminants to provide a list of contaminants for which the subsequent risk assessment activities are focused. The basis for selecting contaminants of concern will include their intrinsic toxicological properties, their physical properties, presence in large quantities, and/or presence in media of potentially critical exposure pathways such as a source of drinking water.

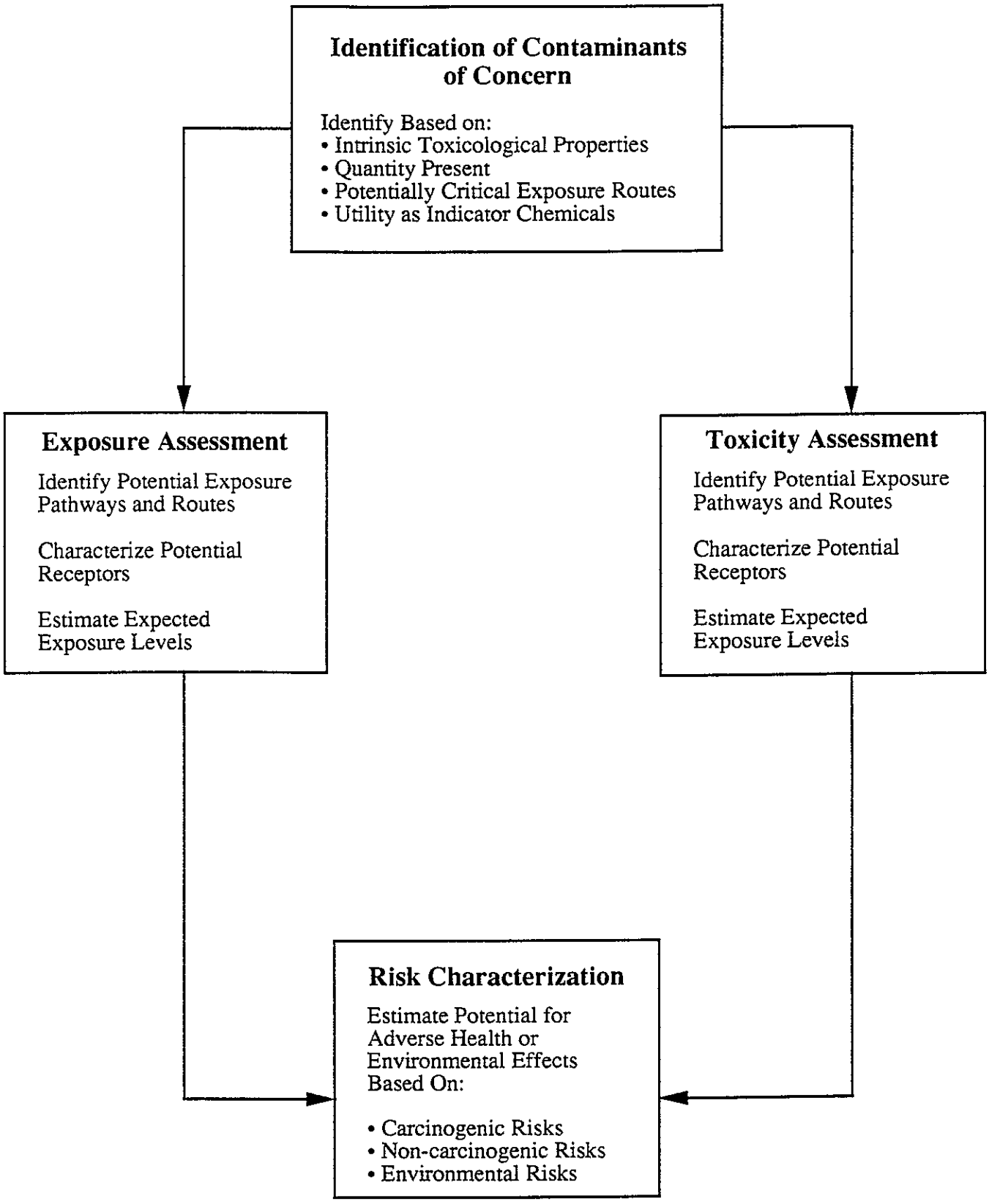


Figure 46. Components of Risk Assessment

9 1 1 3 3 7 0 9 1 1 6

5.3.11.2 Exposure Assessment. The objective of exposure assessment is to estimate the environmental concentrations of hazardous substances so that the extent and duration of human and environmental exposure can be predicted or determined. This objective will be achieved by identifying potential or actual exposure pathways, characterizing potentially exposed populations, and estimating both present and future exposure levels.

The first step of the exposure assessment involves identifying exposure pathways. Each exposure pathway consists of four elements: (1) a source and mechanism of chemical release to the environment; (2) an environmental transport medium, such as groundwater; (3) a potential point for receptor contact with the contaminated medium (i.e., exposure point); and (4) an exposure route at the contact point, such as ingestion of drinking water or crop irrigation.

Data gathered during the development of this work plan, environmental monitoring activities, RFI of the 100-NR-1 operable unit and any other data sources will be used to identify the potential release sources and release mechanisms. As the release mechanism(s) for contaminants are identified (or postulated), the transport medium for the contaminants will also be identified.

The next element of the exposure pathway analysis is identifying the potential exposure points and exposure routes for human and environmental populations. This analysis involves identifying and characterizing maximally exposed individuals for a worst-case scenario, and various populations for which an exposure potential exists. This characterization involves determining the number of individuals in a population, the demographics of each population, and the potential exposure routes to populations and individuals. The analysis will be used to identify exposure points for short and long-term exposures. In addition to existing exposure points, credible future exposure points will be postulated. A preliminary discussion of exposure routes and receptors is found in Section 3.3.

Once this information is gathered, it will be assembled to determine the complete exposure pathways that exist for the 100-NR-3 operable unit. After potential exposure pathways are determined, environmental concentrations for each contaminant of concern or indicator chemical will be estimated at each of the identified exposure point locations. Concentrations will be estimated for each environmental medium through which potential exposures could occur as a function of time to assess short and long-term exposures. These concentrations will be estimated by combining environmental monitoring and characterizations data with numerical modeling to predict the release rates from the various waste sources. Then, the fate and transport of the

contaminants in the transport modeling will consider the environmental transport of contaminants (e.g., groundwater migration), contaminant from one transport medium to another (e.g., sorption, volatilization). The predicted environmental concentrations and exposure route information will then be used to estimate the amount of contaminant that the various receptors potentially could intake (i.e., dosage rate).

5.3.11.3 Toxicity Assessment. The objectives of toxicity assessment are to determine the nature and extent of health and environmental hazards associated with exposure to contaminants from the 100-NR-3 operable unit. The final product of the toxicity assessment is a qualitative description of the toxic properties of each contaminant and a quantitative index of each contaminant's toxicity (i.e., acceptable exposure level).

Available contaminant-specific CAR (e.g., maximum contaminant levels, 25 mrem/yr effective dose equivalent, all pathways) will be used as acceptable levels for human exposure unless exposure at the CAR level results in a risk greater than 10^{-4}. Acceptable levels for other contaminants will be based on reference doses for noncarcinogens and cancer potency factors for carcinogens. These values are available in toxicity profiles from the EPA and the Public Health Service.

Environmental hazard assessment will determine actual or potential effects of contaminants on plants and animals. Acceptable levels for environmental receptors (e.g., various species of fish) will be contaminant background levels established at the Hanford Site or, in the absence of Hanford data, normal values determined by a review of the literature.

5.3.11.4 Risk Characterization. The final component of the risk assessment process is characterizing the risk to various receptors from exposure to contaminants from the 100-NR-3 operable unit. This objective is attained by integrating the information gathered during exposure and toxicity assessments to characterize the potential or actual risks resulting from contaminants released from the 100-NR-3 operable unit. These include the radiological, carcinogenic, noncarcinogenic, and environmental risks.

Potential human risks from the 100-NR-3 operable unit will be assessed by comparing acceptable contaminant exposure levels with actual or predicted levels. For noncarcinogens, the goal will be exposure, such that the sum of fractions of actual or predicted exposure versus the reference dose is less than one. The goal for exposure to carcinogens will be a lifetime risk of contracting cancer between 10^{-7} to 10^{-4}.

The environmental risk evaluation will discuss the effects of exposure on indigenous species, food chains, and habitat. All

of these factors affect environmental quality in the vicinity of the 100-NR-3 operable unit and along exposure pathways.

The final assessment will include a summary of risks associated with the 100-NR-3 operable unit, data associated with each step of the risk assessment process, estimated uncertainty of various parts, assumptions made during the assessment, and distribution of risk across different segments of the population and environment.

The results of the risk assessment will be used to determine whether the 100-NR-3 operable unit poses a potential threat to human health and/or the environment. The results will be the primary means of documenting the decision for choosing the no-action alternative or performing remedial action.

If the no-action alternative is not selected as the preferred alternative for addressing hazards at the 100-NR-3 operable unit, a remedial alternative will be assessed as part of the CMS. The risks for each of the remedial alternatives will also be assessed, but they are beyond the scope of the current effort.

5.3.11.5 Evaluate Data Needs. As data are collected and a better understanding of the site and the risks that it poses are obtained, the preliminary remedial action alternatives developed during scoping should be reviewed and refined. The available data should be evaluated to determine if they are sufficient to develop remedial alternatives. If they are not, additional data collection will be required. When sufficient data are available, remedial response objectives with respect to the contaminants of concern, the areas and volumes of contaminated media, and existing and potential exposure routes and receptors of concern can be developed as part of the CMS.

5.3.12 Task 12 - RFI Phase I Report

An interim report will be presented at the end of the RFI Phase I investigation. This report will consist of a preliminary summary characterization of contamination for the 100-NR-3 operable unit.

5.3.12.1 Subtask 12a - Preparation. Information pertinent to the operable unit's conceptual model will be refined as necessary; sources of contaminant releases will be more definitively identified; the nature and extent of contamination within the operable unit's sources, soil, air, and biota will be described; additional data needs will be specified in detail; a definitive list of contaminant- and location-specific CAR will be provided; and the risks associated with the contaminant release will be presented.

5.3.12.2 Subtask 12b - Review and Approval. This report is defined as a secondary document in Section 9.0 of the Tri-Party Agreement Action Plan. It will be prepared primarily for interim internal review, although EPA and Ecology have the option to comment on it. It will also provide a means for communicating findings to the project CMS coordinator for use in the ongoing evaluation of potential operable unit corrective measures. Corrections or modifications resulting from comments will be incorporated as appropriate.

5.4 CORRECTIVE MEASURES STUDY PHASE I/II: REMEDIAL ALTERNATIVES DEVELOPMENT AND SCREENING

The objective of the CMS is to develop a range of potential corrective measure alternatives that are protective of human health and the environment. A range of corrective measure alternatives for operable unit problems will be developed.

The development of alternatives for the 100-NR-3 operable unit must be coordinated with the concurrent activity for the 100-NR-1 operable unit to ensure that overall remediation objectives can be attained. Remediation options being considered for the 100-NR-3 operable unit could affect the choice of options for the 100-NR-1 and 100-NR-2 operable units.

Four tasks will be utilized to develop remedial alternatives and include:

- Task 1 - Project Management
- Task 2 - Alternatives Development
- Task 3 - Alternatives Screening
- Task 4 - CMS Phase I/II Report: Remedial Alternatives Development.

5.4.1 Task 1 - Project Management

This task is necessary to meet the goals and objectives of the 100-NR-3 RFI/CMS and is discussed in Section 5.1 and Attachment 3, project management plan.

5.4.2 Task 2 - CMS Phase I - Alternatives Development

Section 3.4 presented a general identification of remedial action objectives, general response actions, remedial technologies, and a preliminary list of remedial action alternatives for the 100-NR-3 operable unit. These preliminary response actions, technologies, and alternatives will be

modified, as appropriate, based on the evaluation of RFI data and risk assessment. The development of corrective measures alternatives will be accomplished in the following steps:

- Subtask 2a - Development of corrective action objectives
- Subtask 2b - Development of general response actions
- Subtask 2c - Identification of potential corrective measures technologies
- Subtask 2d - Evaluation of process options
- Subtask 2e - Assembly of corrective measures alternatives
- Subtask 2f - Action-specific CAR identification.

Each task is summarized below. Additional details can be found in EPA's interim final RI/FS guidance document (EPA 1988a).

5.4.2.1 Subtask 2a - Development of Corrective Action Objectives. Corrective action objectives will be developed that state environmental medium-specific or source-specific goals for protecting human health and the environment. The environmental media of concern are soil, air, groundwater, surface water, river sediments and aquatic biota. Contaminants of concern, exposure routes, receptors, and acceptable contaminant levels or ranges of levels for each exposure route will be specified for each medium. Acceptable contaminant levels will be based on identified chemical-specific CAR, advisory or "to-be-considered" criteria, or risk assessment calculations.

5.4.2.2 Subtask 2b - Development of General Response Actions. General response actions, which are broad classifications of actions or combinations of actions that will satisfy the remedial action objectives, will be developed on a medium-specific basis. Examples of general response actions are no action, institutional controls, disposal, extraction, excavation, containment, and treatment.

The important site and waste characteristics will be defined for the 100-NR-3 operable unit as part of this task. These characteristics will include the radiological, chemical and physical conditions to which general response actions might be applied.

5.4.2.3 Subtask 2c - Identification of Potential Corrective Measures Technologies. A list of potential remedial technologies will be developed for each identified general response action. The technologies to be considered should address the key site and

waste characteristics identified in the RFI Phase I report. Process options, which are the different processes within a technology type, will be identified for each technology.

The following example, using a hypothetical groundwater situation, illustrates how the degree of technological specificity narrows in moving from general response action to remedial measure technology to process option categories:

- General response action for groundwater treatment
- Potential remedial technologies within the groundwater treatment category
  - physical
  - chemical
  - biological
- Potential process options within the groundwater chemical treatment technology type
  - neutralization
  - precipitation
  - ion exchange
  - oxidation
  - chemical reduction.

The identified technologies and process options may not all be suitable for use at the 100-NR-3 operaple unit. First, the identified options are evaluated for technical implementation. This is determined by comparing the capabilities of each process option to the physical and chemical characteristics of the operable unit. Sometimes, an entire technology is eliminated because its process options are not technically implementable. The rationale for screening each corrective measure technology will be documented.

5.4.2.4 Subtask 2d - Evaluation of Process Options. Once identified options are evaluated for technical implementation, then the second step involves a closer evaluation of the process options associated with each remaining technology. Process options will be evaluated on the basis of effectiveness, implementability, and cost.

The effectiveness evaluation will focus on:

- The potential effectiveness of the process options in handling the estimated areas or volumes of the contaminated medium and attaining the corrective action objectives for that medium

- The effectiveness of the process options in protecting human health and the environment during corrective measure construction and implementation

- How proven and reliable the process option is with respect to the contaminants and conditions at the 100-NR-3 operable unit.

Both technical and institutional implementability are considered in evaluating process options. Technical implementability will eliminate those options that are clearly ineffective or unworkable at the 100-NR-3 operable unit. Institutional considerations include the ability to obtain necessary permits for any offsite actions, the ability to meet substantive requirements of relevant permits for onsite actions, the availability and capacity of appropriate treatment, storage, and disposal services, and the availability of essential equipment and skilled labor.

Cost will be an evaluation criterion. Relative capital, operations and maintenance costs, as opposed to detailed estimates, will be determined based on engineering judgement. Processes within the same technology type will be compared with respect to cost.

Innovative technologies may be applicable at the 100-NR-3 operable unit. Should an innovative technology exhibit fewer environmental impacts, better treatment, or lower costs over a conventional technology, then it could progress through the screening process.

Applicable technologies with one or more feasible process options will be used in developing corrective measure alternatives. Multiple process options based on one technology may be combined into a given corrective measure alternative. Process options that are not selected for development, generally, will not be considered later in the CMS. They may, however, be reinvestigated during corrective measure design if the associated technology is selected for implementation at the 100-NR-3 operable unit.

5.4.2.5 Subtask 2e - Assembly of Corrective Measure Alternatives. Preliminary alternatives will be developed for each contaminated environmental medium of concern. This will involve assembling medium-specific process options, corrective technologies, and general response actions. Alternatives for the six types of environmental media discussed in Section 5.4.2.1 can be approached using two methods: (1) develop alternatives for the entire operable unit or (2) screen medium-specific alternatives first (Section 5.6) to reduce the alternatives for the entire operable unit. Both methods are consistent with EPA's

interim final RI/FS guidance (EPA 1988a). The chosen method will be discussed with Ecology and EPA before undertaking this task.

Several general approaches will be considered for the operable unit.

- A no-action alternative
- Treatment alternatives ranging from treating wastes prior to onsite storage to eliminating the need for long-term management
- Management alternatives for onsite and offsite waste containment and storage.

Section 121(b)(1) of CERCLA has a statutory preference for permanent treatment and significant waste volume reduction. Containment and treatment alternatives will be developed in conjunction with the selection of corrective action technologies. This is more acceptable than waste removal and offsite disposal alternatives.

5.4.2.6 Subtask 2f - Action-Specific CAR Identification. The preliminary action-specific action requirements, which were identified in Section 3.2.2, will be reexamined after the technology alternatives have been examined to eliminate options that are not desirable or feasible.

5.4.3 Task 3 - CMS Phase II - Corrective Measure Alternatives Screening. Screening follows the development of alternatives and precedes analysis. The objective of screening the alternatives is to reduce the list of potential corrective actions to a manageable level. The potential corrective actions will be evaluated in greater detail, based on effectiveness, implementability, and cost.

The major steps to be performed during the screening process are as follows:

- Corrective action objectives are refined
- Corrective measure alternatives are refined
- The refined alternatives are evaluated on a general basis to determine their effectiveness, implementability, and cost.

The alternatives that meet the corrective action objectives are then retained for detailed analysis in Phase III of the CMS.

The following is a summary of the Phase II CMS process. Further details can be found in the draft EPA RI/FS guidance (EPA 1988a).

5.4.3.1 Subtask 3a - Refinement of Corrective Action Objectives. The corrective action objectives developed in Phase I of the CMS for each environmental medium of interest will be refined based on the information gathered during the RFI. Exposures may occur through multiple pathways and may involve interactions between environmental media. Refinement of the corrective action objectives will ensure protection of human health and the environment from all potential pathways of concern at the operable unit.

Evaluation of media interactions will determine if ongoing releases significantly affect contaminant levels in other media, such as soil to groundwater. Media may be identified that do not pose a significant risk to human health and the environment. The RFI Phase I information will be used to refine corrective action objectives to better fit the project site and to allow for innovative technologies.

5.4.3.2 Subtask 3b - Definition of Corrective Action Alternatives. The corrective action alternatives developed in Phase I of the CMS will be further defined to identify details of process options, process sizing requirements, time frames, and the refined corrective action objectives.

RFI Phase I information will more accurately identify the extent of contamination so that suitable equipment, technologies, and process options can be evaluated.

The specific types of information that will be developed under this task for the technologies and process options used in each alternative will be as follows:

- Size and configuration of onsite removal and treatment systems
- Identification of contaminants that impose the most demanding treatment requirements
- Size and configuration of containment structures
- Time frame in which treatment, containment, or removal goals can be achieved
- Treatment rates or flow rates associated with treatment processes

- Special requirements for construction of treatment or containment structures, staging construction materials, or excavation
- Distances to disposal facilities
- Required permits and imposed limitations.

All information and assumptions used in generating this information will be thoroughly documented.

5.4.3.3 Subtask 3c - Screening Evaluation. The corrective measure alternatives will be screened with regard to the short- and long-term aspects of effectiveness, implementability, and cost. An evaluation of innovative alternatives will also be made and comparisons will be made among similar alternatives. The most promising alternatives will be carried forward for further analysis, and then distinctions across the entire range of alternatives will be made.

Alternatives will be retained that have the most favorable composite evaluation. The selections, to the extent practicable, will preserve the range of appropriate alternatives discussed in Section 5.4.2.5. Ten or fewer alternatives that address the entire operable unit are expected to be retained. Additional alternatives may be needed if offsite disposal alternatives are developed and preferred,as opposed to operable unit-specific alternatives. Unselected alternatives may be reconsidered if new information shows additional advantages.

5.4.3.3.1 Effectiveness Evaluation. Each alternative will be evaluated on the basis of its ability to protect human health and the environment through reductions in toxicity, mobility, or waste volume. Short-term protection needed during the construction and operation period, and long-term protection needed after completion of the corrective measure alternative, will be evaluated. Sensitivity analyses will be prepared to evaluate probable performance.

Residual contaminant levels remaining after a reduction of waste toxicity, mobility, or volume will be compared to contaminant-specific CAR, pertinent to-be-considered values, and levels established through risk assessment calculations.

5.4.3.3.2 Implementability Evaluation. Implementability is the measure of both the technical and institutional feasibility of accomplishing an operable unit remedial alternative. Technical feasibility refers to the ability to construct, operate, meet action-specific, and maintain and monitor the technologies or process options. Institutional feasibility refers to the ability to obtain approvals from appropriate agencies and to procure required services, equipment, and personnel.

Alternatives deemed technically unfeasible will be dropped from consideration. Lack of agency approval will be the only reason institutionally unfeasible alternatives will not be dropped. In the latter situation, the remedial alternative will be retained, if possible, with the incorporation of appropriate coordination steps needed to lessen its negative aspects.

5.4.3.3.3 Cost Evaluation. Comparative cost estimates will be made. Cost estimates will be based on cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates. Both capital and operating and maintenance costs will be considered where appropriate. Present worth analyses will be used to evaluate expenditures that occur over different time periods, so the costs for different remedial alternatives can be compared on the basis of a single figure for each.

5.4.3.3.4 Evaluation of Innovative Alternatives. Innovative technologies will be considered if they are fully developed but lack sufficient cost or performance data for routine use. It is unlikely that alternatives that incorporate innovative technologies will be evaluated as thoroughly as is done with available technologies. However, innovative technologies will pass through the screening phase if they offer promise of significant advantages. The need for treatability studies on retained innovative technologies will be determined in conjunction with subtask 3e.

5.4.3.4 Subtask 3d - Verification of Action-Specific CAR. Identification of action-specific CAR will be made easier by the new information gathered on technologies and configurations during the screening process. The CAR previously identified will be refined by project staff with input from Ecology and EPA. Regulatory agency participation will provide project focus and direction and expedite the CMS Phase I/II report produced under Task 4.

In the process of developing corrective measure alternatives, additional RFI data needs may be identified. An assessment will be made as to their value to the 100-NR-3 conceptual model or alternative evaluation criteria. Any uncertain data needs will be discussed in the detailed analysis of alternatives (Section 5.6) and may be evaluated in a sensitivity analysis. Other data needs may require additional characterization or treatability studies.

5.4.3.5 Subtask 3e - Evaluation of Data Needs. Additional site characterization data needs may develop during the screening phase, which would necessitate additional field investigations or treatability studies. The work would then focus on a more thorough explanation of the effects on operable unit conditions or the performance of the corrective measure technologies and

process option of greatest interest. The probable effectiveness of performance will be evaluated using sensitivity analysis. Data quality objectives will be refined or developed, as needed for any additional investigations.

5.4.4 Task 4 - CMS Phase I/II Report: Alternatives and Screening. The results of the initial development and screening of alternatives will be combined with the interim CMS Phase I/II report, and any significant comments will be contained in that report. This information will help develop a document summarizing both the development and screening of alternatives for the operable unit. The report will list the procedures for defining and evaluating the alternatives.

5.4.4.1 Subtask 4a - Report Preparation. The Phase I/II CMS report will document the results of the identification and development of alternatives. Examples of the types of information to be included in the report are:

- Operable unit background summary with available project scoping information and initial RFI data, to include the nature and extent of contamination and contaminant fate and transport
- Confirmation of the operable unit environmental media of concern; include the rationale for continued inclusion in the CMS
- Identification of the preliminary corrective action objectives for each environmental medium of concern
- Identification of the general response actions for each environmental medium of concern
- Identification of potential corrective measure technology types for each medium-specific general response action category
- Documentation of the assembly of general response actions, process options, and technologies into a range of corrective actions
- Identification of action-specific CAR potentially pertinent to each alternative
- Identification of any new data needs for the Phase II RFI.

The following types of information pertinent to the screening phase will also be included:

- Refined remedial action goals associated with each alternative, including any modifications made to ensure that multiple-pathway exposures and media interactions are addressed

- Definition of each alternative, including extent of remediation, area or volume of contaminated media, energy and area/space requirements of major technologies, process parameters, cleanup time frames, transportation distances, and special considerations

- Screening evaluation summaries and comparisons between each alternative process

- Documentation of the screening process for determination of technical implementability of the technology

- Identification of potential technological process options for each technology type retained after screening

- Documentation of the process option evaluations and the selection of representative process options for each technology type.

A reevaluation of data needs for the RFI Phase II will be included in this report. Details of the CMS Phase I/II report will, in turn, be summarized in the final Phase III CMS report.

5.4.4.2 Subtask 4b - Report Review and Approval. The CMS Phase I/II report will be subject to internal peer review before being forwarded to regulatory agencies. As a primary document, the report will be reviewed and approved (with all required modifications) by both EPA and Ecology.

5.5 RFI PHASE II: TREATABILITY INVESTIGATION

As operable unit information is collected during the RFI Phase I, and alternatives are being developed and screened during the first and second phases of the CMS, additional data needs necessary to adequately evaluate alternatives during corrective measure alternatives analysis may be identified. Activities may include the collection of additional necessary 100-NR-3 characterization data or the performance of treatability studies to better evaluate the performance of certain corrective measure technologies.

The primary purpose of the treatability investigation is to provide sufficient technology performance information and to reduce cost and performance uncertainties to acceptable levels, such that treatment alternatives can be fully developed and evaluated during the CMS Phase III. Secondarily, the treatability investigation may generate information useful in conducting the detailed design of a treatment corrective measure, if the particular technology investigated is a component of the alternative selected to be the corrective measure for 100-NR-3. The allocation of time for a potential treatability investigation also provides a mechanism through which to conduct further operable unit characterization activities in the event that the need for such activities is identified at or toward the end of the RFI Phase I or CMS Phase II.

5.5.1 Task 1 - Project Management

This task is necessary to meet the goals and objectives of the 100-NR-3 RFI/CMS and is discussed in Section 5.1 and Attachment 3, the project management plan.

5.5.2 Task 2 - Source Investigations

Source investigations conducted as part of the Phase I effort will be supplemented to gain information required by the treatability studies and corrective measures development. As such, specific determination of activities conducted under this task are very preliminary in nature, but will consist of three basic tasks:

- Subtask 2a - Data Compilation and Review
- Subtask 2b - Field Investigations
- Subtask 2c - Other Activities.

5.5.2.1 Subtask 2a - Data Compilation and Review. This subtask will involve collection and review of all new information acquired as part of Phase I activities, as well as any additional information acquired as part of other ongoing studies. These data will be reviewed to assess the current understanding of sources within the operable unit, and to determine whether additional characterization is required for corrective measures assessments. This may include (but is not limited to) characterization of sources such as buildings and storage basins, as well as secondary sources such as contaminated sediments within the vadose zone.

5.5.2.2 Subtask 2b - Field Investigations. Any number of field investigations may be conducted should assessments indicate that data sufficient to achieve Phase II corrective measures studies are not available. For example, an additional site walkover may

be conducted during which detailed geophysical and radiation surveys may be performed. These walkovers may be conducted in specific areas to assess any sites that may not have been identified as potential sources during development of the work plan, but were found under Phase I assessments. Other field activities that may include source characterization activities are discussed other Tasks 3, 4, 5, and 6 of this section.

5.5.2.3 Subtask 2c - Other Activities. Additional tasks (as yet unidentified) may also be conducted under source investigations, if warranted. For example, interviews with employees might be required to gain an understanding of a source that was located during the Phase I assessment, for which no written information is available.

5.5.3 Task 3 - Geologic Investigations

Geologic investigations conducted during this phase will be conducted as part of the 100-NR-1 RFI Phase II treatability investigation. Data generated as part of this task will be evaluated for relevance to the 100-NR-3 RFI Phase II treatability investigation.

5.5.4 Task 4 - Surface Water and Sediments Investigations

Further surface water and associated sediments investigations that may be necessary will be conducted as part of the 100-NR-1 Phase II treatability investigation. Data generated as part of this task will be evaluated for relevance to the 100-NR-3 RFI Phase II treatability investigation.

5.5.5 Task 5 - Vadose Zone Investigations

Additional vadose zone investigations may be conducted if Phase I results indicate that current understanding of the nature and extent of contamination within the vadose zone is not sufficient to fulfill CMS requirements. Three subtasks may be performed:

- Subtask 5a- Field Activities
- Subtask 5b - Laboratory Activities
- Subtask 5c - Data Evaluation.

5.5.5.1 Subtask 5a - Field Activities. Additional studies specific to chemical and hydrogeologic characterization may be conducted to determine the extent of contamination in the vadose zone. For example, data resulting from the 100-NR-3 source sampling program (Section 5.3.2.3.2), particularly those samples associated with unplanned releases or subsurface piping, may indicate that further vadose zone investigation is necessary to

fulfill CMS requirements. Also, additional field radiologic and geophysical surveys may be used to assess vadose zone characteristics. Installation of borings may also be warranted to assess contaminant occurrence, although these borings should be coordinated with proposed well installation to avoid duplication.

Soil gas sampling may be conducted at this time if warranted by Phase I results or by Phase II source assessments. The possibility of developing some sort of nonintrusive radiologic assessment, analogous to soil gas sampling, should be investigated.

5.5.5.2 Subtask 5b - Laboratory Activities. Additional laboratory studies may be conducted to assess physical characteristics of the vadose zone using archived and newly collected samples. Vadose zone sediments will be analyzed to determine the sorptive characteristics of the interval, which is important to CMS assessments. Also, additional chemical analyses of samples may be conducted for specific parameters to provide an understanding of contaminant occurrence within the vadose zone.

5.5.5.3 Subtask 5c - Data Evaluation. Specific data evaluation tasks are difficult to determine at this time. However, it is anticipated that these efforts which include but are not limited to: determination of the lateral and vertical extent of contamination associated with specific source areas; complete characterization of contamination in the vadose zone in accordance with CMS requirements and determination of bulk volumes of contaminated material within the vadose zone for CMS purposes. Figures presenting the three-dimensional occurrence of contamination within the vadose zone may be created to meet CMS requirements. Also, additional tables showing the understanding of contaminant occurrence, distribution, and concentration within the vadose zone may be warranted.

5.5.6 Task 6 - Groundwater Investigation

Further necessary groundwater characterization will be conducted as part of the 100-NR-1 RFI Phase II treatability investigation. Data generated as part of this task will be evaluated for relevance to the 100-NR-3 RFI Phase II treatability investigation.

5.5.7 Task 7 - Air Investigations

Air investigations were not an integral part of Phase I studies. However, results of the Phase I assessment may indicate

that more comprehensive air quality studies be conducted. Three subtasks may be conducted:

- Subtask 7a - Field Activities
- Subtask 7b - Analyses
- Subtask 7c - Data Evaluation.

5.5.7.1 Subtask 7a - Field Activities. Should it be warranted by Phase I results, air quality monitoring may need to be conducted in the 100-N Area. This could involve placement of both opacity and sample collection devices that can be used to determine contaminant occurrence in air, as well as wind meters and other measuring devices that would determine wind velocity, direction, and distribution of contaminants in the air column. Typical field sampling devices that may be used could include thermoluminescent dosimeter chips for gamma ray detection, and radiologic samplers for gross alpha and gross beta.

5.5.7.2 Subtask 7b - Analyses. The majority of the air quality monitoring devices that can be used are passive rather than active detectors. As such, laboratory analyses of collected samples would be warranted. Specific parameters and analytical techniques will be dependant upon the nature of the detectors and results of Phase I studies.

5.5.7.3 Subtask 7c - Data Evaluation. Evaluation of acquired data may include activities such as: construction of contaminant distribution plots, estimation of peak contaminant distribution periods, and estimation of contaminant occurrence, nature, and distribution as a result of entrainment in the air column. However, it is difficult to determine specific evaluation tasks as these are dependant upon Phase I and Phase II source investigations.

5.5.8 Task 8 - Ecological Investigations

Although limited ecological investigations are proposed for Phase I, investigations could be expanded in Phase II. In particular, specific exposure routes identified under Phase I will be investigated more thoroughly, with emphasis on those tasks that would fulfill CMS requirements.

5.5.9 Task 9 - Treatability Investigation Work Plan Development

After necessary tests have been identified, this work plan will be updated to include the treatability investigation work plan. The plan will identify the treatability tests needed, the additional site characterization data needed, and any site samples and other test materials and equipment needed to conduct the tests. A schedule will be prepared for obtaining all

necessary site characterization data, samples, test materials, equipment, analytical services, and permits.

The treatability investigation work plan is tentatively classified as a secondary document in the Tri-Party Agreement Action Plan, Section 9.0. However, Ecology may decide to establish this document as a primary document as provided in Section 7.3.6 of the Action Plan. In this case, formal Ecology and EPA approval will be required before the treatability investigation(s) can begin.

Individual treatability investigation work plans will be prepared for the technology to be tested. The development of each plan will involve the following steps:

- Determine the scale of the test
- Identify parameters needed and evaluate the treatment viability of the technology
- Determine specifications for test samples and sample procurement
- Determine the test equipment, materials, and procedures to be used in the treatability test
- Identify where and by whom the tests and any analytical services will be conducted; identify any special procedures and or permits required to transport samples and residues; conduct tests
- Identify the methods required for residue management and disposal
- Identify any special QA/QC needed for the tests
- Identify any special safety training or procedures needed for the tests.

Determining the scale of the test is the first step in developing an individual treatability investigation work plan for a specific technology, because it has a major influence on the cost, schedule, and complexity of the test. Establishing the scale involves: scaling the results to the expected full-scale process; finding data to design, construct, and operate the equipment at a minimum acceptable scale; and obtaining the necessary quantities of site materials for the test. For most treatment technologies, bench-scale tests will be sufficient to obtain the data necessary to evaluate a full-scale process. However, some technologies (e.g., in-situ treatment technologies and containment or barriers technologies), may require pilot-scale tests to obtain the data needed to conduct a satisfactory

evaluation of the technology. Furthermore, if insufficient data are available to design the pilot test, then bench-scale tests will need to be conducted first. The scale of the test will also be influenced by the difficulty in obtaining the sample volume necessary for conducting the test.

The range of each key parameter that will be evaluated in the tests will be specified. Some of these parameters, such as pH or temperature, will be varied over a range determined by site characteristics and the effects of any pretreatment steps. In addition, key performance criteria such as contaminant removal efficiency or leaching rate will be established in the test plan.

The equipment, materials, and test procedures will be specified for each individual treatability investigation as required to obtain the necessary data. In determining what equipment and test procedures are required, particular attention will be given to those identified in a literature survey. The equipment and procedures will also be consistent with approved EPA testing methods. Particular attention will be given to the methods and accuracy required for measuring key performance variables, such as effluent contaminant concentration, to ensure that the sensitivity of the analytical methods and equipment match the sensitivity required to compare results to the test criteria.

Two important considerations in developing each individual plan are where and by whom the tests will be conducted. If the test is to be conducted offsite or at the 100-N Area, special permits may be necessary for either constructing and operating equipment or transporting wastes and residues offsite. Similarly, when the work is conducted by a subcontractor, equipment, test, and sample analyses will need to be negotiated with respect to the treatability investigation work plan.

Management and disposal requirements for residues produced during the test will be determined. The quantity, composition, and location of the waste may influence treatability test plans. Management of the residues may be an important consideration in determining where and at what scale the tests are to be conducted.

Quality assurance/quality control plans will be reviewed to determine any special quality-related requirements necessary for each individual treatability investigation. Special consideration will be given to the ability to detect and reliably measure contaminants at the concentrations required by the criteria, as well as the potential for contamination of samples during collection, storage, and analysis.

Health and safety plans will be reviewed to determine whether any special training or procedures will be needed.

Health and safety considerations will be given to both waste-handling and test operations.

A separate plan will be prepared for each individual treatability investigation and will provide the details necessary for conducting the tests. Each plan will include:

- project description and site background relevant to tests
- corrective measure technology description
- test goals
- description of equipment and materials
- test procedures
- test plan for parameters to be tested
- sampling plan
- analytical methods
- data management
- data analysis and interpretation
- reporting of results
- health and safety
- quality assurance
- residuals management
- schedule
- test sample disposal.

Each of these sections will incorporate information developed during previous activities, as described above.

A literature survey will be undertaken to identify specific data needs for developing the treatability investigations. The objectives of such a survey will be to:

- Determine whether the performances of treatment technologies under consideration have been sufficiently documented on similar wastes, taking into consideration the scale of such documentation (e.g., bench-, pilot-, or full-scale)

9 1 1 3 3 7 0 9 3 1

- Determine the number of times the treatment technologies have been successfully used

- Gather information on relative costs, applicability, removal efficiencies, operations, and maintenance requirements, and implementability of the candidate treatment technologies

- Determine specific testing requirements and appropriate scale for any required treatability tests.

5.5.10 Task 10 - Treatability Investigation Implementation

Bench-scale (laboratory) testing may be used to provide information to determine the feasibility of waste treatment or destruction technologies, although care must be taken in extrapolating laboratory data to full-scale performance. Bench-scale tests can be used to evaluate a wide variety of operating conditions and to determine broad operating conditions to allow optimization during additional bench- or pilot-scale tests. Bench-scale testing is usually a relatively fast and low-cost process.

Potential objectives of bench-scale testing are to determine:

- Effectiveness of the treatment technology on wastes, contaminated soils or groundwater

- Differences in performance between competing manufacturers

- Differences in performance between alternative chemicals used in the treatment process

- Sizing requirements for any pilot-scale studies

- Potential technologies to be pilot tested

- Sizing of those treatment units that would affect the technology cost sufficiently to affect the detailed analysis of alternatives

- Compatibility of process materials with wastes of the 100-NR-3 operable unit.

Prior to initiating bench-scale treatability tests, the following information will be collected or developed and included in the treatability investigation work plan:

- Waste sampling plan
- Waste characterization information, which will be available from RFI Phase I and historical data
- Treatment goals, which will be available from remedial action objectives and action-specific CAR
- Data requirements for estimating the technology cost within -30 to +50% accuracy
- Required test services, equipment, chemicals, and analytical services
- Method of disposal for sampled material.

For a technology that is well developed and tested, bench-scale studies are usually sufficient to evaluate performance on new wastes.

A pilot-scale test, as compared to a bench-scale test, is intended to more accurately simulate the operations of a full-scale process. However, pilot-scale tests require significant time and can be quite costly. Therefore, the need for pilot-scale testing must be determined by balancing the data need against the additional time or money for the test. Pilot-scale testing is often appropriate for innovative technologies, and such testing will be considered if it offers potential significant savings in time or money required for an alternative to achieve remedial action objectives.

Prior to the initiation of any pilot-scale testing, the following information, in addition to the items mentioned above with regard to bench-scale testing, will be collected or developed and included in the treatability investigation work plan:

- Operable unit-specific information impacting test requirements, including waste characteristics, facility characteristics, availability of services and equipment
- Waste requirements for testing; volumes, need for any pretreatment, handling, transport, and disposal
- Specific data requirements for technologies to be tested.

9 1 1 3 8 7 0 9 3 5

Recommended formats for bench-scale and pilot-scale treatability investigation work plans, along with additional details on the process, can be found in EPA's interim final RI/FS guidance document (EPA 1988a).

5.5.11 Task 11 - Other Activities

This "open" task is included in the work plan to emphasize the probability that additional activities may be necessary to satisfactory complete the RFI/CMS. Expanded activities such as consultation with treatment experts, special analyses or other items, may be included as revisions to this work plan after informal (or formal, if required) submittal to and approval by Ecology and EPA.

5.5.12 Task 12 - Data Evaluation

This task consists of compiling and integrating the results from each Phase II RFI characterization task (2 through 8) into the conceptual site model (which is to be revised first at the end of the Phase I RFI).

This summary data evaluation will determine if adequate information has been collected, validated, and interpreted to characterize the extent of contamination in and adjacent to the 100-NR-3 operable unit, the rate of movement of contaminants, and the amounts of contaminants in continuing offsite releases. The adequacy of information collected to support the baseline risk assessment, corrective measure and treatability studies will also be determined. If additional data are needed at this point, the remaining investigations are expected to be focussed on very specific, limited questions such as optimum pH for leaching contaminants from soil.

5.5.13 Task 13 - Phase II Risk Assessment

A Phase II risk assessment will be conducted to support subsequent actions and potential design and/or construction necessary in remediation or a no action result. This assessment is based on all existing data gathered during the RFI/CMS. The risk characterization will therefore be more quantitative than the previously described risk assessments in this work plan.

The Phase II risk asessment must provide a detailed characterization of the site and, when possible, quantitative exposure and toxicity assessments of the contaminants present. The Phase II assessment differs from the baseline assessment in that actual exposure levels will be developed using state-of-the-art modeling techniques. In the absence of existing standards and guidelines for any of the contaminants, the Phase II assessment will generate quantitative indices of toxicity (e.g., unit cancer risk estimates, etc.) for use in the

characterization of risks at the site. The risk characterization will be a quantitative evaluation of the risk assessment values for each probable exposure scenario.

The Phase II process is very similar to the baseline assessment performed earlier during the RFI/CMS. The information requirements for each are similar and the assessment methods used will be consistent. Therefore, the assessment approach outlined in Section 5.2.11 will be utilized. The difference in the approach will be in the level of detail and the ability to utilize data generated during the RFI/CMS.

The level of detail will be limited to the amount of information needed to sufficiently demonstrate an actual hazard to human health or the environment. The level required will depend on the stage of the RFI/CMS and potential type of response action (e.g., removal versus remedial action). The amount of detail will ultimately be determined by results of data generating activities undertaken as a result of this work plan. Such data generating activities should focus on increasing knowledge of the following:

- Contaminants present at the site
- Concentrations from site sampling
- Pathways of contaminants
- Receptors of exposure to contaminants
- Toxicity of contaminants
- Risk characterization.

The results of the Phase II assessment may indicate that the site poses little or no threat to human health or the environment. In such a situation it will be used to support a no-action decision. If the assessment shows that risks are posed then it will be used to support remedial action alternatives. The available data will be sufficient to support one or the other of these alternatives. If the available data are not sufficient then additional data gathering will be conducted. When sufficient data are available, remedial response objectives with respect to the contaminants of concern, the areas and volumes of contaminated media, and existing and potential exposure routes and receptors of concern can be developed as part of the CMS.

5.5.14 Task 14 - RFI Phase II Report

The treatability investigation report will describe RFI Phase II characterization work and the testing performed, the results of the tests, and an interpretation of how the results

will affect the evaluation of the corrective measure alternatives considered for the 100-NR-3 operable unit.

5.5.14.1 Task 14a - Preparation. The report will contain a discussion of the effectiveness of the tested treatment technology for the onsite wastes and an evaluation of how test results affect treatment costs developed during the detailed analysis of alternatives. These results will be combined with the site characterization results, including the results of any further activities carried out under the RFI Phase II, and will be published as the final report documenting all RFI activities for the 100-NR-3 operable unit.

5.5.14.2 Task 14b - Review and Approval. The RFI Phase II (final) report is a primary document, subject to formal review and approval as specified in the Tri-Party Agreement Action Plan, Section 9.0. Internal peer review will precede submittal to Ecology and EPA.

5.6 CORRECTIVE MEASURE STUDY PHASE III: DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

The detailed analysis of remedial alternatives follows the development and screening of alternatives and precedes the actual selection of the corrective action to be implemented at the operable unit. The results of the detailed analysis provide the basis for identifying a preferred alternative and preparing the operable unit corrective measure implementation plan and Hanford RCRA Facility Permit Modification Application. The detailed analysis of alternatives consists of the following components:

- Further definition of each alternative, if appropriate, with respect to the volumes or areas of contaminated environmental media to be addressed, the technologies to be used, and any performance requirements associated with those technologies

- An assessment and a summary of each alternative against evaluation criteria specified in EPA's interim final RI/FS guidance document (EPA 1988a)

- Comparative analysis among each of the alternatives that will facilitate the selection of an operable unit corrective action.

