Los Alamos
NATIONAL LABORATORY

Environment, Safety & Health Division
Los Alamos, New Mexico 87545
FAX (505) 665-3871

NEW MEXICO ENVIRONMENT DEPARTMENT
NOV -7 OFFICE OF THE SECRETARY

Date: November 4, 1994
In Reply Refer To: ESH-DO/94-734
Mail Stop: K491
Telephone: (505) 667-4218

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 3

To Michael Dale	From McQuillan
Co. NMED AIP	Co.
Dept.	Phone # 827-2831
Fax # 672-0466	Fax #

Ms. Kathleen M. Sisneros, Director
Water and Waste Management Division
N. M. Environment Department
P.O. Box 26110
Santa Fe, New Mexico 87502

SUBJECT: RESPONSE TO NMED LETTER OF NOVEMBER 1, 1994, REGARDING TECHNICAL AREA (TA)-50 RADIOACTIVE LIQUID WASTE TREATMENT PLANT

Dear Ms. Sisneros:

We are in receipt of your letter of November 1, 1994, regarding seepage of liquid from tanks located at the Laboratory's Technical Area (TA)-50 Radioactive Liquid Waste Treatment Plant. We would like to provide you with the following clarifications as discussed by Alan McMillan, Deputy Director of the Laboratory's Environment, Safety, and Health (ESH) Division with you by phone on November 3, 1994. Additional information is also provided below regarding these issues.

1. The seepage referenced in the Laboratory's Capital Assets Management Plan and identified in your letter of November 1st originates along cracks in the sides of the concrete clarifiers at TA-50, Building 1. These clarifiers are enclosed in Building 1 and the clarifier sides can be accessed from the basement of the building. Seepage from these cracks is fully contained inside the basement area where the seepage is collected and routed to the head of the plant for treatment.

2. Formal notification concerning the seepage from the clarifiers at the TA-50 Plant has not been made to the NMED under N.M. Water Quality Control Commission (NMWQCC) Regulations since the seepage is fully contained inside the basement, and is collected and routed to the head of the plant. NMED staff have advised the Laboratory in the past that releases contained inside of buildings do not require formal notification under NMWQCC Regulations. The seepage from the TA-50 clarifiers does not discharge to the environment. In addition, there have been numerous NMED inspections of the TA-50 Plant over the years, and NMED inspectors and NMED Agreement-In-Principal staff have viewed this seepage and collection system.

3. The Laboratory had requested a meeting with NMED staff with a tentative date of September 14, 1994, to discuss the on-going sub-surface investigations at TA-50. During the planning for this meeting, it was recognized that several Laboratory organizations had not been fully included and additional time was needed in order to prioritize work and to prepare a complete and comprehensive presentation. NMED's point of contact for the proposed meeting was notified that the Laboratory was not adequately prepared to meet and that the Laboratory would reschedule the meeting at a later date when all Laboratory organizations could be properly represented.

Telephone # Fax # Telephone # 986-3045

Original Disposition: ☐ Destroy ☐ Return ☐ Call for pickup

665 5552

CCNS

Concerned Citizens for Nuclear Safety

827 2965

October 13, 1994

Judith M. Espinosa, Secretary
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, NM 87502

Dear Ms. Epinosa,

Concerned Citizens for Nuclear Safety (CCNS) requests that the New Mexico Environment Department examine current and past operating conditions of the Radioactive Liquid Waste Treatment Facility (RLWTF) at the Los Alamos National Laborato: (LANL). The FY 1996 LANL Capitol Assets Management Plan (CAMP) states that "**[t]he existing plant, built in 1963, provides no separation between radiation work areas and nonradiation work areas. Process tanks in the treatment area are open to the outside environment through windows. The design life of the concrete tankage has virtually expired and seepage is occurring through the tank walls. Mechanical areas and the pretreatment area are crowded with equipment, making maintenance difficult and unsafe.**" The CAMP further states that "**[t]he effluent produced, using 40-year old water treatment technology in the existing plant, contains levels of regulated constituents greater than is allowed by the Clean Water Act and by DOE order 5400.5. This may cause higher than acceptable exposures to the public and wildlife.**" A replacement RLWTF is not scheduled to go on line until the year 2003 (if then). In the interim, continued substandard (and possibly illegal) operations at the existing RLWTF are not an acceptable environmental risk.

Striking similarities can be drawn between operations at the RLWTF and LANL's Omega West Reactor. The Omega West Reactor discharged liquid contaminants for both an undetermined period of time and at an unknown volume. We suspect the same with the RLWTF. In two respects, however, the violations at the RLWTF have possibly even more serious substantial adverse environmental impacts. Contaminants from the Omega West Reactor discharges primarily involved radioactive tritium with a half life of 12.2 years. In contrast, contaminants at the RLWTF are composed of a wide mix of toxic pollutants and radioactive constituents, including plutonium with a half life of 24,000 years. The revelations of environmental contamination at the Omega West Reactor ultimately led to

st Fax Note 7672

Denny McQuillan

Co. State Env. Dept.

No. of Pages 3

Today's Date

Time

From Keith Eastlake

Company

Location

Dept. Charge

voluntary termination of its operations by DOE. Hence, there were no further adverse environmental impacts. Voluntary cessation of operations at the RLWTF cannot be expected because of that facility's critical supporting role for ongoing operations at LANL's plutonium processing facility. Therefore, in the case of the RLWTF, we expect continuing substantial adverse environmental impacts unless the NMED vigorously intervenes.

In CCNS' view, DOE and LANL have consistently diverted funding towards their programmatic goals to the gross neglect of environmental, health and safety concerns. Faced with current and past operating violations at the RLWTF, NMED must determine if DOE and LANL have accepted any lessons learned from the Omega West Reactor contaminations. **In order to protect state water resources and to avoid further environmental contamination on a scale comparable to the Omega West Reactor leaks, the New Mexico Environment Department must immediately undertake effective enforcement action against substandard operations at LANL's Radioactive Liquid Waste Treatment Facility.**

With reference to applicable New Mexico Water Quality Control Commission Regulations, CCNS requests that NMED act upon responses to the following questions:

1) Has LANL provided the NMED with appropriate notification of unpermitted discharges at the RLWTF (as required under Section 1-203)?

2) Has LANL undertaken the necessary corrective activities to contain and remove damage caused by unpermitted discharges at the RLWTF (as required under Section 1-203)?

3) Has LANL, in conjunction with NMED, determined what further corrective activities at the RLWTF may be necessary (as required under Section 1-203)?

4) Has LANL applied for approval of a discharge plan for the RLWTF (as required under Section 3-106)?

5) Are all discharges at the RLWTF permitted under a discharge plan (as required under Section 3-104)?

6) Has LANL met the monitoring, reporting and other requirements for operations at the RLWTF (as specified in Section 3-107)?

CCNS notes that the New Mexico Water Quality Act clearly provides for the issuance of a compliance order requiring immediate compliance (or, if necessary, the commencement of a civil action for appropriate relief, including injunctive relief) against any person or entity who has violated or is violating a requirement or water quality standard adopted pursuant to the Act. Civil and criminal penalties are also provided for against any person or entity who fails to monitor, sample and report as required and who discharges any water contaminant without a permit for the discharge. **CCNS believes that past and ongoing operating violations at the RLWTF are so egregious (both on their factual basis and on the inability of DOE and LANL to institute compliant behavior after the Omega West Reactor leaks) as to warrant the Environment Department's immediate enforcement to the fullest extent of the New Mexico Water Quality Act.**

We look forward to your response and prompt action.

Sincerely,

Kathleen Sabo,
Executive Director

Jay Coghlan
Research Analyst
LANL Programs

cc: Ms. Kathleen Sisneros
Director, Water and Waste Management Division

Mr. David Koss
Director, Environmental Protection Division

Mr. Dennis Mc Quillan
Program Manager, Groundwater Remediation

TA-50

- The central radioactive wastewater treatment facility is 30 years old and is reaching the end of its useful lifespan. The grit chamber has been removed because of leakage which has resulted in radiological groundwater contamination. Organic solvents are discharged to the TA-50 radioactive wastewater treatment facility. The plant is not designed to treat this type of waste and the permit only contains limits for COD (not specific organic compounds). LANL has only recently initiated predesign studies for replacing this facility, and it may take 10 years before a new facility can be constructed and operational. One of the major contributors to the TA-50 wastewater treatment plant is electroplating/metal finishing operations, and it is not clear from the permit fact sheet whether the effluent guidelines for Metal Finishing included in 40 CFR § 433.10 or more stringent limits have been applied to this discharge.

- The influent storage tanks for the radioactive treatment facility at TA-21 have an overflow pipe which discharges into a tile drain field. LANL personnel could not demonstrate through a mass balance that all the wastewater pumped from TA-21 was received at TA-50. Both the raw wastewater collection system and the effluent pipeline are single-walled steel pipe and do not have a leak detection system.

- High-explosives (HE) manufacturing at LANL results in the discharge of organic compounds which are not removed by the existing treatment facilities. High-explosive wastewater from sumps with high organic concentrations should be transported to the burn pad area for treatment in the existing carbon filters until the new centralized high-explosive wastewater facilities are

fax: Bill Stone
from: M. Dale

DRAFT

5 pages

MEMORANDUM

TO: Dennis McQuillan, NMED GWPRB, Program Manager
W. Stone, NMED GWPRB AIP coordinator

FROM: Michael R. Dale, NMED GWPRB AIP/LANL

DATE: 26 September 94

SUBJECT: **Background Information Concerning TA-50**

Below is the background information that you verbally requested on friday, September 24, 1994. I'll fax information for TA-21 on friday. I'll be out all week but leave a message if you have any questions.

TA-50

- The TA-50 liquid waste treatment plant was built in 1963, and is located on a small mesa top south of Mortandad Canyon. The plant receives liquid waste from many technical areas, treats them and then releases the treated effluent into Mortandad Canyon. The plant is primarily used for the removal of transuranic elements from caustic and acidic liquids.

- Industrial waste lines beneath the facility are suspected of leaking. How they know that is beyond me. Possibly some historical indications have occurred, causing these suspicions to exist. The RCRA Facility Investigation report states that a lot of older lines have been bypassed and re-lined. LANL found one leak at a grid tank in 1990; probably because it was not underground. Line 45 (see attachment A), a vitrified clay pipe, was known to have leaked, and was replaced in 1984.

- The facility contained or contains a **large** amount of underground tanks, piping, manholes, etc.(see attachment B) causing the chance for a release or spill very high.

- LANL proposed drilling (Level C PPE) beneath the facility this fall but activities were halted due TA-50's lower ranking in RCRA's prioritized list. No previous drilling has occurred.

- TA-50 is located between the Rendija Canyon fault zone, which lies to the west of the plant, and the Guaje Mountain fault zone, which lies to the east. These faults have cause extensive fracturing at TA-50. Many of the fractures pass through several beds and are termed "major joints", and tend to have a NNW to NNE strike. Fracture flow is the major concern at the site. An intermediate water-bearing zone may exist at a depth ranging from 250 feet to 300 feet. Surge deposits and/or alteration zones, which could hold and transport liquid or vapor, may also exist.

TA-50

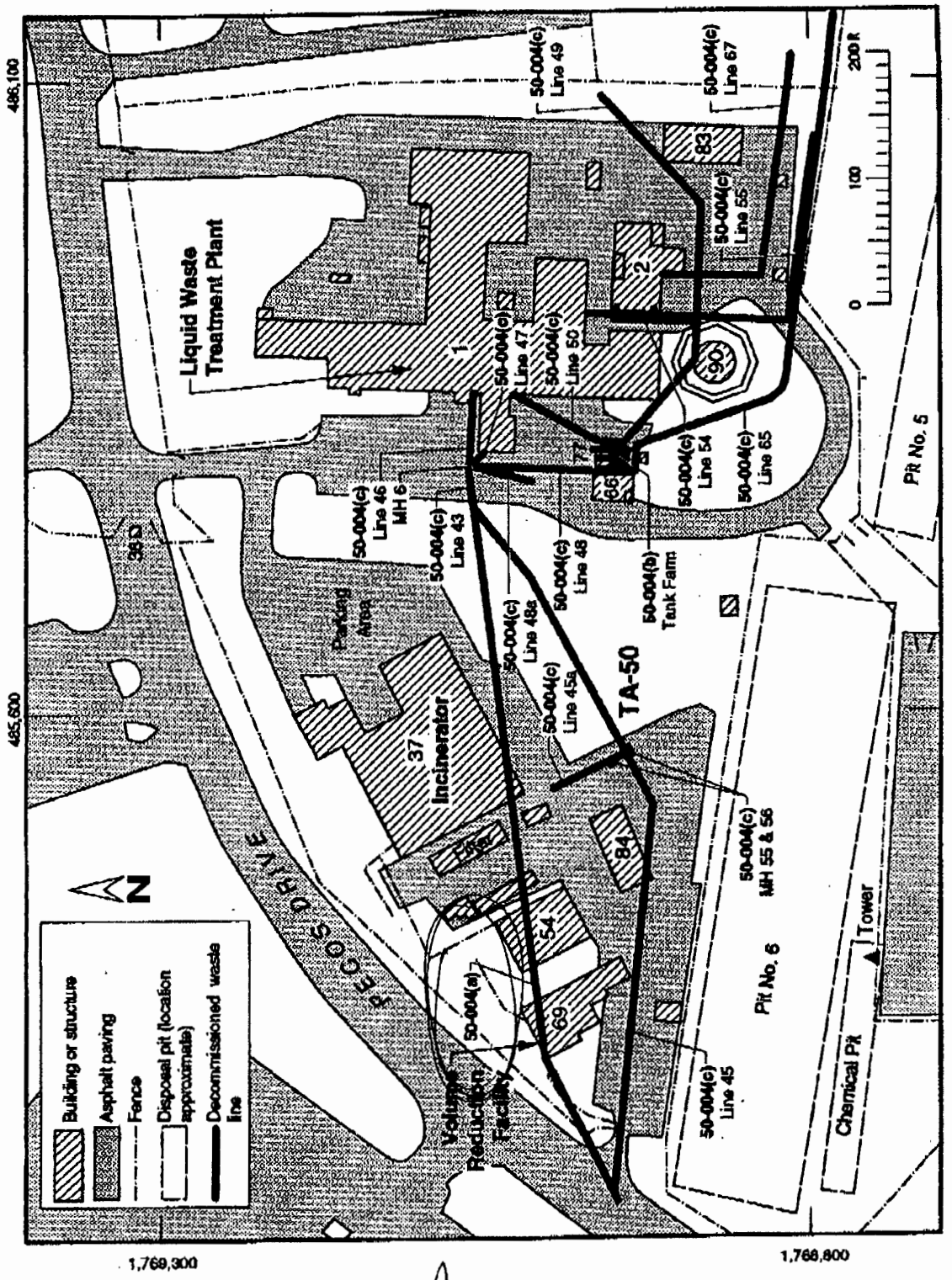

Figure 2-7 Location of decommissioned waste lines, manholes, and tanks at TA-50.

A

TABLE 2-2 (cont'd)

6.	Waste line 48	6 ft
7.	Waste Line 48(a)	6 ft
8.	Waste Line 49	5 ft
9.	Waste Line 54	4 ft
10.	Waste Line 55	5 ft
11.	Waste Line 56	5 ft
12.	Waste Line 65	5 ft
13.	Waste Line 67	17 ft at exit from TA-50-2; 1 ft at canyon outfall
14.	Manhole TA-50-55	8 ft
15.	Manhole TA-50-56	8 ft
16.	Manhole TA-50-6	19 ft
50-008: Volume Reduction Facility (TA-50-69)		5 ft
50-010: Radioactive Decontamination Facility		
Footing details for the extension walls have not been found. Drilling depth ~4 ft		
50-011: Septic Systems		
SWMU 50-011(a)		
Decommissioned septic system leach field and main from septic tank		4 ft

B

TABLE 2-2
DEPTHS BELOW GRADE OF SUBSURFACE
AND PARTIALLY SUBSURFACE TREATMENT FACILITIES SWMUS
(Approximate, at Bottom of Unit)

50-002: Tanks and Drainlines	
50-002(a)	
Tank farm (TA-50-2) concrete tanks (except sludge tank)	17 ft
Sludge tank	25 ft, 6 in.
50-002(b) and 50-002(c)	
Vault containing these two tanks	14 ft
50-002(d)	
Footings of concrete saddles that support aboveground nitric acid storage tank.	5 ft
50-004: Decommissioned Tanks and Waste Lines	
50-004(a)	
Acid waste line	5 to 6 ft
50-004(b)	
Underground reinforced concrete tank farm containing three stainless-steel-lined tanks.	10 ft
50-004(c)	
Thirteen underground waste lines and three manholes (all removed except line 56):	
1. Waste line 44	5 ft
2. Waste line 45	5 ft
3. Waste line 45(a)	7 ft
4. Waste line 46	16 ft
5. Waste line 47	8 ft

B

State of New Mexico
ENVIRONMENT DEPARTMENT
Ground Water Protection and Remediation Bureau
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2918 phone
(505) 827-2965 fax

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

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No Insurance Coverage Provided.
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Sent to	Tom Baca Program Mgr.
Street & Number	LANL MS J591
Post Office, State, & ZIP Code	Los Alamos 87545
Postage	$

April 3, 1996

Tom Baca, Program Manager
Environmental Management
Los Alamos National Laboratory
MS J591
Los Alamos, New Mexico 87545

RE: Discharge Plan Required for TA-50, Liquid Radioactive Waste Treatment Facility

Dear Mr. Baca:

Our records indicate that TA-50, the Liquid Radioactive Waste Treatment Facility which is located on the mesa top adjacent to Mortandad Canyon near the city of Los Alamos in Los Alamos County is currently discharging without an approved discharge plan, which is required under Section 3104. "Discharge Plan Required" of the Water Quality Control Commission (WQCC) Regulations, copy enclosed. You are hereby notified that a discharge plan, as defined in WQCC Reg. 1101.N, is required for the discharge of nitrates and other non-NPDES contaminants from the Liquid Radioactive Waste Treatment Facility, TA-50.

Enclosed are the necessary materials for the preparation of a discharge plan application. In addition, the filing of plans and specifications is required under WQCC Reg. 1202. Please mail three copies of your completed discharge plan and plans and specifications to the Program Manager, Ground Water Pollution Prevention Section, at the address listed below.

New Mexico Environment Department
Ground Water Pollution Prevention Section
P.O. Box 26110
Santa Fe, NM 87502

Plans and specifications should include a plot plan of the property which shows all buildings on the property, the

location and size of all septic tanks and leach fields or other systems used for the treatment and discharge of waste water, and the location and size of all pipelines used for the conveyance and distribution of effluent with valves and distribution boxes as appropriate.

As noted in WQCC Reg. 3106.A, the discharge plan application shall be submitted to the NMED within 120 days of receipt of this letter. If this deadline places undue constraints on a discharger, a written statement showing good cause shall be submitted to the NMED with a request for a deadline extension.

If you have any questions, please contact either John Rogers at 505-827-2713 or Dale Doremus, Program Manager of the Ground Water Pollution Prevention Section at 827-2900.

Sincerely,

Marcy Leavitt, Chief
Ground Water Quality Bureau

ML:JBR/jbr

Enclosures: WQCC Regulations, Discharge Plan Application Instructions

cc: Dennis Erickson, LANL ESH-DD, MS K491
Alex Gancarz, LANL CST-DD, MS J515
Steve Hanson, LANL CST-13, MS E518
Steve Rae, LANL ESH-18, MS K497
James Bearzi, District Manager, NMED Dist. 2
Benito Garcia, Bureau Chief, HRMB
DP Required File

Post-it® Fax Note 7671	Date	# of pages ▶ 2
To Michael Dale	From John Rogers	
Co./Dept.	Co.	
Phone #	Phone # 827-2713	
Fax # 672-0466	Fax #	

Los Alamos
NATIONAL LABORATORY

memorandum

Chemical Science and Technology
Responsible Chemistry for America

CST-13 Rad & Industrial Waste Water
Science, MS E518
Los Alamos, New Mexico 87545

To/MS:	Tori George, General Law, MS A187
Thru:	Steve Hanson, CST-13, MS E518
From/MS:	David Moss, CST-13, MS E518
Phone/FAX:	667-4301/665-6320
Symbol:	CST-13LW-96-058
Date:	April 18, 1996

SUBJECT: POSTING OF MORTENDAD CANYON

The National Pollutant Discharge Elimination System (NPDES) Category 051 Compliance Task Force consists of representatives from the Radioactive and Industrial Wastewater Sciences Group (CST-13), the Water Quality and Hydrology Group (ESH-18), the Department of Energy (DOE), and the New Mexico Environment Department/Agreement in Principle (NMED/AIP). This Task Force was organized to perform a comprehensive technical review of programmatic deficiencies related to the Los Alamos National Laboratory's NPDES-permitted outfall (Outfall 051) at Mortendad Canyon. Provided below is information on the decision reached by the Task Force on the posting of this outfall.

Please inform me of any legal issues you identify related to the Task Force's position on the posting of this outfall. If you have any general questions regarding the posting issue, you may contact me at 667-4301. If you have any questions regarding the radiological survey or ESH-1's position on the recommended posting, contact Brian Scott at (505) 699-2733 (cellular phone) or 104-7343 (pager). Please reply by May 15, 1996.

TASK FORCE POSITION ON POSTING OF OUTFALL AT MORTENDAD CANYON

Mortendad Canyon serves as the outfall for the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50-1. The RLWTF treats radioactive liquid waste generated throughout the Los Alamos National Laboratory. Radioactive liquid waste is treated through the RLWTF and discharged to the outfall. Before and during the discharge to the outfall, the effluent is analyzed for chemical and radiological components as required by the NPDES permit and best management practices.

On February 1, 1996, the Task Force discussed the possibility that the outfall should be posted to protect the public against radioactive exposure. During this meeting, Brian Scott, the ESH-1 support member of the Task Force, gave an update on the Mortendad Canyon radiological survey data conducted in January and compared them with DOE Order 5400.5 derived concentration guidelines (DCGs).

According to Brian Scott, the results of both the RCRA Facility Investigation (RFI) work plan for Operating Unit (OU) 1147 and ESH-1 surveys indicate that the Mortendad Outfall has both elevated radioactive soil concentrations and radiation exposure levels within portions of the stream bed accessible to the public. Soil concentration data entered into a program designed to implement DOE 5400.5 (RESRAD program, designed by Argonne National Laboratory)

indicated that a 100 mrem will be exceeded through a combination of soil ingestion, dust inhalation, and exposure after approximately 24 hours/day for two continuous months.

The Task Force discussed the probability of a 100 mrem exposure to the public at these exposure rates and agreed that a 100 mrem exposure would be highly improbable. However, the Task Force also agreed the outfall area easily accessible to the public should be posted to ensure best management practices are followed.

For compliance purposes, it is recommended that the stream bed be posted "CAUTION, SOIL CONTAMINATION AREA". This recommendation was based on Table 2-4 of the *LANL Radiological Control Manual*, which states that "CAUTION, SOIL CONTAMINATION AREA" is to be posted when contaminated soil is not releasable in occordance with DOE Order 5400.5 (pages 2-14). The soil in this stream bed, if released for unrestricted use, may contribute to radiological exposure pathways which may exceed 100 mrem/year to an individual.

Cy.: Alex Gancarz, CST-DO, MS J515
Joe Graf, ESH-1, MS K487
Roger Huchton, ESH-1, MS K483
Brian Scott, ESH-1, MS G776
Steve Rae, ESH-18, MS K497
Alex Puglisi, ESH-18, MS K497
Mike Saladen, ESH-18, MS K497
Robert King, DOE/LAAO, MS E517
Ken Zamora, DOE/LAAO, MS A316
Ralph Ford-Schmid, NMED/AIP, MS E503
Anna Collery, CST-13/IT Corp., MS E518
CST-13 Group File

LA-13148-MS

UC-940 and UC-721
Issued: April 1996

ROGERS

Ecotoxicological Screen of Potential Release Site 50-006(D) of Operable Unit 1147 of Mortandad Canyon and Relationship to the Radioactive Liquid Waste Treatment Facilities Project

G. J. Gonzales
P. G. Newell

Los Alamos
NATIONAL LABORATORY
Los Alamos, New Mexico 87545

CONTENTS

ACRONYMS

BDAT	Best demonstrated available technology
crql	Contractor-required quantitation limit
DCG	Derived concentration guideline
DI	Data inadequate
EPS	U. S. Environmental Protection Agency
ESAL	Ecotoxicological screening action level
FIMAD	Facility for Information Management, Analysis, and Display
HEAST	Health Effects Assessment Summary Tables
IRIS	Integrated Risk Information System
LANL	Los Alamos National Laboratory
M&O	Management and operation
Max. SC	Maximum soil concentration
MCL	Maximum contaminent level
NFA	No further action
NOAEL	No Observed Adverse Effect Level
NPDES	National Pollution Discharge Elimination System
PCOC	Potential contaminant of concern
PRS	Potential release site
RLWTF	Radioactive Liquid Waste Treatment Facility
SAL	Screening action level (human risk)
SWMU	Solid waste management unit
UTL	Upper tolerance limit

ECOTOXICOLOGICAL SCREEN OF POTENTIAL RELEASE SITE 50-006(D) OF OPERABLE UNIT 1147 OF MORTANDAD CANYON AND RELATIONSHIP TO THE RADIOACTIVE LIQUID WASTE TREATMENT FACILITIES PROJECT

by

G. J. Gonzales and P. G. Newell

ABSTRACT

Potential ecological risk associated with soil contaminants in Potential Release Site (PRS) 50-006(d) of Mortandad Canyon at the Los Alamos National Laboratory was assessed by performing an ecotoxicological risk screen. The PRS surrounds Outfall 051, which discharges treated effluent from the Radioactive Liquid Waste Treatment Facility. Discharge at the outfall is permitted under the Clean Water Act National Pollution Discharge Elimination System. Radionuclide discharge is regulated by US Department of Energy (DOE) Order 5400.5.

Ecotoxicological Screening Action Levels (ESALs) were computed for nonradionuclide constituents in the soil, and human risk SALs for radionuclides were used as ESALs. Within the PRS and beginning at Outfall 051, soil was sampled at three points along each of nine linear transects at 100-ft intervals. Soil samples from 3 depths for each sampling point were analyzed for the concentration of a total of 121 constituents. Only the results of the surface sampling are reported in this report.

The spatial change in radionuclide concentrations from the outfall to the down-canyon sample locations was statistically insignificant. The average concentration (19.7 pCi/g) of alpha-emitting radionuclides was higher than values reported in a different study for all 15 onsite locations for the period 1976–1981 and is 242% of the mean gross alpha concentration measured in the same area between 1975 and 1977 (Purtymun et al., 1980). The variation within transect means in this study was high (avg. std. dev., alpha = 3.1 pCi/g). Although the results of subsurface sampling are not reported here, a cursory review of the data revealed that the concentrations of several of the Potential Contaminants of Concern (PCOCs) are highest at the intermediate sampling depth, 1.5–2.5 ft. Of 121 screened soil constituents, 42 met the criteria for PCOCs. However, 25 of the 42 PCOCs were constituents for which the maximum soil concentration was equal to or less than the lowest required analytical limit, which is known as the "contractor-required quantitation limits" (crql's). Excluding the crql-related PCOCs, there were no semi-volatile PCOCs, 1 volatile PCOC, 5 inorganic PCOCs, and 11 radionuclide PCOCs. The inorganic PCOCs are heavy metals and are of concern because of their susceptibility to biomagnification. There were inadequate data to make a determination on 20 constituents. Animal guild sensitivities in descending order were small herbivore, small omnivore, small carnivore, and large herbivore. In general, PRS 50-006(d) as a whole cannot be proposed for No Further Action at this time from the perspective of potential ecological impact. The results may be compliance issues related to the National Resource Damage Assessment, the Clean Water Act, and/or the Comprehensive Environmental Response, Compensation, and Liability Act. At least 17 PCOCs require further investigation in an Ecological Risk Assessment.

Planned discharge of "supercleaned" waste water from a new plant will add to the complexity of PRS consideration. The authors theorize that radionuclides could be remobilized, making them available for vertical and horizontal transport and for biotic uptake.

1.0. INTRODUCTION

An ecotoxicological screening, hereafter referred to as "the Screen," was conducted in a small portion of Mortandad Canyon at the Los Alamos National Laboratory (LANL), which is located in north central New Mexico (Fig. 1). The purpose of the Screen was to assess the need for an Ecological Risk Assessment of Potential Release Site (PRS) 50-006(d) (Fig. 2). A risk assessment, if needed, would begin to assess the potential past ecological impact of the Radioactive Liquid Waste Treatment Facility (RLWTF), which discharges treated effluent in a Mortandad Canyon inlet. The Screen focussed on examining soil contaminant data for an area including Outfall 051 (Fig. 2), which releases treated effluent from the RLWTF. The sampled area extends 800 ft down canyon from Outfall 051. A secondary purpose of the Screen was to provide screening results that can be used to validate the Probabilistic Risk and Hazard Analysis Group's environmental hazard analysis (EHA) methodology. Validating the EHA methodology provides a link between ecotoxicological impact screening and traditional hazard analysis (HA) such that a simple EHA can be applied to facilities concurrently with the conduct of HAs.

2.0. BACKGROUND

The methodology used in this report is based on the more detailed methodology of Ecological Risk Assessments. Ecological Risk Assessments are currently based on three principles: Problem Formulation, Analysis, and Risk Characterization (EPA, 1992). In the Screen methodology, the Ecological Risk Assessment principles have been broken down into five working components.

- Site Characterization
- Endpoint Selection
- Hazard Identification
- Exposure/Dose-Response Estimation
- Risk Characterization

These components serve as input to a decision tree for the use of ecotoxicological screening action levels (ESALs) at environmental restoration sites (Ebinger et al., 1995).

2.1. Site Characterization

Section 2.1.1 describes the types of operations that have been and continue to be conducted at the RLWTF and associated structures. Section 2.1.2 describes the environmental topography, climate, geology and stratigraphy, hydrology, and ecology associated with PRS 50-006(d).

2.1.1. Discharge Regulation

2.1.1.1. Waste Generation and Discharge. LANL was established during World War II to design the first nuclear weapon and continued to operate to advance nuclear technology after the war. Technical Area 50 (TA-50) was built in response to the growing need for treatment and disposal of Laboratory wastes. The RLWTF, which is within Solid Waste Management Unit (SWMU) 50-001(a) (Fig. 3), began operation in 1963 and continues to operate. This facility treats and removes radioactive elements from liquid waste produced by 75 to 100 waste generators from throughout the Laboratory. The liquid waste is received by a drainline system, SWMU 50-001(b), which is shown in Fig. 4. The facility is designed to treat 250 gal./min of contaminated liquids by neutralization, flocculation/clarification, pH control, ion exchange, and filtration (LANL, 1992).

Of concern to this study is the operational release from SWMU 50-006(d) into Mortandad Canyon through Outfall 051 (Figs. 4, 5, and 2). This release is a permitted outfall release under the National Pollutant Discharge Elimination System (NPDES), Permit No. NM0028355. SWMU 50-006(d) is the treated liquid waste discharge line (No. 64) from the RLWTF [50-001(a)] to the stream channel outfall in Mortandad Canyon. In 1983, this 6-in.-diam iron discharge pipe's route into

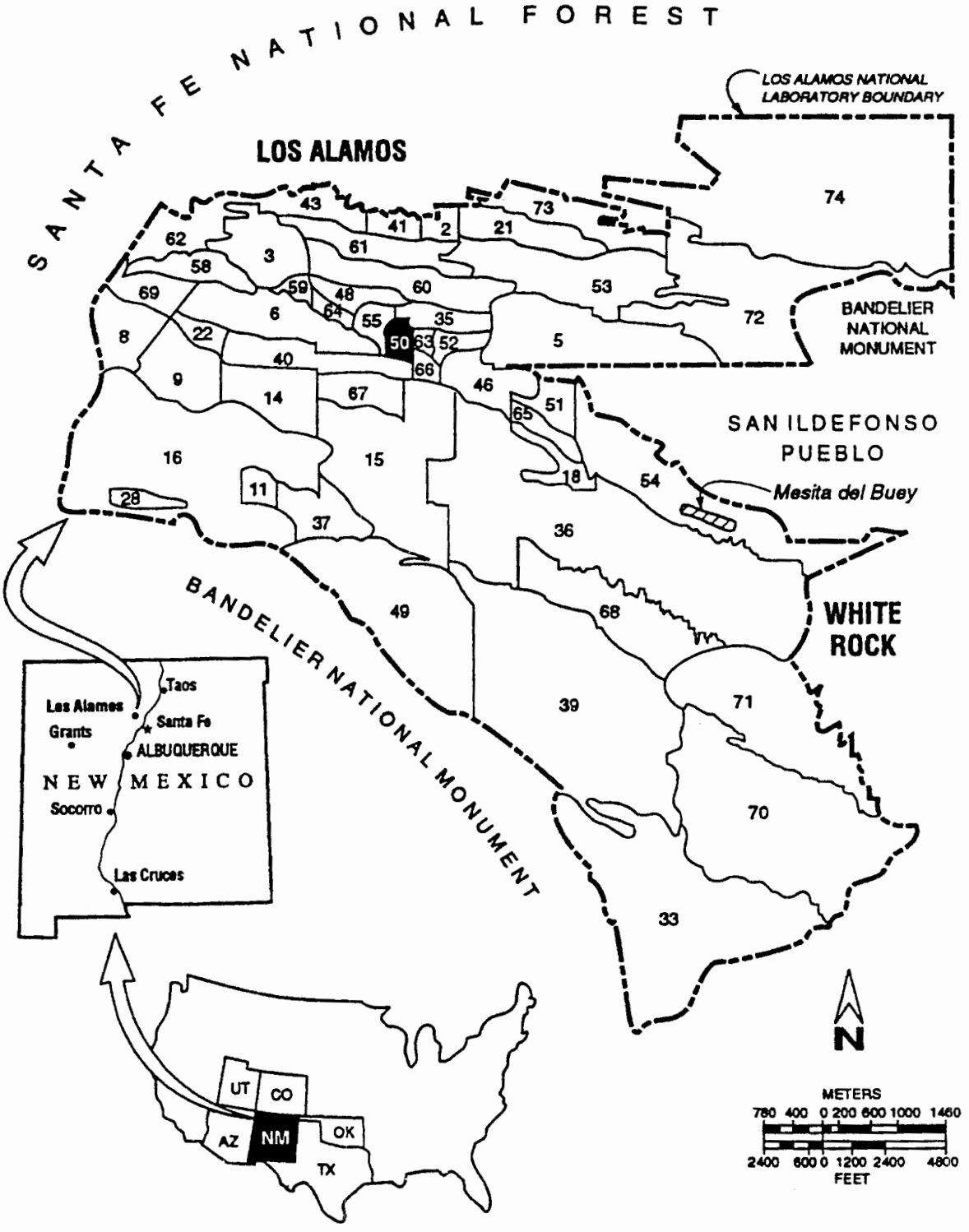

Fig. 1. Location of the Los Alamos National Laboratory.

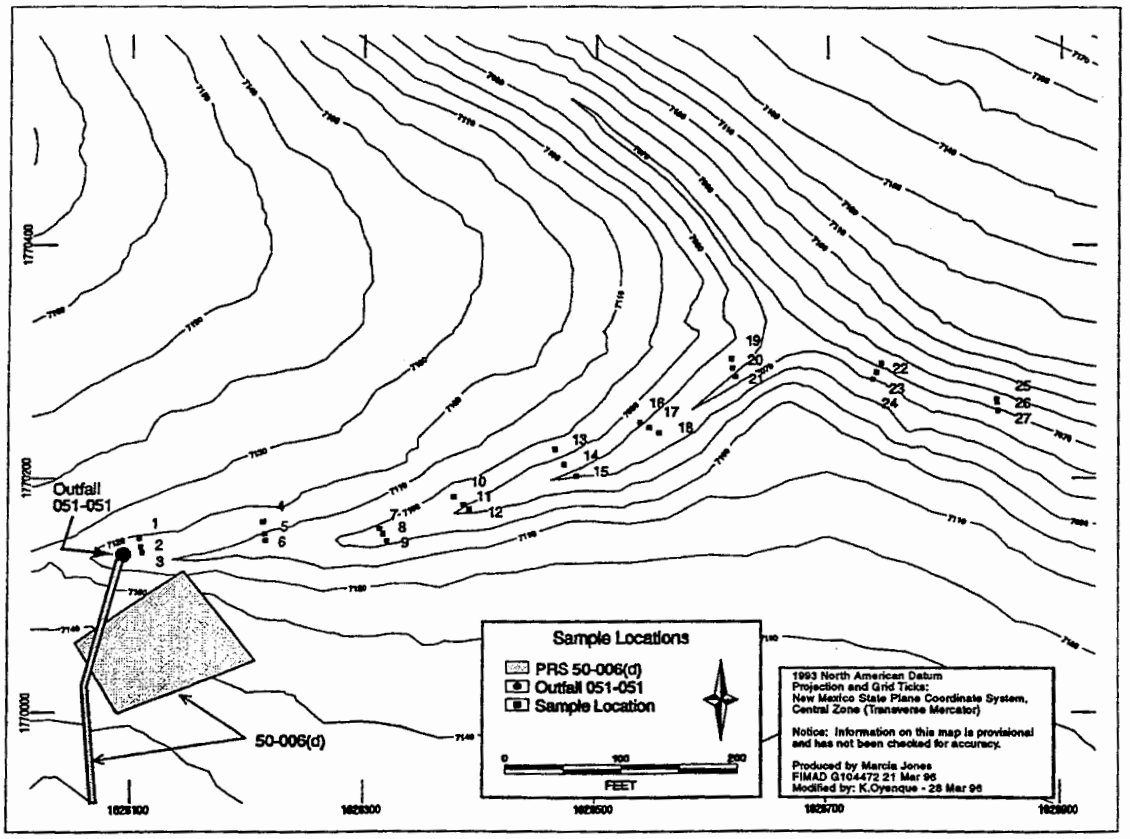

Fig. 2. Approximate location of Outfall 051-051, PRS 50-006(d) and sampling for the ecotoxicological screen. (Note: Samples 1, 2, 3 = "Transect #1"; samples 4, 5, 6 = "Transect #2"; and so on.

Mortandad Canyon was adjusted to accommodate the building of the Target Fabrication Facility (TA-35-213). A US Environmental Protection Agency (EPA) Region VI administrative order was issued to the US Department of Energy (DOE) on February 3, 1985, requiring modification of the outfall to alleviate stream bank erosion caused by the outfall pipe ending 25 ft short of the stream channel. In response to the administrative order, the pipe was extended into the stream channel, and the administrative order was closed on October 15, 1986.

2.1.1.2. Clean Water Act/National Pollution Discharge Elimination System. Although all treated effluent has been and continues to be sampled and screened before release, the treated effluent release into the canyon that began in 1963 has resulted in an accumulation of heavy metals and radionuclides in the stream channel sediments, bank soils, and underlying tuff (LANL, 1992). This outfall is recorded having 13 NPDES outfall permit violations for iron and copper (LANL, 1992).

2.1.1.3. Radiation Protection of the Public and the Environment (DOE 5400.5.) DOE Order 5400.5, "Radiation Protection of the Public and the Environment," regulates the discharge of radionuclides from Outfall 051 (DOE, 1990). In addition to limiting dose to members of the public (onsite and offsite), controls on the release of liquid wastes were adopted to reduce the potential for radiological contamination of natural resources such as land, ground, and ecosystems. Derived Concentration Guideline (DCG) values in the Order for liquid effluent discharges have the objective of minimizing contamination in the environment to the extent practicable.

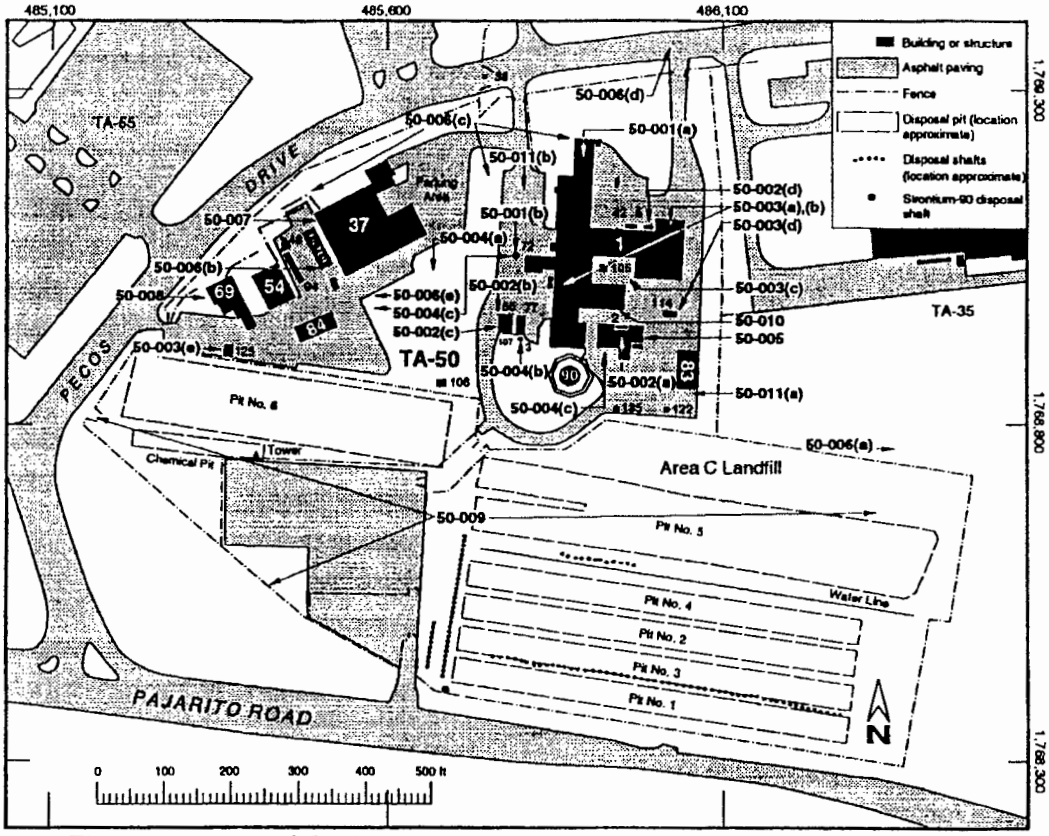

Fig. 3. Location of the SWMU associated with LANL RLWTF operations.

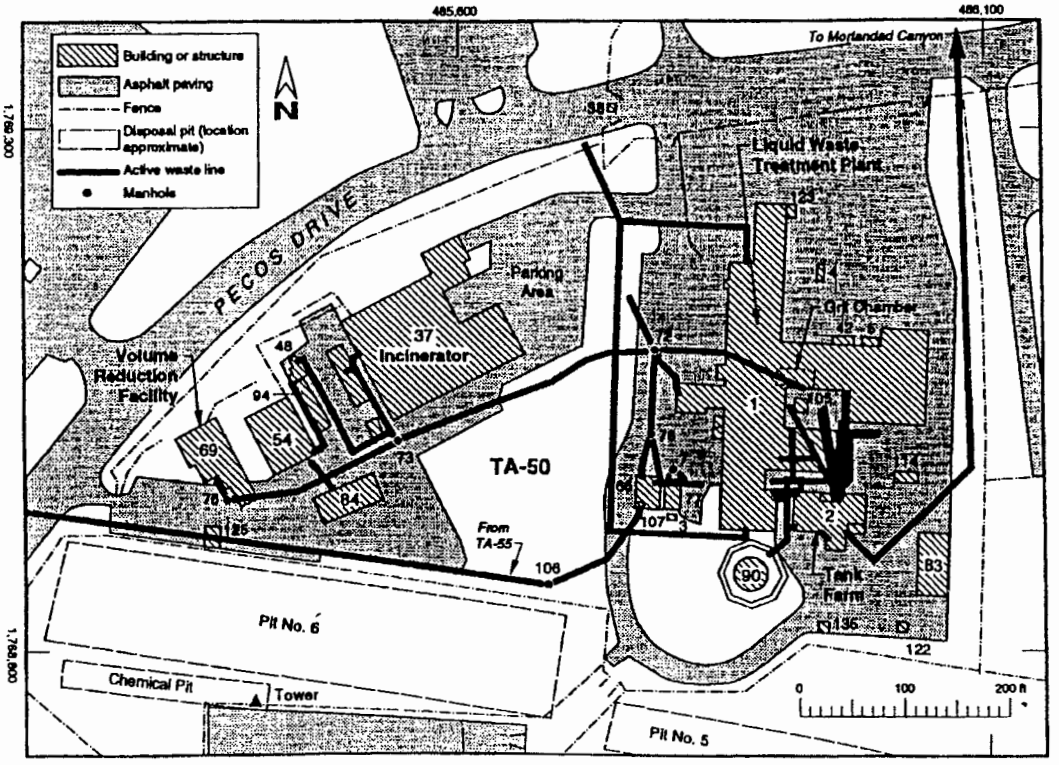

Fig. 4. Schematic of drainline systems for RLWTF influent and effluent.

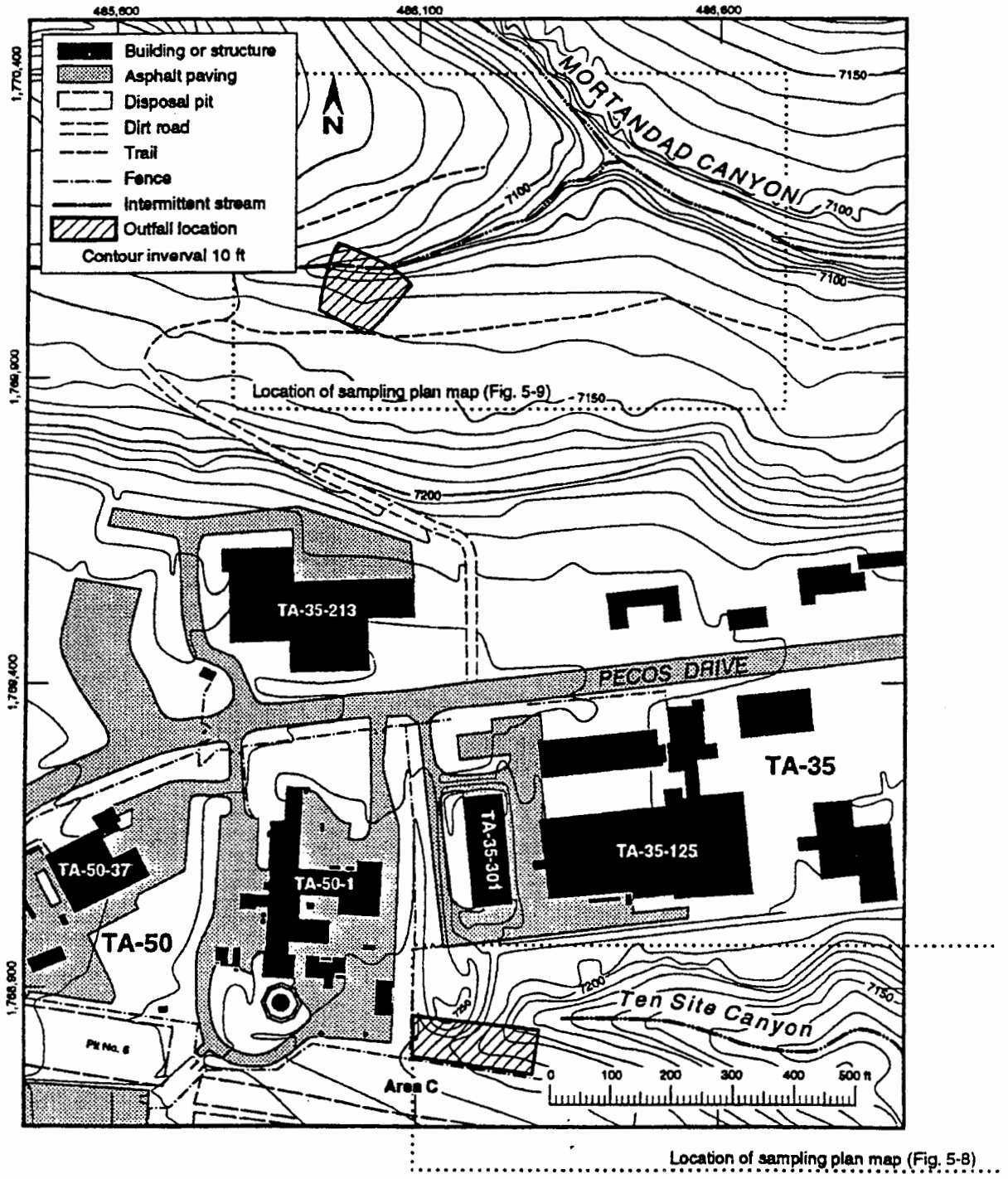

Fig. 5. Map showing the location of the LANL RLWTF discharge into Mortandad Canyon through Outfall 051.

Table 1 is a comparison of arithmetic mean concentrations of radionuclides in the RLWTF process effluent for calendar year 1991 with the DCGs (Bond and Gonzales, 1995). The DCGs were exceeded for four radionuclides (^{90}Sr, ^{137}Cs, ^{239}Pu, and ^{241}Am), and the sum of the normalized radionuclide concentrations (measured concentration divided by DCG) exceeds 1.0. The DCGs are liquid radionuclide discharge screening levels that, if exceeded, require the completion of a Best Available Technology (BAT) study, ultimate consideration of implementing the BAT, and the performance of a risk assessment.

A Best Demonstrated Available Technology (BDAT) study has been completed (RTG, 1995), and the selected technology is a hybrid of reverse osmosis and evaporation as the main treatment processes. The BDAT has resulted in conceptual design of a proposed new RLWTF. The DOE has the expectation that any BDAT implemented by its management and operation (M&O) contractors protect

TABLE 1

AVERAGE RADIONUCLIDE CONTENT AND COMPARISON WITH DCG VALUES OF PROCESS EFFLUENT LANL RLWTF

Radionuclide	Concentration (nCi/L)	DCG* (nCi/L)	Ratio Conc./DCG
^{3}H	484.0	2,000.0	0.24
^{57}Co	0.04	100.0	0.0004
^{75}Se	0.27	20.0	0.01
^{83}Rb	1.9	20.0	0.1
^{84}Rb	0.11	10.0	0.01
^{85}Sr	1.7	70.0	0.02
^{88}Y	0.03	30.0	0.001
^{89}Sr	0.24	20.0	0.012
^{90}Sr	3.7	1.0	3.7
^{137}Cs	3.1	3.0	1.03
^{234}U	0.003	0.5	0.006
^{238}Pu	0.01	0.04	0.25
^{239}Pu	0.04	0.03	1.3
^{241}Am	0.05	0.03	1.7
Gross alpha	0.11	-	-
Gross beta	10.8	-	-

*DCG - Derived Concentration Guideline defined by DOE Order 5400.5 as the concentration of a radionuclide in drinking water that would result in a limiting 100-mrem committed dose by the ingestion pathway over a 1-yr period.

groundwater and prevent radionuclide buildup in the soil (DOE, 1990). For any constituents that exceed ESALs, an Ecological Risk Assessment should examine the relationship between the ESALs and DCGs. This is important to providing critical feedback on whether compliance limits protect human and ecological health adequately.

As a result of the BDAT, a proposed new RLWTF has been designed to the 95% stage. The predicted effluent characteristics are such that the modeled discharge water would be essentially void of ions. This essentially distilled water is planned for discharge to the same PRS in Mortandad Canyon that currently is being used. Although it is a complex process requiring study, the "supercleaned" water could serve as an "ion seeker" that will attract radionuclides that are now bonded to soil colloids (Welch, 1980). This may, in essence, remobilize the radionuclides, making them available for vertical and horizontal transport and for biotic uptake. The distance from the PRS to offsite areas is large; remobilized radionuclides may be transported further down canyon, but equilibrium likely will occur well before the offsite boundary. Nevertheless, hydrologic transport of radionuclides is a complex process requiring site-specific investigation.

The remobilization concept may present a unique opportunity to remediate the PRS-affected area. Based on a preliminary review of the scientific literature, there are strong indications that concentrations of both radionuclides and nonradionuclides can be lowered to below SALs and ESALs using *in situ* phytoextraction. Phytoextraction is the term given to the new technology of using large-biomass plants to translocate soil constituents to easily harvested, above-ground, plant parts. This potential remediation opportunity needs further study.

mention to Joel

2.1.1.4. Discussion. With codification of DOE 5400.5 in the Code of Federal Regulations (10 CFR 834), the DCGs are legally available to the EPA for adoption as maximum contaminant levels (MCLs) with which LANL must comply under statutory enforcement (Hanson, 1994). Because of the BDAT study, current plans to replace or upgrade the RLWTF will result in a much cleaner effluent, essentially consisting of distilled water (RTG, 1995a). This water will possess such a void of ions that its discharge is considered "Discharge of Other Liquids," in DOE 5400.5. In this case, a new discharge location is permitted under the NPDES because "liquid discharges, even though uncontaminated, are prohibited in inactive release areas to prevent the further spread of radionuclides previously deposited" (DOE, 1990).

2.1.2. Environmental Setting

2.1.2.1. Topography. LANL is located in north central New Mexico. The Laboratory lies 100 km (62 mi) north-northeast of Albuquerque, New Mexico, and 40 km (25 mi) northwest of Santa Fe, New Mexico. LANL and the adjacent communities of Los Alamos and White Rock occupy 111 km^2 (43 mi^2) of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons (Fig. 5). The orientation of the mesa top/canyon system is east-west to northwest-northeast. Mesa tops on the west have a maximum elevation of 2400 m (7870 ft) and intersect with the eastern flank of the Jemez Mountains. At the east end of the plateau, the mesa tops have a maximum elevation of 1800 m (5900 ft) as they intersect the Espanola Valley and White Rock Canyon. All other mesa tops are at elevations between the west and east extremes (LANL, May 1992).

TA- 50 (Fig. 1) and the RLWTF are located on the north central half of LANL on the Mesita del Buey. TA-50 is bordered by Mortandad Canyon, Ten Site Canyon, Two Mile Canyon, and Canada del Buey. The mesa top elevations in this area range from 2194–2218 m (7200–7280 ft) (LANL, 1992).

2.1.2.2. Climate. Los Alamos is located in an area with a semi-arid, temperate mountain climate. The predominant wind direction is north to northeast with wind speeds generally less than 5.5 mph (40% of the time), but winds do increase to speeds greater than 11 mph (20% of the time). The strongest winds occur in the spring (LANL, May 1992).

On the Pajarito Plateau, average precipitation is 18 in., with one-third of that resulting from snow. Most rainfall (40%) is the result of intense thunderstorms in July and August that can create large volumes of surface run-off. The winter brings an average accumulation of 130 cm (51 in.) of snow, which also adds to run-off in the warmer months (LANL, May 1992).