The brief summary of the detailed analysis process presented below is derived from EPA's interim final RI/FS guidance document (EPA 1988a).

5.6.1 Task 1 - Definition of Corrective Measure Alternatives

The alternatives that remain after initial screening may need to be defined more completely prior to the detailed analysis. During the detailed analysis, each alternative will be reviewed to determine whether additional definition is required to apply the evaluation criteria consistently and to develop order-of-magnitude cost estimates (-30 to +50%). Information developed to further define alternatives at this stage may include preliminary design calculations, process flow diagrams, sizing of key process components, preliminary layouts, and a discussion of limitations, assumptions, and uncertainties concerning each alternative. Information collected from treatability investigations, if conducted, will also be used to further define applicable alternatives.

5.6.2 Task 2 - Detailed Analysis of Alternatives

Nine evaluation criteria will serve as the basis for conducting the detailed analysis and for subsequent selection of a cost-effective and protective corrective measure. The nine evaluation criteria are:

- Overall protection of human health and the environment
- Compliance with CAR
- Short-term effectiveness
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Implementability
- Cost
- Community acceptance
- Support agency acceptance.

These criteria encompass technical, cost and industrial considerations, compliance with specific promulgated requirements, and environmental and health protection.

The last two criteria will be addressed in the responsiveness summary and permit modification application following the CMS report and the proposed plan.

5.6.2.1 Subtask 2a - Short-Term Effectiveness Analysis. This evaluation criterion addresses the effects of the alternative during the construction and implementation prior to corrective

9 1 1 1 8 8 7 0 9 3 7

action objectives being attained. The following factors relating to effects on human health and the environment will be addressed for each alternative.

- Protection of the community during construction and implementation
- Protection of workers during construction and implementation
- Environmental impacts during construction and implementation
- Time until remedial action objectives are achieved.

The evaluation of these factors will include a discussion of any increased risks posed by the subject remedial alternative and an evaluation of the effectiveness and reliability of protective measures that may be taken for any needed worker protection or environmental impact mitigation.

5.6.2.2 Subtask 2b - Long-Term Effectiveness Analysis. This criterion will address the results of a potential remedial action in terms of any risk that would remain at the operable unit after remedial action objectives have been met. The following components will be addressed to evaluate the extent and effectiveness of controls that may be required to manage residual or untreated wastes:

- Magnitude of remaining risk
- Adequacy of controls
- Reliability of controls.

The evaluation of these components will include an assessment of residual risk, the adequacy of containment systems, long-term environmental monitoring networks, institutional controls, and the potential need to replace components of the remedial alternative.

5.6.2.3 Subtask 2c - Analysis of Reduction in Waste Toxicity, Mobility, and Volume. This evaluation criterion addresses the statutory preference for selecting remedies that employ treatment technologies that permanently and significantly reduce toxicity,

mobility, or volume of a hazardous substance as their principal element (CERCLA 121(b)(1)). The following specific factors will be addressed:

- Treatment processes, the remedies they will employ, and the materials they will treat
- Amount of hazardous materials that will be destroyed or treated
- Degree of expected reduction in toxicity, mobility, or volume as a percentage
- Degree to which treatment will be irreversible
- Type and quantity of treatment residuals that will remain.

Alternatives that treat an operable unit through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction of contaminant mobility, or reduction of total volumes of contaminated media will be deemed to satisfy the preference for permanent treatment.

5.6.2.4 Subtask 2d - Implementability Analysis. The implementability criterion addresses the technical and institutional feasibility of implementing an alternative, compliance with CAR, and the availability of various services and materials required during its implementation as outlined in Section 5.3.3.3.2.

5.6.2.5 Subtask 2e - Cost Analysis. Costing procedures outlined in the Remedial Action Costing Procedures Manual 4 (EPA 1985) will be used in this analysis. Both capital costs and annual operation and maintenance costs will be considered. Costs will be developed within accuracy of -30 to +50%. In addition, a present worth analysis will be conducted so that all alternatives can be compared on the basis of single figure in a common base year. A discount rate of 5% will be used for a period of performance of 30 yr.

5.6.2.6 Subtask 2f - Analysis of Overall Protection of Human Health and the Environment. This evaluation criterion provides a final check to assess whether each alternative meets the statutory requirement that it be protective to human health and the environment (CERCLA 121(d)(1)). The overall assessment of protection is based on a composite of factors discussed under long-term effectiveness and permanence, short-term effectiveness, and compliance with CAR. The analysis will address how each specific alternative achieves protection over time and how operable unit risks are reduced. A discussion will be included

of how each source of contamination is to be eliminated, reduced, or controlled for each alternative.

5.6.2.7 Subtask 2g - Analysis of Community and State Acceptance. A preliminary assessment of community and state acceptance will be limited to formal comments made in earlier phases of the RFI/CMS. Agency comments on the remedial alternative analysis and proposed plan will be specifically addressed in a responsiveness summary prior to the selection of the corrective action and permit modification application development. The potentially impacted community, special interest groups, the general public, and other interested governmental agencies will have an opportunity to review and comment on the CMS report. Community concerns will also be addressed in the responsiveness summary and permit modification application.

5.6.3 Task 3 - Comparison of Corrective Measure Alternatives

Once the alternatives have been individually assessed against the nine criteria, a comparative analysis will be conducted to evaluate each alternative in relation to each evaluation criterion. The key trade offs or concerns among alternatives will generally be based on the evaluations of short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility and volume; implementability; and cost. Overall protection and compliance with CAR serve as a threshold determination in that they either will or will not be met.

The comparative analysis will include a narrative discussion describing the strengths and weaknesses of the alternatives relative to one another with respect to each criterion. The potential advantages in cost or performance of innovative technologies and the degree of uncertainty in their expected performance will also be discussed. The differences between all of the alternatives will be summarized in matrix form to facilitate direct comparisons. The information obtained by analyzing the alternatives individually against the nine criteria in Section 5.6.2 will be the basis for the matrix.

5.6.4 Task 4 - Corrective Measures Study Phase III Report

5.6.4.1 Task 4a - Preparation. The analysis of individual alternatives against the nine criteria will be presented as a narrative discussion accompanied by the summary matrix of Section 5.6.3. The alternatives discussion will include data on technology components, quantity of hazardous materials handled, time required for implementation, process sizing, implementation requirements, and assumptions. The key CAR for each alternative will also be incorporated into those discussions. The discussion will focus on how, and to what extent, the various factors within each of the criteria are addressed. A summary matrix will

highlight the assessment of each alternative with respect to each of the criteria.

5.6.4.2 Task 4b - Review and Approval. The final CMS report is a primary document, specified in Section 9 of the Tri-Party Agreement Action Plan. The CMS report is the main part of the corrective action permit modification application, discussed in Section 7.4.3 of the Action Plan. After Ecology and EPA review the permit modification, the application and supporting documentation will be made available for public review and comment. Public comments must be satisfactorily addressed before the agencies give final approval to the modification.

5.6.5 Task 5 - Corrective Action Plan

Based on the results of the comparison of alternatives in the CMS, the preferred remedial alternative will be selected by Ecology in consultation with EPA. The preferred alternative will be developed into a proposed plan to be completed in accordance with Section 3004 of RCRA and Section 117(a) of CERCLA. The proposed plan (in the form of a permit modification application to Ecology and EPA) and CMS report will be made available for public review at the same time, after regulatory approval. The proposed plan will consist of a very brief summary written for the public that discusses the nature and extent of contamination at the 100-NR-3 operable unit, the overall remediation process, the preferred alternative and its advantages and disadvantages, and the other alternatives that are fully developed and analyzed in the CMS report.

Significant comments on the proposed plan will be addressed in a responsiveness summary to be prepared during the permit modification application process, immediately following the RFI/CMS. The remedial selection process will then be formally documented in the Hanford RCRA permit modification for the 100-NR-3 operable unit.

5.7 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

The corrective action plan in the RCRA permit modification application must comply with National Environmental Policy Act (NEPA) requirements.

5.7.1 Task 1 - Analyze Impacts

The environmental impacts associated with the proposed corrective action plan will be analyzed in terms of overall emissions, resources expected to be consumed in implementing the plan, and impacts resulting from the corrective action(s).

9 1 1 3 8 7 0 9 4 1

5.7.2 Task 2 - Prepare Impact Statement

A report summarizing the expected emissions, resources to be used and impacts will be prepared in the format of the Hanford environmental restoration - environmental impact statement (ER-EIS), with guidance provided by EPA and Ecology.

5.7.3 Task 3 - Review and Approval

If required, the report will be formally attached to the Hanford ER-EIS as an amendment, in accordance with NEPA regulations.

5.8 CLOSURE PLANS AND POST-CLOSURE PERMITS

Two RCRA-regulated TSD facilities in the 100-NR-3 operable unit are specifically required to be closed in accordance with RCRA and state hazardous/dangerous waste regulations. The 120-N-1 (1324-NA) and 116-N-2 (1324-N) disposal facilities are identified in Table D-3 in the Tri-Party Agreement Action Plan. Milestone M-20-35 sets the date for submittal of a closure plan for these units as May 1994.

The RFI/CMS work will provide the information necessary to prepare the closure plan and to determine if a RCRA post-closure permit application must be submitted along with the closure plan. The post-closure permit requirements (if any) may be met by the overall corrective action plan for the 100-NR-3 operable unit. (Post-closure permits typically contain monitoring, maintenance and corrective action requirements).

5.8.1 Task 1 - Prepare Closure Plans

Existing and RFI-generated data will be compiled and integrated into a closure plan for the two disposal facilities. The existing draft closure plans (WHC 1986a and 1987a) will be combined.

If required, a post-closure permit application will be prepared, separate from the 100-NR-3 operable unit corrective action plan and permit modification application.

5.8.2 Task 2 - Review and Approval

The closure plan (and post-closure permit application, if required) will be submitted to Ecology for approval. Ecology and EPA will determine if the plan is complete and technically adequate, and may request modifications or additional information. After agency approval, the plan will be provided to the public for review and comment for a limited time. After satisfactory resolution of comments, the plan will be approved.

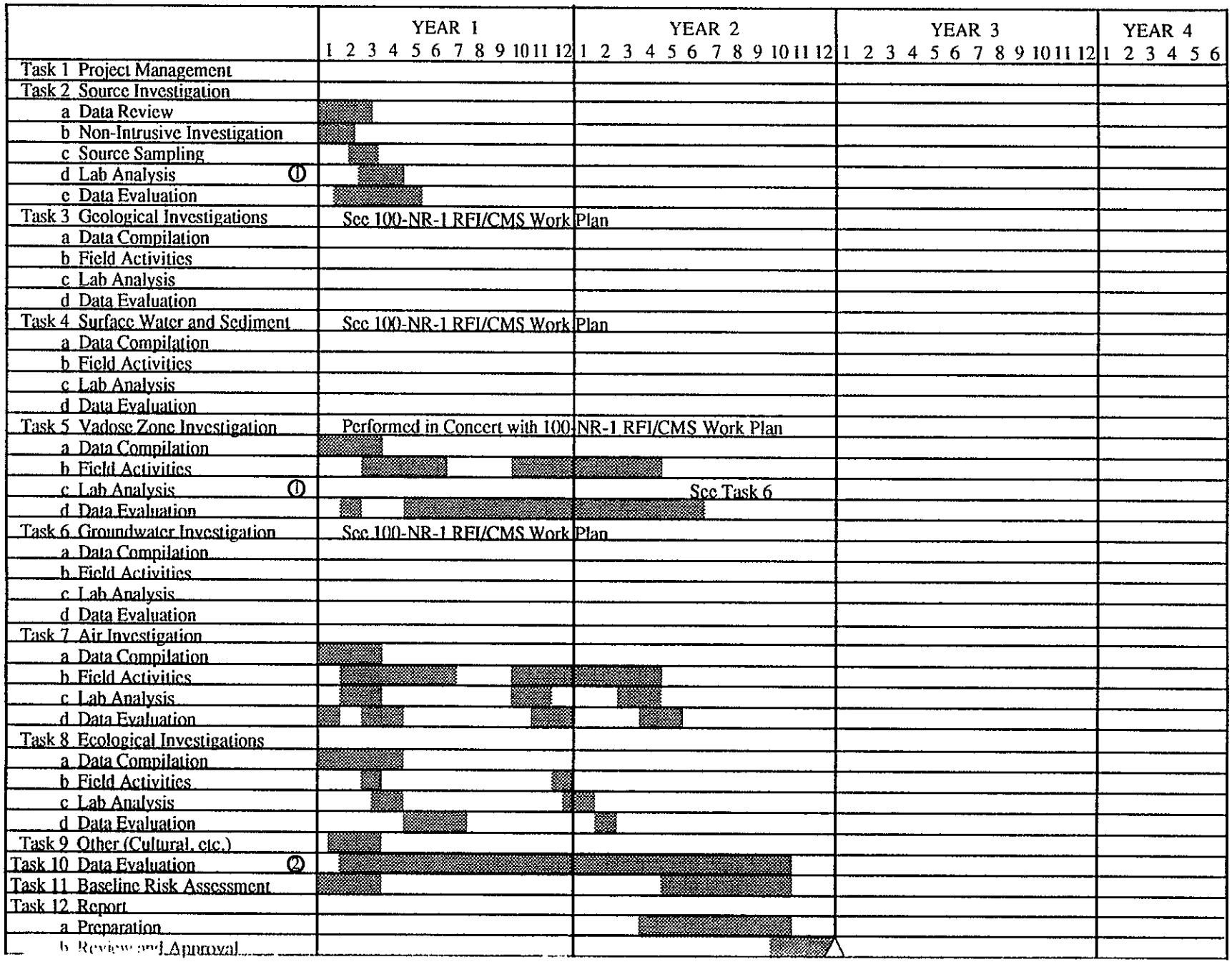
It may be of significance to note that RCRA regulations do not prohibit closure work from proceeding before the closure plan is approved.

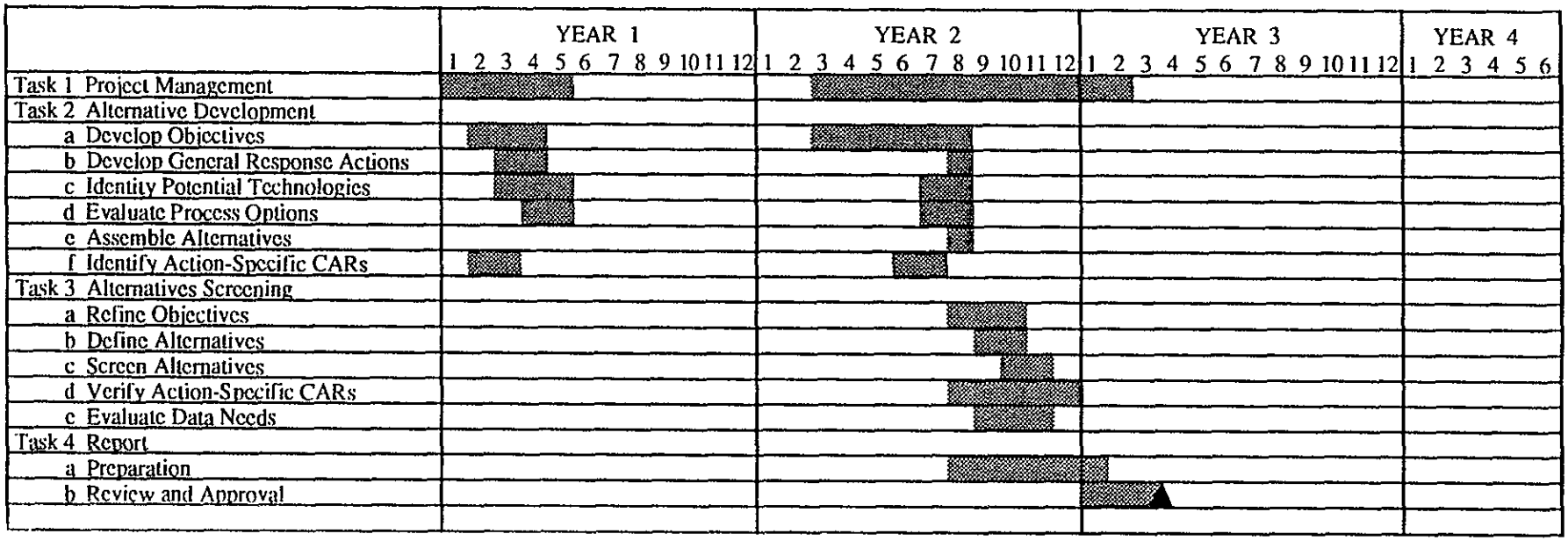
9 1 1 3 3 7 0 9 4 5

6.0 PROJECT SCHEDULE

The anticipated schedule for completing the RFI/CMS for the 100-NR-3 operable unit is presented in Figures 47 through 50. This schedule represents the best professional judgment of the work plan preparation team based on the assumptions stated as footnotes to Figure 48, and should be viewed as an initial planning effort. Many variables exist that could affect the schedule, including resource commitments, findings of the initial RFI data gathering efforts, availability of drilling rigs, availability of suitable treatability data, and federal, state, and public dispute resolutions.

This work plan conforms to the Tri-Party Agreement Action Plan Work Schedule (Figure D-1, page 5). The 100-NR-3 RFI/CMS work plan submittal to Ecology in December 1990 is designated Milestone M-12-12. The RFI is expected to begin in June 1991. The formal end of the RFI/CMS is planned to occur with the issuance of a Hanford RCRA permit modification which authorizes or approves the 100-NR-3 corrective action plan developed during the RFI/CMS. The permit modification date and this work schedule are subject to Ecology and EPA approval.


YEAR 1
1 2 3 4 5 6 7 8 9 10 11 12
YEAR 2
1 2 3 4 5 6 7 8 9 10 11 12
YEAR 3
1 2 3 4 5 6 7 8 9 10 11 12
YEAR 4
1 2 3 4 5 6
Task 1 Project Management
Task 2 Source Investigation
a Data Review
b Non-Intrusive Investigation
c Source Sampling
d Lab Analysis ①
e Data Evaluation
Task 3 Geological Investigations
See 100-NR-1 RFI/CMS Work Plan
a Data Compilation
b Field Activities
c Lab Analysis
d Data Evaluation
Task 4 Surface Water and Sediment
See 100-NR-1 RFI/CMS Work Plan
a Data Compilation
b Field Activities
c Lab Analysis
d Data Evaluation
Task 5 Vadose Zone Investigation
Performed in Concert with 100-NR-1 RFI/CMS Work Plan
a Data Compilation
b Field Activities
c Lab Analysis ①
See Task 6
d Data Evaluation
Task 6 Groundwater Investigation
See 100-NR-1 RFI/CMS Work Plan
a Data Compilation
b Field Activities
c Lab Analysis
d Data Evaluation
Task 7 Air Investigation
a Data Compilation
b Field Activities
c Lab Analysis
d Data Evaluation
Task 8 Ecological Investigations
a Data Compilation
b Field Activities
c Lab Analysis
d Data Evaluation
Task 9 Other (Cultural, etc.)
Task 10 Data Evaluation ②
Task 11 Baseline Risk Assessment
Task 12 Report
a Preparation
b Review and Approval



(1) Assumes 45 days of turnaround for laboratory chemical analysis for groundwater and soils, 30 to 60 days to complete data validation.

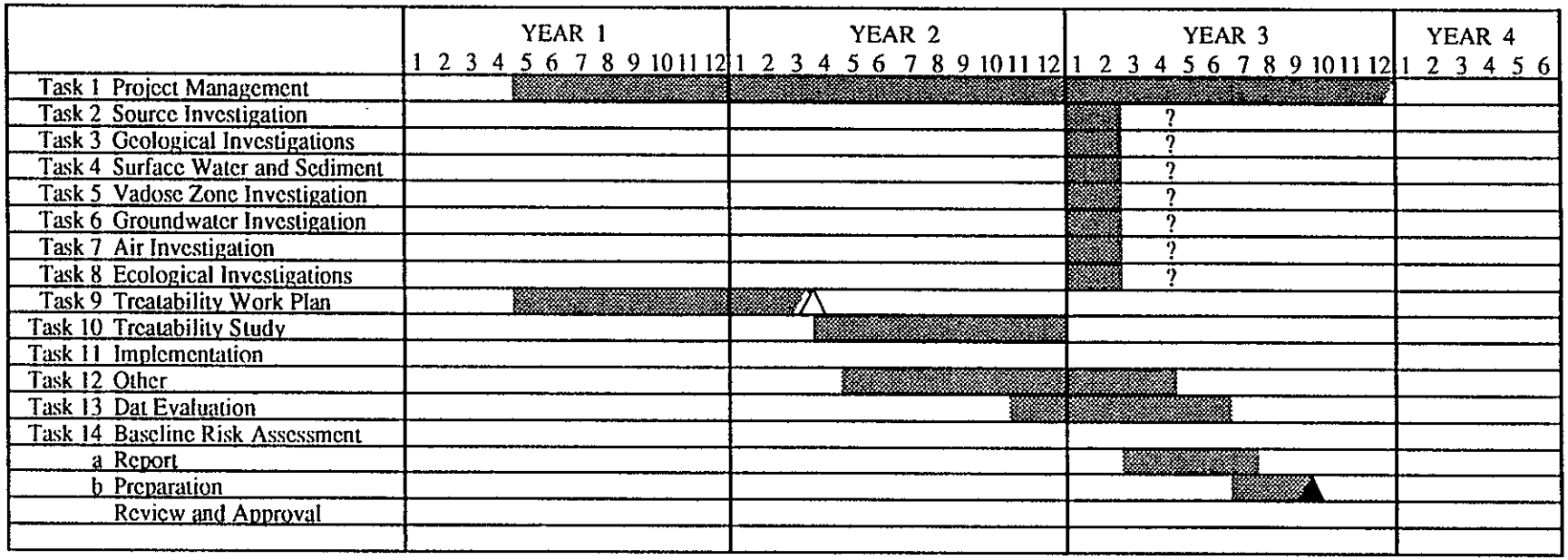
(2) Includes evaluation of data from concurrent adjacent investigations-primarily for the 100-NR-1, 100-KR-4, and 100-HR-3 operable units, for applicability to the 100-NR-3 investigation.

(3) Submittal of 1324-N/1324-NA Closure Plan is Milestone M-20-35 in the Tri-Party Agreement. Due date is May 1994.

LEGEND:

- Duration of Activity
- △ Secondary Report
- ▲ Primary Report

Figure 48. Schedule for 100-NR-3 CMS Phases I and II - Corrective Measures Development and Screening

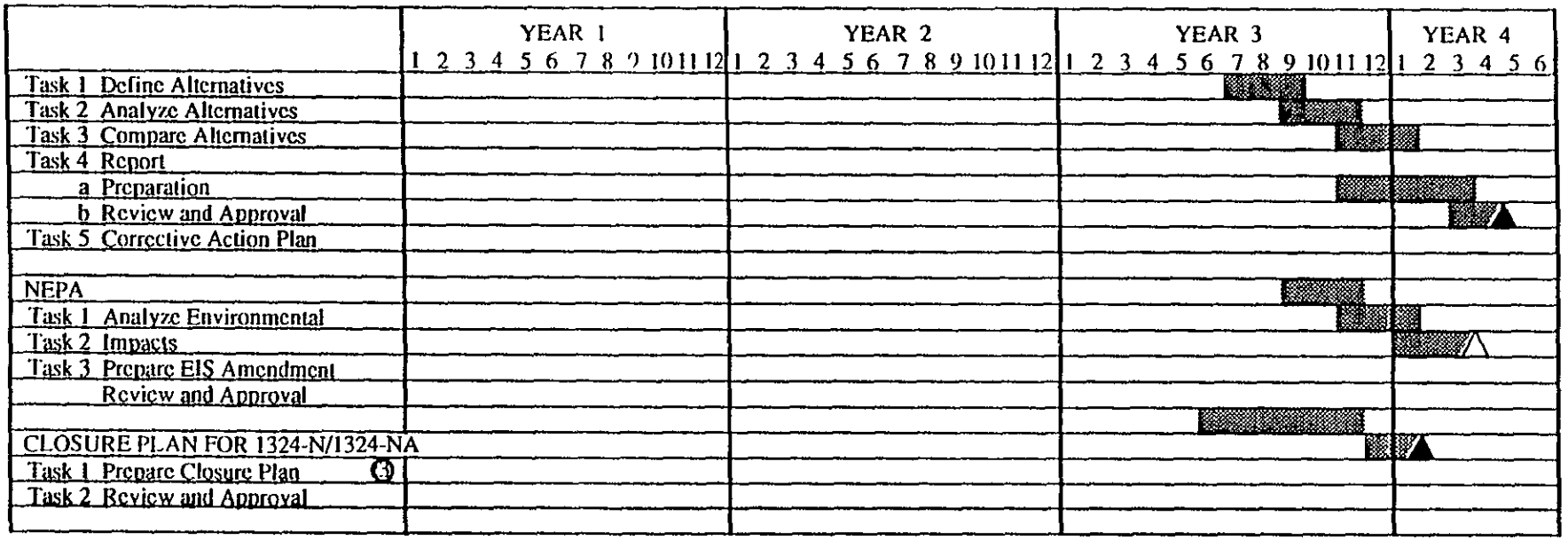


(1) Assumes 45 days of turnaround for laboratory chemical analysis for groundwater and soils, 30 to 60 days to complete data validation.

(2) Includes evaluation of data from concurrent adjacent investigations-primarily for the 100-NR-1, 100-KR-4, and 100-HR-3 operable units, for applicability to the 100-NR-3 investigation.

(3) Submittal of 1324-N/1324-NA Closure Plan is Milestone M-20-35 in the Tri-Party Agreement. Due date is May 1994.

Figure 49. Schedule for 100-NR-3 RFI Phase II - Treatability Study



① Assumes 45 days of turnaround for laboratory chemical analysis for groundwater and soils, 30 to 60 days to complete data validation.

② Includes evaluation of data from concurrent adjacent investigations-primarily for the 100-NR-1, 100-KR-4, and 100-HR-3 operable units, for applicability to the 100-NR-3 investigation.

③ Submittal of 1324-N/1324-NA Closure Plan is Milestone M-20-35 in the Tri-Party Agreement. Due date is May 1994.

Figure 50. Schedule for 100-NR-3 CMS Phase III - Analysis and Selection of Corrective Measures

7.0 REFERENCES

ANSI/ASME (1986), Quality Assurance Program Requirements for Nuclear Facilities, ANSI/ASME NQA-1-1986 Edition, The American Society of Mechanical Engineers, New York, New York

ASTM (1987), Annual Book of ASTM Standards, Section II, Water and Environmental Technology, Volume II.01, American Society of Testing Materials, Philadelphia, Pennsylvania

Chien, Y.M. (1989), Chemical Spill Prevention Control and Countermeasures Plan -- 100 Areas, WHC-SP-0460, prepared by Westinghouse Hanford Company for the U.S. Department of Energy Assistant Secretary for Environment, Safety and Health, Richland, Washington

Cushing, C.E. (ed.) (1989), Hanford Site National Environmental Policy Act (NEPA) Characterization, prepared by Pacific Northwest Laboratory for the U.S. Department of Energy, Richland, Washington

DOE-RL (1990a), RCRA Facility Investigation/Corrective Measures Study Work Plan for the 100-NR-1 Operable Unit, Hanford Site, Richland, Washington, Draft A, U.S. Department of Energy, Richland, Washington

DOE-RL (1990b), Remedial Investigation/Feasibility Study Work Plan for the 100-KR-4 Operable Unit, Hanford Site, Richland, Washington, DOE-RL 90-21, Draft A, U.S. Department of Energy

DOE-RL (1989), Defense Reactor Division - Underground Storage Tanks Summary, UST2.WK1, U.S. Department of Energy, Richland, Washington

DOE-RL (1988), Registration of Hanford Site Class V Underground Injection Wells, DOE-RL 88-11, Environmental Division, Westinghouse Hanford Company, Richland, Washington

DOE (1986), Quality Assurance, DOE Order 5700.6B, Washington, D.C.

Ecker, R.M., Walters, W.H. and F.L. Thompson (1983), N Reactor Thermal Plume Characterization Study During Dual-Purpose Mode of Operation: Part I-Field Investigation; Part II-Computer Simulation, UNI-2620, prepared by Pacific Northwest Laboratory for the U.S. Department of Energy, Richland, Washington

Ecology et al. (1989), Hanford Federal Facility Agreement and Consent Order, U.S. Environmental Protection Agency, U.S. Department of Energy, Washington State Department of Ecology, Olympia, Washington

EPA (1989a), Interim Final RCRA Facility Investigation (RFI) Guidance, Volumes I-IV, EPA 530/SW-89-031, OSWER Directive 9502.00-6D, Waste Management Division Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1989b), Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1989c), Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, Interim Final, EPA/540/1-89/001, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1988a), Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, EPA/540/G-89-004, OSWER Directive 9355.3-1, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1988b), CERCLA Compliance with Other Laws Manual, Draft Guidance, OSWER Directive 9234.1-01, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1988c), Superfund Exposure Assessment Manual, EPA/540/1-88/001, OSWER Directive 9285.5-1, Office of Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1988d), U.S. EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1988e), U.S. EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1987), Data Quality Objectives for Remedial Response Activities, Example Scenario: RI/FS Activities at a Site with Contaminated Soils and Ground Water, EPA/540/G-87/004, OSWER Directive 9355.0-7B, prepared by CDM Federal Programs Corporation for the Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1986a), Superfund Public Health Evaluation Manual, EPA/540/1-86/060, OSWER Directive 9285.4-1, PB87-183125, Office of Emergency and Remedial Response, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1986b), Test Methods for Evaluating Solid Wastes, SW-846, Third Edition, Volumes I-IV, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1986c), 1440 - Occupational Health and Safety Manual, 1986 Edition, Occupational Health and Safety Staff, Office of Administration, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1985), Remedial Action Costing Procedures Manual 4, EPA/600/8-87/049, OSWER Directive 9355.0-10, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

Gee, G.W., P.R. Heller (1985), Unsaturated Water Flow at the Hanford Site: A Review of Literature and Annotated Bibliography, PNL-5428, UC-70, prepared by Pacific Northwest Laboratory for the U.S. Department of Energy, Richland, Washington

Gephart, R.E., R.C. Arnett, R.G. Baca, L.S. Leonhart, F.A. Shane, Jr. (1979), Hydrologic Studies within the Columbia Plateau, Washington: An Integration of Current Knowledge, prepared by Rockwell International, Rockwell Hanford Operations, Energy Systems Group for the U.S. Department of Energy, Richland, Washington

Gilmore, T.J. (1989), Groundwater Quality Assessment Program for the 1324-N/NA Facilities (Draft), prepared by Pacific Northwest Laboratory for the U.S. Department of Energy, Richland, Washington

Gilmore, T.J., E.J. Jensen, M.J. Hartment (1989), Ground-Water Quality Assessment Program for the 1301-N Liquid Waste Disposal Facility, WHC-SD-EN-AP-004, Revision 0, prepared by Pacific Northwest Laboratory for Westinghouse Hanford Company, Richland, Washington

Golder Associates, Inc. (1990), Analysis of 1988 N Reactor Releases, Final Report to Westinghouse Hanford Company, 883-1755, Redmond, Washington

Golder Associates, Inc. (1988a), Assessment of Westinghouse Hanford Company Methods for Estimating Radionuclide Release from Ground Disposal of Waste Water at the N Reactor Sites, WHC-SP-0377, prepared by Westinghouse Hanford Company for the U.S. Department of Energy, Richland, Washington

Greager, E.M. (1979), United Nuclear Industries, Inc. Reactor and Fuels Production Facilities 1978 Effluent Release Report, UNI-1261, Copy No. 14, prepared by United Nuclear Industries for the U.S. Department of Energy, Richland, Washington

Gydesen, C.H. (1985), Preliminary Engineering Study Report, 100-N Sewer System, Project H-677, UNI-2951, Revision 0, prepared by Kaiser Engineers Hanford Company for UNC Nuclear Industries, Richland, Washington

Hughes, D.P. (1985), Conceptual Design Report 100-N Sewer System Project H-677, KEH-85-37-H-677, U299D0, B28464, prepared by Kaiser Engineers Hanford Company for UNC Nuclear Industries, Richland, Washington

Hunt, C.B. (1974), Natural Regions of the United States and Canada, W.H. Freeman and Company, San Francisco, California

ICF Technology, Inc. and Ebasco Services, Inc. (1988), N-Reactor Environmental Status as of April 8, 1988, prepared for Westinghouse Hanford Company, Richland, Washington

Jacques, I.D. (1985), 1300-N Emergency Dump Basin: An Analysis of Radionuclide Concentrations and the Potential for Biotransport, UNI-3509, prepared by UNC Nuclear Industries for the U.S. Department of Energy, Richland, Washington

Jensen, E.J. (1987), Summary of Water-Level Measurements around the 1325-N Crib During the Fall of 1985 and the Winter of 1986-1987, PNL-6374, UC-11, prepared by Pacific Northwest Laboratory for the U.S. Department of Energy, Richland, Washington

Krug, A.D. (1989), 1324-N/NA Surface Impoundment/Percolation Pond Facility Soil Characterization Plan, WHC-SD-EN-AP-008, Westinghouse Hanford Company, Richland, Washington

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

Perkins, C.J. (1990), Westinghouse Hanford Company Environmental Surveillance Annual Report -- 100 Areas Calendar Year 1988, WHC-EP-0258, prepared by Westinghouse Hanford Company for the U.S. Department of Energy Assistant Secretary for Defense Programs, Richland, Washington

Rokkan, D.J. (1988), Westinghouse Hanford Company 100 Areas Environmental Releases for 1987, WHC-EP-0165, UC-11, prepared by Westinghouse Hanford Company for the U.S. Department of Energy Assistant Secretary for Defense Programs, Richland, Washington

Sada, Y. (1989), Background Soil Sampling and Analysis Results for the 1324-N/NA Surface Impoundment/Percolation Pond Facility, Westinghouse Hanford Company, Richland, Washington

Stone, W.A., J.M. Thorp, O.P. Gifford, D.J. Hoitink (1983), Climatological Summary for the Hanford Area, PNL-4622, UC-11, prepared by Pacific Northwest Laboratory Operated for the U.S. Department of Energy by Battelle Memorial Institute for the U.S. Department of Energy, Richland, Washington

Stupka, R.C. (1989), Implementation Plan for Title 40 Code of Federal Regulations Parts 280 and 281; Final Rules for Underground Storage Tanks, WHC-SP-0472, prepared by Westinghouse Hanford Company for the U.S. Department of Energy Assistant Secretary for Environment, Safety and Health, Richland, Washington

Tallent, J. (1988), Black Oil Found in Annex Trench on 10-14-87, Fact Sheet Number 100-N-87-95, Westinghouse Hanford Company, Richland, Washington

Tuck, J.A. (1990), Preliminary 163-N Demineralization Plant Wastewater Stream - Specific Report, WHC-EP-0342, Addendum 4, Draft, prepared by Westinghouse Hanford Company for the U.S. Department of Energy Assistant Secretary Restoration and Waste Management, Richland, Washington

USGS (1986), Coyote Rapids Quadrangle Washington, 7.5 Minute Series (Topographic), 46119-F5-TF-024, U.S. Geological Survey, Denver, Colorado

WHC (1990a), Environmental Engineering, Technology and Permitting Function Quality Assurance Program Plan, WHC-EP-0330, Westinghouse Hanford Company, Richland, Washington

9 1 1 3 6 7 0 9 5 3

WHC (1990b), Diesel Oil Leak, Critique Report Number WHC-C-89-047-100N-20, Revision 2, Westinghouse Hanford Company, Richland, Washington

WHC (1990c), Health Physics Procedures Manual, 100 Areas/Site Surveillance, WHC-IP-0692-1, Westinghouse Hanford Company, Richland, Washington

WHC (1989a), Preliminary Operable Units Designation Project, Environmental Engineering Group, WHC-EP-0216, prepared by Westinghouse Hanford Company for the U.S. Department of Energy Assistant Secretary for Environment, Safety and Health, Richland, Washington

WHC (1989b), (NUSAR) N-Reactor Updated Safety Analysis Report, WHC-SP-0297, Volume 5, Amendment 21, Westinghouse Hanford Company, Richland, Washington

WHC (1989c), WIDS Database Field Descriptions and Data, WHC-MR-0056, Revision 1, Technology Data Management, Westinghouse Hanford Company, Richland, Washington

WHC (1989d), Environmental Investigations and Site Characterization Manual, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington

WHC (1989e), Quality Assurance Manual, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington

WHC (1988a), Unplanned Caustic Spill at Unloading Station, Critique No. WHC-C-88-077-100N-03, Westinghouse Hanford Company, Richland, Washington

WHC (1987a), Closure Plan 1324-NA Percolation Pond, Revision 0, Westinghouse Hanford Company, Richland, Washington

WHC (1987b), Trench Sump Leakage, Critique No. WHC-C-87-032-100N-15, Westinghouse Hanford Company, Richland, Washington

WHC (1987c), Leak in Trench, Critique No. WHC-C-87-062-100N-32, Westinghouse Hanford Company, Richland, Washington

WHC (1987d), Acid Leak and Lack of Containment, Critique No. WHC-UO-87-023-100N-07, Westinghouse Hanford Company, Richland, Washington

WHC (1986a), Part B Permit Application, 1324-N Surface Impoundment, Revision 0, Westinghouse Hanford Company, Richland, Washington

WHC (1986b), Release to the Ground in Excess of pH Limits Set by State Dangerous Waste Regulations, UOR 86-12, Westinghouse Hanford Company, Richland, Washington

WHC (1986c), 163-N Regeneration Waste Spill to Ground, UOR 86-15, Westinghouse Hanford Company, Richland, Washington

WPPSS (1974), Preliminary Safety Analysis Report, Hanford Generating Plant Nuclear Project No. 1, Amendment 5, Washington Public Power Supply System, Richland, Washington

Zimmerman, J. (1987), Diesel Oil Spill, Fact Sheet No. 100-N-87-91, Revision 0, Westinghouse Hanford Company, Richland, Washington

Zoric, J.P. (1989), Oil Spill Prevention Control and Countermeasures Plan, WHC-SP-0437, prepared by Westinghouse Hanford Company for the U.S. Department of Energy Assistant Secretary of Defense Programs, Richland, Washington

Zoric, J.P. (1988), Gasoline Spill to Ground, Fact Sheet Number 100N-88-026, Westinghouse Hanford Company, Richland, Washington

9 1 1 1 3 7 0 9 5 5

ATTACHMENT 1

SAMPLING AND ANALYSIS PLAN

9 1 1 1 3 7 0 9 5 6

THIS PAGE INTENTIONALLY
LEFT BLANK

1.0 INTRODUCTION

1.1 BACKGROUND

The U.S. Environmental Protection Agency (EPA) has included the 100 Area at the Hanford Site on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The 100-N Area has been divided into two source or surface operable units (100-NR-2 and 100-NR-3) and one aggregate source/groundwater operable unit (100-NR-1), for the purpose of focusing and managing the necessary environmental investigations, studies, and actions. Groundwater, surface water, and riparian and aquatic biota for all three operable units are being addressed in the 100-NR-1 work plan. This work plan addresses the 100-NR-3 operable unit.

1.2 PURPOSE AND OBJECTIVES

The purpose of the sampling and analysis plan (SAP) is to describe field procedures and sample locations that will be used to meet the specific objectives for each field task described in Section 5.0 of the work plan. This document will not, however, include the detailed descriptions of all of the field procedures that are typically found in the SAP. Instead, wherever possible, specific procedures will be referred to the latest version of the Westinghouse Hanford environmental investigations and instructions, as outlined in the Environmental Investigations and Site Characterization Manual (WHC 1989). This is done to provide a level of consistency of data collection methods (and ultimately data quality and usability) employed at the 100-NR-3 operable unit and with those used at other areas within the Hanford Site. A copy of the EII must be used in conjunction with this SAP. It is important that the procedures in these documents be referenced and followed.

1.3 CONTENTS

This SAP consists of two parts:

- Attachment 1a -- Field Sampling Plan (FSP)
- Attachment 1b -- Quality Assurance Project Plan (QAPP)

The FSP and QAPP each conform with EPA guidance with respect to content and format (EPA 1988). All procedures (including participant contractor or subcontractor procedures)

required for this project shall be approved as being in compliance with Westinghouse Hanford criteria.

2.0 REFERENCES

EPA (1988), Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Interim Final), EPA/540/G-89/004, OSWER Directive 9335.3-1, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

WHC (1989), Environmental Investigations and Site Characterization Manual, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington

9 1 1 8 3 7 0 9 5 9

ATTACHMENT 1a

FIELD SAMPLING PLAN

9 1 1 3 7 5 9 5 9

THIS PAGE INTENTIONALLY
LEFT BLANK

CONTENTS

1.0 INTRODUCTION SAP/FSP-1

2.0 TASK 2 - SOURCE INVESTIGATION SAP/FSP-2

2.1 Subtask 2b - Nonintrusive Field Investigation SAP/FSP-2
2.1.1 Geodetic and Radiological Verification Surveys SAP/FSP-3
2.1.2 Geophysical Surveys SAP/FSP-5
2.1.3 Soil Gas Survey SAP/FSP-7

2.2 Subtask 2c - Source Sampling SAP/FSP-8
2.2.1 Outer Refuse Area Grouping . . . SAP/FSP-9
2.2.2 182-N High Lift Pumphouse Grouping SAP/FSP-9
2.2.3 Acid/Caustic Storage and Transport System Grouping SAP/FSP-9
2.2.4 116-N-8 Mixed Waste Storage Pad Grouping SAP/FSP-18
2.2.5 184-N Plant Service Power House Grouping SAP/FSP-18
2.2.6 Decontamination Drain Line Leak Grouping SAP/FSP-19
2.2.7 120-N-4 Nonhazardous and Nonradioactive Storage Area Grouping SAP/FSP-19
2.2.8 Regeneration/Filter Backwash Disposal Area Grouping SAP/FSP-19
2.2.9 Office Septic Tank Area Grouping SAP/FSP-20
2.2.10 N-17 Paint Shop Grouping SAP/FSP-20
2.2.11 1120-N Septic Tank Grouping . . . SAP/FSP-20
2.2.12 124-N-10 Sewer System Grouping . SAP/FSP-20
2.2.13 Source Sampling Procedures . . . SAP/FSP-20

2.3 Subtask 2d - Laboratory Analysis SAP/FSP-21

3.0 Task 3 - Geologic Investigations SAP/FSP-21

4.0 Task 4 - Surface Water and Sediment Investigations SAP/FSP-21

5.0 Task 5 - Vadose Zone Investigation SAP/FSP-21

6.0 Task 6 - Groundwater Investigations SAP/FSP-21

7.0 Task 7 - Air Investigation SAP/FSP-30

8.0 Task 8 - Ecological Investigation SAP/FSP-30

9 1 1 3 7 0 9 5 0

CONTENTS (cont.)