2.1.2.3. **Geology and Stratigraphy**. Two zones are important to site characterization and remediation: (1) the Vadose Zone and (2) the Upper Saturated Zone. TA- 50 is underlain by Miocene and Pleistocene volcanic and sedimentary rocks. As shown in Fig. 6, the following geologic units underlie TA-50 (listed from above surface to below ground).

- Tshirege (upper) Member of the Bandelier Tuff
- Otowi (lower) Member of the Bandelier Tuff (including Guaje Pumice)
- Guaje Member
- Puye Formation
- Santa Fe Group

The Puye Formation consists of (in descending order)

- the first Puye Conglomerate,
- basaltic lava flows of Chino Mesa, and
- a second Puye Conglomerate.

The soils of the mesa tops surrounding TA-50 are mainly shallow, well-drained, sandy loams. The soils at PRS 50-006(d) belong to the TOCAL Series (Nyhan et al., 1978).

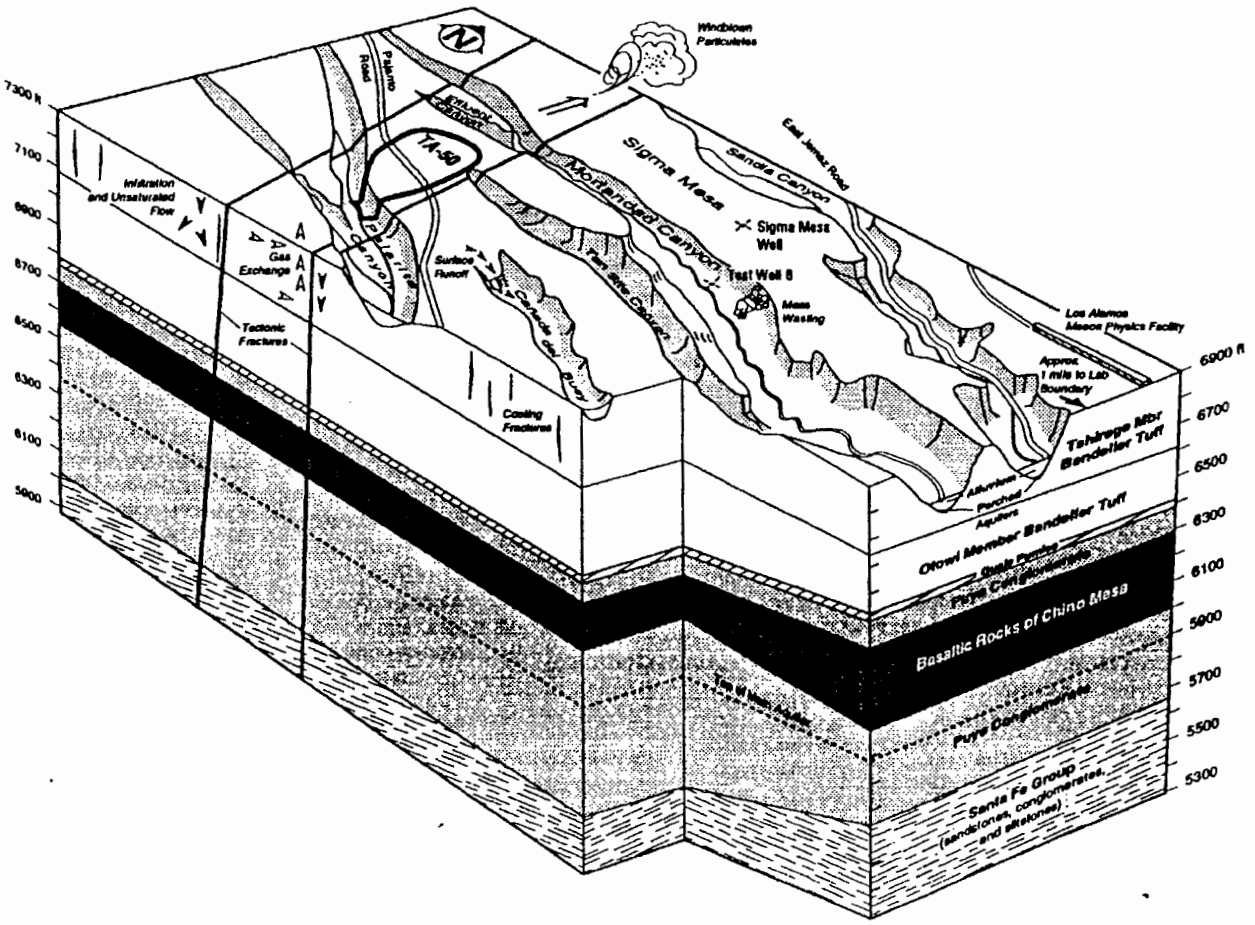

Fig. 6. Schematic block diagram of the geology and stratigraphy of the area surrounding LANL TA-50.

2.1.2.4. **Hydrology.** The surface water hydrology is characterized by ephemeral streams. Runoff from heavy thunderstorms or snows can cause flows that reach the Rio Grande (LANL 1992). Effluent releases from sewage treatment plants, industrial plants, and cooling towers also contribute to limited segment flows in the canyons. Any flow with a high discharge rate (thunderstorm runoff or effluent release) tends to suspend and move large masses of sediment down the canyon, sometimes all the way to the Rio Grande (LANL May 1992).

The groundwater hydrology generally is characterized by three types of systems: (1) shallow alluvium, which is quite permeable; (2) perched water; and/or (3) the main aquifer.

2.1.2.5. **Ecology.** The primary target groups of the ecotoxicological screen were the mammals that use Mortandad Canyon partially or totally for their foraging needs. Table 2 lists each mammal known to be found in Mortandad Canyon along with information on the ecological niche(s) occupied and the animal exposure guild (foraging mode).

3.0. METHODOLOGY

3.1. Endpoint Selection

Application of the screening methodology to PRS 50-006(d), also called SWMU 50-006(d), resulted in the selection of endpoints that focused on community effects on four key animal exposure guilds known to have access to the area known as Mortandad Canyon. The key animal exposure guilds are (1) small herbivore mammal, (2) large herbivore mammal, (3) small carnivore mammal, and (4) small omnivore mammal. In this study, a guild is defined as species that use similar resources in similar ways (Root 1967). The community effect endpoint for each guild is based on calculated ESALs discussed in Sec. 3.4.

3.2. Hazard Identification and Potential Contaminants of Concern

Hazard identification includes listing the constituents selected as candidates for Potential Contaminants of Concern (PCOCs). The basis for generating the list of 121 candidates was knowledge of chemicals processed during historical site activities; i.e., discharge into Mortandad Canyon. Section 3.3 summarizes the sampling and analysis plan used to acquire and measure the amounts of these candidate PCOCs and sample locations are identified in Fig. 2. Candidate PCOCs are listed in Table 3.

3.3. Sampling and Analysis

In June 1993, a four-phase sampling and analysis scheme was employed at PRS 50-006(d)/ Mortandad Canyon sampling area, per RFI Work Plan LA-UR-92-969 (LANL 1992). The four phases were (1) field survey, (2) field screening, (3) field sampling, and (4) laboratory analysis. Every third sample was subjected to the following analyses.

- Gamma spectrometry
- Tritium
- Total Uranium
- Isotopic Uranium
- Isotopic Plutonium
- Strontium-90
- Volatile Organic Aromatics (SW 8246)
- Semi-Volatile Organic Aromatics (SW 8270)
- Metals (SW 6016)
- Polychlorinated biphenyls (SW 8080)

TABLE 2

SPECIES LIST FOR MAMMALS IDENTIFIED WITHIN MORTANDAD CANYON (FROM TA-52 TO SAN ILDEFONSO SACRED AREA)[a,b]

Common Name[a]	Species Name[a]	Niche(s) Occupied[b]	Animal Exposure Guild[b]
Deer mouse	*Peromyscus maniculatus*	Primary consumer/herbivore • Juniper/grassland upland climax • Pinyon/juniper woodland upland climax and early succession • Ponderosa pine upland climax, early succession and riparian • Mixed-conifer forest upland climax and early succession • Spruce/fir upland climax	Small herbivore mammal
Brush mouse	*Peromyscus boylii*	Primary consumer/herbivore • Pinyon/juniper woodland upland climax • Spruce/Fir upland climax	Small herbivore mammal
Pocket gopher	*Thomomys bottae*	Primary consumer/ground-roots • Ponderosa pine forest upland climax	Small herbivore mammal
Long-tailed vole	*Microtus longicaudus*	Primary consumer/ground-grazer • Ponderosa pine forest early succession • Mixed-conifer forest early succession • Spruce/fir upland climax	Small herbivore mammal
Colorado chipmunk	*Eutamias minimus*	Primary consumer/herbivore • Pinyon/juniper woodland upland climax foliage-seed • Ponderosa pine forest upland climax and early succession • Mixed-conifer forest upland climax	Small herbivore mammal
Silky pocket mouse	*Perognathus flavus*	Primary consumer/ground-seed • Ponderosa pine forest upland climax	Small herbivore mammal
Rocky Mountain elk	*Cervus claphus nelsoni*	Primary consumer/ground grazer herbivore • Juniper/grassland upland climax • Pinyon/juniper woodland upland climax • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax • Spruce/fir upland climax	Large herbivore mammal
Mule deer	*Odocoileus hemionus*	Primary consumer/ground browser herbivore • Juniper/grassland upland climax • Pinyon/juniper woodland upland climax • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax • Spruce/fir upland climax	Large herbivore mammal
Black bear	*Ursus americanus*	Omnivore • Juniper woodland upland climax • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax scavenger and omnivore • Spruce/fir upland climax	Large omnivore mammal
Coyote	*Canis latrans*	Secondary consumer/predator/carnivore • Juniper/grassland upland climax • juniper woodland upland climax • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax • Spruce/fir upland climax	Medium carnivore mammal[c]
Porcupine	*Erethizon dorsatum*	Primary consumer/foliage-cambrium • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax	Small herbivore mammal

[a] LANL 1992
[b] Ebinger, et al., 1995
[c] Note: Medium mammal is not a listed animal exposure guild body size. However, for the purposes of this report, a small mammal exposure guild is considered to be protective of the medium mammal.

TABLE 3

CANDIDATE POTENTIAL CONTAMINANTS OF CONCERN AT PRS 50-006(D)

MORTANDAD CANYON

Semi-volatiles	Semi-volatiles (cont)	Volatiles	Inorganics	Radionuclides
Acenapthene	Fluoranthene	Acetone	Antimony	Americium-241
Acenapthylene	Fluorene	Benzene	Arsenic	Barium-133
Anthracene	Hexachlorobenzene	Benzoic acid	Barium	Cesium-134
Aroclor[Mixed-]	Hexachlorobutadiene	Bromodichloromethane	Beryllium	Cesium-137
Benzo[a]anthracene	Hexachlorocyclopentadiene	Bromoform	Cadmium	Cobalt-57
Benzo[a]pyrene	Hexachloroethane	Bromomethane	Cr (III)	Cobalt-60
Benzo[b]fluoranthene	Indeno[1,2,3-cd]pyrene	Butanone[2-]	Cr (IV)	Europium-152
Benzo[g,h,i]perylene	Isophorone	Carbon disulfide	Lead	Plutonium-238
Benzo[k]fluoranthene	2-Methylnapthalene	Carbon tetrachloride	Mercury	Plutonium-239
Bis(2-chlorethoxy)methane	Methylphenol[2-]	Chlorobenzene	Nickel	Potassium-40
Bis(2-chloroethyl)ether	Methylphenol[4-]	Chloroethane	Selenium	Radium-226
Bis(2-chloroisopropyl)ether	Napthalene	Chloroform	Silver	Strontium-90
Bis-(2-ethylhexyl)phthalate	Nitroaniline[2-]	Chloromethane	Thallium	Thorium-232
Bromodiphenyl ether[4-]	Nitroaniline[3-]	Dichlorethane[1,1-]		Tritium
Butyl benzyl phthalate	Nitroaniline[4-]	Dichloroethane[1,2-]		Uranium-234
Chloro-3-methylphenol[4-]	Nitrobenzene	Dichlorethene[1,1-]		Uranium-235
Chloroaniline[4-]	Nitrophenol[2-]	Dichlorethylene[trans-1,2-]		Uranium-238
o-Chlorophenol	Nitrophenol[4-]	Dichlorethylene[cis-1,2-]		
Chrysene	Nitrosodi-n-ropylamine[N-]	Dichloropropane[1,2-]		
Dibenzo[a,h]anthracene	Nitrosodiphenylamine[N-]	Dichloropropene[cis-1,3-]		
Dibenzofuran	Pentachlorophenol	Dichloropropene[trans-1,3-]		
Di-n-butyl phthalate	Phenanthrene	Ethyl benzene		
Di-n-octyl phthalate	Phenol	Hexanone[2-]		
Dichlorbenzene[o-]	Pyrene	Methylene chloride		
Dichlorbenzene[m-]	Trichlorobenzene[1,2,4-]	Styrene		
Dichlorbenzene[p-]	Trichlorophenol[2,4,5-]	Tetrachloroethane[1,1,1,2-]		
Dichlorobenzidiene[3,3'-]	Trichlorophenol[2,4,6-]	Tetrachloroethane[1,1,2,2-]		
Dichlorphenol[2,4-]		Trichloroethane[1,1,1-]		
Diethyl phthalate		Trichloroethane[1,1,2-]		
Dimethyl phthalate		Trichloroethene		
Dimethylphenol[2,4-]		Vinyl chloride		
Dinitrophenol[2,4-]		Xylene[mixed-]		

$NO_3^- - N$

Shallow boreholes (3 ft deep) were made in groups of three along nine linear transects (Fig. 2) that were perpendicular to the stream channel. The first transect was in line with Outfall 051, and the additional eight transects were located at 100-ft intervals extended along the line of drainage, for a total horizontal distance of 800 ft. Each borehole served as a sample point; thus, there were three sample points per transect. Of the three samples, one was positioned in the channel bottom, one was on the north-facing slope, and one was on the south-facing slope. Sample depths within a borehole included 0–0.5 ft ("surface level"), 1.5–2.5 ft, and 3–4 ft. A total of 27 samples was taken from the sampling area at each depth. Beyond reviewing the data for all depths for selecting the maximum soil concentration for comparison against the ESALs and/or background levels, only surface-level radionuclide data are analyzed and presented. Data for all PCOCs for all depths will be analyzed and presented in a subsequent risk assessment report.

3.4. Radionuclide Data Analysis

Surface sample data were reduced and plotted for six radionuclides. Assuming that the samples within a transect constitute replications, data for the six radionuclides were subjected to analysis of variance and ^{241}Am and ^{90}Sr data were subjected to the Duncan's new multiple-range test to evaluate the statistical significance of the spatial changes in radionuclide concentration. The spatial variation (error) is important to understanding the relationship, if any, of discharge from Outfall 051 with the soil contaminant data. Assuming that samples within a transect are replications to statistically analyze spatial changes using least squares analyses is plausible because slope aspect is held constant for each transect; i.e., each transect has a north-facing, a south-facing, and a channel bottom sample.

3.5. Exposure/Dose-Response Estimation

The exposure/dose-response estimation was based on the calculation of the ESAL developed by Ebinger et al. (1994). The ESAL is a screening-level tool used as a benchmark to determine the potential adverse ecological effects at a PRS that may lead to a decision of No Further Action (NFA) or an Ecological Risk Assessment. The ESAL is built on foraging mode, behaviors, types of food consumed, the amount consumed, and the No Observed Adverse Effect Levels (NOAELs) from the EPA's Integrated Risk Information System (IRIS) database (EPA 1992) or Health Effects Assessment Summary Tables (HEAST) (EPA 1993). ESALs were developed for three taxa: mammals, birds, and reptiles. Species within each taxa were grouped into categories having similar exposure profiles because of a common foraging mode. Exposure guilds were developed for carnivores, insectivores, herbivores, grainivores, nectivores, and omnivores. Carnivores primarily consume other vertebrates, insectivores consume arthropods, herbivores feed primarily on the stems and leaves of vegetation, grainivores eat seeds, nectivores consume nectar, and omnivores consume a variety of all these food types. Total ingestion rates and soil ingestion rates for any bird, mammal, or reptile were based on the empirical relationship between body size and metabolic rate (Ebinger et al., 1994).

3.6. Ingestion Estimation

For the preliminary ecotoxicological screening of PRS 50-006(d), the selected animal exposure guilds of concern are within the mammal taxa. The equations in Appendix A were used by Ebinger et. al. (1994) to estimate food and soil ingestion rates for key mammal guilds potentially affected by PRS 50-006(d).

Tables B-1 through B-3 in Appendix B list the parameters used to calculate the intake rates for the key animal exposure guilds in this screening. Table B-4 lists the soil, water, and intake rate for the key animal exposure guilds considered in this report (Ebinger et al., 1994).

3.7. ESAL for Nonradionuclides

The equations for calculating ESALs for systemic nonvolatile inorganic and organic contaminants and nonvolatile carcinogenic contaminants are presented in Appendix C as defined in Ebinger et al. (1994).

3.8. ESAL for Radionuclides

Because radionuclide ESALs have not been developed yet, the radionuclide ESALs used in the Screen are based on the conservative assumptions used to calculate human health Screening Action Levels (SALs) (Ebinger et al., 1995). It is assumed that using SALs that are protective of an individual also will protect an ecological community. Using SALs as ESALs may be conservative; however, the main purpose of the screen is to focus risk assessors and risk managers on PCOCs that need evaluation in a risk assessment, which is the appropriate tool for considering factors that promote or disfavor conservatism. Using SALs as ESALs may not be conservative in all cases. For example, small herbivores, one of the animal guilds targeted in this screen, are present in the contaminated area 100% of the time in some cases. The estimated human SALs for ingestion of radionuclide contaminants in soil at LANL were determined by using the RESRAD computer code (Gilbert et al., 1989). The estimate takes into account all pathways, including external exposure from gamma emitters, inhalation of contaminated dust particles and/or radioactive gases, ingestion of contaminated soil and plants, and consumption of contaminated water. Two assumptions were made.

1. The radiation dose limit for an individual is 10 mrem/yr.
2. The consumption rate of contaminated soil is 200 mg/day.

Refer to LANL (1993) for more detail.

Results based on ESALs or SALs generally are sufficiently conservative to be protective of other ecological components such as plants and microbes.

3.9. Risk Characterization/Ecotoxicological Screening Procedure

A potential ecological risk screening was carried out for each PCOC candidate using the following steps.

(1) **Upper Tolerance Limit (UTL) Comparison**
When data are available, compare the maximum soil concentration with the UTL for the background concentration data at LANL, which is available in the Environmental Restoration Program's "Facility for Information Management, Analysis, and Display" (FIMAD) database (LANL, 1993). Record comparison as "yes" or "no" based on whether the soil concentration is greater than or equal to the UTL (Meyers and Ferenbaugh, 1995).

(2) **Habitat Screening Model (Meyers and Ferenbaugh, 1995)**
Determine if the PRS and adjacent canyon require a complete ESAL screening (continue with step 3) or whether the site can be proposed for NFA based on the habitat exposure model.

(3) **ESAL Comparison**
Nonradionuclides: Compare the maximum soil concentration with the ESAL developed by Ebinger et al. (1994). Record comparison as "yes" or "no" based on whether the soil concentration is greater than or equal to the ESAL.
Radionuclides: Compare the maximum soil concentration with the human health SAL developed by LANL's Environmental Restoration Program and available in FIMAD.

(4) **Risk Ratio Calculation**
A risk ratio is calculated using the following equation (Ebinger et al., 1994):

Risk Ratio (RR) = Soil Concentration/ESAL Value,

where RR = or > 1 establishes a chemical as a PCOC, potentially posing unacceptable risk to the ecology of the area.

(5) **Proposed Status**

PCOC(1): Potential Contaminant of Concern, Category 1. Decision based on comparison of maximum soil concentration (Max. SC) with the UTL and ESAL. Result: UTL < Max. SC >ESAL.
PCOC(2): Potential Contaminant of Concern, Category 2. Decision based on comparison of Max. SC with the ESAL only because of unavailability of UTL. Result: Max. SC > ESAL.
PCOC(3): Potential Contaminant of Concern, Category 3. Decision based on comparison of Max. SC with the UTL only because of unavailability of ESAL. Result: Max. SC > UTL
PCOC(4): Potential Contaminant of Concern, Category 4. Decision based on comparison of Max. SC with the UTL and ESAL. Result: UTL < Max. SC < ESAL.
DI: Data inadequate. Decision based on unavailability of both UTL or ESAL values
NFA(1): No Further Action, Category 1. Decision based on comparison Max. SC with the UTL and ESAL. Result: UTL > Max. SC < ESAL.

A status from the list below is proposed for each analyzed soil constituent.

NFA(2): No Further Action, Category 2. Decision based on comparison Max. SC with the ESAL only because of the unavailability of UTL. Result: Max. SC < ESAL.
NFA(3): No Further Action, Category 3. Decision based on comparison Max. SC with the UTL only because of the unavailability of ESAL. Result: Max. SC < UTL.
NFA(4): No Further Action, Category 4. Decision based on comparison Max. SC with the UTL and ESAL. Result: UTL > Max. SC > ESAL.

(6) **Statistical Analysis**

Analyses of variance were applied to the six selected radionuclide data sets to generally test for significant differences between transect means within any given radionuclide data set. Duncan's new multiple range test was performed on the ^{242}Am and ^{90}Sr data sets to identify whether significant ($\alpha = 0.01$) differences existed between any two specific transect means.

4.0. RESULTS AND DISCUSSION

4.1. Habitat Screening

The habitat screening results are presented in Table 4. At PRS 50-006(d), the landscape condition would categorize as 2, and the accessibility of the PRS to ecological receptors would categorize as a 2–3. The result indicates an ESAL screening should be completed for this site because exposure is likely.

- **Landscape Condition (land use)**

  1 Heavy Industrial/Residential Development
  2 Light/Moderate Disturbance
  3 Little or No Disturbance, Special Habitats (e.g., wetlands, endangered species habitat).

- **Accessibility of PRS to Ecological Receptors**

  0 No access
  1 Low
  2 Moderate
  3 High

TABLE 4

HABITAT SCREENING MODEL RESULTS AT PRS 50-006(D)/MORTANDAD CANYON

(MEYERS AND FERENBAUGH, 1995)

Receptor Access	Landscape Condition		
	1	2	3
0	NFA		
1			
2	NFA/ESA	PRS 50-006(d)	
3	ESA		

4.2. Sampling Results

Table 5 lists the analytical results for six radionuclides sampled in the 0–6 in. soil depth in PRS 50-006 (d). Transect locations and sampling points were shown in Fig. 2. Each group of three samples (Fig. 2) will be referred to by transect number as follows: Transect #1 = samples 1, 2, 3; Transect #2 = samples 4, 5, 6; and so on. Figure 7 shows the concentration of the radionuclides averaged within each transect. Analysis of variance generated F values that were not significant, at $\alpha = 0.01$ and 8/18 df, for all six radionuclides. F values were 1.7, 1.5, 0.6, 0.7, 1.7, and 1.3 for ^{241}Am, ^{238}Pu, ^{239}Pu, ^{232}Th, ^{90}Sr, and ^{137}Cs, respectively. This indicates that there generally is no real difference between the transect means. For the nuclides with the highest calculated F, ^{241}Am and ^{90}Sr, Duncan's test was used to identify whether significant differences between any two specific transect means existed. No significant differences were detected.

Radionuclide and total alpha concentrations followed the general pattern; that is, concentrations were generally higher at transects 7, 8, and 9 than at the up-canyon transects that are closer to the Outfall. For example, total alpha averaged 26.9 pCi/g at Transect #8 compared to 10.0 pCi/g at Transect #2. It is likely that high erosion at the upper end of the channel washes radionuclides to the lower end of the channel, where a human-made sediment trap then retains the wash-down. There is visual evidence of severe erosion at Transect #2, and summer thunderstorms do occur at intensities that are capable of eroding surface soil (Gonzales et al., 1995). The sediment trap is located approximately at Transect #8. The standard deviation averaged across all transects for four alpha-emitting radionuclides was 3.1 pCi/g.

The nine-transect mean alpha concentration averaged for four radionuclides was 19.7 pCi/g. This is higher than the upper 95% confidence limit values reported in a different study for all 15 onsite locations for the period 1976–1981 (Fresquez et al., 1995) and is 242% of the mean gross alpha concentration measured in the same area between 1975 and 1977 (Purtymun et al., 1980). Both of these previous studies sampled 0–2 in. soils. The mean 0–6 in. ^{137}Cs concentration in this study averaged across the 800-ft sampling distance, 18.0 pCi/g, compares to a 0–5 in. ^{137}Cs concentration of 1004 pCi/g for a 525-ft distance and 1152 pCi/g for a 1050-ft distance for the period 1972–1973 (Hakonson et al., 1973). Six of nine transects in this study had a higher gross alpha concentration than all 15 onsite locations in the study by Fresquez et al. (1995).

The results of subsurface sampling by LANL are not reported here.

4.3. Ecotoxicological Screen Results

A summary of the screen results is presented in Table 6. Detailed screen results are presented in Appendix D, Tables D-1 (Small Herbivore Mammal), D-2 (Large Herbivore Mammal), D-3 (Small Carnivore Mammal), and D-4 (Small Omnivore Mammal). Of 121 constituents (59 semi-volatile organics, 32 volatile organics, 13 inorganics, and 17 radionuclides) suspected (based on site history) to be present at PRS 50-006(d), 42 of these met the criteria of one of the PCOC categories [PCOC(1), PCOC(2), PCOC(3), or PCOC(4)], and there were inadequate data ("DI") to make a determination on 20 constituents. The breakdown included 6 PCOC(1) chemicals, 27 PCOC(2) chemicals, 2 PCOC(3) chemicals, and

TABLE 5

SUMMARY OF THE RADIONUCLIDE SAMPLING RESULTS FOR THE 0–6 IN. SOIL DEPTH IN PRS 50-006(D)/MORTANDAD CANYON AREA, LANL (ALL VALUES ARE PCI/G)*

	TRANSECT NUMBER								
Replication No.	1	2	3	4	5	6	7	8	9
Am-241									
1	7.22	8.18	16.53	10.50	6.00	9.03	19.08	18.22	6.13
2	14.33	7.66	9.24	8.37	24.20	6.64	5.21	5.73	7.68
3	6.54	5.58	4.09	6.65	6.88	5.28	2.98	9.23	9.01
Mean	9.36[a]	7.14[a]	9.95[a]	8.51[a]	12.36[a]	6.98[a]	11.94[a]	11.06[a]	7.61[a]
s	4.31	1.38	6.25	1.93	10.26	1.90	9.13	6.44	1.44
Pu-238	1.96	0.08	3.08	0.24	0.67	0.44	4.19	5.91	1.30
	4.41	0.01	2.86	4.09	3.67	2.73	0.03	1.11	3.56
	1.91	0.01	0.60	0.87	0.00	0.05	0.01	7.37	4.18
Mean	2.76	0.03	2.18	1.73	1.45	1.07	1.41	4.80	3.15
s	1.43	0.04	1.37	2.07	1.95	1.45	2.40	3.28	1.27
Pu-239	4.80	0.44	13.23	0.93	1.38	1.25	16.13	17.56	5.70
	11.68	0.03	11.01	10.43	19.73	5.11	0.16	2.97	7.88
	3.97	0.01	0.80	1.52	0.03	0.31	0.15	4.89	13.21
Mean	6.82	0.16	8.35	4.29	7.04	2.22	5.48	8.47	8.68
s	4.23	0.24	6.63	5.32	11.01	2.54	9.23	7.93	3.19
Th-232	2.08	3.23	2.49	3.89	2.24	3.21	1.86	2.53	2.62
	2.56	2.80	2.46	2.53	2.36	2.03	3.01	2.06	3.16
	2.55	1.86	2.68	2.25	2.84	3.22	3.50	3.06	4.38
Mean	2.40	2.63	2.54	2.89	2.48	2.82	2.73	2.55	3.39
s	0.27	0.70	0.12	0.88	0.32	0.68	0.70	0.50	0.90
Sr-90	0.54	0.51	1.05	0.97	0.05	5.14	1.71	3.01	0.54
	0.33	0.59	0.43	1.49	1.17	1.03	0.89	0.93	1.48
	1.83	0.37	1.38	1.39	0.00	1.48	1.37	2.75	1.48
Mean	0.90[a]	0.49[a]	0.95[a]	1.28[a]	0.39[a]	2.55[a]	1.32[a]	2.23[a]	1.17[a]
s	0.81	0.11	0.48	0.28	0.68	2.25	0.41	1.13	0.54
Cs-137	3.48	2.96	19.13	4.76	6.71	7.58	31.56	67.69	6.05
	5.71	0.34	13.25	77.90	42.90	28.30	1.054	14.26	43.53
	5.44	0.44	3.56	11.70	0.50	2.89	1.16	50.15	32.95
Mean	4.88	1.25	11.98	31.45	16.70	12.92	11.26	44.03	27.51
s	1.22	1.49	7.86	40.37	22.90	13.52	17.58	27.23	19.32
Alpha	21.34	9.96	23.02	17.42	23.33	13.10	18.77	26.87	22.94

[a] Means with different letters are significantly different at $\alpha = 0.01$.

* Values in Tables 6 and D-1 through D-4 are not necessarily found in this table — values in Tables 6 and D-1–D-4 are maximums selected from any of the three depths, whereas values in Table 5 present only surface soil samples

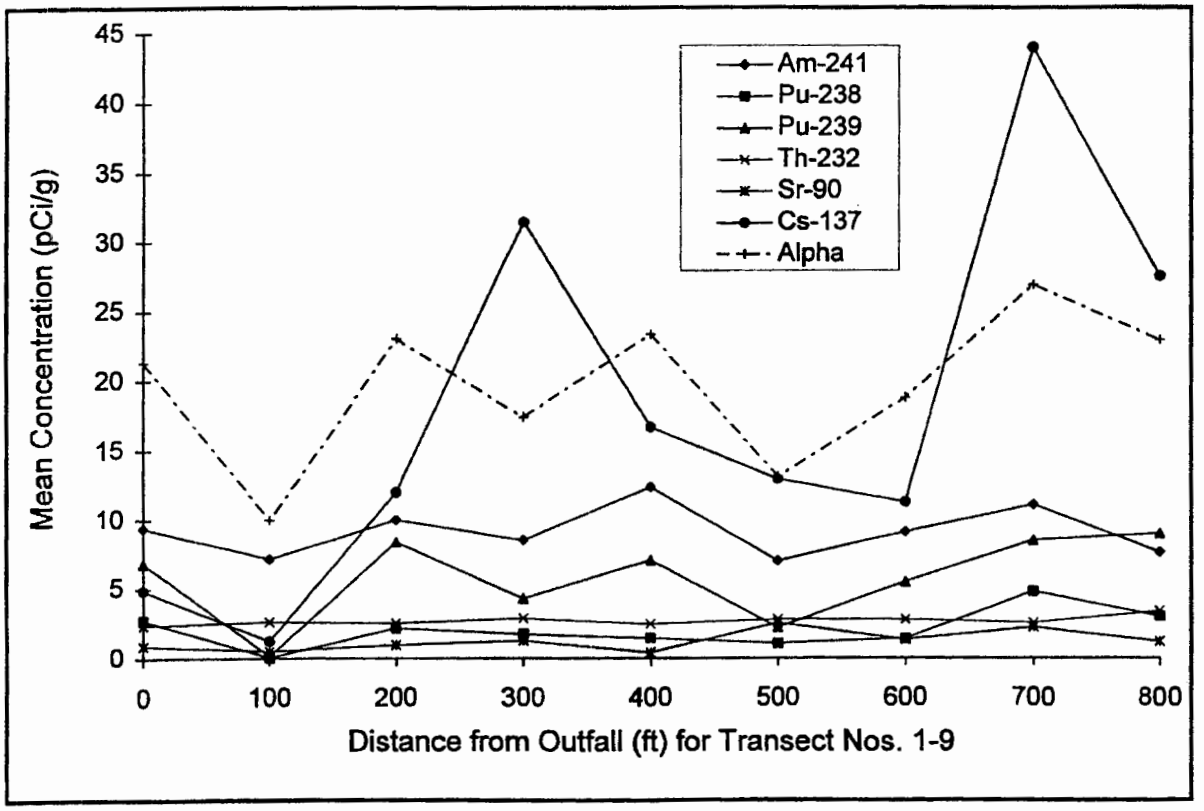

Fig. 7. Mean concentration of radioactive isotopes at 0–6 in. soil depth in PRS 50-006(d), Operable Unit 1147, Mortandad Canyon, LANL.

7 PCOC(4) chemicals. The PCOC list includes 22 semi-volatile organics, 3 volatile organics, 6 inorganics, and 11 radionuclides.

4.4. Discussion of Results

A PCOC result does not necessarily imply that a constituent cannot be proposed for NFA after further evaluation. A PCOC listing only focuses risk assessors and risk managers on the constituents that need to be studied further in a risk assessment.

The nonradionuclide results are based on the conservative assumptions used in the calculation of the ESAL; furthermore, the results are based on the most conservative ESAL or most sensitive animal exposure guild within a taxa. In this screen, the primary sensitive animal exposure guild was the small herbivore mammal. However, in five instances (Indeno[1,2,3-cd]pyrene, N-Nitrosodiphenylamine, N-nitrosodi-n-propylamine, Pentachlorophenol, and Benzoic acid), the small omnivore mammal was the most sensitive animal exposure guild.

The general order of the least to most sensitive mammal exposure guild is large herbivore, small carnivore, small omnivore, and small herbivore. This is somewhat contrary to the general tendency but has the potential for greater impact as follows. Generally, the guilds at the top of a food chain (carnivores) are more affected because of their greater susceptibility to biomagnification. The reason that the potential exists for greater ecological impact when the small herbivore is most sensitive is that lower trophic levels feed higher trophic levels; therefore, impact on lower trophic levels

TABLE 6

POTENTIAL CONTAMINANTS OF CONCERN AT PRS 50-006(D)/MORTANDAD CANYON AREA

PCOC Semi-volatile	Animal Exposure Guild	Max. SC (mg/kg)		UTL (mg/kg)	ESAL[a] (mg/kg)		Risk Ratio	Proposed Status
Aroclor[Mixed-]	Small carnivore mammal				4.89E-02			
	Large herbivore mammal				2.62E-01			
	Small omnivore mammal	1.10E-01	max.		1.05E-02			
	Small hebivore mammal	1.00E+00	crql	---	**7.70E-03**		1.30E+02	PCOC(2)
Benzo[a]pyrene	Small carnivore mammal				1.02E-02	ca		
	Large herbivore mammal				7.29E-01	ca		
	Small omnivore mammal				8.55E-04	ca		
	Small hebivore mammal	6.60E-01	crql	---	**6.29E-04**	ca	1.05E+03	PCOC(2)
Benzo[b]fluoranthene	Small carnivore mammal				6.77E-02	ca		
	Large herbivore mammal				4.80E+00	ca		
	Small omnivore mammal				5.70E-03	ca		
	Small hebivore mammal	6.60E-01	crql	---	**4.20E-03**	ca	1.57E+02	PCOC(2)
Benzo[g,h,i]perylene	Small carnivore mammal				4.66E-01	ca		
	Large herbivore mammal				3.32E+01	ca		
	Small omnivore mammal				3.90E-02	ca		
	Small hebivore mammal	6.60E-01	crql	---	**2.87E-02**	ca	2.30E+01	PCOC(2)
Benzo[k]fluoranthene	Small carnivore mammal				1.55E-01	ca		
	Large herbivore mammal				1.11E+01	ca		
	Small omnivore mammal				1.30E-02	ca		
	Small hebivore mammal	6.60E-01	crql	---	**9.60E-03**	ca	6.88E+01	PCOC(2)
Bis(2-chloroethyl)ether	Small carnivore mammal				6.77E-02	ca		
	Large herbivore mammal				4.80E+00	ca		
	Small omnivore mammal				5.70E-03	ca		
	Small hebivore mammal	6.60E-01	crql	---	**4.20E-03**	ca	1.57E+02	PCOC(2)
Bis(2-chloroisopropyl)ether	Small carnivore mammal				1.10E+00	ca		
	Large herbivore mammal				7.60E+01	ca		
	Small omnivore mammal				8.91E-02	ca		
	Small hebivore mammal	6.60E-01	crql	---	**6.56E-02**	ca	1.01E+01	PCOC(2)
Bis(2-ethylhexyl)phthalate	Small carnivore mammal				5.30E+00	ca		
	Large herbivore mammal				3.80E+02	ca		
	Small omnivore mammal	3.90E-01	max.		4.46E-01	ca		
	Small hebivore mammal	6.60E-01	crql	---	**3.28E-03**	ca	2.01E+02	PCOC(2)
Chrysene	Small carnivore mammal				2.30E+00	ca		
	Large herbivore mammal				1.66E+02	ca		
	Small omnivore mammal				1.95E-01	ca		
	Small hebivore mammal	6.60E-01	crql	---	**1.43E-03**	ca	4.62E+02	PCOC(2)
Dibenzo[a,h]anthracene	Small carnivore mammal				9.20E-03	ca		
	Large herbivore mammal				6.57E-01	ca		
	Small omnivore mammal				7.70E-04	ca		
	Small hebivore mammal	6.60E-01	crql	---	**5.67E-04**	ca	1.16E+03	
Dichlorobenzene[p-]	Small carnivore mammal				2.30E+03	ca		
	Large herbivore mammal				2.22E+02	ca		
	Small omnivore mammal				2.60E-01	ca		
	Small hebivore mammal	6.60E-01	crql	---	**1.91E-03**	ca	3.46E+02	PCOC(2)
Dichlorobenzidiene[3,3']	Small carnivore mammal				1.66E-01	ca		
	Large herbivore mammal				1.18E+01	ca		
	Small omnivore mammal				1.39E-02	ca		
	Small hebivore mammal	1.30E+00	crql	---	**1.02E-02**	ca	1.27E+02	PCOC(2)
Dichlorophenol[2,4-]	Small carnivore mammal				2.10E+00			
	Large herbivore mammal				1.12E+01			
	Small omnivore mammal				4.50E-01			
	Small hebivore mammal	6.60E-01	crql	---	**3.32E-01**		1.99E+00	PCOC(2)

TABLE 6 (CONT)

PCOC Semi-volatile	Animal Exposure Guild	Max. SC (mg/kg)		UTL (mg/kg)	ESAL[a] (mg/kg)		Risk Ratio	Proposed Status
Dinitrophenol [2,4-]	Small carnivore mammal				1.40E+00			
	Large herbivore mammal				7.50E+00			
	Small omnivore mammal				3.01E-01			
	Small hebivore mammal	1.30E+00	crql	---	**2.21E-01**		5.88E+00	PCOC(2)
Hexachlorobenzene	Small carnivore mammal				5.59E-01			
	Large herbivore mammal				3.00E+00			
	Small omnivore mammal				1.20E-01			
	Small hebivore mammal	6.60E-01	crql	---	**8.85E-02**		7.46E+00	PCOC(2)
Hexachlorobutadiene	Small carnivore mammal				9.55E-01	ca		
	Large herbivore mammal				6.82E+01	ca		
	Small omnivore mammal				8.00E-02	ca		
	Small hebivore mammal	6.60E-01	crql	---	**5.88E-02**	ca	1.12E+01	PCOC(2)
Indeno[1,2,3-cd]pyrene	Small carnivore mammal				4.38E-02	ca		
	Large herbivore mammal				3.10E+00	ca		
	Small omnivore mammal	6.60E-01	crql	---	**7.81E-04**	ca	8.45E+02	PCOC(2)
	Small hebivore mammal				2.70E-03	ca		
Nitrosodiphenlyamine[N-]	Small carnivore mammal				1.52E+01	ca		
	Large herbivore mammal				1.10E+03	ca		
	Small omnivore mammal	6.60E-01	crql	---	**2.70E-05**	ca	2.44E+04	PCOC(2)
	Small hebivore mammal				9.37E+02	ca		
Nitrosodi-n-propylamine[N-]	Small carnivore mammal				1.06E-02	ca		
	Large herbivore mammal				7.60E-01	ca		
	Small omnivore mammal	6.60E-01	crql	---	**1.90E-04**	ca	3.47E+03	PCOC(2)
	Small hebivore mammal				6.56E-04	ca		
Nitrobenzene	Small carnivore mammal				3.20E+00			
	Large herbivore mammal				1.72E+01			
	Small omnivore mammal				6.92E-01			
	Small hebivore mammal	6.60E-01	crql	---	**5.09E-01**		1.30E+00	PCOC(2)
Pentachlorophenol	Small carnivore mammal				2.09E+01			
	Large herbivore mammal				1.13E+02			
	Small omnivore mammal	3.30E+00	crql	---	**1.30E+00**		2.54E+00	PCOC(2)
	Small hebivore mammal				3.30E+00			
Trichlorophenol[2,4,6-]	Small carnivore mammal				6.80E+00	ca		
	Large herbivore mammal				4.84E+02	ca		
	Small omnivore mammal				5.67E-01	ca		
	Small hebivore mammal	6.60E-01	crql	---	**4.17E-01**	ca	1.58E+00	PCOC(2)
PCOC Volatile	**Animal Exposure Guild**	**Max. SC (mg/kg)**		**UTL (mg/kg)**	**ESAL[a] (mg/kg)**		**Risk Ratio**	**Proposed Status**
Benzene	Small carnivore mammal				2.60E+00	ca		
	Large herbivore mammal				1.83E-02	ca		
	Small omnivore mammal				2.15E-01	ca		
	Small hebivore mammal	5.00E-03	crql	---	**1.58E-03**	ca	3.16E+00	PCOC(2)
Benzoic acid	Small carnivore mammal				3.11E+01			
	Large herbivore mammal				1.67E+02			
	Small omnivore mammal	5.70E+00		---	**1.90E+00**		3.00E+00	PCOC(2)
	Small hebivore mammal				4.90E+00			
Vinyl chloride	Small carnivore mammal				3.92E-02	ca		
	Large herbivore mammal				2.80E+00	ca		
	Small omnivore mammal				3.30E-03	ca		
	Small hebivore mammal	1.00E-02	crql	---	**2.40E-03**	ca	4.17E+00	PCOC(2)
PCOC Inorganic	**Animal Exposure Guild**	**Max. SC (mg/kg)**		**UTL (mg/kg)**	**ESAL[a] (mg/kg)**		**Risk Ratio**	**Proposed Status**
Chromium (III)	Small carnivore mammal				7.12E+02			
	Large herbivore mammal				5.50E+03			
	Small omnivore mammal				2.21E+02			
	Small hebivore mammal	5.60E+01		3.42E+01	**1.62E+02**		3.46E-01	PCOC(4)

TABLE 6 (CONT)

PCOC Semi-volatile	Animal Exposure Guild	Max. SC (mg/kg)		UTL (mg/kg)	ESAL[a] (mg/kg)		Risk Ratio	Proposed Status
Chromium (IV)	Small carnivore mammal				1.68E+01			
	Large herbivore mammal				9.00E+01			
	Small omnivore mammal				3.60E+00			
	Small hebivore mammal	5.60E+01		3.42E+01	**2.70E+00**		2.07E+01	PCOC(1)
Lead	Small carnivore mammal				6.30E+00			
	Large herbivore mammal				3.37E+01			
	Small omnivore mammal				1.40E+00			
	Small hebivore mammal	7.00E+01		3.90E+01	**9.96E-01**		7.03E+01	PCOC(1)
Mercury	Small carnivore mammal				2.20E+00			
	Large herbivore mammal				1.20E+01			
	Small omnivore mammal				4.81E-01			
	Small hebivore mammal	2.00E-01		1.00E-01	**3.54E-01**		5.65E-01	PCOC(4)
Nickel	Small carnivore mammal				3.49E+01			
	Large herbivore mammal				1.87E+02			
	Small omnivore mammal				7.50E+00			
	Small hebivore mammal	4.80E+01		2.67E+01	**5.50E+00**		8.73E+00	PCOC(1)
Thallium	Small carnivore mammal				---			
	Large herbivore mammal				---			
	Small omnivore mammal	3.40E-01	max.		---			
	Small hebivore mammal	1.20E+00	crql	9.00E-01	---		---	PCOC(3)
PCOC Radionuclide	**Animal Exposure Guild**	**Max. SC (pCi/g)**		**UTL (pCi/g)**	**SAL (pCi/g)**		**Risk Ratio**	**Proposed Status**
Americium-241	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	7.10E+01		---	**1.70E+01**		4.18E+00	PCOC(2)
Cesium-137	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	3.73E+02		1.40E+00	**4.00E+00**		9.33E+01	PCOC(1)
Cobalt-60	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	5.22E+00		---	**9.00E-01**		5.80E+00	PCOC(2)
Plutonium-238	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	1.38E+01		1.40E-02	**2.00E+01**		6.90E-01	PCOC(4)
Plutonium-239	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	4.78E+01		5.20E-02	**1.80E+01**		2.66E+00	PCOC(1)
Potassium-40	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	4.78E+01		3.61E+01	---		---	PCOC(3)
Strontium-90	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	1.83E+01		1.00E+00	**5.90E+00**		3.10E+00	PCOC(1)
Thorium-232	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	4.38E+00		2.68E+00	**5.00E+00**		8.76E-01	PCOC(4)

TABLE 6 (CONT)

PCOC Semi-volatile	Animal Exposure Guild	Max. SC (pCi/g)		UTL (pCi/g)	SAL (pCi/g)		Risk Ratio	Proposed Status
Uranium-234	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	5.61E+00		2.03E+00	**8.60E+01**		6.52E-02	PCOC(4)
Uranium-235	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	3.58E+00		8.80E-02	**1.80E+01**		1.99E-01	PCOC(4)
Uranium-238	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	3.44E+01		1.90E+00	**5.90E+01**		5.83E-01	PCOC(4)

Acryonyms, Definitions, and Footnotes
PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
Max. SC = maximum chemical soil concentration from PRS 50-006(d) analysis results
UTL = Upper Tolerance Limit for LANL's Background Chemical Concentrations in soil
ESAL = Ecotoxicological Screening Action Level
SAL = Human Health Screening Action Level
crql = Contractor Required Quantitation Limit
ca = soil carcinogenic ESAL used when soil systemic ESAL is unavailable
***Bold Type** indicates the lowest ESAL used to screen for potential ecological risk

also can impact higher trophic levels through consumption. Regardless of which guild was found to be the most sensitive, the lowest, or most conservative, ESAL was used to screen the chemicals for potential ecological risk based on the assumption that using the most conservative ESAL and the most sensitive animal exposure guild will bound the other less conservative ESALs and be somewhat protective of less sensitive animal exposure guilds.

The radionuclide results are based on the conservative assumptions used to calculate human health SALs (Ebinger et al., 1995). Until radionuclide ESALs are developed, it is assumed that using SALs that are protective of an individual also will be somewhat protective of a community. In other words, a community-level endpoint allows for the death of some individuals of that community while still allowing the community to remain reproductively intact. Therefore, using an individual-level endpoint, such as the SAL, that does not allow the death of any individual in the community prevents an unacceptable degree of decline in community reproductive capacity. One exception to this is that the reproductive capacity of a community can be affected without deaths of individuals occurring in that community. This issue needs further study with regard to the specific PCOCs and specific ecology of PRS 006(d).

The results of the screen indicate a number of areas of uncertainty that require further investigation to confirm a specific chemical at the PRS as having a PCOC or NFA status in order to assess the status of the entire PRS.

(1) **Proposed Status PCOC(1)**
This status is somewhat driven by the statistical value of the data used, but because all the information required for the screen was available, the certainty of the status is high. Of special concern are the PCOCs Cr(IV), Pb, and Ni because of their potential to bioconcentrate, bioaccumulate, and/or biomagnify.

(2) **Proposed Status PCOC(2)**
This status is driven by the statistical value of data used and by the amount that the soil concentration exceeded the existing ESAL or SAL. If the soil concentration is much greater than the ESAL or SAL, establishing a UTL for that chemical is necessary to assess whether the high concentration is a result of background levels instead of contamination caused by sampling and/or analysis. Otherwise, the chemical is listed as a PCOC and recommended for further investigation into probable exposure scenarios.

(3) **Proposed Status PCOC(3)**
This status is dependent on the statistical value of the data used and on the extent that the maximum soil concentration exceeded the UTL. In the interest of saving time and money on remediation, establishing an ESAL for this chemical may eliminate the need for remediation if the ESAL is greater than both the maximum soil concentration and UTL for that chemical. Otherwise, the chemical must be listed as a PCOC for further evaluation.

(4) **Proposed Status PCOC(4)**
This status will be based on statistical value, process knowledge of the site, and stakeholder input. The issue here is that the maximum soil concentration is greater than the UTL but less than the ESAL. Because the soil concentration is less than the ESAL, LANL may not be required to remediate the contaminant even though it is above background. The assumption is that a maximum soil concentration below an ESAL will cause no observable adverse effects. The relative certainty of the status is low compared with that of PCOC(1).

(5) **Proposed Status DI**
This status requires further investigation and establishment of both a UTL and a ESAL value to completely assess the site.

(6) **Proposed Status NFA(1)**
This status will be based somewhat on the statistical value of the data used, but because all the information required for the screen was available, the relative certainty of the status is high.

(7) **Proposed Status NFA(2)**
This status is somewhat based on the statistical value of the data used and generally can be assumed to stand as a decision because the ESALs are conservative and can be assumed to protect ecological receptors, so UTL establishment may not be a priority.

(8) **Proposed Status NFA(3)**
This status will be based on the statistical value of the data used and may stand as a decision because LANL is not required to remediate beyond background levels. The maximum soil concentration reflects a less than background concentration and thus can be eliminated from the PCOC list.

(9) **Proposed Status NFA(4)**
This status will be based on the statistical value of data used and may stand as a decision even though the maximum soil concentration is greater than the ESAL. Because the UTL is greater than the ESAL and LANL may not be required to remediate beyond chemical background concentration levels, exceeding the ESAL may not be an issue. However, stakeholder input will be key to the decision as to what is best for the environmental health of the site.

Other issues to consider when using the screen results to propose a constituent as NFA or as a PCOC include the following.

1. Evaluating risk ratios on the basis of the actual area of contamination and the actual home range of the animal exposure guilds.

2. Acknowledging the possible underestimation of risk ratios for some carnivores because although their primary foraging mode is as a carnivore, they do get some of their nourishment from fruit or other edible parts of plants.

3. Other foraging modes within bird and reptile taxa may need to be considered at some point in order to eliminate the chance that these other exposure guilds could be the most sensitive, and in overlooking them, the ecological impact is overlooked as well.

4. Evaluating the usefulness of crql's that do not actually give a soil concentration but report a minimum value, which only means the actual maximum soil concentration was equal to or less than the crql.

5. Consideration of multiple PCOC impacts.

6. Consideration of potential impact to plants and microbes.

7. Collection/calculation of additional information on the 20 constituents for which the conclusion at this time is "data inadequate (DI)."

Regarding 4 above, two values are reported for some constituents because two chemical analyses are performed for each constituent, each analysis from a different laboratory. One value is the crql reported by a contracted laboratory and the other is a maximum value that was derived from analysis at LANL, possibly with a different instrument or technique. This result is triggered when, in FIMAD, the maximum value reported is below the crql. Analytical laboratories outside of LANL that process LANL samples are not required to report values below the crql, whereas LANL will report values less than the crql. This issue is the reason that FIMAD reports both a maximum value below the crql and the crql. In general, the crql does not provide an adequate measure of some constituents. When a crql value is greater than background (UTL) and greater than the ESAL or SAL, a constituent must be listed as a PCOC, and further assessment is recommended. The crql's used in this screen included the following.

- Semi-volatiles: 59 crql's out of 62 analytical results with 3 chemicals having both a crql and a maximum value

- Volatiles: 30 crql's out of 32 analytical results

- Inorganics: 2 crql's out of 15 analytical results with 2 chemicals having both a crql and a maximum value

- Radionuclides: 0 crql's out of 17 analytical results.

As is apparent from these results, the crql validity in the screening process will be very influential in evaluating semi-volatile and volatile organic chemicals and, to a lesser extent, a few inorganic chemicals. Also, out of the 42 proposed PCOCs as determined by this screen, 25 of the total proposed PCOCs are based on a reported crql value. All 22 semi-volatile PCOCs are crql-based with 1 chemical having both a crql and a maximum. Two out of three volatile PCOCs and one out of six inorganic PCOCs are crql-based. None out of the eleven radionuclide PCOCs are crql-based.

Regarding 6 above, although plants and microbes are generally less sensitive than animals, significant impact to the plant or microbe trophic level can result in greater impact to the ecology of an area than would impact higher levels of a food chain because plants and microbes play more of a supporting role. Plants do not possess the ability to conjugate contaminants like higher animals. Potential impact to the plant and microbe trophic levels in the area of Mortandad Canyon that includes PRS 006(d) should be considered at least minimally in a risk assessment.

Future analysis of the screening results may include the comparison of risk ratios with ESAL uncertainty. This uncertainty analysis may involve the uncertainty factors and modifying factors developed by EPA to account for variance in toxicological information used for developing ESALs. The comparison would be a "yes" or "no" answer based on whether the ratio is greater than the uncertainty. If the risk ratio is greater than the uncertainty of ESALs, then the PCOC might be considered a candidate for a Voluntary Corrective Action. If the ratio is less than the uncertainty of the ESAL, then the conclusion usually is "no remedial action at this time/retain for analysis over ecologically defined exposure unit" (Ebinger et al., 1995). In an Ecological Risk Assessment, statistical analysis of the data set in relation to both field and analytical error also might be performed to assess the validity of the conclusions drawn from this study.

5.0. CONCLUSIONS

The study resulted in several conclusions.

- It was expected that radionuclide concentration would decrease with distance from the outfall. This did not occur. Because the four-nuclide alpha concentration was 242% of the gross alpha concentration for the period 1975-1977, it is important that sampling at points below the 9th transect be conducted so that the trend in concentration as the LANL boundary is approached can be established.

- Soil erosion in the stream channel likely caused the condition whereby the spatial change in radionuclide concentration was not statistically significant. It is important to maintain vegetative cover to minimize the erosion of soil-adhered radionuclides.

- PRS 50-006(d) as a whole cannot be proposed for NFA at this time from the perspective of potential ecological impact.

- A Phase I Ecological Risk Assessment must be conducted for at least 17 PCOCs.

- Further consideration should be made of, and additional information collected for, 25 crql-based PCOCs and 20 constituents for which there was inadequate data (DI).

- Discharging "superclean" waste water through Outfall 051 may remobilize contaminants, potentially making them available for movement or biotic uptake but possibly creating an opportunity for *in situ* remediation.

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APPENDIX A
MISCELLANEOUS APPLICABLE EQUATIONS

Food Intake estimation (Source: Ebinger et al., 1994)

$$DMI = FMR95/ME$$

where

DMI = dry matter intake (g/d)
FMR95 = upper values of a simultaneous 95% prediction band for the average field metabolic rate (Nagy, 1987)
$\log_{10}(FMR95) = [a + b(\log_{10} x)] + c[d + e(\log_{10} x - \log_{10} x)^2]^{0.5}$
ME = metabolizable energy content of food (kJ/g dry matter) consumed by a specific guild.

The average ME values from Nagy (1987) and Robbins (1983) were used.

Soil Ingestion (Source: Ebinger et al., 1994)

$$SOIL = (DMI) * (f_s) * (1000)$$

where

SOIL = daily soil ingestion rate (mg/d)
f_s = fraction of daily dry matter intake that is soil. A median estimate of
f_s = 0.05 for soil ingestion by wildlife was used for all foraging modes.

Water Intake (Source: Ebinger et al., 1994)

$$WATER = FMR95 \times Scaling\ factor$$

where

WATER = intake rate of water (L/d)
FMR95 = upper values of a simultaneous 95% prediction band for the average field metabolic rate (Nagy, 1987)
$\log_{10}(FMR95) = [a + b(\log_{10} x)] + c[d + e(\log_{10} x - \log_{10} x)^2]^{0.5}$
Scaling factor = scales FMR95 to water turnover

Air Intake (Source: Ebinger et al., 1994)

AIR = FMR95 x Scaling factor
AIR = intake rate of air (m^3/d)
FMR95 = upper values of a simultaneous 95% prediction band for the average field metabolic rate (Nagy, 1987)
$\log_{10}(FMR95) = [a + b(\log_{10} x)] + c[d + e(\log_{10} x - \log_{10} x)^2]^{0.5}$
Scaling factor = scales FMR95 to inhalation

APPENDIX B

VALUES FOR USE IN VARIOUS EQUATIONS

TABLE B-1

PARAMETERS FOR CALCULATING FOOD AND SOIL INGESTION RATES FOR KEY MAMMAL GUILDS POTENTIALLY AFFECTED BY PRS 50-006(D) (SOURCE: EBINGER ET AL., 1994)

MAMMAL EXPOSURE GUILD	BODY MASS	METABOLIZABLE ENERGY
Herbivore	5 g–200 kg	10.3
Carnivore	85 g–35 kg	7.5
Omnivore	5 g–40 kg	14

TABLE B-2

VALUES USED TO CALCULATE FMR95 (SOURCE: EBINGER ET AL., 1994)

Taxa	a	b	$\frac{\_\_\_\_\_}{\log_{10} x}$	x	c	d	e
Mammal	0.525	0.813	2.196	2.311	0.559	1.022	0.015

TABLE B-3

FACTORS USED TO SCALE WATER INTAKE AND INHALATION VOLUMES FROM METABOLIC RATES (FMR95) BY MULTIPLICATION WITH BODY MASS IN KG (W) (SOURCE: EBINGER ET AL., 1994)

	Inhalation Scaling Factor (m^3/kJ)	Water Scaling Factor (L/kJ)
Taxa		
Mammal	$1.30E\text{-}04W^{0.027}$	$6.01E\text{-}04W^{-0.013}$

TABLE B-4

ESTIMATES OF SOIL, AIR, AND WATER INTAKES FOR MAMMALS WITH DIFFERENT FORAGING MODES (SOURCE: EBINGER ET AL., 1994)

Taxa	Foraging Mode	Body Size	Body Mass (kg)	Intake Rates		
				Soil (mg/d)	Water (L/d)	Air (m^3/d)
Mammal	Herbivore	Small	0.005	226	0.01	0.03
	Herbivore	Large	200	1333769	41.26	154.03
	Carnivore	Small	0.085	3043	0.06	0.28
	Omnivore	Small	0.005	166	0.01	0.03

APPENDIX C

ESAL EQUATIONS

Systemic Non-Volatile Inorganic and Organic ESAL (Source: Ebinger et al., 1994)

ESAL = (RfD * BW * CF) / (I * FS)

where

ESAL = Ecotoxicological Screening Action Level concentrations for soils (mg/kg)
RfD = chronic reference intake dose for toxic effects (mg/kgfwt-animal/day from soil
BW = body weight for animal guild (kgfwt)
CF = conversion factor: soil (1.00E+06 mg/kg)
I = food intake for animal guild (mg/day)
FS = fraction of dietary intake estimated as soil (0.05)

Non-volatile Carcinogenic ESAL (Source: Ebinger et al., 1994)

ESAL = (R * BW * CF * SFA) / (SF * I * FS)

where

ESAL = Ecotoxicological Screening Action Level concentrations for soils (mg/kg)
R = target risk or cancer incidence for all classes of cancer (assumed to be 0.01)
BW = body weight for animal guild (kgfwt)
CF = conversion factor: soil (1.00E+06 mg/kg)
SFA = cancer slope conversion factor for specific animal or group:
  SFA = $BW^{1/3}/70^{1/3}$, where
  BW = animal guild body weight (kg)
  70 = weight of standard man in the U.S.A.
SF = slope factor for humans, 1.0/(mg/kg/day)
I = food intake for animal guild (mg/day)
FS = fraction of dietary intake estimated as soil (0.05), and the exposure duration for a given animal guild is assumed to be equal to the mean life-span of that guild.

Systemic Volatile Organic and Inorganic ESAL (Source: Ebinger et al., 1994)

ESAL = BW/ (INGF + INHF)

where

ESAL = Ecotoxicological Screening Action Level concentrations for soils (mg/kg)
BW = body weight for animal guild (kgfwt)
INGF = ingestion factor
  INGF = ING * FS/(RfDo * CF)
INHF = inhalation factor
  INHF = [1/RfDi * INH * (1/ VF + 1/PEF)]
ING = ingestion rate (mg/day)
RfDo = chronic oral reference dose (mg/kgfwt-animal/day)
FS = fraction of dietary intake estimated as soil (0.05)
CF = conversion factor: soil (1.00E+06 mg/kg)

INH	=	inhalation rate (m^3/day)
RfDi	=	chronic inhalation reference dose (mg/kgfwt-animal/day)
VF	=	soil-to-air volatilization factor (m^3/kg), specific for each contaminant
PEF	=	particulate emission constant (4.63 E+09 m^3/kg)

Volatile Carcinogenic organic and inorganic ESAL

ESAL = BW * R * SFA/ (INGF + INHF)

where

ESAL	=	Ecotoxicological Screening Action Level concentrations for soils (mg/kg)
BW	=	body weight for animal guild (kgfwt)
R	=	target risk or cancer incidence for all classes of cancer (assumed to be 0.01)
SFA	=	cancer slope conversion factor for specific animal or group:
		SFA = $BW^{1/3}/70^{1/3}$, where
		BW = animal guild body weight (kg)
		70 = weight of standard man in the U.S.A.
INGF	=	ingestion factor
		INGH = ING * FS * SFo/CF
INHF	=	inhalation factor
		INHF = [SFi * INH * (1/VF + 1/PEF)]
ING	=	ingestion rate (mg/day)
FS	=	fraction of dietary intake estimated as soil (0.05)
SFo	=	oral human slope factor (1/mg/kg/day)
CF	=	conversion factor: soil (1.00E+06 mg/kg)
SFi	=	inhalation human slope factor (1/mg/kg/day)
INH	=	inhalation rate (m^3/day)
VF	=	soil-to-air volatilization factor (m^3/kg), specific for each contaminant
PEF	=	particulate emission constant (4.63 E+09 m^3/kg)

APPENDIX D

DETAILED RESULTS OF ECOTOXICOLOGICAL RISK SCREEN

TABLE D-1

PRELIMINARY ECOTOXICOLOGICAL SCREENING RESULTS FOR POTENTIAL ECOLOGICAL RISK FOR A SMALL HERBIVORE MAMMAL IN PRS 50-006(D)/MORTANDAD AREA

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Semi-volatiles											
Acenapthene	6.60E-01	crql	---	---	1.97E+02		n			3.35E-03	NFA(2)
Acenapthylene	6.60E-01	crql	---	---	---		---				DI
Anthracene	6.60E-01	crql	---	---	1.11E+02		n			5.95E-03	NFA(2)
Aroclor[Mixed-]	1.10E-01 1.00E+00	 crql	---	---	7.70E-03 7.70E-03		y y			1.43E+01 1.30E+02	PCOC(2)
Benzo[a]anthracene	6.60E-01	crql	---	---	---		---				DI
Benzo[a]pyrene	6.60E-01	crql	---	---	6.29E-04	ca	y			1.05E+03	PCOC(2)
Benzo[b]fluoranthene	6.60E-01	crql	---	---	4.20E-03	ca	y			1.57E+02	PCOC(2)
Benzo[g,h,i]perylene	6.60E-01	crql	---	---	2.87E-02	ca	y			2.30E+01	PCOC(2)
Benzo[k]fluoranthene	6.60E-01	crql	---	---	9.60E-03	ca	y			6.88E+01	PCOC(2)
Bis(2-chlorethoxy)methane	6.60E-01	crql	---	---	---		---				DI
Bis(2-chloroethyl)ether	6.60E-01	crql	---	---	4.20E-03	ca	y			1.57E+02	PCOC(2)
Bis(2-chloroisopropyl)ether	6.60E-01	crql	---	---	6.56E-02	ca	y			1.01E+01	PCOC(2)
Bis-(2-ethylhexyl)phthalate	3.90E-01 6.60E-01	 crql	---	---	3.28E-03 3.28E-03	ca	y y			1.19E+02 2.01E+02	PCOC(2)
Bromodiphenyl ether[4-]	6.60E-01	crql	---	---	---		---				DI
Butyl benzyl phthalate	6.60E-01	crql	---	---	1.76E+02		n			3.75E-03	NFA(2)
Chloro-3-methylphenol[4-]	1.30E+00	crql	---	---	---		---				DI
Chloroaniline[4-]	1.30E+00	crql	---	---	1.40E+00		n			9.29E-01	NFA(2)
o-Chlorophenol	6.60E-01	crql	---	---	5.50E+00		n			1.20E-01	NFA(2)
Chrysene	6.60E-01	crql	---	---	1.43E-03	ca	y			4.62E+02	PCOC(2)
Dibenzo[a,h]anthracene	6.60E-01	crql	---	---	5.67E-04	ca	y			1.16E+03	NFA(4)
Dibenzofuran	6.60E-01	crql	---	---	---		---				DI
Di-n-butyl phthalate	4.50E-01 6.60E-01	 crql	---	---	---		---				DI
Di-n-octyl phthalate	6.60E-01	crql	---	---	1.94E+01		n			3.40E-02	NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-1 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorbenzene[o-]	6.60E-01	crql	---	---	9.48E+01		n			6.96E-03	NFA(2)
Dichlorbenzene[m-]	6.60E-01	crql	---	---	---		---				DI
Dichlorbenzene[p-]	6.60E-01	crql	---	---	1.91E-03	ca	y			3.46E+02	PCOC(2)
Dichlorobenzidiene[3,3'-]	1.30E+00	crql	---	---	1.02E-02	ca	y			1.27E+02	PCOC(2)
Dichlorphenol[2,4-]	6.60E-01	crql	---	---	3.32E-01		y			1.99E+00	PCOC(2)
Diethyl phthalate	6.60E-01	crql	---	---	8.30E+02		n			7.95E-04	NFA(2)
Dimethyl phthalate	6.60E-01	crql	---	---	1.10E+03		n			6.00E-04	NFA(2)
Dimethylphenol[2,4-]	6.60E-01	crql	---	---	5.53E+01		n			1.19E-02	NFA(2)
Dinitrophenol[2,4-]	1.30E+00	crql	---	---	2.21E-01		y			5.88E+00	PCOC(2)
Fluoranthene	6.60E-01	crql	---	---	1.38E+02		n			4.78E-03	NFA(2)
Fluorene	6.60E-01	crql	---	---	1.38E+02		n			4.78E-03	NFA(1)
Hexachlorobenzene	6.60E-01	crql	---	---	8.85E-02		y			7.46E+00	PCOC(2)
Hexachlorobutadiene	6.60E-01	crql	---	---	5.88E-02	ca	y			1.12E+01	PCOC(2)
Hexachlorocyclopentadiene	6.60E-01	crql	---	---	7.70E+00		n			8.57E-02	NFA(2)
Hexachloroethane	6.60E-01	crql	---	---	1.10E+00		n			6.00E-01	NFA(2)
Indeno[1,2,3-cd]pyrene	6.60E-01	crql	---	---	2.70E-03	ca	y			2.44E+02	PCOC(2)
Isophorone	6.60E-01	crql	---	---	1.66E+02		n			3.98E-03	NFA(2)
2-Methylnapthalene	6.60E-01	crql	---	---	---		---				DI
Methylphenol[2-]	6.60E-01	crql	---	---	5.53E+01		n			1.19E-02	NFA(2)
Methylphenol[4-]	6.60E-01	crql	---	---	5.50E+01		n			1.20E-02	NFA(2)
Napthalene	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[2-]	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[3-]	3.30E+00	crql	---	---	---		---				DI
Nitroaniline[4-]	3.30E+00	crql	---	---	---		---				DI
Nitrobenzene	6.60E-01	crql	---	---	5.09E-01		y			1.30E+00	PCOC(2)
Nitrophenol[2-]	6.60E-01	crql	---	---	---		---				DI
Nitrophenol[4-]	3.30E+00	crql	---	---	---		---				DI

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-1 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nitrosodi-n-propylamine[N-]	6.60E-01	crql	---	---	6.56E-04	ca	y			1.01E+03	PCOC(2)
Nitrosodiphenylamine[N-]	6.60E-01	crql	---	---	9.37E+02	ca	n			7.04E-04	NFA(2)
Pentachlorophenol	3.30E+00	crql	---	---	3.30E+00		y			1.00E+00	PCOC(2)
Phenanthrene	6.60E-01	crql	---	---	---		---				DI
Phenol	6.60E-01	crql	---	---	6.64E+01		n			9.94E-03	NFA(2)
Pyrene	6.60E-01	crql	---	---	8.30E+01		n			7.95E-03	NFA(2)
Trichlorobenzene[1,2,4-]	6.60E-01	crql	---	---	1.64E+01		n			4.02E-02	NFA(2)
Trichlorophenol[2,4,5-]	6.60E-01	crql	---	---	1.11E+02		n			5.95E-03	NFA(2)
Trichlorophenol[2,4,6-]	6.60E-01	crql	---	---	4.17E-01	ca	y			1.58E+00	PCOC(2)
Volatiles											
Acetone	2.70E-02		---	---	1.11E+02		n			2.43E-04	NFA(2)
Benzene	5.00E-03	crql	---	---	1.58E-03	ca	y			3.16E+00	PCOC(2)
Benzoic acid	5.70E+00		---	---	4.90E+00		y			1.16E+00	PCOC(2)
Bromodichloromethane	5.00E-03	crql	---	---	1.98E+01		n			2.53E-04	NFA(2)
Bromoform	5.00E-03	crql	---	---	1.98E+01		n			2.53E-04	NFA(2)
Bromomethane	1.00E-02	crql	---	---	1.50E+00		n			6.67E-03	NFA(2)
Butanone[2-]	2.00E-02	crql	---	---	2.00E+03		n			1.00E-05	NFA(2)
Carbon disulfide	5.00E-03	crql	---	---	1.22E+01		n			4.10E-04	NFA(2)
Carbon tetrachloride	5.00E-03	crql	---	---	7.85E-01		n			6.37E-03	NFA(2)
Chlorobenzene	5.00E-03	crql	---	---	2.10E+01		n			2.38E-04	NFA(2)
Chloroethane	1.00E-02	crql	---	---	1.12E-02	ca	n			8.93E-01	NFA(2)
Chloroform	5.00E-03	crql	---	---	1.40E+00		n			3.57E-03	NFA(2)
Chloromethane	1.00E-02	crql	---	---	3.53E-01	ca	n			2.83E-02	NFA(2)
Dichlorethane[1,1-]	5.00E-03	crql	---	---	---		---				NFA(2)
Dichloroethane[1,2-]	5.00E-03	crql	---	---	5.04E-02	ca	n			9.92E-02	NFA(2)
Dichlorethene[1,1-]	5.00E-03	crql	---	---	9.96E-01		n			5.02E-03	NFA(2)
Dichlorethylene[trans-1,2-]	5.00E-03	crql	---	---	1.88E+01		n			2.66E-04	NFA(2)

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NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-1 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorethylene[cis-1,2-]	5.00E-03	crql	---	---	---		---				DI
Dichloropropane[1,2-]	5.00E-03	crql	---	---	6.75E-02	ca	n			7.41E-02	NFA(2)
Dichloropropene[cis-1,3-]	5.00E-03	crql	---	---	2.55E-02	ca	n			1.96E-01	NFA(2)
Dichloropropene[trans-1,3-]	5.00E-03	crql	---	---	2.55E-02	ca	n			1.96E-01	NFA(2)
Ethyl benzene	5.00E-03	crql	---	---	1.07E+02		n			4.67E-05	NFA(2)
Hexanone[2-]	2.00E-02	crql	---	---	---		---				DI
Methylene chloride	5.00E-03	crql	---	---	6.50E+00		n			7.69E-04	NFA(2)
Styrene	5.00E-03	crql	---	---	2.21E+02		n			2.26E-05	NFA(2)
Tetrachloroethane[1,1,1,2-]	5.00E-03	crql	---	---	9.90E+00		n			5.05E-04	NFA(2)
Tetrachloroethane[1,1,2,2-]	5.00E-03	crql	---	---	2.29E-02	ca	n			2.18E-01	NFA(2)
Trichloroethane[1,1,1-]	5.00E-03	crql	---	---	---		---				DI
Trichloroethane[1,1,2-]	5.00E-03	crql	---	---	4.40E+00		n			1.14E-03	NFA(2)
Trichloroethene	5.00E-03	crql	---	---	4.17E-01	ca	n			1.20E-02	NFA(2)
Vinyl chloride	1.00E-02	crql	---	---	2.40E-03	ca	y			4.17E+00	PCOC(2)
Xylene[mixed-]	5.00E-03	crql	---	---	1.98E+02		n			2.53E-05	NFA(2)
Inorganics											
Antimony	1.50E-01		2.50E+01	n/n	3.87E-02		y			3.88E+00	NFA(4)
	1.20E+00	crql			3.87E-02		y			3.10E+01	NFA(4)
Arsenic	5.80E+00	crql	1.16E+02	n	8.85E-04		y			6.55E+03	NFA(4)
Barium	1.60E+02	crql	1.14E+04	n	2.32E-01		y			6.90E+02	NFA(4)
Beryllium	2.00E+00	crql	3.31E+01	n	5.97E-01		y			3.35E+00	NFA(4)
Cadmium	1.20E+00	crql	2.70E+01	n	5.50E-03		y			2.18E+02	NFA(4)
Chromium (Total)	**5.60E+01**		**3.4E+02**	**y**	---						
Cr (III)	5.60E+01		3.42E+02	y	1.62E+02		n			3.46E-01	PCOC(4)
Cr (IV)	5.60E+01		3.42E+02	y	2.70E+00		y			2.07E+01	PCOC(1)
Lead	7.00E+01		3.90E+02	y	9.96E-01		y			7.03E+01	PCOC(1)
Mercury	2.00E-01		1.00E-00	y	3.54E-01		n			5.65E-01	PCOC(4)

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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
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NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-1 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nickel	4.80E+01		2.67E+01	y	5.50E+00		y			8.73E+00	PCOC(1)
Selenium	4.10E-01		1.70E+00	n	1.66E-02		y			2.47E+01	NFA(4)
Silver	8.00E+00		1.80E+03	n	1.50E-03		y			5.33E+03	NFA(4)
Thallium	3.40E-01 1.20E+00	crql	9.00E-01	n/y	---		---				NFA(1) PCOC(3)
Radionuclides	**(pCi/g)**		**(pCi/g)**					**(pCi/g)**			
Americium-241	7.10E+01		---	---				1.70E+01	y	4.18E+00	PCOC(2)
Barium-133	4.50E-01		---	---				---	---		DI
Cesium-134	3.20E-01		---	---				1.80E+00	n	1.78E-01	NFA(2)
Cesium-137	3.73E+02		1.40E+00	y				4.00E+00	y	9.33E+01	PCOC(1)
Cobalt-57	2.30E+00		---	---				4.00E+01	n	5.75E-02	NFA(2)
Cobalt-60	5.22E+00		---	---				9.00E-01	y	5.80E+00	PCOC(2)
Europium-152	1.90E+00		---	---				---	---		DI
Plutonium-238	1.38E+01		1.40E-02	y				2.00E+01	n	6.90E-01	PCOC(4)
Plutonium-239	4.78E+01		5.20E-02	y				1.80E+01	y	2.66E+00	PCOC(1)
Potassium-40	4.78E+01		3.61E+01	y				---	---		PCOC(3)
Radium-226	4.61E+00		---	---				5.00E+00	n	9.23E-01	NFA(2)
Strontium-90	1.83E+01		1.00E+00	y				5.90E+00	y	3.10E+00	PCOC(1)
Thorium-232	4.38E+00		2.68E+00	y				5.00E+00	n	8.75E-01	PCOC(4)
Tritium	1.05E+02		---	---				8.10E+02	n	1.30E-01	NFA(2)
Uranium-234	5.61E+00		2.03E+00	y				8.60E+01	n	6.52E-02	PCOC(4)
Uranium-235	3.58E+00		8.80E-02	y				1.80E+01	n	1.99E-01	PCOC(4)
Uranium-238	3.44E+01		1.90E+00	y				5.90E+01	n	5.83E-01	PCOC(4)

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DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
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NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

FOOTNOTES

[a]All soil sample concentration values for PRS 50-006(d) were taken from FIMAD (6/95). All values are maximums, except where noted as crql - the Contract Required Quantitaton Limit for that chemical.

[b]Upper Tolerance Limits (UTLs) for background chemical concentrations in soil at LANL were taken from FIMAD (6/95).

[c]Ecotoxicological Screening Action Level (ESAL) values were taken from Appendix C of LA-UR95-439. ESAL values are soil systemic screening action levels, except where noted (ca) for soil carcinogenic screening action level.

[d]Human Health Screening Action Level (SAL) values were taken from FIMAD (revised as of 9/1/94).

TABLE D-2

PRELIMINARY ECOTOXOCOLOGICAL SCREENING RESULTS FOR POTENTIAL ECOLOGICAL RISK FOR LARGE HERBIVORE ANIMALS IN PRS 50-006(D)/MORTANDAD CANYON

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Semi-volatiles											
Acenapthene	6.60E-01	crql	---	---	6.60E+03		n			1.00E-04	NFA(2)
Acenapthylene	6.60E-01	crql	---	---	---		---				DI
Anthracene	6.60E-01	crql	---	---	9.33E+02		n			7.07E-04	NFA(2)
Aroclor[Mixed-]	1.10E-01		---	---	2.62E-01		n			4.20E-01	NFA(2)
	1.00E+00	crql			2.62E-01		y			3.82E+00	PCOC(2)
Benzo[a]anthracene	6.60E-01	crql	---	---	---		---				DI
Benzo[a]pyrene	6.60E-01	crql	---	---	7.29E-01	ca	n			9.05E-01	NFA(2)
Benzo[b]fluoranthene	6.60E-01	crql	---	---	4.80E+00	ca	n			1.38E-01	NFA(2)
Benzo[g,h,i]perylene	6.60E-01	crql	---	---	3.32E+01	ca	n			1.99E-02	NFA(2)
Benzo[k]fluoranthene	6.60E-01	crql	---	---	1.11E+01	ca	n			5.95E-02	NFA(2)
Bis(2-chlorethoxy)methane	6.60E-01	crql	---	---	---		---				DI
Bis(2-chloroethyl)ether	6.60E-01	crql	---	---	4.80E+00	ca	n			1.38E-01	NFA(2)
Bis(2-chloroisopropyl)ether	6.60E-01	crql	---	---	7.60E+01	ca	n			8.68E-03	NFA(2)
Bis-(2-ethylhexyl)phthalate	3.90E-01		---	---	3.80E+02	ca	n			1.03E-03	NFA(2)
	6.60E-01	crql			3.80E+02		n			1.74E-03	
Bromodiphenyl ether[4-]	6.60E-01	crql	---	---	---		---				DI
Butyl benzyl phthalate	6.60E-01	crql	---	---	6.00E+03		n			1.10E-04	NFA(2)
Chloro-3-methylphenol[4-]	1.30E+00	crql	---	---	---		---				DI
Chloroaniline[4-]	1.30E+00	crql	---	---	4.69E+01		n			2.77E-02	NFA(2)
o-Chlorophenol	6.60E-01	crql	---	---	1.87E+02		n			3.53E-03	NFA(2)
Chrysene	6.60E-01	crql	---	---	1.66E+02	ca	n			3.98E-03	NFA(2)
Dibenzo[a,h]anthracene	6.60E-01	crql	---	---	6.57E-01	ca	y			1.00E+00	PCOC(2)
Dibenzofuran	6.60E-01	crql	---	---	---		---				DI
Di-n-butyl phthalate	4.50E-01		---	---	---		---				DI
	6.60E-01	crql									
Di-n-octyl phthalate	6.60E-01	crql	---	---	6.56E+02		n			1.01E-03	NFA(2)

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NFA(2) = no further action. Soil concentration < ESAL; no UTL

NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-2 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorbenzene[o-]	6.60E-01	crql	---	---	3.20E+03		n			2.06E-04	NFA(2)
Dichlorbenzene[m-]	6.60E-01	crql	---	---	---		---				DI
Dichlorbenzene[p-]	6.60E-01	crql	---	---	2.22E+02	ca	n			2.97E-03	NFA(2)
Dichlorobenzidiene[3,3'-]	1.30E+00	crql	---	---	1.18E+01	ca	n			1.10E-01	NFA(2)
Dichlorphenol[2,4-]	6.60E-01	crql	---	---	1.12E+01		n			5.89E-02	NFA(2)
Diethyl phthalate	6.60E-01	crql	---	---	2.81E+04		n			2.35E-05	NFA(2)
Dimethyl phthalate	6.60E-01	crql	---	---	3.75E+04		n			1.76E-05	NFA(2)
Dimethylphenol[2,4-]	6.60E-01	crql	---	---	1.90E+03		n			3.47E-04	NFA(2)
Dinitrophenol[2,4-]	1.30E+00	crql	---	---	7.50E+00		n			1.73E-01	NFA(2)
Fluoranthene	6.60E-01	crql	---	---	4.73E+00		n			1.40E-01	NFA(2)
Fluorene	6.60E-01	crql	---	---	4.73E+00		n			1.40E-01	NFA(2)
Hexachlorobenzene	6.60E-01	crql	---	---	3.00E+00		n			2.20E-01	NFA(2)
Hexachlorobutadiene	6.60E-01	crql	---	---	6.82E+01	ca	n			9.68E-03	NFA(2)
Hexachlorocyclopentadiene	6.60E-01	crql	---	---	2.62E+02		n			2.52E-03	NFA(2)
Hexachloroethane	6.60E-01	crql	---	---	3.75E+01		n			1.76E-02	NFA(2)
Indeno[1,2,3-cd]pyrene	6.60E-01	crql	---	---	3.10E+00	ca	n			2.13E-01	NFA(2)
Isophorone	6.60E-01	crql	---	---	5.60E+03		n			1.18E-04	NFA(2)
2-Methylnapthalene	6.60E-01	crql	---	---	---		---				DI
Methylphenol[2-]	6.60E-01	crql	---	---	1.90E+03		n			3.47E-04	NFA(2)
Methylphenol[4-]	6.60E-01	crql	---	---	1.87E+02		n			3.53E-03	NFA(2)
Napthalene	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[2-]	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[3-]	3.30E+00	crql	---	---	---		---				DI
Nitroaniline[4-]	3.30E+00	crql	---	---	---		---				DI
Nitrobenzene	6.60E-01	crql	---	---	1.72E+01		n			3.84E-02	NFA(2)
Nitrophenol[2-]	6.60E-01	crql	---	---	---		---				DI
Nitrophenol[4-]	3.30E+00	crql	---	---	---		---				DI

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DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-2 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nitrosodi-n-propylamine[N-]	6.60E-01	crql	---	---	7.60E-01	ca	n			8.68E-01	NFA(2)
Nitrosodiphenylamine[N-]	6.60E-01	crql	---	---	1.10E+03	ca	n			6.00E-04	NFA(2)
Pentachlorophenol	3.30E+00	crql	---	---	1.13E+02		n			2.92E-02	NFA(2)
Phenanthrene	6.60E-01	crql	---	---	---		---				DI
Phenol	6.60E-01	crql	---	---	2.20E+03		n			3.00E-04	NFA(2)
Pyrene	6.60E-01	crql	---	---	2.80E+03		n			2.36E-04	DI
Trichlorobenzene[1,2,4-]	6.60E-01	crql	---	---	5.55E+02		n			1.19E-03	NFA(2)
Trichlorophenol[2,4,5-]	6.60E-01	crql	---	---	3.70E+03		n			1.78E-04	NFA(2)
Trichlorophenol[2,4,6-]	6.60E-01	crql	---	---	4.84E+02	ca	n			1.36E-03	NFA(2)
Volatiles											
Acetone	2.70E-02		---	---	3.70E+03		n			7.30E-06	NFA(2)
Benzene	5.00E-03	crql	---	---	1.83E-02	ca	n			2.73E-01	NFA(2)
Benzoic acid	5.70E+00		---	---	1.67E+02		n			3.41E-02	NFA(2)
Bromodichloromethane	5.00E-03	crql	---	---	6.71E+02		n			7.45E-06	NFA(2)
Bromoform	5.00E-03	crql	---	---	6.71E+02		n			7.45E-06	NFA(2)
Bromomethane	1.00E-02	crql	---	---	5.25E+01		n			1.90E-04	NFA(2)
Butanone[2-]	2.00E-02	crql	---	---	6.64E+04		n			3.01E-07	NFA(2)
Carbon disulfide	5.00E-03	crql	---	---	4.12E+02		n			1.21E-05	NFA(2)
Carbon tetrachloride	5.00E-03	crql	---	---	2.66E+01		n			1.88E-04	NFA(2)
Chlorobenzene	5.00E-03	crql	---	---	7.12E+02		n			7.02E-06	NFA(2)
Chloroethane	1.00E-02	crql	---	---	1.30E+01	ca	n			7.69E-04	NFA(2)
Chloroform	5.00E-03	crql	---	---	4.84E+01		n			1.03E-04	NFA(2)
Chloromethane	1.00E-02	crql	---	---	4.09E+02	ca	n			2.44E-05	NFA(2)
Dichlorethane[1,1-]	5.00E-03	crql	---	---	---		---				DI
Dichloroethane[1,2-]	5.00E-03	crql	---	---	5.85E-01	ca	n			8.55E-03	NFA(2)
Dichlorethene[1,1-]	5.00E-03	crql	---	---	3.37E+01		n			1.48E-04	NFA(2)
Dichlorethylene[trans-1,2-]	5.00E-03	crql	---	---	6.37E+02		n			7.85E-06	NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
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NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-2 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nickel	4.80E+01		2.67E+01	y	1.87E+02		n			2.57E-01	PCOC(4)
Selenium	4.10E-01		1.70E+00	n	5.62E-01		n			7.30E-01	NFA(1)
Silver	8.00E+00		1.80E+03	n	5.25E-02		y			1.52E+02	NFA(4)
Thallium	3.40E-01 1.20E+00	 crql	9.00E-01	n/ y	---		---				NFA(3) PCOC(3)
Radionuclides	**(pCi/g)**		**(pCi/g)**					**(pCi/g)**			
Americium-241	7.10E+01		---	---				1.70E+01	y	4.18E+00	PCOC(2)
Barium-133	4.50E-01		---	---				---	---		DI
Cesium-134	3.20E-01		---	---				1.80E+00	n	1.78E-01	NFA(2)
Cesium-137	3.73E+02		1.40E+00	y				4.00E+00	y	9.33E+01	PCOC(1)
Cobalt-57	2.30E+00		---	---				4.00E+01	n	5.75E-02	NFA(2)
Cobalt-60	5.22E+00		---	---				9.00E-01	y	5.80E+00	PCOC(2)
Europium-152	1.90E+00		---	---				---	---		DI
Plutonium-238	1.38E+01		1.40E-02	y				2.00E+01	n	6.90E-01	PCOC(4)
Plutonium-239	4.78E+01		5.20E-02	y				1.80E+01	y	2.66E+00	PCOC(1)
Potassium-40	4.78E+01		3.61E+01	y				---	---		PCOC(3)
Radium-226	4.61E+00		---	---				5.00E+00	n	9.23E-01	NFA(2)
Strontium-90	1.83E+01		1.00E+00	y				5.90E+00	y	3.10E+00	PCOC(1)
Thorium-232	4.38E+00		2.68E+00	y				5.00E+00	n	8.75E-01	PCOC(4)
Tritium	1.05E+02		---	---				8.10E+02	n	1.30E-01	NFA(2)
Uranium-234	5.61E+00		2.03E+00	y				8.60E+01	n	6.52E-02	PCOC(4)
Uranium-235	3.58E+00		8.80E-02	y				1.80E+01	n	1.99E-01	PCOC(4)
Uranium-238	3.44E+01		1.90E+00	y				5.90E+01	n	5.83E-01	PCOC(4)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
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NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

FOOTNOTES

[a]All soil sample concentration values for PRS 50-006(d) were taken from FIMAD (6/95). All values are maximums, except where noted as crql—the Contract Required Quantitaton Limit for that chemical.

[b]Upper Tolerance Limits (UTLs) for background chemical concentrations in soil at LANL were taken from FIMAD (6/95).

[c]Ecotoxicological Screening Action Level (ESAL) values were taken from Appendix C of LA-UR-95-439. ESAL values are soil systemic screening action levels, except where noted (ca) for soil carcinogenic screening action level.

[d]Human Health Screening Action Level (SAL) values were taken from FIMAD (revised as of 9/1/94).

TABLE D-2 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorethylene[cis-1,2-]	5.00E-03	crql	---	---	---		---				DI
Dichloropropane[1,2-]	5.00E-03	crql	---	---	7.82E-01	ca	n			6.39E-03	NFA(2)
Dichloropropene[cis-1,3-]	5.00E-03	crql	---	---	2.96E+01	ca	n			1.69E-04	NFA(2)
Dichloropropene[trans-1,3-]	5.00E-03	crql	---	---	2.96E+01	ca	n			1.69E-04	NFA(2)
Ethyl benzene	5.00E-03	crql	---	---	3.60E+03		n			1.39E-06	NFA(2)
Hexanone[2-]	2.00E-02	crql	---	---	---		---				DI
Methylene chloride	5.00E-03	crql	---	---	2.19E+02		n			2.28E-05	NFA(2)
Styrene	5.00E-03	crql	---	---	7.50E+03		n			6.67E-07	NFA(2)
Tetrachloroethane[1,1,1,2-]	5.00E-03	crql	---	---	3.35E+02		n			1.49E-05	NFA(2)
Tetrachloroethane[1,1,2,2-]	5.00E-03	crql	---	---	2.66E-01	ca	---			1.88E-02	DI
Trichloroethane[1,1,1-]	5.00E-03	crql	---	---	---		---				
Trichloroethane[1,1,2-]	5.00E-03	crql	---	---	1.46E+02		n			3.42E-05	NFA(2)
Trichloroethene	5.00E-03	crql	---	---	4.84E+02	ca	n			1.03E-05	NFA(2)
Vinyl chloride	1.00E-02	crql	---	---	1.30E+03	ca	n			7.69E-06	NFA(2)
Xylene[mixed-]	5.00E-03	crql	---	---	6.70E+03		n			7.46E-07	NFA(2)
Inorganics											
Antimony	1.50E-01 1.20E+00	 crql	2.50E+00	n/ n	1.30E+00 1.30E+00		n n			1.15E-01 9.23E-01	NFA(1)
Arsenic	5.80E+00	crql	1.16E+01	n	3.00E-02		y			1.93E+02	NFA(4)
Barium	1.60E+02	crql	1.14E+03	n	7.90E+00		y			2.03E+01	NFA(4)
Beryllium	2.00E+00	crql	3.31E+00	n	2.02E+01		n			9.90E-02	NFA(1)
Cadmium	1.20E+00	crql	2.70E+00	n	1.87E-01		y			6.42E+00	NFA(4)
Chromium (Total) Cr (III) Cr (IV)	**5.60E+01** 5.60E+01 5.60E+01		**3.42E+01** 3.42E+01 3.42E+01	**y** y y	--- 5.50E+03 9.00E+01		 n n			 1.02E-02 6.22E-01	 PCOC(4) PCOC(4)
Lead	7.00E+01		3.90E+01	y	3.37E+01		y			2.08E+00	PCOC(1)
Mercury	2.00E-01		1.00E-01	y	1.20E+01		n			1.67E-02	PCOC(4)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-3
PRELIMINARY ECOTOXOCOLOGICAL SCREENING RESULTS FOR POTENTIAL ECOLOGICAL RISK FOR SMALL CARNIVORE ANIMALS IN PRS 50-006(D)/MORTANDAD CANYON

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Semi-volatiles											
Acenapthene	6.60E-01	crql	---	---	1.20E+03		n			5.50E-04	NFA(2)
Acenapthylene	6.60E-01	crql	---	---	---		---				DI
Anthracene	6.60E-01	crql	---	---	6.98E+02		n			9.45E-04	NFA(2)
Aroclor[Mixed-]	1.10E-01 1.00E+00	crql	---	---	4.89E-02 4.89E-02		y/ y			2.25E+00 2.04E+01	PCOC(2)
Benzo[a]anthracene	6.60E-01	crql	---	---	---		---				DI
Benzo[a]pyrene	6.60E-01	crql	---	---	1.02E-02	ca	y			6.47E+01	PCOC(2)
Benzo[b]fluoranthene	6.60E-01	crql	---	---	6.77E-02	ca	y			9.75E+00	PCOC(2)
Benzo[g,h,i]perylene	6.60E-01	crql	---	---	4.66E-01	ca	y			1.42E+00	PCOC(2)
Benzo[k]fluoranthene	6.60E-01	crql	---	---	1.55E-01	ca	y			4.26E+00	PCOC(2)
Bis(2-chlorethoxy)methane	6.60E-01	crql	---	---	---		---				DI
Bis(2-chloroethyl)ether	6.60E-01	crql	---	---	6.77E-02	ca	y			9.75E+00	PCOC(2)
Bis(2-chloroisopropyl)ether	6.60E-01	crql	---	---	1.10E+00	ca	n			6.00E-01	NFA(2)
Bis-(2-ethylhexyl)phthalate	3.90E-01 6.60E-01	crql	---	---	5.30E+00 5.30E+00	ca	n/ n			7.36E-02 1.25E-01	NFA(2) NFA(2)
Bromodiphenyl ether[4-]	6.60E-01	crql	---	---	---		---				DI
Butyl benzyl phthalate	6.60E-01	crql	---	---	1.10E+03		n			6.00E-04	NFA(2)
Chloro-3-methylphenol[4-]	1.30E+00	crql	---	---	---		---				DI
Chloroaniline[4-]	1.30E+00	crql	---	---	8.70E+00		n			1.49E-01	NFA(2)
o-Chlorophenol	6.60E-01	crql	---	---	3.49E+01		n			1.89E-02	NFA(2)
Chrysene	6.60E-01	crql	---	---	2.30E+00	ca	n			2.87E-01	NFA(2)
Dibenzo[a,h]anthracene	6.60E-01	crql	---	---	9.20E-03	ca	y			7.17E+01	PCOC(2)
Dibenzofuran	6.60E-01	crql	---	---	---		---				DI
Di-n-butyl phthalate	4.50E-01 6.60E-01	crql	---	---	---		---				DI
Di-n-octyl phthalate	6.60E-01	crql	---	---	1.22E+02		n			5.40E-03	NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

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NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-3 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorbenzene[o-]	6.60E-01	crql	---	---	5.98E+02		n			1.10E-03	NFA(2)
Dichlorbenzene[m-]	6.60E-01	crql	---	---	---		---				DI
Dichlorbenzene[p-]	6.60E-01	crql	---	---	2.30E+03	ca	n			2.87E-04	NFA(2)
Dichlorobenzidiene[3,3'-]	1.30E+00	crql	---	---	1.66E-01	ca	y			7.83E+00	PCOC(2)
Dichlorphenol[2,4-]	6.60E-01	crql	---	---	2.10E+00		n			3.14E-01	NFA(2)
Diethyl phthalate	6.60E-01	crql	---	---	5.20E+03		n			1.27E-04	NFA(2)
Dimethyl phthalate	6.60E-01	crql	---	---	7.00E+03		n			9.43E-05	NFA(2)
Dimethylphenol[2,4-]	6.60E-01	crql	---	---	3.49E+02		n			1.89E-03	NFA(2)
Dinitrophenol[2,4-]	1.30E+00	crql	---	---	1.40E+00		n			9.29E-01	NFA(2)
Fluoranthene	6.60E-01	crql	---	---	8.73E+02		n			7.56E-04	NFA(2)
Fluorene	6.60E-01	crql	---	---	8.73E+02		n			7.56E-04	NFA(2)
Hexachlorobenzene	6.60E-01	crql	---	---	5.59E-01		y			1.18E+00	PCOC(2)
Hexachlorobutadiene	6.60E-01	crql	---	---	9.55E-01	ca	n			6.91E-01	NFA(2)
Hexachlorocyclopentadiene	6.60E-01	crql	---	---	4.89E+01		n			1.35E-02	NFA(2)
Hexachloroethane	6.60E-01	crql	---	---	7.00E+00		n			9.43E-02	NFA(2)
Indeno[1,2,3-cd]pyrene	6.60E-01	crql	---	---	4.38E-02	ca	y			1.51E+01	PCOC(2)
Isophorone	6.60E-01	crql	---	---	1.00E+03		n			6.60E-04	NFA(2)
2-Methylnapthalene	6.60E-01	crql	---	---	---		---				DI
Methylphenol[2-]	6.60E-01	crql	---	---	3.49E+02		n			1.89E-03	NFA(2)
Methylphenol[4-]	6.60E-01	crql	---	---	3.49E+01		n			1.89E-02	NFA(2)
Napthalene	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[2-]	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[3-]	3.30E+00	crql	---	---	---		---				DI
Nitroaniline[4-]	3.30E+00	crql	---	---	---		---				DI
Nitrobenzene	6.60E-01	crql	---	---	3.20E+00		n			2.06E-01	NFA(2)
Nitrophenol[2-]	6.60E-01	crql	---	---	---		---				DI
Nitrophenol[4-]	3.30E+00	crql	---	---	---		---				DI

Definitions:

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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
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Max. SC = maximum soil concentration

TABLE D-3 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nitrosodi-n-propylamine[N-]	6.60E-01	crql	---	---	1.06E-02	ca	y			6.23E+01	PCOC(2)
Nitrosodiphenylamine[N-]	6.60E-01	crql	---	---	1.52E+01	ca	n			4.34E-02	NFA(2)
Pentachlorophenol	3.30E+00	crql	---	---	2.09E+01		n			1.58E-01	NFA(2)
Phenanthrene	6.60E-01	crql	---	---	---		---				DI
Phenol	6.60E-01	crql	---	---	4.19E+02		n			1.58E-03	NFA(2)
Pyrene	6.60E-01	crql	---	---	5.24E+02		n			1.26E-03	NFA(2)
Trichlorobenzene[1,2,4-]	6.60E-01	crql	---	---	1.03E+02		n			6.39E-03	NFA(2)
Trichlorophenol[2,4,5-]	6.60E-01	crql	---	---	6.98E+02		n			9.45E-04	NFA(2)
Trichlorophenol[2,4,6-]	6.60E-01	crql	---	---	6.80E+00	ca	n			9.71E-02	NFA(2)
Volatiles											
Acetone	2.70E-02		---	---	6.98E+02		n			3.87E-05	NFA(2)
Benzene	5.00E-03	crql	---	---	2.60E+00	ca	n			1.92E-03	NFA(2)
Benzoic acid	5.70E+00		---	---	3.11E+01		n			1.83E-01	NFA(2)
Bromodichloromethane	5.00E-03	crql	---	---	1.25E+02		n			4.00E-05	NFA(2)
Bromoform	5.00E-03	crql	---	---	1.25E+02		n			4.00E-05	NFA(2)
Bromomethane	1.00E-02	crql	---	---	9.80E+00		n			1.02E-03	NFA(2)
Butanone[2-]	2.00E-02	crql	---	---	8.60E+03		n			2.33E-06	NFA(2)
Carbon disulfide	5.00E-03	crql	---	---	7.68E+01		n			6.51E-05	NFA(2)
Carbon tetrachloride	5.00E-03	crql	---	---	5.00E+00		n			1.00E-03	NFA(2)
Chlorobenzene	5.00E-03	crql	---	---	1.33E+02		n			3.77E-05	NFA(2)
Chloroethane	1.00E-02	crql	---	---	1.82E-01	ca	n			5.49E-02	NFA(2)
Chloroform	5.00E-03	crql	---	---	9.00E+00		n			5.56E-04	NFA(2)
Chloromethane	1.00E-02	crql	---	---	5.70E+00	ca	n			1.75E-03	NFA(2)
Dichlorethane[1,1-]	5.00E-03	crql	---	---	---		---				DI
Dichlorethane[1,2-]	5.00E-03	crql	---	---	6.00E-01	ca	n			8.33E-03	NFA(2)
Dichlorethene[1,1-]	5.00E-03	crql	---	---	4.40E+00		n			1.14E-03	NFA(2)
Dichlorethylene[trans-1,2-]	5.00E-03	crql	---	---	1.19E+02		n			4.21E-05	NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-3 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorethylene[cis-1,2-]	5.00E-03	crql	---	---	---		---				DI
Dichloropropane[1,2-]	5.00E-03	crql	---	---	8.03E-01	ca	n			6.23E-03	NFA(2)
Dichloropropene[cis-1,3-]	5.00E-03	crql	---	---	4.14E-01	ca	n			1.21E-02	NFA(2)
Dichloropropene[trans-1,3-]	5.00E-03	crql	---	---	4.14E-01	ca	n			1.21E-02	NFA(2)
Ethyl benzene	5.00E-03	crql	---	---	6.78E+02		n			7.37E-06	NFA(2)
Hexanone[2-]	2.00E-02	crql	---	---	---		---				DI
Methylene chloride	5.00E-03	crql	---	---	4.08E+01		n			1.23E-04	NFA(2)
Styrene	5.00E-03	crql	---	---	1.40E+03		n			3.57E-06	NFA(2)
Tetrachloroethane[1,1,1,2-]	5.00E-03	crql	---	---	6.24E+01		n			8.01E-05	NFA(2)
Tetrachloroethane[1,1,2,2-]	5.00E-03	crql	---	---	2.73E-01	ca	n			1.83E-02	NFA(2)
Trichloroethane[1,1,1-]	5.00E-03	crql	---	---	---		---				DI
Trichloroethane[1,1,2-]	5.00E-03	crql	---	---	1.89E+01		n			2.65E-04	NFA(2)
Trichloroethene	5.00E-03	crql	---	---	6.80E+00	ca	n			7.35E-04	NFA(2)
Vinyl chloride	1.00E-02	crql	---	---	3.92E-02	ca	n			2.55E-01	NFA(2)
Xylene[mixed-]	5.00E-03	crql	---	---	1.20E+03		n			4.17E-06	NFA(2)
Inorganics											
Antimony	1.50E-01		2.50E+00	n/ n	2.44E-01		n/y			6.14E-01	NFA(1)
	1.20E+00	crql			2.44E-01					4.91E+00	NFA(4)
Arsenic	5.80E+00	crql	1.16E+01	n	5.60E-03		y			1.04E+03	NFA(4)
Barium	1.60E+02	crql	1.14E+03	n	1.50E+00		y			1.07E+02	NFA(4)
Beryllium	2.00E+00	crql	3.31E+00	n	2.60E+00		n			7.69E-01	NFA(1)
Cadmium	1.20E+00	crql	2.70E+00	n	2.42E-02		y			4.96E+01	NFA(4)
Chromium (Total)	**5.60E+01**		**3.42E+01**	y	---		---				NFA(3)
Cr (III)	5.60E+01		3.42E+01	y	7.12E+02		n			7.87E-02	PCOC(4)
Cr (IV)	5.60E+01		3.42E+01	y	1.68E+01		y			3.33E+00	PCOC(1)
Lead	7.00E+01		3.90E+01	y	6.30E+00		y			1.11E+01	PCOC(1)
Mercury	2.00E-01		1.00E-01	y	2.20E+00		n			9.09E-02	PCOC(4)

Definitions:

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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
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NFA(2) = no further action. Soil concentration < ESAL; no UTL
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Max. SC = maximum soil concentration

TABLE D-3 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nickel	4.80E+01		2.67E+01	y	3.49E+01		y			1.38E+00	PCOC(1)
Selenium	4.10E-01		1.70E+00	n	1.05E-01		y			3.92E+00	NFA(4)
Silver	8.00E+00		1.80E+03	n	9.80E-03		y			8.16E+02	NFA(4)
Thallium	3.40E-01 1.20E+00	crql	9.00E-01	n/ y	---		---				NFA(3) PCOC(3)
Radionuclides	**(pCi/g)**		**(pCi/g)**					**(pCi/g)**			
Americium-241	7.10E+01		---	---				1.70E+01	y	4.18E+00	PCOC(2)
Barium-133	4.50E-01		---	---				---	---		DI
Cesium-134	3.20E-01		---	---				1.80E+00	n	1.78E-01	NFA(2)
Cesium-137	3.73E+02		1.40E+00	y				4.00E+00	y	9.33E+01	PCOC(1)
Cobalt-57	2.30E+00		---	---				4.00E+01	n	5.75E-02	NFA(2)
Cobalt-60	5.22E+00		---	---				9.00E-01	y	5.80E+00	PCOC(2)
Europium-152	1.90E+00		---	---				---	---		DI
Plutonium-238	1.38E+01		1.40E-02	y				2.00E+01	n	6.90E-01	PCOC(4)
Plutonium-239	4.78E+01		5.20E-02	y				1.80E+01	y	2.66E+00	PCOC(1)
Potassium-40	4.78E+01		3.61E+01	y				---	---		PCOC(3)
Radium-226	4.61E+00		---	---				5.00E+00	n	9.23E-01	NFA(2)
Strontium-90	1.83E+01		1.00E+00	y				5.90E+00	y	3.10E+00	PCOC(1)
Thorium-232	4.38E+00		2.68E+00	y				5.00E+00	n	8.75E-01	PCOC(4)
Tritium	1.05E+02		---	---				8.10E+02	n	1.30E-01	NFA(2)
Uranium-234	5.61E+00		2.03E+00	y				8.60E+01	n	6.52E-02	PCOC(4)
Uranium-235	3.58E+00		8.80E-02	y				1.80E+01	n	1.99E-01	PCOC(4)
Uranium-238	3.44E+01		1.90E+00	y				5.90E+01	n	5.83E-01	PCOC(4)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

FOOTNOTES

[a]All soil sample concentration values for PRS 50-006(d) were taken from FIMAD (6/95). All values are maximums, except where noted as (crql)— the Contract Required Quantitaton Limit for that chemical.

[b]Upper Tolerance Limits (UTLs) for background chemical concentrations in soil at LANL were taken from FIMAD (6/95).

[c]Ecotoxicological Screening Action Level (ESAL) values were taken from Appendix C of LA-UR-95-439. ESAL values are soil systemic screening action levels, except where noted (ca) for soil carcinogenic screening action level.