9.0 Task 9 - Cultural Resources Investigation . . . SAP/FSP-30

10.0 Standard Field Procedures SAP/FSP-30

10.1 Sample Designation SAP/FSP-31
10.1.1 Facility Association SAP/FSP-31
10.1.2 Type of Sample With Sample Number SAP/FSP-31

10.2 Sample Equipment and Procedures SAP/FSP-32

10.3 Sample Handling SAP/FSP-35

10.4 Decontamination SAP/FSP-35

10.5 Waste Handling SAP/FSP-35

11.0 References SAP/FSP-35

FIGURES:

FSP-1 Source Sample Locations at 182-N High Lift Pumphouse Grouping and Acid/Caustic Storage and Transport System Grouping . . . SAP/FSP-13

FSP-2 Source Sample Locations at 184-N Plant Service Power House Grouping and Decontamination Drain Line Leak Grouping . SAP/FSP-14

FSP-3 Source Sample Locations at Regeneration/ Filter Backwash Disposal Area Grouping, Office Septic Tank Area Grouping, N-17 Paint Shop Grouping, and 1120-N Septic Tank Grouping SAP/FSP-15

FSP-4 Source Sample Locations at 100-N Sewer System Grouping SAP/FSP-16

TABLES:

FSP-1 Source Sampling at 100-NR-3 . . . . . SAP/FSP-10

FSP-2 Comprehensive List of Analytes and Parameters SAP/FSP-22

1.0 INTRODUCTION

This field sampling plan (FSP) is Part a of Attachment 1, sampling and analysis plan (SAP), of the RCRA facility investigation/corrective measures study (RFI/CMS) work plan for the 100-NR-3 operable unit. This plan provides direction for obtaining field samples for implementation of the RFI for the 100-NR-3 operable unit and is designed to be used in conjunction with the 100-NR-3 operable unit work plan, other attachments to that plan, and referenced procedures. This plan references many of the sampling and related procedures to the Westinghouse Hanford Company's Environmental Investigations and Site Characterization Manual (WHC 1989). Sampling contractors should be familiar with the manual (WHC 1989) and the SAP and have these documents readily available throughout all activities conducted as part of the RFI.

The work plan contains important summaries on the background and setting of 100-NR-3 operable unit in the first three sections, and a description of the objectives of the FSP in Section 5.0. Field personnel will be aware of the project schedule contained in Section 6.0 of the work plan (or the most recent update of that schedule).

The quality assurance project plan (QAPP), Attachment 1b, must be used with the FSP. The QAPP references the sampling equipment and procedures, and analytical procedures and quality assurance requirements that must be used to obtain good representative field samples and measurements. The health and safety plan (HSP), Attachment 2, which specifies procedures for occupational health and safety protection, will be used by project field personnel. The data management plan (DMP), Attachment 4, includes the requirements for field notebooks and required data procedures.

The RFI Phase I program includes the following tasks:

- Task 1 - Project management
- Task 2 - Source characterization

  Subtask 2a - Data review and evaluation

  Subtask 2b - Nonintrusive field characterization

  Subtask 2c - Source sampling

  Subtask 2d - Laboratory analysis

- Task 3 - Geologic investigations
- Task 4 - Surface water and sediment investigation
- Task 5 - Vadose investigations
- Task 6 - Groundwater investigations
- Task 7 - Air investigations
- Task 8 - Ecological investigation
- Task 9 - Cultural investigation
- Task 10 - Data evaluation
- Task 11 - Baseline risk assessment
- Task 12 - RFI Phase I report.

This FSP addresses only those tasks (and related subtasks) in which field activity is to be conducted. In the 100-NR-3 operable unit, the primary field emphasis is on Task 2 - source characterization and is presented in Section 2.0. Other field-related tasks (Tasks 3 through 9) will be briefly addressed in Sections 3.0 through 9.0. Section 10.0 presents standard field procedures.

2.0 TASK 2 - SOURCE INVESTIGATIONS

The purpose of the source investigation for the 100-NR-3 operable unit is to identify the locations and types of sources that exist in this unit that may pose a threat to human health and the environment or contribute to groundwater contamination in the 100-N Area. Another purpose of the source investigation is to determine if an imminent and substantial risk is present which may warrant immediate attention. Sources will be characterized by two means - nonintrusive surveys and sampling activities which are described below.

2.1 SUBTASK 2b - NONINTRUSIVE FIELD INVESTIGATION

Prior to source sampling activities, several nonintrusive investigations will be conducted. These include geodetic and radiological verification surveys, geophysical surveys, and a soil-gas survey.

2.1.1 Geodetic and Radiological Verification Surveys

A topographic base map will be developed at a scale that will allow the precision needed to show elevation contours at 2 ft intervals, at a scale of 1:2000. Mapping information will be shared and/or collected in concert with source operable unit investigations. The 100-N Area coordinates will be the primary reference grid with Hanford Site coordinates included. Facilities and sources will be included, corrected, and supplemented as appropriate, based on an inspection of aerial photographs of the 100-N Area.

This subtask will also include a site radiological survey of surface and subsurface radioactive contamination. The survey will be conducted in accordance with procedures outlined in the Health Physics Procedures Manual (WHC 1990).

The focus will be on visual observation, and field screening of radiation exposure and/or contamination rates and airborne and soil gas concentrations of volatile organic compounds (VOC). Soil gas measurements for VOC will be made by digging a small hole and taking a brief measurement with a photo-ionization or flame-ionization detector. The information from this survey will be used to minimize the potential for unexpected radiation or VOC exposure during subsequent tasks to account for information that was not available from the historic files.

Surface geologic mapping will be performed in conjunction with the site walkover and the radiological survey.

2.1.1.1 Map Construction. The site topographic map will be at a scale that will allow the precision needed to show elevation contours at 2-ft intervals. Site features such as the 100-N boundary, Columbia River, fence lines, gates, buildings, disposal facilities and pipelines will be included. The site map will extend 328 ft beyond the boundary of 100-N Area. The 100-N Area grid system will be used with the Hanford grid system referenced. Third order precision and accuracy will be used for the development of the site map. Procedures and protocol established in "Surveying," EII 12.1 (WHC 1989) will be followed.

Horizontal and vertical control will also be provided for sampling points and grids established for completing the following:

- Surface radiation survey
- Electromagnetic induction/magnetometer (EMI/MAG) survey

- Ground-penetrating radar (GPR) survey
- Soil-gas survey.

Horizontal and vertical control will be established on four points at each survey grid location required for these surveys. Surveys are to be completed by a surveyor who is licensed and registered in the state of Washington. Vertical control will be referenced to a United States Geological Survey datum obtained from permanent benchmark. Surveys will be based on the Washington State Plane Coordinate South Zone System on NAD 83 Geodetic Survey and Lambert Projection.

For those areas which may be inaccessible to a field survey crew, aerial photos will be used. These photos will be available in the field for location verification.

2.1.1.2 Radiological Survey. This task will be performed in conjunction with the geodetic survey task to establish and define the extent of surface contamination and potential areas of subsurface contamination in the 100-NR-3 operable unit. The procedures of the Health Physics Manual (WHC 1990) and "Administration of Radiation Surveys to Support Environmental Characterization Work on the Hanford Site," EII 2.3 (WHC 1989) will be followed for this survey. This activity will employ methods and practices to maintain radiation exposure "as low as reasonably achievable" (ALARA) in compliance with regulatory requirements. This activity will locate any areas of radioactive contamination in surficial soils within the operable unit. Background surface radiation conditions will also be determined so that meaningful comparisons can be made to the data in potentially impacted areas.

2.1.1.2.1 Surface Radiation Survey Locations and Frequency. The background plot established for the 100-NR-3 RFI/CMS will be used for determining background surface radiation levels at the 100-NR-3 operable unit. This background radiation survey will be conducted on land surface within the 100-NR-3 operable unit boundary. The background plot will be approximately 174 ft by 151 ft. Sampling at the background plot will be conducted at intersecting points on approximately a 25 ft grid to obtain discrete readings at each point. This grid spacing may be modified if it is determined that a closer spacing is required. Approximately 56 points will be sampled using this grid spacing.

Sampling within the operable unit will be conducted along transect at a minimum of 25 ft intervals to determine the location and extent of elevated radiation levels. This grid spacing may also be modified if it is determined that a closer spacing is required. Where elevated level of radiation that is statistically greater than background is encountered along a transect (statistically significant levels will be determined by

elevated levels above the 0.95/0.95 upper tolerance limit of the background distribution, or by other statistical methods, as appropriate), the survey will depart from the transect to locate and quantify the source of the reading. The area with elevated radiation levels will be staked and flagged.

2.1.1.2.2 Surface Radiation Survey Background and Anomaly Designations. The grid coordinates established for the background plot will be designated A, B, C, etc., along the length of the plot and 1, 2, 3, etc., along the width of the plot. Each point measured will be designated by the combined grid coordinates (e.g., B2, C1).

Each anomaly detected during the surface radiation survey will be identified with a unique designation number. The designation will indicate that the anomaly was identified during the surface radiation survey and include the numerical sequence of the anomaly. For example, the first anomaly detected will be SRAD #1. The anomaly will be staked and located in the field, and plotted on the base map.

2.1.2 Geophysical Surveys

This task will further define the vertical and horizontal extent of soil contamination surrounding and below hazardous waste disposal facilities in the 100-NR-3 operable unit.

Geophysical surveys will be conducted in accordance with "Geophysical Survey Work," EII 11.2 (WHC 1989) and the Data Quality Objectives for Remedial Response Activities (EPA 1987).

2.1.2.1 Electromagnetic Induction/Magnetometer (EMI/MAG) Survey. The objective of the EMI/MAG survey is twofold:

- To precisely locate buried facilities
- To screen large areas for potential contamination for subsequent sampling.

2.1.2.1.1 EMI/MAG Survey Locations and Frequencies. The implementation of the EMI/MAG survey will be a one-time occurrence. Initially a MAG survey will be conducted to define locations of the buried pipelines. Locations of the pipelines will be staked and the EMI survey will be conducted over the facilities as described below. A site reconnaissance will be conducted prior to the EMI survey to identify the background noise level at each facility.

For the smaller facilities, the survey will be conducted on a grid of 10 ft intervals to determine the length and the width of the facility. Horizontal control will be established. The survey will continue until readings approach background levels.

For the larger facilities, the survey will be conducted on 25 ft intervals to determine the length and the width of the facility.

The grid spacing will be larger for long pipelines. A grid will be surveyed with two lines running parallel to the pipeline. Readings will be taken perpendicular to the strike of the pipeline at approximately 50 ft intervals. Facilities that will be surveyed on this grid spacing include the following:

- Buried fuel oil pipeline associated with the aboveground fuel oil tanks
- Buried process effluent pipelines
- Buried discharge pipelines to the Columbia River (including alternate pipeline locations as shown on some drawings).

2.1.2.1.2 EMI/MAG Survey Anomaly Designation. Each anomaly detected during the EMI survey will be identified with a unique designation number. The designation will indicate which facility the anomaly is associated with, indicate the anomaly was identified during the EMI survey, and include the numerical sequence of the anomaly.

Where the objective of the EMI survey is to precisely locate buried facilities, the designation will include the facility name and waste information data system (WIDS) number if applicable. The facility boundaries will be staked and subsequently plotted on a base map using the relative coordinates from the grid established in the geodetic survey. The name of the facility and coordinates will be marked on the stakes.

2.1.2.1.3 EMI/MAG Survey Equipment and Procedures. Details on magnetometer and electrometer survey equipment and procedures shall be specified in "Geophysical Survey Work," EII 11.2 (WHC 1989). Alternatively, the EMI/MAG survey may be conducted by approved participant contractor or subcontractor procedures as specified in Section 4.0 of the QAPP. These procedures will include details on equipment specifications, including sensitivities and interference, signal generator and antennae array, and data logging equipment.

2.1.2.2 Ground-Penetrating Radar Survey. This activity will determine the locations and boundaries of buried features that are presently uncertain and other facilities that may not have been adequately identified during the EMI/MAG survey.

2.1.2.2.1 Ground-Penetrating Radar Survey Locations and Frequencies. The GPR survey will be conducted at the locations that are not adequately defined during the EMI/MAG survey described in Section 2.2.2.1. A 49 ft grid will initially be

9 1 1 1 3 7 0 9 5 7

surveyed to determine facility boundaries and depths. Horizontal control for the grid will be established. Closer grid spacing may be conducted if resolution of the GPR signals is adequate to determine specific types of buried objects (i.e., drums).

2.1.2.2.2 Ground-Penetrating Radar Survey Equipment and Procedures. The GPR survey will be conducted along transects run between opposing stakes sited in the geodetic survey. Results will be plotted as to location by reference to the established grid systems.

Details on GPR survey equipment and procedures shall be specified in a Westinghouse Hanford EII to be developed in accordance with "Preparation and Revision of Environmental Investigations Instructions," EII 1.2 (WHC 1989). Alternatively, GPR may be conducted by participant contractor or subcontractor procedures approved and controlled as specified in Section 4.0 of the QAPP. These procedures will specify equipment sensitivities and interferences, radar antennae range, recording equipment, calibration requirements, and personnel certification/training requirements.

2.1.3 Soil-Gas Survey

The objective of the soil gas survey is to identify areas where petroleum products or organic solvents may have been released. Areas where volatile organic compounds are detected in the soil-gas survey may be further investigated.

2.1.3.1 Soil-Gas Survey Locations and Frequencies. The areas covered by the soil-gas survey will be identified during site mapping (Section 2.2.1.1). Probes for the soil-gas survey will be installed on a grid with about 25-ft intervals.

Probes will be installed around the perimeter of existing buildings on about 25-ft centers. This grid spacing may be modified if it is determined that a closer spacing is required to define the extent of contamination.

Probes will be installed on a grid with about 49-ft intervals where large areas are to be covered.

The extent of contamination will be determined by installing additional probes until no detectable contamination is found in two adjacent probes bounding the area.

Probes will be installed to about 3 to 6 ft depth at all locations. Final depth at any individual location will depend on subsurface obstructions.

2.1.3.2 Sample Designation. Stakes will be used to mark the locations of the gas probes. Each probe location will be

designated with a unique number associated with a unique number associated with the facility being covered by the survey. This number will be followed by the letters "SG" to denote soil gas, and a number indicating sequence. The sample number will be marked in indelible ink on each stake for the probe locations. The number will also be used to indicate gas samples obtained for analysis.

2.1.3.3 Sampling Equipment and Procedures. Equipment required to conduct the soil gas survey includes: (a) stainless steel probes, (b) gas-tight fittings for the probes, (c) Vacuum pump for purging and sampling, and (d) sample containers (may include gas tight syringes, stainless steel cylinders, tedlar bags, glass sample bulbs). Complete details on equipment and procedures for soil gas probe installation, penetrating and sealing pavement, purge volumes, sample depths, soil gas extraction, sample collection, and sample analysis shall be specified in procedures to be developed in "Soil-Gas Sampling," EII 5.9 (WHC 1989). These procedures shall be approved and controlled as specified in Section 4.0 of the QAPP.

2.1.3.4 Sample Handling and Analysis. Soil gas samples will be obtained in clean gas-tight sample containers. Level II analysis for volatile organic (including methane for all landfill facilities) and halogenated compounds will be conducted onsite using a field portable gas chromatograph or samples will be shipped to a laboratory for analysis by EPA Method 8240 (Level III) (EPA 1986). The gas chromatograph will be equipped with a photo-ionization detector photo-ionization detector and an electron-capture detector. The photo-ionization detector is suitable for detecting VOCs and the electron-capture detector is capable of detecting halogenated organic compounds at low concentrations.

Additionally, information on sample procedures is provided in Section 4.0 of the QAPP, sample custody in Section 5.0, and analytical procedures in Section 7.0. Procedures for soil-gas surveys will be specified in a procedure to be developed in "Soil-Gas Sampling," EII 5.9 (WHC 1989), approved and controlled as specified in Section 4.0 of the QAPP, will also contain information on sample collection, handling and analysis.

2.2 SUBTASK 2c - SOURCE SAMPLING

Source sampling will be conducted to determine the existence and concentration of contaminants. The purpose of source sampling is only to verify the existence and concentration, not to determine the extent of contamination. Therefore, source sampling will include a minimum of samples from each applicable unit.

Table FSP-1 presents the source sampling to be conducted at each unit with in 100-NR-3. Figure FSP-1 through FSP-4 shows the proposed sample locations. Section 3.1.1 of the 100-NR-3 work plan provides known background information on each of the units within 100-NR-3. This information was used to determine the source sampling locations. The data review and evaluation and nonintrusive investigation subtasks (2a and 2b, respectively) may provide information which could add or delete sampling locations from the program. In addition, further samples may be collected at the discretion of the field team leader, based upon conditions observed in the field, such as high instrument readings or observed contamination.

The basic strategy for source sampling is to either sample the contents of waste management units (e.g., septic tanks, french drains, neutralization pits, etc.) or sample the soil in the area of unplanned releases. Soil samples will be obtained at both the surface and at a depth of 4 ft. The 4 ft depth was chosen because, based on conversations with Westinghouse Hanford personnel, 4 ft appears to be generally below the zone of excavation and backfilling. Another reason for the 4 ft sample depth is that, per Westinghouse Hanford guidelines, excavations below 4 ft require shoring or trenching.

The following sections discuss the source samples to be collected from the groupings and units within. All samples will be analyzed for the constituents described in Section 2.4.

2.2.1 Outer Refuse Area Grouping

No source samples are planned for this area. The nonintrusive investigation will address these units.

2.2.2 182-N High Lift Pumphouse Grouping

The contents of the 124-N-2 Septic Tank will be sampled with a ponar grab sampler or similar device. Access to the septic tank will be determined in the field. The proposed sample location is shown in Figure FSP-1.

The other sources within the 182-N High Lift Pumphouse grouping will not be sampled. These sources will be addressed in the surface water investigation.

2.2.3 Acid/Caustic Storage and Transport System Grouping

The contents of the 120-N-7 Unloading Station French Drain will be sampled with a ponar grab sampler or similar device. In addition, two surface and subsurface samples will be collected in each of the unloading areas where two documented unplanned releases (UN-100-N-33 and December 26, 1987) occurred (four samples total). Sample locations will be determined in the field

Table FSP-1. Source Sampling at 100-NR-3. (sheet 1 of 3).

Designation Number	Alias/ Location	Work Plan Section	Contents	Sample Type and Number: Surface Soil	Sample Type and Number: Subsurface Soil	Comments
---	HGP Burn Pit	3.1.1.1.1				No samples planned. Non-intrusive investigation will address these sources.
---	Grass Dump	3.1.1.1.2				
---	Construction Debris Dump	3.1.1.1.3				
124-N-2	Septic Tank	3.1.1.2.1	1			Contents of septic tank only.
---	184-N Overflow	3.1.1.2.2				No samples planned.
---	182-N Drain Outfall	3.1.1.2.3				
---	September 1986 UPR	3.1.1.2.4				
---	108-N Chemical Unloading Facility	3.1.1.3.1				Contents of french drains will be sampled. Surface and subsurface samples will be collected at areas of unplanned releases.
120-N-7	Unloading Station French Drain		1			
UN-100-N-33	UPR			1	1	
---	December 26, 1987 UPR			1	1	
---	108-N Neutralization Pit	3.1.1.3.1	1			Contents of neutralization pit and french drains will be sampled. Surface and subsurface samples will be collected in the area of the unplanned release.
120-N-6	Sulfuric Acid Tank French Drains		5			
UN-100-N-15	UPR			1	1	
120-N-5	Neutralization Unit and French Drains	3.1.1.3.2	2			Content samples from the containment vaults. Surface and subsurface soil samples at areas of unplanned releases.
UN-100-N-34	UPR			1	1	
---	August 7, 1987 UPR			1	1	
---	September 2, 1987 UPR			1	1	
---	November 9, 1987 UPR			1	1	
120-N-3	163-N Neutralization Pit and French Drain	3.1.1.3.3	1			Content samples of the french drain.
120-N-8	163-N Sulfuric Acid Day Tank Vent French Drain	3.1.1.3.4	1			Content samples from the french drain.

Table FSP-1. Source Sampling at 100-NR-3. (sheet 2 of 3).

Designation Number	Alias/ Location	Work Plan Section	Contents	Sample Type and Number: Surface Soil	Sample Type and Number: Subsurface Soil	Comments
---	Regeneration Waste Transport System	3.1.1.3.5	1			Content samples from sump. Surface and subsurface samples from locations of unplanned releases.
---	June 14, 1986 UPR			1	1	
---	June 30, 1986 UPR			1	1	
124-N-1	Septic Tank	3.1.1.3.6	1			Content sample from septic tank.
116-N-8	Mixed Waste Storage Pad	3.1.1.4				No source samples planned. Nonintrusive investigation will address this source.
---	184-N Plant Service Power House	3.1.1.5.1				No source sampling planned.
---	184-N Day Tanks	3.1.1.5.2				Two surface and subsurface soil samples from within day tank containment area.
UN-100-N-19	UPR			1	1	
UN-100-N-21	UPR			1	1	
---	September 9, 1987 UPR					
---	166-N to 184-N Piping	3.1.1.5.3				Surface and subsurface soil samples from locations of unplanned releases.
UN-100-N-18	UPR			1	1	
UN-100-N-22	UPR			1	1	
UN-100-N-23	UPR			1	1	
---	October 14, 1987 UPR			1	1	
---	April 26, 1989 UPR			1	1	
UN-100-N-6	UPR	3.1.1.6		1	1	Surface and subsurface soil sample from location of unplanned release.
120-N-4	Nonhazardous Nonradioactive Storage Pad	3.1.1.7.1				No source sampling planned. Nonintrusive investigation will address this source unit.
---	1716-N Service Station USTs	3.1.1.7.2				No source sampling planned. Nonintrusive investigation will address this source unit.

Table FSP-1. Source Sampling at 100-NR-3. (sheet 3 of 3).

Designation Number	Alias/ Location	Work Plan Section	Contents	Sample Type and Number: Surface Soil	Sample Type and Number: Subsurface Soil	Comments
120-N-1	1324-NA	3.1.1.8.1				No source samples planned. Nonintrusive, vadose zone, and groundwater investigations will address this unit.
---	South Settling Pond	3.1.1.8.2				No source samples planned. Nonintrusive, vadose zone, and groundwater investigations will address this unit.
120-N-2	1324-N	3.1.1.8.3				No source samples planned. Nonintrusive, vadose zone, and groundwater investigations will address this unit.
130-N-1	Filter Backwash Pond	3.1.1.8.4	1	1		One liquid and one sediment sample from this source unit.
---	1143-N Paint Shop	3.1.1.8.5				No source samples planned. Nonintrusive investigations will address this source unit.
124-N-5	1117-N Septic Tank	3.1.1.9.1	1			Content sample from septic tank.
124-N-6	1113-N Septic Tank	3.1.1.9.2	1			Content sample from septic tank.
124-N-7	1115-N Septic Tank	3.1.1.9.3	1			Content sample from septic tank.
124-N-8	1134-N Septic Tank	3.1.1.9.4	1			Content sample from septic tank.
---	N-17 Paint Shop	3.1.1.10		1	1	Surface and subsurface soil sample in area of compressor leak.
124-N-9	1120-N Septic Tank	3.1.1.11	1			Content sample from septic tank.
124-N-10	100-N Sewer System	3.1.1.12.1	3			Content samples from each lagoon.
UN-100-N-11	UPR	3.1.1.12.2				No source sample planned. Nonintrusive investigation will address this unit.

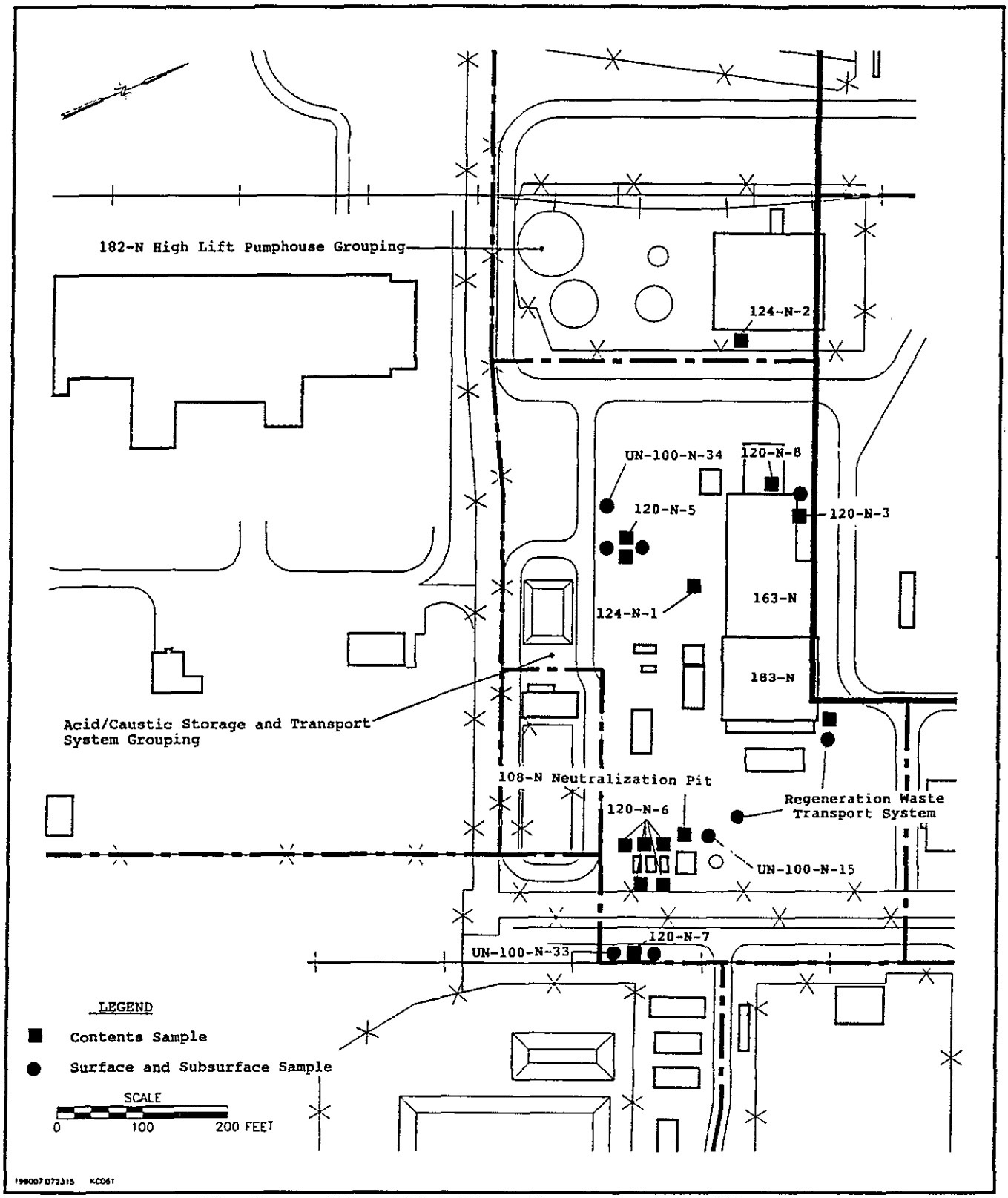


Figure FSP-1. Source Sample Locations at 182-N High Lift Pumphouse Grouping and Acid/Caustic Storage and Transport System Grouping

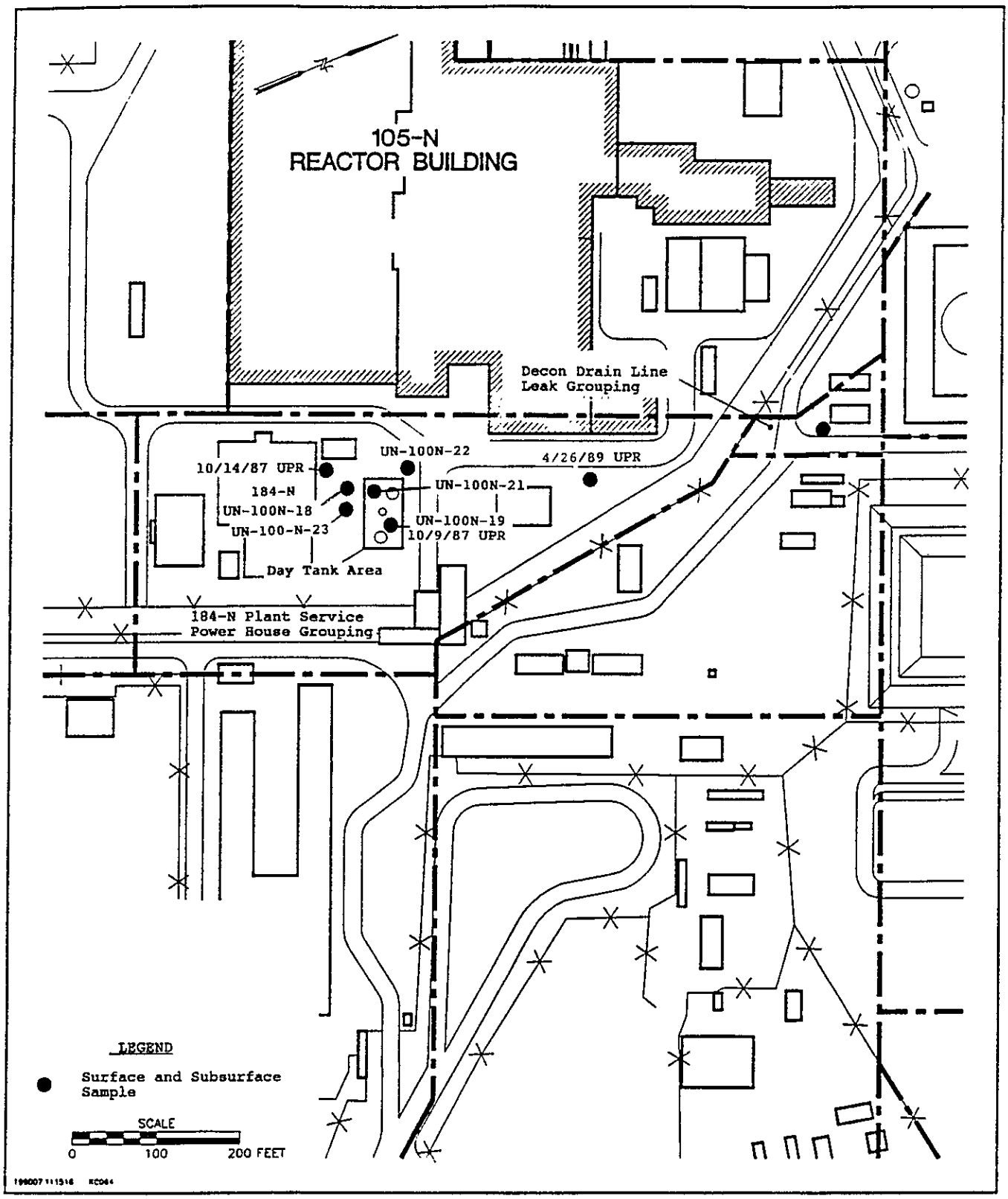


Figure FSP-2. Source Sample Locations at 184-N Plant Service Power House Grouping and Decontamination Drain Line Leak Grouping

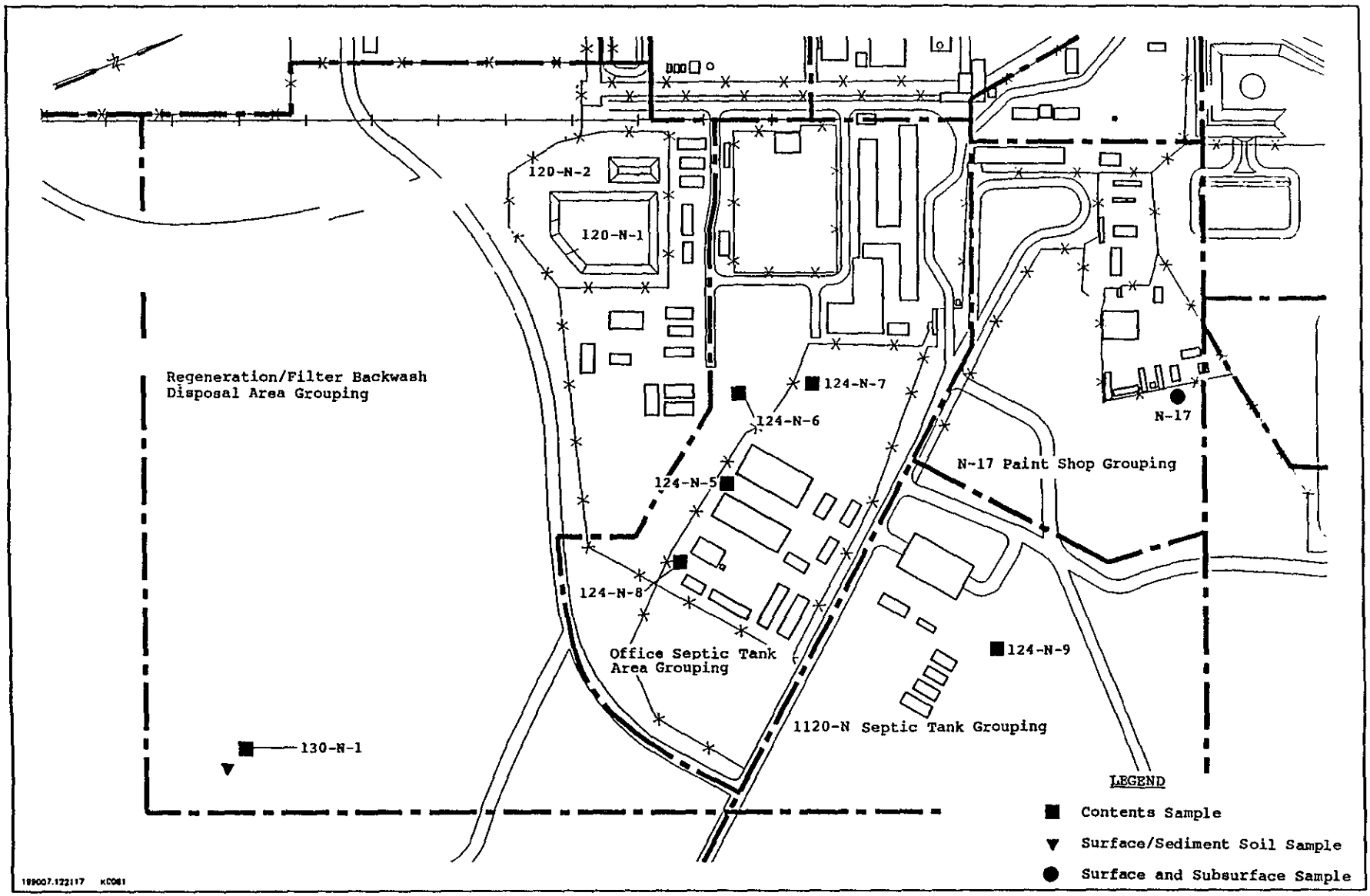


Figure FSP-3. Source Sample Locations at Regeneration/Filter Backwash Disposal Area Grouping, Office Septic Tank Area Grouping, N-17 Paint Shop Grouping, and 1120-N Septic Tank Grouping

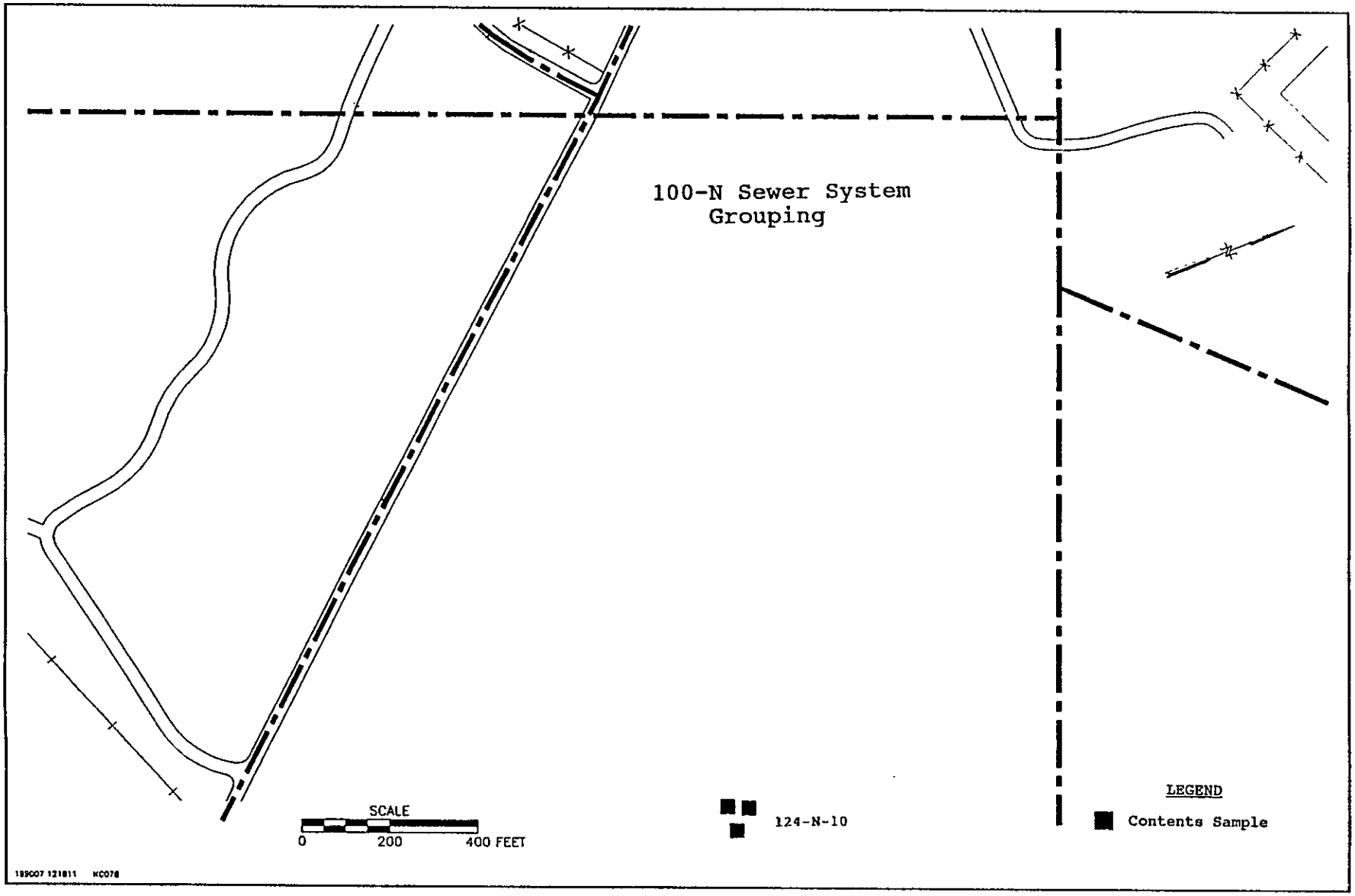


Figure FSP-4. Source Sample Locations at 100-N Sewer System Grouping

based upon data review and evaluation. The subsurface samples will be collected from a depth of 4 ft with a sampling scoop after excavation with a backhoe. Sample locations are shown in Figure FSP-1.

A sample will be collected of the contents of each of the five 120-N-6 Sulfuric Acid Tank French Drains. A ponar grab sampler or similar device will be used. In addition, one surface and one subsurface sample will be collected in the area of the March 20, 1981, unplanned release (UN-100-N-15). The area of the spill was between the 108-N Building and the sulfuric acid tank. The specific sample location will be determined in the field based on data review and evaluation. The subsurface sample will be collected from a depth of 4 ft with a sampling scoop after excavation with a backhoe. Sample locations are shown in Figure FSP-1.

A sample will be collected from the contents of the 108-N Neutralization Pit. Based on conversations with Westinghouse Hanford personnel, the contents may either be liquid or sludge. The sampling method will be determined based upon field observations.

Two contents samples will be collected from the 120-N-5 Neutralization Unit. One sample will be collected from the bottom of each of the two containment vaults associated with the unit. A ponar grab sampler or similar device will be used. In addition, four surface and four subsurface samples will be collected. Each set of surface and subsurface samples will be placed near the area of one of the four documented unplanned releases associated with this unit. These are UN-100-N-34, August 7, 1987, September 2, 1987, and November 9, 1987, unplanned releases. UN-100-N-34 occurred at the containment vaults. The August 7, 1987, unplanned release occurred in an unlined portion of the trench north of the 163-N building. The specific location of the September 2, 1987, unplanned release is unknown. The November 9, 1987, unplanned release occurred in a dry well within the trench. All subsurface samples will be collected from a depth of 4 ft using a sampling scoop after excavation with a backhoe. Sample locations are shown in Figure FSP-1.

The contents of the 120-N-3 Neutralization Pit and French Drain will be sampled. A ponar grab sampler or similar device will be used to retrieve a sample from the french drain. The sample location is shown in Figure FSP-1.

The contents of the 120-N-8 Sulfuric Acid Day Tank French Drain will be sampled. A ponar grab sampler or similar device will be used to retrieve a sample from the french drain. The sample location is shown in Figure FSP-1.

A contents sample will be collected from the sump associated with the regeneration waste transport system. The sump is located on the north side of the 163-N Building. A ponar grab sampler or similar device will be used to obtain the sample. In addition, two sets of each surface and subsurface samples will be collected in the areas where the two documented unplanned releases occurred. The June 14, 1986, release occurred south of the 163-N Building. The June 30, 1986, release occurred near the above-mentioned sump. Specific sampling locations will be determined based upon data review and evaluation and nonintrusive investigations. The subsurface samples will be collected from a depth of 4 ft with a sampling scoop after excavation with a backhoe. Sample locations are shown in Figure FSP-1.

The contents of the 124-N-1 Septic Tank will be sampled with a ponar grab sampler or similar device. Access to the septic tank will be determined in the field. The sample location is shown in Figure FSP-1.

2.2.4 116-N-8 Mixed Waste Storage Pad Grouping

No source sampling is planned for this unit. The nonintrusive field investigation will address potential releases from this source.

2.2.5 184-N Plant Service Power House Grouping

No source sampling is planned for the 184-N Plant Service Power House Boiler. Two surface and subsurface sets of samples are planned for the 184-N Day Tank containment area. One sample location will be placed in the area where the fuel oil day tank overflowed in April 1984 (UN-100-N-19). The other sample location will be placed in the area where the diesel oil day tanks overflowed on April 25, 1986 (UN-100-N-21) and October 9, 1987. The specific sample locations will be determined in the field based on data review and evaluation. The subsurface samples will be collected from a depth of 4 ft with a sampling scoop after excavation with a backhoe. Sample locations are shown in Figure FSP-2.

A maximum of five sets each of surface and subsurface samples will be collected along the 166-N to 184-N piping area. One surface and subsurface sample will be collected from the area outside the day tank area where the June 23, 1986, unplanned release (UN-100-N-22) occurred. One surface and subsurface sample will be collected in the area of the August 1973 unplanned release (UN-100-N-18). One surface and subsurface sample will be collected from an area where a ruptured diesel line released on January 10, 1987 (UN-100-N-23). A surface and subsurface soil sample will be collected near the 184-N Annex where a fuel oil leak occurred on October 14, 1987. One surface and subsurface soil sample will be collected in the area of the April 26, 1989,

release of diesel oil from the 4-in. pipe between 166-N and 184-N. The specific locations of these samples will be determined based upon further data review and evaluation and the nonintrusive investigation. All subsurface samples will be collected from a depth of 4 ft using a sampling scoop after excavation with a backhoe. Sample locations are shown in Figure FSP-2.

2.2.6 Decontamination Drain Line Leak Grouping

One surface and one subsurface soil sample is planned for the area where the September 10, 1985, unplanned release (UN-100-N-6) from the 1 1/2-in. chemical decontamination waste drain line between 105-N and the 1310-N Silo. The specific sample location will be determined in the field based upon further data review and evaluation and the nonintrusive investigation. The subsurface sample will be collected from a depth of 4 ft using a sampling scoop after excavation with a backhoe. The sample location is shown in Figure FSP-2.

2.2.7 120-N-4 Nonhazardous and Nonradioactive Storage Area Grouping

No source sampling is planned for the source units within this grouping. The data review and evaluation and nonintrusive field investigations subtasks (2a and 2b, respectively) will address these units.

2.2.8 Regeneration/Filter Backwash Disposal Area Grouping

One surface water and one sediment sample will be collected from the 130-N-1 Filter Backwash Discharge Pond. The sample locations will be placed near the discharge point from the 183-N building to the pond. Surface water samples will be collected by lowering a clean container into the water and filling the appropriate sample containers. The sediment sample will be collected using a ponar grab sampler or similar device. Sample locations are shown in Figure FSP-3.

The 120-N-1, 120-N-2, and south settling pond units have no planned source sampling associated with them. These units will be addressed in the nonintrusive, vadose zone, and groundwater investigations. Likewise, no source sampling is planned for the 1143-N Paint Shop. The nonintrusive investigation will address this unit.