[d]Human Health Screening Action Level (SAL) values were taken from FIMAD (revised as of 9/1/94)

TABLE D-4
PRELIMINARY ECOTOXOCOLOGICAL SCREENING RESULTS FOR POTENTIAL ECOLOGICAL RISK FOR SMALL OMNIVORE ANIMALS IN PRS 50-006(D)/MORTANDAD CANYON

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Semi-volatiles											
Acenapthene	6.60E-01	crql	---	---	2.63E+02		n			2.51E-03	NFA(2)
Acenapthylene	6.60E-01	crql	---	---	---		---				DI
Anthracene	6.60E-01	crql	---	---	1.50E+02		n			4.39E-03	NFA(2)
Aroclor[Mixed-]	1.10E-01		---	---	1.05E-02		y			1.05E+01	PCOC(2)
	1.00E+00	crql			1.05E-02		y			9.52E+01	PCOC(2
Benzo[a]anthracene	6.60E-01	crql	---	---	---		---				DI
Benzo[a]pyrene	6.60E-01	crql	---	---	8.55E-04	ca	y			7.72E+02	PCOC(2)
Benzo[b]fluoranthene	6.60E-01	crql	---	---	5.70E-03	ca	y			1.16E+02	NFA(4)
Benzo[g,h,i]perylene	6.60E-01	crql	---	---	3.90E-02	ca	y			1.69E+01	NFA(4)
Benzo[k]fluoranthene	6.60E-01	crql	---	---	1.30E-02	ca	y			5.08E+01	NFA(4)
Bis(2-chlorethoxy)methane	6.60E-01	crql	---	---	---		---				DI
Bis(2-chloroethyl)ether	6.60E-01	crql	---	---	5.70E-03	ca	y			1.16E+02	PCOC(2)
Bis(2-chloroisopropyl)ether	6.60E-01	crql	---	---	8.91E-02	ca	y			7.41E+00	PCOC(2)
Bis-(2-ethylhexyl)phthalate	3.90E-01		---	---	4.46E-01	ca	n			8.75E-01	NFA(2)
	6.60E-01	crql			4.46E-01		y			1.48E+00	PCOC(2)
Bromodiphenyl ether[4-]	6.60E-01	crql	---	---	---		---				DI
Butyl benzyl phthalate	6.60E-01	crql	---	---	2.39E+02		n			2.76E-03	NFA(2)
Chloro-3-methylphenol[4-]	1.30E+00	crql	---	---	---		---				DI
Chloroaniline[4-]	1.30E+00	crql	---	---	1.90E+00		n			6.84E-01	NFA(2)
o-Chlorophenol	6.60E-01	crql	---	---	7.50E+00		n			8.80E-02	NFA(2)
Chrysene	6.60E-01	crql	---	---	1.95E-01	ca	y			3.39E+00	PCOC(2)
Dibenzo[a,h]anthracene	6.60E-01	crql	---	---	7.70E-04	ca	y			8.57E+02	PCOC(2)
Dibenzofuran	6.60E-01	crql	---	---	---		---				DI
Di-n-butyl phthalate	4.50E-01		---	---	---		---				DI
	6.60E-01	crql									
Di-n-octyl phthalate	6.60E-01	crql	---	---	2.63E+01		n				NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESA
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-4 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorbenzene[o-]	6.60E-01	crql	---	---	1.29E+02		n			5.12E-03	NFA(2)
Dichlorbenzene[m-]	6.60E-01	crql	---	---			---				DI
Dichlorbenzene[p-]	6.60E-01	crql	---	---	2.60E-01	ca	n			2.54E+00	NFA(2)
Dichlorobenzidiene[3,3'-]	1.30E+00	crql	---	---	1.39E-02	ca	n			9.35E+01	NFA(2)
Dichlorphenol[2,4-]	6.60E-01	crql	---	---	4.51E-01		y			1.46E+00	PCOC(2)
Diethyl phthalate	6.60E-01	crql	---	---	1.10E+03		n			6.00E-04	NFA(2)
Dimethyl phthalate	6.60E-01	crql	---	---	1.50E+03		n			4.40E-04	NFA(2)
Dimethylphenol[2,4-]	6.60E-01	crql	---	---	7.52E+01		n			8.78E-03	NFA(2)
Dinitrophenol[2,4-]	1.30E+00	crql	---	---	3.01E-01		y			4.32E+00	PCOC(2)
Fluoranthene	6.60E-01	crql	---	---	1.88E+02		n			3.51E-03	NFA(2)
Fluorene	6.60E-01	crql	---	---	1.88E+02		n			3.51E-03	NFA(2)
Hexachlorobenzene	6.60E-01	crql	---	---	1.20E-01		y			5.49E+00	PCOC(2)
Hexachlorobutadiene	6.60E-01	crql	---	---	8.00E-02	ca	y			8.25E+00	PCOC(2)
Hexachlorocyclopentadiene	6.60E-01	crql	---	---	1.05E+01		n			6.29E-02	NFA(2)
Hexachloroethane	6.60E-01	crql	---	---	1.50E+00		n			4.40E-01	NFA(2)
Indeno[1,2,3-cd]pyrene	6.60E-01	crql	---	---	7.81E-04	ca	y			8.45E+02	PCOC(2)
Isophorone	6.60E-01	crql	---	---	2.26E+02		n			2.93E-03	NFA(2)
2-Methylnapthalene	6.60E-01	crql	---	---	---		---				DI
Methylphenol[2-]	6.60E-01	crql	---	---	7.52E+01		n			8.78E-03	NFA(2)
Methylphenol[4-]	6.60E-01	crql	---	---	7.50E+00		n			8.80E-02	NFA(2)
Napthalene	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[2-]	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[3-]	3.30E+00	crql	---	---	---		---				DI
Nitroaniline[4-]	3.30E+00	crql	---	---	---		---				DI
Nitrobenzene	6.60E-01	crql	---	---	6.92E-01		n			9.54E-01	NFA(2)
Nitrophenol[2-]	6.60E-01	crql	---	---	---		---				DI
Nitrophenol[4-]	3.30E+00	crql	---	---	---		---				DI

Definitions:

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NFA(3) = no further action. Soil concentration < UTL; no ESA
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-4 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nitrosodi-n-propylamine[N-]	6.60E-01	crql	---	---	1.90E-04	ca	y			3.47E+03	PCOC(2)
Nitrosodiphenylamine[N-]	6.60E-01	crql	---	---	2.70E-05	ca	y			2.44E+04	PCOC(2)
Pentachlorophenol	3.30E+00	crql	---	---	1.30E+00		y			2.54E+00	PCOC(2)
Phenanthrene	6.60E-01	crql	---	---	---		---				DI
Phenol	6.60E-01	crql	---	---	9.02E+01		n			7.32E-03	NFA(2)
Pyrene	6.60E-01	crql	---	---	1.13E+02		n			5.85E-03	DI
Trichlorobenzene[1,2,4-]	6.60E-01	crql	---	---	2.23E+01		n			2.96E-02	NFA(2)
Trichlorophenol[2,4,5-]	6.60E-01	crql	---	---	1.50E+02		n			4.39E-03	NFA(2)
Trichlorophenol[2,4,6-]	6.60E-01	crql	---	---	5.67E-01	ca	y			1.16E+00	PCOC(2)
Volatiles											
Acetone	2.70E-02		---	---	1.50E+02		n			1.80E-04	NFA(2)
Benzene	5.00E-03	crql	---	---	2.15E-01	ca	n			2.32E-02	NFA(2)
Benzoic acid	5.70E+00		---	---	1.90E+00		y			3.00E+00	PCOC(2)
Bromodichloromethane	5.00E-03	crql	---	---	2.69E+01		n			1.86E-04	NFA(2)
Bromoform	5.00E-03	crql	---	---	2.69E+01		n			1.86E-04	NFA(2)
Bromomethane	1.00E-02	crql	---	---	2.10E+00		n			4.76E-03	NFA(2)
Butanone[2-]	2.00E-02	crql	---	---	2.70E+03		n			7.41E-06	NFA(2)
Carbon disulfide	5.00E-03	crql	---	---	1.65E+01		n			3.03E-04	NFA(2)
Carbon tetrachloride	5.00E-03	crql	---	---	1.10E+00		n			4.55E-03	NFA(2)
Chlorobenzene	5.00E-03	crql	---	---	2.86E+01		n			1.75E-04	NFA(2)
Chloroethane	1.00E-02	crql	---	---	1.52E-02	ca	n			6.58E-01	NFA(2)
Chloroform	5.00E-03	crql	---	---	1.90E+00		n			2.63E-03	NFA(2)
Chloromethane	1.00E-02	crql	---	---	4.80E-01	ca	n			2.08E-02	NFA(2)
Dichlorethane[1,1-]	5.00E-03	crql	---	---	---		---				DI
Dichloroethane[1,2-]	5.00E-03	crql	---	---	6.85E-02	ca	n			7.30E-02	NFA(2)
Dichlorethene[1,1-]	5.00E-03	crql	---	---	1.40E+00		n			3.57E-03	NFA(2)
Dichlorethylene[trans-1,2-]	5.00E-03	crql	---	---	---		---				DI

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Max. SC = maximum soil concentration

TABLE D-4 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorethylene[cis-1,2-]	5.00E-03	crql	---	---	---		---				NFA(2)
Dichloropropane[1,2-]	5.00E-03	crql	---	---	9.17E-02	ca	n			5.45E-02	NFA(2)
Dichloropropene[cis-1,3-]	5.00E-03	crql	---	---	3.47E-02	ca	n			1.44E-01	NFA(2)
Dichloropropene[trans-1,3-]	5.00E-03	crql	---	---	3.47E-02	ca	n			1.44E-01	NFA(2)
Ethyl benzene	5.00E-03	crql	---	---	1.46E+02		n			3.42E-05	NFA(2)
Hexanone[2-]	2.00E-02	crql	---	---	---		---				DI
Methylene chloride	5.00E-03	crql	---	---	8.80E+00		n			5.68E-04	NFA(2)
Styrene	5.00E-03	crql	---	---	3.01E+02		n			1.66E-05	NFA(2)
Tetrachloroethane[1,1,1,2-]	5.00E-03	crql	---	---	1.34E+01		n			3.73E-04	NFA(2)
Tetrachloroethane[1,1,2,2-]	5.00E-03	crql	---	---	3.12E-02	ca	n			1.60E-01	NFA(2)
Trichloroethane[1,1,1-]	5.00E-03	crql	---	---	---		---				DI
Trichloroethane[1,1,2-]	5.00E-03	crql	---	---	5.90E+00		n			8.47E-04	NFA(2)
Trichloroethene	5.00E-03	crql	---	---	5.67E-01	ca	n			8.82E-03	NFA(2)
Vinyl chloride	1.00E-02	crql	---	---	3.30E-03	ca	y			3.03E+00	PCOC(2)
Xylene[mixed-]	5.00E-03	crql	---	---	7.78E+01		n			6.43E-05	NFA(2)
Inorganics											
Antimony	1.50E-01 1.20E+00	 crql	2.50E+00	n/n	5.26E-02 5.26E-02		y y			2.85E+00 2.28E+01	NFA(4)
Arsenic	5.80E+00	crql	1.16E+01	n	1.20E-03		y			4.83E+03	NFA(4)
Barium	1.60E+02	crql	1.14E+03	n	3.16E-01		y			5.07E+02	NFA(4)
Beryllium	2.00E+00	crql	3.31E+00	n	8.12E-01		y			2.46E+00	NFA(4)
Cadmium	1.20E+00	crql	2.70E+00	n	7.50E-03		y			1.60E+02	NFA(4)
Chromium (Total) Cr (III) Cr (IV)	**5.60E+01** 5.60E+01 5.60E+01		**3.42E+01** 3.42E+01 3.42E+01	**y** y y	 2.21E+02 3.60E+00		 n y			 2.54E-01 1.56E+01	 PCOC(4) PCOC(1)
Lead	7.00E+01		3.90E+01	y	1.40E+00		y			5.00E+01	PCOC(1)
Mercury	2.00E-01		1.00E-01	y	4.81E-01		n			4.16E-01	PCOC(4)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-4 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nickel	4.80E+01		2.67E+01	y	7.50E+00		y			6.40E+00	PCOC(1)
Selenium	4.10E-01		1.70E+00	n	2.26E-02		y			1.81E+01	NFA(4)
Silver	8.00E+00		1.80E+03	n	2.10E-03		y			3.81E+03	NFA(4)
Thallium	3.40E-01 1.20E+00	crql	9.00E-01	n/y	---		---				NFA(3) PCOC(3)
Radionuclides	(pCi/g)		(pCi/g)					(pCi/g)			
Americium-241	7.10E+01		---	---				1.70E+01	y	4.18E+00	PCOC(2)
Barium-133	4.50E-01		---	---				---	---		DI
Cesium-134	3.20E-01		---	---				1.80E+00	n	1.78E-01	NFA(2)
Cesium-137	3.73E+02		1.40E+00	y				4.00E+00	y	9.33E+01	PCOC(1)
Cobalt-57	2.30E+00		---	---				4.00E+01	n	5.75E-02	NFA(2)
Cobalt-60	5.22E+00		---	---				9.00E-01	y	5.80E+00	PCOC(2)
Europium-152	1.90E+00		---	---				---	---		DI
Plutonium-238	1.38E+01		1.40E-02	y				2.00E+01	n	6.90E-01	PCOC(4)
Plutonium-239	4.78E+01		5.20E-02	y				1.80E+01	y	2.66E+00	PCOC(1)
Potassium-40	4.78E+01		3.61E+01	y				---	---		PCOC(3)
Radium-226	4.61E+00		---	---				5.00E+00	n	9.23E-01	NFA(2)
Strontium-90	1.83E+01		1.00E+00	y				5.90E+00	y	3.10E+00	PCOC(1)
Thorium-232	4.38E+00		2.68E+00	y				5.00E+00	n	8.75E-01	PCOC(4)
Tritium	1.05E+02		---	---				8.10E+02	n	1.30E-01	NFA(2)
Uranium-234	5.61E+00		2.03E+00	y				8.60E+01	n	6.52E-02	PCOC(4)
Uranium-235	3.58E+00		8.80E-02	y				1.80E+01	n	1.99E-01	PCOC(4)
Uranium-238	3.44E+01		1.90E+00	y				5.90E+01	n	5.83E-01	PCOC(4)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

FOOTNOTES

[a]All soil sample concentration values for PRS 50-006(d) were taken from FIMAD (6/95). All values are maximums, except where noted as crql—the Contract Required Quantitaton Limit for that chemical.

[b]Upper Tolerance Limits (UTLs) for background chemical concentrations in soil at LANL were taken from FIMAD (6/95).

[c]Ecotoxicological Screening Action Level (ESAL) values were taken from Appendix C of LA-UR-95-439. ESAL values are soil systemic screening action levels, except where noted (ca) for soil carcinogenic screening action level.

[d]Human Health Screening Action Level (SAL) values were taken from FIMAD (revised as of 9/1/94).

REQUEST FOR ADDITIONAL INFORMATION ON TECHNICAL AREA 50 POTENTIAL RELEASE SITES 50-006(a, c), 50-007, and 50-008

NMED Issue:
This RFI Report included information on the following solid waste management units (SWMUs): 50-006(a and c), 50-007 and 50-008.

1. Elevated concentrations of beryllium, chromium and nickel were found to be associated with samples collected at a pipe rack. The area is currently in use and it is unclear which SWMU this is associated with. If the rack is not currently associated with a SWMU then it is recommended that the area be given a new designation and added to the permit.

LANL Response:

Concentrations of beryllium, chromium, cadmium, silver and nickel were elevated with respect to background in some samples collected downgradient from the pipe rack. The four samples containing elevated inorganics were taken within about 75 ft of the pipe rack location. However, interviews with mechanical technicians associated with work performed at that location indicate that constituents of Ni and Be would not have their source in the pipe rack, although Ag is sometimes a component of solder, and Cd can be a trace element in electrogalvanized pipe. In addition, we investigated a nearby transportable container ("skid") that was to be used for an adjacent incinerator. The incinerator was never fired up and no wastes were handled at the skid. Some modification of the skid took place at this location, but this was limited to cutting and welding. Therefore, based on this more detailed investigation and contrary to statements made in the RFI Report, we have determined that neither the pipe rack nor the incinerator skid is the source of all, or perhaps any, of the constituents. Rather, we believe the source is the air emissions from stacks at adjacent buildings, which, as stated in the RFI Work Plan for Operable Unit 1147, were the target of this phase of sampling.

Regardless of the source of contamination, because elevated concentrations of these chemicals were found we conducted a risk assessment to ensure this area did not present a human health risk. The risk assessment shows that the risk from exposure to these chemicals is within the National Contingency Plan acceptable risk range of 1 in a million to 1 in 10,000, using an industrial land use scenario. The risk assessment is summarized below, and the full text is presented in Attachment A. This risk assessment further supports our recommendation for no further action, as stated in the RFI Report, for PRSs 50-006(c), 50-007, and 50-008. PRS 50-006(a) will be further investigated under the Field Unit 4 Canyons Study and the Material Disposal Area C investigation as stated in the RFI Report.

Summary of risk assessment:
The RCRA Facility Investigation Report for Potential Release Sites 50-006(c), 50-007, 50-008, and 50-006(a) identified elevated values of beryllium, cadmium, chromium, and silver in three of eight soil samples collected from the drainage downgradient from the pipe rack. A human health risk assessment was conducted on the characterization data of the soil samples to determine whether adverse human health effects were likely for the industrial users of the area. The risk assessment was conducted using the data of the three sampling locations closest to the pipe rack. The area where the other five samples were collected has been graded, paved, and is now a parking lot. The arithmetic mean of the data for each chemical was used to represent the most likely exposure (MLE) and the reasonable maximum exposure (RME). As a conservative check, the arithmetic mean of the three samples was compared to the mean of all eight soil samples, and it was found that the three samples chosen for the risk assessment produced higher mean values of chemical concentrations.

This is an industrial area, not open to the general public, which will stay under Laboratory control for the foreseeable future. Therefore, an industrial scenario was utilized. Toxicity values used in the risk assessment calculations were extracted from the EPA's Integrated Risk Information System and the Health Effects Assessment Summary Tables. The EPA has stated that the upper end of acceptable risk can range from 10-04 to 10-06 (one in ten thousand to one in one million occurrences of excess cancer risk in a population), depending on site-specific considerations (EPA 1990, 0559). The result of the carcinogenic evaluation at the pipe rack is a risk of 3 x 10-07 for the MLE and 2 x 10-05 for the RME, well within the EPA guidelines. The calculated noncarcinogenic hazard indices for the MLE (0.001) and the RME (0.03) are less than one, indicating exposures under the industrial exposure assumptions are not expected to result in adverse noncarcinogenic effects. The results of the human health risk assessment suggest that potential exposure to COPCs in soil downgradient from the pipe rack would not result in adverse noncarcinogenic health effects or an unacceptable cancer risk to industrial users.

NMED Issue:
2. In addition, a review of the sampling information presented for beryllium related to SWMUs 56-006(c), 50-007 and 50-008, indicates that the calculated upper tolerance limit (UTL) is too high for this metal. The highest value for beryllium was 1.1 mg/kg which should probably be the UTL for TA-50. Using the facility-wide value for this metal does not appear appropriate, and a site-specific value should be used.

LANL Response:
We assume that "56-006(c)" is meant to read "50-006(c)."
The soils around TA-50 are derived from native Bandelier Tuff and are disturbed due to construction, trenching, paving and backfilling. The LANL background data set was derived from soils overlying Bandelier Tuff specifically for the purpose of this type of comparison. It is more relevant and important to compare the distribution of beryllium values at the SWMU with the distribution of beryllium values in the LANL background data set. Histograms of the two beryllium data sets follow at the end of this response. (The SWMU histogram does not include three outliers, described below.) Comparison shows that the distribution of the LANL Background beryllium is inclusive of the SWMU beryllium values and that the mean of the SWMU beryllium distribution is indeed less than the mean of the LANL Background beryllium distribution. Fifty-two of the 55 sample values from this SWMU were within a range of 0.16 to 1.2 mg/kg with a mean of 0.53 and median of 0.5. These comparable statistical values and the picture presented by the SWMU histogram indicate that those 52 values belong to a nearly normally distributed population of beryllium values. Of the remaining 3 sample values, 1 was a nondetect (<0.08 mg/kg), and the other 2 (9.8 and 150 mg/kg) were at the pipe rack site. Use of the LANL background beryllium UTL did not cause unusually elevated sample values to be overlooked during the screening; only the samples at the pipe rack site do not belong to the beryllium population at the SWMU.

NMED Issue:
3. Further characterization of Ten Site Canyon is recommended, as well as, removal of the hummock area in Ten Site Canyon which contained high levels of radionuclides and polychlorinated biphenyls.

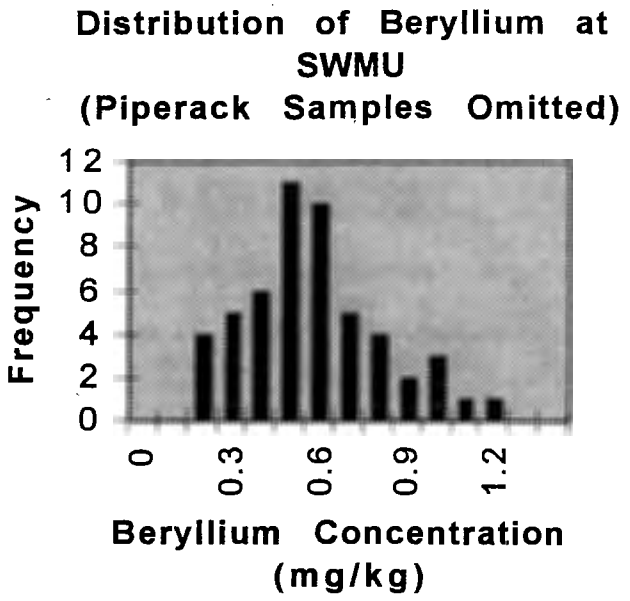
LANL Response:
The Laboratory agrees that removal and proper disposal of the material of the hummock will preclude further dissemination during large storm events of this localized contaminated pocket of radioactivity and PCBs. An Interim Action Plan was developed, and the sediment removal took place on November 13-14, 1996. NMED DOE-Oversite Bureau personnel observed the field activity and will take verification samples. Ten Site Canyon characterization will be moved to the authority of the canyons study under LANL ER Field Unit 4, as will any permanent remedy or remediation.

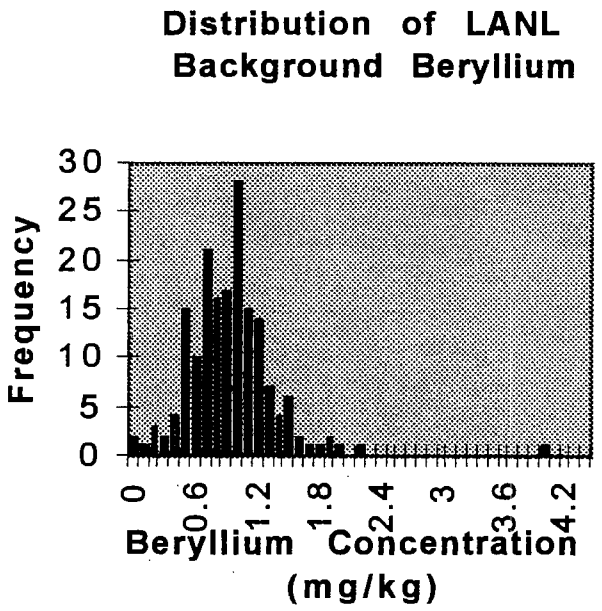
NMED Issue
4. LANL shall summarize all deviations from the approved Workplan.

LANL Response:
Stainless steel coring tool for collection of undisturbed samples. All soils around TA-50 are disturbed. Numerous activities have caused disturbance, and mixing of surface soils after potential airborne deposition would have occurred. Therefore, the stainless steel scoop method, collecting soil to a depth of 6 inches, was the more appropriate method to collect any potentially contaminated soils than use of the stainless steel coring tool.

Field laboratory for analysis of samples. The field laboratory originally proposed in the Work Plan was not used. Instead, all samples were submitted to a fixed-site laboratory. The envisioned field laboratory was not practical. Fixed-site laboratory methods are generally more reliable for large suites of analytes.

Additional samples collected at Ten Site Canyon. Field screening identified a localized area of elevated gross alpha/beta at a "hummock," a physical feature consisting of a small deposit of sediment in the stream channel. It was decided that the single sample originally planned for that area was not sufficient to characterize the hummock. Additional samples were collected upstream and downstream from the hummock.


Distribution of Beryllium at SWMU
(Piperack Samples Omitted)
Frequency
12
10
8
6
4
2
0
0
0.3
0.6
0.9
1.2
Beryllium Concentration
(mg/kg)


Distribution of LANL Background Beryllium
Frequency
30
25
20
15
10
5
0
0
0.6
1.2
1.8
2.4
3
3.6
4.2
Beryllium Concentration
(mg/kg)

ATTACHMENT A RISK ASSESSMENT DATA AND EQUATIONS: TA-50 SURFACE SOIL ISSUE

1.0 INTRODUCTION

A human health risk assessment was conducted on the characterization data of the soil samples taken downgradient from the pipe rack at TA-50 to determine whether adverse human health effects were likely for the industrial users of the area. The results indicate that potential exposure to chemicals in the soil downgradient from the pipe rack should not result in adverse carcinogenic or noncarcinogenic health effects.

The human health risk assessment presented here follows the process outlined in the policy document "Risk-Based Corrective Action Process" (Dorries 1996, 1297). The human health risk assessment process consists of four steps: identification of chemicals of potential concern (COPCs), exposure assessment, toxicity assessment, and risk characterization. The data, exposure parameters, toxicity values and profiles, risk assessment equations and conclusions are presented in the following sections.

1.1 Identification of Chemicals of Potential Concern

The RCRA Facility Investigation Report for Potential Release Sites 50-006(c), 50-007, 50-008, and 50-006(a) identified elevated values of beryllium, cadmium, chromium, and silver from eight soil samples collected from the drainage downgradient from the pipe rack. A visit to the site revealed that since the time these samples were collected the adjacent parking area has been expanded and pavement now covers the area where the five samples farthest from the pipe rack were collected. This area has had a culvert installed, the soil graded and it has been covered by asphalt. Since there is no longer a complete pathway from COPC to receptor, no health risk can be assessed from these covered sampling locations. This risk assessment is therefore conducted using the data of the three remaining sampling locations which were collected from the small unpaved area closest to the pipe rack. Although this small area is still unpaved, a large storage unit is situated on top of half of that unpaved area, and a tree, the pipe rack, a tank, and a picnic table occupy the rest of the unpaved area.

The soil sample containing the highest concentrations of each COPC is among the three remaining samples. The arithmetic mean of the sampling results for each COPC was calculated for the data set of the three remaining samples and compared to the same

calculation for the data set from original eight soil samples. For each COPC, the arithmetic mean of the three remaining soil samples is greater than the arithmetic mean for the original eight samples. This assures that the risk has not been artificially lowered by deleting the covered samples from consideration in this risk assessment. The arithmetic mean of the data for each chemical was used to represent the most likely exposure (MLE) and the reasonable maximum exposure (RME). When a chemical was reported as not detected (as represented by the "<" symbol), the detection limit was averaged in with the detected values. These values are presented in Table A-1.

TABLE A-1

SOIL SAMPLE DATA

Location ID	Sample ID	Beryllium (mg/kg)	Cadmium (mg/kg)	Total Chromium (mg/kg)	Silver (mg/kg)
	UTL[a]	1.95	2.6	19.3	N/A
	Residential SAL[b]	0.14	38	211	380
50-5062	AAA2470	0.62	<0.4	9.3	<1
50-5063	AAA2471	150	170	810	17
50-5064	AAA2472	<0.08	<0.4	1.1	410
	Arithmetic Mean	50.2	56.9	273.5	142.7

[a]UTL = Upper Tolerance Limit
[b]SAL = Screening Action Limit

1.2 Exposure Assessment

The area where the samples were collected in 1993 is located downgradient from the pipe rack in Technical Area (TA) 50, among buildings such as the Liquid Waste Treatment Plant, the Incinerator Complex, and the Waste Characterization Reduction and Repacking Facility. This is an industrial area, not open to the general public, which will stay under Laboratory

control for the foreseeable future. Therefore, an industrial scenario risk assessment was conducted.

Total chromium is assumed to be composed of one part chromium VI and six parts chromium III according to the Health Effects Assessment Summary Tables (HEAST), a standard risk assessment tool (Miller 1994, 1169). The mean of total chromium was multiplied by one-seventh in order to estimate the mean of chromium VI, and by six-sevenths in order to estimate the mean of chromium III.

The mean value of each chemical was multiplied by the dust loading factor of 9×10^{-5} g/m^3 to yield the input value for dust for the industrial worker (Dorries 1996, 1297). Table A-2 presents the data used in the risk assessment.

TABLE A-2

CONCENTRATIONS USED IN RISK ASSESSMENT CALCULATIONS

Chemical	Average On-Site Soil (mg/kg)	Average Dust (ug/m^3)
Beryllium	20.3	2×10^{-3}
Cadmium	36.6	3×10^{-3}
Chromium	117	1x 10-2^{-2}
Chromium VI	19.5	2×10^{-3}
Silver	54	5×10^{-3}

Industrial scenario exposure parameters listed in the document "Risk-Based Corrective Action Process" were used in the risk assessment (Dorries 1996, 1297). There are three exceptions. The first is that the exposure time input parameter has been modified to reflect site-specific conditions. It is not realistic to expect that an industrial worker would spend two to four hours per day in this small unpaved area surrounded by a parking lot. The most likely exposure would be a person occasionally spending an hour at the picnic table having lunch during good weather. A reasonable maximum exposure could be a person spending an hour for lunch at the picnic table each working day and an hour per day working in or around the pipe rack regardless of the weather. The second exception is the fraction ingested input

parameter was modified had to be adjusted to reflect the limited time spent at the site. The third exception is that the intake rate for inhalation of dust has been updated to reflect the values recommended in the EPA's Exposure Factors Handbook, 1989. Table A-3 presents these industrial scenario exposure parameters.

TABLE A-3

INDUSTRIAL SCENARIO EXPOSURE PARAMETERS

Pathway	Parameter (units)	Most Likely Exposure	Maximum Reasonable Exposure
All Pathways	BW[a] (kg)	70	70
	EF[b] (days/yr)	25	250
	ED[c] (yr)	9	25
Inhalation of Dust	IR[d] (m3/hr)	0.5	1.1
	ET[e] (hr/day)	0.16	1
Ingestion of Soil	IR (mg/day)	50	100
	FI[f] (unitless)	0.2	.3

[a] BW = Body weight.
[b] EF = Exposure frequency.
[c] ED = Exposure duration.
[d] IR = Intake rate.
[e] ET = Exposure time.
[f] FI = Fraction ingested from contaminated source.
[g] AF = Soil-to-skin adherence factor.
[h] SA = Skin surface area exposed.

Intake equations used in risk assessment calculate the intake of COPCs via ingestion and inhalation pathways by combining the concentration of the COPC in soil with exposure parameters for the industrial scenario. The intake results are used in subsequent calculations along with toxicity parameters to evaluate carcinogenic risk and the potential for noncarcinogenic health effects.

Intake of COPCs via soil ingestion is calculated according to equation Eq. A-1.

$$\text{Intake}_{ing} = \frac{C \times IR \times EF \times ED}{BW \times AT} \qquad \text{(Eq. A-1)}$$

where,

$Intake_{ing}$ = amount of soil ingested daily (mg/kg/day),

C = COPC concentration in soil (mg/kg),

IR = soil ingestion rate (mg/day),

EF = exposure frequency (days/yr),

ED = exposure duration (yr),

AT = averaging time (ED x 365 days/yr for noncarcinogens, 25550 days for carcinogens), and

BW = body weight (kg).

Intake of COPCs via inhalation of fugitive dust is calculated according to equation Eq. A-2.

$$Intake_{inh} = \frac{C \times PC \times IR \times ET \times EF \times ED}{BW \times AT} \qquad \text{(Eq. A-2)}$$

where,

$Intake_{inh}$ = amount of soil inhaled daily (mg/kg/day),

C = COPC concentration in soil (mg/kg),

PC = particulate concentration in air ($9 \times 10^{-5} mg/m^3$),

IR = inhalation rate (m3/hr),

ET = exposure time (hr/day),

EF = exposure frequency (days/yr),

ED = exposure duration (yr),

BW = body weight (kg), and

AT = averaging time (ED x 365 days/yr for noncarcinogens, 25550 days for carcinogens).

1.3 Toxicity Assessment

The purpose of the toxicity assessment is to present information regarding the potential for COPCs to cause adverse health effects in exposed individuals and to provide an estimate of the relationship between the extent of exposure to a chemical and the increased likelihood and/or severity of adverse health effects.

1.3.1 Toxicity Values

The toxicity value used to evaluate noncarcinogenic effects for a COPC is the reference dose (RfD). The RfD has been developed based upon the concept that a threshold dose exists below which adverse effects would not occur. RfDs exist for both chronic and subchronic exposures; chronic exposure RfDs were used in this risk assessment because of the length of the exposure periods involved (9 years). The Environmental Protection Agency's (EPA's) Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST) were used, in this order, to identify RfD values.

For COPCs with carcinogenic effects, the slope factor and accompanying weight-of-evidence is used to evaluate toxicity. The slope factor is derived based upon the concept that there is no threshold of exposure below which a carcinogenic response may not occur. The slope factor is used to estimate the upper-bound lifetime probability of cancer induction as a result of exposure to a certain level of a suspected or known carcinogen. Weight-of-evidence carcinogenicity classifications are:

A = human carcinogen,

B1 = probable human carcinogen, but limited human data are available,

B2 = probable human carcinogen with sufficient evidence in animals and inadequate or no evidence in humans,

C = possible human carcinogen,

D = not classifiable as to human carcinogenicity, and

E = evidence of noncarcinogenicity for humans.

Tables A-4 and A-5 present the toxicity values used in the risk assessment and the reference material in which these values are listed.

TABLE A-4

REFERENCE DOSES USED IN THE RISK ASSESSMENT CALCULATIONS

Chemical	EPA Class	Oral Reference Dose (Chronic) (mg/kg/day)	Source	Inhalation Reference Dose (Chronic) (μg/kg-day)	Source
Beryllium	B2[a]	5×10^{-3}	IRIS[b], December 1996	N/A	N/A
Cadmium	B1[c]	1×10^{-3}	IRIS[b], December 1996	5.7×10^{-5}	N/A
Chromium III	D[d]	1	IRIS, December 1996	N/A	IRIS, December 1996
Chromium VI	A[e]	5×10^{-3}	IRIS, December 1996	N/A	N/A
Silver	D	5×10^{-3}	IRIS, December 1996	N/A	N/A

[a] B2 = probable human carcinogen with sufficient evidence in animals and inadequate or no evidence in humans.

[b] IRIS = Integrated Risk Information System

[c] B1 = Probable human carcinogen, but limited human data are available.

[d] D = Not classifiable as to human carcinogenicity.

[e] A = Human carcinogen.

N/A = Not available

TABLE A-5

SLOPE FACTORS USED IN THE RISK ASSESSMENT CALCULATIONS

Chemical	EPA Class	Oral Slope Factor [1/(mg/kg/day)]	Source	Inhalation Slope Factor [1/(mg/kg/day)]	Source
Beryllium	B2 [a]	4.3	IRIS[b] December 1996	8.4	HEAST[c] FY[d] 1994
Cadmium (dust)	B1[e]	N/A	N/A	6.3	IRIS January 1995
Chromium III	D[f]	N/A	N/A	N/A	N/A
Chromium VI	A[g]	N/A	N/A	290	IRIS December 1996
Silver	D	N/A	N/A	N/A	N/A

[a] B2 = Probable human carcinogen with sufficient evidence in animals and inadequate or no evidence in humans

[b] IRIS = Integrated Risk Information System

[c] HEAST = Health Effects Assessment Summary Tables

[d] FY = Fiscal year.

[e] B1 = Probable human carcinogen, but limited human data are available.

[f] D = Not classifiable as to human carcinogenicity.

[g] A = Human carcinogen.

N/A = Not available

1.3.2 Toxicity Profiles for Chemicals of Potential Concern

Toxicity profiles are provided in this section for the COPCs beryllium, cadmium, chromium, and silver.

1.3.2.1 Toxicity Profile for Beryllium

Oral Reference Dose: IRIS lists the oral RfD for beryllium as 5×10^{-3} mg/kg/day. This value was derived with an uncertainty factor of 100.

Carcinogen Classification: Group B2, probable human carcinogen. The oral slope factor is listed in IRIS as $(4.3 \text{ mg/kg/day})^{-1}$, the inhalation unit risk value as $(2.4 \times 10\text{-}03 \text{ mg/m3})^{-1}$, and the inhalation slope factor as $(8.4 \text{ mg/kg/day})^{-1}$.

Uses: Beryllium is a metallic element, occurring naturally as a chemical component of certain rocks, coal and oil, soil, and volcanic dust. It is used as an aerospace structural material, as a moderator and reflector in nuclear reactors, and in a copper alloy used for springs, electrical contacts and nonsparking tools.

Health Effects: Various health effects related to beryllium exposure have been documented in human and animal investigations. The major toxicologic effects of beryllium are on the lung. Exposure to beryllium may produce an acute chemical pneumonitis, hypersensitivity, and berylliosis - a chronic granulomatous pulmonary disease. Contact dermatitis is the most common beryllium-related toxic effect. Exposure to soluble beryllium compounds may result in a delayed-type hypersensitivity reaction of papulovesicular lesions on the skin. *In vitro* studies of genotoxicity have shown that beryllium will induce morphologic transformation in mammalian cells. It will also decrease fidelity of DNA synthesis, but is negative when tested as a mutagen in bacterial systems (Amdur, et al, *Casarett and Doull's Toxicology, the Basic Science of poisons*, 1991, Pergamon Press).

Study Support: The oral RfD for beryllium is listed in IRIS as 5×10^{-3} mg/kg/day. The no observable adverse effect level (NOAEL) is listed as 5 ppm (0.54 mg/kg of body weight/day) in drinking water. The RfD value is based on a lifetime study of 52 weanling rats which received 0 or 5 ppm beryllium (as beryllium sulfate) in drinking water. At natural death, the rats were dissected and gross and microscopic changes were noted in the heart, kidney, liver, and spleen. There were no effects of treatment on these organs or on lifespan, urinalysis, serum glucose, cholesterol, and uric acid, or on numbers of tumors. Male rats experienced decreased growth rates from 2 to 6 months of age. In a similar study, doses of 0.95 mg/kg/day caused decreased body weights in female mice. Male mice exhibited slight increases in body weight.

The uncertainty factor applied to derivation of the oral RfD is 100. This factor accounts for interspecies (10X) conversion and for protection of sensitive human subpopulations (10X). The confidence level is low because only one dose level was administered. Although numerous inhalation investigations and a supporting chronic oral bioassay in mice exist, along with work that indicates a higher dose level may be a no observable effect level (NOEL), these studies are considered low to medium in quality. Therefore, the database is given a confidence level of low.

The classification of beryllium as Group B2 - Probable Human Carcinogen is based on its ability to induce lung cancer via inhalation in rats and monkeys and to induce osteosarcomas in rabbits via intravenous or intramedullary injection. Human epidemiology studies are considered to be inadequate. The oral slope factor is listed in IRIS as 4.3 mg/kg/day^{-1}, the inhalation unit risk value as (2.4 x 10-03 mg/m3)$^{-1}$, and the inhalation slope factor as (8.4 mg/kg/day)$^{-1}$. The estimate for the oral slope factor is derived from a study which did not show a significant increase in tumorigenic response. While this study is limited by use of only one non-zero dose group and the occurrence of high mortality and unspecified time and site of the tumors, it was used as the basis of the quantitative estimate because exposure occurred via the most relevant route.

1.3.2.2 Toxicity Profile for Cadmium

Oral Reference Dose: IRIS lists the oral RfD for cadmium in food as 1 x 10^{-3} mg/kg/day. This value was derived with an uncertainty factor of 10.

Carcinogen Classification: Group B1, probable human carcinogen. The EPA has not established an oral slope factor for cadmium. The EPA has established an inhalation unit risk of 1.8 x 10^{-3} μg/m3^{-1} and inhalation slope factor of (6.3 mg/kg/day)$^{-1}$

Uses: Cadmium is a metallic element, occurring primarily in zinc, copper, and lead ores. It is used in solders, dental amalgams, cathode material for nickel-cadmium storage batteries, as a color pigment for paints and plastics and in rustproof electroplating. A major nonoccupational source of respirable cadmium is cigarettes.

Health Effects: Exposure to high levels of cadmium via inhalation severely damages the lungs and can cause death. Inhalation of lower levels for a period of years results in accumulation of cadmium in the kidneys that can cause kidney disease. Long-term exposure to cadmium by inhalation may also cause fragile bones.

Long-term exposure of workers to cadmium via inhalation in an occupational setting may increase the risk of developing lung cancer. Experimental studies indicate that mice and hamsters exposed to cadmium by inhalation do not develop lung cancer; however, rats clearly do. Pregnant female rodents that inhaled high levels of cadmium produced fewer litters and the pups exhibited more birth defects than usual. Inhalation of cadmium also causes liver damage and changes in the immune system in rats and mice. Currently, it is not known whether inhalation of cadmium affects the ability of humans to reproduce or has

harmful effects on the fetus, liver, heart, nervous system, or immune system in humans (Life Systems, Inc. 1992, 1053).

Dermal contact with cadmium is not known to cause adverse health effects in animals or humans (Life Systems, Inc. 1992, 1053).

Study Support: IRIS lists the oral reference dose for cadmium in food as 1×10^{-3} mg/kg/day. The reference dose is based on the highest level of cadmium in the human renal cortex (200 µg cadmium/g wet renal cortex) that is not associated with significant proteinuria, the critical effect of interest. A toxicokinetic model was used to determine the highest level of exposure associated with the lack of a critical effect. An uncertainty factor of 10 was applied to account for intrahuman variability to the toxicity of this chemical in the absence of specific data on sensitive individuals. The level of confidence in the reference dose is high because of the many studies available on the toxicity of cadmium in both humans and animals.

The classification of cadmium as a Group B1 probable human carcinogen is based on limited evidence of its carcinogenicity in humans available from several epidemiologic studies which demonstrated a possible association with lung and prostate cancers. There is also sufficient evidence of cadmium's carcinogenicity in rats and mice by the inhalation route (lung tumors), intratracheal instillation (mammary tumors in female rats, multiple sites in males), and intramuscular or subcutaneous injection (injection site and distant site tumors). EPA has not established an oral slope factor for cadmium. EPA has established an inhalation unit risk of $(1.8 \times 10^{-3}$ µg/m3$)^{-1}$ and an inhalation slope factor of (6.3 mg/kg/day$)^{-1}$ based primarily on an epidemiologic study of cadmium smelter workers in which an increased risk of lung, trachea, and bronchus cancer mortality was observed. The supporting study used a relatively large cohort and smoking and concurrent arsenic exposures were accounted for in the quantitative analysis for cadmium.

1.3.2.3 Toxicity Profile for Chromium

Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. It is important for glucose metabolism, and may be a cofactor for insulin. Chromium is present in the environment in several valent forms, the most common of which are chromium 0, chromium III, and chromium VI. Chromium III occurs naturally in the environment, whereas chromium VI and Chromium 0 (metal chromium) are generally produced by industrial processes. Chromium III or chromium VI produced by the chemical industry are used for chrome plating, the manufacture of dyes and pigments, leather, wood preservatives, and treatment of cooling tower water. Smaller amounts are used in drilling

muds, textiles, and toner for copying machines (Syracuse Research Corporation 1991, 1241).

1.3.2.3.1 Chromium III

Oral Reference Dose: 1 mg/kg/day. This reference dose was derived with an uncertainty factor of 100 and a modifying factor of 10.

Carcinogen Classification: Group D, not classifiable as to human carcinogenicity. Trivalent chromium (chromium III) is much less toxic and more abundant in nature than the hexavalent form (chromium VI). Chromium VI readily crosses all membranes and is reduced intracellularly to trivalent chromium. There is no evidence to suggest that chromium III is converted into chromium VI in biological systems (Amdur et al. 1991, 1239).

Health Effects: Respiratory effects have been observed in workers exposed to chromium III; however, other forms of chromium were present. The respiratory system is the primary target for injury following inhalation exposure in laboratory animals. Rats and mice inhaling various levels of chromium III oxide had increased lung weights, marked hyperplasia, interstitial fibrosis, and epithelial necrosis (Syracuse Research Corporation 1991, 1241).

Study Support: IRIS lists the chronic oral reference dose as 1 mg/kg/day, which is the same value listed in HEAST as the subchronic oral reference dose. These values are based on a chronic feeding study in rats. Even after feeding up to 5% of chromic oxide in the diet for 84 days, no adverse effects were observed at any dose level.

An uncertainty factor of 100 was applied to the oral reference dose. This factor accounts for the interhuman and interspecies variability of the toxicity of chromium III. The oral reference dose is limited to insoluble salts of chromium III. Confidence in the principal study is rated as low because of a lack of explicit detail on protocol and results. Low confidence in the database reflects the lack of high-dose supporting data. A modifying factor of 10 reflects uncertainty in the no observable effect level. An inhalation risk assessment for chromium III is under review by an EPA work group.

Chromium III is not believed to be carcinogenic.

1.3.2.3.2 Chromium VI

Oral Reference Dose: 5×10^{-3} mg/kg/day. This reference dose was derived with an uncertainty factor of 500.

Carcinogen Classification: Group A, human carcinogen. IRIS lists an inhalation unit risk value of $(1.2 \times 10^{-2}\ \mu g/m3)^{-1}$. The corresponding inhalation slope factor is $(290\ mg/kg/day)^{-1}$.

Health Effects: Chromate sensitive workers acutely exposed to chromium VI develop asthma and other signs of respiratory distress. Symptoms include erythema of the face, nasopharyngeal pruritus, nasal blocking, coughing and wheezing. In a retrospective mortality study, intermediate- to chronic-duration occupational exposure to chromium VI showed an increased risk of death due to noncancer respiratory disease. Occupational exposure has also been associated with adverse effects on the gastrointestinal system and severe liver injury. Additionally, chromium VI has been associated with an increased incidence of bronchogenic and nasal cancer following chronic occupational exposure.

Study Support: IRIS lists a chronic oral reference dose for chromium VI as 5×10^{-3} mg/kg/day. This value is based on a year-long study in rats that were administered hexavalent and trivalent chromium in drinking water. No significant changes in appearance, weight gain, food consumption, or histologic lesions were observed in any of the treatment groups. An uncertainty factor of 500 accounts for the expected interhuman and interspecies variability in the toxicity of the chemical in lieu of specific data, and an additional factor of 5 to compensate for the less-than-lifetime exposure duration of the principal study. The oral reference dose is limited to soluble salts of metallic chromium VI. Confidence in the principal study is low because of the small number of animals tested, the small number of parameters measured, and the lack of toxic effect at the highest dose tested. Confidence in the database is low because the supporting studies are of equally low quality, and teratogenic and reproductive endpoints are not well studied.

Chromium VI is considered to be carcinogenic only by inhalation and is classified as a Group A human carcinogen. IRIS lists an inhalation unit risk value of $(1.2 \times 10^{-2}\ \mu g/m3)^{1}$. The corresponding inhalation slope factor is $(290\ mg/kg/day)^{-1}$. The confidence in this unit risk factor is high because there is sufficient epidemiologic evidence in humans supporting this conclusion.

1.3.2.4 Toxicity Profile for Silver

Oral Reference Dose: 5×10^{-3} mg/kg/day. This reference dose was derived using an uncertainty factor of 3.

Carcinogen Classification: Group D, not classifiable as to human carcinogenicity.

Uses: Silver is a metal. It is used in jewelry, silverware, electronic equipment, dental fillings, and photographs. Silver also occurs in compounds such as silver nitrate, silver chloride, silver sulfide, and silver oxide.

Health Effects: The most serious health effect resulting from silver exposure is believed to be argyria. Argyria is a gray or blue-gray coloration of the skin that is caused by eating or breathing silver compounds over time. Exposure to dust that contains silver compounds, such as silver nitrate or silver oxide, may cause breathing problems, lung and throat irritation, and stomach pain. Mild allergic reactions have been seen in humans due to skin exposure to silver compounds. One long-term animal study suggested that high levels of silver nitrate in drinking water may have caused a slight effect on the brain. Another study found that exposure to silver nitrate or silver chloride led to enlargement of the heart. Animal studies, however, have not been complete enough to measure these effects adequately (Clement International Corporation 1994, 1344).

Study Support: The oral reference dose for silver is listed in IRIS as 5×10^{-3} mg/kg/day. This value is based on a 2- to 9-year human intravenous study. Argyria is the critical effect of silver ingestion in humans. It results in a bluish-gray discoloration of the skin from deposition of silver in the dermis and from silver-induced production of melanin. This deposition has not been associated with any adverse health effects. Data from 10 males and 2 females who were given intravenous injections of silver arsphenamine over a period of 2 to 9 years were collected. After a dose of 4, 7, or 8 g, argyria developed in some patients. Other patients developed argyria after 10, 15, or 20 g. Biospectrometric examination of skin biopsies showed a correlation between the degree of discoloration and the level of silver that was present. The lowest intravenous dose resulting in argyria was 1 g of metallic silver (an oral dose of 0.014 mg/kg/day). This was determined to be the lowest observable adverse effect level (LOAEL). A no observable adverse effect level (NOAEL) was not established.

An uncertainty factor of 3 was used to account for sensitive individuals. An uncertainty factor was not assigned for the study duration because the dose was apportioned over a lifetime of 70 years. The confidence level in the oral reference dose is low. A NOAEL was not established because the study used individuals who were being treated for syphilis and may have been in bad health. Confidence in the database was low because the supporting studies were not controlled and the amount of silver ingestion was difficult to determine. The intravenous administration also required a dose conversion that introduces uncertainty. Currently, no values are listed for an inhalation RfC.

Silver is classified as Group D, not classifiable as to human carcinogenicity. Induction of local sarcomas in animals after implantation of foils and discs of silver has been seen; however, the interpretation of these results is questionable. No evidence of human carcinogenicity has been reported even with the frequent therapeutic use of silver. Classification of a chemical as Group D precludes quantitative toxicity assessment. No slope factor is listed.

1.4 Risk Characterization

Risk characterization is the final step in the risk assessment process. Toxicity and exposure assessments are summarized and integrated into quantitative and qualitative expressions of risk. To characterize potential carcinogenic effects, probabilities that an individual will develop cancer over a lifetime of exposure are estimated from projected intakes and chemical-specific dose-response information. To characterize potential noncarcinogenic effects, comparisons are made between projected intakes of COPCs and toxicity values including reference doses. Major assumptions, scientific judgments, and estimates of the uncertainties embodied in the assessment are also presented.

1.4.1 Carcinogenic Risk and Noncarcinogenic Health Effects Equations

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer as the result of exposure to a carcinogen. Excess cancer risks are calculated according to equation Eq. A-4.

$$\text{Risk} = \text{CDI} \times \text{SF} \qquad \text{(Eq. A-4)}$$

Where:

CDI = chronic daily intake (mg/kg/day), and

SF = carcinogenic slope factor.

A hazard quotient of one is used to evaluate potential noncarcinogenic health effects from exposure. At this value, COPC intake is equal to the reference dose, the dose at which adverse effects are not likely to be seen. Hazard quotients were calculated according to Equation A-5.

$$\text{HQ} = \frac{\text{Intake (mg/kg-d)}}{\text{RfD (mg/kg-d)}} \qquad \text{(A-5)}$$

where,

HQ = Hazard quotient, and

RfD = Reference dose.

1.4.2 Risk Assessment Results

This risk assessment was conducted for the three soil samples taken downgradient from the pipe rack at TA-50 using the data, exposure parameters, toxicity values and toxicity profiles presented in this appendix. The results for the carcinogenic risk for the MLE and RME are presented in tables A-6 and A-7, respectively, and the noncarcinogenic health effects in tables A-8 and A-9.

TABLE A-6

TA-50 CANCER RISK CALCULATED FROM SOIL SAMPLES NEAR PIPE RACK FOR MOST LIKELY EXPOSURE INDUSTRIAL SCENARIO

Chemical	Inhalation of Dust	Soil Ingestion	Total
Beryllium	2×10^{-09}	3×10^{-7}	3×10^{-07}
Cadmium (dust)	2×10^{-09}	0	2×10^{-09}
Cadmium (food)	2×10^{-09}	0	2×10^{-09}
Chromium VI	9×10^{-09}	0	9×10^{-09}
Scenario Total			**3×10^{-07}**

TABLE A-7

TA-50 CANCER RISK CALCULATED FROM SOIL SAMPLES NEAR PIPE RACK FOR REASONABLE MAXIMUM EXPOSURE INDUSTRIAL SCENARIO

Chemical	Inhalation of Dust	Soil Ingestion	Total
Beryllium	3×10^{-07}	2×10^{-05}	2×10^{-05}
Cadmium (dust)	2×10^{-07}	0	2×10^{-07}
Cadmium (food)	2×10^{-07}	0	2×10^{-07}
Chromium VI	1×10^{-06}	0	1×10^{-06}
Scenario Total			**2×10^{-05}**

The result of the carcinogenic evaluation is a risk of 3×10^{-07} for the MLE and 2×10^{-05} for the RME. The EPA has stated that the upper end of acceptable risk can range from10^{-04} to 10^{-06} (one in ten thousand to one in one million occurrences of excess cancer risk in a

population), depending on site-specific considerations (EPA 1990, 0559). Based on current site conditions, the estimated cancer risks are within or below the range of acceptable risk levels. Given the conservative nature of this evaluation and the small size of the potential exposure area, this result indicates that COPC concentrations in the soil should not pose an unacceptable cancer risk under the exposure assumptions for the industrial scenario.

In Table A-8 and A-9, hazard quotients for the COPCs are presented by pathway for the MLE and RME industrial scenarios. The calculated hazard quotients for the MLE and RME are less than one, indicating exposures are not expected to result in adverse effects. Because all of the COPCs are metals, it is possible that additive exposure could result in toxicity. However, when hazard quotients for these COPCs are summed, the resultant hazard indices are less than one, indicating adverse effects are unlikely to occur effects under the exposure assumptions for the industrial scenario.

TABLE A-8

TA-50 NON-CANCER HEALTH HAZARD CALCULATED FROM SOIL SAMPLES NEAR PIPE RACK FOR MOST LIKELY EXPOSURE INDUSTRIAL SCENARIO

Chemical	Soil Ingestion	Hazard Quotient
Beryllium	1×10^{-04}	1×10^{-04}
Cadmium (food)	6×10^{-04}	6×10^{-04}
Chromium III	2×10^{-06}	2×10^{-06}
Chromium VI	8×10^{-05}	8×10^{-05}
Silver	3×10^{-04}	3×10^{-04}
Scenario Total (Hazard Index)		**0.001**

TABLE A-9

TA-50 NON-CANCER HEALTH HAZARD CALCULATED FROM SOIL SAMPLES NEAR PIPE RACK FOR REASONABLE MAXIMUM EXPOSURE INDUSTRIAL SCENARIO

Chemical	Soil Ingestion	Hazard Quotient
Beryllium	3×10^{-03}	3×10^{-03}
Cadmium (food)	2×10^{-02}	2×10^{-02}
Chromium III	7×10^{-05}	7×10^{-05}
Chromium VI	2×10^{-03}	2×10^{-03}
Silver	8×10^{-03}	8×10^{-03}
Scenario Total (Hazard Index)		**0.03**

1.4.3 Assessment of Uncertainty in the Risk Assessment

Uncertainty is inherent in many aspects of the risk assessment process and generally arises from a lack of knowledge concerning site conditions, the toxicology of the COPCs, and the degree to which an individual will be exposed to those chemicals. Various assumptions are then made based on information presented in the scientific literature or on professional judgment. While some assumptions have significant scientific basis, others have less scientific basis. The assumptions that introduce the greatest amount of uncertainty and their effect on the carcinogenic dose and noncarcinogenic risk estimates are discussed below. This discussion is qualitative in nature because the uncertainties associated with risk assessment results are often difficult to quantify.

1.4.3.1 Site Conditions

The soil samples that comprised the basis of this risk assessment were collected in a biased manner in the drainage pathway in order to increase the probability of detecting any elevated levels of chemicals. This biased sampling approach may lead to an over estimation of contamination present within an exposure unit. This, in turn, may lead to an overestimation of human health risk.

1.4.3.2 Toxicology of the Chemicals of Potential Concern

Uncertainty is inherent in the toxicity values for each COPC. The toxicity profiles discuss the scientific studies upon which the toxicity values are based. Uncertainty factors applied to the study results account for the quality of available data and differences between study animals and human populations, and are designed to provide a health protective bias. The uncertainty factors used to derive reference doses for COPCs range from 3 for silver, 10 for cadmium, to 100 for beryllium and chromium. The health protective bias embedded in the reference dose and cancer slope factor are more likely to overestimate rather than underestimate noncarcinogenic health effects and cancer risk.

1.4.3.3 Exposure Characteristics

Uncertainties are also inherent in the exposure characteristics for individual exposures. It is very unlikely that an industrial worker will choose to spend 2 hours per day lunching and working in the area of elevated levels of COPCs on a repetitive basis. Additionally, this risk assessment assumed that exposure to COPCs could actually occur, ignoring the storage unit

which covers half of the unpaved area. Therefore, the cancer risk and potential for noncarcinogenic adverse health effects are overestimated.

1.5 Conclusions

The results of the human health risk assessment suggest that potential exposure to COPCs in soil downgradient from the pipe rack would not result in adverse noncarcinogenic health effects or an unacceptable cancer risk to industrial users.

PROPOSED AGENDA FOR THE MAY 20, 1996, FIELD TRIP BY NMED TO THE TA-50 RLW TREATMENT FACILITY

Location	Time	Topic/Activity
TA-50 Conference Room	10:00-10:20	D. Moss: RLWT Facility & collection system
	10:20-10:40	S. Yarbro: Pre-treatment at TA-55 design review - end of May comments - end of June receive column - early fall
RLWT Facility	10:40-11:30	D. Moss: Plant Tour
Mortandad Canyon	11:30-12:15	D. Moss: Outfall D. Rogers: Mortandad Canyon overview
Lunch	12:15-1:15	B. Beers: Lunch at Otowi Cafeteria
TA-50 Conference Room	1:15-1:45	D. Rogers: Mortandad Canyon: Hydrogeology and Surveillance Monitoring
	1:45-2:30	A. Bond: TA-50 Process Upgrades
	2:30	End of Field Trip

TA-50-1 5-20-96 OUTFALL – Ground Discharge

PLAN PLANT TOUR

	Group	Phone	Mail Stop
DAVID MOSS	CST-13	7-4301	E-518
STEVE YARBRO	NMT-2	667-2333	E 511
Steve Rae – owner of DP	ESH-18	665-1859	K 497
Steve Hanson	CST-13	667-4301	E518
John Rogers	NMED/GWQB	827-2713	
Dennis McQuillan	NMED/GWQB	827-2831	
Neil Williams	ESH-18	665-0454	K497
Alan Bond	CST-13	7-4301	E 518
Michael Duke – coordinator	NMED DOE OP	672-0449	J993
BOB BEERS – coordinator of DP	ESH-18	667-7969	K497
William Schveler (Bill) – primary environmental contact for TA-55	NMT-7	667-1193	E501
David Rogers	ESH-18	7-0313	K-497

Ken Zamora came in afternoon
– representing D.O.E.

- MEETING NOTES -
Radioactive Liquid Waste Treatment Plant

May 20, 1996
10 am - 2:30 pm
TA-50 Conf. Rm

DAVE MOSS

- Radioactive Liquid Waste Treatment Plant - Oview
  - only radioactive/industrial WWTP @ LANL
  - radioactive wastewater from TA-55 + TA-21 (no more discharge at TA-21).
  - deal w/ alpha-radiation
  - consolidated stacks into 1 discharge
  - influent from lab sinks, analytical work in hoods, evaporative waters, custodial sinks, etc.
  - ~ 5,000,000 gal. per year
  - operating since 1961
  - do not accept RCRA listed waste
  - sludge characterized as mixed-waste in past (has caused inconvenience
  - WAC discharge criteria
  - total toxic organic limit under NPDES.

- Collection System
  - gravity-driven via pipes (and some trucking in)
  - 8" polypropylene line w/ 6" line inside
  - 3 miles of collection systems
  - pipeline monitored by vaults every 500' (~50 vaults)
    - vaults monitored by computer system. If leak in 6" pipe, leakage flows down 8" pipe to vault thereby setting off alarm. No real alarms to date.

Treatment Plant Pretreatment - Nitric acid recovery @ TA-55

Steve Yarbro

Typical Liquid Wastes

- Acid waste
  - comes from nitrate-based process systems
- Caustic waste
  - generated by the chloride-based process systems
- Industrial waste streams

Acid Waste - goals

NO_3^- < 45 ppm $\Rightarrow$ (10 ppm NO_3^- as N)

pH 2-12 w/ avg of 4-5

Best process = distillation

- evaporation to remove dissolved solids and concentrate radionuclides
- continue to cement concentrated bottoms (cement fixation)
- ?
- distallation column pilot plant

Summary:

- distillation is best current technology for NO_3^- removal
- remove NO_3^- + radioactivity in same operation
- need to complete control studies & select final column interval

- caustic materials neutralized, settled out & filtered.

Discharge to Mortandad Canyon

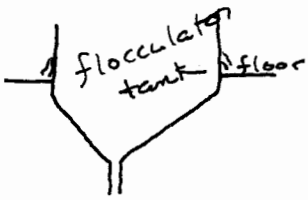
- outfall in Effluent Canyon, a small tributary to Mortandad.

- 4x per week @ 25,000 gallons per discharge.

⇒ 14,300 gpd

//

"Leaking" out of flocculators built in 60's



- Dave Moss says "leaking" is very poor choice of words. Is really "weeping of salts" - wicking of water through concrete; water drawn out by salts
- Leaking grit chamber no longer in use (they don't need grit removal anyway.)
- Levels of water in tanks monitored by ultrasound @ night (daily monitoring). No sign of appreciable leakage.

- lime + ferric sulfate used.

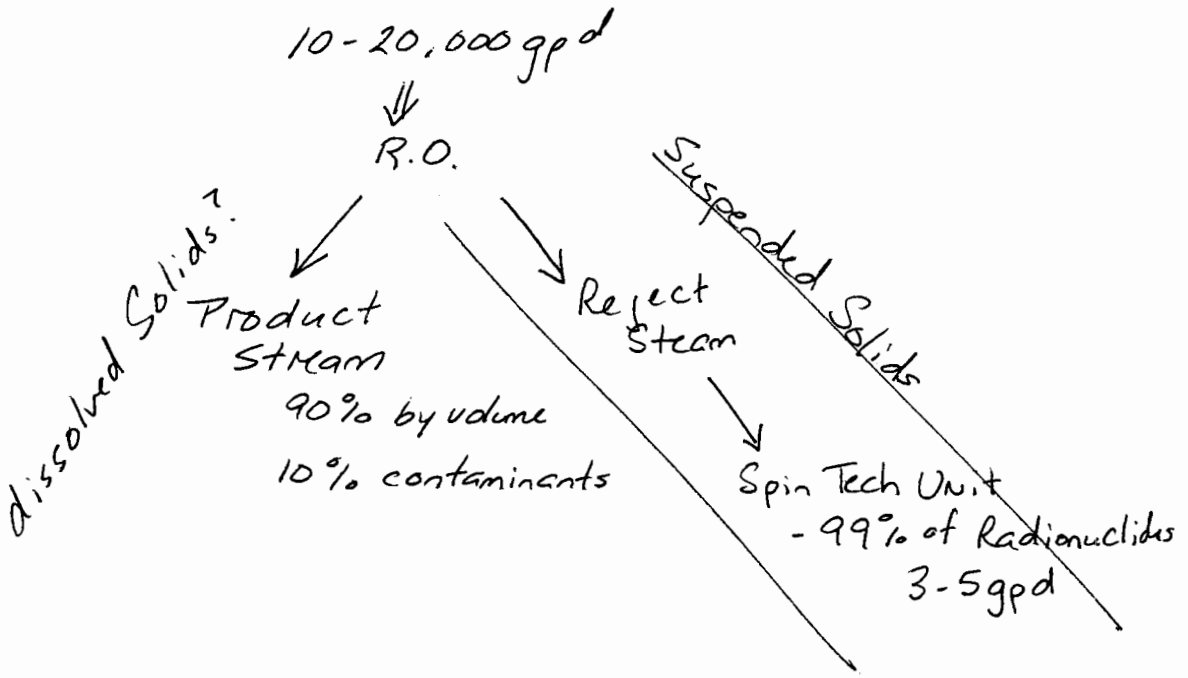
TA-50 Process Upgrades · Alan Bond

Ultrafiltration + Reverse Osmosis

- ultrafiltration reduces suspended solids so wask stream ready for R.O. (think of it as coarse R.O.)

DCGs - derived concentration guidelines (radionuclide limits)

concentrated stream w/ 90% nitrates, much reduced flows.



R.O. unit : 17,997 gpd : 45 ppm ⇒ 10 NO_3^- as N

Clarifier : 2,003 gpd @ 250ppm NO_3^- ⇒ 63 NO_3^- as N

- rad component
- TDS ?
- could this be used as irrigation water?

Hydrology David Rogers on Purtyman Study.

- 10-15' of water in alluvium @ 70'

- Test Well #8: 1000', no intermediate aquifers encountered during drilling.
  - cable tool

  Dennis McQuillan pointed out that w/ cable tool you'd never know whether or not you were going through saturated zones.

- filtered vs. unfiltered wrt metals.

- David says alluvial aquifer totally replaced each year w/ 100% of water loss due to E.T. (This is very hard to imagine!). Also says aquifer end in "Tower" Mortandad Canyon. This is based on MWs in alluvium. But no wells down in bedrock where alluvial aquifer could be leaking to.

Invoice No.	Date	Voucher	Gross Amount	Discount	Net Amount
0548D-CO	073096	CO834V	#PU#RI - 50.00	0548DTEL6	50.00

RECEIVED
AUG 19 1996
GROUND WATER SUPERFUND

RECEIVED
AUG 19 1996
GROUND WATER SUPERFUND

Check No.	Date	Vendor No.	Vendor Name	Total Amount
-S- 743204	073196	P1425100	NEW MEXICO ENVIRONMEN	50.00

SEE OTHER SIDE FOR CODE EXPLANATIONS

Los Alamos

Los Alamos National Laboratory

EXPLANATION OF CODES

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University of California
Accounting Division, Mail Stop P240
Los Alamos, New Mexico 87545

Phyllis

ACKNOWLEDGEMENT OF RECEIPT OF CHECK/CASH

I hereby acknowledge receipt of Check No. 743204 dated 7/31/96

or cash, received in the amount of $ 50.00 from _____

for LANL \ TA-50 Radioactive Liquid Waste Treatment Facility (Facility Name) 1132 (DP No.)

Submitted to ASD by: Tera Salazar Date: 8/20/96

Received in ASD by: _____ Date: _____

Filing Fee [X] New Facility [X] Renewal [ ]

Modification [ ] Other [ ] (Explain) _____

Organization Code 530340 Applicable FY 97

To be deposited in the Ground Water Section Discharge Plan Fees.

Full Payment [ ] or Annual Increment [ ]

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UNIVERSITY OF CALIFORNIA
P.O. BOX 1663, MS P240
LOS ALAMOS, NEW MEXICO 87545

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00109

Los Alamos
NATIONAL LABORATORY

Environmental Management
EM, J591
Los Alamos, New Mexico 87545
(505) 667-2211
FAX (505) 665-8190

Date: August 5, 1996
Refer to: EM:96-327

Ms. Marcy Leavitt, Chief
Ground Water Quality Bureau
New Mexico Environment Department
PO Box 26110
Santa Fe, New Mexico 87502

Dear Ms. Leavitt:

The Los Alamos National Laboratory would like to request a short deadline extension for submittal of the ground water discharge plan, requested by your agency, for the Radioactive Liquid Waste Treatment Facility (RLWTF) at Technical Area 50. Recently, the Laboratory determined that institutional commitment to the plan would be most effective if signatory approval was obtained from each of the institutional programs affected. As a result, while the plan is complete, scheduling conflicts have prevented the Laboratory from obtaining all of the final reviews and signatures desired. Therefore, the Laboratory is requesting a short extension of the deadline until close of business on Monday, August 19, 1996.

Any questions regarding this request should be addressed to Bob Beers of the Laboratory's Water Quality and Hydrology Group at 667-7969.

Sincerely,

Thomas E. Baca, Program Manager
Environmental Management Program

TEB/jja

Cy: EM File

GROUND WATER DISCHARGE PLAN APPLICATION

for the

TA-50 Radioactive Liquid Waste Treatment Facility

Prepared By
Los Alamos National Laboratory

August 16, 1996

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

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Executive Summary

This Ground Water Discharge Plan Application is being submitted in response to the New Mexico Environment Department's (NMED) letter of April 3, 1996, in which a discharge plan was requested for the discharge of nitrates and other non-NPDES contaminants from Los Alamos National Laboratory's (LANL) Radioactive Liquid Waste Treatment Facility (RLWTF) at Technical Area (TA)-50 (See Map 1.0). Treated effluent from the RLWTF is discharged into Mortandad Canyon at NPDES Outfall 051 (See Appendix B for information on Outfall 051).

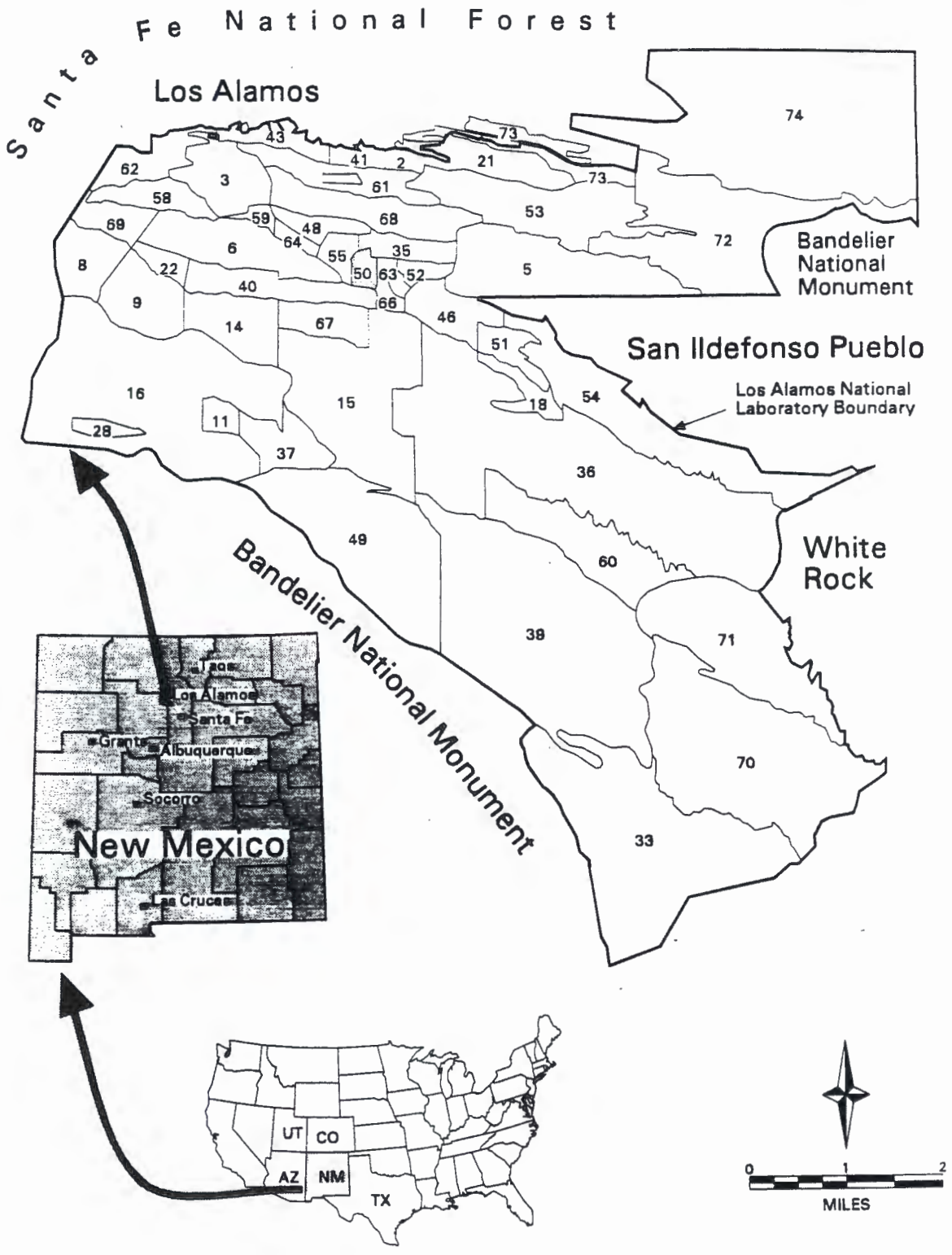
The RLWTF was constructed in 1963 and since that time has been in continuous operation. Figures 1.0 and 1.2 present a site plan and aerial photograph of the RLWTF, respectively. The treatment technologies currently used include chemical flocculation, precipitate settling, filtration, and solidification via cementation. The solidified waste is transferred from TA-50 to TA-54, Area G, for storage and disposal. In 1993 the RLWTF initiated a comprehensive program to non-destructively test (NDT) all process tanks and refurbish or replace, as appropriate. In April, 1992, the Laboratory initiated a Best Available Technology (BAT) evaluation to identify technologies necessary to ensure compliance with Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and the Environment". Based upon the BAT evaluation, the RLWTF developed a two-phased plan to upgrade treatment processes; The basic configuration proposed is for an ultrafiltration (TUF) step followed by reverse osmosis (RO) in Phase I and nitrate removal in Phase II. The completion dates for Phase I and II upgrades are June 30, 1997, and January 31, 1998, respectively.

Nitrate (NO3-N) and fluoride (F) concentrations in Mortandad Canyon's alluvial ground water presently exceed WQCC ground water standards but current trends are downward. Cyanide (CN) and total dissolved solids (TDS) have, on occasion, been discharged by the RLWTF at concentrations greater than WQCC ground water standards but recent (1990-1995) monitoring data does not show elevated concentrations in the alluvial ground water. Research by Purtymun (1977) indicates that once the concentrations of nitrates (NO3-N) and fluorides (F) in the effluent are reduced then concentrations of those contaminants in the alluvial ground water will naturally decline due to the relatively rapid turn-over of water and chemicals in storage.

The Laboratory is proposing to implement the following corrective actions for this Ground Water Discharge Plan Application: First, RLWTF treatment processes will be upgraded during Phase I and II to enable the treated effluent to meet or exceed WQCC ground water standards for nitrate (NO3-N) and fluoride; and Second, using a network of six ground water monitoring wells the Laboratory will closely monitor the quality of Mortandad Canyon's alluvial ground water to demonstrate that the improvements in water quality are consistent with the NMWQCC standards.

MAP 1.0

TA-50 RLW Treatment Facility Ground Water Discharge Plan



FIMAD G104747 03 Jun 96

FIGURE 1.0

TA-50 RLW Treatment Facility Ground Water Discharge Plan - Site Plan

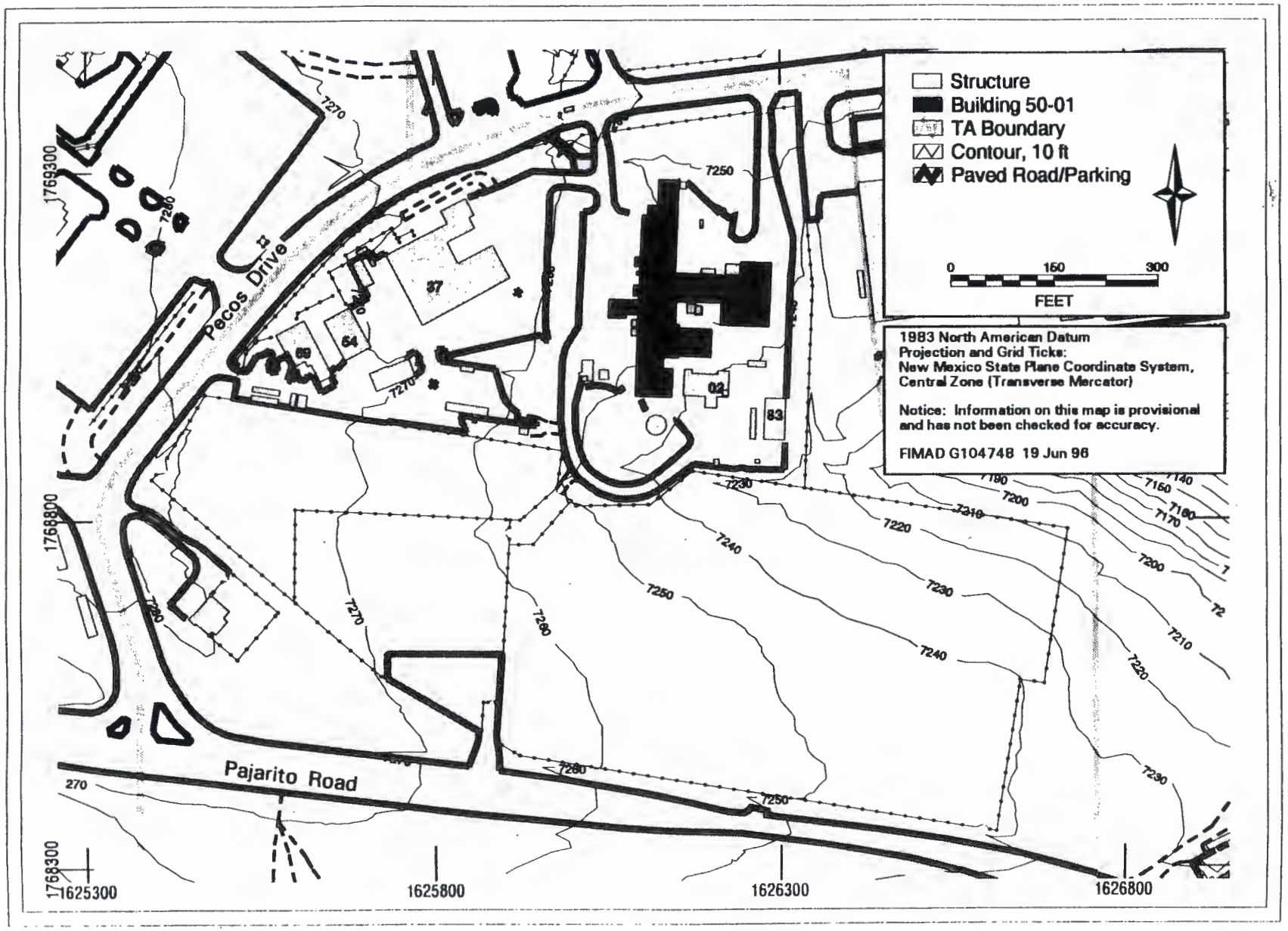
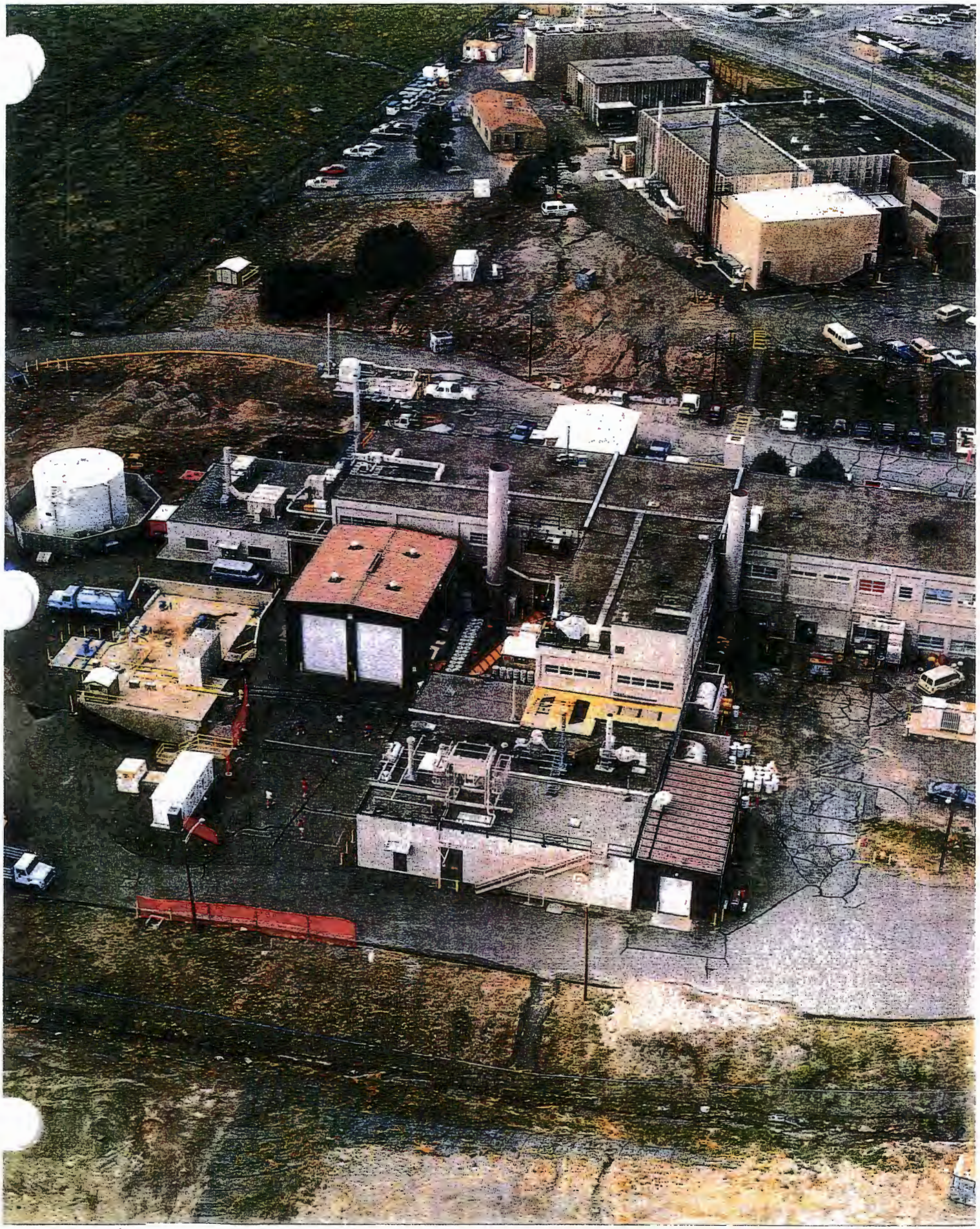
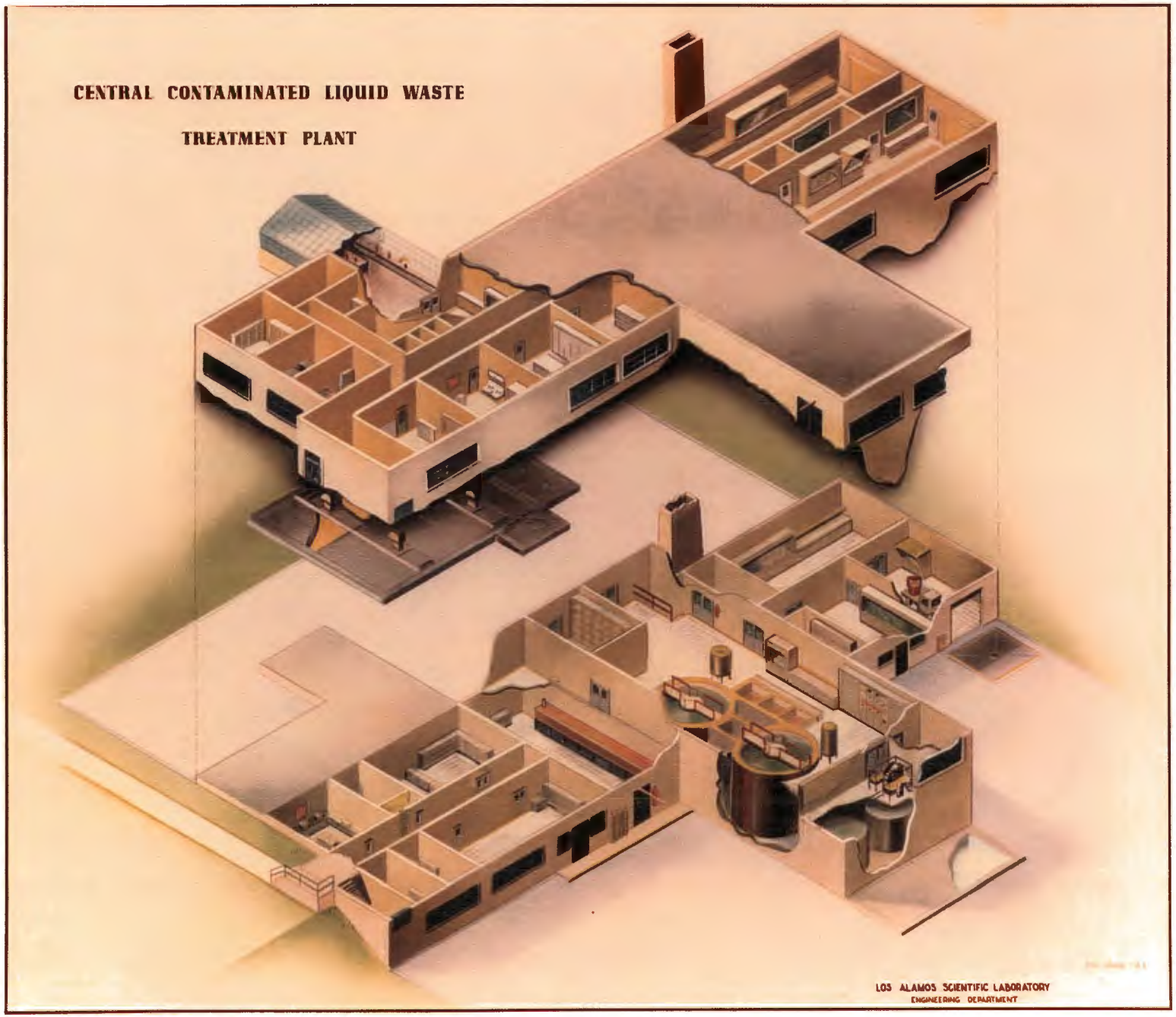


FIGURE 1.1



Aerial Photograph of Los Alamos National Laboratory's Radioactive Liquid Waste Treatment Facility at Technical Area-50.


CENTRAL CONTAMINATED LIQUID WASTE
TREATMENT PLANT
LOS ALAMOS SCIENTIFIC LABORATORY
ENGINEERING DEPARTMENT

PART A

Name of Facility: TA-50 Radioactive Liquid Waste Treatment Facility
Los Alamos National Laboratory
Los Alamos, New Mexico

Name of Persons Responsible for Discharge:

Mr. G. Tom Todd
Area Manager
U.S. Department of Energy
Los Alamos Area Office
528 35th Street
Los Alamos, NM 87544
(505)667-5105

Mr. Thomas E. Baca
Program Manager
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PO Box 1663, Mail Stop J515
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(505) 667-4457

Contact Person for TA-50 Plant Operations:

Mr. Steven Hanson
Group Leader, Radioactive & Industrial Wastewater Science
Los Alamos National Laboratory
PO Box 1663, Mail Stop E518
Los Alamos, NM 87544
(505)667-4301

1. Location of Discharge Site:

- **County:** Los Alamos
- **Latitude/Longitude of Discharge Point:**
  Latitude: 35° 51' 58.3"
  Longitude: 106° 17' 48.5"
- **Vicinity Map**: See Map 1.0
- **Distance to Los Alamos in Miles**: Approx. 1.0 mile to the LA Townsite

2. Type of Operation, Facility or Development:

Wastewater plant for the treatment of low-level, radioactive liquid waste.

3. Current and Proposed Method(s) of Treatment, Storage, and Disposal of Effluent.

A. Current Collection, Process, and Monitoring Systems

Collection System

Liquid waste is conveyed to the RLWTF via a gravity flow pipeline termed the collection system (See Map 2.0). The main pipeline branches to approximately six technical areas, and is eventually connected to sinks and drains within those facilities. The RLWTF is responsible for the collection system up to the first manhole leading up to the facility it serves, as well as some required instrumentation for process tankage within the confines of those facilities. The collection system was replaced in 1984 with a double encased polyethylene pipe to meet waste compatibility and secondary containment issues.

The collection system is continuously monitored for breach of containment and consists of conductivity monitors strategically located within manholes along the collection system. These monitors are designed to alarm at the presence of liquid and to date, no breach of containment has been detected. The monitors alarm the RLWTF operators as well as the utilities Central Alarm Station which is manned 24 hours a day.

Process Tanks

In 1993, the RLWTF initiated a Non-Destructive Testing (NDT) Program to demonstrate the integrity of the facility's process tanks. While all tanks in use were found to be corrosion free, tank upgrades were initiated by the RLWTF to establish secondary containment and leak detection or inspectability. A summary of tank upgrades is presented below and in Table 1.0.

• Influent Tanks:

(1) TA-50-2 WM-2 Tank Farm: Four (4) new 20,000 gallon carbon steel above ground tanks with secondary containment and leak detection are currently being installed. Construction is scheduled for completion in December, 1996. These tanks will replace the existing below ground, single-walled, 75,000 gallon influent tank.

(2) TA-50-2 WM-2: A new 20,000 gallon carbon steel double-wall tank is currently being installed inside of the existing concrete tank. The presence of the existing concrete tank will provide an effective tertiary containment barrier and allow for visual inspection. This project is scheduled for completion in October, 1996.

(3) TA-50-66 Process Tank: In 1994 the existing tank was replaced with a new 5,000 gallon stainless steel tank. Secondary containment for this tank is provided by a concrete vault with a chemical resistant lining. This tank is used for accumulating process waste that requires pretreatment.

• Treatment Vessels:

(1) TA-50-01 Clarifiers: Currently, the primary treatment vessels of the RLWTF are two, 25,000 gallon, concrete tanks with steel flocculator chambers. In 1994, both vessels were scheduled for non-destructive testing and revitalization through descaling, surface preparation, and re-coating with an epoxy liner. Non-Destructive Testing (NDT) of the clarifiers showed that the concrete walls and reinforcing steel was sound and corrosion-free. One clarifier has completed the revitalization process and the second is currently in progress.

Treatment System

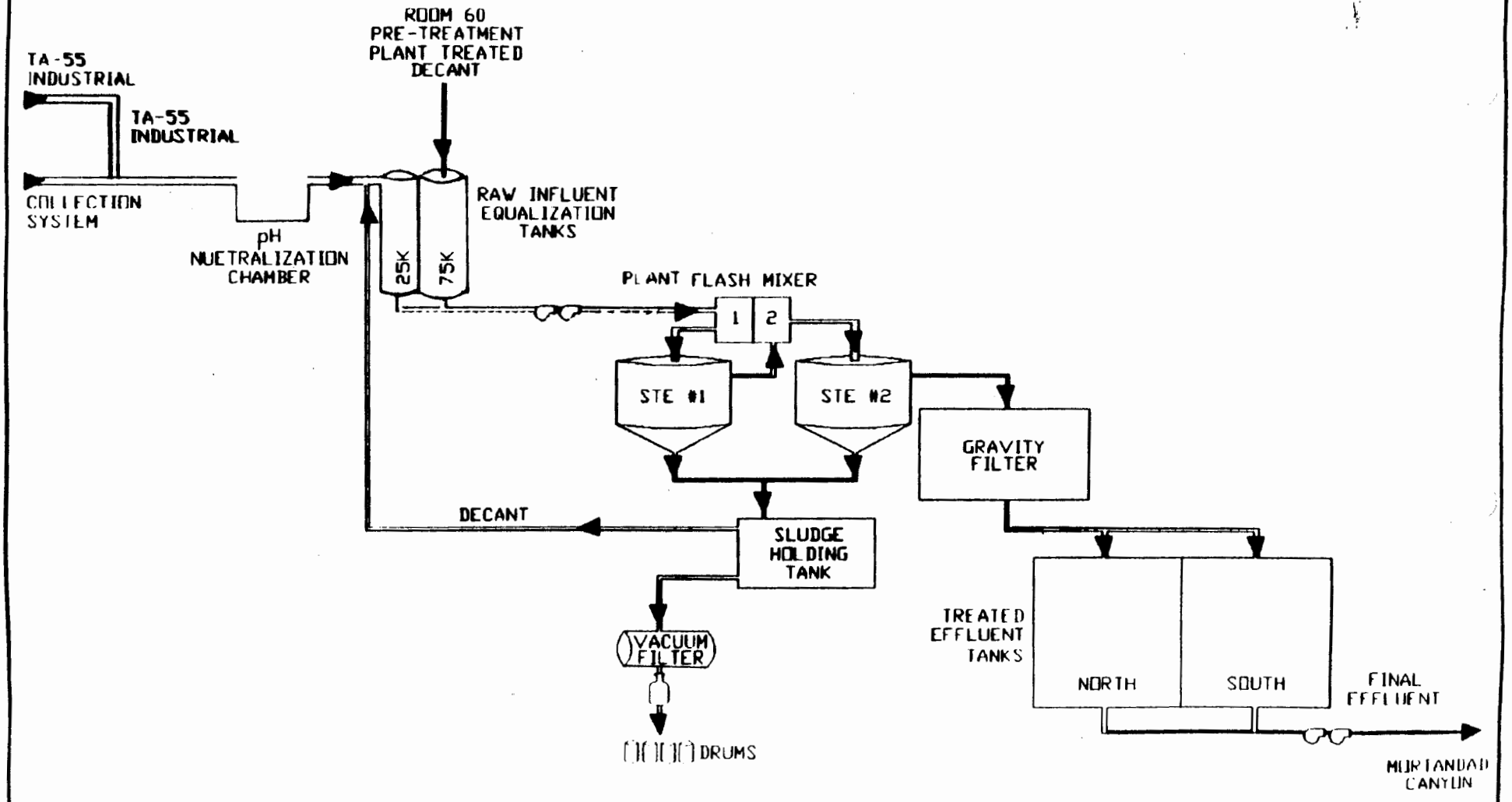
As illustrated in Figure 2.0, RLWTF Current Treatment Processes, liquid waste is first collected in influent tanks to provide storage capacity before batch treatment in a single shift, eight hour per day operation. During operation, waste is pumped to the chemical feeders where ferric sulfate and lime are added to form a ferric hydroxide flocculant. Floc particles containing radionuclides settle by gravity to the bottom of the clarifier to form a sludge layer and the supernatant flows over the weir at the top of the clariflocculator. The sludge is transferred to a sludge holding tank in preparation for filtration which is accomplished by a rotary vacuum filter. The filter cake resulting from this operation then consists of the separated Low Level Waste that is drummed and disposed of at TA-54, Area G. Supernatant, decanted from the top of the sludge holding tanks, and filtrate, from the rotary vacuum filter, are recycled to the influent holding tanks.

The clarifier supernatant is passed through an anthracite gravity filter to remove any unsettled floc. Carbon dioxide is bubbled through the gravity filter plenum to lower the pH to below 9 and to reduce scale formation resulting from clarifier operations. The filtered effluent is then collected in effluent holding tanks where pH, and gross radioactivity measurements are performed. The contents of the tank are then discharged through NPDES Outfall 051 to Mortandad Canyon.

Waste Acceptance Criteria and Administrative Controls

An integral part of the RLWTF's operations is LANLs program for administratively controlling influent quality. Each group or division that generates radioactive liquid waste is represented by a Waste Management Coordinator. At some sites, one person may represent several groups. The Waste Management Coordinator, the primary contact between generators and the RLWTF, has the authority to implement administrative controls for the group or division represented.

Figure 2.0 RLWTF CURRENT TREATMENT PROCESSES



The Waste Management Coordinator must ensure that:

- Waste streams not identified and listed under the Laboratory's National Pollution Discharge Elimination System (NPDES) permit are not discharged into the RLWTF's collection system;
- Operating personnel are familiar with pertinent administrative requirements, and waste management regulations;
- The radioactivity level of liquid waste is kept to a minimum and does not exceed the recommended limits as set forth in the RLWTF's Waste Acceptance Criteria (WAC). A copy of the RLWTF's WAC has been included in Appendix C;
- Listed hazardous wastes as defined by the Resource Conservation and Recovery Act (RCRA) and PCB wastes subject to regulation under the Toxic Substances Control Act (TSCA) are not discharged into the radioactive liquid waste collection system;
- The RLWTF is notified immediately of unusual or accidental discharges that may violate waste management regulations so that it may take corrective actions; and
- The RLWTF is contacted to coordinate disposal of radioactive liquid waste that does not meet requirements for discharge to the radioactive liquid waste collection system.

Collection System Monitoring

The RLWTF utilizes a microprocessor-based control system to monitor: Flows in the RLW collection system; Process tank levels; and Discharge volumes into the collection system at each of the primary waste generator sites. Alarms are received at both the RLWTF and at the continuously-manned Utilities Control Center. Control Center personnel call key RLWTF personnel at home if an alarm condition occurs during off-hours.

B. Proposed Treatment System Upgrades

Introduction

In order to meet the Derived Concentration Guidelines (DCGs) established by Department of Energy (DOE) Order 5400.5 and NMWQCC ground water standards, the RLWTF needs to upgrade current treatment processes. The RLWTF has begun implementation of a two-phased plan to meet: (1) DCGs and WQCC ground water standards for fluoride (F) in Phase I; and (2) the WQCC ground water standard for nitrate (NO3-N) in Phase II. The discussion which follows presents a description of the proposed Phase I and II treatment process upgrades at the RLWTF.

Phase I Treatment System Upgrades to the RLWTF

RLWTF personnel have completed engineering and pilot testing of the technologies available for Phase I treatment process upgrades. Based upon successful testing, RLWTF personnel have selected Tubular Ultrafiltration (TUF) followed by Reverse Osmosis (RO) as the preferred treatment process upgrade for Phase I. These process upgrades will enable the RLWTF to:

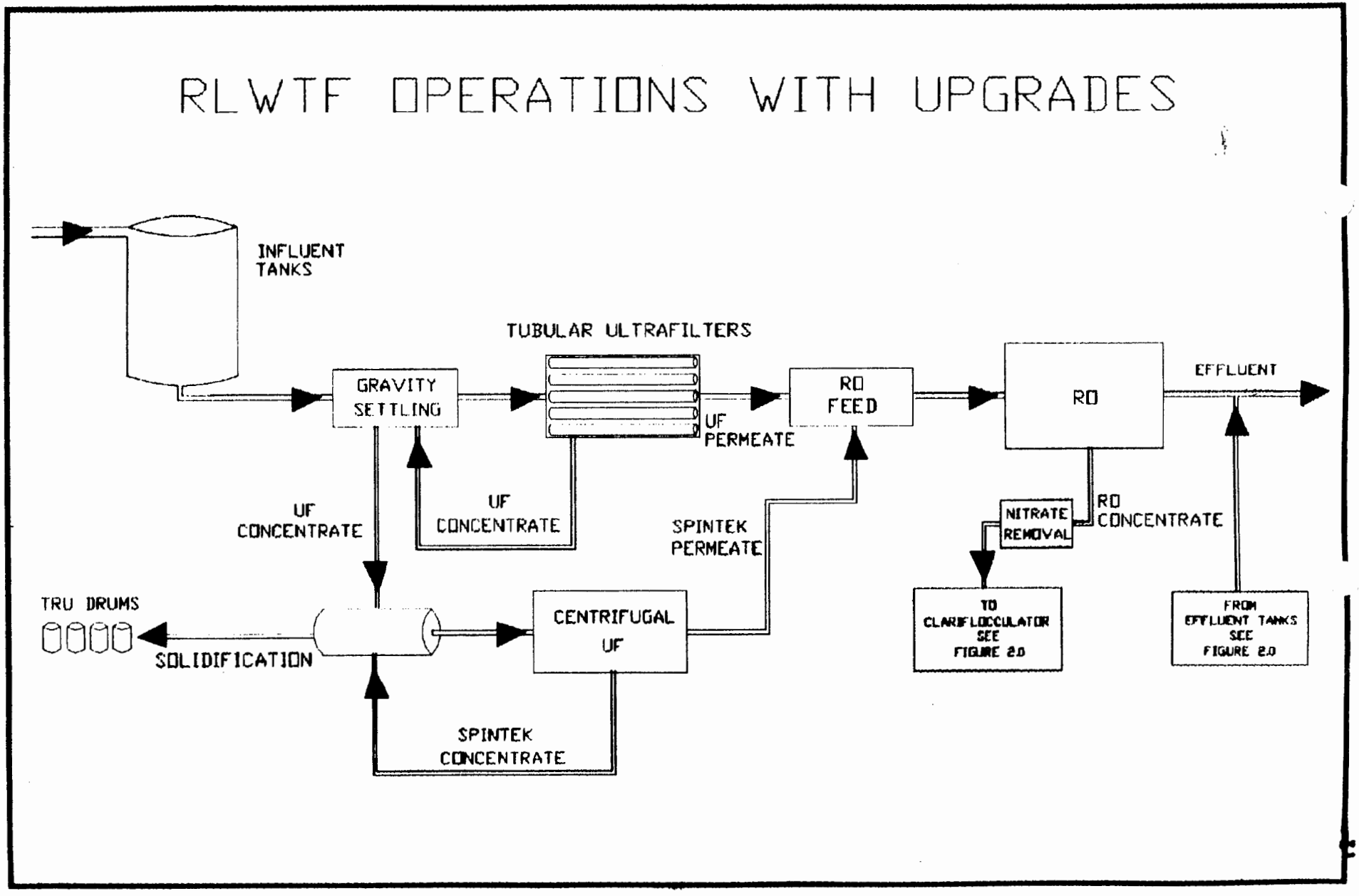
- Ensure that treated effluent is discharged below the Derived Concentration Guidelines (DCGs) for radionuclides set forth in DOE Order 5400.5, "Radiation Protection of the Public and the Environment";
- Reduce fluoride concentrations in the treated effluent by reducing its source, the food grade lime used during flocculation; and
- Concentrate nitrates in the wastestream for removal under Phase II.

TUF provides enhanced effluent quality by removing suspended solids and separating the majority of radioactivity from the waste stream. It provides effluent free of suspended solids to allow efficient operation of the RO which follows. Filtration capabilities of RO operate at the molecular level rejecting dissolved solids from the waste stream at greater than 96% rejection rates. The use of RO has been widely demonstrated in industry and municipalities when high purity product water is a requirement.

Figure 2.1 presents the RLWTF treatment process after implementation of the Phase I process upgrades: TUF and RO. The RO unit is the final treatment process prior to discharge and the RO membrane is expected to reject all constituents at the concentrations set forth in the WQCC ground water standards. The reject, or concentrate stream from the RO unit will be diverted to the clarifier for further radionuclide removal and subsequent blending back into the RLWTF effluent stream.

In March, 1996, LANL's Waste Management Program Office contracted with an independent industry consultant to evaluate the treatment options most appropriate for the RLWTF. The consultant's assessment was that the basic TUF and RO process configuration proposed by the RLWTF for Phase I was sound and should meet the design basis performance objectives.

FIGURE 2.1



Phase II Treatment System Upgrades at the RLWTF

The objective of Phase II upgrades is to remove nitrates in the RO reject stream to below WQCC ground water standards. The RLWTF and an independent industry consultant conducted separate assessments of the best technologies available for nitrate removal and determined that three treatment processes warrant further study:

(1) Evaporation. Evaporation through the use of a low-temperature evaporator or other system will be evaluated through pilot testing on surrogate waste;

(2) Biological Denitrification. To evaluate biological denitrification, a pilot scale reactor vessel is currently being fabricated to be used for simulation of full scale operation. This vessel and associated hardware will be used to determine the operational parameters of this system; and

(3) Selective Ion Exchange. The RLWTF has procured the hardware to begin pilot work to evaluate selective ion exchange for nitrate removal. Currently, RLWTF personnel are in contact with vendors for this type of resin.

Parallel engineering evaluations of these three options will produce the engineering data necessary to select the system that is most applicable to the RLWTF's waste stream. Additional criteria to be evaluated are the volume and disposal form of secondary wastes, the overall cost and operability of the process, and safety to operating personnel. A schedule for implementation of Phase II upgrades has been presented in Table 1.0. Installation and test-out of Phase II equipment will be completed by January 31, 1998.

If preliminary results of pilot testing of the Biological Denitrification Process or the Selective Ion Exchange Process indicates that one of these options exhibits satisfactory contaminant removal and operational performance, the DOE and Laboratory will determine the feasibility of scale-up and subsequent installation and start-up of an interim treatment unit prior to completion of the final evaluation of all three processes. Determination of satisfactory contaminant removal and operational performance for interim use will be made by DOE and the Laboratory in coordination with NMED.

Table 1.0. Summary of Completed, In Progress, and Proposed Upgrades to the RLWTF.

Plant Integrity Upgrades	Start Date	Completion Date
• Eliminate Influent from the Solids Section of the Grit Chamber.	August, 1990	September, 1990
• Install New Neutralization Chamber & Monitoring Station to Eliminate Grit Chamber Function.	August, 1990	August, 1993
• Install New Collection Lines from TA-55 to TA-50.	August, 1990	June, 1995
• Replace WM-66 Acid Tank with New SS Tank.	January, 1994	August, 1994
• Non-Destructive Testing of All Concrete Tanks.	June, 1994	December, 1994
• Non-Destructive Testing of all Steel Tanks.	May, 1993	September, 1993
• Refurbish Clarifiers (2).	August, 1995	October, 1996
• Install New Influent Tank Farm.	Dec., 1993	December, 1996
• Video Inspect Pipelines & Pressure Test Equipment.	April, 1995	On-Going
Phase I Process Upgrades: TUF and RO	**Start Date**	**End Date**
• BAT Evaluation Conducted per DOE Order 5400.5.	April, 1992	May, 1995
• Engineering of Phase I Upgrades.	February, 1994	June, 1996
• Procurement, Installation, and Start-Up.	May, 1996	March, 1997
• Test-Out Period.	March, 1997	June, 1997
• Phase I Fully Operational.	----	June, 1997
Phase II Process Upgrades: Nitrate Removal	**Start Date**	**End Date**
• BAT Evaluation Conducted.	April, 1992	May, 1995
• Parallel Evaluation of Available Technologies by RLWTF and an Independent Consultant.	March, 1996	June, 1996
• NEPA Review of Process Upgrades.	February, 1996	September, 1996
• Parallel Engineering of 3 Options.	July, 1996	June, 1997
• Parallel Pilot Testing of 3 Options:		
1) Evaporation.	October, 1996	May, 1997
2) Biological Denitrification.	October, 1996	April, 1997
3) Selective Ion Exchange.	October, 1996	March, 1997
• Evaluation of Pilot Testing.	May, 1997	June, 1997
• Selection of Nitrate Removal Process.	June, 1997	July, 1997
• Procurement of Equipment, Installation and Start-Up.	July, 1997	January, 1998
• Phase II Upgrades Fully Operational.	----	January, 1998

B. Proposed Treatment System Upgrades (Continued)

Nitric Acid Recovery System (NARS) at TA-55

In addition to process upgrades at the RLWTF, the Laboratory is also initiating source reduction of nitrates as a means of enhancing treatment process efficiency. TA-55, the major source of nitrates in the RLWTF influent, will install a Nitric Acid Recovery System (NARS) which is capable of recycling the nitric acid used in plutonium stabilization operations. The system will process 1 Liter per minute (L/min) of 2 M to 5 M solution drawn from the existing nitric acid storage tanks and generate a product stream of 45 parts per million (ppm) nitric acid for discharge to the RLWTF. NARS is scheduled for completion in June, 1998, although efforts are being made to accelerate implementation of this system.

4. Quantity of Discharge:

There are 20,885 gallons of effluent per each effluent tank batch discharged. Typically, the RLWTF discharges 0, 1, or 2 tanks of treated effluent on a run day resulting in daily discharge volumes of 0 gallons per day (gpd), 20,885 gpd or 41,770 gpd, respectively. Discharges only occur on days when the plant is in operation, typically 4 to 6 days per week. During a typical operating week the RLWTF discharges between 2 and 8 tanks of treated effluent. The large variability in discharge quantities is due to fluctuations in influent flow. Based on these figures, it can be estimated that the RLWTF will discharge between 104 and 416 times during a year, or between 2.17 million gallons (MG) per year and 8.69 MG per year. In 1994, the RLWTF discharged 5.506 MG to NPDES Outfall 051. Reference: Appendix D. RLWTF Annual Report for 1994.

5. Method Used to Meter or Calculate the Discharge Rate:

Effluent is stored in two identical effluent tanks which overflow into each other. During the treatment process, an effluent tank will be filled until it overflows into the adjoining effluent tank. At this point the tank is considered full. As an effluent tank is discharged, the discharge pumps shut off automatically when the water in the tank has dropped to a set level. In this way the volume of water discharged from either tank will always be the same (20,885 gallons). Tank volume is verified periodically by filling the tank to its on/off control point using a metered source of industrial water.

6. Flow Characteristics:

The discharge pump produces an average flow rate of 720 gallons per minute when operating. The flow of treated effluent discharged at the NPDES Outfall is intermittent due to the RLWTF's method of discharging in batches.

7. Discharge Quality.

Since the existing RLWTF treatment process was designed in the early 1960's for radionuclide removal, the facility's current effluent quality does not routinely meet all of the WQCC ground water standards. NPDES compliance and RLWTF operational data, summarized in Tables 1.1 and 1.2, respectively, shows that the RLWTF's treated effluent has consistently exceeded WQCC ground water standards for fluoride (F) and nitrate (NO3-N), and occasionally exceeded the standards for cyanide (CN) and total dissolved solids (TDS). See Appendix D for the complete data record for 1994 for RLWTF operational monitoring of treated effluent.

8. Location of Water Supply and Injection Wells.

Map 3.0 shows that no water supply wells or injection wells are located within 1 mile of the RLWTF discharge point (NPDES Outfall 051)

9. Location of Seeps, Springs, Bodies of Water or Water Courses.

All seeps, springs, bodies of water, and water courses are presented on Map 3.0.

10. Location of Monitor Wells

Monitoring of the Mortandad Canyon alluvial ground water will be conducted through an existing network of six (6) monitoring wells constructed during the period 1960 through 1974. Tables 2.0 and 2.1 present the coordinates, elevations, construction and completion dates, and completion depths for these wells. Map 4.0 illustrates the location of the monitoring wells in Mortandad Canyon.

One of the monitoring wells selected for the Monitoring Plan, MCO-3, has been out-of-service since 1993 due to erosion around the well casing. While it is expected that repairs can be made and the well will be brought back into service, as a contingency plan the Laboratory proposes to substitute a surface water sampling station, GS-1, if MCO-3 is unavailable for sampling. GS-1 is an appropriate substitute for MCO-3 because the alluvium in that reach of Mortandad Canyon is very thin (7 ft. at MCO-3), thus creating a intimate relationship between surface and ground water, i.e. the quality of water at MCO-3 closely mirrors the quality at GS-1.