2.2.9 Office Septic Tank Area Grouping

Each of the four septic tanks (124-N-5, 124-N-6, 124-N-7, and 124-N-8) will be sampled. The contents of each septic tank will be sampled using a ponar grab sampler or similar device.

Access to each of the tanks will be determined in the field. Sample locations are shown in Figure FSP-3.

2.3.10 N-17 Paint Shop Grouping

One surface and subsurface soil sample will be collected in the area of the compressor oil leak near the N-17 Paint Shop. The exact sampling location will be determined in the field based upon data review and evaluation and the nonintrusive investigation. The subsurface soil sample will be collected from a depth of 4 ft using a sampling scoop after excavation with a backhoe. The sample location is shown in Figure FSP-3.

2.2.11 1120-N Septic Tank Grouping

The contents of the 124-N-9 septic tank will be sampled using a ponar grab sampler or similar device. Access to the septic tank will be determined in the field.

2.2.12 124-N-10 Sewer System Grouping

One sediment/sludge sample will be collected from each of the three lagoons located at the 124-N-10 (100-N) Area Central Sewage Plant (124-N-10) located east of the main 100-N Area. The samples will be collected near the inlet point at each of the lagoons. Samples will be collected using a ponar grab sampler or similar device. Sample locations are shown in Figure FSP-4.

No source sampling will be conducted at the location of the October 2, 1975, unplanned release (UN-100-N-11). Based on conversation with Westinghouse Hanford personnel, the contaminated material was removed and the area was cleared by radiation survey. Therefore, this area will be addressed in the nonintrusive investigation.

2.2.13 Source Sampling Procedures

Source sampling will generally be conducted according to "Soil and Sediment Sampling," EII 5.2 (WHC 1989). Contents samples will be collected according to "Method for Sampling Sludges or Sediments Through Open Water Gravity Corer and Ponar Grab Sampler," EII 5.2, Appendix G (WHC 1989). Surface soil samples will be collected according to "Surface Sampling Method," EII 5.2, Appendix E (WHC 1989). Subsurface soil samples will be collected according to "Surface Sampling Method (Test Pits/Trenches)," EII 5.2, Appendix F (WHC 1989).

Further sampling procedures are discussed in Section 10.0 of this field sampling plan. Sample handling procedures (sample preparation and preservation, chain of custody, sample transportation, etc.) are discussed in the QAPP.

2.3 SUBTASK 2d - LABORATORY ANALYSIS

Laboratory analysis will be conducted on all source samples (soil, water, and sludge). The analysis will include determination of chemical and radiological properties. Table FSP-2 shows the list of radiological and chemical analytes.

3.0 TASK 3 - GEOLOGIC INVESTIGATIONS

Geologic investigations are not within the scope of work for the 100-NR-3 work plan. The 100-NR-1 groundwater operable unit work plan contains geologic investigations for the entire 100-N Area. Data generated from the investigations will be evaluated for relevance to the 100-NR-3 Phase I RFI as part of Task 10 - data evaluation.

4.0 TASK 4 - SURFACE WATER AND SEDIMENT INVESTIGATIONS

Surface water and sediment investigations are not within the scope of work for the 100-NR-3 work plan. The 100-NR-1 groundwater operable unit work plan contains surface water and sediment investigations for the entire 100-N Area. Data generated from these investigations will be evaluated for relevance to the 100-NR-3 Phase I RFI as part of Task 10 - data evaluation.

5.0 TASK 5 - VADOSE ZONE INVESTIGATION

The vadose zone is investigated to a limited extent in the source characterization (Task 2). In addition, the 100-NR-1 work plan includes vadose zone sampling within the boundaries of 100-NR-3 during monitoring well installation. No further vadose zone investigation is planned in Phase I of the RFI. Should results of the source investigation warrant further vadose zone study, the vadose zone investigation may be expanded. Data generated during these activities will be reviewed for relevance to the 100-NR-3 investigation during Task 10 - data evaluation.

6.0 TASK 6 - GROUNDWATER INVESTIGATIONS

Groundwater investigations are not within the scope of work for the 100-NR-3 work plan. The 100-NR-1 groundwater operable unit work plan contains groundwater investigations for the entire 100-N Area. Data generated from the investigations will be evaluated for relevance to the 100-NR-3 Phase I RFI as part of Task 10 - data evaluation.

Table FSP-2. Comprehensive List of Analytes and Parameters. (sheet 1 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Radionuclide	Strontium-90	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Tritium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Uranium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Plutonium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Cobalt-60	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Technetium-99	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Cesium-137	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Americium-241	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Carbon-14	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-152	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-154	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-155	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gamma Scan	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gross beta	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gross alpha	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Iodine-129	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Nickel-63	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
Inorganic	Aluminum	CLP[e]	40 mg/kg	±20	±25	200 µg/L	±10	±20
	Antimony	CLP[e]	12 mg/kg	±20	±25	60 µg/L	±10	±20
	Barium	CLP[e]	40 mg/kg	±20	±25	200 µg/L	±10	±20
	Beryllium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Cadmium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Chromium Hexavalent	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Chromium Total	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20

Table FSP-2. Comprehensive List of Analytes and Parameters. (sheet 2 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Inorganic (cont.)	Cobalt	CLP[e]	10 mg/kg	±20	±25	50 µg/L	±10	±20
	Copper	CLP[e]	5 mg/kg	±20	±25	25 µg/L	±10	±20
	Iron	CLP[e]	20 mg/kg	±20	±25	100 µg/L	±10	±20
	Magnesium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Manganese	CLP[e]	3 mg/kg	±20	±25	15 µg/L	±10	±20
	Nickel	CLP[e]	8 mg/kg	±20	±25	40 µg/L	±10	±20
	Potassium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Silver	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Sodium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Vanadium	CLP[e]	10 mg/kg	±20	±25	50 µg/L	±10	±20
	Zinc	CLP[e]	4 mg/kg	±20	±25	20 µg/L	±10	±20
	Arsenic	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Lead	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Mercury	CLP[e]	0.04 mg/kg	±20	±25	0.2 µg/L	±10	±20
	Selenium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Thallium	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Total Cyanide	CLP	500 mg/kg	±20	±25	10 µg/L	±10	±20
	Free cyanide	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Zirconium	Westinghouse	Westinghouse	±20	±25	±20 µg/L	±10	±20
	Nitrate	ASTM D-4327[f]	500 mg/kg	±20	±25	2,500 µg/L	±10	±20
	Sulfate	ASTM D-4327[f]	100 mg/kg	±20	±25	500 µg/L	±10	±20
Volatile organic	Benzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Carbon tetrachloride	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chloroform	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25

Table FSP-2. Comprehensive List of Analytes and Parameters. (sheet 3 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Volatile organic (cont.)	1,1-dichloroethene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1 dichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,2 dichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Methylene chloride	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Tetrachloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Tetrachloroethelene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Toluene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1,1-trichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Vinyl chloride	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Xylene (total)	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Bromodichloromethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Bromoform	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Carbon disulfide	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chlorobenzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chloroethane	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Chloromethane	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Dibromochloromethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,2-dichloropropane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Ethyl benzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	2-hexanone	CLP[e]	50 µg/L	±10	±25	50 µg/L	±20	±25
	2-butanone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Acetone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Cis-1,3-dichloropropene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Trans-1,3-dichloropropene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25

Table FSP-2. Comprehensive List of Analytes and Parameters. (sheet 4 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Volatile organic (cont.)	Bromomethane	CLP[e]	µg/L	±10	±25	µg/L	±20	±25
	1,2-dichlorethene (total)	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1,2,2-tetrachloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	4-methyl-2-pentanone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Styrene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Vinyl acetate	CLP[e]	10 µg/L	±10	±25	5 µg/L	±20	±25
Semivolatile organic	Phenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Bis (2-chloroethyl) ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-chlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,3-dichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,4-dichorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzyl alcohol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,2-dichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-methylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-methylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	N-nitrosodipropylamine	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachloroethane	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Nitrobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Isophorone	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-nitrophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-dimethylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzoic acid	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Bis(2-chloroethoxy)methane	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-dichlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30

Table FSP-2. Comprehensive List of Analytes and Parameters. (sheet 5 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Semivolatile organic (cont.)	1,2,4-trichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Naphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-chloroanaline	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorobutadiene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-chloro-3 methylphenol (para-chloro-metal-cresol)	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-methylnaphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorocyclopentadiene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4,6-trichlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4,5-trichlorophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	2-chloronaphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Dimethyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Acenaphthylene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	3-nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Acenaphthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-Dinitrophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	4-Nitrophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Dibenzofuran	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-Dinitrotoluene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,6-Dinitrotoluene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Diethylphthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Chlorophenyl phenyl ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Fluorene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30

Table FSP-2. Comprehensive List of Analytes and Parameters. (sheet 6 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Semivolatile organic (cont.)	4,6-Dinitro-2-methylphenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	N-nitrodiphenylamine	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Bromophenyl phenyl ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Pentachlorophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Phenathrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Di-n-butylphthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Butyl benzyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	3,3'-Dichlorobenzidine	CLP[e]	0.66 mg/kg	±20	±25	20 µg/L	±30	±30
	Benzo(a)anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Bis (2-ethylhexyl) phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Chrysene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Di-n-octyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(b)Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(k)Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(a)pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
Semivolatile organic (cont.)	Indenol(1,2,3-cd)pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	DiBenz(a,h)anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(g,h,i)perylene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
Pesticides/PCBs	alpha-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	beta-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30

Table FSP-2. Comprehensive List of Analytes and Parameters. (sheet 7 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Pesticides/PCBs	delta-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
(cont.)	gamma-BHC(lindane)	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Heptachlor	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Aldrin	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Heptachlor epoxide	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Endosulfan I	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Dieldrin	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDE	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endrin	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endosulfan II	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDD	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endosulfan sulfate	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDT	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Methoxychlor	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Endrin ketone	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	alpha-chlordane	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	gamma-chlordane	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Toxaphene	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	2,4,5-TP (Silvex)	CLP	80.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	2,4-D	CLP	80.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	Arochlor 1016	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1221	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1232	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1242	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30

Table FSP-2. Comprehensive List of Analytes and Parameters. (sheet 8 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Pesticides/PCBs	Arochlor 1248	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
(cont.)	Arochlor 1254	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	Arochlor 1260	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
Ion	Chloride	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Fluoride	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Phosphate	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Ammonium	ASTM D-4327[f]	1 mg/kg	±15	±25	500 µg/L	±10	±20

[a] Analytical methods shall be approved by Westinghouse Hanford or Westinghouse-approved participant contractor or subcontractor procedures. All procedure reviews and approvals shall be in compliance with applicable Westinghouse Hanford procedure control or procurement procedures. Once laboratory methods are approved, this table shall be updated to provide appropriate method references.

[b] Values for detection limits, precision and accuracy are to be considered only as target values for initial procurement negotiations with the analytical laboratory. Precision is expressed as relative percentage difference (RPD); accuracy is expressed as percentage recovery. Target values for precision and accuracy do not apply to samples with greater than 200 counts per minute radioactivity. This table shall be updated to reflect negotiated contractual values as specified in the final procurement documents.

[c] MDC = minimum detectable concentration in soil.

[d] MDL = minimum detection limit in water.

[e] Standard methods shall be as specified in EPA Contract Laboratory Program Statement of Work for Organic Analysis (EPA 1988d) or EPA Contract Laboratory Program Statement of Work for Inorganic Analysis (EPA 1988e) as appropriate.

[f] Standard methods are from 1988 Annual Book of ASTM Standards (ASTM 1987).

7.0 TASK 7 - AIR INVESTIGATION

The primary objective of the air investigation for the 100-NR-3 operable unit is to ensure the safety of the field personnel. Therefore, the air monitoring procedures are included in Attachment 2, HSP. Similarly, no compilation of meteorological data is envisioned in the phase. If necessary, real-time data (e.g., wind speed, wind direction, temperature) will be obtained from the Hanford meteorology station prior to and during sampling.

8.0 TASK 8 - ECOLOGICAL INVESTIGATION

The ecological investigation for the 100-NR-3 operable unit will consist of a review of biological data developed and evaluated at other areas on the Hanford Site, supplemented by a focused, onsite walkover survey. The biological data compilation will be reviewed to determine if field activities are required.

9.0 TASK 9 - CULTURAL RESOURCES INVESTIGATIONS

A cultural resource investigation has identified the location of surficial archaeological or historical sites listed on or eligible for the National Register of Historic Places. However, additional archaeological sites may exist along the Columbia River immediately adjacent to the 100-N Area and will be part of this investigation.

The task will involve verifying the location of known sites by reviewing available data on historic land uses by local Indian tribes as well as early 20th century land use by pioneer farmers and settlers. The focus of the investigation will be to determine whether archaeological resources are present at proposed drilling or remediation sites. A Class 3 field survey will be conducted by a qualified archaeologist as part of the initial RFI field activities. The Hanford Cultural Resource Management Plan (Chatters 1989) will be followed during the review process. No RFI work will be performed in this area of known sites prior to completion of this task.

10.0 STANDARD FIELD PROCEDURES

Standard field procedures used in the 100-N Area field activities will strictly follow Westinghouse Hanford's document, Environmental Investigations and Site Characterization Manual (WHC 1989). Standard field procedures include sample designation, equipment and procedures, and handling.

10.1 SAMPLE DESIGNATION

Samples will be designated by a code, which includes a facility association code and a sample type code, followed by a sequential number. Once completed, the "Sample Identification and Data Entry into HEIS Database," EII 5.10 (WHC 1989) will supercede sample designation instructions outlined in the following page.

10.1.1 Facility Association

Source samples collected will be identified by association with the particular grouping from which the sample was obtained. Abbreviations for grouping to be used in the sample designations include:

- HLP - 182-N High Lift Pumphouse Grouping
- ACS - Acid/Caustic Storage and Transport System Grouping
- PSP - 184-N Plant Service Power House Grouping
- DDL - Decontamination Drain Line Leak Grouping
- FBD - Regeneration/Filter Backwash Disposal Waste Disposal Area Grouping
- OST - Office Septic Tank Area Grouping
- NPS - N-17 Paint Shop Grouping
- SEP - 1120-N Septic Tank Grouping
- NSS - 100-N Sewer System Grouping.

10.1.2 Type of Sample With Sample Number

The code described above may be followed by a code describing the type of sample and sample number. These codes include:

- CON - X - Contents sample with sample number
- SUR - X - Surface soil/sediment sample with sample number
- SUB - X - Subsurface soil sample with sample number.

An example of the overall sample code is as follows:

- ACS-CON-1: Contents sample collected from the Acid/Caustic Storage and Transport System Grouping.

If a Hanford Site or Westinghouse Hanford specific sample identification or coding system is developed prior to field activities, then the Hanford system will be used instead of the system described above.

10.2 SAMPLE EQUIPMENT AND PROCEDURES

Details describing sampling equipment and procedures for most of the field sampling activities are described in the Westinghouse Hanford manual on environmental investigations (WHC 1989), and include the following:

- General Administrative Requirements

EII 1.1	Hazardous Waste Site Entry Requirements
EII 1.2	Preparation and Revision of Environmental Investigations Instructions
EII 1.4	Deviation from Environmental Investigations Instructions
EII 1.5	Field Logbooks
EII 1.6	Records Management
EII 1.7	Indoctrination, Training and Qualification
EII 1.9	Work Plan Review
EII 1.10	Identifying, Evaluating and Documenting Suspect Waste Sites
EII 1.11	Control and Transmittal of Laboratory Analytical Data

- Health and Safety

EII 2.1	Preparation of Health and Safety Plans
EII 2.2	Occupational Health Monitoring

EII 2.3	Administration of Radiation Surveys to Support Environmental Characterization Work on the Hanford Site

- Equipment Maintenance

EII 3.1	User Calibration of Health and Safety M&TE
EII 3.2	Health and Safety Monitoring Instruments
EII 3.3	Calibration Coordination

- Hazardous Materials

EII 4.1	Nonradioactive Hazardous Waste Disposal
EII 4.2	Interim Control of Unknown Waste

- Field Sampling

EII 5.1	Chain of Custody
EII 5.2	Soil and Sediment Sampling
EII 5.3	Biotic Sampling
EII 5.4	Decontamination of Drilling Equipment
EII 5.5	Decontamination of Equipment for RCRA/ CERLCA Sampling
EII 5.6	Control of Geophysical Logging
EII 5.7A	Hanford Geotechnical Sample Library Control
EII 5.8	Groundwater Sampling
EII 5.9	Soil-Gas Sampling
EII 5.10	Sample Identification and Data Entry into HEIS Database
EII 5.11	Sample Packaging and Shipping
EII 5.12	Air Quality Sampling of Ambient and Downwind Air at Waste Sites

EII 5.13	Drum Sampling
EII 5.14	Drum Handling

- Drilling

EII 6.1	Activity Reports of Field Operations
EII 6.2	Groundwater Monitoring Wells Technical Oversight
EII 6.4	Groundwater Resource Protection Well Maintenance
EII 6.5	Plugging and Abandoning of Characterization Boreholes
EII 6.6	Groundwater Well Characterization and Evaluation
EII 6.7	Groundwater Well and Borehole Drilling
EII 6.8	Well Completion
EII 6.9	Groundwater Well and Borehole Identification and Tracking
EII 6.10	Abandoning/Decommissioning Groundwater Wells

- Reclamation

EII 8.3	Remediation of Groundwater Wells

- Geology

EII 9.1	Geologic Logging

- Hydrology

EII 10.1	Aquifer Testing
EII 10.2	Measurement of Groundwater Levels
EII 10.3	Disposal of Well Construction/Development Waters
EII 10.4	Well Development Activities

9 1 1 3 7 0 6 9 5

- Geophysics

  EII 11.1 Geophysical Logging

  EII 11.2 Geophysical Survey Work

- Surveying and Mapping

  EII 12.1 Surveying.

10.3 SAMPLE HANDLING

Field logs will be maintained to record all field observations and activities in accordance with "Field Logbooks," EII 1.5 (WHC 1989). Samples for laboratory analysis will be placed in containers and properly preserved in accordance with Section 4.0 of the QAPP. All samples for laboratory analysis will be transported under chain of custody in accordance with "Chain of Custody," EII 5.1 (WHC 1989), Section 5.0 of the QAPP, and "Sample Packaging and Shipping," EII 5.11 (WHC 1989).

10.4 DECONTAMINATION

Decontamination procedures have been established for the Hanford Site by Westinghouse Hanford and are provided in "Field Decontamination of Drilling, Well Development and Sampling Equipment," EII 5.4 (WHC 1989), which includes decontamination requirements and specific methods for radiological and nonradiological contamination.

10.5 WASTE HANDLING

A minimum of dangerous and radioactive wastes will be generated during the field investigation. Any waste generated will be contained in drums in accordance with "Interim Control of Unknown, Suspected Hazardous and Mixed Waste," EII 4.2 (WHC 1989). Drums will be designated by the parameters of interest.

11.0 REFERENCES

Chatters, J.C. (ed.) (1989), Hanford Cultural Resources Management Plan, PNL-6942, prepared by Pacific Northwest Laboratory for the U.S. Department of Energy, Richland, Washington

EPA (1987), Data Quality Objectives for Remedial Response Activities, Example Scenario: RI/FS Activities at a Site with Contaminated Soils and Ground Water, EPA/540/G-87/004, OSWER Directive 9355.0-7B, prepared by CDM Federal Programs Corporation for the Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1986), Test Methods for Evaluating Solid Wastes, SW-846, Third Edition, Volumes I-IV, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

WHC (1990), Health Physics Procedures Manual, 100 Areas/Site Surveillance, WHC-IP-0692-1, Westinghouse Hanford Company, Richland, Washington

WHC (1989), Environmental Investigations and Site Characterization Manual, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington

9 1 1 1 3 7 3 9 9 7

DOE/RL 90-23
DRAFT A

100-NR-3 QUALITY ASSURANCE PROJECT PLAN

Revision -0-

Westinghouse Hanford Company
Environmental Engineering and Technology Function
Richland, Washington

Approved by:

US EPA Unit Manager: Date:

US EPA QA Officer: Date:

State of Washington Department of Ecology Unit Manager: Date:

State of Washington Department of Ecology QA Manager: Date:

US DOE Unit Manager: Date:

US DOE QA Officer: Date:

Westinghouse Hanford/EE&T Technical Lead: Date:

Westinghouse Hanford QA Officer: Date:

9 1 1 3 3 7 3 9 9 9

ATTACHMENT 1b

QUALITY ASSURANCE PROJECT PLAN

CONTENTS

1.0 Project Description SAP/QAPP-1

1.1 Project Objective SAP/QAPP-1
1.2 Background Information SAP/QAPP-1
1.3 Quality Assurance Project Plan Applicability and Relationship to the Westinghouse Hanford Company Quality Assurance Program SAP/QAPP-1
1.4 Schedule of Activities SAP/QAPP-3

2.0 Project Organization and Responsibilities . . . SAP/QAPP-5

2.1 Technical Lead Responsibilities SAP/QAPP-5
2.2 Analytical Laboratories SAP/QAPP-5
2.3 Other Support Contractors SAP/QAPP-6

3.0 Objectives for Measurements SAP/QAPP-6

4.0 Sampling Procedures SAP/QAPP-16

4.1 Procedure Approvals and Control SAP/QAPP-16
4.1.1 Westinghouse Hanford Procedures . SAP/QAPP-16
4.1.2 Participant Contractor/ Subcontractor Procedures SAP/QAPP-17
4.2 Sampling Procedures SAP/QAPP-17
4.2.1 Soil Sampling SAP/QAPP-17
4.2.2 Sample Container Selection . . . SAP/QAPP-18
4.3 Other Procedures SAP/QAPP-18
4.4 Procedure Changes SAP/QAPP-18

5.0 Sample Custody SAP/QAPP-18

6.0 Calibration Procedures SAP/QAPP-25

7.0 Analytical Procedures SAP/QAPP-25

8.0 Data Reduction, Validation, and Reporting . . . SAP/QAPP-26

8.1 Data Reduction and Data Package Preparation SAP/QAPP-26
8.2 Validation SAP/QAPP-27
8.2.1 Validation Report Preparation for Level II Methods SAP/QAPP-27
8.2.2 Validation Report Preparation for Level III, Level IV, and Level V Methods SAP/QAPP-28
8.3 Final Review and Records Management Considerations SAP/QAPP-29

CONTENTS (cont.)

9.0 Internal Quality Control SAP/QAPP-29

10.0 Performance and System Audits SAP/QAPP-31

11.0 Preventive Maintenance SAP/QAPP-32

12.0 Data Assessment Procedures SAP/QAPP-32

13.0 Corrective Action SAP/QAPP-34

14.0 Quality Assurance Reports SAP/QAPP-34

15.0 References SAP/QAPP-35

FIGURES:

QAPP-1 Location of 100-NR-3 Operable Unit SAP/QAPP-2

TABLES:

QAPP-1 Comprehensive List of Analytes and Parameters SAP/QAPP-7

QAPP-2 Sampling and Investigative Procedures for RFI Phase I Investigation at the 100-NR-3 Operable Unit SAP/QAPP-19

QAPP-3 Sample Containers and Preservation Requirements for Soil/Sediment Samples . . SAP/QAPP-22

QAPP-4 Sample Containers and Preservation Requirements for Water Samples SAP/QAPP-23

1.0 PROJECT DESCRIPTION

A RCRA Facility Investigation (RFI) is being conducted at the 100-NR-3 operable unit to characterize releases of dangerous and/or radioactive wastes to the environment. This attachment to the work plan for the 100-NR-3 operable unit RFI/corrective measures study (CMS) constitutes the quality assurance project plan (QAPP) for the Phase I RFI, the operable unit characterization.

1.1 PROJECT OBJECTIVE

The primary objective of the environmental investigations in the 100-NR-3 operable unit is to further define the extent and location of sources of radioactive contamination and other inorganic and volatile and nonvolatile organic contaminants in the surface, the vadose zone and terrestrial biota. Data resulting from this investigation will be evaluated to determine the most feasible options for remediation or closure.

1.2 BACKGROUND INFORMATION

The 100-NR-3 operable unit at 100-N is located in the northern part of the Hanford Site as shown on RFI/CMS. Detailed background information regarding the history and present use of the unit is provided in the 100-NR-3 work plan. Figure QAPP-1 shows the location of the 100-NR-3 operable unit.

1.3 QUALITY ASSURANCE PROJECT PLAN APPLICABILITY AND RELATIONSHIP TO THE WESTINGHOUSE HANFORD COMPANY QUALITY ASSURANCE PROGRAM

This QAPP applies specifically to the Phase I field activities and laboratory analyses performed as part of RFI in 100-NR-3. It is an element of the sampling and analysis plan (SAP) prepared specifically for this phase of investigation, and is prepared in compliance with Westinghouse Hanford Company (Westinghouse Hanford) QA program plan for Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) remedial investigation/feasibility study (RI/FS) activities. This plan describes the means selected to implement the overall QA program requirements defined by the Westinghouse Hanford Company Quality Assurance Manual, WHC-CM-4-2, (WHC 1989a), as applicable to CERCLA RI/FS environmental investigations, while accommodating the specific requirements for

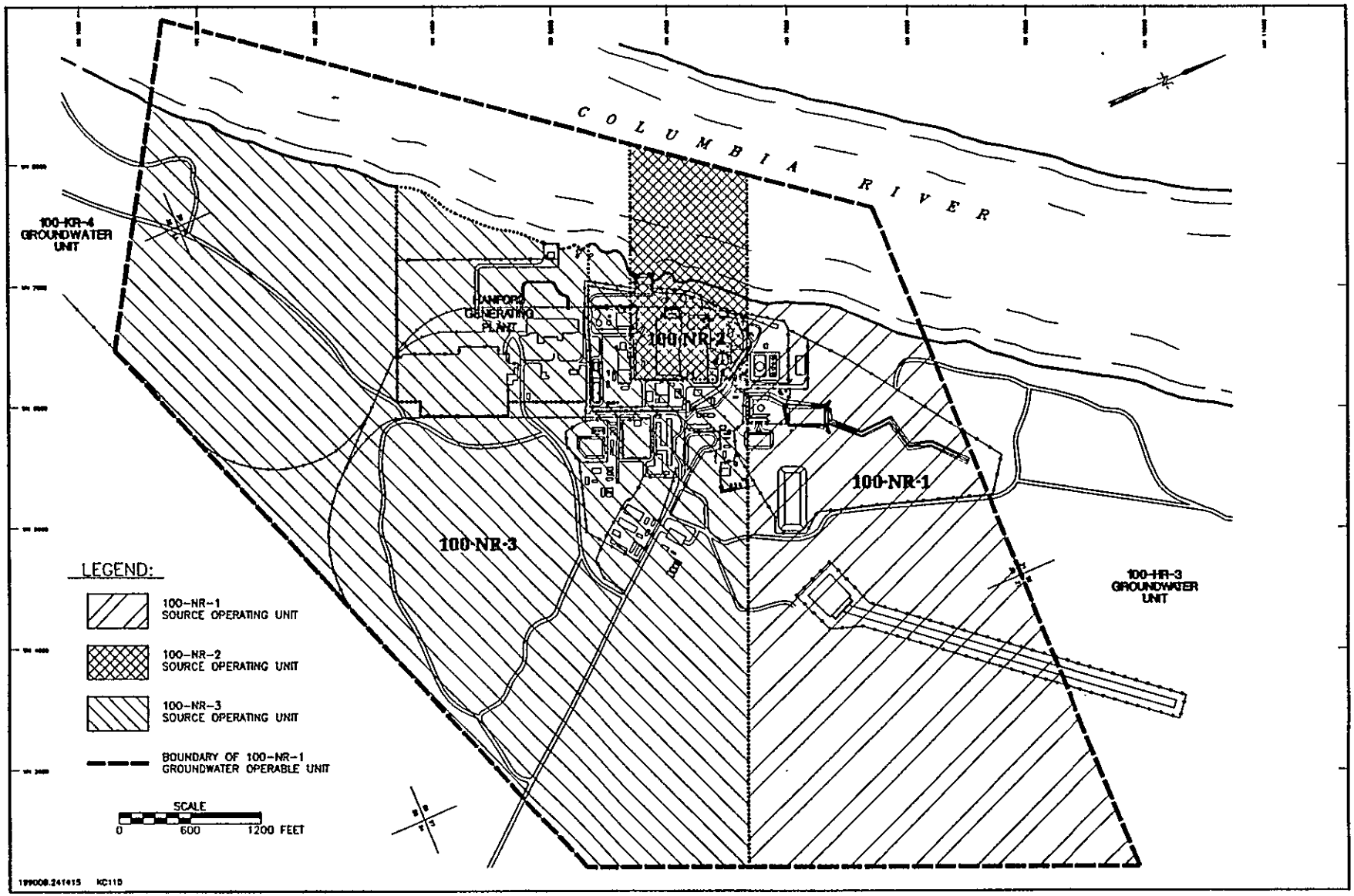


Figure QAPP-1. Location of the 100-NR-3 Operable Unit.

project plan format and content agreed upon in the Hanford Federal Facility Agreement and Consent Order (Ecology et al. 1989). It contains a matrix of procedural resources (from WHC-CM-4-2, the Westinghouse Hanford Environmental Investigations and Site Characterization Manual, WHC-CM-7-7 [WHC 1989b]) and from the Health Physics Procedures Manual (WHC-IP-0692 [WHC 1990]) that have been drawn upon to support the 100-NR-3 QAPP. This plan is subject to mandatory review and revision prior to use on subsequent phases of the investigation. Distribution and revision control of this plan shall be in compliance with quality requirements (QR) 6.0, "Document Control" from WHC-CM-4-2 (WHC 1989a) and other standard Westinghouse Hanford document control procedures. The QAPP distribution shall routinely include all review/approval personnel indicated on the title page of the document and all other individuals designated by the Westinghouse Hanford technical lead. All plans and procedures referenced in the QAPP are available for regulatory review on request by the direction of the technical lead.

1.4 SCHEDULE OF ACTIVITIES

The investigations that will be conducted in 100-NR-3 will be subdivided into two or more discrete phases and a number of individual tasks. Because the results of the task activity in an individual phase may significantly affect the technical activities planned for subsequent phases, this QAPP shall undergo mandatory review after completion of each phase and shall be updated or modified to accommodate any required revisions in the scope of work. This version of the QAPP applies specifically to Phase I of the RI.

Individual task scopes for Phase I are briefly described below. More detailed discussions are contained in Section 5.3 of the work plan and the field sampling plan (FSP).

Task 1: Project Management. This task entails directing and documenting project activities to ensure that data and evaluations generated meet work-plan goals and objectives, and to administer the project within budget and schedule.

Task 2: Source Investigation. Task 2 involves gathering additional information on potential sources of contamination within 100-NR-3. Engineering plans will be reviewed and geodetic, radiological and geophysical surveys will be conducted to better determine the location of buried objects and structures and surface and subsurface contamination. Topographical maps will be updated and normalized to the 100-N grid. A soil gas survey will be conducted at selected source units in an attempt to determine the areal distribution of volatile organic contaminants of concern as a means of reducing costs during the analytical effort required in sampling activities. Surface soil

and sediment samples will be collected from source units as described in the work plan and in the field sampling plans.

Task 3: Geologic Investigation. Review and evaluation of additional existing and new data regarding geologic conditions at the site will be conducted. A site survey will be conducted to map soils and define site parameters that will impact sampling activities. Geologic data will also be collected during source sampling and will be integrated with other appropriate investigations in the 100-NR-1 and 100-NR-3 RFI/CMS'.

Task 4: Surface Water and Sediment Investigation. This task will consist of appropriate coordination with the 100-NR-1 RFI, which will address potential surface water contamination from sources in 100-NR-3.

Task 5: Vadose Zone Investigation. This task will entail integration of data regarding properties of the vadose zone collected by evaluation of existing data during source-sampling activities in this RFI/CMS and groundwater investigation activities conducted during the 100-NR-1 RFI.

Task 6: Groundwater Investigation. Task 6 will comprise appropriate coordination with the 100-NR-1 RFI, which will address potential groundwater contamination from sources in 100-NR-3.

Task 7: Air Investigation. Meteorological data will be compiled and the existing ambient air monitoring program evaluated in order to augment the parameter list for the proposed monitoring program. Monitoring of air quality well be conducted during Tasks 1 and 7 activities.

Task 8: Ecological Investigation. A detailed literature review and quantitative species survey will be conducted by qualified biologists. Recommendations will be made for appropriate biotic sampling activities in later phases of the investigation.

Task 9: Other Investigations. A cultural resource evaluation will be conducted to verify the locations of known archaeological sites in 100-N-3 by review of existing data and by a field survey.

Task 10: Data Evaluation. Data from the investigations of Tasks 1 through 8 will be processed and preliminary recommendations for additional investigations will be made.

Task 11: Baseline Risk Assessment. A study will be completed that identifies and assesses the risks associated with potential corrective measures.

Task 12: Phase I RI Report. An interim report will be prepared that summarizes the results of Phase I investigations, presents available results from the baseline risk assessment, and provides preliminary characterization of 100-NR-3.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 TECHNICAL LEAD RESPONSIBILITIES

The Environmental Engineering and Technology Function of Westinghouse Hanford has primary responsibilities for conducting this investigation. Organizational charts are included in the project management plan (PMP) for this operable unit that define personnel assignments and individual Westinghouse Hanford field team structures applicable to the various types of tasks included in Phase I.

External participant contractors or subcontractors shall be evaluated and selected for certain portions of task activities at the direction of the technical lead in compliance with procedures "Procurement Document Control," QR 4.0; quality instructions "Procurement Document Control," QI 4.1; "External Services Control," QI 4.2; "Control of Purchased Items and Services" QR 7.0; "Procurement Planning and Control," QI 7.1; and "Supplier Evaluation," QI 7.2 (WHC 1989a). Major participant contractor and subcontractor resources are listed in Figure PMP-2 of the PMP. All contractor plans and procedures shall be approved prior to use and shall be available for regulatory review after Westinghouse Hanford approval. All analytical procedures shall be reviewed and approved by the Westinghouse Hanford analytical laboratories organization.

2.2 ANALYTICAL LABORATORIES

A Westinghouse Hanford field sampling team will be assigned responsibility for screening all samples for gross alpha and beta/gamma radioactivity, and for separating samples into two groups for further analysis. Samples with activity greater than or equal to those derived from DOE Order 5480.11, Radiation Protection for Occupational Workers (DOE 1988) will be routed to a Westinghouse Hanford or another Hanford Site participant contractor laboratory equipped and qualified to perform analysis of radioactive samples. Samples with activity below occupational worker standards shall be routed to an approved Westinghouse Hanford, participant contractor, or subcontractor laboratory. For subcontractors or participant contractors, applicable quality requirements shall be invoked as part of the approved procurement document or work order. At the technical lead's direction, services of alternate qualified laboratories shall be procured

for radioactive samples analysis (if on site laboratory capacity is not available) and for the performance of split sample analysis. If such an option is selected, the QA plan and applicable analytical procedures from the alternate laboratory shall be approved by Westinghouse Hanford prior to their use. All analyses shall be coordinated through the Westinghouse Hanford Office of Sample Management (OSM) and shall be performed in compliance with Westinghouse Hanford approved laboratory QA plans and analytical procedures, subject to the surveillance controls invoked by "Source Surveillance and Inspection," QI 7.3 (WHC 1989a).

2.3 OTHER SUPPORT CONTRACTORS

Procurement of all other contracted field activities shall be in compliance with standard Westinghouse Hanford procurement procedures requirements as discussed in Sections 2.1 and 4.1. All work shall be performed in compliance with Westinghouse Hanford-approved QA plans/procedures, subject to controls of "Source Surveillance and Inspection," QI 7.3, if the work is performed offsite (WHC 1989a). Onsite work is subject to controls identified in "Surveillance," QI 10.4 (WHC 1989a). Applicable quality requirements shall be invoked as part of the approved procurement document or work order.

3.0 OBJECTIVES FOR MEASUREMENTS

Data quality objectives for 100-NR-3 are summarized in Section 4.0 of the work plan. Additional analytical data based on soil and groundwater sampling activities will be obtained and evaluated to further characterize the nature and extent of radioactive and hazardous contamination and to determine the most feasible options for remediation. The analytes of interest for this operable unit are listed in Table QAPP-1, and include radionuclides, ions, metals, volatile organic compounds, and extractable organic compounds. Analytical data will be obtained at several different levels, based on the criteria provided in Data Quality Objectives for Remedial Response Activities (EPA 1987), and are described below.

Level V: Nonstandard methods will be required for analysis of radionuclides and other analytes determined to be in a radioactive matrix by the Level I screening process. Depending on the level of radioactivity noted in screening, analysis will either be performed onsite by a qualified Westinghouse Hanford or participant contractor laboratory, or offsite by an approved subcontractor or participant contractor. Laboratories may or may not be contract laboratory program (CLP) participant laboratories, and new or modified analytical methods will be required. Detection limits, precision, and accuracy will be

Table QAPP-1. Comprehensive List of Analytes and Parameters. (sheet 1 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Radionuclide	Strontium-90	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Tritium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Uranium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Plutonium	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Cobalt-60	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Technetium-99	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Cesium-137	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Americium-241	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Carbon-14	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-152	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-154	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Europium-155	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gamma Scan	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gross beta	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Gross alpha	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Iodine-129	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
	Nickel-63	Westinghouse	Westinghouse	±30	±25	Westinghouse	±10	±25
Inorganic	Aluminum	CLP[e]	40 mg/kg	±20	±25	200 µg/L	±10	±20
	Antimony	CLP[e]	12 mg/kg	±20	±25	60 µg/L	±10	±20
	Barium	CLP[e]	40 mg/kg	±20	±25	200 µg/L	±10	±20
	Beryllium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Cadmium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Chromium Hexavalent	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Chromium Total	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20

Table QAPP-1. Comprehensive List of Analytes and Parameters. (sheet 2 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Inorganic (cont.)	Cobalt	CLP[e]	10 mg/kg	±20	±25	50 µg/L	±10	±20
	Copper	CLP[e]	5 mg/kg	±20	±25	25 µg/L	±10	±20
	Iron	CLP[e]	20 mg/kg	±20	±25	100 µg/L	±10	±20
	Magnesium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Manganese	CLP[e]	3 mg/kg	±20	±25	15 µg/L	±10	±20
	Nickel	CLP[e]	8 mg/kg	±20	±25	40 µg/L	±10	±20
	Potassium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Silver	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Sodium	CLP[e]	1,000 mg/kg	±20	±25	5,000 µg/L	±10	±20
	Vanadium	CLP[e]	10 mg/kg	±20	±25	50 µg/L	±10	±20
	Zinc	CLP[e]	4 mg/kg	±20	±25	20 µg/L	±10	±20
	Arsenic	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Lead	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Mercury	CLP[e]	0.04 mg/kg	±20	±25	0.2 µg/L	±10	±20
	Selenium	CLP[e]	1 mg/kg	±20	±25	5 µg/L	±10	±20
	Thallium	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Total Cyanide	CLP	500 mg/kg	±20	±25	10 µg/L	±10	±20
	Free cyanide	CLP[e]	2 mg/kg	±20	±25	10 µg/L	±10	±20
	Zirconium	Westinghouse	Westinghouse	±20	±25	±20 µg/L	±10	±20
	Nitrate	ASTM D-4327[f]	500 mg/kg	±20	±25	2,500 µg/L	±10	±20
	Sulfate	ASTM D-4327[f]	100 mg/kg	±20	±25	500 µg/L	±10	±20
Volatile organic	Benzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Carbon tetrachloride	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chloroform	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25

Table QAPP-1. Comprehensive List of Analytes and Parameters. (sheet 3 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Volatile organic (cont.)	1,1-dichloroethene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1 dichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,2 dichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Methylene chloride	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Tetrachloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Tetrachloroethelene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Toluene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1,1-trichloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Vinyl chloride	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Xylene (total)	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Bromodichloromethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Bromoform	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Carbon disulfide	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chlorobenzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Chloroethane	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Chloromethane	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Dibromochloromethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,2-dichloropropane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Ethyl benzene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	2-hexanone	CLP[e]	50 µg/L	±10	±25	50 µg/L	±20	±25
	2-butanone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Acetone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Cis-1,3-dichloropropene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Trans-1,3-dichloropropene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25

Table QAPP-1. Comprehensive List of Analytes and Parameters. (sheet 4 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Volatile organic (cont.)	Bromomethane	CLP[e]	µg/L	±10	±25	µg/L	±20	±25
	1,2-dichlorethene (total)	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	1,1,2,2-tetrachloroethane	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	4-methyl-2-pentanone	CLP[e]	10 µg/L	±10	±25	10 µg/L	±20	±25
	Styrene	CLP[e]	5 µg/L	±10	±25	5 µg/L	±20	±25
	Vinyl acetate	CLP[e]	10 µg/L	±10	±25	5 µg/L	±20	±25
Semivolatile organic	Phenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Bis (2-chloroethyl) ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-chlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,3-dichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,4-dichorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzyl alcohol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	1,2-dichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-methylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-methylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	N-nitrosodipropylamine	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachloroethane	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Nitrobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Isophorone	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-nitrophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-dimethylphenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzoic acid	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Bis(2-chloroethoxy)methane	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-dichlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30

Table QAPP-1. Comprehensive List of Analytes and Parameters. (sheet 5 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Semivolatile organic (cont.)	1,2,4-trichlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Naphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-chloroanaline	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorobutadiene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-chloro-3 methylphenol (para-chloro-metal-cresol)	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-methylnaphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorocyclopentadiene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4,6-trichlorophenol	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4,5-trichlorophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	2-chloronaphthalene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2-nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Dimethyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Acenaphthylene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	3-nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Acenaphthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-Dinitrophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	4-Nitrophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Dibenzofuran	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,4-Dinitrotoluene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	2,6-Dinitrotoluene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Diethylphthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Chlorophenyl phenyl ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Fluorene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Nitroaniline	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30

Table QAPP-1. Comprehensive List of Analytes and Parameters. (sheet 6 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Semivolatile organic (cont.)	4,6-Dinitro-2-methylphenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	N-nitrodiphenylamine	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	4-Bromophenyl phenyl ether	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Hexachlorobenzene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Pentachlorophenol	CLP[e]	1.6 mg/kg	±20	±25	50 µg/L	±30	±30
	Phenathrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Di-n-butylphthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Butyl benzyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	3,3'-Dichlorobenzidine	CLP[e]	0.66 mg/kg	±20	±25	20 µg/L	±30	±30
	Benzo(a)anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Bis (2-ethylhexyl) phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Chrysene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Di-n-octyl phthalate	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(b)Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(k)Fluoranthene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(a)pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
Semivolatile organic (cont.)	Indenol(1,2,3-cd)pyrene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	DiBenz(a,h)anthracene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
	Benzo(g,h,i)perylene	CLP[e]	0.33 mg/kg	±20	±25	10 µg/L	±30	±30
Pesticides/PCBs	alpha-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	beta-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30

Table QAPP-1. Comprehensive List of Analytes and Parameters. (sheet 7 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Pesticides/PCBs	delta-BHC	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
(cont.)	gamma-BHC(lindane)	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Heptachlor	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Aldrin	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Heptachlor epoxide	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Endosulfan I	CLP	8.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Dieldrin	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDE	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endrin	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endosulfan II	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDD	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Endosulfan sulfate	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	4,4'-DDT	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	Methoxychlor	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Endrin ketone	CLP	16.0 µg/L	±20	±25	0.10 µg/L	±30	±30
	alpha-chlordane	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	gamma-chlordane	CLP	80.0 µg/L	±20	±25	0.05 µg/L	±30	±30
	Toxaphene	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	2,4,5-TP (Silvex)	CLP	80.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	2,4-D	CLP	80.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	Arochlor 1016	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1221	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1232	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
	Arochlor 1242	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30

Table QAPP-1. Comprehensive List of Analytes and Parameters. (sheet 8 of 8).

Category of analysis	Analyte of interest	Standard or reference method[a]	Soil[b]			Water[b]		
			MDC[c]	Precision (RPD)	Accuracy (%)	MDL[d]	Precision (RPD)	Accuracy (%)
Pesticides/PCBs	Arochlor 1248	CLP	80.0 µg/L	±20	±25	0.5 µg/L	±30	±30
(cont.)	Arochlor 1254	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
	Arochlor 1260	CLP	160.0 µg/L	±20	±25	1.0 µg/L	±30	±30
Ion	Chloride	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Fluoride	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Phosphate	ASTM D-4327[f]	1 mg/kg	±10	±20	500 µg/L	±10	±20
	Ammonium	ASTM D-4327[f]	1 mg/kg	±15	±25	500 µg/L	±10	±20

[a] Analytical methods shall be approved by Westinghouse Hanford or Westinghouse-approved participant contractor or subcontractor procedures. All procedure reviews and approvals shall be in compliance with applicable Westinghouse Hanford procedure control or procurement procedures. Once laboratory methods are approved, this table shall be updated to provide appropriate method references.

[b] Values for detection limits, precision and accuracy are to be considered only as target values for initial procurement negotiations with the analytical laboratory. Precision is expressed as relative percentage difference (RPD); accuracy is expressed as percentage recovery. Target values for precision and accuracy do not apply to samples with greater than 200 counts per minute radioactivity. This table shall be updated to reflect negotiated contractual values as specified in the final procurement documents.

[c] MDC = minimum detectable concentration in soil.

[d] MDL = minimum detection limit in water.

[e] Standard methods shall be as specified in EPA Contract Laboratory Program Statement of Work for Organic Analysis (EPA 1988d) or EPA Contract Laboratory Program Statement of Work for Inorganic Analysis (EPA 1988e) as appropriate.

[f] Standard methods are from 1988 Annual Book of ASTM Standards (ASTM 1987).

specific to the method, which must be prepared, reviewed, and approved prior to use in compliance with applicable Westinghouse Hanford procurement control procedures.

Level IV: Full CLP analytical methods and protocols will be used on approximately 20% of samples. These analyses will undergo rigorous QA/QC documentation as mandated by the CLP.

Level III: Level III analyses shall be performed for selected analytes using standard EPA and American Society for Testing and Materials (ASTM) methods, as shown in Table QAPP-1. Data validation requirements and intralaboratory quality control (QC) requirements shall be invoked that, in terms of data quality, approximate the requirements of the CLP for Level IV analysis.

Level II: Soil gas samples shall be obtained from locations at specific sources, as discussed in Section 5.0 of the work plan and in Task 2 of the field sampling plan, and at the drill site locations for purposes of determining the distribution of volatile organic contaminants of concern. Soil gas samples exhibiting detectable levels of the contaminants of concern will necessitate full laboratory analysis for volatile organic contaminants of concern for the soil samples collected during Task 3. Task 2 soil samples will also be analyzed using laboratory screening methods such as XRF, specific conductance, ion selective electrodes, headspace/GC, solvent extraction/GC, and beta/gamma radiation screening. Samples exhibiting above background levels of laboratory screening parameters will necessitate full laboratory analyses for operable unit contaminants of concern.

Level I: Soil samples shall undergo field screening to determine gross alpha and beta/gamma radiation and the presence of combustible and/or ionizable organic compounds. Samples exhibiting radioactivity greater than occupational worker standards will be automatically routed to an appropriately equipped and qualified onsite Westinghouse Hanford or participant contractor laboratory for analysis. Screening shall be performed by qualified Westinghouse Hanford radiation protection technologists as specified in governing procedures.

As noted in Section 4.6 of Data Quality Objectives for Remedial Response Activities: Volume I. Development Process (EPA 1987), universal goals for precision, accuracy, representativeness, completeness, and comparability cannot be practically established at the outset of an investigation. Historical data are available, however, that may be used as minimum guidelines for selection or preparation of analytical methods appropriate for this investigation. Table QAPP-1 provides preliminary values for method detection limits, precision, and accuracy that are intended for use in initial

procurement negotiations with the analytical laboratory. These preliminary values are based on the results of evaluation of the data quality objectives specified in the work plan, the reference specifications identified in Table QAPP-1, and the general performance capabilities currently expected for laboratories involved in environmental analyses. After individual laboratory statements of work are negotiated and procedures are developed and approved, Table QAPP-1 and this section shall be revised to reference approved detection limit, precision, and accuracy criteria as project requirements.

Goals for data representativeness are addressed qualitatively by the specification of sampling locations and intervals in the FSP. Objectives for completeness for this investigation shall require that contractually or procedurally established requirements for precision and accuracy be met for at least 90% of the total number of requested determinations. Failure to meet this criterion shall be documented in data summary reports and shall be considered in the validation process. Corrective action measures shall be initiated by the technical lead as appropriate. Approved analytical procedures shall require the use of the reporting techniques and units consistent with the EPA reference methods listed in Table QAPP-1 to facilitate the comparability of data sets in terms of precision and accuracy.

4.0 SAMPLING PROCEDURES

Sampling and analysis activities during corrective actions must meet stringent requirements to ensure results that are valid. Procedures necessary to ensure validatability of results are defined in this section.

4.1 PROCEDURE APPROVALS AND CONTROL

4.1.1 Westinghouse Hanford Procedures

The Westinghouse Hanford procedures cited in this QAPP have been selected from the quality assurance program index included in a Westinghouse Hanford QA program plan for CERCLA RI/FS activities. Selected procedures include environmental investigations instructions (EII) from the Environmental Investigations and Site Characterization Manual (WHC 1989b), the operational health physics procedures from the Health Physics Procedures Manual (WHC 1990) and QR and QI from the Westinghouse Hanford Quality Assurance Manual (WHC 1989a). Procedure approval, revision, and distribution control requirements applicable to EII are addressed in "Preparation and Revision of Environmental Investigation Instructions," EII 1.2 (WHC 1989b); requirements applicable to QI and QR are addressed in

9 1 1 1 3 7 1 0 1 7

"Instructions, Procedures, and Drawings," QR 5.0; "Preparation of Quality Assurance Documents," QI 5.1; "Document Control," QR 6.0; and "Quality Assurance Document Control," QI 6.1 (WHC 1989a). Other procedures applicable to the preparation, review, approval, and revision of Hanford analytical laboratories organization procedures shall be as defined in the various procedures and manuals identified in a QA program plan for CERCLA RI/FS activities. All procedures are available for regulatory review on request at the direction of the Westinghouse Hanford technical lead.

4.1.2 Participant Contractor/Subcontractor Procedures

As noted in Section 2.1, participant contractor/subcontractor services shall be procured under the applicable requirements of "Procurement Document Control," QR 4.0; "Procurement Document Control," QI 4.1; "External Services Control," QI 4.2; "Control of Purchased Items and Services," QR 7.0; "Procurement Planning and Control," QI 7.1; and/or "Supplier Evaluation," QI 7.2 (WHC 1989a). Whenever such services require procedural controls, requirements for submittal of procedures for Westinghouse Hanford review and approval prior to use shall be included in the procurement document or work order, as applicable. In addition to the submittal of analytical procedures, analytical laboratories shall be required to submit the current version of their internal QA program plans. All analytical laboratory plans and procedures shall be reviewed and approved prior to use by qualified personnel from the Westinghouse Hanford analytical laboratories organization, or other qualified personnel, as directed by the technical lead; all reviewers shall be qualified under the requirements of "Indoctrination, Training, and Qualification," EII 1.7 (WHC 1989b). All participant contractor or subcontractor procedures, plans, and/or manuals shall be retained as project quality records in compliance with "Records Management," EII 1.6 (WHC 1989b); "Quality Assurance Records," QR 17.0; and "Quality Assurance Records Control," QI 17.1 (WHC 1989a). All such documents are available for regulatory review on request, at the direction of the Westinghouse Hanford technical lead.

4.2 SAMPLING PROCEDURES

4.2.1 Soil Sampling

All soil sampling shall be performed in accordance with EII 5.2 "Soil and Sediment Sampling" (WHC 1989b). Test pit sampling shall be in accordance with the auger or grab sample techniques described in EII 5.2 (WHC 1989b). Sample numbers, types, location, and other site-specific considerations shall be as defined by the FSP and will be conducted in compliance with all relevant EEIs and HPPs. Documentation requirements are

contained within individual EII and the data management plan (DMP). All procedures related to sampling are identified in Table QAPP-2 as applicable to individual tasks.

4.2.2 Sample Container Selection

Sample container types and preservation requirements for Phase I of this investigation are shown in Tables QAPP-3 and QAPP-4; sample container types, container preparation codes, preparation requirements, and special-handling requirements are defined by "Soil and Sediment Sampling," EII 5.2 (WHC 1989b).

4.3 OTHER PROCEDURES

Other procedures that will be required specifically for this phase of the investigation are identified in Table QAPP-2 for each individual task. Documentation requirements shall be addressed within individual procedures and/or the DMP as appropriate. Analytical procedures are listed in Table QAPP-1.

4.4 PROCEDURE CHANGES

Should deviations from established EII or OHP be required to accommodate unforseen field situations, they may be authorized by the field team leader in accordance with the requirements of "Deviation from Environmental Investigations Instructions," EII 1.4 (WHC 1989b). Documentation, review, and disposition of instruction change authorization forms are defined within EII 1.4. Other types of procedure change requests shall be documented as required by the Westinghouse Hanford procedures governing their preparation.

5.0 SAMPLE CUSTODY

All samples obtained during the course of this investigation shall be controlled as required by "Chain of Custody," EII 5.1 (WHC 1989b) from the point of origin to the analytical laboratory. Laboratory chain-of-custody procedures shall be reviewed and approved as required by Westinghouse Hanford procurement control procedures as noted in Section 4.1, and shall ensure the maintenance of sample integrity and identification throughout the analytical process. At the direction of the technical lead, requirements for return of residual sample materials after completion of analysis shall be defined in accordance with those procedures defined in the procurement documentation to participant contractor/subcontractor laboratories. Chain-of-custody forms shall be initiated for returned residual samples as required by the approved procedures applicable within the participating laboratory. Results of

Table QAPP-2. Sampling and Investigative Procedures for RFI Phase I Investigation at the 100-NR-3 Operable Unit. (sheet 1 of 3).

	1	2	3*	4*	5	6*	7	8	9	10	11
EII 1.5		X						X			
EII 1.6	X	X			X		X	X	X	X	X
EII 1.7		X						X			
EII 1.10		X						X			
EII 1.11		X						X			
EII 2.1		X						X			
EII 2.2		X						X			
EII 2.3		X						X			
EII 3.1		X						X			
EII 3.2		X						X			
EII 4.1		X									
EII 4.2		X									
EII 5.1		X			X						
EII 5.2		X			X						
EII 5.3											
EII 5.4											
EII 5.5		X			X						
EII 5.8											
EII 5.9		X									
EII 5.10		X									
EII 5.11		X			X						
EII 5.14		X									
EII 6.1											
EII 6.2											
EII 6.4											
EII 6.5											
EII 6.6											
EII 6.7											
EII 6.8											
EII 6.9											

* - Not applicable to 100-NR-3.

Table QAPP-2. Sampling and Investigative Procedures for RFI Phase I Investigation at the 100-NR-3 Operable Unit. (sheet 2 of 3).

	1	2	3*	4*	5	6*	7	8	9	10	11
EII 9.1											
EII 10.1											
EII 10.2											
EII 10.3											
EII 10.4											
EII 11.1											
EII 11.2		X									
EII 12.1		X		X				X			
OHP 2.1.1		X									
OHP 2.1.1.15		X									
OHP 2.1.14		X									
OHP 3.0		X						X			
OHP 3.1		X						X			
OHP 5.3.2		X									
OHP 6.6.1.2		X									
OHP 6.6.1.3		X									
OHP 6.6.1.4		X									
OHP 6.6.1.5		X									
OHP 6.6.1.6		X						X			
OHP 6.6.1.7		X									
OHP 6.6.1.9											
OHP 6.6.1.11		X									
OHP 6.6.1.12		X									
OHP 6.6.1.13		X									
OHP 6.6.1.14		X									
OHP 6.6.1.16		X									
OHP 8.0		X									
OHP 8.1		X									
OHP 9.0		X						X			
OHP 9.1		X						X			

* - Not applicable to 100-NR-3.

9 1 1 1 3 7 1 0 2 1

Table QAPP-2. Sampling and Investigative Procedures for RFI Phase I Investigation at the 100-NR-3 Operable Unit. (sheet 3 of 3).

	1	2	3*	4*	5	6*	7	8	9	10	11
OHP 10.0		X									
OHP 10.1		X									
OHP 10.1.1		X									
OHP 10.1.2		X									
OHP 10.1.3		X									
OHP 11.0		X									
OHP 11.1		X									
OHP 11.1.1		X									

* - Not applicable to 100-NR-3.

Table QAPP-3. Sample Containers and Preservation Requirements for Soil/Sediment Samples.

Description	Requirement	Preservatives	Holding Time
TCL Volatile Organics	1 x 120 ml glass	4°C	14 days
TCL Semivolatile Organics	1 x 16 oz glass	4°C	7 days
TAL Metals	1 x 16 oz glass	4°C	6 months
Radionuclides	Westinghouse		
Ammonia-N[a]	1 x 16 oz glass	4°C	6 months
Carbonate[a]	1 x 16 oz glass	4°C	6 months
Chloride[a]	1 x 16 oz glass	4°C	6 months
Fluoride[a]	1 x 16 oz glass	4°C	6 months
Nitrate[a]	1 x 16 oz glass	4°C	6 months
Phosphate[a]	1 x 16 oz glass	4°C	6 months
Sulfate[a]	1 x 16 oz glass	4°C	6 months
Sulfamate	Westinghouse		
Oxalate	Westinghouse		

[a] May be analyzed from the same aliquot.

Legend:

TCL = target compound list
TAL = target analyte list

Table QAPP-4. Sample Containers and Preservation Requirements for Water Samples. (sheet 1 of 2).

Description	Requirement	Preservatives	Holding Time
TCL Volatile Organics	3-40 ml amber glass	HCl pH<2 Cool 4°C	14 days
TCL Semivolatile Organics	2-80 oz amber glass	Cool 4°C	7 days
TCL Pesticides/PCBs	1-80 oz amber glass	Cool 4°C	7 days
TAL Metals	1-1L HDPE	HNO_3 pH<2 Cool 4°C	6 months
Chromium hexavalent	250-ml HDPE	Cool 4°C	24 hrs
Radionuclides	Westinghouse		
Oxalate	Westinghouse		
Sulfamate	Westinghouse		
Ammonia-N	1-1L HDPE	H_2SO_4 pH<2 Cool 4°C	28 days
Alkalinity	1-250 ml HDPE	Cool 4°C	14 days
BOD	1-1L HDPE	Cool 4°C	48 hours
COD	1-125 ml HDPE	Cool 4°C H_2SO_4 pH<2	28 days
DO	300 ml	None	Analyze immediately
Hardness	250 ml HDPE	HNO_3 pH<2	6 months
Organic carbon	1-125 ml HDPE	HCl pH<2 Cool 4°C	28 days

Table QAPP-4. Sample Containers and Preservation Requirements for Water Samples. (sheet 2 of 2).

Description	Requirement	Preservatives	Holding Time
Nitrate[a]	1-25 ml HDPE	Cool 4°C	48 hours
Sulfate[a]	1-125 ml HDPE	Cool 4°C	28 days
Chloride[a]	1-125 ml HDPE	None	28 days
Fluoride[a]	1-500 ml HDPE	None	28 days
Total Dissolved Solids[a]	1-125 ml HDPE	Cool 4°C	7 days
Total Suspended Solids[a]	1-125 ml HDPE	Cool 4°C	7 days
Phosphate (ortho)[a]	1-125 ml HDPE	Cool 4°C	48 hours
pH[a]	--	--	Field measurement
Conductivity[a]	--	--	Field measurement
Carbonate[a]	1-125 ml HDPE	Cool 4°C	14 days
Bicarbonate[a]	1-125 ml HDPE	Cool 4°C	14 days

[a] May be analyzed from the same aliquot.

Legend:

BOD = biochemical oxygen demand
COD = chemical oxygen demand
DO = dissolved oxygen
HDPE = high-density polyethylene
TCL = target compound list
TAL = target analyte list

analyses shall be traceable to original samples through the unique code or identifier specified in the FSP. All results of analyses shall be controlled as permanent project quality records as required by "Quality Assurance Records," QR 17.0 (WHC 1989a), "Records Management," EII 1.6 (WHC 1989b), and the DMP.

6.0 CALIBRATION PROCEDURES

Calibration of all Westinghouse Hanford measuring and test equipment, whether in existing inventory or purchased for this investigation, shall be controlled as required by "Control of Measuring and Test Equipment," QR 12.0; "Acquisition and Calibration of Portable Measuring and Test Equipment," QI 12.1 (WHC 1989a); "Measuring and Test Equipment Calibration by User," QI 12.2 (WHC 1989a); and/or "User Calibration of Health and Safety Measuring and Test Equipment," EII 3.1 (WHC 1989b). Routine operational checks for Westinghouse Hanford field equipment shall be as defined within applicable EII or procedures; similar information shall be provided in Westinghouse Hanford approved participant contractor or subcontractor procedures.

Calibration of Westinghouse Hanford, participant contractor, or subcontractor laboratory equipment used for Level III analysis shall be as defined by applicable standard analytical methods, subject to Westinghouse Hanford review and approval. Calibration of Westinghouse Hanford, participant contractor, or subcontractor laboratory equipment used for Level V analysis shall be as defined by the Westinghouse Hanford-approved analytical method.

7.0 ANALYTICAL PROCEDURES

Analytical methods or procedures for each analytical level identified in Table QAPP-1 and Section 3.0 shall be selected or developed and approved prior to use in compliance with appropriate Westinghouse Hanford procedure and/or procurement control requirements as noted in Section 4.1. As noted in Section 4.6 of Data Quality Objectives for Remedial Response Activities: Volume 1, Development Process (EPA 1987), universal goals for precision, accuracy, representativeness, completeness, and comparability cannot be practically specified at the beginning of an investigation. Historical data for precision and accuracy are available for many analytes of interest, however, and shall be used as minimum guidelines for selection or preparation of analytical methods appropriate for this investigation. Table QAPP-1 provides general guidelines and reference sources for method detection limits, precision, and accuracy, as available, for each analyte of interest; they are sorted by the required analytical level. Where guidelines are

not available, statistical guidelines appropriate for determining precision and accuracy shall be developed, included in procedures, and submitted for Westinghouse Hanford review and approval. Once individual laboratory statements of work are negotiated and procedures are approved, Table QAPP-1 shall be revised to include actual method references and approved detection limit, precision, and accuracy criteria as project requirements.

All analytical procedures approved for use in this investigation shall require the use of standard reporting techniques and units consistent with EPA reference methods in order to facilitate the comparability of data sets in terms of precision and accuracy. All approved procedures shall be retained in the project quality records and shall be available for regulatory review upon request at the direction of the Westinghouse Hanford technical lead.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 DATA REDUCTION AND DATA PACKAGE PREPARATION

All analytical laboratories shall be responsible for preparing a report summarizing the results of analysis and for preparing a detailed data package that includes all information necessary to perform data validation. Data summary report format and data package content shall be defined in the laboratories' analytical methods/internal QA program plans, subject to Westinghouse Hanford review and approval requirements as noted in Section 4.1. As a minimum, data packages shall include the following:

- Sample receipt and tracking documentation, including identification of the organization and individuals performing the analysis, the names and signatures of the responsible analysts, sample holding time requirements, references to applicable chain-of-custody procedures, and the dates of sample receipt, extraction, and analysis

- Instrument calibration documentation, including equipment type and model, with continuing calibration data for the time period in which the analysis was performed

- QC data, as appropriate for the methods used, including matrix spike/matrix spike duplicate data, recovery percentages, precision data, laboratory blank data, and identification of any nonconformances that may have

affected the laboratory's measurement system during the time period in which the analysis was performed

- The analytical results or data deliverables, including reduced data, reduction formulas or algorithms, and identification of data outliers or deficiencies.

Other supporting information, such as initial calibration data, reconstructed ion chromatographs, spectrograms, traffic reports, and raw data, need not be included in the submittal of individual data packages unless specifically required to support validation report preparation for the CLP statements of work (EPA 1988b, 1989) methods as defined in Section 8.2. All sample data, however, shall be retained by the analytical laboratory and made available for systems or program audit purposes upon request by Westinghouse Hanford, Department of Energy-Richland Operations Office (DOE-RL), or regulatory agency representatives. Such data shall be retained by the analytical laboratory through the duration of their contractual statement of work, at which point it shall be turned over to Westinghouse Hanford for archiving.

The completed data package shall be reviewed and approved by the analytical laboratory's QA Manager prior to submittal to Westinghouse Hanford for validation. The requirements of this section shall be included in procurement documentation or work orders, as appropriate, in compliance with the standard Westinghouse Hanford procurement control procedures referenced in Section 4.1.

8.2 VALIDATION

Validation of the completed data package may be performed by qualified Westinghouse Hanford personnel from the office of Sample Management. Selection of qualified reviewers and assignment of validation responsibilities shall be as directed by the Westinghouse Hanford technical lead and shall be defined in procurement documentation or work orders as appropriate.

8.2.1 Validation Report Preparation for Level II Methods

Level II screening analyses performed for this investigation are noted in Section 3.0 and Table QAPP-1. All procedures shall include specific requirements for validation report preparation that are appropriate for the particular procedure and equipment type, and shall be reviewed and approved by Westinghouse Hanford prior to implementation in compliance with the standard Westinghouse Hanford procurement control procedures referenced in Section 4.1.

8.2.2 Validation Report Preparation for Level III, Level IV, and Level V Methods

All validation report requirements for Level III, Level IV, and Level V analyses shall be established within individual methods requirements, subject to Westinghouse Hanford review and approval as discussed in Section 4.1. Validation report requirements shall be in general compliance with the guidelines provided in EPA guidelines for Level IV analyses, modified as necessary to accommodate the allowances of the applicable reference methods listed for each analyte of interest in Table QAPP-1. In general, for organic analyses, validation reports shall be prepared documenting overchecks of the following areas as recommended in Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses (EPA 1988a):

- Data summary narrative
- Sample holding times
- Gas chromatograph/mass spectrometer tuning and mass calibration requirements
- Continuing calibration requirements
- Method blank sample requirements
- Surrogate recovery requirements
- Matrix spike/matrix spike duplicate requirements
- Internal standards performance requirements
- Target compound identification requirements
- Target compound quantitation requirements and reported detection limits
- Any tentatively identified compounds, library search, assessment, and quantitation requirements
- Overall data assessment requirements.

For inorganic analyses, validation reports shall be prepared documenting overchecks of the following areas, as recommended in Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (EPA 1988b):

- Data summary narrative
- Sample holding times

9 1 1 3 5 7 1 0 9 9

- Continuing calibration requirements
- Method blank sample requirements
- Interference check sample requirements
- Laboratory control sample requirements
- Duplicate sample analysis
- Matrix spike sample requirements
- Atomic absorption QC requirements
- Inductively coupled plasma serial dilution requirements
- Overall data assessment requirements.

8.3 FINAL REVIEW AND RECORDS MANAGEMENT CONSIDERATIONS

All validation reports and supporting analytical data packages shall be subjected to a final technical review by a qualified reviewer at the direction of the Westinghouse Hanford technical lead, prior to submittal to the regulatory agencies or inclusion in reports or technical memoranda. All validation reports, data packages, and review comments shall be retained as permanent project quality records in compliance with "Records Management," EII 1.6 (WHC 1989b), "Quality Assurance Records," QA 17.0 (WHC 1989a), and the DMP.

9.0 INTERNAL QUALITY CONTROL

All analytical samples shall be subject to in-process QC measures in both the field and laboratory. Unless otherwise specified in the approved FSP, the following minimum field QC requirements apply for Level III, Level IV, and Level V analyses.

These requirements are adapted from Test Methods for Evaluating Solid Waste (SW-846) (EPA 1986), as modified by the proposed rule changes included in the Federal Register, Volume 54, No. 13 (EPA 1989).

- Field duplicate samples. For each shift of sampling activity under an individual sampling subtask, a minimum of 5% of the total collected samples shall be duplicated, or one duplicate shall be collected for every 20 samples, whichever is greater. Duplicate samples shall be retrieved from the same sampling location using the same equipment and sampling technique, and shall be placed into two identically

prepared and preserved containers. All field duplicates shall be analyzed independently as an indication of gross errors in sampling techniques. Duplicate samples will be analyzed for the same Table QAPP-1 parameters as the environmental samples.

- Split samples. At the technical lead's direction, field or field duplicate samples may be split in the field and sent to an alternative laboratory as a performance audit of the primary laboratory. Split samples shall be analyzed by the independent laboratory compliance with approved methods based on the same reference standards that are invoked for the primary laboratory. For this investigation, performance requirements shall be met by analyzing a minimum of one split sample for each analytical method identified in Table QAPP-1.

- Blind samples. At the technical lead's direction, blind reference samples may be introduced into any sampling round as a performance and audit of the primary laboratory. Blind sample type shall be as directed by the technical lead and may be from traceable standards or from routine samples spiked with a known concentration of a known compound. For this investigation, performance requirements shall be met by analyzing a minimum of one blind sample for each analytical method identified in Table QAPP-1.

- Field blanks. Field blanks shall consist of pure deionized distilled water, transferred into a sample container at the site and preserved with the reagent specified for the analytes of interest. Field blanks are used as a check on reagent and environmental contamination, and shall be collected at the same frequency as field duplicate samples.

- Equipment blanks. Equipment blanks shall consist of pure deionized distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures, and shall be collected at the same frequency as field duplicate samples.

- Trip blanks. Trip blanks consist of pure deionized distilled water added to one clean sample container, accompanying each batch of containers shipped to the sampling activity. Trip blanks shall be returned unopened to the laboratory, and are prepared as a check on possible contamination originating from container

9 1 1 3 3 7 1 0 3 1

preparation methods, shipment, handling, storage, or site conditions. In compliance with standard Westinghouse Hanford procurement procedures, requirements for trip blank preparation shall be included in procurement documents of work orders to the sample container supplier and/or preparer.

The above QC samples require separate, distinct sample identification from the environmental samples.

The internal QC checks performed by analytical laboratories for Level III and Level V laboratory analyses shall meet the following minimum requirements:

- Matrix spiked samples. Matrix spiked samples require the addition of a known quantity of a representative analyte of interest to the sample as a measure of recovery percentage. The spike shall be made in a replicate of a field sample. Replicate samples are separate aliquots removed from the same sample container in the laboratory. Spike compound selection, quantities, and concentrations shall be described in the analytical procedures submitted for Westinghouse Hanford review and approval. One sample shall be spiked per analytical batch, or once every 20 samples, whichever is greater.

- QC reference samples and appropriate QA requirements. A QC reference sample shall be prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. Reference samples are required as an independent check on analytical technique and methodology, and shall be run with every analytical batch, or every 20 samples, whichever is greater.

Other requirements specific to laboratory analytical equipment calibration are included in Section 6.0.

The minimum requirements of this section shall be invoked in procurement documents or work orders in compliance with standard Westinghouse Hanford procedures as noted in Section 4.1.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance, system, and program audits are scheduled to begin early in the execution of this work plan and continue through work plan completion. Collectively, the audits address quality affecting activities that include, but are not limited to, measurement system accuracy, intramural and extramural

analytical laboratory services, field activities, and data collection, processing, validation and management.

Performance audits of the accuracy of laboratory analysis are implemented in accordance with Standard Operating Procedure "Laboratory Analysis Performance Audits," EII 1.12 (WHC 1989b). System audit requirements are implemented in accordance with Standard Operating Procedure "Surveillance," QI 10.4 (WHC 1989a). Surveillances will be performed regularly throughout the course of the work plan activities. Additional performance and system "surveillance" may be scheduled as a consequence of corrective action requirements, or may be performed upon request. All quality affecting activities are subject to surveillance.

All aspects of inter-operable unit activities will also be evaluated as part of routine environmental restoration program-wide QA audits under the Standard Operating Procedure requirements of WHC-CM-4-2 (WHC 1989a). Program audits shall be conducted in accordance with "Audits," QR 18.0, "Audit Programming and Scheduling," QI 18.1, and "Planning, Performing, Reporting, and Followup of Quality Audits," QI 18.2 by auditors qualified in accordance with "Qualification of Quality Assurance Personnel," QI 2.5 (WHC 1989a).

11.0 PREVENTIVE MAINTENANCE

All measurement and testing equipment used in the field and laboratory that directly affect the quality of the analytical data shall be subject to preventive maintenance measures that ensure minimization of measurement system downtime. For this investigation, such measures are confined to laboratory equipment because all field measurements are related either to the measurement of the sample interval or to the determination of radiological or other health and safety hazards. Laboratories shall be responsible for performing or managing the maintenance of their analytical equipment; maintenance requirements, spare parts lists, and instructions shall be included in individual methods or in laboratory QA plans, subject to Westinghouse Hanford review and approval. When samples are analyzed using EPA reference methods, the requirements for preventive maintenance of laboratory analytical equipment as defined by the reference method shall apply.

12.0 DATA ASSESSMENT PROCEDURES

Characterization data from this phase of the investigation will be assessed at two levels. As previously discussed in Section 8.0, analytical data shall first be compiled and reduced by the laboratory and validated in a manner appropriate for the individual analytical level. As discussed in Section 5.0 of the

work plan, and as directed by the technical lead, various statistical and probabilistic techniques may be selected for use in the process of data comparison and analysis. Statistical procedures to be used will include:

- Soil or water data where three or more samples are collected will be statistically analyzed using analysis of variance. Duncan's Multiple Range test will be used to compare mean values of groups of data such as background group to test group. Significant differences will be looked for at P = 0.05.

- Precision (i.e., duplicate samples) will be measured by:

$$RFD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2}$$

RPD = relative to difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values.

- Precision - If calculated from three or more replicates, the relative standard deviation (RSD) will be used.

$$RSD = (s/\bar{y}) \times 100\%$$

s = standard deviation
$\bar{y}$ = mean of replicate analyses.

- Accuracy (i.e., measurements where sample spikes are used)

$$\% R = 100\% \times \left[\frac{S - U}{Csa} \right]$$

% R = percent recovery
S = measured concentration in spiked sample
U = measured concentration in unspiked sample
Csa = actual concentration of spike added.

- Accuracy - for measurements where a standard reference material (Srm) is used:

$$\% R = 100\% \times \left(\frac{Cm}{Csrm} \right)$$

% R = percent recovery
Cm = measured concentration of SRM
Csrm = actual concentration of SRM

- Method Detection Limit =

$$MDL = t\ (n-1,\ 1-\alpha = 0.99) \times S$$

MDL = method detection limit
S = standard deviation of the replicate analysis
t (n-1, 1-α = 0.99) = Students t value appropriate to a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

In all cases, the statistical methodologies and assumptions to be used in the evaluation shall be defined by written directions that are signed, dated, and retained as project quality records in compliance with "Records Management," EII 1.6 (WHC 1989b). Applicable directions shall be documented in the final report for this phase of the characterization of 100-NR-3 produced in Task 11.

13.0 CORRECTIVE ACTION

Corrective action requests required as a result of surveillance reports, nonconformance reports, or audit activity shall be documented and dispositioned as required by "Corrective Action," QR 16.0; "Trending/Trend Analysis," QI 16.1; and Corrective Action Reporting," QI 16.2 (WHC 1989a). Primary responsibilities for corrective action resolution are assigned to the technical lead and the quality coordinator. Other measurement systems, procedures, or plan corrections that may be required as a result of routine review processes shall be resolved as required by governing procedures or shall be referred to the technical lead for resolution. Copies of all surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project QA records upon completion or closure.

14.0 QUALITY ASSURANCE REPORTS

As previously stated in Sections 10.0 and 13.0, project activities shall be regularly assessed by auditing and

surveillance processes. Surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project quality records upon completion or closure of the activity. A report such as that described in "Trending/Trend Analysis," QI 16.1 (WHC 1989a), summarizing all audit, surveillance, and instruction change authorization activity (see Section 4.4), as well as any associated corrective actions, shall be prepared by the quality coordinator at the completion of Phase I or annually beginning 1 yr after approval of the work plan, whichever is sooner. The report(s) shall be submitted to the technical lead for incorporation into the final report prepared at the end of Phase I of the investigation. The final report shall include an assessment of the overall adequacy of the total measurement system with regard to the data quality objectives of the investigation.

15.0 REFERENCES

DOE (1988), Radiation Protection for Occupational Workers, DOE Order 5480.11, U.S. Department of Energy, Washington, D.C.

Ecology et al. (1989), Hanford Federal Facility Agreement and Consent Order, U.S. Environmental Protection Agency, U.S. Department of Energy, Washington State Department of Ecology, Olympia, Washington

EPA (1989), Hazardous Waste Management System; Testing and Monitoring Activities (Proposed Rule), Volume 54, No. 13, pp. 3212-3228, Federal Register

EPA (1988a), Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1988b), Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1987), Data Quality Objectives for Remedial Response Activities, Example Scenario: RI/FS Activities at a Site with Contaminated Soils and Ground Water, EPA/540/G-87/004, OSWER Directive 9355.0-7B, prepared by CDM Federal Programs Corporation for the Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA (1986), Test Methods for Evaluating Solid Wastes, SW-846, Third Edition, Volumes I-IV, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

WHC (1990), Health Physics Procedures Manual, 100 Areas/Site Surveillance, WHC-IP-0692-1, Westinghouse Hanford Company, Richland, Washington

WHC (1989a), Quality Assurance Manual, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington

WHC (1989b), Environmental Investigations and Site Characterization Manual, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington

9 1 1 1 3 7 1 0 3 7

ATTACHMENT 2

HEALTH AND SAFETY PLAN

THIS PAGE INTENTIONALLY
LEFT BLANK

CONTENTS

1.0 General Considerations and Requirement HSP-1

1.1 Introduction HSP-1
1.2 Designated Safety Personnel HSP-2
1.3 Medical Surveillance HSP-4
1.4 Training HSP-5
1.5 Training for Visitors HSP-6
1.6 Radiation Dosimetry HSP-7
1.7 Requirements for the Use of Respiratory Protection HSP-7

2.0 General Procedures HSP-7

2.1 General Work Safety Practices HSP-8
2.1.1 Work Practices HSP-8
2.1.2 Personal Protective Equipment HSP-9
2.1.3 Personal Decontamination HSP-10
2.1.4 Emergency Preparation HSP-11
2.2 Confined Space/Test Pit Entry Procedures . . . HSP-11

3.0 Site Background HSP-12

4.0 Scope of Work and Potential Hazards HSP-20

4.1 Work Tasks HSP-20
4.2 Potential Hazards HSP-20
4.3 Assessment and Mitigation of Potential Hazards HSP-23

5.0 Environmental and Personal Monitoring HSP-25

5.1 Volatile Organic Compounds Monitoring HSP-26
5.2 Airborne Radioactive Materials and Radiation Monitoring HSP-27

6.0 Personal Protective Clothing and Respiratory Protection HSP-28

6.1 Personal Protective Equipment HSP-28
6.2 Heat Stress HSP-28
6.3 Hypothermia HSP-29

7.0 Site Control HSP-29

8.0 Decontamination Procedures HSP-30

8.1 Personnel Decontamination HSP-31
8.2 Equipment Decontamination HSP-31

CONTENTS (cont.)

8.3 Sampling and Monitoring Equipment HSP-32
8.4 Respiratory Protection Equipment HSP-33
8.5 Heavy Equipment HSP-33

9.0 Contingency and Emergency Response Plans HSP-33

9.1 Procedure for Personnel Injured in the Exclusion Zone HSP-34
9.2 Procedure for Personnel Injury in the Support Area HSP-35
9.3 Procedures for Fire and Explosions HSP-36
9.4 Procedure for Personal Protective Equipment Failure HSP-36
9.5 Procedure for Failure of Other Equipment . . . HSP-37
9.6 Emergency Escape Routes HSP-37
9.7 Response Action to Chemical Exposure HSP-37
9.8 Emergency Telephone Numbers HSP-37

10.0 References HSP-38

FIGURES:

HSP-1 Source Units Within the 100-NR-3 Operable Unit HSP-13

TABLES:

HSP-1 Waste Management Units and Unplanned Releases at Operable Unit 100-NR-3 . . . . . HSP-14

HSP-2 Potential Contaminants at 100-N HSP-21

HSP-3 Known Radiologic Hazards HSP-22

1.0 GENERAL CONSIDERATIONS AND REQUIREMENTS

1.1 INTRODUCTION

The purpose of this task-specific health and safety plan (HSP) is to establish standards health and safety procedures for Westinghouse Hanford Company (Westinghouse Hanford) employees and contractors engaged in remedial investigation activities in the 100-NR-3 operable unit. These activities will include drilling and sampling boreholes, well installation, and environmental sampling in areas of known chemical and radiological contamination.

All employees of Westinghouse Hanford or any other contractors who are participating in onsite activities in the 100-NR-3 operable unit shall:

1. Read the HSP and attend a pre-job safety meeting to review and discuss the HSP

2. Follow all health and safety procedures specified in this document and in the applicable Hazardous Waste Operations Permit (HWOP).

Each HWOP must be signed by all involved personnel, including managers and laborers. Employees are encouraged to bring any questions or concerns to the site safety officer. The approved HWOP will serve as the agenda for a mandatory "tailgate" safety meeting before startup each day. Additional tailgate safety meetings or safety briefings will be held at any time it is deemed necessary by the site safety officer, the health physics technician, or the field team leader.

A brief HWOP will be prepared for each work site (e.g., pond, trench, ditch, etc.) which will reiterate the following information for that specific site and task(s) and follow the format and guidance in "Preparation of Hazardous Waste Operations Permits," EII 2.1 (WHC 1989)

1. Inventory of suspected chemical and/or radiological hazards

2. Discussion of existing and potential physical hazards

3. Methods for mitigating known and potential site-specific hazards.

Each HWOP will be reviewed and approved by: the operable unit technical lead, the field team leader, the site safety officer, environmental health and pesticide services section, industrial safety and fire protection, health physics, the technical lead's manager, and the manager of any other Westinghouse Hanford personnel with work responsibilities at the site, as related to the particular HWOP. The Westinghouse health physics department will also provide input and approval on radiological matters. The HWOP will also be reviewed and signed for concurrence by any non-Westinghouse Hanford contractor whose personnel are participating at the job site.

The levels of protection and procedures specified in this plan are based on the best available information and represent the minimum health and safety requirements to be observed at all times by Westinghouse Hanford employees and contractors while engaged in tasks associated with this project. Should any situation arise which is judged to be beyond the scope of the monitoring, personal protection, or decontamination procedures specified here or in the HWOP, work activities will stop and all personnel will withdraw from the exclusion zone as directed by the site safety officer, the health physics technician, and the field team leader. After review of the situation, the site safety officer will determine the need to upgrade the level of protection as specified in the PHSP or to revise the health and safety procedures for this activity. Any changes to health and safety procedures or changes to the HWOP must be approved by the site safety officer.

1.2 DESIGNATED SAFETY PERSONNEL

The field team leader, health and safety officer, site safety officer, and health physics technician are responsible for site safety and health. For sites with radiological concerns, the health physics department will provide guidance and/or support. Specific individuals will be assigned on a task by task basis by project management, and their names will be properly recorded before the task is initiated.

All activities on site must be cleared through the field team leader. The field team leader has responsibility for the following:

- Allocating and administering the resources to successfully comply with all technical and health and safety requirements
- Verifying that all permits, supporting documentation, and clearances are in place (i.e., electrical outage requests, welding permits, excavation permit, HSP,

sampling plan, Radiation Work Permit, onsite/offsite radiation shipping records, etc.)

- Providing technical advice during routine operations and emergencies
- Informing the appropriate site management and safety personnel of the activities to be performed each day
- Resolving any conflicts that may arise between Radiation Work Permits and implementation of the HSP with cognizant health physics management
- Handling of emergency response situations as may be required
- Conducting pre-job safety meeting and periodic tailgate safety meetings
- Interactions with adjacent building occupants and/or inquisitive public.

The health and safety officer (HSO) is responsible for preparing the HWOP. The health and safety officer, a member of Westinghouse Hanford's Environmental Field Services, must meet the qualifications for an HSO per "Preparation of Hazardous Waste Operations Permits," EII 2.1 and Section 4.4.3.

The site safety officer shall act as the site safety and health supervisor and is responsible for implementing the HSP at the site. The site safety officer shall:

- Be present during all work plan activities
- Monitor chemical, physical, and (in conjunction with the health physics technician) radiation hazards to assess the degree of hazard present; monitoring shall specifically include organic vapor detection, radiation screening, and confined space evaluation
- Determine protection levels, clothing, and equipment needed to ensure the safety of personnel in conjunction with the health physics technician
- Monitor performance of all personnel to ensure that the required safety procedures are followed
- Halt operations immediately, if necessary, because of safety and/or health concerns
- Conduct safety briefings as necessary

- At the field team leader's request, prepare summary reports of health and safety activities at the conclusion of each task.

The health physics technician is responsible for assuring that all radiological monitoring and protection procedures are being followed as specified in the appropriate Radiation Work Permit. Industrial hygiene and safety personnel will provide safety with an overview during drilling operations consistent with Westinghouse Hanford policy and provide technical advice as requested. Also, an additional industrial hygienist and health physics technician may be requested to provide downwind sampling for hazardous materials and radiological contaminants, respectively, and other analyses as required.

The ultimate responsibility and ultimate authority for employee health and safety lies with the employee. Each employee is responsible for exercising the utmost care and good judgment in protecting personal health and safety and that of fellow employees. Should any employee observe a potentially unsafe condition or situation, it is the responsibility of that employee to immediately bring the observed condition to the attention of the appropriate health and safety personnel, as designated above. In the event of a serious health or safety situation, the employee automatically has temporary 'stop-work' authority and the responsibility to immediately notify the field team leader or site safety officer. When work is temporarily halted because of a safety or health concern, personnel will exit the exclusion zone and meet at a predetermined place in the support zone. The field team leader, site safety officer, and health physics technician will determine the next course of action.

1.3 MEDICAL SURVEILLANCE

All Westinghouse Hanford personnel and contractors engaged in onsite activities on 100-NR-3 must have baseline physical examinations and be participants in the Westinghouse Hanford (or an equivalent) hazardous waste worker medical surveillance program.

Medical examinations will be designed by the Hanford Environmental Health Foundation (HEHF) to identify any preexisting conditions that may place an employee at high risk, and will verify that each worker is physically able to perform the work required by this work plan without undue risk to personal health. The physician shall determine the existence of conditions that may reduce the effectiveness or prevent the employee's use of respiratory protection. The physician shall also determine the presence of conditions that may pose undue risk to the employee while performing the physical tasks of this work plan using Level B personal protection equipment. This

would include any condition that increases the employee's susceptibility to heat stress.

The examining physician's report will not include any nonoccupational diagnoses unless directly related to the employee's fitness for work required.

1.4 TRAINING

Before engaging in any onsite remedial investigation activities, each team member is required to have received 40 h of health and safety training related to hazardous waste site operations and at least 8 r of refresher training each year thereafter, as specified in 29 CFR 1910 (OSHA 1988a). In addition, supervisors are required to have supervisory health training. At a minimum this training must include the following topics:

- Employee rights and responsibilities under the Occupational Safety and Health Administration (OSHA)
- Personal protection equipment and clothing, use and care, particularly fitting, operation, and use of cascade breathing air systems and SCBA
- Chemical and radiological hazard recognition
- Radiation worker training
- Vehicle operation, mandatory rules, and regulations
- Safe use of drilling and sampling equipment
- Handling, storage, and transportation of hazardous chemical and radioactive materials
- Site control and management
- Safe sampling techniques
- Site surveillance, observation, and safety plan development
- Proper decontamination methods for personnel, protective clothing, and equipment
- Use of field test equipment for radioactivity, explosivity, and other measurements as needed
- Communication procedures.

The field team leader and site safety officer will provide site-specific instructions regarding anticipated hazards, levels of protection, site monitoring, and operation of equipment before work begins, and thereafter, as appropriate.