CONSTITUENT	1994 AVERAGE	1994 MAX	1994 MIN	1995 AVERAGE	1995 MAX	1995 MIN	1996 AVERAGE	1996 MAX	1996 MIN	WQCC 3103. STANDARDS
CADMIUM	0.00062	0.005	<0.0001	0.0004	0.002	<0.0001	0.0009	0.003	0.0001	0.01
CHROMIUM	0.0047	0.024	<0.0004	0.007	0.044	<0.001	0.0111	0.035	<0.005	0.05
COPPER	0.10	0.22	0.03	0.11	0.4	0.043	0.12	0.28	0.04	1
IRON	0.12	0.5	0.02	0.2	3.4	0.03	0.09	0.17	0.03	1
MERCURY	0.0003	0.0006	0.0001	0.0004	0.002	0.00004	0.001	0.0111	<0.0002	0.002
NICKEL	0.037	0.092	<0.015	0.038	0.095	<0.015	0.025	0.055	0.014	0.2
LEAD	0.004	0.02	<0.002	0.004	0.018	<0.002	0.014	<0.046	0.002	0.05
pH	6.51	6.84	6.3	6.76	7.7	6.1	7.1	7.6	6.5	6 TO 9
ZINC	0.048	0.19	<0.005	0.046	0.15	0.011	0.05	0.17	0.02	10
Total Toxic Organics		0.014	U		U	U		0.34	U	NA
Ra 226&228 (pCi/L)	3.09	10.38	<ldl	6.39	11.7	<ldl	4.75	8.4	<ldl	30 pCi/L
TKN	5.6	6.4	4.8	7.24	9.95	2.7	8.38	12.27	3	NA
NH3-N	5.8	12	0.6	4.8	7.9	0.55	6.18	9.26	0.95	NA
NO3-N	41.7	90	23	34	58.3	13	131.3	239	32.3	10

Notes

TTO=Total Toxic Organics: See Appendix B for complete listing of compounds

U=No compounds detected above the laboratory's quantitation limit

ldl=laboratory detection limit

All units, excluding pH and Ra 226&228, are in mg/L

effluent Conc. not gw

Table 1.1

NPDES Monitoring Data for Outfall 051
January, 1994 -- May, 1996

CONSTITUENT	1993 AVERAGE	1993 MAX	1993 MIN	1994 AVERAGE	1994 MAX	1994 MIN	1995 AVERAGE	1995 MAX	1995 MIN	WQCC 3103. STANDARDS
ALUMINUM				0.13	0.3	<ldl	0.11	0.4	<ldl	5.0
ARSENIC	0.002	0.0034	0.002	0.000	0.003	<ldl	0.001	0.0049	<ldl	0.1
BARIUM	0.016	0.054	0.005	0.013	0.018	0.009	0.023	0.065	0.007	1.0
BORON							0.17	0.29	0.11	0.75
CADMIUM -	0.002	0.004	0.001	0.002	0.01	<ldl	<ldl	<ldl	<ldl	0.01
CHLORIDE	62	148	35	33	48	3	49	75	24	250
CHROMIUM	0.012	0.04	0.001	0.008	0.03	<ldl	0.007	0.04	<ldl	0.05
COBALT				0.002	0.01	<ldl	0.001	0.005	<ldl	0.05
COPPER	0.2	0.4	0.1	0.1	0.2	0.1	0.1	0.2	0.1	1.0
CYANIDE	0.2	0.4	0.03	0.1	0.1	0.02	0.1	0.25	0.01	0.2
FLUORIDE	2.9	4.9	1.3	1.9	3.3	1.1	2.6	6.7	1.7	1.6
IRON	0.3	0.7	0.1	0.2	0.6	0.04	0.2	0.4	<ldl	1.0
LEAD	0.04	0.37	0.001	0.004	0.024	<ldl	<ldl	<ldl	<ldl	0.05
MERCURY	0.0002	0.0004	0.0002	0.0002	0.0003	<ldl	0.0003	0.0004	<ldl	0.002
NICKEL	0.061	0.36	0.001	0.048	0.085	0.025	0.035	0.069	0.01	0.20
AMMONIA-N	6.07	8.6	4.87	5.50	9.2	2.2	5.284	7.8	2.05	NA
NITRATE-N	359.8	726.6	45.0	45.5	87.0	24.0	81.6	307.0	2.1	10.0
NITRITE-N	0.86	5.6	0.02	1.17	4.7	<ldl	0.63	1.84	0.11	NA
pH	7.2	7.6	6.81	7.2	7.4	6.7	7.2	8.5	6.8	6 TO 9
SELENIUM	0.002	0.0037	0.002	0.001	0.003	<ldl	0.0007	0.006	<ldl	0.05
SILVER	0.002	0.007	0.001	0.000	0.01	<ldl	0.003	0.028	<ldl	0.05
SULFATE	64	108	41	47	71	4	60	104	38	600
TDS	2659	4990	1100	842	1424	630	872	2692	290	1000
URANIUM	0.005	0.014	0.001	0.007	0.035	<ldl	0.005	0.008	<ldl	5.0
ZINC	0.137	0.2657	0.049	0.068	0.109	0.028	0.025	0.07	<ldl	10.0

Notes

All units, excluding pH, are in mg/L

ldl= Laboratory Detection Limit

Data Source: 1993,1994, and 1995 Annual Reports for the RLWTF at TA-50: by CST-13

Table 1.2

RLWTF Operational Monitoring of Treated Effluent
1993-1995

Table 2.0. Latitude/Longitude and Elevations for Monitor Wells in Mortandad Canyon

Observation Wells	Location		Elevation (ft)
	Longitude	Latitude	
MCO-3	106° 17' 38"	35° 51' 55"	7053
MCO-4	106° 16' 51"	35° 51' 50"	6900
MCO-5	106° 16' 36"	35° 51' 48"	6876
MCO6	106° 16' 22"	35° 51' 42"	6849
MCO-7	106° 16' 11"	35° 51' 38"	6827
MCO-7.5	106° 16' 00"	35° 51' 37"	6809

Reference: Purtymun, 1995

Table 2.1. Well Characteristics of Mortandad Canyon Observation Wells.

Well Name	Date Drilled	Date Completed	Depth Drilled (ft)	Depth Completed(ft)
MCO-3	3/67	3/67	18	12
MCO-4	10/63	10/63	24	19
MCO-5	10/60	10/60	47	46
MCO-6	10/60	3/74	82	47
MCO-7	10/60	10/60	77	69
MCO-7.5	11/61	4/74	60	60

Reference: Purtymun, 1995.

11. Ground Water Conditions.

a. Depth to Ground Water at the Discharge Site:

(1) The depth to the perched alluvial ground water in Mortandad Canyon varies temporally and with distance down the canyon. Depths to saturation typically are:

- Less than 1 ft. at the RLWTF Outfall, which is located at the confluence of Mortandad and Effluent Canyons;
- From 5 ft. to 22 ft. at MCO-4 in the upper reach of the canyon;
- From 30 ft. to 33 ft. at MCO-6 in the middle reach of the canyon and
- From 50 ft. to 60 ft. at MCO-8 in the lower reach of the canyon.

(2) Depth to the main aquifer at Mortandad Canyon Test Well No. 8, located near the middle of the canyon, is 968 ft.

b. Flow Direction of Ground Water Below the Site: Southeast

c. Gradient of Ground Water Below the Site:
The gradient of the saturated alluvium between MCO-3 and MCO-4, in the upper reach of the canyon below the RLWTF Outfall, is approximately 300 ft. per mile.

d. Reference or Source of Information for 10. a, b, c, Above:
Stoker et al. 1991. Extent of Saturation in Mortandad Canyon.

e. Total Dissolved Solids(TDS) Concentration (mg/L) of the Ground Water:
The TDS concentration of the perched alluvial ground water in Mortandad Canyon is 300-600 mg/L.

f. Reference or Source of Information:
Los Alamos National Laboratory Environmental Surveillance Report for 1993.

See Appendix E for a detailed description of the hydrologic setting of Mortandad Canyon.

Quality of Mortandad Canyon Alluvial Ground Water

Table 2.2 presents nitrate concentrations in Mortandad Canyon alluvial ground water from 1981 to 1995. A comparison of this data to the WQCC nitrate standard of 10 mg/L (as nitrogen) shows that while high concentrations of nitrates have been present as recently as 1994, the overall trend is downward. Purtymun (1977) determined that the loss of nitrates could be attributed to uptake by plants, adsorbtion onto alluvial material, and infiltration into underlying tuff (See Appendix E). In 1995, the average nitrate concentration among the seven wells sampled was 15 mg/L (as nitrogen). This downward trend is further illustrated in Figure 3.0. It is expected that this downward trend will become more pronounced once Phase II nitrate removal processes are operational.

Appendix F presents ground water quality data for six Mortandad Canyon alluvial monitoring wells from 1981 through 1995. Comparison of this data with the WQCC ground water standards shows that, beside nitrate, only one parameter, fluoride (F), has consistently exceeded ground water standards. Figure 3.1 illustrates the current downward trend in fluoride concentrations in the alluvial ground water. Once Phase I process upgrades are operational and the use of lime in the treatment process is reduced then more pronounced down-trending towards background conditions should be expected. Cyanide (CN) and TDS have been discharged by the RLWTF at concentrations greater than WQCC ground water standards but recent (1990-1995) monitoring data does not show elevated concentrations in the alluvial ground water.

STATION NAME	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	MAX	MIN	AVERAGE
MCO-3	217	59	29	25	15	4	42	9	111	13	5	23				217	4	46
MCO-4	145	60	75	104	56	90	38	123	107	52	35	58	66	17		145	17	73
MCO-4B															14			14
MCO-5	103	108	99	115	61	106	78	110	24	19	8	5	11	7	9	115	5	58
MCO-6B															17			17
MCO-6	497	555	440	650	54	102	56	19	81	38	29	19	54	48	18	650	18	177
MCO-7	27	19	68	25	110	74	54	111	82	7	26	16	60	61	18	111	7	51
MCO-7.5	16	13	108	77	111	74	55	109	82	77	27	28		57	15	111	13	61
MCO-7A															16			16

Data Source: Los Alamos National Laboratory's Water Quality & Hydrology Group (ESH-18)

for the year
Average, max, min ?

Table 2.2

Mortandad Canyon Alluvial Ground Water Monitoring Stations: 1981-1995
Nitrate Concentrations: NO3-N (mg/L)

Figure 3.0: Nitrate (NO3-N) Concentrations in Six Mortandad Canyon Monitoring Wells from 1981 to 1995.

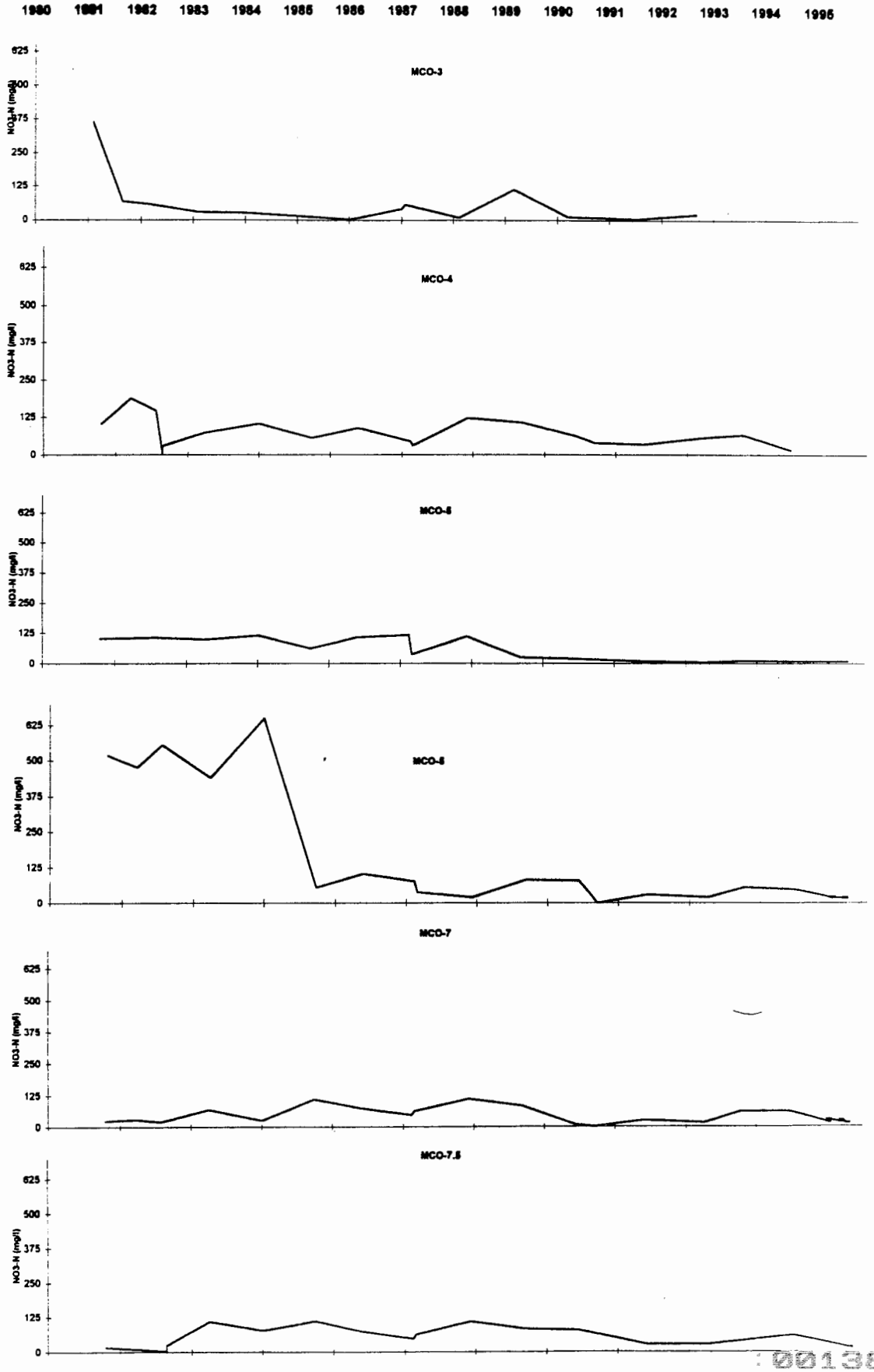
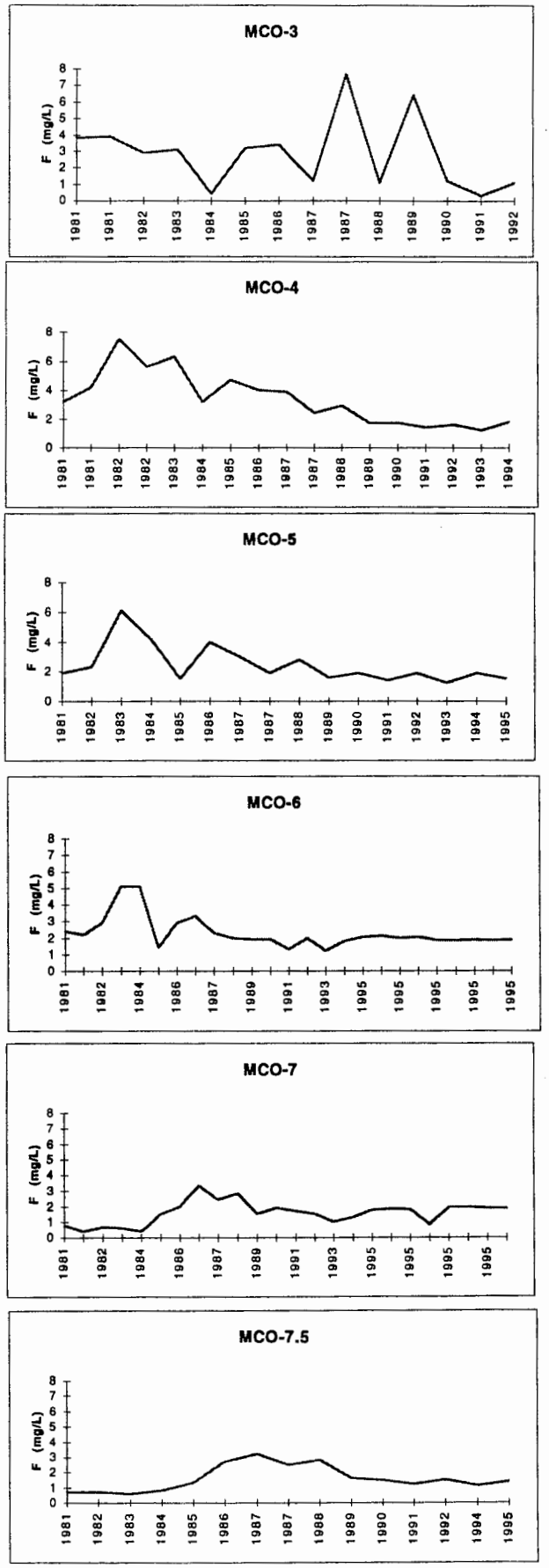


Figure 3.1: Fluoride (F) Concentrations in Six Mortandad Canyon Monitoring Wells from 1981 to 1995.



Mortandad Canyon Mass Balances

In 1977 Purtymun (Appendix E) evaluated the mass balance of water and chemicals (including nitrate) in the alluvial groundwater in Mortandad Canyon. With respect to water balance, water sources during the 1963-1974 study period were from industrial effluents from TA-50 and storm runoff and waste water from TA-48. The proportion of storm water and TA-48 discharge to TA-50 effluent ranged from about 0.6 to 1.7. The amount of water in storage (at the end of the year) in the alluvial groundwater during this time was about 20% of the surface water inflow. As the groundwater body does not extend beyond the Laboratory boundary, this implies large annual water losses from the system. Purtymun (1977) attributed these water losses to evapotranspiration and seepage into the underlying tuff.

Comparison of concentrations of chemicals in yearly effluent samples and groundwater samples shows that groundwater concentrations are about 30 to 50% of effluent concentrations. This holds true for sodium, chloride, nitrates, and total dissolved solids. Thus, dilution of the groundwater occurs continually. The amount of nitrate in storage in the Mortandad Canyon groundwater in 1974 was about 2.6% of the amount disposed of since 1963. The amount of chemicals unaccounted for in the inventory were taken up by plants, adsorbed onto alluvial material, or carried into the underlying tuff by infiltrating water. Purtymun (1977) concludes that "The rapid loss of water and its associated chemicals from the aquifer prevents chemical accumulation and indicates that cessation of effluent release to the canyon would rapidly improve the quality of water in the aquifer".

Related Ground Water Monitoring Projects

The Laboratory is currently preparing a site-wide Hydrogeologic Workplan pursuant to a request from NMED's Hazardous and Radioactive Materials Bureau. The Workplan is scheduled to be submitted to NMED during September, 1996. The Workplan will address both the Resource Conservation and Recovery Act (RCRA) regulatory ground water monitoring requirements, and the Hazardous and Solid Waste Amendments (HSWA) hydrogeologic permit requirements. The Workplan will describe proposed ground water characterization and monitoring activities Laboratory-wide, including their scheduled implementation, and specifically will include activities in and adjacent to Mortandad Canyon. Once the Hydrogeologic Workplan is approved by NMED, any proposed ground water activities relevant to Mortandad Canyon are expected to compliment this discharge plan, and may be included in a subsequent discharge plan modification, as appropriate.

The Laboratory has an on-going Environmental Restoration Project that is responsible for preparing RCRA Facility Investigation (RFI) task/site work plans that establish the technical approach and methodology for environmental investigations. An RFI work plan will be prepared for Mortandad Canyon, and at this writing, is currently scheduled for submittal to NMED in September 1997. The general purpose of the RFI investigation in Mortandad Canyon will be to:

- Determine the potential for contaminant transport into or within Mortandad Canyon watersheds;
- Evaluate human health risks and ecological impacts associated with the presence of contaminants;
- Refine conceptual models for contaminant transport;
- Assess the potential for interconnections between ground water in alluvium, perched intermediate zones, and the regional aquifer; and
- Assess the projected impact that contaminants may have on off-site receptors and the Rio Grande.

Once the RFI work plan for Mortandad Canyon is approved by NMED, any proposed ground water activities are expected to compliment this discharge plan, and may be included in a subsequent discharge plan modification, as appropriate.

12. Flooding Potential of the Site.

Map 5.0 , the 100-Year Floodplain, illustrates that the RLWTF at TA-50 is not within the boundaries of the 100-year flood plain.
Reference: McLin, 1992.

13. Description of Soils.

See Appendix E for a description of the soil distribution and characteristics of Mortandad Canyon.

14. Description of Geology.

See Appendix E for a description of the bedrock stratigraphy of Mortandad Canyon.

15. Operations and Maintenance Plan.

Detailed Operating Procedures (DOP) for the RLWTF at TA-50 Building 1 have been attached in Appendix G. These procedures ensure the quality of operations and the safety of personnel. Specifically, the DOP describes the procedures for:

- Routine treatment of liquid waste at the RLWTF;
- Routine rotary vacuum filter operations;
- Routine wastewater and sludge sampling; and
- Proper response to hard alarms.

16. Contingency Plan.

The RLWTF and LANL maintain three contingency plans to address actions that will be taken in the event of an emergency or spill at the facility:

1) Contingency Plan ;
2) Spill Prevention Control and Countermeasure Plan (SPCC); and
3) LANL Emergency Management Plan.

The Contingency Plan and the LANL Emergency Management Plan have been enclosed in Appendix G. Due to its size, the SPCC Plan has not been included in this discharge plan but is available upon request.

After January 31, 1998, as a contingency against discharging nitrates (N03-N) in excess of WQCC standards, each batch of treated effluent will be screened for nitrates prior to discharge. This will enable plant operators at the RLWTF to minimize their response time to sub-standard treatment process performance.

While the RLWTF has, and will continue to be, the most regular source of surface water entering Mortandad Canyon, storm water runoff and industrial discharges from NPDES permitted outfalls are additional sources. In order to quantify the ratio between RLWTF and other sources, the Laboratory will compare annual discharges from the RLWTF with discharge records from gaging station GS-1 (See Map 4.0) on an annual basis and report the results to the Ground Water Bureau as part of this discharge plan's reporting. Depending upon the results, the Laboratory will determine if there is a need for additional sampling locations upstream of the RLWTF's discharge point. These sampling locations would serve as control points for establishing the relative influence of other water sources in the drainage and how they affect ground water quality.

The Laboratory's approach in developing corrective actions for this ground water discharge plan is based upon Purtymun's research (1977) and the data record for Mortandad Canyon; both strongly indicate that after reducing the input of contaminants from RLWTF effluent the alluvial ground water will naturally attenuate to below WQCC ground standards. Following this position, the Laboratory is making a commitment to implement substantial process upgrades at the RLWTF, meet WQCC ground water standards in the treated effluent, and expand existing monitoring of the alluvial ground water. However, in the event that these corrective actions prove to be inadequate, the Laboratory is committed to revisiting its approach and evaluating alternative actions.

17. Monitoring Plan.

The Laboratory proposes to develop new data and use data from the following on-going monitoring programs to provide a comprehensive Monitoring Plan for the RLWTF Ground Water Discharge Plan Application:

(1) NPDES compliance sampling of treated effluent;

(2) RLWTF operational sampling of treated effluent;

(3) Groundwater Management Protection Program sampling of Mortandad Canyon's alluvial ground water; and

(4) NPDES Stormwater Program stream gaging of Mortandad Canyon.

Further information on NPDES compliance sampling and RLWTF operational sampling are presented in Appendix A. Table 3.0, presented on the following page, summarizes the sampling point locations, frequency, and sampling constituents of the Proposed Monitoring Plan.

Table 3.0. Proposed Monitoring Plan for the RLWTF Ground Water Discharge Plan Application

LOCATION	PARAMETER	NOTE	MONITORING FREQUENCY*
Discharge Point	Batch Volume, in gallons		Per batch
Discharge Point	pH		Per batch
Discharge Point	Nitrate Screening		Per batch
Discharge Point	Total Nitrogen	1	1/week
Discharge Point	Health Standards	3	1/month
Discharge Point	Total Toxic Organics	7	1/month
Discharge Point	Radium-226 & Radium-228		1/month
Discharge Point	Secondary & Irrigation Stds	4,5	1/month
Wells MCO-6	Nitrates (NO3-N)		Quarterly
Wells MCO-6	Health Stds	3	Quarterly
Wells MCO-6	Secondary Stds	4	Quarterly
Wells MCO-6	Irrigation Stds	5	Quarterly
Wells MCO-3,4,5,7,7.5	Nitrates (NO3-N)		Annual
Wells MCO-3,4,5,6,7,7.5	Radiochemistry	2	Annual
Wells MCO-3,4,5,7,7.5	Health Stds	3	Annual
Wells MCO-3,4,5,7,7.5	Secondary Stds	4	Annual
Wells MCO-3,4,5,7,7.5	Irrigation Stds	5	Annual
Wells MCO-3,4,5,6,7,7.5	Organics	6	1 per 3 Years
Mortandad Canyon Gaging Station	Surface Flows		Continuous

Notes

1. Total Nitrogen: TKN, Ammonia, NO2, NO3.
2. Radiochemistry: Uranium, Combined Ra-226 & Ra-228.
3. Health Standards (3103 A.): Ag, As, Ba, Cd, CN, Cr, F, Hg, NO3, Pb, Se.
4. Secondary Standards (3103 B.): Cl, Cu, Fe, Mn, SO4, Zn, TDS, and pH.
5. Irrigation Standards (3103 C): Al, B, Co, Mo, Ni
6. Volatile and Semivolatile Compounds, EPA SW 846 and Methods 8240 and 8270.
7. Total Toxic Organics (TTOs): See Appendix B for a listing of analytes in this method.

* Monitoring Plan data will be reported to the NMED annually.

Reporting

All RLWTF ground water discharge plan monitoring results will be submitted annually to the New Mexico Environment Department, Ground Water Protection and Remediation Bureau. The Laboratory's Environmental Surveillance Report is also submitted annually to NMED and presents extensive ground and surface water quality data for all water supply wells, monitor wells, and surface water stations in the Laboratory's network of sampling locations.

18. Closure Plan.

Currently, Los Alamos National Laboratory has no plans to discontinue RLWTF system components or abandon Mortandad Canyon ground water monitor wells during the term of the discharge permit. When the facility is ultimately closed it will be monitored, decontaminated, and decommissioned in accordance with applicable state and federal requirements.

I certify that I am familiar with the information contained in the application and that to the best of my knowledge and belief such information is true, complete, and accurate.

August 5, 1996

Mr. Dennis J. Erickson
Director, ESH Division
Los Alamos National Laboratory

Date

August 15, 1996

Mr. G. Tom Todd
Area Manager
U.S. Department of Energy
Los Alamos Area Office

Date

Discharge Plan Roles and Responsibilities

Successful implementation of the Ground Water Discharge Plan Application for the Radioactive Liquid Waste Treatment Facility at TA-50 requires a coordinated commitment by Laboratory management. The roles and responsibilities in accordance with the Laboratory management structure are defined as follows:

ESH Division Director--The ESH Division Director is the "owner" of the Laboratory's environmental permits and has overall responsibility and accountability for providing regulatory support and technical expertise for preparation of this Ground Water Discharge Plan Application.

EM Program Manager--The EM Program Manager is the primary point-of-contact with the Department of Energy (DOE) for environmental management and is responsible for securing funding for upgrades to the RLWTF.

CST Division Director--The CST Division Director is responsible for providing radioactive liquid waste treatment capabilities to the Environmental Management Program and is the institutional owner of the RLWTF.

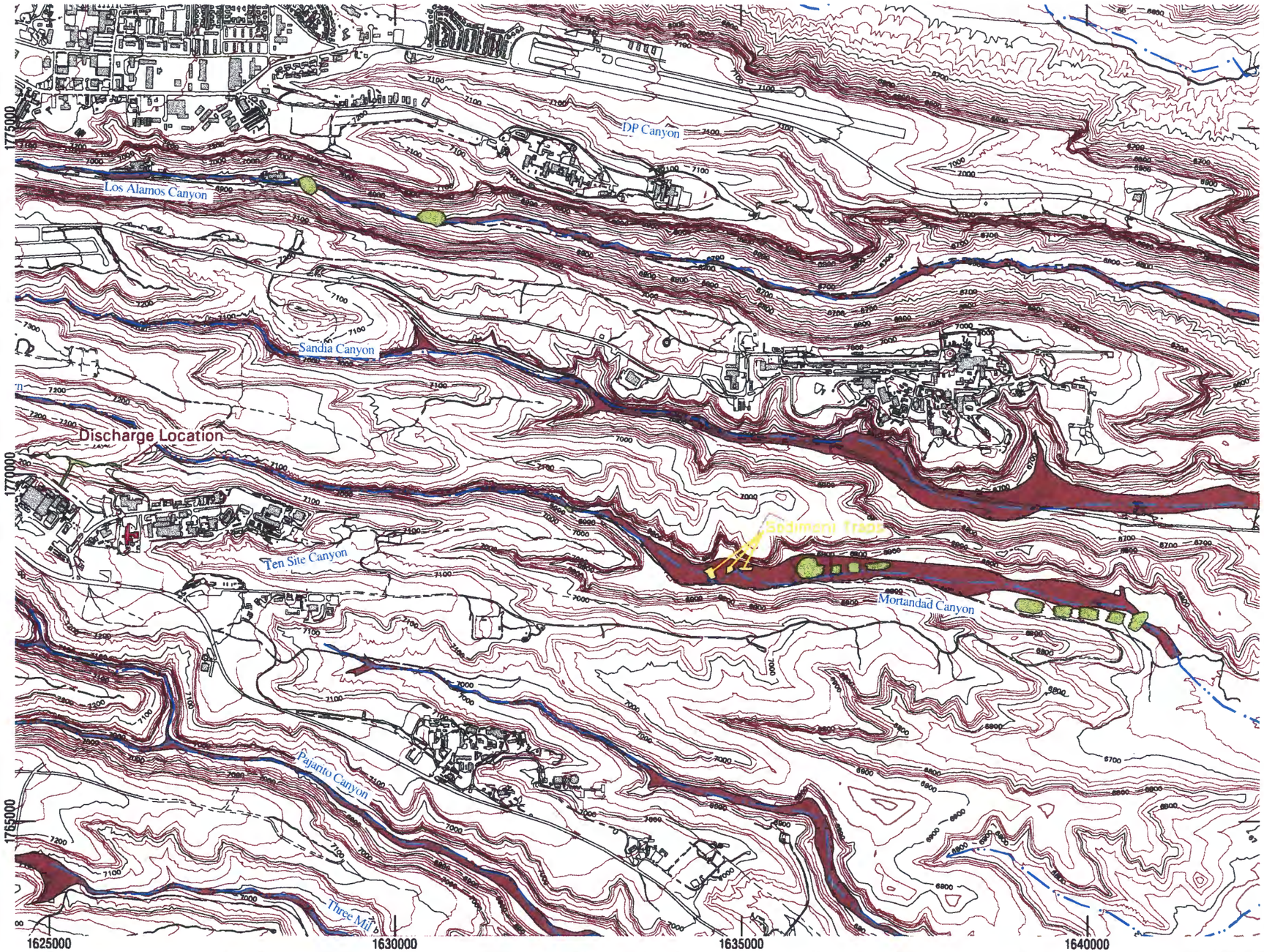
APPROVED: **RLWTF GROUND WATER DISCHARGE PLAN APPLICATION**

ESH Division	Dennis Erickson, Division Director	August 15, 1996 Date
EM Program	for Thomas Baca, Program Manager	8-15-96 Date
CST Division	Alexander Gancarz, Division Director	August 15, 1996 Date

MAPS

MAP 5.0

TA-50 RLW Treatment Facility Ground Water Discharge Plan - 100-Year Floodplain



LEGEND

- Contour, 100 ft
- Contour, 20 ft
- Intermittent Stream
- Roads, Dirt
- Roads, Paved
- Road/Trail
- Building 50-01
- Floodplain
- Sediment Trap
- Structure
- Wetland

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 5000
Feet per inch on map = 1600

SCALE 1:19200

METERS

FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1965. Other boundary, structure, and utility data are from Los Alamos National Laboratory Engineering Division and Los Alamos County Utility and Engineering Departments. Contour data are from Los Alamos National Laboratory Environmental Restoration Project aerial survey, September 1994.

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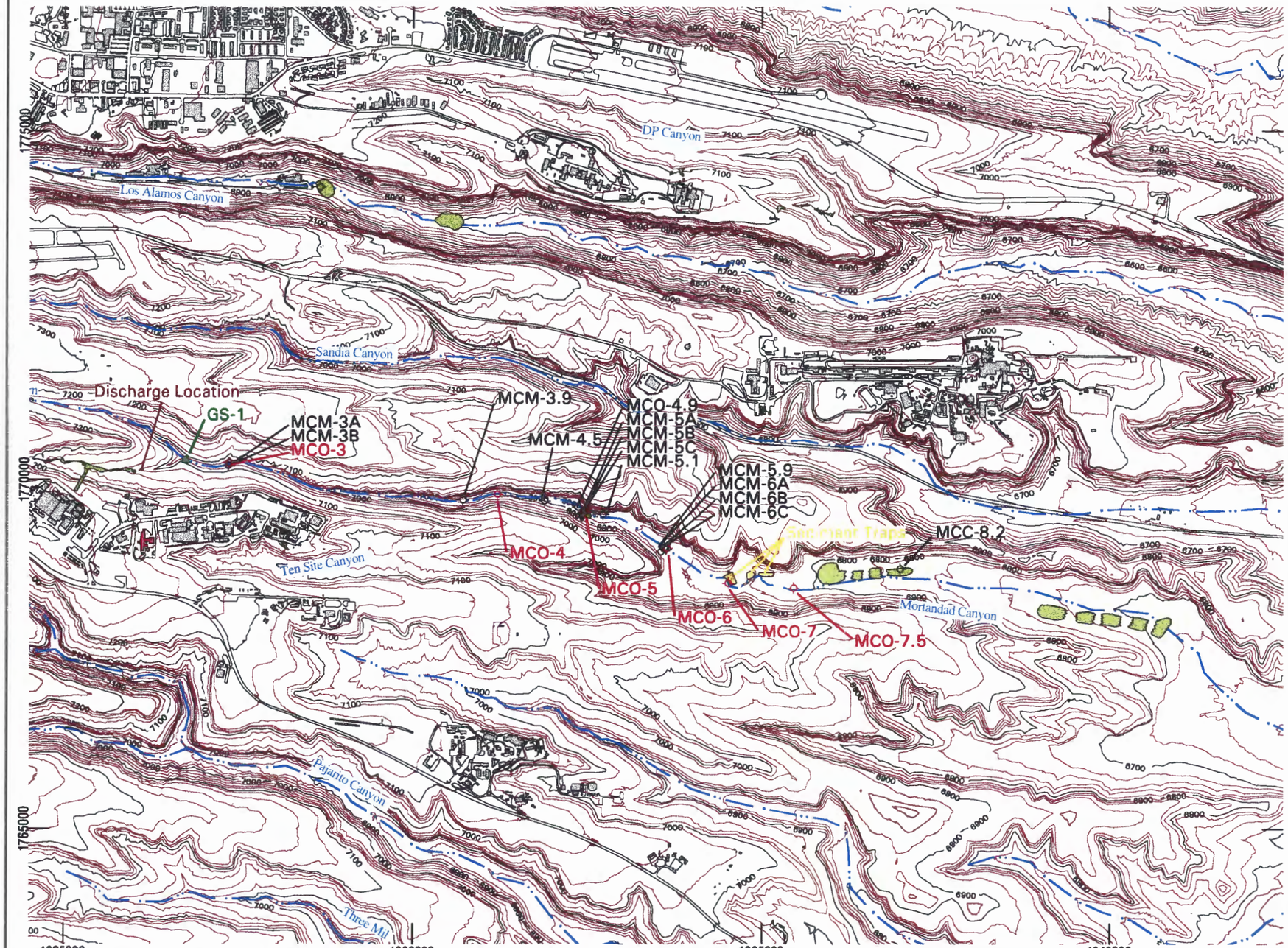
FIMAD is the electronic data repository for the Environmental Restoration Project at Los Alamos National Laboratory.
Produced by: Marcia Jones

Date: July 26, 1996 FIMAD Plot ID: G104751

MAP

TA-50 RLW Treatment Facility Ground Water Discharge Plan - Monitoring Wells



LEGEND

- Contour, 100 ft
- Contour, 20 ft
- Intermittent Stream
- Roads, Paved
- Building 50-01
- Sediment Trap
- Structure
- Wetland
- Stream Gaging Station
- Discharge Plan Monitoring Well
- Other Monitoring Well

Discharge Plan Monitoring Wells
MCO-3
MCO-4
MCO-5
MCO-6
MCO-7
MCO-7.5

Mortandad Canyon Stream Gaging Station
GS-1

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 5000
Feet per inch on map = 1600

SCALE 1:19200

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1986. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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FIMAD is the electronic data repository for the Environmental Restoration Project at Los Alamos National Laboratory.

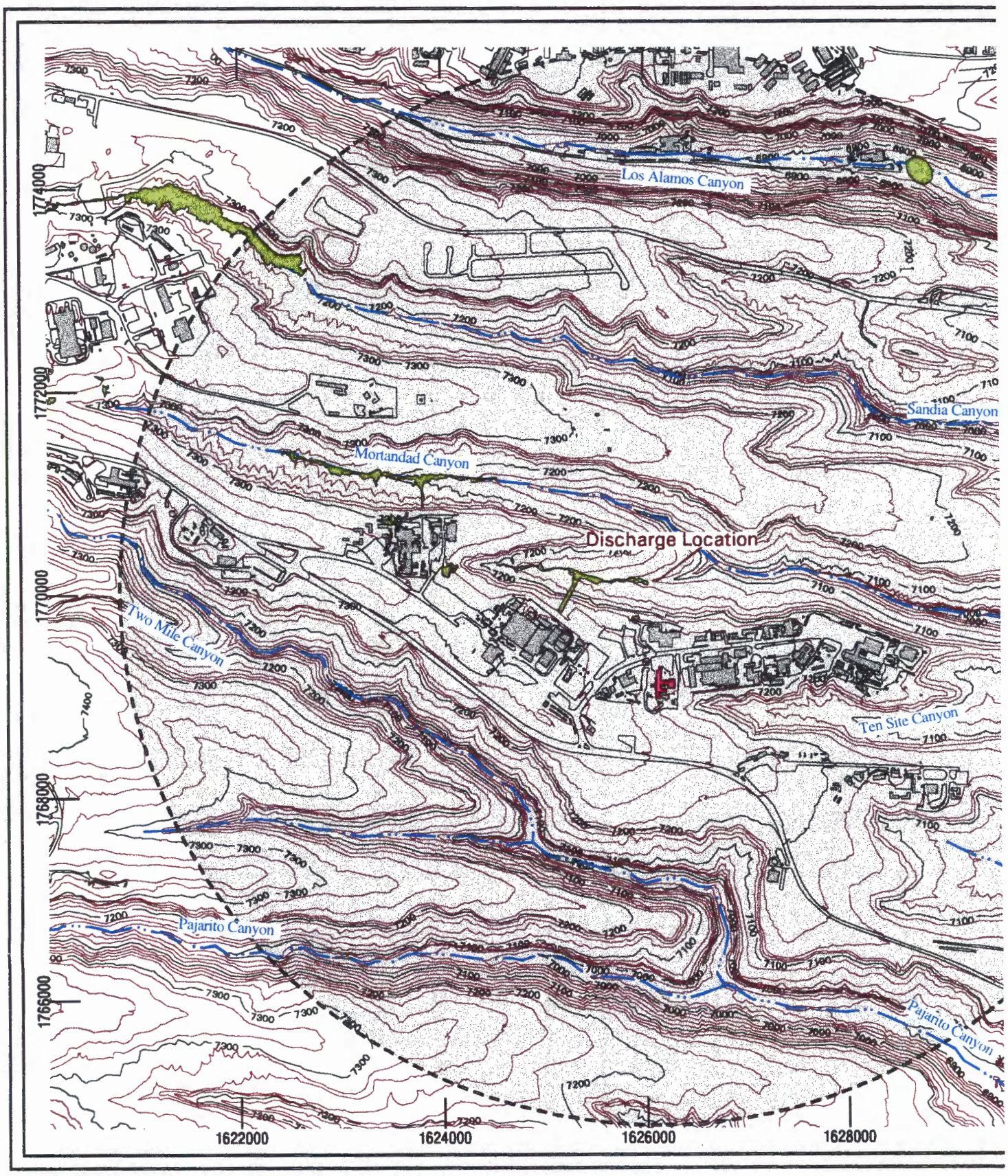
Produced by: Marcia Jones

Date: August 02, 1996 FIMAD Plot ID: G104750

00149

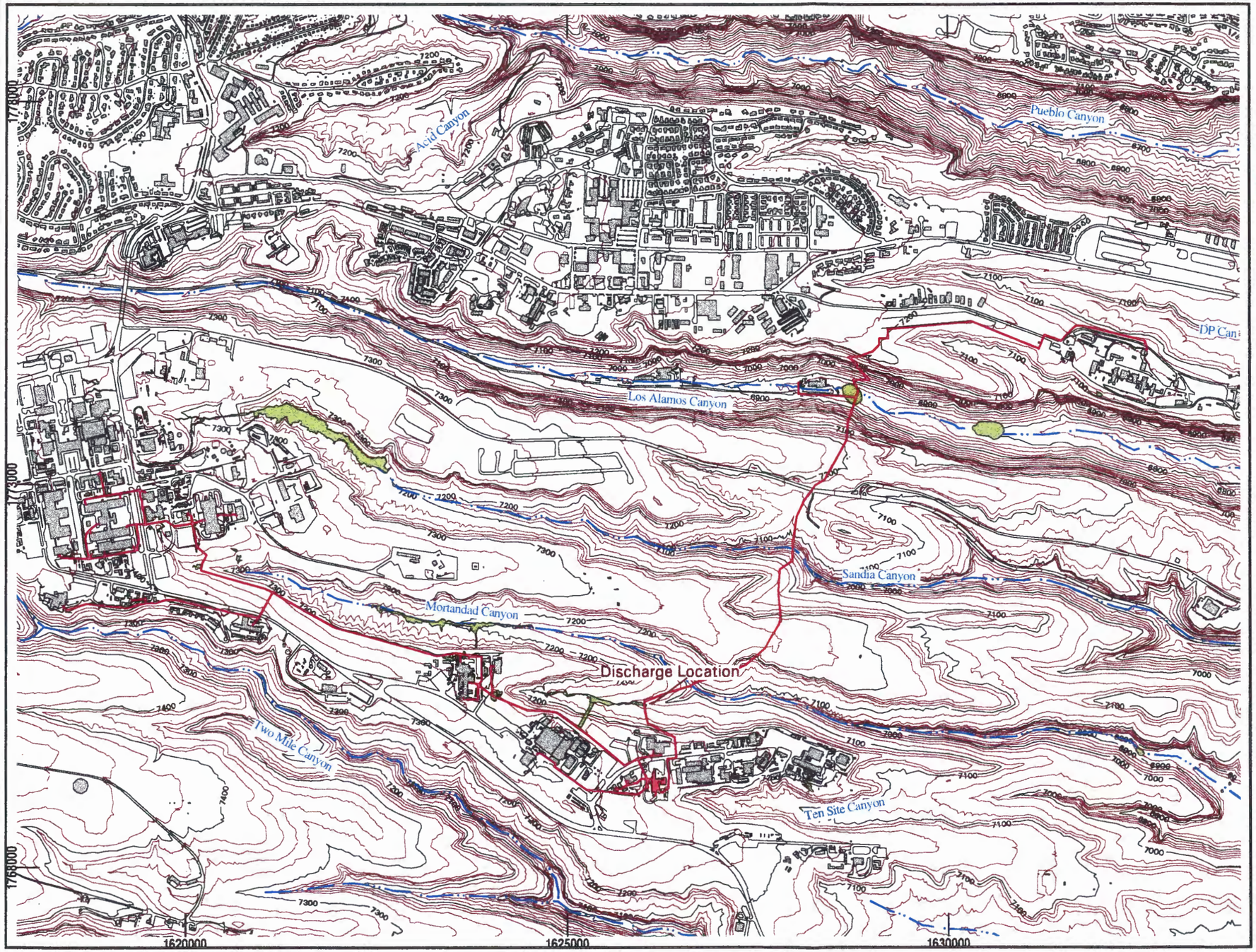
MAP 3.0

TA-50 RLW Treatment Facility Ground Water Discharge Plan - Water Supply a



MAP 2.0

TA-50 RLW Treatment Facility Ground Water Discharge Plan - Radioactive Liquid Waste Collection System



LEGEND

- Contour, 100 ft
- Contour, 20 ft
- Intermittent Stream
- Radioactive Liquid Waste Line
- Roads, Paved
- Building 50-01
- Sediment Trap
- Structure
- Wetland

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 5000
Feet per inch on map = 1400

SCALE 1:16800

METERS

FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1965. Other boundary, structure, and utility data are from Los Alamos National Laboratory Engineering Division and Los Alamos County Utility and Engineering Departments. Contour data are from Los Alamos National Laboratory Environmental Restoration Project aerial survey, September 1991.

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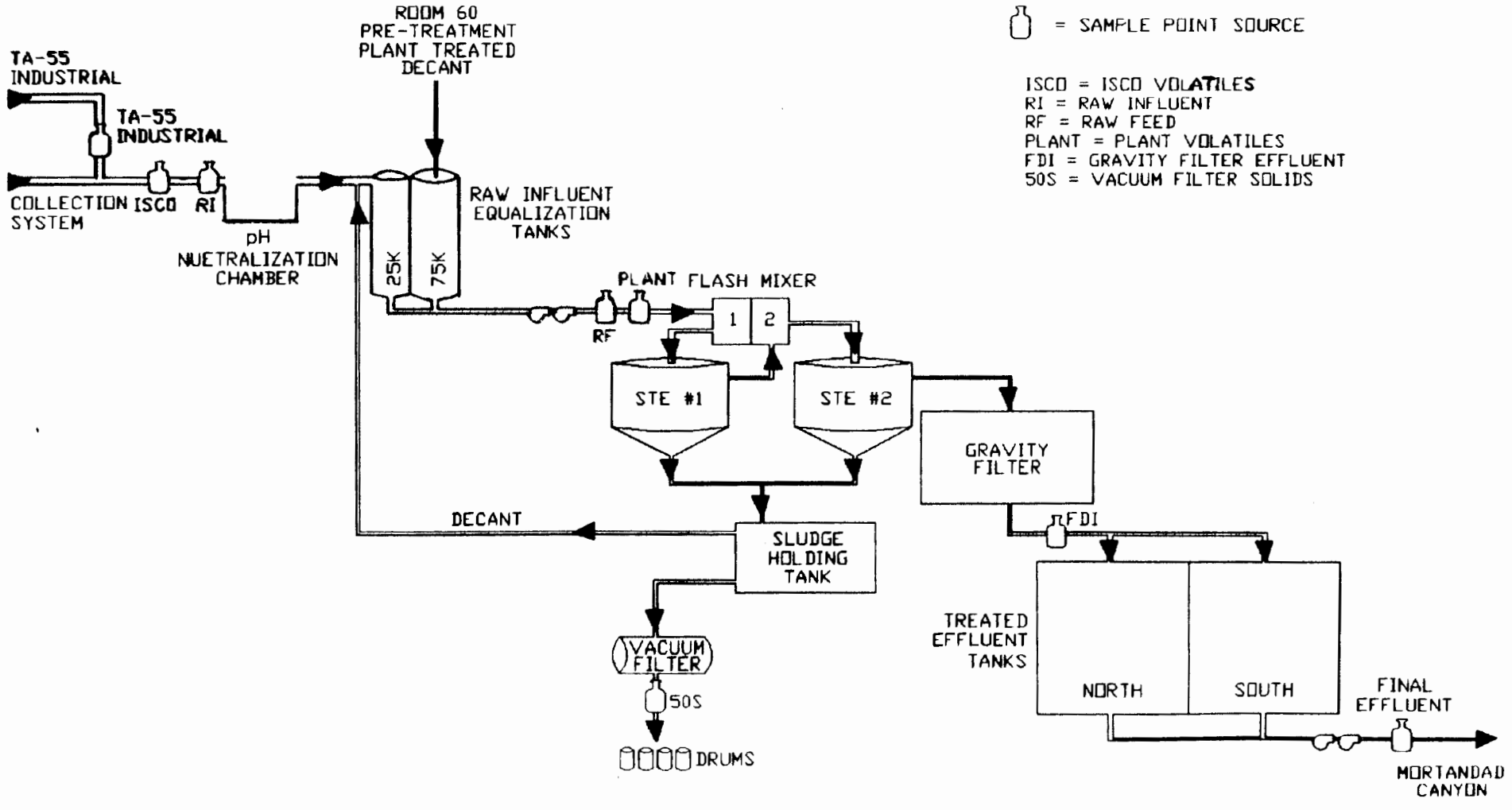
Produced by: Marcia Jones

Date: July 25, 1996 FIMAD Plot ID: G104807

APPENDIX A

SAMPLING AT TA-50-1
MAIN PLANT OPERATIONS



Sampling at TA-50 Radioactive Liquid Waste Treatment Facility
Main Plant Operations (Routine)

	Operational							Regulatory
Sample	TA-55 Industrial	ISCO Volatiles	Raw Influent	Raw Daily Feed	Plant Volatiles	Gravity Filter Effluent	Vacuum Filter Solids	NPDES
ID Tag	TA55	Immyy.dd	RDI, RWC, RMC	RDF	Pmmyy.dd	FDI, FWC, FMC	50Smmyy.dd	NPDESmmyy.dd
Location	WM-201	pH Neutralization Chamber	pH Neutralization Chamber	discharge side of pumps 3 and 4	discharge side of pumps 3 and 4	discharge side of gravity filter	discharge side of vacuum filter	final effluent discharge to Mortendad Canyon
Analysis Formats and Parameters	*weekly:* gross Alpha ^{241}Am pH	*weekly:* VOC SVOC	*daily:* pH gross Alpha, Beta,Gamma ^{3}H *weekly composite:* pH gross Alpha, Beta,Gamma ^{137}Cs, ^{241}Am radioisotopic COD, NH_3-N *monthly composite:* pH gross Alpha, Beta, Gamma ^{3}H $^{234, 235}U$ $^{238, 239}Pu$ $^{89, 90}Sr$ ^{241}Am, ^{137}Cs Alkalinity-Mo Alkalinity-P Aluminum	*daily:* pH gross Alpha, Beta,Gamma ^{3}H	*weekly:* VOC SVOC	*daily:* pH gross Alpha, Beta,Gamma ^{3}H *weekly composite:* pH gross Alpha, Beta,Gamma ^{137}Cs, ^{241}Am radioisotopic COD, NH_3-N *monthly composite:* pH gross Alpha, Beta, Gamma ^{3}H $^{234, 235}U$ $^{238, 239}Pu$ $^{89, 90}Sr$ ^{241}Am, ^{137}Cs Alkalinity-Mo Alkalinity-P Aluminum	*per batch treated:* gross Alpha $^{234, 235}U$ $^{238, 239}Pu$ ^{241}Am % Solids TCLP: Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Se, Tl	*weekly grab:* pH TSS COD (T) Cd, Pb, Cu, Fe, Zn, Hg, Cr, Ni *monthly grab:* Total N Nitrate-Nitrite (as N) Ammonia (as N) Total Toxic Organics $^{226, 228}Ra$

			Ammonia-N Arsenic Barium Beryllium Boron Cadmium Calcium Cations (T) Chloride Chromium (T) Cobalt COD Conductivity Copper Cyanide Fluoride Hardness Iron Lead Magnesium Mercury Nickel Nitrate-N Nitrite-N Phosphorus Plutonium (T) Potassium Selenium Silica Dioxide Silver Sodium Sulfate TDS TSS Thallium Uranium Vanadium Zinc			Ammonia-N Arsenic Barium Beryllium Boron Cadmium Calcium Cations (T) Chloride Chromium (T) Cobalt COD Conductivity Copper Fluoride Hardness Iron Lead Magnesium Mercury Nickel Nitrate-N Nitrite-N Phosphorus Plutonium (T) Potassium Selenium Silica Dioxide Silver Sodium Sulfate TDS Thallium Uranium Vanadium Zinc		

APPENDIX B

Permit No. NM0028355

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C... 1251 et. seq; the "Act"),

University of California
Management Contractor for Operation
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

and

Department of Energy
Los Alamos Area Office
Los Alamos, New Mexico 87544

(See Part II.J.)

is authorized to discharge from a facility located at Los Alamos National Laboratory, Los Alamos, Los Alamos County, New Mexico

to various streams which are tributaries of Segment No. 2-111 and Segment No. 2-118 of the Rio Grande Basin.

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I (17 pages), II (7 pages), and III (7 pages) hereof.

This permit shall become effective on August 1, 1994

This permit and the authorization to discharge shall expire at midnight, October 31, 1998.

Prepared By:

Frederick O. Humke, P.E.
Environmental Engineer
Industrial Permits Section (6W-PI)

Signed and issued on June 24, 1994

Myron O. Knudson, P.E.
Director
Water Management Division (6W)

OUTFALL 051

During the period beginning the effective date and lasting through the expiration date, the permittee is authorized to discharge from Outfall 051 - industrial waste treatment plant discharge.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations			
	Mass(lbs/day)		Other Units (Specify)	
	Daily Avg	Daily Max	Daily Avg	Daily Max
Flow (MGD)	N/A	N/A	(*1)	(*1)
Ammonia (as N)	N/A	N/A	(*1) mg/l	(*1) mg/l
Chemical Oxygen Demand	94	156	125 mg/l	125 mg/l
Total Suspended Solids	18.8	62.6	N/A	N/A
Total Cadmium	0.06	0.30	(*3) mg/l	(*3) mg/l
Total Chromium	0.19	0.38	(*3) mg/l	(*3) mg/l
Total Copper	0.63	0.63	(*3) mg/l	(*3) mg/l
Total Iron	1.0	2.0	N/A	N/A
Total Lead	0.06	0.15	(*3) mg/l	(*3) mg/l
Total Mercury	0.003	0.09	(*3) mg/l	(*3) mg/l
Total Nickel	N/A	N/A	(*1) mg/l	(*1) mg/l
Total Nitrogen	N/A	N/A	(*1) mg/l	(*1) mg/l
Nitrate-Nitrite (as N)	N/A	N/A	(*1) mg/l	(*1) mg/l
Total Zinc	0.62	1.83	(*3) mg/l	(*3) mg/l
Total Toxic Organics (*2)	N/A	N/A	1.0 mg/l	1.0 mg/l
Radium-226 + Radium-228	N/A	N/A	30.0 pCi/l	30.0 pCi/l
Other WQ Parameters	N/A	N/A	(*3)	(*3)

Effluent Characteristic	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow (MGD)	Continuous	Record
Ammonia (as N)	1/Month	Grab
Chemical Oxygen Demand	1/Week	Grab
Total Suspended Solids	1/Week	Grab
Total Cadmium	1/Week	Grab
Total Chromium	1/Week	Grab
Total Copper	1/Week	Grab
Total Iron	1/Week	Grab
Total Lead	1/Week	Grab
Total Mercury	1/Week	Grab
Total Nickel	1/Week	Grab
Total Nitrogen	1/month	Grab
Nitrate-Nitrite (as N)	1/month	Grab
Total Zinc	1/Week	Grab
Total Toxic Organics (*2)	1/Month	Grab
Radium-226 + Radium-228	1/Month	Grab
Other WQ Parameters	1/Year	Grab

OUTFALL 051

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored continuous, record.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Following the final treatment, prior to or at the point of discharge from TA-50-1 Treatment Plant (Latitude 35°51'58.3" and Longitude 106°17'48.5") to Mortandad Canyon.

(*1) Report
(*2) As defined in 40 CFR 433.11(e).
(*3) See Part II, Paragraph 2.

40 CFR - Protection of Environment

Section 433.11 - Specialized definitions.

The definitions set forth in 40 CFR Part 401 and the chemical analysis methods set forth in 40 CFR Part 136 are both incorporated here by reference. In addition, the following definitions apply to this part:

(a) The term ``T'', as in ``Cyanide, T'', shall mean total.

(b) The term ``A'', as in ``Cyanide A'', shall mean amenable to alkaline chlorination.

(c) The term ``job shop'' shall mean a facility which owns not more than 50% (annual area basis) of the materials undergoing metal finishing.

(d) The term ``independent'' printed circuit board manufacturer shall mean a facility which manufacturers printed circuit boards principally for sale to other companies.