In addition, each inexperienced (never having performed site characterization) employee will be directly supervised by a trained, experienced person for a minimum of 3 days of field procedures. There are often several on-the-job trainees on a job site at the same time. Each will be training for a specific activity, usually with the experienced team member who is responsible for that activity. All members of the field team are supervised by the field team leader and site safety officer.

The field team leader and site safety officer will receive an additional 8 h of supervisory training (in addition to the refresher training discussed above) to cover the following topics:

- Management of restricted and safe zones
- Medical surveillance
- Regulatory requirements
- Rules for handling untrained site visitors
- Site management
- Other environmental, safety, and health topics which relate to the sampling and characterization effort.

1.5 TRAINING FOR VISITORS

For the purposes of this section, visitors are defined as any persons visiting the Hanford Site including, but not limited to, those engaged in surveillance, inspection, or observation activities who are not Westinghouse Hanford employees or Westinghouse Hanford contractors directly involved in RFI activities.

Visitors who must enter a controlled zone (either Contamination Reduction Zone or Exclusion Zone), shall be subject to all of the applicable training, respirator fit testing, and medical surveillance requirements discussed in "Hazardous Waste Site Entry," EII 1.1 (WHC 1989), Section 5.3.2 and Attachment 2.

All visitors shall be informed of potential hazards and emergency procedures by their escorts and conform to "Hazardous Waste Site Entry," EII 1.1 (WHC 1989) and Section 5.3.1.

1.6 RADIATION DOSIMETRY

All personnel engaged in onsite activities shall be assigned dosimeters according to the requirements of the Radiation Work Permit (RWP) applicable to that activity.

All visitors to 100-NR-3 shall be assigned, at a minimum, basic dosimeters to be exchanged annually.

1.7 REQUIREMENTS FOR THE USE OF RESPIRATORY PROTECTION

All employees of Westinghouse Hanford and subcontractors must be included in a medical surveillance program and be approved for the use of respiratory protection by an HEHF or other licensed physician. Each team member must be trained in the selection, limitations, and proper use and maintenance of respiratory protection (existing respiratory protection training may be applicable to the 40-h training and refresher course requirement).

Before using any negative-pressure respirator, each employee must be fit-tested (within the past year) for the specific make, model, and size of respirator the individual will be using, according to the Westinghouse Hanford fit testing procedures. Beards (including a few days' growth), large sideburns, or moustaches which may interfere with a proper respirator seal are not permitted.

Subcontractors must provide evidence to Westinghouse Hanford that their medical surveillance and respiratory protection programs comply with 29 CFR 1910.120 and 29 CFR 1910.134, respectively (OSHA 1988a).

2.0 GENERAL PROCEDURES

The following personal hygiene and work practice guidelines are intended to prevent injuries and adverse health effects. A hazardous waste site poses a multitude of health and safety concerns because of the variety and number of hazardous substances present. These guidelines represent the minimum standard procedures for reducing potential risks associated with this project and are to be followed by all job-site employees <u>at all times</u>.

2.1 GENERAL WORK SAFETY PRACTICES

2.1.1 Work Practices

- Eating, drinking, smoking, taking medications, chewing gum, etc., is prohibited within the exclusion zone. All sanitation facilities shall be located outside of the exclusion zone; decontamination is required before using such facilities.

- Personnel shall avoid direct contact with contaminated materials unless proper protection equipment is used. Remote handling of casing, auger flights, etc. will be practiced whenever practical.

- While operating in the controlled zone, personnel shall use the "buddy system" or be in visual contact with someone outside of the controlled zone at all times.

- The buddy system will be used when appropriate for manual lifting.

- Requirements of Westinghouse Hanford radiation protection and Radiation Work Permit manuals shall be followed for all work involving radioactive materials or conducted within a radiologically controlled area.

- Work operations onsite shall not start before sunrise and shall cease at sunset, unless the entire control zone is adequately illuminated with artificial lighting. A new tour (shift) will man the drilling rig after completion of each shift.

- Do not handle soil, waste samples, or any other potentially contaminated items unless wearing the protective gloves and other appropriate PPE clothing specified in the HWOP.

- Whenever possible, stand upwind of excavations, boreholes, well casings, drilling spoils, etc., as indicated by an onsite windsock.

- Stand clear of the trench during excavation. Always approach the excavation from upwind. All trenches should be properly shored or sloped.

- Be alert to potentially changing exposure conditions as evidenced by perceptible odors, unusual appearance of excavated soils, oily sheen on water, etc.

- Do not enter any test pit trench greater than 4 ft in depth unless in accordance with procedures specified in the HWOP.

- Do not, <u>under any circumstances</u>, enter or ride in or on any backhoe bucket, materials hoist, or any other similar device not specifically designed for carrying human passengers.

- All drilling operations members must make a conscientious effort to remain aware of their own and other's positions in regards to rotating equipment, cat heads, u-joints, etc. Drilling operations members must be extremely careful when assembling, lifting, and carrying flights or pipe to avoid pinch-point injuries and collisions.

- Tools and equipment will be kept off the ground whenever possible to avoid tripping hazards and the spread of contamination.

- Personnel not involved in operation of the drill rig or monitoring activities shall remain a safe distance from the rig as indicated by the field team leader.

- Catalytic converters on the underside of vehicles are sufficiently hot to ignite dry prairie grass. Team members should not drive over dry grass that is higher than the ground clearance of the vehicle and should be aware of the potential fire hazard posed by catalytic converters at all times. <u>Never</u> allow a running vehicle to sit in a stationary location over dry grass or other combustible materials.

- Team members will attempt to minimize truck tire disturbance of all stabilized sites.

- Follow all provisions of each site-specific Hazardous Work Permit as addressed in the HWOP, including cutting and welding permits, confined space entry, and excavation.

- Radiation monitoring of sampling area will be conducted prior to sampling activities.

2.1.2 Personal Protective Equipment

- Personal protective equipment will be selected specifically for the hazards identified in the HWOP. The site safety officer is responsible for choosing the appropriate type and level of protection required for different activities at the job site. Protective

equipment selection will be done in conjunction with the cognizant Health Physics Department for areas having radiological concerns.

- Levels of protection shall be appropriate to the hazard to avoid either excessive exposure or additional hazards imposed by excessive levels of protection. The HWOP will contain provisions for adjusting the level of protection as necessary. These personal protective equipment specifications must be followed at all times, as directed by the field team leader, health physics technician, and site safety officer.

- Each employee must have available a hard, hat, safety glasses, and substantial protective footwear to wear if specified in the HWOP.

- The exclusion zone around drilling or other noisy operations will be posted "Hearing Protection Required." The type of hearing protection to be worn will be specified in the HWOP with other personal protective equipment.

- Personnel should maintain a high level of awareness of the limitations in mobility, dexterity, and visual impairment inherent in the use of Level B and Level C personal protective equipment.

- Personnel should be alert to the symptoms of fatigue, heat stress, and cold stress and their effect on the normal caution and judgment of personnel.

- Life jackets must be worn and employees shall use the "buddy system" for any activities over water (e.g., water column sampling of the Columbia River). Additional rescue equipment, such as a rope or pole, shall also be available.

2.1.3 Personal Decontamination

- The HWOP will describe in detail methods of personnel decontamination, including the use of contamination control corridors and step-off pads when appropriate.

- Thoroughly wash hands and face before eating or putting anything in the mouth, to avoid hand-to-mouth contamination. Eating areas will be designated.

- At the end of each work day or each job, disposable clothing shall be removed and placed in (chemical contamination) drums or plastic lined boxes as

appropriate. Clothing that can be cleaned shall be sent to the Hanford Laundry.

- Individuals are expected to thoroughly shower before leaving the work site or Hanford Site if directed to do so by the health physics technician, site safety officer, or field team leader.

2.1.4 Emergency Preparation

- A multipurpose dry chemical fire extinguisher, a fire shovel, a complete field first-aid kit (including bottles of eyewash solution), and a portable deluge shower shall be available at every drill site.

- Prearranged hand signals or other means of emergency communication will be established when respiratory protection equipment is to be worn, since this equipment seriously impairs speech communications.

- The Hanford Fire Department and emergency medical team shall be notified prior to the start of a site investigation project. This notification shall include the location and nature of the various types of field work activities as described in the work plan. A site location map shall be included in this notification.

2.2 CONFINED SPACE/TEST PIT ENTRY PROCEDURES

The following procedures apply to the entry of any confined space which, for the purpose of this document, shall be defined as any space having limited egress (access to an exit) and the potential for the presence or accumulation of a toxic or explosive atmosphere. This includes manholes, certain trenches (particularly those through waste disposal areas), and all test pits greater than 4 ft in depth in potentially contaminated soil. If confined spaces are going to be entered as part of the work operations, a Hazardous Work Permit (filled out for confined space entry) must be obtained from Industrial Safety and Fire Protection.

The identified remedial investigation activities on 100-NR-3 should not require confined space entry. Nevertheless, the hazards associated with confined spaces are of such severity that all employees should be familiar with the safe work practices discussed below.

No employee shall enter any test pit or trench greater than 4 ft in depth unless the sides are shored or laid back to a stable slope as specified in 29 CFR 1926.652 (OSHA 1988b) or equivalent state occupational health and safety regulations.

When an employee is required to enter a pit or trench 4 ft or more in depth, an adequate means of access and egress, such as a slope of at least 2:1 to the bottom of the pit, or a secure ladder or steps shall be provided.

Before entering any confined space, including any test pit, the atmosphere will be tested for flammable gases, oxygen deficiency, and organic vapors. If other specific contamination, such as radioactive materials or other gases and vapors may be present, additional testing for those substances shall be conducted. Depending on the situation, the space may require ventilation and retesting before entry.

Any employee entering a confined or partially confined space must be equipped with an appropriate level of respiratory protection in keeping with the monitoring procedures discussed previously and the action levels for airborne contaminants (see Warnings and Action Levels in HWOP).

No employee shall enter any test pit requiring the use of Level B protection, unless a backup person also equipped with a pressure-demand SCBA is present. No backup personal shall attempt any emergency rescue unless a second backup person equipped with a SCBA is present, or the appropriate emergency response authorities have been notified and additional help is on the way.

3.0 SITE BACKGROUND

The 100-N Area is located in the north central part of the Hanford Site and is situated along the southern shoreline of the Columbia River. The 100-NR-3 operable unit is designated a source operable unit, and is associated with the 100-NR-1 aggregate source/groundwater unit.

Fifty potential sources of contamination have been identified at 100-NR-3. These include both waste management units and unplanned releases. The source units have been arranged into logical groupings based on proximity and operational parameters. The source units located in 100-NR-3 are shown on Figure HSP-1. Table HSP-1 lists and provides brief background information for each source unit in 100-NR-3.

The contaminants which may be present in the 100-NR-3 Area include a very wide range of organic and inorganic compounds, elements and radionuclides. It is important to note that a few potential contaminants may not have been detected because analyses have not been performed to determine their presence. For example, groundwater and surface water samples from the 100-N Area have not been routinely analyzed for plutonium and americium. In addition, the adequacy of quality control and

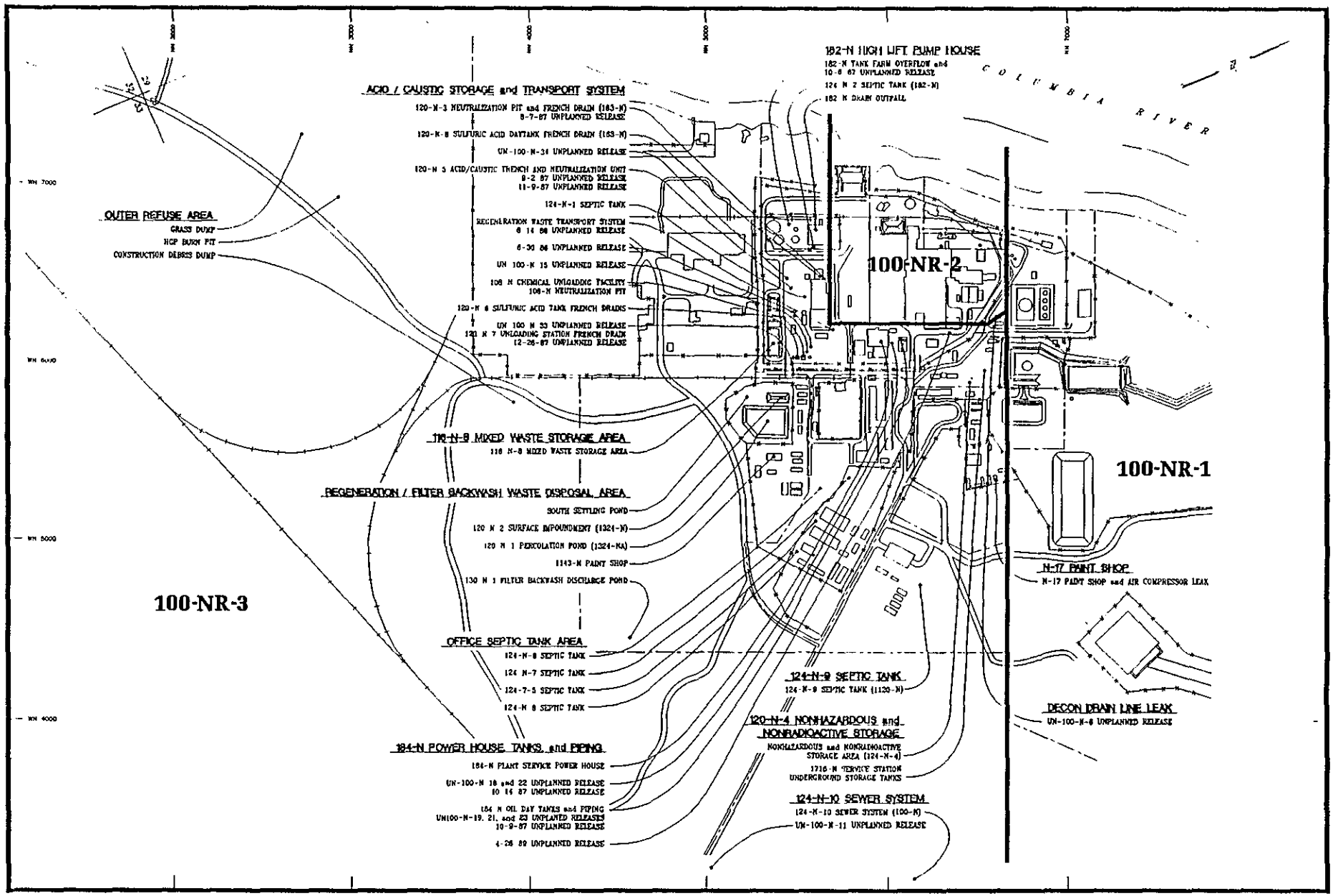


Figure HSP-1. Source Units Within the 100-NR-3 Operable Unit

Table HSP-1. Waste Management Units and Unplanned Releases at 100-NR-3. (sheet 1 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
1. Outer Refuse Area Grouping				
---	HGP Burn Pit	Unknown	Trash.	Pit used for burning of trash. Unknown if flammable solvents were burned.
---	Grass Dump	Unknown	Grass; unknown if other wastes were disposed.	Pit for storage of grass clippings.
---	Construction Debris Dump	Unknown	Construction debris of unknown nature.	Used by J.A. Jones Construction Co. for disposal of construction rubble (e.g., dirt, cement, asphalt, metal, and wood)
2. 182-N High Lift Pumphouse Grouping				
124-N-2	182-N Septic Tank	1963-present	Sanitary sewage.	Serves personnel from 182-N Building.
---	182-N Tank Farm Overflow	Unknown-present	Overflow water analyzed for temperature, pH, total suspended solids, oil and grease, and chlorine per NPDES permit.	NPDES Discharge Point Number 005 via a 36-inch raw water return line.
---	182-N Drain System	Unknown-present	Primarily water analyzed for temperature, pH, total suspended solids, and oil and grease per NPDES permit.	NPDES Discharge Permit Number 006 via a 42-inch raw water return line.
---	Lube Oil Line Leak	2/6/87	5 gal of turbine oil.	Pinhole leak in lube oil line allowed oil to enter secondary steam system. Discharged to river with steam condensate.
3. Acid/Caustic Storage and Transport System Grouping				
---	108-N Chemical Unloading Facility	1963-present	93% sulfuric acid and 50% sodium hydroxide.	Unloading area for trucks or railcars. Has three above ground sulfuric acid tanks and one aboveground sodium hydroxide tank.

Table HSP-1. Waste Management Units and Unplanned Releases at 100-NR-3. (sheet 2 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
3. Acid/Caustic Storage and Transport System Grouping (cont.)				
120-N-7	Unloading Station French Drain	1963-3/87	93% sulfuric acid and 50% sodium hydroxide.	French drain for receiving incidental spills during railcar or tank truck unloading.
120-N-6	Sulfuric Acid Tank French Drains (5)	1963-3/87	93% sulfuric acid.	French drains surrounding acid tanks for containment of incidental spills.
---	108-N Neutralization Pit	1983-present	Waste sulfuric acid.	The unit was used to neutralize waste sulfuric from 108-N floor drains and acid transfer tank drainage.
UN-100-N-15	108-N Unloading Facility	3/20/81	Unknown amount of sulfuric acid and rinsewater.	Transfer line leak during pumping of liquid from 108-N to french drain.
UN-100-N-33	108-N Unloading Facility	11/9/81	Approximately 1,000 gal of sulfuric acid.	Spilled to ground during transfer from railcar to storage tank.
---	108-N Unloading Facility Spill	12/26/87	Approximately 10 gal of sodium hydroxide.	Spilled during transfer from railcar to storage tank.
120-N-5	Acid/Caustic Transfer French and Neutralization Unit	1963-present	Sulfuric acid and sodium hydroxide	Piping trench between 108-N and 163-N and containment vaults.
UN-100-N-34	Acid/Caustic Transfer French and Neutralization Unit	5/12/80	Approximately 3,400 gallons of sulfuric acid.	Pipeline rupture filled containment vaults and spilled to ground. Acid was neutralized.
---	Acid/Caustic Transfer Trench	8/7/87	Unknown amount of sulfuric acid.	Acid had corroded away exposed trench area releasing to the soil.
---	Acid/Caustic Transfer Trench	9/2/87	Unknown amount of sodium hydroxide.	Leak in piping was contained in trench.

Table HSP-1. Waste Management Units and Unplanned Releases at 100-NR-3. (sheet 3 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
3. Acid/Caustic Storage and Transport System Grouping (cont.)				
---	Acid/Caustic Transfer Trench	11/9/87	Approximately 200 gal of sulfuric acid spilled and approximately 15 to 30 gal released to ground.	Leak in piping escaped trench through a dry well. Contaminated soil was removed.
120-N-3	163-N Neutralization Pit and French Drain	12/63-3/87	Sulfuric acid and sodium hydroxide.	French drain and vault receiving drainage from 163-N Acid and Caustic Day Tank Area.
120-N-8	163-N Sulfuric Acid Day Tank Vent French Drain	12/63-5/13/88	Sulfuric acid.	Tank overflows are vented to the french drain.
---	Regeneration Waste Transport System	1977-present	Acid and caustic regeneration wastes.	Sump and pipeline delivering wastes from 163-N to 1324-N.
---	Regeneration Waste Transport System	6/14/86	Approximately 6,500 gal of acidic regeneration wastes.	Pipeline leak during transfer. Spill was neutralized and contaminated soil was removed.
---	Regeneration Waste Transport System	6/30/86	Approximately 1,000 gal of acidic regeneration wastes.	Pipeline leak during transfer. Spill was neutralized and contaminated soil was removed.
124-N-1	163-N Septic Tank	1963-present	Sanitary sewage.	Serving 163-N, 183-N, 1127-N, and 1128-N buildings.
4. Mixed Waste Storage Area Grouping				
116-N-8	Mixed Waste Storage Pad	12/86-present	Radioactively contaminated oil and miscellaneous dangerous process chemicals.	Paved and curbed concrete pad for mixed waste storage in drums and miscellaneous containers.

Table HSP-1. Waste Management Units and Unplanned Releases at 100-NR-3. (sheet 4 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
5. 184-N Plant Service Power House				
---	184-N Plant Service Power House	1963-Present	Hydrocarbons, particulates, sulfur dioxide, sulfur trioxide, carbon monoxide, nitrogen oxide, and aldehydes.	Routine and systematic releases from boiler stacks.
---	184-N Day Tanks	1963-Present	No. 6 (Bunker C) fuel oil and diesel oil.	Two 350,000-gal fuel oil tanks and one 8,000-gal diesel oil tank surrounded by a containment wall.
UN-100-N-19	Fuel Oil Day Tank at 184-N	4/84	Approximately 2,000 gal of fuel oil.	Tank overflowed during filling. Oil contained within walls and removed.
UN-100-N-21	Diesel Oil Day Tank at 184-N	4/25/86	Approximately 800 gal of diesel oil.	Tank overflowed during filling. Oil removed from containment area.
---	Diesel Oil Day Tank at 184-N	10/9/87	Unknown amount of diesel oil.	Tank overflowed during filling. Oil was removed.
---	166-N - 184-N Piping	1963-present	No. 6 fuel oil and No. 2 diesel oi.	Underground fuel supply piping.
UN-100-N-18	Diesel oil supply line between 166-N and 184-N	8/73	Approximately 200 gal of diesel oil.	Line leak caused by external corrosion.
UN-100-N-22	Diesel oil supply line near 184-N	6/23/86	Approximately 1,000 gal of diesel oil.	Line leak caused by external corrosion. Contaminated soil removed. Oil detected in groundwater.
UN-100-N-23	Diesel oil supply line near 184-N	1/10/87	Approximately 200 gal of diesel oil.	Line leak caused by external corrosion. Oil detected in groundwater.
---	Fuel oil pipe fitting at 184-N Annex	10/14/87	Unknown amount of fuel oil.	Oil leaked from loose pipe fitting during transfer to boiler. Oil contained and removed.
---	Diesel oil supply line between 166-N and 184-N	4/26/89	A minimum of 300 gal of diesel oil.	Line leak in three places. 46 drums of contaminated soil removed.

Table HSP-1. Waste Management Units and Unplanned Releases at 100-NR-3. (sheet 5 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
6. Decon Drain Line Leak Grouping				
UN-100-N-6	1-1/2-Inch, Chemical Decontamination Waste Drain Line between 105-N and 1310-N	9/10/85	Approximately 1,800 gal of irradiated wastewater with 0.2 Ci - Co-60, 0.04 Ci - Mn-54, 0.003 Ci - Ru-103, and 0.003 Ci - Cs-137.	Four locations along line passing through 100-NR-3. Contaminated soil removed.
7. Nonhazardous and Nonradioactive Storage Area				
120-N-4	Nonhazardous and nonradioative storage area	11/85-present	Nonhazardous and nonradioactive oils and aqueous liquid.	Curbed concrete pad for container storage.
100-N-SS-27 100-N-SS-28	1716-N Service Station Underground Storage Tanks	100-N-SS-27 1967-present; 100-N-SS-28 1976-present	Unleaded gasoline.	Two 1,000 to 4,000 gal underground storage tanks associated with service station.
8. Regeneration/Filter Backwash Waste Disposal Area Grouping				
120-N-2	1324-N Surface Impoundment (formerly North Settling Pond)	1977-1988	Corrosive regeneration wastes and filter backwash water.	1977-1983 unlined settling pond; 1983-1986 out of service; 1986-1988 lined surface impoundment.
---	South Settling Pond	1977-1983	Corrosive regeneration wastes and filter backwash water. Unlined settling pond.	
120-N-1	1324-NA Percolation Pond	1977-present	Corrosive regeneration wastes and filter backwash water. Currently receives nonregulated neutralized regeneration wastewater.	Unlined percolation pond.
130-N-1 (formerly 126-N-1)	Filter Backwash Discharge Pond	1983-present	Filter backwash water.	Unlined percolation basin.
---	1143-N Paint Shop	Unknown-present	Paint wastes and associated water, spent thinner, spent garnet sand and paint chips.	Paint shops with water scrubber in the paint booth, a solvent accumulation drum, and an outdoor sandblasting area.

Table HSP-1. Waste Management Units and Unplanned Releases at 100-NR-3. (sheet 6 of 6).

WIDS Designation Number	Alias/ Location	Operational Dates	Waste Description	Unit or Release Description
9. Office Septic Tank Area Grouping				
124-N-5	1117-N Septic Tank (Sewer System V)	1981-2/87	Sanitary sewage.	Septic tank and drainfield.
124-N-6	1113-N Septic Tank (Sewer System VI)	1979/80-2/87	Sanitary sewage.	Septic tank and drainfield.
124-N-7	1115-N Septic Tank (Sewer System VII)	1984-2/87	Sanitary sewage.	Septic tank and drainfield.
124-N-8	1134-N Septic Tank (Sewer System VIII)	1983-present	Sanitary sewage.	Septic tank and drainfield.
10. N-17 Paint Shop Area Grouping				
---	N-17 Paint Shop	Unknown-present	Waste paint, solvents, and oils.	Two waste accumulation drums (one for waste paint, the other for waste oil); sandblasting area.
11. 1120-N Septic Tank Grouping				
124-N-9	1120-N Septic Tank	1985-present	Sanitary sewage.	Septic tank and drainfield
12. 100-N Sewer System Grouping				
124-N-10	100-N Sewer System	2/87-present	Sanitary sewage.	Central sewer system with three lagoons, sewer trunk line and other pipelines, and lift stations.
UN-100-N-11	Corner of Route 4 north and access road	10/2/75	Radioactive soil and asphalt.	Valve bonnet fell from truck onto road and rolled into adjacent field. Valve bonnet, asphalt, and soil removed.

quality assurance procedures for some historical analyses is acknowledged to be open to question. These considerations form the basis for a few of the RFI sampling and analysis tasks.

Table HSP-1 locates and profiles the various units. Radioactive elements disposed in these operable units include activation and fusion products. An inventory of chemicals known to be disposed in waste sites in the 100-N Area are shown in Table HSP-2. The table is based on the previous evaluation of waste volumes and characteristics and the known nature and extent of contamination. The list contains all known waste constituents. Other parameters that are known to be both highly elevated above background levels and commonly found (present in at least 10% of the samples) in the 100-NR-3 soil and groundwater environments are also included as contaminants. This means that several contaminants reported at very low concentrations are not included.

4.0 SCOPE OF WORK AND POTENTIAL HAZARDS

While the information presented in Section 3.0 is believed to be representative of the constituents and quantities of wastes at the time of discharge, the present chemical nature, location, extent, and ultimate fate of these wastes in and around the liquid disposal facilities are largely unknown. The emphasis of the RCRA facility investigation in 100-NR-3 will be to characterize the nature and extent of contamination in surface soils, the vadose (unsaturated subsurface soil) zone, terrestrial biota and the atmosphere.

4.1 WORK TASKS

Work tasks are described in Section 5.0 of the work plan.

4.2 POTENTIAL HAZARDS

Table HSP-3 presents a list of known or suspected radiological hazards. Chemical contaminants and approximate quantities released were previously presented in Tables HSP-1 and HSP-2. In spite of the rather extensive list of substances known or suspected to have been released within 100-NR-3, soil and groundwater sampling conducted to date indicate that chemical contaminants of potential concern are pH, sulfate and petroleum derivatives. Protection levels will be determined by the estimated site inventory, onsite conditions, sampling results, and Westinghouse Hanford standards. Immediate actions will be listed in the site-specific HWOP.

Table HSP-2. Potential Contaminants at 100-N.

Contaminants	
4-methyl-2-pentanone	Lead
Acetone	Lithium
Alpha	Magnesium
Aluminum	Manganese-54
Americium	Methyl isobutyl ketone
Ammonium ion	Morpholine
Antimony-125	Nickel
Arsenic	Nickel-63
Barium	Nitrate
Beryllium	Perchloroethylene
Beta	pH
Bis(2-ethylhexyl)phthalate	Phosphate
Boron	Plutonium-238, 239, 240
Cadmium	Potassium
Calcium	Radium
Carbon-14	Ruthenium-103
Cesium-137	Ruthenium-106
Chloride	Sodium
Chlorobenzene	Strontium
Chloroform	Strontium-90
Chromium	Sulfate
Cobalt-60	Technicium-99
Coliform	Tetraethylpyrophosphate
Copper	Tetrahydrofuran
Cyanide	Thiourea
Cyclotetrasiloxane, octomethyl	Titanium
Diesel Oil	Tin-125
Ethylbenzene	Trans-1,2-dichloroethene
Fluoride	Trichloroethylene
Fuel Oil	Tritium
Hydrazine	Uranium
Iodine-129	Vanadium
Iron	Zinc

Table HSP-3. Known Radiologic Hazards.

Radionuclide	Type of Radiation	Target Organ
H-3	Soft ß- (18.6 keV)	Whole body
Co-60	312 keV ß-; 1.17 1.33 meV gamma	Whole body
Sr-90	540 keV ß-	Bone
Tc-99	292 keV ß-	Kidney
Cs-137	510 keV ß-; 661 keV gamma	Whole body
U-238	4 to 6 MeV alpha	Kidney

Source: NCRP 1980

As discussed previously, this project will involve source sampling, surface soil sampling and drilling shallow boreholes for subsurface characterization.

The degree of the potential occupational hazards is expected to be similar for each of the designated tasks. The likelihood of encountering hazardous chemical or radioactive substances will clearly be greatest during intrusions into and through the strata in the vicinity of the liquid waste disposal facilities.

Potential hazards include:

1. External radiation (gamma, and to a lesser extent, beta) from radioactive materials in the soil;

2. Internal radiation due to radionuclides present in contaminated soil entering the body by ingestion or through open cuts and scratches;

3. Internal radiation due to inhalation of particulate (dust) contaminated with radioactive materials;

4. Inhalation of toxic vapors or gases such as volatile organics or ammonia;

5. Inhalation or ingestion of particulate (dust) contaminated with inorganic or organic chemicals;

6. Dermal exposure to soil and/or groundwater contaminated with radionuclides;

7. Dermal exposure to soil and/or groundwater contaminated with inorganic or organic chemicals, and toxic metals;

8. Physical hazards such as noise, heat stress, and cold stress;

9. Slips, trips, falls, bumps, cuts, pinch points, falling objects, other overhead hazards, crushing injuries, etc., typical of every construction-related job site; and

10. Unknown and/or unexpected underground utilities.

4.3 ASSESSMENT AND MITIGATION OF POTENTIAL HAZARDS

The likelihood of significant exposure (100mR/h or greater) to external radiation is remote and can be readily monitored and controlled by limiting exposure time, increasing distance, and employing shielding as required.

Internal radiation via inhalation or inadvertent ingestion or contaminated dust is a realistic concern and must be continuously evaluated by the health physics technician. Appropriate respiratory protection, protective clothing, and decontamination procedures will be implemented as necessary to reduce potential inhalation, ingestion, and dermal exposure to acceptable levels.

Exposure to toxic chemical substances via the dermal exposure route is not expected to pose a significant problem for the designated tasks, given the use of proper protective clothing. The appropriate level of personal protective clothing and respiratory protection will vary from soil sampling during drilling operations to sampling Columbia River water. In general, all activities conducted within an exclusion zone will require Level D-2 (see Sections 6.0 and 6.1). These levels of protection will be upgraded or downgraded as appropriate, based on real-time hazard evaluation and action levels.

High volume particulate samplers are in operation in and around 100-NR-3. Chemical exposure via inhalation of contaminated dust is not expected to cause a significant hazard because of the relatively low concentrations of chemicals in soil and low concentration of dust in the ambient air. Activities that result in high levels of airborne particulate (i.e., dusty operations) will require respiratory protection.

Similarly, airborne concentrations of toxic gases/vapors are not expected to exceed applicable permissible exposure limits. As mentioned above, however, the interactions and fate of these compounds are not well characterized. The site safety officer will periodically monitor airborne levels of toxic vapors and gases with direct reading field instruments selected for the anticipated hazards. A detailed monitoring plan, with frequency and location of measurements,specific chemical hazards, and type and mode of detection instrument to be used will be included in each HWOP. Air monitoring with direct reading instruments will be carried out continuously in the event of the detection of breathing zone concentrations greater than background levels. Respiratory protection will be employed as appropriate. Warning levels and action levels will be designated in the HWOPs.

The site safety officer and field team leader must make every effort to identify any and all underground utilities in the vicinity of all intrusive operations such as drilling or trenching. Should the work crew encounter an unanticipated underground utility, work shall be halted until the nature and status of the line is determined.

5.0 ENVIRONMENTAL AND PERSONAL MONITORING

The site safety officer shall be present at all times during work activities. Air quality monitoring equipment will be used during the field activities to quantify exposure of vapors and gases which pose risks. This equipment is intended to provide adequate warning and allow appropriate action to be taken to prevent harmful exposure to chemical and radiological contaminants released into the work environment. The air monitoring program will consist of monitoring air for contaminant vapor/gases in the vicinity of boreholes and breathing zones, and monitoring the general area for radiation. A health physics technician must be onsite at all times and will observe the action levels and procedures specified in the Radiation Work Permit and appropriate as low as reasonably achievable (ALARA) plans. Core samples will also be monitored to determine levels of radioactivity and occupational risks before actual sample collection. As indicated above, the decision to modify the level of protection will be made by the site safety officer, the cognizant health physics supervisor, and the field team leader. This decision will be based on, but not limited to the following:

- Interpretation of organic vapor, gas, and radiation detection instrument readings by health physics technician and health and safety personnel
- Visual observation such as wind, dust, discoloration, etc.
- Unusual odors or those characteristic of contaminants
- Measurement with other sampling devices such as O_2 and explosive level meters
- Information specific to the individual sites (i.e., known or suspected chemical contaminants and levels of each)
- Physical characteristics of the work environment such as temperature and pH.

Air sampling may be required downwind of the referenced waste sites to monitor particulates and vapors before job startup. Siting of such sampling devices will be determined by health physics technician, site safety officer, and HEHF (if appropriate). Any time that personnel sampling is required to determine exposure levels (other than radiological), it must be done by HEHF. Discrete sampling of ambient air within the work zone and breathing zone will be conducted using a direct reading instrument, as specified in the HWOP, and other methods as deemed

appropriate (e.g., pumps with tubes, O_2 meters, etc.). The following standards will be used in determining critical levels:

- Environmental, Safety, and Health Programs for Depatment of Energy Operations, DOE Order 5480.1B Chapter XI (DOE 1986)
- Air Contaminants - Permissible Exposure Limits, 29 CFR 1910.1000 (OSHA 1989)
- Threshold Limit Values and Biological Exposure Indices for 1989-1990 (ACGIH 1990)
- NIOSH Pocket Guide to Chemical Hazards (NIOSH 1985), recommended exposure limits for substances that do not have either a limit value or a permissible exposure limit.

It is expected that the levels of protection determined from monitoring airborne radioactive contamination will provide an adequate level of protection from hexavalent chrome. If environmental sampling indicates higher concentrations than expected, personal air sampling for hexavalent chrome will be conducted as necessary to fully characterize the inhalation hazard.

Until actual contamination levels are determined, whenever airborne fugitive dust is visible within the work area, employees within the exclusion zone shall don air-purifying respirators with dust/mist filters. Water mists may be used to control the resultant suspension of natural dusts and contaminants, as appropriate. If deemed necessary, work within the exclusion zone which involves disturbing the soil surface shall temporarily cease, and employees shall leave the exclusion zone and move upwind.

5.1 VOLATILE ORGANIC COMPOUNDS MONITORING

The site safety officer shall have a direct reading instrument, as specified in the HWOP, onsite at all times and will establish "background readings" upwind of any excavation, spoils pile, borehole, etc.

Instruments used by the site safety officer will be calibrated according to "User Calibration of Health and Safety M&TE" EII 3.1. Instruments used to monitor organic vapors and gases will be checked for calibration daily before and after use, according to the manufacturer's recommended or approved method, with certified calibration gas. Calibration information will be recorded in the field logbook at the time of calibration. Field instruments will be calibrated at field ambient temperature.

Conditions such as unusual humidity or temperatures that may affect instrument performance will be recorded in the field logbook.

Each HWOP will contain action levels based on the hazards identified for that activity. The HWOP action levels may be lower, but will not be higher than, the following:

> A consistent reading in the breathing zone that is up to 2.5 p/m above the upwind background level for 5 min shall be the action level for donning air-purifying respirators equipped with the appropriate cartridges. Any indication of cartridge "breakthrough" must be reported to the site safety officer immediately. The site safety officer and field team leader will evaluate the situation and determine the action to be taken. Any breathing zone readings consistently greater than 2.5 p/m above background for 10 min or greater than 10 p/m other than for a brief peak will be the action level for temporarily discontinuing work, and upgrading the level of respiratory protection to level B SCBAs or airlines as specified in the HWOP. Warning and action levels will be based on criteria referenced in DOE Order 5480.1B (DOE 1986).

5.2 AIRBORNE RADIOACTIVE MATERIALS AND RADIATION MONITORING

An onsite health physics technician will monitor external radiation and contamination levels. Monitoring for airborne radioactivity will be accomplished as specified in the applicable RWP/HWOP or as conditions warrant.

Appropriate respiratory protection shall be required when conditions are such that the airborne contamination levels may exceed an 8-h derived air concentration (i.e., the presence of high levels of uncontained, loose contamination on exposed surfaces or operations which may raise excessive levels of dust contaminated with airborne radioactive materials, such as excavation and/or drilling under extremely dry conditions).

Specific conditions requiring the use of respiratory protection because of radioactive materials in air will be incorporated into the Radiation Work Permit. If, in the judgment of the health physics technician, any of these conditions arise, work shall cease until appropriate respiratory protection is provided.

6.0 PERSONAL PROTECTIVE CLOTHING AND RESPIRATORY PROTECTION

The following scheme will be used to designate the required levels of personal protective equipment and respiratory protection: the alphabetical designations 'B,' 'C,' and 'D,' shall refer to levels of respiratory protection (OSHA 1988a) (i.e., pressure-demand air supplying respirators with escape provisions, air-purifying respirators, and no respiratory protection, respectively). Since potential dermal exposure hazards may independently require a wide variety of personal protective clothing, regardless of an approved level of respiratory protection, the numerical designations '1,' '2,' and '3' will be used to specify the level of protective clothing that is to be employed (i.e., fully-encapsulating, chemical resistant, and nonprotective) the level of protective equipment can be completely defined by a designation of 'C-2,' 'B-1,' etc. The guidelines listed in Section 6.1 should be referred to when determining protection levels.

6.1 PERSONAL PROTECTIVE EQUIPMENT

The level of personal protective equipment required initially at the site during excavation, drilling, and sampling activities will be specified in the unique HWOP for each job within the operable unit. Personal protective clothing and respiratory protection shall be selected to limit exposure to anticipated chemical and radiological hazards. Work practices and engineering controls as described in the HWOP will also be used to control exposure, since a personal protection equipment ensemble alone cannot protect against all hazards. The following guidelines will be used to specify personal protective equipment ensembles, based on the potential hazards determined in the HWOP:

> Occupational Safety and Health Standards, 29 CFR 1910 (OSHA 1988a)
>
> Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (NIOSH et al. 1985).

6.2 HEAT STRESS

Working in protective clothing can greatly increase the likelihood of heat fatigue, heat exhaustion, and heat stroke, the latter a life-threatening condition. If temperatures at the site are above 65°F, the wet bulb globe temperature index shall be monitored to assess the potential for heat stress. Work/rest periods will be adjusted according to the standards stated in current threshold limit values (ACGIH 1990). Sufficient cool water and disposable drinking cups will be provided in the rest

area. Engineering controls, such as solar shielding, also will be applied when and where appropriate.

All employees are to be alert to the possibility and symptoms of heat stress. Should any of the following symptoms occur--extreme fatigue, cramps, dizziness, headache, nausea, profuse sweating, pale clammy skin--the employee is to immediately leave the work area, rest, cool off, and drink plenty of cool water. The site safety officer and the field team leader shall be immediately informed of the problem, and shall obtain emergency medical assistance as needed.

6.3 HYPOTHERMIA

Working in extreme cold and exposed areas may create a risk of hypothermia. Portable heaters, insulated work clothing, and access to a heated vehicle or other enclosure may be provided, as needed to help mitigate cold stress. All employees should be alert to the symptoms, which include increasing disorientation and impaired judgment, shivering, weakness, numbness, drowsiness, and low body temperature. Unconsciousness may result if the symptoms are undetected. Should any employee observe behavior that indicates such symptoms, escort the victim out of the work area to a vehicle or other heated, protected area. Notify the site safety officer and field team leader, who shall obtain emergency medical assistance.

7.0 SITE CONTROL

The field team leader, site safety officer, and health physics technician are designated to coordinate access control and security on the site. Special site control measures will be necessary to restrict public access to drilling operations located outside of fenced areas of 100-NR-3. A temporary exclusion zone will be established (a minimum of a 25-ft radius) at each digging or drilling location. The exclusion zone will be clearly marked with rope and "Controlled Area" or "Surface Contamination Area" signs. If the exclusion zone is to be established for greater than 90 days then chain, not rope, will be used. The size and shape of the exclusion zone will be dictated by the types of hazards expected, the climatic conditions, and specific drilling and sampling operations required. The ground surface of the area immediately around the drill hole, the corridors to the command post, and the decontamination area and escape route will be covered with appropriate material to reduce contamination of personnel and equipment. Exclusion zone boundaries will be increased or decreased based upon results of field monitoring, environmental changes, or work technique changes. The site Radiation Work Permit, and the contractor's standard operating procedures for

radiation protection will also dictate the boundary size and shape. Portable sanitation facilities shall be located outside of the exclusion zone. No unauthorized person shall be allowed within the controlled zone and no authorized person shall be allowed within the exclusion zone unless equipped with the required level of personal protective equipment and respiratory protection. If known or suspected radioactive contaminants are present, all personnel who enter the exclusion zone will be required to go through decontamination procedures (radiological and chemical) before leaving the zone. All team members must be surveyed for radioactive contamination upon leaving the exclusion zone.

The onsite command post and staging area will be established near the exclusions zone on the upwind side, as determined by an onsite windsock, if physically possible. Exact location for the command post is to be determined just before start of work. Vehicle access, availability of utilities (power and telephone), wind direction, and proximity to sample locations should be considered in establishing command post location.

8.0 DECONTAMINATION PROCEDURES

Remedial investigation activities will require entry into areas of known chemical and radiological contamination. Consequently, it is likely that personnel and equipment will be contaminated with hazardous chemical and radiological substances.

During drilling and sampling activities at the site potential sources of contamination include, but are not limited to, airborne vapors, gases, dust, mists and aerosols; splashes and spill; walking through contaminated areas; and handling contaminated equipment. All personnel who enter the exclusion zone will be required to go through decontamination procedures upon leaving the zone. Decontamination areas shall be located upwind of the work area (based on the recorded predominant wind direction) and shall be sufficiently distant from the work site, so as to allow for errant wind gusts, which may occasionally blow in from the work site. The procedures discussed below are intended to be compatible with EII procedures, "Decontamination of Drilling Equipment," EII 5.4 and "Decontamination of Equipment for RCRA/CERCLA Sampling," EII 5.5 (WHC 1989).

Decontamination procedures shall be consistent with Level B and Level C decontamination protocol. Specific decontamination procedures will be provided in the HWOP. The following are examples of the equipment and facilities that may be used:

1. Decontamination garbage/dirty equipment bags
2. Decontamination pad/corridor cover (kraft paper)

9 1 1 3 7 1 0 7 0

3. Emergency response pressurized water tank with wand and adjustable spray nozzle
4. Bagging and taping material
5. Emergency water deluge and eyewash bottles
6. Detergent, brush, and bucket
7. Barrels
8. Step out pads
9. Sponges, wipes, and rags
10. Tables and stands.