(e) The term ``TTO'' shall mean total toxic organics, which is the summation of all quantifiable values greater than .01 milligrams per liter for the following toxic organics:

Acenaphthene
Acrolein
Acrylonitrile
Benzene
Benzidine
Carbon tetrachloride (tetrachloromethane)
Chlorobenzene
1,2,4-Trichlorobenzene
Hexachlorobenzene
1,2,-Dichloroethane
1,1,1-Trichloroethane
Hexachloroethane
1,1-Dichloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
Chloroethane
Bis (2-chloroethyl) ether
2-Chloroethyl vinyl ether (mixed)
2-Chloronaphthalene
2,4,6-Trichlorophenol
Parachlorometa cresol
Chloroform (trichloromethane)
2-Chlorophenol
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3-Dichlorobenzidine
1,1-Dichloroethylene
1,2-Trans-dichloroethylene
2,4-Dichlorophenol
1,2-Dichloropropane
1,3-Dichloropropylene (1,3-dichloropropene)
2,4-Dimethylphenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
1,2-Diphenylhydrazine

Ethylbenzene
Fluoranthene
4-Chlorophenyl phenyl ether
4-Bromophenyl phenyl ether
Bis (2-chloroisopropyl) ether
Bis (2-chloroethoxy) methane
Methylene chloride (dichloromethane)
Methyl chloride (chloromethane)
Methyl bromide (bromomethane)
Bromoform (tribromomethane)
Dichlorobromomethane
Chlorodibromomethane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
Naphthalene
Nitrobenzene
2-Nitrophenol
4-Nitrophenol
2,4-Dinitrophenol
4,6-Dinitro-o-cresol
N-nitrosodimethylamine
N-nitrosodiphenylamine
N-nitrosodi-n-propylamine
Pentachlorophenol
Phenol
Bis (2-ethylhexyl) phthalate
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
1,2-Benzanthracene
(benzo(a)anthracene)
Benzo(a)pyrene (3,4-benzopyrene)
3,4-Benzofluoranthene (benzo(b)fluoranthene)
11,12-Benzofluoranthene (benzo(k)fluoranthene)
Chrysene
Acenaphthylene
Anthracene
1,12-Benzoperylene (benzo(ghi)perylene)
Fluorene
Phenanthrene
1,2,5,6-Dibenzanthracene (dibenzo(a,h)anthracene)
Indeno(1,2,3-cd) pyrene (2,3-o-phenlene pyrene)
Pyrene
Tetrachloroethylene
Toluene
Trichloroethylene
Vinyl chloride (chloroethylene)
Aldrin
Dieldrin
Chlordane (technical mixture and metabolites)
4,4-DDT
4,4-DDE (p,p-DDX)
4,4-DDD (p,p-TDE)
Alpha-endosulfan
Beta-endosulfan

Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
(BHC-hexachloro-
cyclohexane)
Alpha-BHC
Beta-BHC
Gamma-BHC
Delta-BHC
(PCB-polychlorinated biphenyls)
PCB-1242 (Arochlor 1242)
PCB-1254 (Arochlor 1254)
PCB-1221 (Arochlor 1221)
PCB-1232 (Arochlor 1232)
PCB-1248 (Arochlor 1248)
PCB-1260 (Arochlor 1260)
PCB-1016 (Arochlor 1016)
Toxaphene
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

[48 FR 32485, July 15, 1983; 48 FR 43682, Sept. 26, 1983, as amended at 51 FR 40421, Nov. 7, 1986]

APPENDIX C

6.0 LIQUID RADIOACTIVE WASTE

The Radioactive and Industrial Wastewater Science Group treats and disposes of aqueous low-level radioactive waste. This waste is usually discharged to the RLWTFs through a network of buried pipelines, generally referred to as the radioactive liquid waste collection system (RLWCS). The RLWTFs consist of the TA-50-1 Main Radioactive Liquid Waste Treatment Plant (Main Plant), the TA-50-1, Room 60 Pretreatment Plant (Pretreatment Plant), and the TA-21-257, Radioactive Liquid Waste Treatment Plant (DP-257). Waste acceptance criteria for the RLWTFs are based on the following:

- DOE Order 5820.2A
- DOE Order 5400.5
- U.S. Department of Transportation (DOT) regulations
- RCRA regulations
- New Mexico Water Quality Control Commission regulations
- National Pollutant Discharge Elimination System (NPDES) permit
- As-low-as-reasonably-achievable (ALARA) considerations

Liquid waste meeting the requirements of this Chapter should be poured down drains in sinks connected to the RLWCS, which is connected to the RLWTFs; however, generators not connected to the RLWTFs by the RLWCS may have waste transported to the RLWTFs in containers or a tanker truck for treatment.

6.1 Transportation Requirements

Generally liquid waste is transferred to the RLWTFs through the RLWCS; however, occasionally liquid waste may be transported to the RLWTFs in containers, such as Tuff Tanks™, 55-gallon drums, or tanker trucks.

Unless arrangements are made with the RLWTFs, generating groups are responsible for transporting smaller volumes of liquid waste (up to 55-gallons) to the RLWTFs. The RLWTFs may assist in transporting larger volumes of liquid waste, such as waste in Tuff Tanks™ and volumes large enough to be transported by tanker truck. Generating groups may incur the cost of transporting liquid waste transported by the RLWTFs.

All tranported waste must be properly documented with a WPF and a CWDR. The generating group must provide at least 48 hours notice before the waste is transported to the RLWTF. If the waste is to be transported by the Radioactive and Industrial Wastewater Science, the generator will be contacted to coordinate the time and place of the pickup. The exact location must be specified for the pickup. Either the waste generator or the WMC must be present at the time and place of pickup to ensure that the correct items are transported. Failure to have a waste generator or WMC at the designated site and time may result in a delay of the waste pickup. In addition, if Radioactive and Industrial Wastewater Science

assists in transporting waste, the generating organization must provide the necessary equipment, such as forklifts, required for safely transferring the waste.

6.2 Container Requirements

Containers must be approved by DOT for transportation of the given waste type and must meet the following criteria:

- Be made of a material that will not react with the transported liquid waste
- Have surfaces that are clean and free of any oils and chemicals
- Be of sufficient thickness that any deformation is within design parameters
- Have no bottom outlets that are unprotected
- Be in good condition, with no leaks, rusting, dents, bulges, or other structural defects that could impair the integrity or safe handling of the container

If integrity of the container is questionable, the waste generator must test the container to ensure safe transportation of the liquid waste in the container. Waste packaged in unacceptable containers will not be accepted.

Waste Generator organizations are ultimately responsible for their waste containers. After waste is disposed of at the RLWTF, containers provided by the waste generating group will be triple-rinsed by Radioactive and Industrial Wastewater Science Group and returned to the generator.

Transport of highly radioactive aqueous waste requiring shielding is not anticipated; however, if shielding is required, the waste generator must provide an adequate amount to comply with the Laboratory's ALARA policy. After the waste is disposed, the shielding material is returned to the waste generator.

6.3 Package Weight

Package weight must not exceed the rated capacity of the container based on DOT-specified package certification tests for the contained material. No other requirements or restrictions are specified for package weight.

6.4 Waste Content

The content of liquid waste sent to the RLWTFs must meet certain criteria, identified below:

- *Radionuclides*: The maximum allowable radioactivity concentration for waste discharged to the Main Plant and DP-257 is 0.5 μCi/l and for waste discharged to the Pretreatment Plant through the acid and caustic lines is 60 μCi/l for acid waste and 4500 μCi/l for caustic waste. The concentration limits for radionuclides acceptable for discharge to the RLWTFs are listed in Table 6-1. Waste-generating groups must make special arrangements with the Radioactive and Industrial Wastewater Science Group for the treatment of liquid waste having an activity greater than 0.5 μCi/l and not destined for treatment at the Pretreatment Plant. Generators of radioactive liquid waste having an activity greater than 0.5 μCi/l may be required to provide Radioactive and Industrial Wastewater Science with biweekly summaries of volumes and activity levels of each of the waste discharged to the RLWCS.

- *Tritium*: Accelerator-produced tritium is not allowed for treatment at the RLWTFs. The concentration of reactor-produced tritium allowed is 20,000 pCi/l.

- *Radium*: The concentration of ^{226}Ra and ^{228}Ra in the waste must not exceed 30 pCi/L.

- *Chemical Waste*: Inorganic acids and bases with a pH between 2 and 12 are accepted for treatment at the RLWTFs. Inorganic acids and bases, which may be regulated by RCRA because of their corrosivity, are accepted on a case-by-case basis. DP-257 and the Main Plant are not permitted under RCRA. Waste regulated by RCRA, such as acetone, methyl-ethyl-ketone (MEK), 1,1,1-trichloroethane (TCA), and electroplating waste, are not acceptable for treatment at the Main Plant or DP-257. If RCRA waste are treated through the plant, Radioactive and Industrial Wastewater Science may be charged with a violation of RCRA. For additional information concerning RCRA, contact the Hazardous and Solid Waste Group. Organic waste not regulated by RCRA (e.g., scintillation cocktails, such as "Ultima Gold") may be accepted for treatment on a case-by-case basis, dependent on the chemical constituents, concentration, and volume generated.

- *Nitrates:* Waste streams containing nitrates will be accepted on a case-by-case basis.

- *Metals*: Waste streams containing metals regulated by RCRA (see Appendix B) are not acceptable for treatment at the Main Plant and DP-257; therefore, the metal concentrations must not exceed the limits provided in Table 6-2. Waste streams containing RCRA-regulated metals are acceptable for discharge to the Pretreatment Plant on a case-by-case basis. Limits for other metals regulated by the NPDES permit are also listed in Table 6-2.

- *Temperature*: The temperature of liquid waste discharged to the RLWCS should not exceed 60°C (140°F).

- *Unacceptable Waste*: Waste streams containing any of the following components are unacceptable for treatment or disposal at the RLWTFs:

- PCBs
- Electroplating operations waste
- Sanitary waste
- Infectious microorganisms or microorganisms capable of generating hydrogen sulfide

Radioactive and Industrial Wastewater Science accepts each waste stream on a case-by-case basis.

6.5 External Package Contamination/Dose Rate

To keep radiation exposures to personnel and the environment ALARA, qualified personnel, such as Health Physics Operations radiological control technicians (RCTs) must survey containerized waste for surface contamination and dose rates. Removable surface contamination may not exceed the limits established in Table 2-2 of the *LANL Radiological Control Manual* (Los Alamos National Laboratory 1992a). The external surface dose rate of a package of liquid waste may not exceed 200 mrem/hr.

TABLE 6-1

Limits on Radionuclides Acceptable for Discharge to the RLWTFs

	Maximum Allowable Concentration (Ci/l)
Treatment Location	
Main Plant (includes industrial waste from TA-55)	5.0E-7 total
DP Plant	5.0E-7 total
Pretreatment Plant (waste from TA-55-PF4)	
Process Caustic Waste	4.5E-3 alpha
Process Acid Waste	6.0E-5 alpha
Radionuclide	
^{74}As	4.0E-8
^{7}Be	1.0E-6
^{141}Ce	5.0E-8
^{134}Cs	2.0E-9
^{137}Cs	3.0E-9
^{56}Co	1.0E-8
^{57}Co	1.0E-7
^{58}Co	4.0E-8
^{60}Co	5.0E-9
^{152}Eu	2.0E-8
^{3}H (accelerator- produced)^{3}H (reactor-produced)	0 (none allowed) 2.0E-8
^{133}I	1.0E-8
^{52}Mn	2.0E-8
^{54}Mn	5.0E-8
$^{226}Ra + ^{228}Ra$	3.0E-11
^{83}Rb	2.0E-8
^{84}Rb	1.0E-8
^{46}Sc	2.0E-8
^{48}Sc	2.0E-8
^{75}Se	2.0E-8
^{22}Na	1.0E-8
^{85}Sr	7.0E-8
^{89}Sr	2.0E-8
^{90}Sr	1.0E-9
^{113}Sn	5.0E-8
^{48}V	2.0E-8
^{88}Y	3.0E-8
^{65}Zn	9.0E-9

TABLE 6-2

Limits on Metals Acceptable for Discharge to the RLWTFs

Metal	Allowable Concentration (mg/L)
Aluminum	≤ 5.0
Arsenic	< 5.0
Barium	< 100≤ 5.0
Boron	< 1.0
Cadmium	< 5.0
Chromium	≤ 1.0
Cobalt	≤ 1.0
Copper	< 5.0
Lead	< 0.2
Mercury	< 5.0
Silver	< 1.0
Selenium	≤ 0.10
Vanadium	≤ 95.40
Zinc	

TABLE 6-3

Unacceptable Waste

The following RCRA regulated waste

waste exhibiting the characteristic of ignitability as defined in 40 CFR§261.21
waste exhibiting the characteristic of reactivity as defined in 40 CFR §261.23
waste exhibiting the characteristic of toxicity as defined in 40 CFR §261.24
F-listed waste as define in 40 CFR§261.31
K-listed waste as define in 40 CFR §261.32
P-listed waste as defined in 40 CFR §261.33
U-listed waste as define in 40 CFR §261.33

PCB

Waste at temperatures greater than 140° F

Nonaqueous waste

Infectious microorganisms

Sanitary waste, except from specific showers and sinks in change rooms where radioactivity may be present

Microorganisms that could generate hydrogen sulfide (H_2S)

6.6 Package Marking and Labeling

All labels and markings required by the DOT for the waste must be on the containers prior to transport. Containers must also have completed *Health Physics Radioactive Materials Survey Tag*.

6.7 Additional Requirements/Restrictions

Storage Tanks. All tanks used to store liquid waste must meet the requirements of the Laboratory's *Spill Prevention Control and Countermeasure Plan* and *Storm Water Pollution Prevention Plan.* Contact the Water Quality and Hydrology Group for additional information.

Posting of Sinks Connected to the RLWCS. Each sink connected to the RLWCS must be posted with a sign informing the user of the requirements for disposing of waste down the drains, See Appendix F for a current sign with information that must be posted at each sink. The generating group is responsible for ensuring all sinks are posted and the most current sign is posted. Signs may be obtained from Radioactive and Industrial Wastewater Science Group at 667-4301. The operating group may develop and post its own signs; however, at a minimum all information on signs supplied by the Radioactive and Industrial Wastewater Science Group must be on the signs and the Radioactive and Industrial Wastewater Science Group must approve the signs.

Labeling of Radioactive Waste Lines. Pipelines within buildings and connected to the RLWCS should be labeled "Radioactive Waste Line." Contact Radioactive and Industrial Wastewater Science at 667-4301 for labels and for assistance in determining which pipelines are connected to the RLWCS.

Connections to the RLWCS. A WPF must be submitted and approved through Radioactive and Industrial Wastewater Science before any waste can be discharged to the RLWTFs through a connection to the RLWCS.

New Waste Streams. Each operation creating a new waste stream requiring treatment through the RLWTFs must be characterized on a WPF.

Modification of a Waste Stream. When the characteristics of a waste stream change, the waste generator must notify Radioactive and Industrial Wastewater Science and submit a new WPF. Examples of modified waste streams are operational changes that cause a significant differences in the chemical, physical, or radionuclide composition of the waste or a significant difference in the volume of waste

piped to the RLWCS. Radioactive and Industrial Wastewater Science must approve the new WPF before transfer to the RLWCS can resume or a containerized waste can be transported.

Standard Operating Procedures. Each operation involving the generation, management, handling, or disposal of liquid waste requires a standard operating procedures (SOP), which must be prepared, reviewed, and approved as specified in Administrative Requirement 1-3, *Standard Operating Procedures and Special Work Permits.* Each SOP must specify the methods for segregating radioactive liquid waste from other nonradioactive hazardous or nonhazardous materials, proper and safe handling of liquid waste, and proper disposal and transportation of liquid waste. Radioactive and Industrial Wastewater Science personnel are available to help liquid waste-generating groups prepare these SOPs; other groups from the Environment, Safety, and Health Division, such as Health Physics Operations, the Health Physics Measurement Group, and Nuclear Criticality Safety may also be consulted.

Radioactive and Industrial Wastewater Science must review all SOPs involving the generation or disposal of liquid waste before the SOPs are implemented. To ensure compliance with the SOPs and applicable regulations, as well as to determine where program improvements are needed, Radioactive and Industrial Wastewater Science reserves the right to perform periodic field operational reviews of these SOPs. The frequency of the reviews shall depend on the needs of the particular operations.

APPENDIX D

ANNUAL REPORT

SUMMARY OF OPERATING DATA

RADIOACTIVE & INDUSTRIAL WASTEWATER SCIENCE GROUP - CST-13

CALENDAR YEAR, 1994

Prepared By: Robert T. Harris 7-11-95
R.T. Harris Date

And: [signature] 7/18/95
D.L. Hall Date

Checked By: William David Moss 8/14/95
W.D. Moss Date

Checked By: alan Bond 10-20-95
A.J. Bond Date

Approved By: Steven W. Hanson 10-27-95
S.W. Hanson Date

Los Alamos

CONTENTS PAGE

TA-50 WM-1
FLOW SUMMARY
****
From January, 1994 to December, 1994

	Influent	Treated	Time	Rate	Effluent	DP	Omega	Misc	Recirc	Sludge	Caustic	Acid
January, 1994												
Total	1553591	1689363	73.57		1695577	0	0	51343	0	0	3238	1685
Maximum	134130	158792	7.08	435.3	161483						2937	
Minimum	10260	29398	1.58	293.39	80742						9	
Average	50116	93854	4.09	379.57	105974						324	
February, 1994												
Total	1473583	1464117	65.24		1453354	0	0	25549	0	0	157	11
Maximum	165833	155687	7.53	453.5	161483						88	
Minimum	24441	15734	0.67	335.05	80742						10	
Average	52628	81340	3.62	377.56	90835						39	
March, 1994												
Total	1804610	2025163	89.59		2028896	136674	0	79268	0	12209	0	0
Maximum	154555	173284	7.17	433.7	161483	69999		53000				
Minimum	16661	40785	1.85	266.85	80742	26072		9198				
Average	58213	92053	4.07	377.25	101445	45558		26423				
April, 1994												
Total	1471067	1704028	80.01		1372609	68242	0	0	264378	6381	0	0
Maximum	116824	176597	7.82	436.3	161483				129601			
Minimum	23721	6381	0.75	141.80	80742				66871			
Average	49036	94668	4.45	348.45	114384				88126			
May, 1994												
Total	1533012	1606347	72.30		1614835	69381	0	0	0	0	0	0
Maximum	149444	170179	7.50	438.0	161483							
Minimum	21556	29398	1.42	305.18	80742							
Average	49452	76493	3.44	368.11	107656							

TA-50 WM-1
FLOW SUMMARY
****
From January, 1994 to December, 1994

	Influent	Treated	Time	Rate	Effluent	DP	Omega	Misc	Recirc	Sludge	Caustic	Acid
June, 1994												
Total	1508659	1700547	77.37		1695579	66200	0	83300	0	0	0	0
Maximum	95547	169558	7.67	454.7	161483			37800				
Minimum	19202	32297	1.83	294.14	80742			19000				
Average	50289	89502	4.07	365.94	94199			27767				
July, 1994												
Total	1741369	1966696	87.86		2018546	122474	0	96500	0	2187	0	0
Maximum	134560	156929	6.30	468.7	161483	63540		52000				
Minimum	24850	46789	2.58	302.25	80742	58934		44500				
Average	56173	93652	4.18	372.22	96121	61237		48250				
August, 1994												
Total	1728093	1930934	86.31		1857063	142657	0	7380	0	32055	0	0
Maximum	117522	146991	7.33	448.0	161483	74795						
Minimum	22591	40578	2.00	330.12	80742	67862						
Average	55745	83954	3.75	376.83	92853	71329						
September, 1994												
Total	1594699	1695269	77.67		1614838	0	51396	42586	65422	32404	0	0
Maximum	115452	150304	7.83	407.0	161483							
Minimum	22403	53000	2.17	319.93	80742							
Average	53157	84763	3.88	368.14	89713							
October, 1994												
Total	1538717	1620650	81.03		1614836	16289	0	52370	0	27346	0	0
Maximum	104242	129187	6.17	408.5	161483			51954		23599		
Minimum	26921	3747	1.67	15.31	80742			416		3747		
Average	49636	77174	3.86	336.69	100927			26185		13673		

TA-50 WM-1
FLOW SUMMARY
****
From January, 1994 to December, 1994

	Influent	Treated	Time	Rate	Effluent	DP	Omega	Misc	Recirc	Sludge	Caustic	Acid
November, 1994												
Total	1920201	1963683	84.88		1937803	35237	0	10219	0	0	0	1683
Maximum	137663	183843	7.92	418.2	161483			8705				
Minimum	36146	38301	1.75	332.47	80742			1514				
Average	64007	93509	4.04	384.94	101990			5110				
December, 1994												
Total	1861673	1924995	81.92		1937802	45827	0	49970	0	3341	0	0
Maximum	134053	145749	6.88	449.8	161483							
Minimum	36711	56933	2.45	353.07	80742							
Average	60054	101316	4.31	392.50	107656							
From January, 1994 to December, 1994												
Total	19729274	21291792	957.75		20841738	702981	51396	498485	329800	115923	3395	3379
Maximum	1920201	2025163			2028896	142657		96500	264378	32404	3238	1685
Minimum	1471067	1464117			1372609	16289		7380	65422	2187	157	11
Average	1644106	1774316	79.81	370.52	1736812	58582	4283	41540	27483	9660	283	282

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
January, 1994

Item	TREATED (1689364 liters) Concentration	Num	Total(Ci)	FINAL (1695574 liters) Concentration	Num	Total(Ci)
ALPHA	8.30E-08	1	1.40E-01	3.60E-10	1	6.10E-04
BETA	1.40E-09	1	2.37E-03	6.10E-10	1	1.03E-03
GAMMA	1.10E-08	1	1.86E-02	4.00E-09	1	6.78E-03
TRITIUM	0.00E+00	0		5.50E-08	1	9.33E-02
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.60E-08	1	2.70E-02	1.00E-09	1	1.70E-03
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	6.76E-04	4.00E-10	1	6.78E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	5.10E-08	1	8.62E-02	1.50E-10	1	2.54E-04
Pu-239	7.00E-09	1	1.18E-02	2.00E-11	1	3.39E-05
Rb-83	0.00E+00	0		8.00E-10	1	1.36E-03
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
January, 1994

Item	TREATED (1689364 liters) Concentration	Num	Total(Ci)	FINAL (1695574 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		7.00E-10	1	1.19E-03
Sr-89	6.00E-11	1	1.01E-04	1.50E-10	1	2.54E-04
Sr-90	8.80E-11	1	1.49E-04	6.00E-11	1	1.02E-04
Tl	1.00E-03	1	1.69E+03	1.00E-03	1	1.70E+03
TOTALPLUTONIUM	5.80E-08	1	9.80E-02	1.70E-10	1	2.88E-04
U	8.10E-02	1	1.37E+05	4.00E-03	1	6.78E+03
U-234	4.00E-10	1	6.76E-04	3.00E-12	1	5.09E-06
U-235	3.00E-10	1	5.07E-04	8.00E-13	1	1.36E-06
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	8.60E-10	1	1.45E-03	0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.26E-01			1.99E-03

TA-50 WM-1

ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)

****

February, 1994

26-Jun-1995 11:03 AM

Item	TREATED (1464117 liters) Concentration	Num	Total(Ci)	FINAL (1453350 liters) Concentration	Num	Total(Ci)
ALPHA	1.20E-07	1	1.76E-01	3.00E-10	1	4.36E-04
BETA	1.00E-09	1	1.46E-03	4.30E-10	1	6.25E-04
GAMMA	1.10E-08	1	1.61E-02	4.00E-09	1	5.81E-03
TRITIUM	0.00E+00	0		1.90E-08	1	2.76E-02
Am	0.00E+00	0		0.00E+00	0	
Am-241	2.00E-08	1	2.93E-02	4.80E-11	1	6.98E-05
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	5.86E-04	4.00E-10	1	5.81E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	8.00E-10	1	1.17E-03	0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	1.00E-07	1	1.46E-01	1.40E-10	1	2.03E-04
Pu-239	6.00E-09	1	8.78E-03	1.60E-11	1	2.33E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)

****

February, 1994

Item	TREATED (1464117 liters) Concentration	Num	Total(Ci)	FINAL (1453350 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	5.00E-11	1	7.32E-05	5.00E-11	1	7.27E-05
Sr-90	6.00E-12	1	8.78E-06	1.60E-11	1	2.33E-05
Tl	1.00E-03	1	1.46E+03	1.00E-03	1	1.45E+03
TOTALPLUTONIUM	1.06E-07	1	1.55E-01	1.56E-10	1	2.27E-04
U	3.70E-02	1	5.42E+04	3.00E-03	1	4.36E+03
U-234	5.00E-10	1	7.32E-04	4.00E-12	1	5.81E-06
U-235	3.00E-10	1	4.39E-04	2.00E-12	1	2.91E-06
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	4.70E-10	1	6.88E-04	0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.86E-01			3.05E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
March, 1994

26-Jun-1995 11:03 AM

Item	TREATED (2025163 liters) Concentration	Num	Total(Ci)	FINAL (2028892 liters) Concentration	Num	Total(Ci)
ALPHA	4.10E-08	1	8.30E-02	2.20E-10	1	4.46E-04
BETA	5.80E-10	1	1.17E-03	4.70E-10	1	9.54E-04
GAMMA	1.10E-08	1	2.23E-02	4.00E-09	1	8.12E-03
TRITIUM	0.00E+00	0		9.40E-08	1	1.91E-01
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.70E-09	1	3.44E-03	8.00E-11	1	1.62E-04
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	8.10E-04	4.00E-10	1	8.12E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	3.20E-08	1	6.48E-02	1.00E-10	1	2.03E-04
Pu-239	3.90E-09	1	7.90E-03	1.30E-11	1	2.64E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
March, 1994

Item	TREATED (2025163 liters) Concentration	Num	Total(Ci)	FINAL (2028892 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	7.00E-12	1	1.42E-05	1.00E-11	1	2.03E-05
Sr-90	6.00E-12	1	1.22E-05	2.30E-11	1	4.67E-05
Tl	2.00E-03	1	4.05E+03	2.00E-03	1	4.06E+03
TOTALPLUTONIUM	3.59E-08	1	7.27E-02	1.13E-10	1	2.29E-04
U	6.10E-02	1	1.24E+05	2.00E-03	1	4.06E+03
U-234	6.00E-11	1	1.22E-04	1.80E-12	1	3.65E-06
U-235	2.00E-11	1	4.05E-05	3.00E-13	1	6.09E-07
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			7.63E-02			3.96E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
April, 1994

26-Jun-1995 11:03 AM

Item	TREATED (1704028 liters) Concentration	Num	Total(Ci)	FINAL (1372607 liters) Concentration	Num	Total(Ci)
ALPHA	1.00E-07	1	1.70E-01	4.10E-10	1	5.63E-04
BETA	1.50E-09	1	2.56E-03	2.90E-10	1	3.98E-04
GAMMA	1.20E-08	1	2.04E-02	4.00E-09	1	5.49E-03
TRITIUM	0.00E+00	0		1.10E-07	1	1.51E-01
Am	0.00E+00	0		0.00E+00	0	
Am-241	5.00E-09	1	8.52E-03	1.00E-10	1	1.37E-04
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	6.82E-04	4.00E-10	1	5.49E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	1.00E-07	1	1.70E-01	1.90E-10	1	2.61E-04
Pu-239	5.00E-09	1	8.52E-03	2.20E-11	1	3.02E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
April, 1994

Item	TREATED (1704028 liters) Concentration	Num	Total(Ci)	FINAL (1372607 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	7.00E-12	1	1.19E-05	8.00E-12	1	1.10E-05
Sr-90	6.00E-12	1	1.02E-05	8.00E-12	1	1.10E-05
Tl	2.00E-03	1	3.41E+03	2.00E-03	1	2.75E+03
TOTALPLUTONIUM	1.05E-07	1	1.79E-01	2.12E-10	1	2.91E-04
U	4.30E-02	1	7.33E+04	7.00E-03	1	9.61E+03
U-234	5.00E-10	1	8.52E-04	4.00E-12	1	5.49E-06
U-235	2.00E-10	1	3.41E-04	2.00E-13	1	2.75E-07
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.89E-01			4.34E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
May, 1994

Item	TREATED (1606346 liters) Concentration	Num	Total(Ci)	FINAL (1614832 liters) Concentration	Num	Total(Ci)
ALPHA	5.50E-08	1	8.83E-02	2.20E-10	1	3.55E-04
BETA	2.80E-10	1	4.50E-04	2.90E-10	1	4.68E-04
GAMMA	1.20E-08	1	1.93E-02	4.00E-09	1	6.46E-03
TRITIUM	0.00E+00	0		1.23E-07	1	1.99E-01
Am	0.00E+00	0		0.00E+00	0	
Am-241	3.00E-09	1	4.82E-03	1.00E-10	1	1.61E-04
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	6.43E-04	4.00E-10	1	6.46E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	6.10E-08	1	9.80E-02	1.00E-10	1	1.61E-04
Pu-239	3.50E-09	1	5.62E-03	1.40E-11	1	2.26E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
May, 1994

Item	TREATED (1606346 liters) Concentration	Num	Total(Ci)	FINAL (1614832 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	6.00E-12	1	9.64E-06	7.00E-12	1	1.13E-05
Sr-90	4.00E-12	1	6.43E-06	1.30E-11	1	2.10E-05
Tl	2.00E-03	1	3.21E+03	2.00E-03	1	3.23E+03
TOTALPLUTONIUM	6.45E-08	1	1.04E-01	1.14E-10	1	1.84E-04
U	1.30E-01	1	2.09E+05	2.00E-03	1	3.23E+03
U-234	2.00E-10	1	3.21E-04	3.00E-12	1	4.84E-06
U-235	1.30E-10	1	2.09E-04	5.00E-13	1	8.07E-07
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	5.80E-10	1	9.32E-04	0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.09E-01			3.51E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
June, 1994

Item	TREATED (1700545 liters) Concentration	Num	Total(Ci)	FINAL (1695575 liters) Concentration	Num	Total(Ci)
ALPHA	4.30E-08	1	7.31E-02	8.00E-11	1	1.36E-04
BETA	2.00E-09	1	3.40E-03	2.90E-10	1	4.92E-04
GAMMA	1.20E-08	1	2.04E-02	4.00E-09	1	6.78E-03
TRITIUM	0.00E+00	0		3.40E-08	1	5.76E-02
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.20E-09	1	2.04E-03	4.00E-11	1	6.78E-05
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	1.00E-02	1	1.70E+04	1.00E-02	1	1.70E+04
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	6.80E-04	4.00E-10	1	6.78E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	4.10E-08	1	6.97E-02	5.60E-11	1	9.50E-05
Pu-239	4.80E-09	1	8.16E-03	9.00E-12	1	1.53E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
June, 1994

Item	TREATED (1700545 liters) Concentration	Num	Total(Ci)	FINAL (1695575 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	7.00E-12	1	1.19E-05	9.00E-12	1	1.53E-05
Sr-90	6.00E-12	1	1.02E-05	7.00E-12	1	1.19E-05
Tl	1.00E-02	1	1.70E+04	1.00E-02	1	1.70E+04
TOTALPLUTONIUM	4.58E-08	1	7.79E-02	6.50E-11	1	1.10E-04
U	9.10E-02	1	1.55E+05	1.00E-02	1	1.70E+04
U-234	7.00E-11	1	1.19E-04	9.00E-13	1	1.53E-06
U-235	6.00E-11	1	1.02E-04	4.00E-13	1	6.78E-07
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			8.01E-02			1.80E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
July, 1994

26-Jun-1995 11:03 AM

Item	TREATED (1966695 liters) Concentration	Num	Total(Ci)	FINAL (2018541 liters) Concentration	Num	Total(Ci)
ALPHA	1.30E-08	1	2.56E-02	2.10E-10	1	4.24E-04
BETA	1.20E-09	1	2.36E-03	3.60E-10	1	7.27E-04
GAMMA	1.20E-08	1	2.36E-02	4.00E-09	1	8.07E-03
TRITIUM	0.00E+00	0		7.30E-08	1	1.47E-01
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.10E-09	1	2.16E-03	9.00E-11	1	1.82E-04
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	4.00E-03	1	7.87E+03	0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	2.00E-10	1	3.93E-04	4.00E-10	1	8.07E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	1.20E-08	1	2.36E-02	1.00E-10	1	2.02E-04
Pu-239	2.10E-09	1	4.13E-03	1.70E-11	1	3.43E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
July, 1994

Item	TREATED (1966695 liters) Concentration	Num	Total(Ci)	FINAL (2018541 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	6.00E-12	1	1.18E-05	7.00E-12	1	1.41E-05
Sr-90	5.00E-12	1	9.83E-06	6.00E-12	1	1.21E-05
Tl	2.00E-03	1	3.93E+03	0.00E+00	0	
TOTALPLUTONIUM	1.41E-08	1	2.77E-02	1.17E-10	1	2.36E-04
U	1.17E-01	1	2.30E+05	0.00E+00	0	
U-234	8.00E-11	1	1.57E-04	2.00E-12	1	4.04E-06
U-235	4.00E-11	1	7.87E-05	1.00E-12	1	2.02E-06
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			3.01E-02			4.24E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
August, 1994

26-Jun-1995 11:03 AM

Item	TREATED (1930934 liters) Concentration	Num	Total(Ci)	FINAL (1857058 liters) Concentration	Num	Total(Ci)
ALPHA	3.70E-08	1	7.14E-02	2.20E-10	1	4.09E-04
BETA	1.20E-09	1	2.32E-03	2.40E-10	1	4.46E-04
GAMMA	1.20E-08	1	2.32E-02	4.00E-09	1	7.43E-03
TRITIUM	0.00E+00	0		4.10E-08	1	7.61E-02
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.20E-09	1	2.32E-03	6.30E-11	1	1.17E-04
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	3.20E-02	1	6.18E+04	5.00E-03	1	9.29E+03
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	2.00E-10	1	3.86E-04	2.00E-10	1	3.71E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	3.30E-08	1	6.37E-02	1.80E-10	1	3.34E-04
Pu-239	3.20E-09	1	6.18E-03	3.50E-11	1	6.50E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
August, 1994

Item	TREATED (1930934 liters) Concentration	Num	Total(Ci)	FINAL (1857058 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	2.60E-11	1	5.02E-05	7.00E-12	1	1.30E-05
Sr-90	5.00E-12	1	9.65E-06	8.00E-12	1	1.49E-05
Tl	5.00E-03	1	9.65E+03	5.00E-03	1	9.29E+03
TOTALPLUTONIUM	3.62E-08	1	6.99E-02	2.15E-10	1	3.99E-04
U	1.10E-01	1	2.12E+05	6.00E-03	1	1.11E+04
U-234	8.00E-11	1	1.54E-04	1.20E-11	1	2.23E-05
U-235	6.00E-11	1	1.16E-04	7.00E-13	1	1.30E-06
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			7.25E-02			5.40E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
September, 1994

Item	TREATED (1695269 liters) Concentration	Num	Total(Ci)	FINAL (1614833 liters) Concentration	Num	Total(Ci)
ALPHA	3.70E-08	1	6.27E-02	3.70E-10	1	5.97E-04
BETA	3.80E-09	1	6.44E-03	9.40E-10	1	1.52E-03
GAMMA	1.20E-08	1	2.03E-02	5.00E-09	1	8.07E-03
TRITIUM	0.00E+00	0		3.10E-07	1	5.01E-01
Am	0.00E+00	0		0.00E+00	0	
Am-241	2.60E-09	1	4.41E-03	8.00E-11	1	1.29E-04
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	2.00E-03	1	3.39E+03	2.00E-03	1	3.23E+03
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	2.00E-10	1	3.39E-04	2.00E-10	1	3.23E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	2.80E-08	1	4.75E-02	2.60E-10	1	4.20E-04
Pu-239	4.60E-09	1	7.80E-03	4.00E-11	1	6.46E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
September, 1994

Item	TREATED (1695269 liters) Concentration	Num	Total(Ci)	FINAL (1614833 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	1.10E-09	1	1.86E-03	0.00E+00	0	
Sr-89	1.10E-09	1	1.86E-03	2.70E-10	1	4.36E-04
Sr-90	6.00E-12	1	1.02E-05	5.00E-12	1	8.07E-06
Tl	2.00E-03	1	3.39E+03	2.00E-03	1	3.23E+03
TOTALPLUTONIUM	3.26E-08	1	5.53E-02	3.00E-10	1	4.84E-04
U	9.00E-02	1	1.53E+05	5.00E-03	1	8.07E+03
U-234	1.00E-10	1	1.70E-04	5.00E-12	1	8.07E-06
U-235	3.00E-11	1	5.09E-05	5.00E-13	1	8.07E-07
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	5.00E-10	1	8.48E-04	0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	1.20E-09	1	2.03E-03	0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			5.99E-02			6.23E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
October, 1994

Item	TREATED (1620650 liters) Concentration	Num	Total(Ci)	FINAL (1614832 liters) Concentration	Num	Total(Ci)
ALPHA	2.80E-08	1	4.54E-02	1.90E-10	1	3.07E-04
BETA	1.30E-09	1	2.11E-03	7.30E-10	1	1.18E-03
GAMMA	1.20E-08	1	1.94E-02	4.00E-09	1	6.46E-03
TRITIUM	0.00E+00	0		1.99E-07	1	3.21E-01
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.40E-09	1	2.27E-03	4.70E-11	1	7.59E-05
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	2.00E-03	1	3.24E+03	2.00E-03	1	3.23E+03
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	2.00E-10	1	3.24E-04	2.00E-10	1	3.23E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	2.80E-08	1	4.54E-02	9.00E-11	1	1.45E-04
Pu-239	3.80E-09	1	6.16E-03	2.30E-11	1	3.71E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
October, 1994

Item	TREATED (1620650 liters) Concentration	Num	Total(Ci)	FINAL (1614832 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	1.60E-11	1	2.59E-05	6.00E-11	1	9.69E-05
Sr-90	9.00E-12	1	1.46E-05	6.00E-12	1	9.69E-06
Tl	5.00E-03	1	8.10E+03	5.00E-03	1	8.07E+03
TOTALPLUTONIUM	3.18E-08	1	5.15E-02	1.13E-10	1	1.82E-04
U	4.90E-01	1	7.94E+05	9.00E-03	1	1.45E+04
U-234	3.00E-10	1	4.86E-04	9.00E-12	1	1.45E-05
U-235	5.00E-11	1	8.10E-05	8.00E-13	1	1.29E-06
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			5.44E-02			2.74E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
November, 1994

26-Jun-1995 11:03 AM

Item	TREATED (1963681 liters) Concentration	Num	Total(Ci)	FINAL (1937799 liters) Concentration	Num	Total(Ci)
ALPHA	8.10E-08	1	1.59E-01	2.10E-10	1	4.07E-04
BETA	6.00E-09	1	1.18E-02	1.60E-09	1	3.10E-03
GAMMA	2.60E-08	1	5.11E-02	4.00E-09	1	7.75E-03
TRITIUM	0.00E+00	0		1.97E-07	1	3.82E-01
Am	0.00E+00	0		0.00E+00	0	
Am-241	5.00E-09	1	9.82E-03	5.70E-11	1	1.10E-04
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	3.00E-03	1	5.89E+03	1.00E-03	1	1.94E+03
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	2.00E-10	1	3.93E-04	2.00E-10	1	3.88E-04
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	1.20E-09	1	2.36E-03	0.00E+00	0	
Pu-238	8.00E-08	1	1.57E-01	1.20E-10	1	2.33E-04
Pu-239	8.00E-09	1	1.57E-02	2.20E-11	1	4.26E-05
Rb-83	2.20E-09	1	4.32E-03	3.90E-09	1	7.56E-03
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
November, 1994

Item	TREATED (1963681 liters) Concentration	Num	Total(Ci)	FINAL (1937799 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	4.00E-10	1	7.85E-04	9.00E-10	1	1.74E-03
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	2.90E-09	1	5.69E-03	2.60E-09	1	5.04E-03
Sr-89	1.60E-09	1	3.14E-03	5.00E-10	1	9.69E-04
Sr-90	1.10E-11	1	2.16E-05	6.00E-12	1	1.16E-05
Tl	1.00E-03	1	1.96E+03	1.00E-03	1	1.94E+03
TOTALPLUTONIUM	8.80E-08	1	1.73E-01	1.42E-10	1	2.75E-04
U	7.40E-01	1	1.45E+06	3.50E-02	1	6.78E+04
U-234	4.00E-10	1	7.85E-04	1.70E-11	1	3.29E-05
U-235	1.30E-10	1	2.55E-04	9.00E-13	1	1.74E-06
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	1.70E-09	1	3.34E-03	0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	1.90E-09	1	3.73E-03	0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.84E-01			4.20E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
December, 1994

Item	TREATED (1924995 liters) Concentration	Num	Total(Ci)	FINAL (1937798 liters) Concentration	Num	Total(Ci)
ALPHA	7.80E-08	1	1.50E-01	2.20E-10	1	4.26E-04
BETA	7.00E-10	1	1.35E-03	3.10E-10	1	6.01E-04
GAMMA	1.20E-08	1	2.31E-02	4.00E-09	1	7.75E-03
TRITIUM	0.00E+00	0		2.80E-08	1	5.43E-02
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.50E-09	1	2.89E-03	5.90E-11	1	1.14E-04
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	2.00E-03	1	3.85E+03	4.00E-03	1	7.75E+03
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	1.10E-09	1	2.12E-03	1.30E-09	1	2.52E-03
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	7.30E-08	1	1.41E-	1.30E-10	1	2.52E-04
Pu-239	4.00E-09	1	7.70E-03	2.60E-11	1	5.04E-05
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)

****

December, 1994

Item	TREATED (1924995 liters) Concentration	Num	Total(Ci)	FINAL (1937798 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	4.00E-11	1	7.70E-05	5.00E-11	1	9.69E-05
Sr-90	6.00E-12	1	1.15E-05	6.00E-12	1	1.16E-05
Tl	1.00E-03	1	1.92E+03	1.00E-03	1	1.94E+03
TOTALPLUTONIUM	7.70E-08	1	1.48E-01	1.56E-10	1	3.02E-04
U	3.60E-01	1	6.93E+05	9.00E-03	1	1.74E+04
U-234	4.00E-10	1	7.70E-04	6.00E-12	1	1.16E-05
U-235	2.00E-10	1	3.85E-04	5.00E-13	1	9.69E-07
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	5.00E-10	1	9.62E-04	0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.52E-01			4.29E-04

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
From January, 1994 to December, 1994

Item	TREATED (21291787 liters) Average	Maximum	Minimum	Num	Total(Ci)	FINAL (20841691 liters) Average	Maximum	Minimum	Num	Total(Ci)
ALPHA	5.97E-08	1.20E-07	0.00E+00	12	1.27E+00	2.51E-10	4.10E-10	0.00E+00	12	5.23E-03
BETA	1.75E-09	1.20E-07	0.00E+00	12	3.72E-02	5.47E-10	1.60E-09	0.00E+00	12	1.14E-02
GAMMA	1.29E-08	1.20E-07	0.00E+00	12	2.75E-01	4.08E-09	5.00E-09	0.00E+00	12	8.51E-02
TRITIUM	0.00E+00			0		1.07E-07	3.10E-07	0.00E+00	12	2.23E+00
Am	0.00E+00			0		0.00E+00			0	
Am-241	4.97E-09	2.00E-08	1.10E-09	12	1.06E-01	1.47E-10	1.00E-09	4.00E-11	12	3.06E-03
As-74	0.00E+00			0		0.00E+00			0	
Ba-140	0.00E+00			0		0.00E+00			0	
Be-7	0.00E+00			0		0.00E+00			0	
Ce-141	0.00E+00			0		0.00E+00			0	
Co	7.86E-03	3.20E-02	2.00E-03	7	1.67E+05	4.00E-03	1.00E-02	1.00E-03	6	8.34E+04
Co-56	0.00E+00			0		0.00E+00			0	
Co-57	0.00E+00			0		0.00E+00			0	
Co-58	0.00E+00			0		0.00E+00			0	
Co-60	0.00E+00			0		0.00E+00			0	
Cr-51	0.00E+00			0		0.00E+00			0	
Cs-134	0.00E+00			0		0.00E+00			0	
Cs-137	3.75E-10	1.10E-09	2.00E-10	12	7.98E-03	4.08E-10	1.30E-09	2.00E-10	12	8.51E-03
Eu-152	0.00E+00			0		0.00E+00			0	
Fe-59	0.00E+00			0		0.00E+00			0	
I-133	0.00E+00			0		0.00E+00			0	
Mn-52	0.00E+00			0		0.00E+00			0	
Mn-54	8.00E-10	8.00E-10	8.00E-10	1	1.70E-02	0.00E+00			0	
N02-N	0.00E+00			0		0.00E+00			0	
N03-N	0.00E+00			0		0.00E+00			0	
Na-22	0.00E+00			0		0.00E+00			0	
Nb-95	1.20E-09	1.20E-09	1.20E-09	1	2.56E-02	0.00E+00			0	
Pu-238	5.32E-08	1.00E-07	1.20E-08	12	1.13E+00	1.35E-10	2.60E-10	5.60E-11	12	2.81E-03
Pu-239	4.66E-09	8.00E-09	2.10E-09	12	9.92E-02	2.14E-11	4.00E-11	9.00E-12	12	4.46E-04
Rb-83	2.20E-09	2.20E-09	2.20E-09	1	4.68E-02	2.35E-09	3.90E-09	8.00E-10	2	4.90E-02
Rb-84	0.00E+00			0		0.00E+00			0	
Rb-85	0.00E+00			0		0.00E+00			0	
Sb-124	0.00E+00			0		0.00E+00			0	

TA-50 WM-1
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
From January, 1994 to December, 1994

Item	TREATED (21291787 liters) Average	Maximum	Minimum	Num	Total(Ci)	FINAL (20841691 liters) Average	Maximum	Minimum	Num	Total(Ci)
Sc-46	0.00E+00			0		0.00E+00			0	
Sc-48	0.00E+00			0		0.00E+00			0	
Se-75	4.00E-10	4.00E-10	4.00E-10	1	8.52E-03	9.00E-10	9.00E-10	9.00E-10	1	1.88E-02
Sn-113	0.00E+00			0		0.00E+00			0	
Sr-82	0.00E+00			0		0.00E+00			0	
Sr-85	2.00E-09	2.90E-09	1.10E-09	2	4.26E-02	1.65E-09	2.60E-09	7.00E-10	2	3.44E-02
Sr-89	2.44E-10	1.60E-09	6.00E-12	12	5.19E-03	9.40E-11	5.00E-10	7.00E-12	12	1.96E-03
Sr-90	1.32E-11	8.80E-11	4.00E-12	12	2.80E-04	1.37E-11	6.00E-11	5.00E-12	12	2.85E-04
Tl	2.83E-03	1.00E-02	1.00E-03	12	6.03E+04	2.91E-03	1.00E-02	1.00E-03	11	6.06E+04
TOTALPLUTONIUM	5.79E-08	1.06E-07	1.41E-08	12	1.23E+00	1.56E-10	3.00E-10	6.50E-11	12	3.25E-03
U	1.96E-01	7.40E-01	3.70E-02	12	4.17E+06	8.36E-03	3.50E-02	2.00E-03	11	1.74E+05
U-234	2.57E-10	5.00E-10	6.00E-11	12	5.48E-03	5.64E-12	1.70E-11	9.00E-13	12	1.18E-04
U-235	1.27E-10	3.00E-10	2.00E-11	12	2.70E-03	7.17E-13	2.00E-12	2.00E-13	12	1.49E-05
V-48	0.00E+00			0		0.00E+00			0	
Xe-133	0.00E+00			0		0.00E+00			0	
Y-88	9.27E-10	1.70E-09	5.00E-10	3	1.97E-02	0.00E+00			0	
Zn-65	0.00E+00			0		0.00E+00			0	
Zr-85	0.00E+00			0		0.00E+00			0	
Zr-88	9.86E-10	1.90E-09	4.70E-10	5	2.10E-02	0.00E+00			0	
Zr-95	0.00E+00			0		0.00E+00			0	
TOTAL ALPHA					1.35E+00					6.45E-03

TA-50 WM-1
GROSS ALPHA REMOVAL
****
CALENDAR YEAR, 1994

MONTH	TREATED (Ci)	EFFLUENT (Ci)	REMOVAL FACTOR = $\frac{INF - EFF}{INF} \times 100$
JAN	1.26 E-1	1.99 E-3	98.42
FEB	1.86 E-1	3.05 E-4	99.84
MAR	7.63 E-2	3.96 E-4	99.48
APR	1.89 E-1	4.34 E-4	99.77
MAY	1.09 E-1	3.51 E-4	99.68
JUN	8.01 E-2	1.80 E-4	99.78
JUL	3.01 E-2	4.24 E-4	98.59
AUG	7.25 E-2	5.40 E-4	99.26
SEP	5.99 E-2	6.23 E-4	98.96
OCT	5.44 E-2	2.74 E-4	99.50
NOV	1.84 E-1	4.20 E-4	99.77
DEC	1.52 E-1	4.29 E-4	99.72
ANNUAL	1.35	6.45 E-3	99.52

VOLUME OF FLOW:

INFLUENT = 21,291,792 LITERS
EFFLUENT = 20,841,738 LITERS

TA-50

RADIOACTIVE WASTE TREATMENT PLANT EFFLUENT COMPARED WITH DCG 5400.5.