8.1 PERSONNEL DECONTAMINATION

All personnel who access the exclusion and contamination reduction zones of the project will process through decontamination at the end of any given work shift or any other time they leave the respective zones. A decontamination corridor will be established within the exclusions zone for each task of the campaign. Clothing that is disposable will be removed in such a manner that outer layers are removed first and placed in containers which will be sealed when full or at the end of each day. Nondisposable clothing (such as special work procedure) that can be cleaned will be removed, bagged, and sent to the laundry. All wash liquids used for decontamination purposes must be properly disposed of per applicable state/federal regulations. If radiological contaminants are known or suspected, each team member must be surveyed by a health physics technician after removing outer personal protective equipment and before proceeding to an uncontrolled area. If radioactive contamination is detected, the individual involved shall be escorted to an appropriate decontamination area by the health physics technician. If location of the contamination indicates an inhalation of contaminants may have occurred, the health physics technician will obtain nasal smears from workers for counting/analysis. Health Physics Dosimetry shall also be notified, and the determination for further BIO-ASSAY, if needed, will be made at that time. Site-specific radiation decontamination procedures will be provided in the Radiation Work Permit and HWOP.

8.2 EQUIPMENT DECONTAMINATION

Equipment decontamination methods will generally consist of washing or steam cleaning with a detergent/water or other decontamination solution, as specified in the field sampling plan (FSP). Rinsing with a diluted nitric acid solution may be necessary to remove metal oxides and hydroxides. Field contamination of drilling equipment, where applicable, shall be performed within impoundments in the decontamination zone to ensure that all wash liquids are captured. All wash liquids used

for decontamination purposes must be properly disposed of per applicable state/federal regulations.

Downhole drilling equipment shall be decontaminated before use on another borehole as required to assure the safety of personnel and prevent cross contamination of samples.

Equipment which is radiologically contaminated beyond the limits specified in the Radiation Work Permit shall not be decontaminated in the field. Such equipment shall be decontaminated per "Decontamination of Drilling Equipment," EII 5.4 (WHC 1989) before rinse.

8.3 SAMPLING AND MONITORING EQUIPMENT

All possible measures should be taken by personnel to prevent or limit the contamination of any sampling and monitoring equipment used. In general, air monitoring instruments will not be contaminated by chemicals unless splashed or set down on contaminated areas. Any delicate instrument that cannot be easily decontaminated should be protected while it is being used by placing it in a bag and using tape to secure the bag around the instrument. Openings in the bag can be made for sample intake, electrical connections, etc. Personnel performing field maintenance procedures on air monitoring instruments should be aware of the fact that instruments may become contaminated internally if air containing high concentrations of radioactive particulate is drawn through the instrument.

Foreign material, which collects within the probe tip and on the face of the lamp on the HNU photoionization detector, may be chemically or radioactively contaminated and should be handled appropriately when disassembling the probe or cleaning the lamp. A similar situation exists with the readout probe and metallic frit filters in the sampling line of the organic vapor analyzer. All instruments and equipment must be surveyed by the health physics technician for the purpose of radiological contamination control before removal from the exclusion zone. Items with detectable levels of contamination must be controlled as radioactive material or controlled or regulated equipment.

Sampling devices require special cleaning and decontamination as detailed in "Decontamination of Equipment for RCRA/CERCLA Sampling," EII 5.5 (WHC 1989). When appropriate, disposable sampling equipment will be used to eliminate the need for decontamination liquids.

8.4 RESPIRATORY PROTECTION EQUIPMENT

Respiratory protection equipment will be specified in the HWOP. There is a high potential for airline hoses to become contaminated; therefore, whenever possible, hoses should be covered with plastic. If contaminated, they may have to be discarded. Cleaning and decontamination of face pieces will be performed by the mask cleaning station (i.e., Hanford Laundry). Maintenance of special respiratory protection equipment (i.e., escape pack respirators) is performed by Personal Protective Equipment Unit in MP-412, 200 West Area.

8.5 HEAVY EQUIPMENT

All possible measures will be taken to prevent or limit the contamination of heavy equipment. Those parts of drilling equipment that become contaminated above limits specified in the RWP/HWOP, such as auger flights, shall be decontaminated per "Decontamination of Drilling Equipment," EII 5.4 (WHC 1989) before reuse to minimize personnel contamination potential and cross contamination of sample between boreholes.

9.0 CONTINGENCY AND EMERGENCY RESPONSE PLANS

The following procedures have been established to deal with emergency situations that might occur during drilling or sampling operations. As a general rule, in the event of an unanticipated, potentially hazardous situation as indicated by instrument readings, visible contamination, unusual or excessive odors, etc., team members shall temporarily cease operations and move upwind to a predesignated safe area. Any individual leaving a radiologically controlled area needs to be released by a health physics technician, even if that individual is going to the first aid station or the hospital. If this cannot be accomplished, for whatever reason, the health physics technician must accompany the individual to the first aid station or the hospital. There will be available ambulance and paramedic services, should they be needed.

A two-way radio will be operational and be manned by the field team leader to maintain contact with the team's base station. When feasible, personnel in the exclusion zone will maintain line-of-sight with the field team leader. Any failure of radio communications will require evaluation by the site safety officer and the field team leader of whether personnel shall leave the exclusion zone. Communications from rig to rig or site to site will also be provided so that the site safety officer or field team leader can respond to an emergency. In addition, a series of three 1-s horn blasts from a truck in the

support zone is the emergency signal for all personnel to leave the exclusion zone.

The following standard hand signals will be used in all case:

• Hand gripping throat	Out of air, can't breathe
• Grip partner's wrist or both hands around waist	Leave area
• Hands on top of head	Need assistance
• Thumbs up	OK, affirmative
• Thumbs down	No, negative

The site safety officer is directly responsible for providing safety recommendations on the site to the site emergency coordinator. The site emergency coordinator for the 100-NR-3 drilling operations will be the field team leader.

The site emergency coordinator will be responsible for the evacuation, emergency treatment, emergency transport of field personnel as necessary, and for the notification of the appropriate Hanford Site facility emergency response units and management staff.

Emergency communications will be maintained during all onsite field activities by two-way radio contact. If an emergency occurs, such as fire or explosion, all onsite personnel should exit the site in an upwind direction and assemble in a predesignated area. All emergency response actions for each job will be covered in the tailgate meeting with the HWOP. If an onsite injury occurs, team members should employ the following procedures.

9.1. PROCEDURE FOR PERSONNEL INJURED IN THE EXCLUSION ZONE

Designated emergency response members of the field team shall be trained and certified in first aid and cardiopulmonary resuscitation. There will be sufficient people trained to provide at a minimum one trained person per work shift. If an injury occurs, the designated team members will provide appropriate assistance. Only trained, certified personnel should attempt to give first aid. If able, the injured person should proceed through decontamination to the nearest available source of first aid. There will be available radio or phone or other communication in the immediate area to allow ready availability of ambulance and paramedics should they be needed.

Upon notification of a serious injury in the exclusion zone, the emergency signal of three 1-s horn blasts will be sounded. All site personnel will assemble at the decontamination line. The site safety officer and field team leader should evaluate the nature of the injury and the extent of decontamination possible before the injured person is moved to the support area. No person should reenter the exclusion zone until the cause of the injury is determined and measures taken to prevent recurrence.

Should any employee exhibit erratic behavior or fall unconscious because of apparent heat illness, the emergency three horn blasts shall be sounded and the field team leader shall immediately call for an ambulance. Designated first aid personnel, if within the exclusion zone, shall immediately proceed through decontamination with the victim, as follows:

1. Remove victim's outer protective clothing and discard.
2. Remove own outer protective clothing and discard.
3. Remove victim's inner protective clothing and discard.
4. Remove own inner protective clothing and discard.
5. Proceed with first aid for heat illness.

In extremely cold or exposed working situations, if an employee shows increasing disorientation or any other symptoms of hypothermia, follow the basic emergency and decontamination procedures for heat stroke, then proceed with first aid for hypothermia.

9.2 PROCEDURE FOR PERSONNEL INJURY IN THE SUPPORT AREA

Upon notification of an injury in the support area, the field team leader and the site safety officer will assess the situation. If the cause of the injury or loss of the injured person does not affect the performance or safety of site personnel, operations may continue, with initiation of first aid and summoning of medical assistance as discussed above. If the injury increases the risk to others, the emergency signal of three 1-s horn blasts will be sounded and all site personnel shall move to the decontamination area for further instructions. Activities onsite will stop until the hazardous condition (if any) is evaluated and reduced to an acceptable level.

9.3 PROCEDURES FOR FIRE AND EXPLOSIONS

The dry chemical fire extinguishers, which are required on all field vehicles, are effective for fires involving ordinary combustibles (wood, grass, etc.) flammable liquids, and electrical equipment. They are appropriate for small, localized fires such as a drum of burning refuse, small burning gasoline spill, vehicle engine fire, etc. No attempt should be made to use the provided extinguishers for well-established fires or large areas/volumes of flammable liquids.

In the case of fire, prevention is the best contingency plan. Smoking in the exclusion zone is strictly prohibited and smoking materials, where permitted, should be extinguished with care.

In the event of a fire or explosion, the following steps are to be taken.

1. Immediately notify site emergency personnel and the local fire department by contacting the Hanford Patrol by phone (811) or by radio (station 1) to relay message.

2. If the situation can be readily controlled with available resources <u>without jeopardizing personal health and safety or the health and safety of other site personnel</u>, take immediate action to do so.

If the fire cannot be readily controlled, take the following steps.

1. Upon discovery of a fire or explosion onsite, the emergency signal of three 1-s horn blasts will be sounded and all site personnel will assemble upwind of the fire at the decontamination line. The fire department will be called and all personnel will move to a safe distance from the involved area. Again, based on the individual tailgate meetings, a decision to send all personnel immediately out of the exclusion area may be an option.

2. Isolate the fire to prevent spreading, if possible.

3. Clear the area of all personnel working in the immediate vicinity.

9.4 PROCEDURE FOR PERSONAL PROTECTIVE EQUIPMENT FAILURE

If any site worker experiences a failure or alteration of protective equipment that may jeopardize the level of protection

provided by the equipment, that person and that person's buddy shall immediately proceed through decontamination and leave the exclusion zone. In the event of respiratory protection failure, the primary concern will be getting the person to breathable air, and decontamination will be secondary. Reentry shall not be permitted until the equipment has been repaired or replaced, or the conditions leading to the problem are adequately evaluated and corrected.

9.5 PROCEDURE FOR FAILURE OF OTHER EQUIPMENT

If onsite monitoring equipment fails to operate properly, the field team leader and site safety officer shall be notified and then determine the effect of the failure on continuing operations. If the failure may compromise health and safety procedures or jeopardize the safety of personnel, all personnel shall leave the exclusion zone until the equipment is repaired or replaced.

9.6 EMERGENCY ESCAPE ROUTES

In the event that an emergency situation prevents exiting the exclusion zone by way of the decontamination area, exit the exclusion zone in any direction, preferably upwind, avoiding any barriers. Site-specific situations will be covered in more detail in the HWOP.

9.7 RESPONSE ACTION TO CHEMICAL EXPOSURE

Responses of this nature will be covered in the HWOP. Designated first aid field team members will be briefed on these procedures from the HWOP, and only those designated individuals will treat the exposed person. The site safety officer or field team leader should be notified of any chemical exposure incidents as soon as possible, so that appropriate actions may be taken to prevent further exposure.

9.8 EMERGENCY TELEPHONE NUMBERS

Local Resources:	Hanford Emergency Response Team	375-2400
Ambulance:	Hanford Fire Department will dispatch the ambulance	375-2400
Hospital:	Kadlec Hospital, Richland	946-4611

Police (Local or State):	Hanford Patrol	375-2400
Fire Department	Hanford Fire Department	375-2400
Poison Control Center:		800-572-5842

EMERGENCY CONTACTS

Industrial Safety:	P.A. Wright (PNL)/ H.N. Bowers (WHC)	376-1634/ 373-3948
Health Physics:	J.R. Berry (PNL)/ J.B. Levin (WHC)	376-3057 373-1333
Field Team Leaders:	PNL or WHC	
Environmental:	W.J. Bjorklund/ TBD	376-4781/ TBD

10.0 REFERENCES

ACGIH (1990), Threshold Limit Values and Biological Exposure Indices for 1989-1990, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio

DOE (1986), Environmental, Safety, and Health Program for Department of Energy Operations, DOE Order 5480.1B, U.S. Department of Energy, Washington, D.C.

NCRP (1980), Management of Persons Accidentally Contaminated with Radionuclides, Report No. 65, National Council on Radiation Protection and Measurements, Bethesda, Maryland

NIOSH (1985), Pocket Guide to Chemical Hazards, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Washington, D.C.

NIOSH/OSHA/USCG/EPA (1985), Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, U.S. Coast Guard, and U.S. Environmental Protection Agency, Washington, D.C.

OSHA (1989), Occupational Safety and Health Standards, Title 29, Code of Federal Regulations, Part 1910.1000, Occupational Safety and Health Administration, Washington, D.C.

OSHA (1988a), Occupational Safety and Health Standards, Title 29, Code of Federal Regulations, Part 1910, Occupational Safety and Health Administration, Washington, D.C.

OSHA (1988b), Safety and Health Regulations for Construction, Title 29, Code of Federal Regulations, Part 1926.652, Occupational Safety and Health Administration, Washing, D.C.

WHC (1989), Environmental Investigations and Site Characterizations Manual, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington

THIS PAGE INTENTIONALLY
LEFT BLANK

ATTACHMENT 3

PROJECT MANAGEMENT PLAN

THIS PAGE INTENTIONALLY
LEFT BLANK

CONTENTS

1.0 Introduction PMP-1

2.0 Project Organization and Responsibilities PMP-1

2.1 Interface of Regulatory Authorities and the Department of Energy PMP-1
2.2 Project Organization and Responsibilities . . PMP-1

3.0 Reporting Requirements PMP-5

4.0 Financial and Project Tracking Requirements PMP-11

4.1 Management Control PMP-11
4.2 Meetings and Progress Reports PMP-12

5.0 References PMP-12

FIGURES:

PMP-1 Project Organization for Hanford Site RFI/CMS Projects PMP-2

PMP-2 Example Project Organization, 100-NR-3 RFI/CMS Contractor Team PMP-3

PMP-3 Technical Resources for Conducting RCRA Facility Investigation/Corrective Measures Studies PMP-6

PMP-4 Soil Sampling Team PMP-7

PMP-5 Biological Sampling Team PMP-8

PMP-6 Physical and Geophysical Survey Team PMP-9

PMP-7 Vadose Zone Drilling and Sampling Team PMP-10

THIS PAGE INTENTIONALLY
LEFT BLANK

1.0 INTRODUCTION

The purpose of this project management plan (PMP) is to define the administrative and institutional tasks necessary to support Resource Conservation and Recovery Act of 1976 (RCRA) remedial investigation/feasibility study (RFI/CMS) activities in the 100-NR-3 operable unit at the Hanford Site. This plan defines the responsibilities of the various participants, the organizational structure, and the project tracking and reporting procedures.

The Environmental Protection Agency (EPA), Washington Department of Ecology (Ecology), and the Department of Energy (DOE) have entered into an agreement and consent order for remedial and corrective action on the Hanford Site. An action plan, which implements this agreement, defines EPA and Ecology regulatory integration and the methods and processes to be used to implement the agreement. This PMP is in accordance with the provisions of the action plan.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 INTERFACE OF REGULATORY AUTHORITIES AND THE DEPARTMENT OF ENERGY

The 100-NR-3 operable unit consists of active and inactive waste management units to be remedied under the Resource Conservation and Recovery Act. The Washington Department of Ecology (Ecology) has been designated as the lead regulatory agency as defined in the agreement. Accordingly, Ecology is responsible for overseeing remedial activity at this unit and ensuring that the applicable authorities of both EPA and Ecology are applied. The specific responsibilities of Ecology, EPA and DOE are detailed in the action plan.

2.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project organization is shown on Figure PMP-1. Figure PMP-2 shows the 100-NR-3 contractor team project organization. The following sections describe the responsibilities of the individuals shown on this figure.

Project Manager. The EPA, DOE, and Ecology each have designated one individual as Project Manager, who will serve as the primary point of contact for all activities to be carried out

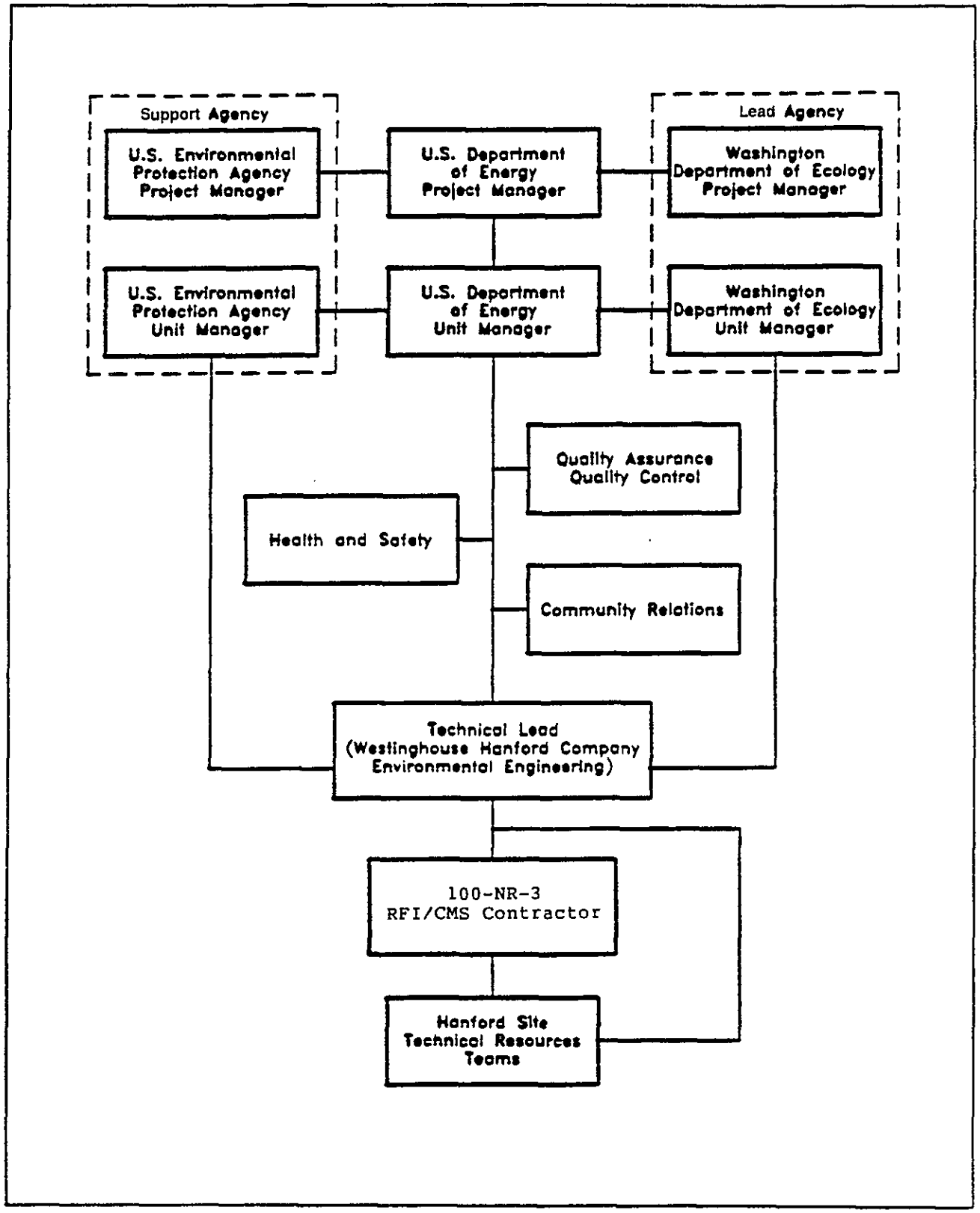


Figure PMP-1. Project Organization for Hanford Site RFI/CMS Projects

9 1 1 3 3 7 1 0 3 3

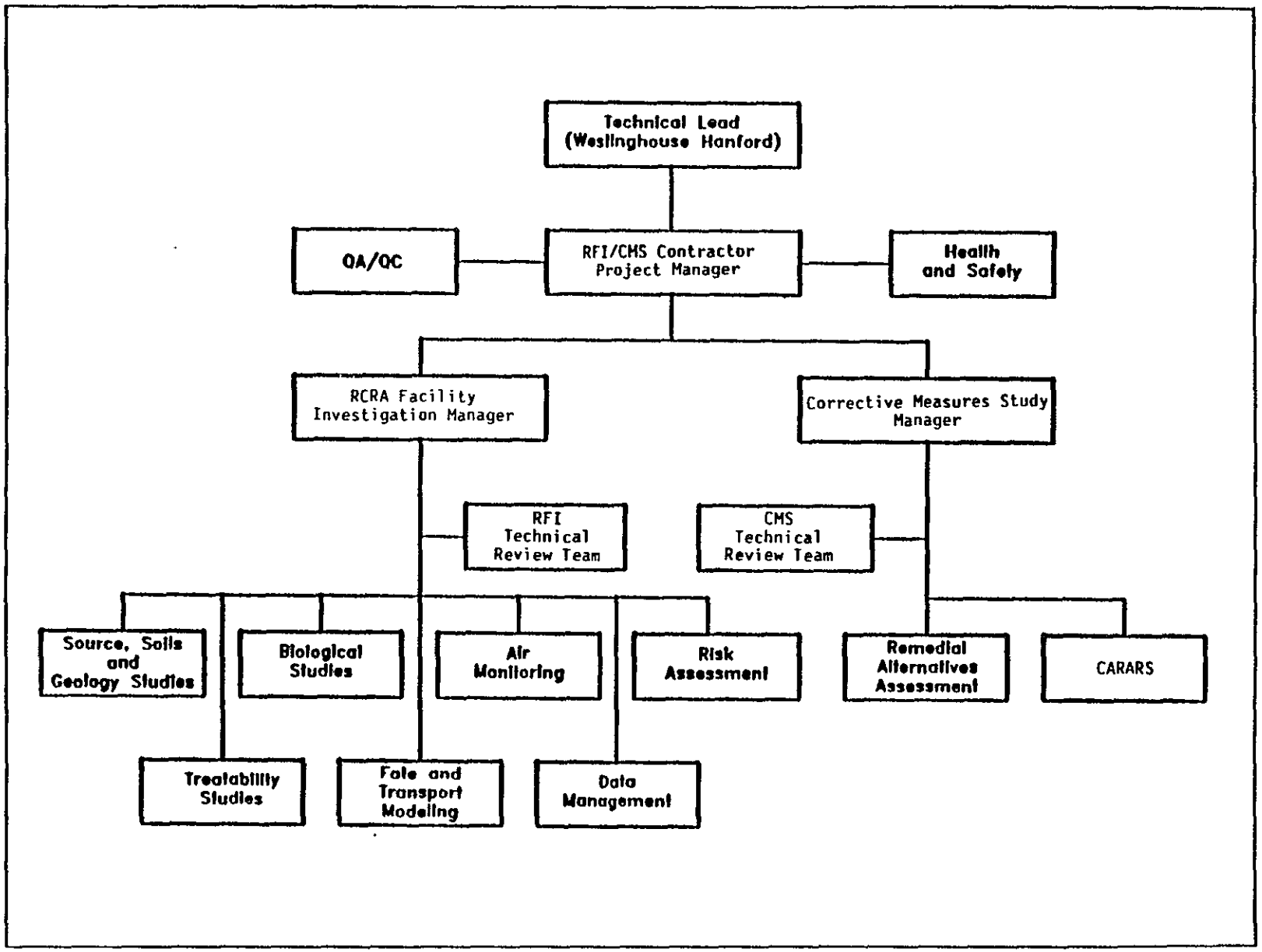


Figure PMP-2. Example Project Organization, 100-NR-3 RFI/CMS Contractor Team

under the agreement and action plan. The responsibilities of the Project Manager are given in Section 4.1 of the action plan.

Unit Manager. The Unit Manager from Ecology will serve as the lead unit manager. The role of the unit manager is described in Section 4.2 of the action plan.

Quality Assurance Officer. The QA Officer retains the necessary organizational independence and authority to identify conditions adverse to quality and to inform the Technical Lead of needed corrective action.

Quality Coordinator. The Quality Coordinator is responsible for coordinating and/or oversight of performance to the quality assurance project plan (QAPP) requirements by means of internal auditing and surveillance techniques.

Health and Safety Officer (Environmental Division/Environmental Field Services). The Health and Safety officer is responsible for determining potential health and safety hazards from volatile and/or toxic compounds during sample handling and sampling decontamination activities and has the responsibility and authority to halt field activities due to unacceptable health and safety hazards.

Health Physics Coordinator. The Health Physics Coordinator, associated with the Westinghouse Hanford Health Physics Department, will provide radiological health and safety input as well as survey support to RFI/CMS activities conducted in radiologically controlled area. He/she has the responsibility and authority to halt field activities due to unacceptable radiological work practices or radiological health risk.

Community Relations Coordinator. The Community Relations Coordinator will be responsible for coordinating all community relations activities. Since there will be a single community relations plan (CRP), to be developed for and implemented by DOE, the community relations coordinator will be responsible for community relations over all 78 operable units at the Hanford Site.

Technical Lead. The Technical Lead will be a designated person within the Westinghouse Hanford Environmental Engineering Group. The responsibilities of the Technical Lead will be to plan, authorize, and control work so that it can be completed on schedule and within budget, and to ensure that all planning and work performance activities are technically sound.

RCRA Facility Investigation Coordinator. The RFI Coordinator will be responsible for coordinating all activities related to Phases I and II of the RFI, including data collection, analysis, and reporting. The RFI Coordinator will be from the

Westinghouse Hanford Environmental Engineering Group, and will be responsible for keeping the Technical Lead informed on the RFI work status and any problems that may arise.

Corrective Measures Study Coordinator. The CMS Coordinator will be responsible for coordinating all activities related to Phases I, II, and III of the CMS, including data collection, analysis, and reporting. The CMS Coordinator will be from the Westinghouse Hanford Environmental Engineering Group, and will be responsible for keeping the Technical Lead informed on the CMS work status and any problems that may arise.

RCRA Facility Investigation Technical Resources. The various technical resources responsible for performing the RFI are shown on Figure PMP-3. These resources will be responsible for performing data collection, analysis, and reporting, for the technical activities related to the RFI. Figures PMP-4 through PMP-7 show detailed organizational structure for specific RFI tasks.

Internal and external work orders and subcontractor task orders will be written by the RFI Coordinator to use these technical resources, which are under the control of the Technical Lead. Statements of work will be provided that will include a discussion of authority and responsibility, a schedule with clearly defined milestones, and a task description including specific requirements. Each group will keep the RFI Coordinator informed on the RFI work status performed by that group and of any problems that may arise.

Corrective Measures Study Technical Resources. The various technical resources responsible for performing the CMS are also shown on Figure PMP-3. These resources will be responsible for identifying and screening remedial alternatives, and for detailed evaluation of selected alternatives. Work teams reporting to the Technical Lead for various phases and types of work are shown in Figures PMP-4 through PMP-7.

Internal and external work orders and subcontractor task orders will be written by the CMS Coordinator to use these technical resources, which are under the control of the Technical Lead. Statements of work will be provided that will include a discussion of authority and responsibility, a schedule with clearly defined milestones, and a task description including specific requirements. Each group will keep the CMS Coordinator informed on the CMS work status performed by that group and of any problems that may arise.

Subject/Activity	TECHNICAL RESOURCES	
	RCRA Facility Investigation	Corrective Measures Study
Hydrology and geology	Westinghouse Hanford [a]/Geosciences; PNL [b]/Earth and Environmental Sciences Center	Westinghouse Hanford/ Geosciences
Toxicology and risk/endangerment assessment	Westinghouse Hanford/Environmental Technology; PNL/Earth and Environmental Sciences Center; PNL/Life Sciences Center	Westinghouse Hanford/ Environmental Technology
Environmental chemistry	Westinghouse Hanford/Geosciences; PNL/Earth and Environmental Sciences Center	Westinghouse Hanford/ Geosciences
Geotechnical and civil engineering	Westinghouse Hanford/Geosciences (Planning); PNL/Earth and Environmental Sciences Center	N/A
Geotechnical and civil engineering	N/A	Westinghouse Hanford/ Environmental Engineering PNL/Waste Technology Center
Ground water treatment engineering	N/A	Westinghouse Hanford/ Environmental Engineering PNL/Waste Technology Center
Waste stabilization and treatment	N/A	Westinghouse Hanford/ Environmental Engineering PNL/Waste Technology Center
Surveying	Kaiser Engineers Hanford	N/A
Soil and water	Westinghouse Hanford/Environmental Engineering/Environmental Field Services/Office of Sample Management and subcontractor; PNL/Earth and Environmental Services Center/Materials and Chemical Services Center	N/A
Drilling and well installation	Westinghouse Hanford/Geosciences/ Environmental field services; Kaiser Engineers	N/A
Radiation protection	Westinghouse Hanford/Health Physics	N/A

[a] Westinghouse Hanford = Westinghouse Hanford Company
[b] PNL = Pacific Northwest Laboratory

Figure PMP-3. Technical Resources for Conducting RCRA Facility Investigations/Corrective Measures Studies

9 1 1 3 3 7 1 0 2 7

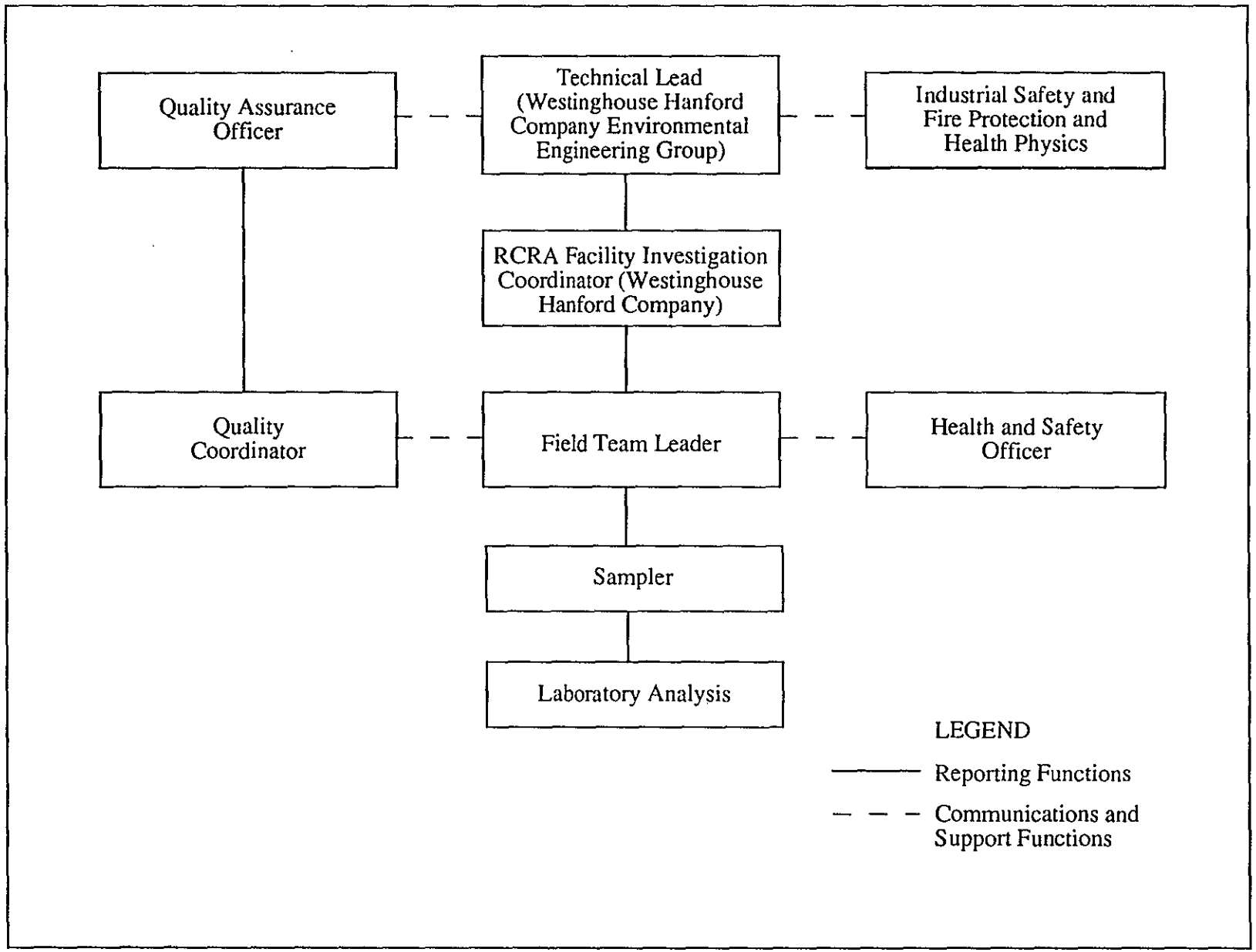


Figure PMP-4. Soil Sampling Team

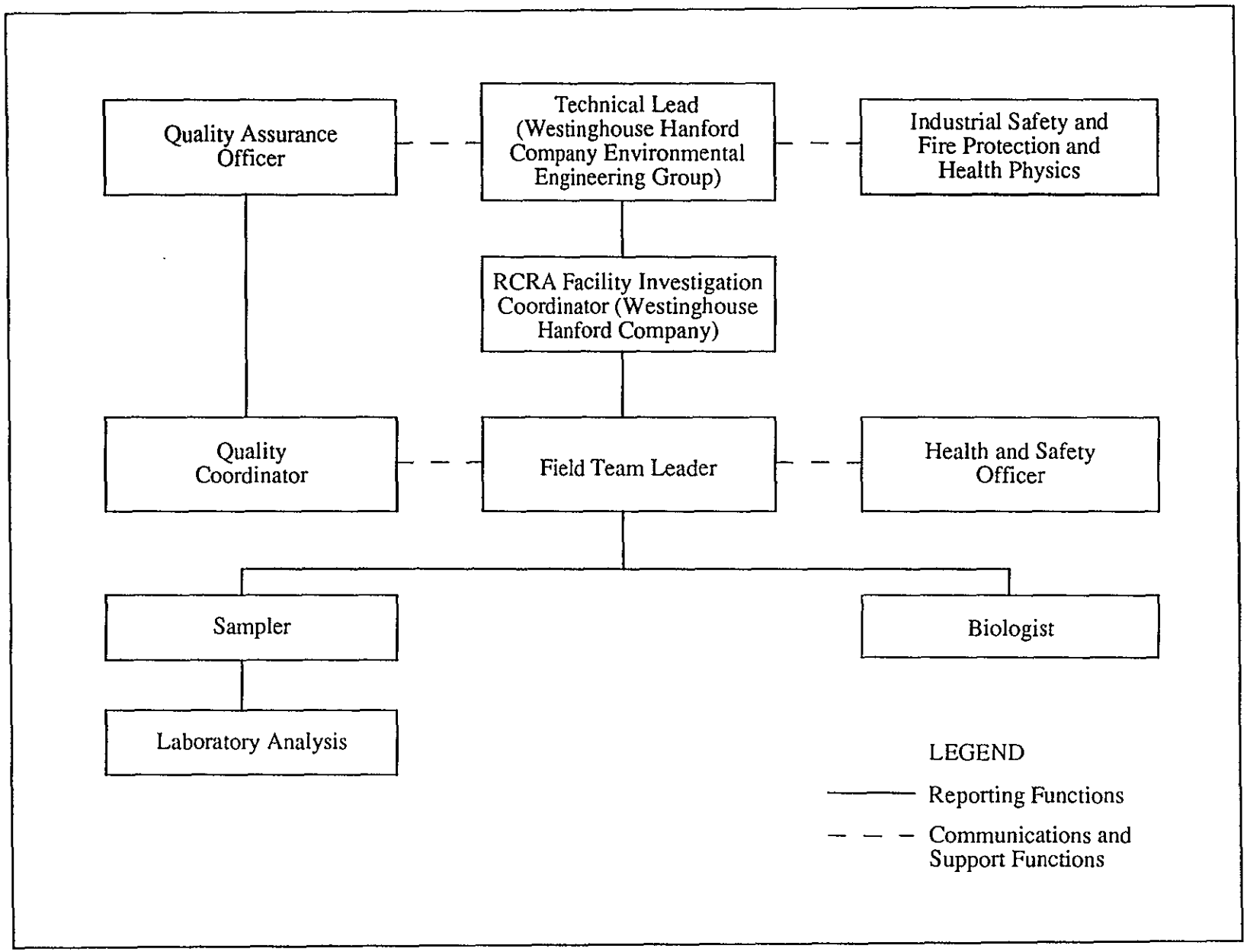


Figure PMP-5. Biological Sampling Team

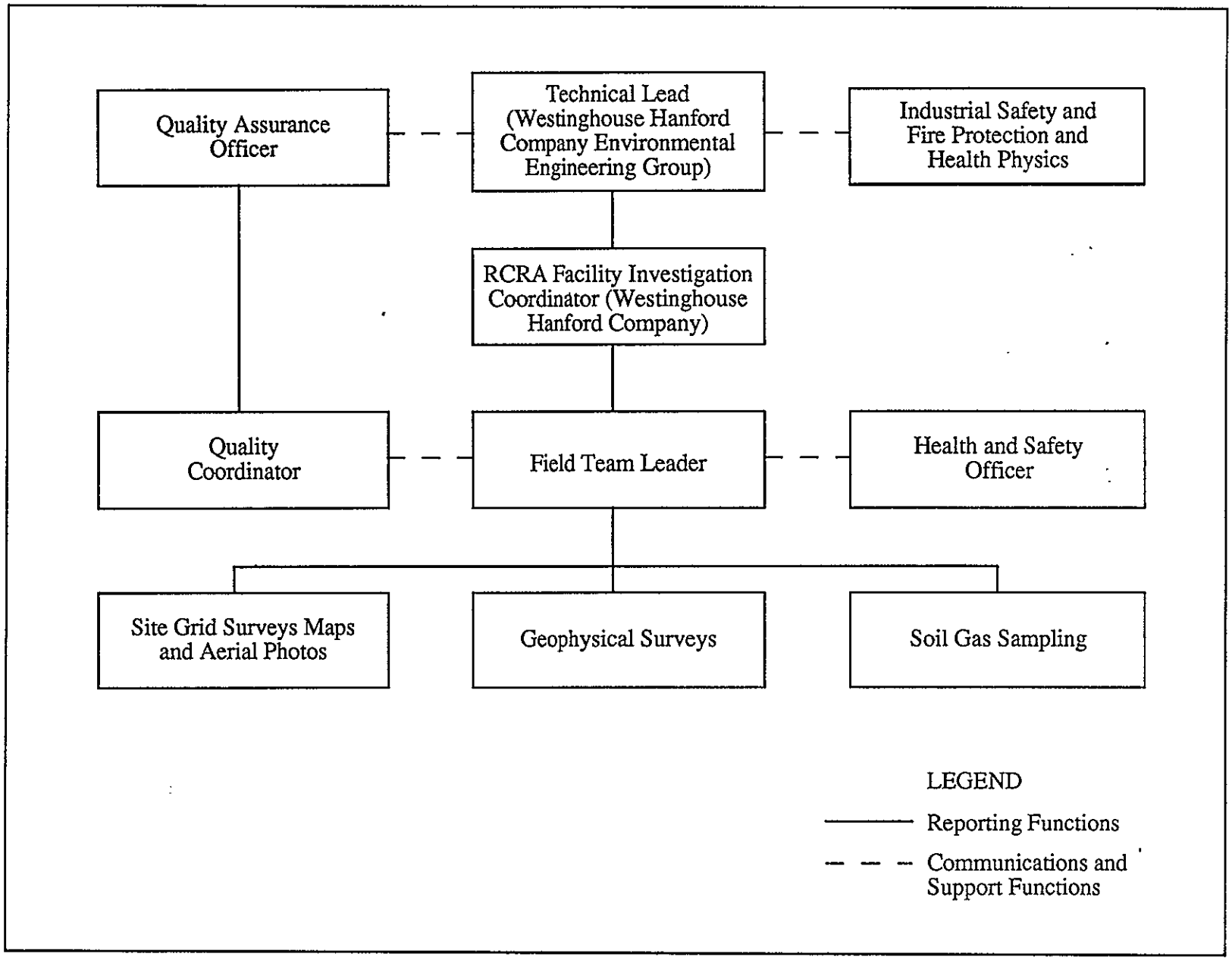


Figure PMP-6. Physical and Geophysical Survey Team

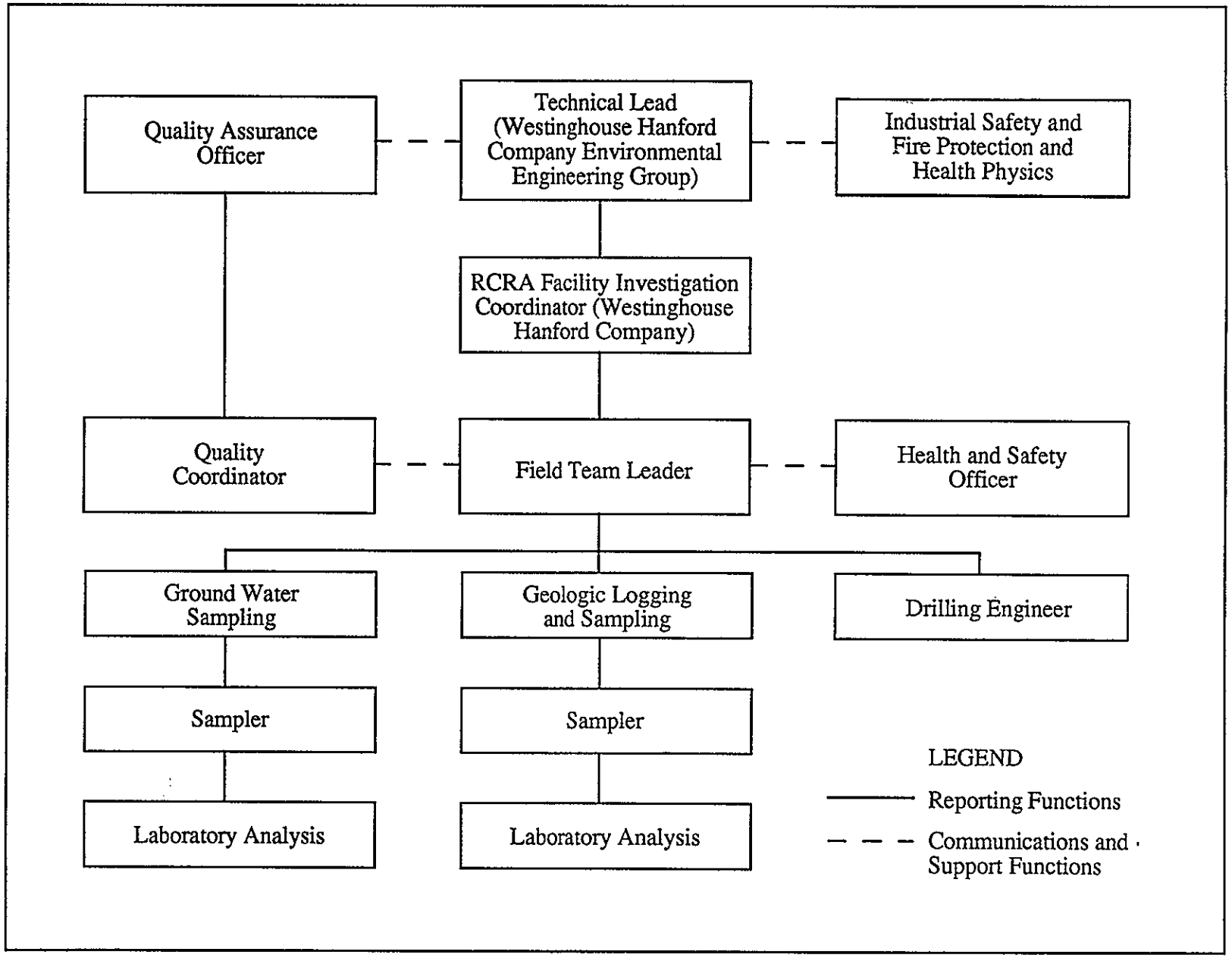


Figure PMP-7. Vadose Zone Drilling and Sampling Team

3.0 REPORTING REQUIREMENTS

All RFI/CMS plans and reports will be categorized as either primary or secondary documents as described by Section 9.1 of the action plan. The process for document review and comment is covered by the action plan Section 9.2. Revision, should it become necessary after finalization of any documents, is covered by Section 9.3 of the action plan. Changes in the work schedule, as well as minor field changes can be made without having to process a formal revision. The process for making these changes is covered by the action plan in Section 12.0. Administrative records, which must be maintained to support the Hanford Site RCRA permit modification, are described in Section 9.4 of the action plan.

4.0 FINANCIAL AND PROJECT TRACKING REQUIREMENTS

4.1 MANAGEMENT CONTROL

Westinghouse Hanford will be responsible to plan and control activities and to provide effective technical, cost, and schedule baseline managements. The Westinghouse Hanford Management Control System (MCS) will be used for effective planning and control practices. The MCS meets the requirements of DOE Order 4700.1, Project Management System (DOE 1987) and DOE Order 2250.1B, Cost and Schedule Control Systems Criteria for Contract Performance Measurement (DOE 1985). The primary goals of the Westinghouse Hanford MCS are to provide methods for planning, authorizing, and controlling work so that it can be completed on schedule and within budget and to ensure that all planning and work performance activities are technically sound and in conformance with management and quality requirements.

The work plan schedule and major milestones are described in Section 6.0 of the 100-NR-3 operable unit work plan. The work plan schedule will be the primary vehicle for the Unit Manager and Technical Lead to track progress. The work plan schedule must be consistent with the work schedule contained in the action plan for implementation of the agreement.

The work plan schedule will be updated at least annually, with the primary purpose to expand the current fiscal year and follow-on year. In addition, any approved schedule changes (see Section 12.0 of the action plan for formal change control system) would be incorporated at this time, if not previously incorporated. This update will be performed in the fourth quarter of the fiscal year (e.g., July to September) for the upcoming fiscal year. The work schedule can be revised at any time during the year if the need arises, but would be restricted

to major changes that would not be suitable for the change control process.

4.2 MEETINGS AND PROGRESS REPORTS

Project Manager and Unit Manager must meet periodically to discuss progress, review plans, and address any issues that have arisen. The Project Manager's meeting will take place at least quarterly and is discussed in Section 8.1 of the action plan. The Unit Manager's meeting will take place at least monthly. Details of the Unit Manager's meetings are given in Section 8.2 of the action plan. The DOE shall prepare and issue a quarterly progress report to EPA and Ecology. Details of this report are given in Section 8.2 of the action plan.

5.0 REFERENCES

DOE (1985), Cost and Schedule Control Systems Criteria for Contract Performance Measurement, DOE Order 2250.1B, U.S. Department of Energy, Washington, D.C.

DOE (1987), Project Management System, DOE Order 4700.1, U.S. Department of Energy, Washington, D.C.

ATTACHMENT 4

DATA MANAGEMENT PLAN

THIS PAGE INTENTIONALLY
LEFT BLANK

CONTENTS

1.0 Introduction and Objectives DMP-1

1.1 Introduction DMP-1
1.2 Objectives DMP-1

2.0 Types of Data DMP-2

2.1 Data Types DMP-2
2.2 Data Collection DMP-2
2.3 Data Storage and Access DMP-2
2.4 Data Quantity DMP-11

3.0 Data Management Plan DMP-11

3.1 Objective DMP-11

3.2 Organizations Controlling Data DMP-18
3.2.1 Environmental Engineering Section . . . DMP-18
3.2.2 Office of Sample Management DMP-18
3.2.3 Environmental Data Management Center . . DMP-18
3.2.4 Information Resource Management DMP-20
3.2.5 Hanford Environmental Health Foundation DMP-20
3.2.6 Environmental Health and Pesticide Services Section DMP-20
3.2.7 Technical Training Support Section . . . DMP-20
3.2.8 Pacific Northwest Laboratory DMP-20

3.3 Databases DMP-21
3.3.1 Nonradiological Exposure and Medical Records DMP-21
3.3.2 Radiological Exposure Records DMP-21
3.3.3 Training Records DMP-21
3.3.4 Environmental Information/Administrative Record DMP-21
3.3.5 Sample Status Tracking DMP-21

4.0 Environmental Information Management Plan DMP-21

5.0 Hanford Environmental Information System DMP-22

5.1 Objective DMP-22
5.2 Integration of 100-NR-3 Data into HEIS DMP-23

6.0 References DMP-23

CONTENTS (cont.)

FIGURES:

DMP-1 General Data Management Plan for 100-NR-3 Work Plan Task Data DMP-19

DMP-2 General Data Management Plan for 100-NR-3 Work Plan Task Data After Implementation of HEIS DMP-23

TABLES:

DMP-1 Site Characterization DMP-3

DMP-2 Management of Related Administrative Data DMP-10

DMP-3 Site Characterization-Estimated Data Quantity DMP-12

1.0 INTRODUCTION AND OBJECTIVES

1.1 INTRODUCTION

An extensive amount of data will be generated in connection with the Resource Conservation and Recovery Act (RCRA) facility investigation/corrective measures study (RFI/CMS) process for the 100-NR-3 operable unit. The quality of these data is extremely important to the full remediation of the operable unit as agreed upon by the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), Washington Department of Ecology (Ecology), and interested parties.

This data management plan (DMP) addresses management of data generated from the 100-NR-3 operable unit work plan, field sampling plan (FSP), quality assurance project plan (QAPP), and health and safety plan (HSP) activities.

Development of a comprehensive plan for the management of all environmental data generated at the Hanford Site is under way. The Environmental Information Management Plan (EIMP) (Steward 1989), released in March 1989, describes activities in the Environmental Data Management Center (EDMC) and provides a description of the long-range goals for management of scientific and technical data. The EIMP is currently under review and is expected to be revised and expanded in fiscal year 1990.

1.2 OBJECTIVES

This DMP describes the process for the data collection and control procedures for validated data, records, documents, correspondence, and other information associated with the 100-NR-3 RFI/CMS.

This DMP addresses the following:

- Types of data to be collected
- Plans for managing data
- Organizations controlling data
- Databases used to store the data

- Environmental Information Management Plan
- Hanford Environmental Information System (HEIS).

2.0 TYPES OF DATA

2.1 DATA TYPES

General data types include field logbooks, verified sample analyses, historic data, chain-of-custody forms, quality assurance/quality control (QA/QC) data, reports, memoranda/meeting minutes, telephone conversations, archived samples, raw sample data, videotapes, magnetic media and supporting documentation, paper tapes, personnel training records, exposure records, respiratory protection fitting records, personnel health and safety records, and compliance and regulatory data. Table DMP-1 lists the data types and applicable procedures by work plan task. Table DMP-2 lists data types for health and safety planning, as well as for regulatory compliance activities.

2.2 DATA COLLECTION

Data will be collected according to the FSP and the QAPP. Table DMP-1 lists controlling procedures for data collection and handling before turnover of responsibility to the organization responsible for data storage. All procedures for data collection will be approved in compliance with applicable Westinghouse Hanford Company (Westinghouse Hanford) procedures. Where Westinghouse Hanford Environmental Investigations Instructions (EII) are referenced, they will be the latest approved versions from the Environmental Investigations and Site Characterizations Manual (WHC 1989).

2.3 DATA STORAGE AND ACCESS

Data will be handled and stored according to procedures approved in compliance with applicable Westinghouse Hanford procedures. Data controlling organizations are listed in Tables DMP-1 and Table DMP-2. The EDMC is the central files manager and process facility. All data entering the EDMC will be indexed, recorded, and placed into safe and secure storage. Data designated for placement into the administrative record will be copied, placed into the Hanford Site Administrative Record File, and distributed by the EDMC to the user community.

Table DMP-1. Site Characterization. (sheet 1 of 7).

Work Plan Task	Data Type	Procedure	Controlling Organization EDMC[a]	Controlling Organization Others
OPERABLE UNIT CHARACTERIZATION				
Task 1 - Project Management (Addressed in Project Management Plan)				
Task 2 - Source Characterization				
Subtask 2a - Data Review and Evaluation	Historic: Engineering plans, reports	EII 1.6	X	
	Telephone conversations	EII 1.6	X	
	Memoranda/minutes	EII 1.6	X	
Subtask 2b - Nonintrusive Investigations	Logbooks	EII 1.5	X	
Subtask 2c - Source Sampling	Magnetic media and supporting documentation	EII 1.6	X	
	Chart Recordings	EII 1.6	X	
	Chain of custody	EII 5.1	X	
	QA/QC		X	OSM[b]
Subtask 2d - Laboratory Analysis	Validated sample analysis	EII 1.6	X	
	QA/QC	EII 1.6	X	OSM
Task 3 - Geological Investigations				
Subtask 3a - Data Compilation	Technical memos	EII 1.6	X	
	Geological logs	EII 9.1	X	
Subtask 3b - Field Activities	Aerial photographs	EII 1.6	X	
	Log books	EII 1.5 EII 11.1	X	
	Magnetic media and supporting documentation	EII 1.6	X	
	Chart recordings	EII 1.6	X	
Subtask 3c - Data Evaluation	Log books	EII 1.5	X	
	QA/QC	EII 1.6	X	

Table DMP-1. Site Characterization. (sheet 2 of 7).

Work Plan Task	Data Type	Procedure	Controlling Organization EDMC[a]	Others
Task 4 - Surface Water and Sediments Investigations (See Data Management Plan for 100-NR-1 Operable Unit)				
Task 5 - Vadose Investigations (See Source Investigations and Data Management Plan for 100-NR-1 Operable Unit)				
Task 6 - Ground Water Investigations (See Data Management Plan for 100-NR-1 Operable Unit)				
Task 7 - Air Investigations (See Data Management Plan for 100-NR-1 Operable Unit)				
Task 8 - Ecological Investigations				
Subtask 8a - Data Compilation	Technical memos	EII 1.6	X	
Subtask 8b - Field Activities	Aerial photographs	EII 1.6	X	
	Log books	EII 1.5	X	
		EII 11.1	X	
	Magnetic media and supporting documentation	EII 1.6	X	
	Chart recordings	EII 1.6	X	
Subtask 8c - Data Evaluation	Log books	EII 1.5	X	
	QA/QC	EII 1.6	X	
Task 9 - Cultural Resource Investigations				
Task 10 - Data Evaluations	Technical memos	EII 1.6	X	
Task 11 - Baseline Risk Assessment	Technical memos	EII 1.6	X	
	Computer models	EII 1.6	X	
	Magnetic media and supporting documentation	EII 1.6	X	

Table DMP-1. Site Characterization. (sheet 3 of 7).

Work Plan Task	Data Type	Procedure	Controlling Organization EDMC[a]	Others
Task 12 - Report				
Subtask 12a - Prepare	Report	EII 1.6	X	
Subtask 12b - Review/Approval	Approval	EII 1.6	X	
CMS PHASE I/II REMEDIAL ALTERNATIVES DEVELOPMENT				
Task 1 - Project Management (Addressed in Project Management Plan)				
Task 2 - Alternatives Development				
Subtask 2a - Develop Objectives	Technical memos	EII 1.6	X	
Subtask 2b - Develop General Response Actions	Technical memos	EII 1.6	X	
Subtask 2c - Identify Potential Technologies	Technical memos	EII 1.6	X	
Subtask 2d - Evaluate Process Options	Technical memos	EII 1.6	X	
Subtask 2e - Assemble Alternatives	Technical memos	EII 1.6	X	
Subtask 2f - Identify/Action-Specific CARs	Technical memos	EII 1.6	X	
Task 3 - Alternatives Screening				
Subtask 3a- Refine Objectives	Technical memos	EII 1.6	X	
Subtask 3b - Define Alternatives	Technical memos	EII 1.6	X	
Subtask 3c - Screen Alternatives	Technical memos	EII 1.6	X	
Subtask 3d - Identify/Action-Specific CARs	Technical memos	EII 1.6	X	
Subtask 3e - Evaluate Data Needs	Technical memos	EII 1.6	X	

Table DMP-1. Site Characterization. (sheet 4 of 7).

Work Plan Task	Data Type	Procedure	Controlling Organization EDMC[a]	Controlling Organization Others
Task 4 - Report				
Subtask 4a - Prepare	Report	EII 1.6	X	
Subtask 4b - Review/Approval	Approval	EII 1.6	X	
RFI PHASE II TREATABILITY INVESTIGATION				
Task 1 - Project Management (Addressed in Project Management Plan)				
Task 2 - Source Investigations				
Subtask 2a - Data Compilations and Review	Technical memos	EII 1.6	X	
Subtask 2b - Field Activities	Technical memos	EII 1.6	X	
Subtask 2c - Other				
Task 3 - Geologic Investigations (See Data Management Plan for 100-NR-1 Operable Unit)				
Task 4 - Surface Water and Sediments Investigations (See Data Management Plan for 100-NR-1 Operable Unit				
Task 5 - Vadose Zone Investigations				
Subtask 5a - Field Activities	Technical memos	EII 1.6	X	
Subtask 5b - Laboratory Analysis	Technical memos	EII 1.6	X	
Subtask 5c - Data Evaluation	Technical memos	EII 1.6	X	
Task 6 - Ground Water Investigations (See Data Management Plan for 100-NR-1 Operable Unit)				
Task 7 - Air Investigations				
Subtask 7a - Field Activities	Technical memos	EII 1.6	X	
Subtask 7b - Laboratory Analysis	Technical memos	EII 1.6	X	
Subtask 7c - Data Evaluation	Technical memos	EII 1.6	X	
Task 8 - Ecological Investigations				
Subtask 8a - Field Activities	Technical memos	EII 1.6	X	
Subtask 8b - Laboratory Analysis	Technical memos	EII 1.6	X	
Subtask 8c - Data Evaluation	Technical memos	EII 1.6	X	
Task 9 - Treatability Work Plan Implementation	Work Plan	EII 1.6	X	

Table DMP-1. Site Characterization. (sheet 5 of 7).

Work Plan Task	Data Type	Procedure	Controlling Organization EDMC[a]	Others
Task 10 - Treatability Work Plan Implementation	Pilot and test data	EII 1.5	X	
	Log books			
	Sample analysis	EII 1.6	X	
	Magnetic media	EII 1.6	X	
	Technical memos	EII 1.6	X	
Task 11 - Other Activities		Plan		
Task 12 - Data Evaluation	Log books	EII 1.5	X	
	QA/QC	EII 1.6	X	
Task 13 - Phase II Risk Assessment	Technical memos	EII 1.6	X	
Task 14 - Report				
Subtask 14a - Prepare	Report	EII 1.6	X	
Subtask 14b - Review/Approve	Report	EII 1.6	X	
CMS PHASE III REMEDIAL ALTERNATIVES ANALYSIS				
Task 1 - Define Alternatives	Technical memos	EII 1.6	X	
Task 2 - Alternatives Analysis	Technical memos	EII 1.6	X	
Subtask 2a - Short-term Effectiveness Analysis	Computer modeling	EII 1.6	X	
	Magnetic media and supporting			
	documentation	EII 1.6	X	
	Technical memos	EII 1.6	X	
Subtask 2b - Long-term Effectiveness Analysis	Computer modeling	EII 1.6	X	
	Magnetic media and supporting			
	documentation	EII 1.6	X	
	Technical memos	EII 1.6	X	

Table DMP-1. Site Characterization. (sheet 6 of 7).

Work Plan Task	Data Type	Procedure	Controlling Organization EDMC[a]	Controlling Organization Others
Subtask 2c - Analysis of Reduction in Waste Toxicity, Mobility, and Volume	Technical memos	EII 1.6	X	
Subtask 2d - Implement-ability	Technical memos	EII 1.6	X	
Subtask 2e - Cost Analysis	Technical memos	EII 1.6	X	
Subtask 2f - Analysis of Overall Protection of Human Health and the Environment	Technical memos	EII 1.6	X	
Subtask 2g - Analysis of Community and State Acceptance	Technical memos	EII 1.6	X	
Task 3 - Compare Alternatives	Technical memos	EII 1.6	X	
Task 4 - Report				
Subtask 4a - Prepare	Report	EII 1.6	X	
Subtask 4b - Review/Approve	Report	EII 1.6	X	

Table DMP-1. Site Characterization. (sheet 7 of 7).

Work Plan Task	Data Type	Procedure	Controlling Organization EDMC[a]	Others
Task 5 - Corrective Action Plan	Plan	EII 1.6	X	
NEPA				
Task 1 - Analysis	Technical memos	EII 1.6	X	
Task 2 - Prepare	Report	EII 1.6	X	
Task 3 - Review/Approve	Technical memos	EII 1.6	X	
CLOSURE PLANS AND POST-CLOSURE PERMITS				
Task 1- Prepare	Report	EII 1.6	X	
Task 2 - Review/Approve	Report	EII 1.6	X	
INTERIM REMEDIAL ACTIONS	Technical memos	EII 1.6	X	

[a] EDMC - Environmental data management center

[b] OSM - Office of sample management

Table DMP-2. Management of Related Administrative Data.

Category	Data type	Controlling Document/ Procedure	Database or Controlling Organization				
			TRI	HEHF	ORE	EDMC	EHPSS
Personnel	Personnel training and and qualifications	See Section 3.0					
	Occupational exposure records (nonradiologic)	EII 2.2		X			X
	Radiological exposure records	See Section 3.0				X	
	Respiratory protection fitting					X	
	Personal health and safety records	EII 2.1		X			X
Compliance/ regulatory	Applicable or relevant and appropriate requirement/screening levels	EII 1.6				X	
	Guidance document tracking	EII 1.6				X	
	Compliance issues	EII 1.6				X	
	Problem resolution	EII 1.6				X	
	Administrative record	TPA-AP-06-RO & TPA-AP-10-RO				X	

TRI - Training Record Information Systems
HEHF - Hanford Environmental Health Foundation
ORE - Occupation Radiation Exposure
EDMC - Environmental Data Management Center
EHPS - Environmental Health and Pesticide Services Section

The following data types will reside in locations other than the EDMC.

Data type	Data location
• QA/QC laboratory data	Office of Sample Management (Westinghouse Hanford Company)
• Archived sample index	Office of Sample Management (Westinghouse Hanford Company)
• Archived samples	Laboratory performing analyses (see the archived sample index)
• Training records	Technical Training Support Section (Westinghouse Hanford Company)
• Meteorological data	Hanford Meteorological Station (Pacific Northwest Laboratory)
• Health and safety	Hanford Environmental Health Foundation records
• Personal protection fitting	Environmental Health and Pesticide Services Section (Westinghouse Hanford Company)
• Radiological exposure	Pacific Northwest Laboratory.

2.4 DATA QUANTITY

Data quantities are described in the work plan and the FSP. Estimated data quantities, as shown in Table DMP-3 are provided for the purpose of data volume and work load planning.

3.0 DATA MANAGEMENT

3.1 OBJECTIVE

A considerable amount of data will be generated through the implementation of the 100-NR-3 operable unit work plan, FSP, and HSP. THE QAPP provides the specific procedural direction and control for obtaining and analyzing samples in conformance with requirements to ensure quality data results. The FSP provides the detailed logistical methods to be employed in selecting the location, depth, frequency of collection, etc., of media to be

Table DMP-3. Site Characterization - Estimated Data Quantity. (sheet 1 of 6).

Work Plan Task	Data Type	Estimated No. of Documents/ Articles	Estimated No. of Sample Locations	Estimated Total No. of Samples	Estimated No. of Analyses/ Per Sample	Estimated Total No. of Data Points
Task 1 - Project Management (Addressed in Project Management Plan)						
Task 2 - Source Investigations						
Subtask 2a - Data Compilation	Historic:	25				
	Engineering plans, report	5				
	Personal Interviews	10				
	Memorandum/minutes	10				
Subtask 2b - Nonintrusive Investigation	Aerial photographs	10				
	Log books	1				
	Magnetic media and supporting documentation	1				
	Maps	5				
Subtask 2c - Source Sampling	Logbooks	4				
	Magnetic media and supporting documentation	4				
	Chart Recordings					
	Chain of Custody	14	30	45	7	
	QA/QC	10	10	15		
Subtask 2d - Laboratory Analysis	Validated sample analysis	1			7	315
	QA/QC	1			7	105
Task 3 - Geological Investigations						
Subtask 3a - Data Compilation	Reports/Documents	10				
	Geological logs	30				
Subtask 3b - Field Activities	Aerial photographs	4				
	Log books	4				
	Magnetic media and supporting documentation	4				
	Chart recordings					

Table DMP-3. Site Characterization - Estimated Data Quantity. (sheet 2 of 6).

Work Plan Task	Data Type	Estimated No. of Documents/ Articles	Estimated No. of Sample Locations	Estimated Total No. of Samples	Estimated No. of Analyses/ Per Sample	Estimated Total No. of Data Points
Task 4 - Surface Water and Sediments Investigations (See Data Management Plan for 100-NR-1 Operable Unit)						
Task 5 - Vadose Investigations (See Source Investigations and 100-NR-1 Operable Unit Data Management Plan)						
Task 6 - Ground Water Investigations (See Data Management Plan for 100-NR-1 Operable Unit)						
Task 7 - Air Investigations						
Subtask 7a - Data Compilation	Technical memos	1				
	Historical reports	5				
Subtask 7b - Field Activities	Aerial Photographs	1				
	Log books	1				
	Magnetic media and supporting documentation	1				
	QA/QC	1				
Subtask 7c - Data Evaluation	Log books	1				
	QA/QC					
Task 8 - Ecological Investigations						
Subtask 8a - Data Compilation	Technical memos	1				
Subtask 8b - Field Activities	Aerial photographs	10				
	Log books	1				

Table DMP-3. Site Characterization - Estimated Data Quantity. (sheet 3 of 6).

Work Plan Task	Data Type	Estimated No. of Documents/ Articles	Estimated No. of Sample Locations	Estimated Total No. of Samples	Estimated No. of Analyses/ Per Sample	Estimated Total No. of Data Points
Task 9 - Cultural Resource Investigations	Hanford Plan	1				
Task 10 - Data Evaluations	Technical memos	1				
Task 11 - Baseline Risk Agreement	Technical memos	1				
	Computer models	4				
	Magnetic media and supporting documentation	4				
Task 12 - Report						
Subtask 12a - Prepare	Report	1				
Subtask 12b - Review/Approval	Approval	1				
CMS PHASE I/II REMEDIAL ALTERNATIVES DEVELOPMENT						
Task 1 - Project Management (Addressed in Project Management Plan)						
Task 2 - Alternative Development						
Subtask 2a - Develop Objectives	Technical memos	1				
Subtask 2b - Develop General Response Actions	Technical memos					
Subtask 2c - Identify Potential Technologies	Technical memos	1				
Subtask 2d - Evaluate Process Options	Technical memos	3				

Table DMP-3. Site Characterization - Estimated Data Quantity. (sheet 4 of 6).

Work Plan Task	Data Type	Estimated No. of Documents/ Articles	Estimated No. of Sample Locations	Estimated Total No. of Samples	Estimated No. of Analyses/ Per Sample	Estimated Total No. of Data Points
Subtask 2e - Assemble Alternatives	Technical memos	1				
Subtask 2f - Identify/Action-Specific CARs	Technical memos	1	X	X	X	2170
Task 3 - Alternatives Screening	Technical memos	1				
Subtask 3a - Refine Objectives	Technical memos	1				
Subtask 3b - Define Alternatives	Technical memos	1				
Subtask 3c - Screen Alternatives	Technical memos	1				
Subtask 3d - Identify/Action-Specific CARs	Technical memos	1				
Subtask 3e - Evaluate Data Needs	Technical memos	1				
Task 4 - Report						
Subtask 4a - Prepare	Report	1				
Subtask 4b - Review/Approval	Approval	1				
RFI PHASE II OPERABLE UNIT CHARACTERIZATION AND TREATABILITY						
Task 1 - Project Management (Addressed in Project Management Plan)						
Task 2 - Source Investigations						
Subtask 2a - Data Compilation Review	Technical Memos	1				
Subtask 2b - Field Activities	Technical Memos	1				
Subtask 2c - Other	TBD	TBD				
Task 3 - Geologic Investigations						
Subtask 3a - Field Activities	Technical memos	1				
Subtask 3b - Laboratory Analysis	Technical memos	1				
Subtask 3c - Data Evaluation	Technical memos	1				
Task 4 - Surface Water and Sediments Investigations (See Data Management Plan for 100-NR-1 Operable Unit)						
Task 5 - Vadose Zone Investigations						
Subtask 5a - Field Activities	Technical memos	1				
Subtask 5b - Laboratory Analysis	Technical memos	1				

Table DMP-3. Site Characterization - Estimated Data Quantity. (sheet 5 of 6).

Work Plan Task	Data Type	Estimated No. of Documents/ Articles	Estimated No. of Sample Locations	Estimated Total No. of Samples	Estimated No. of Analyses/ Per Sample	Estimated Total No. of Data Points
Subtask 5c - Data Evaluation	Technical memos	1				
Task 6 - Ground Water Investigations (See Data Management Plan for 100-NR-1 Operable Unit)						
Task 7 - Air Investigations						
Subtask 7a - Field Activities	Technical memos	1				
Subtask 7b - Laboratory Analysis	Technical memos	1				
Subtask 7c - Data Evaluation	Technical memos	1				
Task 8 - Ecological Investigations						
Subtask 8a - Field Activities	Technical memos	1				
Subtask 8b - Laboratory Analysis	Technical memos	1				
Subtask 8c - Data Evaluation	Technical memos	1				
Task 9 - Treatability Work Plan Development	Work Plan	Unknown				
Task 10 - Treatability Work Plan Implementation	Pilot and test data/ Log books Sample analysis Magnetic media Technical memos	"				
Task 11 - Cultural Resource Investigations	Plan	1				
Task 12 - Data Evaluation	Log books	1				
Task 13 - Baseline Risk Assessment	Technical memos	1				
Task 14 Report						
Subtask 14a - Prepare						
Subtask 14b - Review/Approve						
CMS PHASE III REMEDIAL ALTERNATIVES ANALYSIS						
Task 1 - Define Alternatives	Technical memos	1				
Task 2 - Alternative Analysis	Technical memos	1				
Task 3 - Compare Alternatives	Technical memos	1				

Table DMP-3. Site Characterization - Estimated Data Quantity. (sheet 6 of 6).

Work Plan Task	Data Type	Estimated No. of Documents/ Articles	Estimated No. of Sample Locations	Estimated Total No. of Samples	Estimated No. of Analyses/ Per Sample	Estimated Total No. of Data Points
Task 4 - Report						
Subtask 4a - Prepare	Report	1				
Subtask 4b - Review/Approve	Report	1				
Task 5 - Corrective Action Plan	Work Plan	Unknown				
NEPA						
Task 1 - Analyze	Technical memos	1				
Task 2 - Prepare	Report	1				
Task 3 - Review/Approve	Report	1				
CLOSURE PERMITS						
Task 1 - Prepare	Report	1				
Task 2 - Review/Approve	Report	1				
INTERIM REMEDIAL ACTIONS	Technical memos To be determined	TBD				

[a] EDMC = Environmental data management center

[b] OSM - Office of sample management

sample and the methods to be employed to obtain samples of the selected media for cataloging, shipment, and analysis.

Figure DMP-1 displays the general DMP outline for data generated through 100-NR-3 activities.

3.2 ORGANIZATIONS CONTROLLING DATA

This section describes the organizations that will receive data generated from 100-NR-3 activities.

3.2.1 Environmental Engineering Section

The Westinghouse Hanford Environmental Engineering Group provides the technical lead. The technical lead is responsible for maintaining and transmitting data to the designated storage facility.

3.2.2 Office of Sample Management

The Westinghouse Hanford Office of Sample Management (OSM) will validate all data packages received from the laboratory. Validated summary data will be forwarded to the technical lead for use and submittal to the EDMC. Nonvalidated or preliminary data will be forwarded to the technical lead upon request. Preliminary data will be clearly labeled as such. The OSM will maintain raw sample data, QA/QC laboratory data and the archived sample index. The OSM is scheduled to develop written data management procedures in 1990.

3.2.3 Environmental Data Management Center

The EDMC is the Westinghouse Hanford Environmental Division's central facility and service that provides a file management system for processing environmental information. The EDMC manages and controls the Administrative Record and the Administrative Record Public Access Room. Data transmittal to the EDMC is governed by the following procedures:

- EII 1.6 "Records Management" (WHC 1989)
- TPA-AP-06-R0, Predecisional Draft, "Clearance and Release of Administrative Record Documentation" (DOE-RL et al. 1990a)
- TPA-AP-07-R0, Predecisional Draft, "Information Transmittals and Receipt Control" (DOE-RL et al. 1990b)

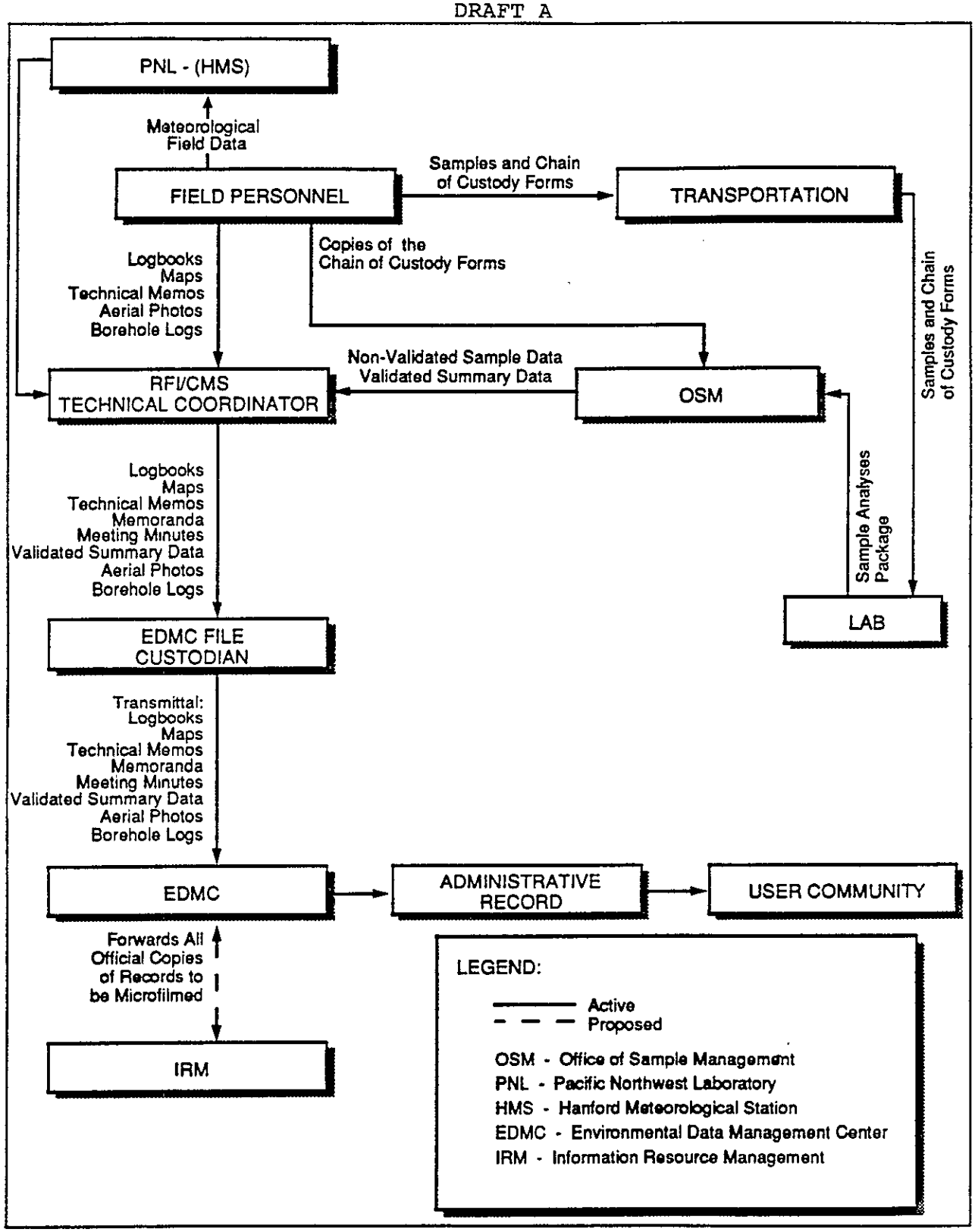


Figure DMP-1. General Data Management Plan for 100-NR-3 Work Plan Task Data

- TPA-AP-10-R0, "Administrative Record Management" (DOE-RL et al. 1990c)

- WHC-EP-0219, Environmental Information Management Plan (Steward 1989).

Procedures addressing record control before transmittal to EDMC will be developed in fiscal year 1990.

3.2.4 Information Resource Management

The Information Resource Management (IRM) is the designated records custodian (permanent storage) for Westinghouse Hanford. The procedural link between the EDMC and the IRM is being developed.

3.2.5 Hanford Environmental Health Foundation

The Hanford Environmental Health Foundation (HEHF) performs the analyses on the nonradiological health and exposure data and forwards summary reports to the Fire and Protection Group and the Environmental Health and Pesticide Services Section (EHPSS) within the Westinghouse Hanford Environmental Division. Nonradiological and health exposure data are maintained also for other site contractors (Pacific Northwest Laboratory [PNL] and Kaiser Engineers Hanford [KEH]) associated with 100-NR-3 activities. The HEHF provides summary data to the appropriate site contractor. The preparation of health and safety plans addressed in "Preparation of Hazardous Waste Operations Permits," EII 2.1 (WHC 1989) and occupational health monitoring is covered in "Occupational Health Monitoring," EII 2.2 (WHC 1989). Data management procedures are currently under development.

3.2.6 Environmental Health and Pesticide Services Section

The Westinghouse Hanford EHPSS maintains personal protection equipment fitting records and maintains nonradiological health field exposure and exposure summary reports provided by HEHF for Westinghouse Hanford Environmental Division and subcontractor personnel.

3.2.7 Technical Training Support Section

The Westinghouse Hanford Technical Training Support Section provides training and maintains training records (see Section 3.3.4).

3.2.8 Pacific Northwest Laboratory

The PNL operates the Hanford Meteorological Station (HMS) that collects and maintains meteorological. Additionally, PNL collects and maintains radiation exposure data. Data management

is discussed in the Hanford Meteorological Data Collection System and Data Base (Andrews 1988).

3.3 DATABASES

The HMS, controlled by PNL, collects and maintains meteorological data. This database contains meteorological data dating from 1943 to present. The Hanford Meteorological Data Collection System and Data Base (Andrews 1988) is the document that explains meteorological data management.

3.3.1 Nonradiological Exposure and Medical Records

The HEHF collects and maintains data for all nonradiological exposure records and medical records.

3.3.2 Radiological Exposure Records

The PNL collects and maintains data on occupational radiation exposure. This database contains respiratory personnel protection equipment fitting records, work restrictions, and radiation exposure information.

3.3.3 Training Records

Training records for Westinghouse Hanford and subcontractor personnel are managed by the Westinghouse Hanford technical Training Support Section. Other Hanford Site contractors (PNL and KEH) maintain their own personnel training records.

3.3.4 Environmental Information/Administrative Record

Westinghouse Hanford EDMC personnel manage environmental information and the administrative record. The administrative record provides an index and key information on all data transmitted to the EDMC. This database is used to assist in data retrieval and to produce index lists as required.

3.3.5 Sample Status Tracking

The OSM maintains the sample status tracking database. This database contains information about each sample. Information maintained includes ample number, ship data, receipt data, and laboratory identification.

4.0 ENVIRONMENTAL INFORMATION MANAGEMENT PLAN

The EIMP (Steward 1989) was issued is March 1989 and is currently under review. The EIMP is expected to be revised and expanded in fiscal year 1990. The first part of the EIMP

provides an overview of the Westinghouse Hanford Environmental Division's working files management system and addresses the management of information transmitted to the EDMC, the Environmental Division's designated file manager, in support of Environmental Restoration Program activities. An overview is presented of the EDMC's location, operating mechanics, field file support services, automated support services, and the composition and compilation of an agency-required Administrative Record.

The second part of the EIMP addresses future plans for management of scientific and technical data. The planning and control activities affecting data are discussed. These activities include data collection, analysis, integration, transfer, storage, retrieval, and presentation.

5.0 HANFORD ENVIRONMENTAL INFORMATION SYSTEM

5.1 OBJECTIVE

The HEIS is being developed by PNL for Westinghouse Hanford as a primary resource for computerized storage, retrieval, and analysis of quality-assured technical data associated with CERCLA RFI/CMS activities and Resource Conversation and Recovery Act of 1976 (RCRA) facility investigation/corrective measure study (RFI/CMS) activities being undertaken at the Hanford Site. The HEIS will provide a means of interactive access to data sets. Implementation of HEIS will serve to facilitate data consistency, quality, traceability, and security within a single controlled database. The HEIS is expected to be operational by September 1990.

The following is a list of data subjects proposed to be entered into HEIS:

- Geologic
- Geophysics
- Atmospheric
- Biotic
- Site Characterization
- Soil Gas
- Waste Site Information
- Surface Monitoring
- Groundwater.

Existing databases that are proposed to be incorporated, in whole or in part, within HEIS include the Waste Information Data System (WIDS), and the Hanford Groundwater Database.

Considerable resources are being devoted to completing development and implementing HEIS in fiscal year 1990. The HEIS

is accompanied by a detailed operator and procedure manual that is being prepared by PNL for Westinghouse Hanford.

5.2 INTEGRATION OF 100-NR-3 DATA INTO HEIS

All data collected before the implementation of HEIS will be handled and stored according to the DMP described in Section 3.0. Figure DMP-2 outlines the general data management for data collected after implementation of HEIS. Data collected prior to implementing HEIS will be entered eventually into HEIS as time and resources allow.

6.0 REFERENCES

Andrews, G.L. (1988), Hanford Meteorological Data Collection System and Data Base, PNL-6509, Pacific Northwest Laboratory, Richland, Washington

DOE-RL et al. (1990a), Clearance and Release of Administrative Record Documentation, Predecisional Draft, TPA-AP-06-R0, U.S. Department of Energy-Richland Operations Office, U.S. Environmental Protection Agency, and Washington Department of Ecology, Richland, Washington

DOE-RL et al. (1990b), Information Transmittals and Receipt Control, Predecisional Draft, TPA-AP-07r), U.S. Department of Energy-Richland Operations Office, U.S. Environmental Protectional Agency, and Washington Department of Ecology, Richland, Washington

DOE-RL et al. (1990c), Administrative Record Management, Predecisional Draft, TPA-AP-10-R0, U.S. Department of Energy-Richland Operations Office, U.S. Environmental Protection Agency, and Washington Department of Ecology, Richland, Washington

DOE/RL (1990d), Draft RCRA Facility Investigation/Corrective Measures Study Work Plan for the 100-NR-1 Operable Unit, DOE/RL 90-22

Steward, J.C. (1989), Environmental Information Management Plan, WHC-EP-0219, Westinghouse Hanford Company, Richland, Washington

WHC (1988), Environmental Investigations and Site Characterizations Manual, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington

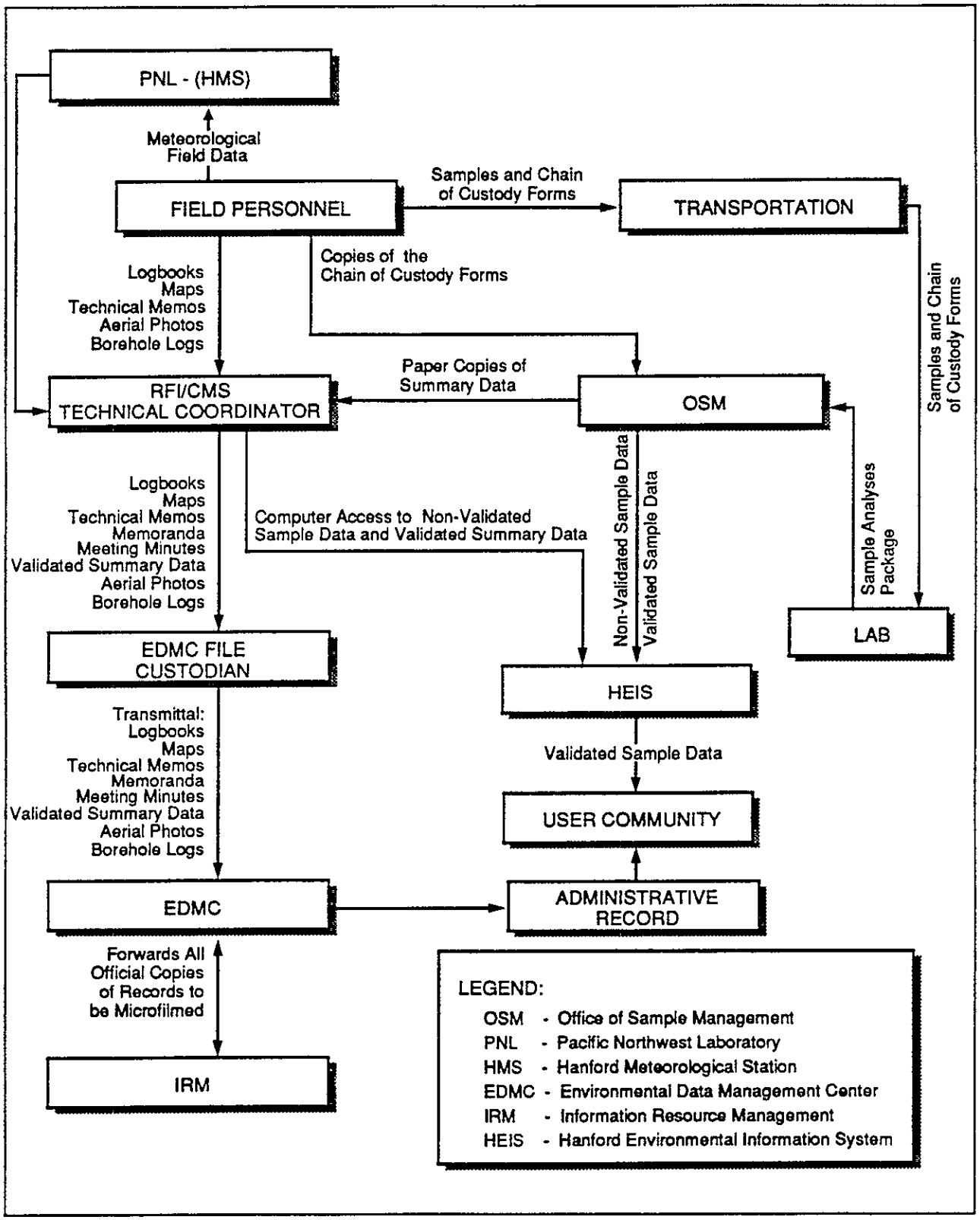


Figure DMP-2. General Data Management Plan for 100-NR-3 Work Plan Task Data after Implementation of HEIS

1.0 INTRODUCTION

A community relations plan (CRP) has been developed for the Hanford Site Environmental Restoration Program. Because community relations activities are so interrelated among operable units, a decision was made to develop a single CRP that will have the capability to address specific individual concerns associated with each operable unit, but will still provide continuity and general coordination of all the Environmental Restoration Program activities with regard to community involvement. The site-wide CRP discusses Hanford Site background information, history of community involvement at the Hanford Site, and community concerns regarding the Hanford Site. It also delineates the community relations program that the Department of Energy-Richland Operations Office, the Environmental Protection Agency Region 10 Office, and the Washington Department of Ecology will cooperatively implement throughout the cleanup of all the operable units at the Hanford Site. All community relations activities associated with the 100-NR-3 operable unit work plan will be conducted under this overall Hanford Site CRP.

DECON DRAIN LINE LEAK

UN-100-N-6 UNPLANNED RELEASE

PLATE 1

SOURCE UNITS in the 100-NR-3 OPERABLE UNIT