****

CALENDAR YEAR, 1994

Radioactive Isotopes	Mean Concentration (µCi/ml)	DCG 5400.5 (µCi/ml)	Conc./DCG Ratio
^{3}H	1.07 E-4	2.0 E-3	0.05
^{54}Mn		5.0 E-5	
^{56}Co		1.0 E-5	
^{57}Co		1.0 E-4	
^{58}Co		4.0 E-5	
^{60}Co		5.0 E-6	
^{75}Se	9.00 E-7	2.0 E-5	0.05
^{83}Rb	2.35 E-6	2.0 E-5	0.12
^{84}Rb		1.0 E-5	
^{85}Sr	1.65 E-6	7.0 E-5	0.02
^{88}Y		3.0 E-5	
^{89}Sr	9.40 E-8	2.0 E-5	0.005
^{90}Sr	1.37 E-8	1.0 E-6	0.01
^{137}Cs	4.08 E-7	3.0 E-6	0.14
^{234}U	5.64 E-9	5.0 E-7	0.01
^{238}Pu	1.35 E-7	4.0 E-8	3.38
$^{239,240}Pu$	2.14 E-8	3.0 E-8	0.71
^{241}Am	1.47 E-7	3.0 E-8	4.9

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
January, 1994

26-Jun-1995 02:32 PM

Item	TREATED (1689364 liters) Concentration	Num	Total(mg)	FINAL (1695574 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	5.00E+00	1	8.45E+06	4.55E+02	1	7.71E+08
ALKALINITY-P	5.00E+00	1	8.45E+06	5.00E+00	1	8.48E+06
ALUMINUM	0.00E+00	0		0.00E+00	0	
ANTIMONY	1.00E-03	1	1.69E+03	2.00E-03	1	3.39E+03
ARSENIC	2.00E-03	1	3.38E+03	2.00E-03	1	3.39E+03
BARIUM	3.70E-02	1	6.25E+04	1.80E-02	1	3.05E+04
BERYLIUM	6.20E-02	1	1.05E+05	1.00E-02	1	1.70E+04
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	5.00E-03	1	8.45E+03	3.00E-03	1	5.09E+03
CALCIUM	1.50E+01	1	2.53E+07	1.68E+02	1	2.85E+08
CHLORIDE	3.30E+01	1	5.57E+07	3.95E+01	1	6.70E+07
COD	4.70E+01	1	7.94E+07	1.80E+01	1	3.05E+07
CONDUCTIVITY	3.70E+02	1		1.33E+03	1	
COPPER	1.69E-01	1	2.86E+05	1.24E-01	1	2.10E+05
CYANIDE	2.00E-02	1	3.38E+04	2.50E-02	1	4.24E+04
FLUORIDE	8.30E-01	1	1.40E+06	1.65E+00	1	2.80E+06
IRON	9.00E-01	1	1.52E+06	7.00E-02	1	1.19E+05
LEAD	8.20E-02	1	1.39E+05	2.00E-03	1	3.39E+03
MAGNESIUM	5.00E-01	1	8.45E+05	5.00E-01	1	8.48E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	3.00E-03	1	5.07E+03	2.00E-04	1	3.39E+02
MO3-N	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
NH3-N	2.10E+00	1	3.55E+06	2.80E+00	1	4.75E+06
NICKEL	1.16E-01	1	1.96E+05	4.50E-02	1	7.63E+04
NO2-N	3.00E-02	1	5.07E+04	3.08E-01	1	5.22E+05
NO3-N	1.51E+01	1	2.55E+07	6.53E+01	1	1.11E+08
pH	6.9	1		7.3	1	
PHOSPHATE	2.00E+00	1	3.38E+06	4.50E-01	1	7.63E+05
POTASSIUM	7.00E+00	1	1.18E+07	2.00E+01	1	3.39E+07
SELENIUM	2.00E-03	1	3.38E+03	2.00E-03	1	3.39E+03
SILVER	3.00E-03	1	5.07E+03	1.00E-03	1	1.70E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
January, 1994

Item	TREATED (1689364 liters) Concentration	Num	Total(mg)	FINAL (1695574 liters) Concentration	Num	Total(mg)
SO4	4.10E+01	1	6.93E+07	6.20E+01	1	1.05E+08
SODIUM	3.90E+01	1	6.59E+07	1.26E+02	1	2.14E+08
TDS	2.96E+02	1	5.00E+08	9.24E+02	1	1.57E+09
TOTALCATIONS	2.62E+00	1		1.50E+01	1	
TOTALCHROMIUM	3.30E-02	1	5.57E+04	5.00E-03	1	8.48E+03
TOTALHARDNESS	1.55E+01	1	2.62E+07	1.68E+02	1	2.86E+08
TSS	0.00E+00	0		0.00E+00	0	
VANADIUM	0.00E+00	0		0.00E+00	0	
ZINC	1.43E-01	1	2.42E+05	6.20E-02	1	1.05E+05

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
February, 1994

26-Jun-1995 02:32 PM

Item	TREATED (1464117 liters) Concentration	Num	Total(mg)	FINAL (1453350 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	1.80E+01	1	2.64E+07	4.90E+02	1	7.12E+08
ALKALINITY-P	5.00E+00	1	7.32E+06	5.00E+00	1	7.27E+06
ALUMINUM	0.00E+00	0		0.00E+00	0	
ANTIMONY	2.00E-03	1	2.93E+03	2.00E-03	1	2.91E+03
ARSENIC	2.00E-03	1	2.93E+03	2.00E-03	1	2.91E+03
BARIUM	4.00E-02	1	5.86E+04	1.40E-02	1	2.03E+04
BERYLIUM	1.80E-02	1	2.64E+04	1.00E-02	1	1.45E+04
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	6.00E-03	1	8.78E+03	4.00E-03	1	5.81E+03
CALCIUM	3.10E+01	1	4.54E+07	1.32E+02	1	1.92E+08
CHLORIDE	3.20E+01	1	4.69E+07	3.93E+01	1	5.71E+07
COD	9.60E+01	1	1.41E+08	3.10E+01	1	4.51E+07
CONDUCTIVITY	4.30E+02	1		1.35E+03	1	
COPPER	1.51E-01	1	2.21E+05	9.20E-02	1	1.34E+05
CYANIDE	4.00E-02	1	5.86E+04	4.00E-02	1	5.81E+04
FLUORIDE	5.90E-01	1	8.64E+05	1.07E+00	1	1.56E+06
IRON	8.30E-01	1	1.22E+06	1.80E-01	1	2.62E+05
LEAD	6.80E-02	1	9.96E+04	2.00E-03	1	2.91E+03
MAGNESIUM	1.00E+00	1	1.46E+06	5.00E-01	1	7.27E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	1.20E-02	1	1.76E+04	2.00E-04	1	2.91E+02
MO3-N	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
NH3-N	4.40E+00	1	6.44E+06	4.70E+00	1	6.83E+06
NICKEL	1.12E+00	1	1.65E+06	2.90E-02	1	4.21E+04
NO2-N	2.00E-02	1	2.93E+04	2.00E-02	1	2.91E+04
NO3-N	3.00E+01	1	4.39E+07	4.80E+01	1	6.98E+07
pH	6.6	1		7.4	1	
PHOSPHATE	2.70E+00	1	3.95E+06	2.50E-01	1	3.63E+05
POTASSIUM	5.00E+00	1	7.32E+06	6.00E+00	1	8.72E+06
SELENIUM	2.00E-03	1	2.93E+03	2.00E-03	1	2.91E+03
SILVER	9.00E-03	1	1.32E+04	1.00E-03	1	1.45E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
February, 1994

Item	TREATED (1464117 liters) Concentration	Num	Total(mg)	FINAL (1453350 liters) Concentration	Num	Total(mg)
SO4	3.66E+01	1	5.36E+07	4.80E+01	1	6.98E+07
SODIUM	4.20E+01	1	6.15E+07	1.17E+02	1	1.70E+08
TDS	3.44E+02	1	5.04E+08	8.48E+02	1	1.23E+09
TOTALCATIONS	3.60E+00	1		1.41E+01	1	
TOTALCHROMIUM	3.20E-02	1	4.69E+04	4.00E-03	1	5.81E+03
TOTALHARDNESS	3.20E+01	1	4.69E+07	1.32E+02	1	1.93E+08
TSS	8.00E+00	1	1.17E+07	0.00E+00	0	
VANADIUM	0.00E+00	0		0.00E+00	0	
ZINC	1.39E-01	1	2.04E+05	1.09E-01	1	1.58E+05

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
March, 1994

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Item	TREATED (2025163 liters) Concentration	Num	Total(mg)	FINAL (2028892 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	1.20E+01	1	2.43E+07	5.30E+02	1	1.08E+09
ALKALINITY-P	5.00E+00	1	1.01E+07	1.00E+00	1	2.03E+06
ALUMINUM	0.00E+00	0		0.00E+00	0	
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	2.00E-03	1	4.05E+03	2.00E-03	1	4.06E+03
BARIUM	3.50E-02	1	7.09E+04	1.40E-02	1	2.84E+04
BERYLIUM	1.90E-02	1	3.85E+04	2.00E-03	1	4.06E+03
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	2.00E-03	1	4.05E+03	2.00E-03	1	4.06E+03
CALCIUM	1.50E+01	1	3.04E+07	1.65E+02	1	3.35E+08
CHLORIDE	3.30E+01	1	6.68E+07	4.00E+01	1	8.12E+07
COD	1.38E+02	1	2.79E+08	4.00E+01	1	8.12E+07
CONDUCTIVITY	3.50E+02	1		1.28E+03	1	
COPPER	2.47E-01	1	5.00E+05	9.50E-02	1	1.93E+05
CYANIDE	6.00E-02	1	1.22E+05	7.00E-02	1	1.42E+05
FLUORIDE	4.80E-01	1	9.72E+05	1.25E+00	1	2.54E+06
IRON	8.00E-01	1	1.62E+06	5.50E-01	1	1.12E+06
LEAD	7.30E-02	1	1.48E+05	3.00E-03	1	6.09E+03
MAGNESIUM	2.00E+00	1	4.05E+06	5.00E-01	1	1.01E+06
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	7.30E-03	1	1.48E+04	3.00E-04	1	6.09E+02
MO3-N	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
NH3-N	4.60E+00	1	9.32E+06	6.30E+00	1	1.28E+07
NICKEL	8.70E-02	1	1.76E+05	4.50E-02	1	9.13E+04
NO2-N	1.10E-01	1	2.23E+05	4.50E+00	1	9.13E+06
NO3-N	2.69E+01	1	5.45E+07	2.92E+01	1	5.92E+07
pH	6.2	1		7.1	1	
PHOSPHATE	7.00E-01	1	1.42E+06	3.50E-01	1	7.10E+05
POTASSIUM	2.00E+00	1	4.05E+06	6.00E+00	1	1.22E+07
SELENIUM	2.00E-03	1	4.05E+03	2.00E-03	1	4.06E+03
SILVER	4.00E-03	1	8.10E+03	2.00E-03	1	4.06E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
March, 1994

Item	TREATED (2025163 liters) Concentration	Num	Total(mg)	FINAL (2028892 liters) Concentration	Num	Total(mg)
SO4	2.70E+01	1	5.47E+07	4.20E+01	1	8.52E+07
SODIUM	4.30E+01	1	8.71E+07	1.14E+02	1	2.31E+08
TDS	3.40E+02	1	6.89E+08	8.80E+02	1	1.79E+09
TOTALCATIONS	2.94E+00	1		1.37E+01	1	
TOTALCHROMIUM	2.70E-02	1	5.47E+04	7.00E-03	1	1.42E+04
TOTALHARDNESS	1.70E+01	1	3.44E+07	1.66E+02	1	3.36E+08
TSS	2.00E+00	1	4.05E+06	0.00E+00	0	
VANADIUM	0.00E+00	0		0.00E+00	0	
ZINC	1.30E-01	1	2.63E+05	3.60E-02	1	7.30E+04

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
April, 1994

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Item	TREATED (1704028 liters) Concentration	Num	Total(mg)	FINAL (1372607 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	2.40E+01	1	4.09E+07	4.20E+02	1	5.76E+08
ALKALINITY-P	5.00E+00	1	8.52E+06	5.00E+00	1	6.86E+06
ALUMINUM	0.00E+00	0		0.00E+00	0	
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	2.00E-03	1	3.41E+03	2.00E-03	1	2.75E+03
BARIUM	3.80E-02	1	6.48E+04	1.10E-02	1	1.51E+04
BERYLIUM	9.00E-03	1	1.53E+04	2.00E-03	1	2.75E+03
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	2.00E-03	1	3.41E+03	2.00E-03	1	2.75E+03
CALCIUM	1.60E+01	1	2.73E+07	1.42E+02	1	1.95E+08
CHLORIDE	3.00E+00	1	5.11E+06	3.00E+00	1	4.12E+06
COD	1.11E+02	1	1.89E+08	2.70E+01	1	3.71E+07
CONDUCTIVITY	4.00E+02	1		1.05E+03	1	
COPPER	1.74E-01	1	2.97E+05	1.18E-01	1	1.62E+05
CYANIDE	3.00E-02	1	5.11E+04	7.00E-02	1	9.61E+04
FLUORIDE	1.20E+00	1	2.04E+06	1.72E+00	1	2.36E+06
IRON	4.90E-01	1	8.35E+05	3.90E-01	1	5.35E+05
LEAD	6.90E-02	1	1.18E+05	3.00E-03	1	4.12E+03
MAGNESIUM	2.00E+00	1	3.41E+06	5.00E-01	1	6.86E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	4.00E-03	1	6.82E+03	2.00E-04	1	2.75E+02
MO3-N	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
NH3-N	4.24E+00	1	7.23E+06	4.56E+00	1	6.26E+06
NICKEL	5.20E-02	1	8.86E+04	4.20E-02	1	5.76E+04
NO2-N	4.00E-02	1	6.82E+04	6.00E-01	1	8.24E+05
NO3-N	2.22E+01	1	3.78E+07	2.98E+01	1	4.09E+07
pH	6.7	1		7.3	1	
PHOSPHATE	2.05E+00	1	3.49E+06	4.06E-01	1	5.57E+05
POTASSIUM	5.00E+00	1	8.52E+06	6.00E+00	1	8.24E+06
SELENIUM	2.00E-03	1	3.41E+03	2.00E-03	1	2.75E+03
SILVER	3.00E-03	1	5.11E+03	2.00E-03	1	2.75E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
April, 1994

Item	TREATED (1704028 liters) Concentration	Num	Total(mg)	FINAL (1372607 liters) Concentration	Num	Total(mg)
SO4	3.00E+00	1	5.11E+06	4.00E+00	1	5.49E+06
SODIUM	4.50E+01	1	7.67E+07	8.70E+01	1	1.19E+08
TDS	2.78E+02	1	4.74E+08	6.56E+02	1	9.00E+08
TOTALCATIONS	3.13E+00	1		1.12E+01	1	
TOTALCHROMIUM	3.40E-02	1	5.79E+04	8.00E-03	1	1.10E+04
TOTALHARDNESS	1.80E+01	1	3.07E+07	1.42E+02	1	1.96E+08
TSS	7.00E+00	1	1.19E+07	0.00E+00	0	
VANADIUM	0.00E+00	0		0.00E+00	0	
ZINC	1.08E-01	1	1.84E+05	2.80E-02	1	3.84E+04

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
May, 1994

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Item	TREATED (1606346 liters) Concentration	Num	Total(mg)	FINAL (1614832 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	5.00E+00	1	8.03E+06	4.70E+02	1	7.59E+08
ALKALINITY-P	5.00E+00	1	8.03E+06	5.00E+00	1	8.07E+06
ALUMINUM	0.00E+00	0		0.00E+00	0	
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	2.00E-03	1	3.21E+03	2.00E-03	1	3.23E+03
BARIUM	3.90E-02	1	6.26E+04	1.30E-02	1	2.10E+04
BERYLIUM	9.00E-03	1	1.45E+04	2.00E-03	1	3.23E+03
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	2.00E-03	1	3.21E+03	2.00E-03	1	3.23E+03
CALCIUM	3.00E+01	1	4.82E+07	1.22E+02	1	1.97E+08
CHLORIDE	3.70E+01	1	5.94E+07	4.30E+01	1	6.94E+07
COD	6.90E+01	1	1.11E+08	4.10E+01	1	6.62E+07
CONDUCTIVITY	4.90E+02	1		1.30E+03	1	
COPPER	3.60E-01	1	5.78E+05	1.17E-01	1	1.89E+05
CYANIDE	2.00E-02	1	3.21E+04	2.00E-02	1	3.23E+04
FLUORIDE	7.40E-01	1	1.19E+06	1.57E+00	1	2.54E+06
IRON	3.20E-01	1	5.14E+05	1.20E-01	1	1.94E+05
LEAD	5.70E-02	1	9.16E+04	3.00E-03	1	4.84E+03
MAGNESIUM	2.00E+00	1	3.21E+06	5.00E-01	1	8.07E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	3.00E-03	1	4.82E+03	2.00E-04	1	3.23E+02
MO3-N	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
NH3-N	5.60E+00	1	9.00E+06	9.20E+00	1	1.49E+07
NICKEL	1.39E-01	1	2.23E+05	3.70E-02	1	5.97E+04
NO2-N	2.00E-02	1	3.21E+04	7.50E-01	1	1.21E+06
NO3-N	3.20E+01	1	5.14E+07	4.27E+01	1	6.90E+07
pH	3.5	1		7.2	1	
PHOSPHATE	6.50E-01	1	1.04E+06	1.50E-01	1	2.42E+05
POTASSIUM	5.00E+00	1	8.03E+06	6.00E+00	1	9.69E+06
SELENIUM	2.00E-03	1	3.21E+03	3.00E-03	1	4.84E+03
SILVER	2.00E-03	1	3.21E+03	2.00E-03	1	3.23E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
May, 1994

Item	TREATED (1606346 liters) Concentration	Num	Total(mg)	FINAL (1614832 liters) Concentration	Num	Total(mg)
SO4	1.80E+01	1	2.89E+07	5.00E+01	1	8.07E+07
SODIUM	3.20E+01	1	5.14E+07	1.21E+02	1	1.95E+08
TDS	3.20E+02	1	5.14E+08	8.20E+02	1	1.32E+09
TOTALCATIONS	3.41E+00	1		1.55E+01	1	
TOTALCHROMIUM	3.80E-02	1	6.10E+04	7.00E-03	1	1.13E+04
TOTALHARDNESS	3.20E+01	1	5.14E+07	1.22E+02	1	1.98E+08
TSS	3.00E+00	1	4.82E+06	0.00E+00	0	
VANADIUM	0.00E+00	0		0.00E+00	0	
ZINC	1.48E-01	1	2.38E+05	5.60E-02	1	9.04E+04

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
June, 1994

26-Jun-1995 02:32 PM

Item	TREATED (1700545 liters) Concentration	Num	Total(mg)	FINAL (1695575 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	5.00E+00	1	8.50E+06	4.31E+02	1	7.31E+08
ALKALINITY-P	5.00E+00	1	8.50E+06	5.00E+00	1	8.48E+06
ALUMINUM	2.30E-01	1	3.91E+05	4.70E-02	1	7.97E+04
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	0.00E+00	0		0.00E+00	0	
BARIUM	3.50E-02	1	5.95E+04	1.50E-02	1	2.54E+04
BERYLIUM	1.40E-02	1	2.38E+04	1.00E-02	1	1.70E+04
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	1.00E-02	1	1.70E+04	1.00E-02	1	1.70E+04
CALCIUM	1.50E+01	1	2.55E+07	1.50E+02	1	2.54E+08
CHLORIDE	3.60E+01	1	6.12E+07	3.80E+01	1	6.44E+07
COD	1.00E+02	1	1.70E+08	1.90E+01	1	3.22E+07
CONDUCTIVITY	5.20E+02	1		1.19E+03	1	
COPPER	3.12E-01	1	5.31E+05	1.36E-01	1	2.31E+05
CYANIDE	4.00E-02	1	6.80E+04	4.00E-02	1	6.78E+04
FLUORIDE	9.30E-01	1	1.58E+06	1.61E+00	1	2.73E+06
IRON	6.80E-01	1	1.16E+06	9.00E-02	1	1.53E+05
LEAD	8.70E-02	1	1.48E+05	1.00E-02	1	1.70E+04
MAGNESIUM	2.00E+00	1	3.40E+06	5.00E-01	1	8.48E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	5.40E-03	1	9.18E+03	1.00E-04	1	1.70E+02
MO3-N	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
NH3-N	7.30E+00	1	1.24E+07	8.40E+00	1	1.42E+07
NICKEL	2.16E-01	1	3.67E+05	4.30E-02	1	7.29E+04
NO2-N	2.00E-02	1	3.40E+04	2.00E-02	1	3.39E+04
NO3-N	3.94E+01	1	6.70E+07	5.70E+01	1	9.66E+07
pH	3.4	1		7.4	1	
PHOSPHATE	2.60E+00	1	4.42E+06	4.50E-01	1	7.63E+05
POTASSIUM	6.00E+00	1	1.02E+07	5.00E+00	1	8.48E+06
SELENIUM	0.00E+00	0		0.00E+00	0	
SILVER	1.80E-02	1	3.06E+04	1.00E-02	1	1.70E+04

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
June, 1994

Item	TREATED (1700545 liters) Concentration	Num	Total(mg)	FINAL (1695575 liters) Concentration	Num	Total(mg)
SO4	2.80E+01	1	4.76E+07	5.20E+01	1	8.82E+07
SODIUM	3.40E+01	1	5.78E+07	1.19E+02	1	2.02E+08
TDS	7.34E+03	1	1.25E+10	8.54E+02	1	1.45E+09
TOTALCATIONS	3.60E+00	1		1.31E+01	1	
TOTALCHROMIUM	4.60E-02	1	7.82E+04	1.00E-02	1	1.70E+04
TOTALHARDNESS	1.70E+01	1	2.89E+07	1.50E+02	1	2.55E+08
TSS	9.00E+00	1	1.53E+07	0.00E+00	0	
VANADIUM	3.40E-02	1	5.78E+04	2.00E-02	1	3.39E+04
ZINC	8.80E-02	1	1.50E+05	6.80E-02	1	1.15E+05

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
July, 1994

26-Jun-1995 02:32 PM

Item	TREATED (1966695 liters) Concentration	Num	Total(mg)	FINAL (2018541 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	5.00E+00	1	9.83E+06	3.32E+02	1	6.70E+08
ALKALINITY-P	5.00E+00	1	9.83E+06	5.00E+00	1	1.01E+07
ALUMINUM	5.00E-01	1	9.83E+05	0.00E+00	0	
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	2.00E-03	1	3.93E+03	2.00E-03	1	4.04E+03
BARIUM	5.00E-02	1	9.83E+04	0.00E+00	0	
BERYLIUM	8.00E-03	1	1.57E+04	0.00E+00	0	
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	7.00E-03	1	1.38E+04	0.00E+00	0	
CALCIUM	1.50E+01	1	2.95E+07	1.07E+02	1	2.16E+08
CHLORIDE	2.20E+01	1	4.33E+07	2.80E+01	1	5.65E+07
COD	8.90E+01	1	1.75E+08	1.80E+01	1	3.63E+07
CONDUCTIVITY	3.00E+02	1		9.00E+02	1	
COPPER	3.96E-01	1	7.79E+05	0.00E+00	0	
CYANIDE	2.00E-02	1	3.93E+04	2.00E-02	1	4.04E+04
FLUORIDE	6.20E-01	1	1.22E+06	2.16E+00	1	4.36E+06
IRON	6.20E-01	1	1.22E+06	2.00E-01	1	4.04E+05
LEAD	1.00E-01	1	1.97E+05	0.00E+00	0	
MAGNESIUM	2.00E+00	1	3.93E+06	5.00E-01	1	1.01E+06
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	5.00E-03	1	9.83E+03	1.00E-04	1	2.02E+02
MO3-N	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
NH3-N	5.30E+00	1	1.04E+07	4.80E+00	1	9.69E+06
NICKEL	7.50E-02	1	1.48E+05	0.00E+00	0	
NO2-N	7.00E-02	1	1.38E+05	4.70E+00	1	9.49E+06
NO3-N	2.35E+01	1	4.62E+07	4.10E+01	1	8.28E+07
pH	4.5	1		7.2	1	
PHOSPHATE	1.50E+00	1	2.95E+06	3.00E-01	1	6.06E+05
POTASSIUM	4.00E+00	1	7.87E+06	5.00E+00	1	1.01E+07
SELENIUM	2.00E-03	1	3.93E+03	2.00E-03	1	4.04E+03
SILVER	1.70E-02	1	3.34E+04	0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
July, 1994

Item	TREATED (1966695 liters) Concentration	Num	Total(mg)	FINAL (2018541 liters) Concentration	Num	Total(mg)
SO4	2.30E+01	1	4.52E+07	5.60E+01	1	1.13E+08
SODIUM	2.90E+01	1	5.70E+07	1.22E+02	1	2.46E+08
TDS	3.36E+02	1	6.61E+08	7.30E+02	1	1.47E+09
TOTALCATIONS	2.18E+00	1		1.04E+01	1	
TOTALCHROMIUM	7.00E-02	1	1.38E+05	0.00E+00	0	
TOTALHARDNESS	1.70E+01	1	3.34E+07	1.08E+02	1	2.17E+08
TSS	5.00E+00	1	9.83E+06	0.00E+00	0	
VANADIUM	5.00E-02	1	9.83E+04	0.00E+00	0	
ZINC	1.20E-01	1	2.36E+05	0.00E+00	0	

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
August, 1994

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Item	TREATED (1930934 liters) Concentration	Num	Total(mg)	FINAL (1857058 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	5.00E+00	1	9.65E+06	3.66E+02	1	6.80E+08
ALKALINITY-P	5.00E+00	1	9.65E+06	5.00E+00	1	9.29E+06
ALUMINUM	2.63E+00	1	5.08E+06	3.00E-01	1	5.57E+05
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	2.00E-03	1	3.86E+03	2.00E-03	1	3.71E+03
BARIUM	4.10E-02	1	7.92E+04	1.10E-02	1	2.04E+04
BERYLIUM	2.10E-01	1	4.05E+05	2.80E-02	1	5.20E+04
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	7.00E-03	1	1.35E+04	3.00E-03	1	5.57E+03
CALCIUM	1.50E+01	1	2.90E+07	9.50E+01	1	1.76E+08
CHLORIDE	2.40E+01	1	4.63E+07	2.80E+01	1	5.20E+07
COD	7.10E+01	1	1.37E+08	1.50E+01	1	2.79E+07
CONDUCTIVITY	6.90E+03	1		1.05E+03	1	
COPPER	8.00E-01	1	1.54E+06	1.90E-01	1	3.53E+05
CYANIDE	1.30E-01	1	2.51E+05	5.00E-02	1	9.29E+04
FLUORIDE	4.30E-01	1	8.30E+05	2.53E+00	1	4.70E+06
IRON	6.40E-01	1	1.24E+06	1.90E-01	1	3.53E+05
LEAD	6.40E-02	1	1.24E+05	5.00E-03	1	9.29E+03
MAGNESIUM	2.00E+00	1	3.86E+06	5.00E-01	1	9.29E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	4.00E-03	1	7.72E+03	3.00E-04	1	5.57E+02
MO3-N	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
NH3-N	6.00E+00	1	1.16E+07	5.90E+00	1	1.10E+07
NICKEL	6.70E-01	1	1.29E+06	8.50E-02	1	1.58E+05
NO2-N	2.00E-02	1	3.86E+04	5.50E-01	1	1.02E+06
NO3-N	2.71E+02	1	5.23E+08	3.15E+01	1	5.85E+07
pH	2.0	1		7.1	1	
PHOSPHATE	1.60E+00	1	3.09E+06	2.60E-01	1	4.83E+05
POTASSIUM	6.00E+00	1	1.16E+07	6.00E+00	1	1.11E+07
SELENIUM	2.00E-03	1	3.86E+03	2.00E-03	1	3.71E+03
SILVER	4.20E-02	1	8.11E+04	3.00E-03	1	5.57E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
August, 1994

Item	TREATED (1930934 liters) Concentration	Num	Total(mg)	FINAL (1857058 liters) Concentration	Num	Total(mg)
SO4	2.40E+01	1	4.63E+07	5.00E+00	1	9.29E+06
SODIUM	5.30E+01	1	1.02E+08	1.65E+02	1	3.06E+08
TDS	3.82E+02	1	7.38E+08	7.46E+02	1	1.39E+09
TOTALCATIONS	2.22E+01	1		1.19E+01	1	
TOTALCHROMIUM	5.90E-02	1	1.14E+05	7.00E-03	1	1.30E+04
TOTALHARDNESS	1.70E+01	1	3.28E+07	9.55E+01	1	1.77E+08
TSS	3.00E+00	1	5.79E+06	0.00E+00	0	
VANADIUM	1.17E-01	1	2.26E+05	9.00E-02	1	1.67E+05
ZINC	2.05E-01	1	3.96E+05	6.50E-02	1	1.21E+05

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
September, 1994

27-Jun-1995 08:52 AM

Item	TREATED (1695269 liters) Concentration	Num	Total(mg)	FINAL (1614833 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	5.00E+00	1	8.48E+06	3.32E+02	1	5.36E+08
ALKALINITY-P	5.00E+00	1	8.48E+06	5.00E+00	1	8.07E+06
ALUMINUM	7.50E-01	1	1.27E+06	1.52E-01	1	2.45E+05
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	2.00E-03	1	3.39E+03	2.00E-03	1	3.23E+03
BARIUM	6.80E-02	1	1.15E+05	1.40E-02	1	2.26E+04
BERYLIUM	2.00E-02	1	3.39E+04	3.00E-03	1	4.84E+03
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	9.00E-03	1	1.53E+04	6.00E-03	1	9.69E+03
CALCIUM	4.00E+00	1	6.78E+06	8.40E+01	1	1.36E+08
CHLORIDE	3.00E+01	1	5.09E+07	3.90E+01	1	6.30E+07
COD	8.90E+01	1	1.51E+08	2.70E+01	1	4.36E+07
CONDUCTIVITY	5.90E+02	1		1.15E+03	1	
COPPER	5.60E-01	1	9.49E+05	1.96E-01	1	3.17E+05
CYANIDE	4.00E-02	1	6.78E+04	3.50E-02	1	5.65E+04
FLUORIDE	2.02E+00	1	3.42E+06	3.29E+00	1	5.31E+06
IRON	6.00E-01	1	1.02E+06	1.20E-01	1	1.94E+05
LEAD	6.70E-02	1	1.14E+05	5.00E-03	1	8.07E+03
MAGNESIUM	1.60E+01	1	2.71E+07	5.00E-01	1	8.07E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	4.00E-03	1	6.78E+03	2.00E-04	1	3.23E+02
MO3-N	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
NH3-N	1.50E-01	1	2.54E+05	2.20E+00	1	3.55E+06
NICKEL	3.40E-01	1	5.76E+05	7.40E-02	1	1.19E+05
NO2-N	1.00E-01	1	1.70E+05	6.70E-01	1	1.08E+06
NO3-N	5.40E+01	1	9.15E+07	5.80E+01	1	9.37E+07
pH	3.4	1		6.9	1	
PHOSPHATE	2.10E+00	1	3.56E+06	3.00E-01	1	4.84E+05
POTASSIUM	6.00E+00	1	1.02E+07	8.00E+00	1	1.29E+07
SELENIUM	2.00E-03	1	3.39E+03	2.00E-03	1	3.23E+03
SILVER	1.90E-02	1	3.22E+04	1.00E-03	1	1.61E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
September, 1994

Item	TREATED (1695269 liters) Concentration	Num	Total(mg)	FINAL (1614833 liters) Concentration	Num	Total(mg)
SO4	3.60E+01	1	6.10E+07	5.70E+01	1	9.20E+07
SODIUM	7.80E+01	1	1.32E+08	1.98E+02	1	3.20E+08
TDS	4.40E+02	1	7.46E+08	8.48E+02	1	1.37E+09
TOTALCATIONS	5.05E+00	1		1.31E+01	1	
TOTALCHROMIUM	7.70E-02	1	1.31E+05	1.30E-02	1	2.10E+04
TOTALHARDNESS	2.00E+01	1	3.39E+07	8.45E+01	1	1.36E+08
TSS	9.00E+00	1	1.53E+07	0.00E+00	0	
VANADIUM	6.70E-02	1	1.14E+05	6.00E-02	1	9.69E+04
ZINC	1.20E-01	1	2.03E+05	9.40E-02	1	1.52E+05

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
October, 1994

27-Jun-1995 08:52 AM

Item	TREATED (1620650 liters) Concentration	Num	Total(mg)	FINAL (1614832 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	5.00E+00	1	8.10E+06	3.46E+02	1	5.59E+08
ALKALINITY-P	5.00E+00	1	8.10E+06	5.00E+00	1	8.07E+06
ALUMINUM	5.05E-01	1	8.18E+05	2.50E-02	1	4.04E+04
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	2.00E-03	1	3.24E+03	2.00E-03	1	3.23E+03
BARIUM	4.60E-02	1	7.45E+04	1.20E-02	1	1.94E+04
BERYLIUM	2.00E-03	1	3.24E+03	1.00E-03	1	1.61E+03
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	5.00E-03	1	8.10E+03	2.00E-03	1	3.23E+03
CALCIUM	1.50E+01	1	2.43E+07	1.04E+02	1	1.68E+08
CHLORIDE	1.40E+01	1	2.27E+07	1.90E+01	1	3.07E+07
COD	8.80E+01	1	1.43E+08	2.70E+01	1	4.36E+07
CONDUCTIVITY	5.20E+02	1		1.00E+03	1	
COPPER	4.50E-01	1	7.29E+05	1.60E-01	1	2.58E+05
CYANIDE	6.00E-02	1	9.72E+04	1.00E-01	1	1.61E+05
FLUORIDE	6.40E-01	1	1.04E+06	1.75E+00	1	2.83E+06
IRON	4.70E-01	1	7.62E+05	6.40E-02	1	1.03E+05
LEAD	6.60E-02	1	1.07E+05	4.00E-03	1	6.46E+03
MAGNESIUM	3.00E+00	1	4.86E+06	5.00E-01	1	8.07E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	8.00E-03	1	1.30E+04	2.00E-04	1	3.23E+02
MO3-N	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
NH3-N	5.60E+00	1	9.08E+06	7.30E+00	1	1.18E+07
NICKEL	1.30E-01	1	2.11E+05	3.50E-02	1	5.65E+04
NO2-N	7.20E-02	1	1.17E+05	1.10E+00	1	1.78E+06
NO3-N	2.80E+01	1	4.54E+07	3.20E+01	1	5.17E+07
pH	3.2	1		6.7	1	
PHOSPHATE	2.20E+00	1	3.57E+06	2.80E-01	1	4.52E+05
POTASSIUM	8.00E+00	1	1.30E+07	7.00E+00	1	1.13E+07
SELENIUM	2.00E-03	1	3.24E+03	2.00E-03	1	3.23E+03
SILVER	3.30E-02	1	5.35E+04	1.00E-03	1	1.61E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
October, 1994

Item	TREATED (1620650 liters) Concentration	Num	Total(mg)	FINAL (1614832 liters) Concentration	Num	Total(mg)
SO4	8.00E+00	1	1.30E+07	4.30E+01	1	6.94E+07
SODIUM	3.40E+01	1	5.51E+07	1.41E+02	1	2.28E+08
TDS	3.22E+02	1	5.22E+08	7.44E+02	1	1.20E+09
TOTALCATIONS	3.51E+00	1		1.12E+01	1	
TOTALCHROMIUM	7.60E-02	1	1.23E+05	2.50E-02	1	4.04E+04
TOTALHARDNESS	1.80E+01	1	2.92E+07	1.04E+02	1	1.69E+08
TSS	4.00E+00	1	6.48E+06	0.00E+00	0	
VANADIUM	6.80E-02	1	1.10E+05	6.70E-02	1	1.08E+05
ZINC	2.20E-01	1	3.57E+05	7.00E-02	1	1.13E+05

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
November, 1994

27-Jun-1995 08:52 AM

Item	TREATED (1963681 liters) Concentration	Num	Total(mg)	FINAL (1937799 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	1.80E+01	1	3.53E+07	4.60E+02	1	8.91E+08
ALKALINITY-P	2.00E+00	1	3.93E+06	3.30E+01	1	6.39E+07
ALUMINUM	1.53E-01	1	3.00E+05	2.50E-02	1	4.84E+04
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	2.00E-03	1	3.93E+03	2.00E-03	1	3.88E+03
BARIUM	3.60E-02	1	7.07E+04	1.00E-02	1	1.94E+04
BERYLIUM	3.00E-03	1	5.89E+03	1.00E-03	1	1.94E+03
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	1.20E-02	1	2.36E+04	1.00E-03	1	1.94E+03
CALCIUM	2.00E+01	1	3.93E+07	8.20E+01	1	1.59E+08
CHLORIDE	2.70E+01	1	5.30E+07	4.80E+01	1	9.30E+07
COD	3.80E+01	1	7.46E+07	4.20E+01	1	8.14E+07
CONDUCTIVITY	3.70E+02	1		1.79E+03	1	
COPPER	1.80E+00	1	3.53E+06	1.15E-01	1	2.23E+05
CYANIDE	3.00E-02	1	5.89E+04	1.20E-01	1	2.33E+05
FLUORIDE	1.07E+00	1	2.10E+06	2.66E+00	1	5.15E+06
IRON	1.70E+00	1	3.34E+06	7.10E-02	1	1.38E+05
LEAD	8.50E-02	1	1.67E+05	5.00E-03	1	9.69E+03
MAGNESIUM	6.30E+00	1	1.24E+07	5.00E-01	1	9.69E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	7.00E-03	1	1.37E+04	3.00E-04	1	5.81E+02
MO3-N	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
NH3-N	3.00E+00	1	5.89E+06	3.50E+00	1	6.78E+06
NICKEL	2.70E-01	1	5.30E+05	6.50E-02	1	1.26E+05
NO2-N	2.00E-02	1	3.93E+04	4.80E-01	1	9.30E+05
NO3-N	3.20E+01	1	6.28E+07	8.70E+01	1	1.69E+08
pH	6.6	1		7.1	1	
PHOSPHATE	2.20E+00	1	4.32E+06	5.00E-01	1	9.69E+05
POTASSIUM	1.00E+01	1	1.96E+07	5.20E+01	1	1.01E+08
SELENIUM	2.00E-03	1	3.93E+03	2.00E-03	1	3.88E+03
SILVER	1.70E-02	1	3.34E+04	1.00E-03	1	1.94E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
November, 1994

Item	TREATED (1963681 liters) Concentration	Num	Total(mg)	FINAL (1937799 liters) Concentration	Num	Total(mg)
SO4	2.50E+01	1	4.91E+07	6.90E+01	1	1.34E+08
SODIUM	4.80E+01	1	9.43E+07	3.40E+02	1	6.59E+08
TDS	3.52E+02	1	6.91E+08	1.42E+03	1	2.76E+09
TOTALCATIONS	3.42E+00	1		2.03E+01	1	
TOTALCHROMIUM	5.70E-02	1	1.12E+05	3.00E-02	1	5.81E+04
TOTALHARDNESS	2.63E+01	1	5.16E+07	8.25E+01	1	1.60E+08
TSS	3.00E+00	1	5.89E+06	0.00E+00	0	
VANADIUM	6.70E-02	1	1.32E+05	5.00E-02	1	9.69E+04
ZINC	2.40E-01	1	4.71E+05	1.05E-01	1	2.03E+05

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
December, 1994

27-Jun-1995 08:52 AM

Item	TREATED (1924995 liters) Concentration	Num	Total(mg)	FINAL (1937798 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	2.30E+01	1	4.43E+07	4.38E+02	1	8.49E+08
ALKALINITY-P	2.00E+00	1	3.85E+06	5.00E+00	1	9.69E+06
ALUMINUM	3.60E-01	1	6.93E+05	3.00E-01	1	5.81E+05
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	3.00E-03	1	5.77E+03	3.00E-03	1	5.81E+03
BARIUM	5.10E-02	1	9.82E+04	9.00E-03	1	1.74E+04
BERYLIUM	1.00E-03	1	1.92E+03	3.00E-02	1	5.81E+04
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	4.00E-03	1	7.70E+03	3.00E-03	1	5.81E+03
CALCIUM	1.70E+01	1	3.27E+07	1.25E+02	1	2.42E+08
CHLORIDE	2.80E+01	1	5.39E+07	2.90E+01	1	5.62E+07
COD	5.00E+01	1	9.62E+07	2.50E+01	1	4.84E+07
CONDUCTIVITY	3.00E+02	1		1.05E+03	1	
COPPER	1.05E+00	1	2.02E+06	1.20E-01	1	2.33E+05
CYANIDE	6.00E-02	1	1.15E+05	4.00E-02	1	7.75E+04
FLUORIDE	1.47E+00	1	2.83E+06	1.71E+00	1	3.31E+06
IRON	4.70E-01	1	9.05E+05	4.00E-02	1	7.75E+04
LEAD	1.47E-01	1	2.83E+05	2.40E-02	1	4.65E+04
MAGNESIUM	3.00E+00	1	5.77E+06	5.00E-01	1	9.69E+05
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	1.20E-02	1	2.31E+04	3.00E-04	1	5.81E+02
MO3-N	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
NH3-N	6.00E+00	1	1.15E+07	6.30E+00	1	1.22E+07
NICKEL	6.00E-02	1	1.15E+05	2.50E-02	1	4.84E+04
NO2-N	2.00E-02	1	3.85E+04	4.10E-01	1	7.94E+05
NO3-N	2.00E+01	1	3.85E+07	2.40E+01	1	4.65E+07
pH	6.7	1		7.1	1	
PHOSPHATE	1.60E+00	1	3.08E+06	3.10E-01	1	6.01E+05
POTASSIUM	5.00E+00	1	9.62E+06	8.00E+00	1	1.55E+07
SELENIUM	2.00E-03	1	3.85E+03	2.00E-03	1	3.88E+03
SILVER	8.00E-03	1	1.54E+04	3.00E-03	1	5.81E+03

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
December, 1994

Item	TREATED (1924995 liters) Concentration	Num	Total(mg)	FINAL (1937798 liters) Concentration	Num	Total(mg)
SO4	2.50E+01	1	4.81E+07	7.10E+01	1	1.38E+08
SODIUM	3.60E+01	1	6.93E+07	1.24E+02	1	2.40E+08
TDS	1.64E+02	1	3.16E+08	6.30E+02	1	1.22E+09
TOTALCATIONS	4.75E+00	1		1.28E+01	1	
TOTALCHROMIUM	6.00E-02	1	1.15E+05	1.00E-02	1	1.94E+04
TOTALHARDNESS	2.00E+01	1	3.85E+07	1.26E+02	1	2.43E+08
TSS	1.00E+00	1	1.92E+06	0.00E+00	0	
VANADIUM	5.50E-02	1	1.06E+05	8.20E-02	1	1.59E+05
ZINC	8.50E-02	1	1.64E+05	6.00E-02	1	1.16E+05

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TA-50 WM-1

ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)

****

From January, 1994 to December, 1994

27-Jun-1995 01:47 PM

Item	INF TREATED (21291787 liters) Average	Maximum	Minimum	Num	Total(mg)	EFF FINAL (20841691 liters) Average	Maximum	Minimum	Num	Total(mg)
ALKALINITY-MO	1.08E+01	2.40E+01	5.00E+00	12	2.31E+08	4.22E+02	5.30E+02	3.32E+02	12	8.81E+09
ALKALINITY-P	4.50E+00	5.00E+00	2.00E+00	12	9.58E+07	7.00E+00	3.30E+01	1.00E+00	12	1.46E+08
ALUMINUM	7.33E-01	2.63E+00	1.53E-01	7	1.56E+07	1.41E-01	3.00E-01	2.50E-02	6	2.95E+06
ANTIMONY	1.50E-03	2.00E-03	1.00E-03	2	3.19E+04	2.00E-03	2.00E-03	2.00E-03	2	4.17E+04
ARSENIC	2.09E-03	3.00E-03	2.00E-03	11	4.45E+04	2.09E-03	3.00E-03	2.00E-03	11	4.36E+04
BARIUM	4.30E-02	6.80E-02	3.50E-02	12	9.16E+05	1.28E-02	1.80E-02	9.00E-03	11	2.67E+05
BERYLIUM	3.12E-02	2.10E-01	1.00E-03	12	6.65E+05	9.00E-03	3.00E-02	1.00E-03	11	1.88E+05
BORON	0.00E+00			0		0.00E+00			0	
CADMIUM	5.92E-03	1.20E-02	2.00E-03	12	1.26E+05	3.45E-03	1.00E-02	1.00E-03	11	7.20E+04
CALCIUM	1.73E+01	3.10E+01	4.00E+00	12	3.69E+08	1.23E+02	1.68E+02	8.20E+01	12	2.56E+09
CHLORIDE	2.66E+01	3.70E+01	3.00E+00	12	5.66E+08	3.28E+01	4.80E+01	3.00E+00	12	6.84E+08
COD	8.22E+01	1.38E+02	3.80E+01	12	1.75E+09	2.75E+01	4.20E+01	1.50E+01	12	5.73E+08
CONDUCTIVITY	9.62E+02	6.90E+03	3.00E+02	12		1.20E+03	1.79E+03	9.00E+02	12	
COPPER	5.39E-01	1.80E+00	1.51E-01	12	1.15E+07	1.33E-01	1.96E-01	9.20E-02	11	2.77E+06
CYANIDE	4.58E-02	1.30E-01	2.00E-02	12	9.76E+05	5.25E-02	1.20E-01	2.00E-02	12	1.09E+06
FLUORIDE	9.18E-01	2.02E+00	4.30E-01	12	1.96E+07	1.91E+00	3.29E+00	1.07E+00	12	3.99E+07
IRON	7.10E-01	1.70E+00	3.20E-01	12	1.51E+07	1.74E-01	5.50E-01	4.00E-02	12	3.62E+06
LEAD	8.04E-02	1.47E-01	5.70E-02	12	1.71E+06	6.00E-03	2.40E-02	2.00E-03	11	1.25E+05
MAGNESIUM	3.48E+00	1.60E+01	5.00E-01	12	7.42E+07	5.00E-01	5.00E-01	5.00E-01	12	1.04E+07
MANGANESE	0.00E+00			0		0.00E+00			0	
MERCURY	6.22E-03	1.20E-02	3.00E-03	12	1.33E+05	2.17E-04	3.00E-04	1.00E-04	12	4.52E+03
MO3-N	0.00E+00			0		0.00E+00			0	
NO2-N	0.00E+00			0		0.00E+00			0	
NO3-N	0.00E+00			0		0.00E+00			0	
NH3-N	4.52E+00	7.30E+00	1.50E-01	12	9.63E+07	5.50E+00	9.20E+00	2.20E+00	12	1.15E+08
NICKEL	2.73E-01	1.12E+00	5.20E-02	12	5.82E+06	4.77E-02	8.50E-02	2.50E-02	11	9.95E+05
NO2-N	4.52E-02	1.10E-01	2.00E-02	12	9.62E+05	1.18E+00	4.70E+00	2.00E-02	12	2.45E+07
NO3-N	4.95E+01	2.71E+02	1.51E+01	12	1.05E+09	4.55E+01	8.70E+01	2.40E+01	12	9.47E+08
pH	5.0	6.9	2.0	12		7.1	7.4	6.7	12	
PHOSPHATE	1.82E+00	2.70E+00	6.50E-01	12	3.89E+07	3.34E-01	5.00E-01	1.50E-01	12	6.96E+06
POTASSIUM	5.75E+00	1.00E+01	2.00E+00	12	1.22E+08	1.12E+01	5.20E+01	5.00E+00	12	2.34E+08
SELENIUM	2.00E-03	2.00E-03	2.00E-03	11	4.26E+04	2.09E-03	3.00E-03	2.00E-03	11	4.36E+04
SILVER	1.46E-02	4.20E-02	2.00E-03	12	3.11E+05	2.45E-03	1.00E-02	1.00E-03	11	5.12E+04

TA-50 WM-1
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
From January, 1994 to December, 1994

Item	INF TREATED (21291787 liters) Average	Maximum	Minimum	Num	Total(mg)	EFF FINAL (20841691 liters) Average	Maximum	Minimum	Num	Total(mg)
SO4	2.46E+01	4.10E+01	3.00E+00	12	5.23E+08	4.66E+01	7.10E+01	4.00E+00	12	9.71E+08
SODIUM	4.28E+01	7.80E+01	2.90E+01	12	9.10E+08	1.48E+02	3.40E+02	8.70E+01	12	3.08E+09
TDS	9.09E+02	7.34E+03	1.64E+02	12	1.94E+10	8.42E+02	1.42E+03	6.30E+02	12	1.75E+10
TOTALCATIONS	5.03E+00	2.22E+01	2.18E+00	12		1.35E+01	2.03E+01	1.04E+01	12	
TOTALCHROMIUM	5.08E-02	7.70E-02	2.70E-02	12	1.08E+06	1.15E-02	3.00E-02	4.00E-03	11	2.39E+05
TOTALHARDNESS	2.08E+01	3.20E+01	1.55E+01	12	4.43E+08	1.24E+02	1.68E+02	8.25E+01	12	2.57E+09
TSS	4.91E+00	9.00E+00	1.00E+00	11	1.05E+08	0.00E+00			0	
VANADIUM	6.54E-02	1.17E-01	3.40E-02	7	1.39E+06	6.15E-02	9.00E-02	2.00E-02	6	1.28E+06
ZINC	1.45E-01	2.40E-01	8.50E-02	12	3.10E+06	6.85E-02	1.09E-01	2.80E-02	11	1.43E+06

TA-50

WASTE TRANSFERRED TO TA-50

****

CALENDAR YEAR, 1994

	FROM OMEGA (Liters)	FROM TA-21-DP-257 (Liters)
JAN		
FEB		
MAR	136,674	
APR	68,242	
MAY	69,381	
JUN	66,200	
JUL	122,474	
AUG	142,657	
SEP		51,396
OCT	16,289	
NOV	35,237	
DEC	45,827	
TOTAL	702,981	51,396
AVERAGE	58,582	

TA-21 DP-257
FLOW SUMMARY
****
From January, 1994 to December, 1994

	Influent	Treated	Run Time	Trmt Rate	Filt Run	Filt Rate	Transfer	Misc	Recirc
January, 1994									
Total	67650	69650	3.92		2.92		6332	0	0
Maximum	16000								
Minimum	1000								
Average	2182			296.13		96.96	422		
February, 1994									
Total	69000	0	0.00		0.00		0	0	0
Maximum	11000								
Minimum	1000								
Average	2464			0.00		0.00			
March, 1994									
Total	48857	130857	5.82		4.80		135078	0	0
Maximum	9000	67539	3.25	471.89	2.92	171.60	69650		
Minimum	-1461	23217	0.82	346.35	0.55	94.02	25327		
Average	1576	32714	1.46	300.04		97.05	2412		
April, 1994									
Total	90163	63318	2.60		2.23		59097	5155	0
Maximum	16000								
Minimum	2000								
Average	3005	12664	0.52	81.18		23.08	767		
May, 1994									
Total	40429	65429	3.00		3.00		73871	0	0
Maximum	6000								
Minimum	429								
Average	1304	10905	0.50	60.58		14.78	786		

TA-21 DP-257
FLOW SUMMARY
****
From January, 1994 to December, 1994

	Influent	Treated	Run Time	Trmt Rate	Filt Run	Filt Rate	Transfer	Misc	Recirc
June, 1994									
Total	53871	73871	3.03		3.53		65429	0	0
Maximum	11000								
Minimum	-4000								
Average	1796	10553	0.43	58.05		12.15	564		
July, 1994									
Total	147526	124526	5.17		4.45		128746	17000	0
Maximum	30000	65429	2.67	436.19	2.28	122.57	67539	9000	
Minimum	-14000	59097	2.50	368.90	2.17	105.36	61207	8000	
Average	4759	13836	0.57	89.45		25.33	933	5667	
August, 1994									
Total	63871	73871	3.67		2.45		146686	0	0
Maximum	17000						74926		
Minimum	1000						71760		
Average	2060	7387	0.37	33.55		12.26	940		
September, 1994									
Total	32433	46433	2.30		1.78		0	0	0
Maximum	6000								
Minimum	-3567								
Average	1081	4221	0.21	30.59		9.64			
October, 1994									
Total	41000	0	0.00		0.00		13719	0	0
Maximum	7000								
Minimum	1000								
Average	1323			0.00		0.00	72		

TA-21 DP-257
FLOW SUMMARY
****
From January, 1994 to December, 1994

	Influent	Treated	Run Time	Trmt Rate	Filt Run	Filt Rate	Transfer	Misc	Recirc
				November, 1994					
Total	38207	61207	2.27		2.18		33770	0	0
Maximum	9000								
Minimum	1000								
Average	1274	5101	0.19	37.45		9.51	165		
				December, 1994					
Total	22000	0	0.00		0.00		44323	0	0
Maximum	3000								
Minimum	1000								
Average	710			0.00		0.00	201		
				From January, 1994 to December, 1994					
Total	715007	709162	31.78	0.00	27.34	0.00	707051	22155	0
Maximum	147526	130857					146686	17000	
Minimum	22000	46433					6332	5155	
Average	59584	59097	0.00	371.91	0.00	105.44	58921	1846	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
January, 1994

26-Jun-1995 11:03 AM

Item	TREATED (69650 liters) Concentration	Num	Total(Ci)	FINAL (6332 liters) Concentration	Num	Total(Ci)
ALPHA	4.30E-08	1	2.99E-03	0.00E+00	0	
BETA	7.70E-09	1	5.36E-04	0.00E+00	0	
GAMMA	1.10E-08	1	7.66E-04	0.00E+00	0	
TRITIUM	1.50E-06	1	1.04E-01	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	2.90E-08	1	2.02E-03	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	2.79E-05	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	4.30E-09	1	2.99E-04	0.00E+00	0	
Pu-239	8.00E-09	1	5.57E-04	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
January, 1994

Item	TREATED (69650 liters) Concentration	Num	Total(Ci)	FINAL (6332 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	3.00E-11	1	2.09E-06	0.00E+00	0	
Sr-90	2.10E-10	1	1.46E-05	0.00E+00	0	
Tl	1.00E-03	1	6.97E+01	0.00E+00	0	
TOTALPLUTONIUM	1.23E-08	1	8.57E-04	0.00E+00	0	
U	1.42E-01	1	9.89E+03	0.00E+00	0	
U-234	3.00E-10	1	2.09E-05	0.00E+00	0	
U-235	4.00E-11	1	2.79E-06	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			2.90E-03			0.00E+00

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
February, 1994

26-Jun-1995 11:03 AM

Item	TREATED (liters) Concentration	Num	Total(Ci)	FINAL (0 liters) Concentration	Num	Total(Ci)
ALPHA	0.00E+00	0		0.00E+00	0	
BETA	0.00E+00	0		0.00E+00	0	
GAMMA	0.00E+00	0		0.00E+00	0	
TRITIUM	0.00E+00	0		0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	0.00E+00	0		0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	0.00E+00	0		0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	0.00E+00	0		0.00E+00	0	
Pu-239	0.00E+00	0		0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
February, 1994

Item	TREATED (liters) Concentration	Num	Total(Ci)	FINAL (0 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	0.00E+00	0		0.00E+00	0	
Sr-90	0.00E+00	0		0.00E+00	0	
Tl	0.00E+00	0		0.00E+00	0	
TOTALPLUTONIUM	0.00E+00	0		0.00E+00	0	
U	0.00E+00	0		0.00E+00	0	
U-234	0.00E+00	0		0.00E+00	0	
U-235	0.00E+00	0		0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			0.00E+00			0.00E+00

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
March, 1994

26-Jun-1995 11:03 AM

Item	TREATED (130857 liters) Concentration	Num	Total(Ci)	FINAL (135078 liters) Concentration	Num	Total(Ci)
ALPHA	1.50E-08	1	1.96E-03	0.00E+00	0	
BETA	4.70E-09	1	6.15E-04	0.00E+00	0	
GAMMA	1.10E-08	1	1.44E-03	0.00E+00	0	
TRITIUM	1.65E-06	1	2.16E-01	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.10E-08	1	1.44E-03	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	5.23E-05	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	9.00E-10	1	1.18E-04	0.00E+00	0	
Pu-239	1.70E-09	1	2.22E-04	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
March, 1994

Item	TREATED (130857 liters) Concentration	Num	Total(Ci)	FINAL (135078 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	2.00E-11	1	2.62E-06	0.00E+00	0	
Sr-90	1.20E-10	1	1.57E-05	0.00E+00	0	
Tl	2.00E-03	1	2.62E+02	0.00E+00	0	
TOTALPLUTONIUM	2.60E-09	1	3.40E-04	0.00E+00	0	
U	2.22E-01	1	2.91E+04	0.00E+00	0	
U-234	7.00E-11	1	9.16E-06	0.00E+00	0	
U-235	2.00E-11	1	2.62E-06	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.79E-03			0.00E+00

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
April, 1994

Item	TREATED (63318 liters) Concentration	Num	Total(Ci)	FINAL (59097 liters) Concentration	Num	Total(Ci)
ALPHA	5.80E-09	1	3.67E-04	0.00E+00	0	
BETA	4.70E-09	1	2.98E-04	0.00E+00	0	
GAMMA	1.20E-08	1	7.60E-04	0.00E+00	0	
TRITIUM	1.63E-06	1	1.03E-01	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	3.70E-09	1	2.34E-04	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	2.53E-05	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	4.30E-10	1	2.72E-05	0.00E+00	0	
Pu-239	1.80E-09	1	1.14E-04	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
April, 1994

Item	TREATED (63318 liters) Concentration	Num	Total(Ci)	FINAL (59097 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	4.00E-11	1	2.53E-06	0.00E+00	0	
Sr-90	8.00E-11	1	5.07E-06	0.00E+00	0	
Tl	2.00E-03	1	1.27E+02	0.00E+00	0	
TOTALPLUTONIUM	2.23E-09	1	1.41E-04	0.00E+00	0	
U	1.61E-01	1	1.02E+04	0.00E+00	0	
U-234	2.90E-10	1	1.84E-05	0.00E+00	0	
U-235	8.00E-12	1	5.07E-07	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			3.94E-04			0.00E+00

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
May, 1994

Item	TREATED (65429 liters) Concentration	Num	Total(Ci)	FINAL (73871 liters) Concentration	Num	Total(Ci)
ALPHA	1.50E-08	1	9.81E-04	0.00E+00	0	
BETA	3.10E-09	1	2.03E-04	0.00E+00	0	
GAMMA	1.20E-08	1	7.85E-04	0.00E+00	0	
TRITIUM	7.30E-07	1	4.78E-02	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	2.50E-09	1	1.64E-04	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	1.50E-02	1	9.81E+02	0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	2.62E-05	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	3.90E-10	1	2.55E-05	0.00E+00	0	
Pu-239	1.50E-09	1	9.81E-05	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
May, 1994

Item	TREATED (65429 liters) Concentration	Num	Total(Ci)	FINAL (73871 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	2.00E-11	1	1.31E-06	0.00E+00	0	
Sr-90	8.00E-11	1	5.23E-06	0.00E+00	0	
Tl	1.00E-02	1	6.54E+02	0.00E+00	0	
TOTALPLUTONIUM	1.89E-09	1	1.24E-04	0.00E+00	0	
U	1.15E-01	1	7.52E+03	0.00E+00	0	
U-234	1.10E-08	1	7.20E-04	0.00E+00	0	
U-235	3.90E-10	1	2.55E-05	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.03E-03			0.00E+00

TA-21 DP-257

ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)

****

June, 1994

26-Jun-1995 11:03 AM

Item	TREATED (73871 liters) Concentration	Num	Total(Ci)	FINAL (65429 liters) Concentration	Num	Total(Ci)
ALPHA	1.50E-08	1	1.11E-03	0.00E+00	0	
BETA	3.10E-09	1	2.29E-04	0.00E+00	0	
GAMMA	1.20E-08	1	8.86E-04	0.00E+00	0	
TRITIUM	7.30E-07	1	5.39E-02	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	2.50E-09	1	1.85E-04	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	1.50E-02	1	1.11E+03	0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	2.95E-05	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	3.90E-10	1	2.88E-05	0.00E+00	0	
Pu-239	1.50E-09	1	1.11E-04	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
June, 1994

Item	TREATED (73871 liters) Concentration	Num	Total(Ci)	FINAL (65429 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	2.00E-11	1	1.48E-06	0.00E+00	0	
Sr-90	8.00E-11	1	5.91E-06	0.00E+00	0	
Tl	1.00E-02	1	7.39E+02	0.00E+00	0	
TOTALPLUTONIUM	1.89E-09	1	1.40E-04	0.00E+00	0	
U	1.15E-01	1	8.50E+03	0.00E+00	0	
U-234	1.10E-08	1	8.13E-04	0.00E+00	0	
U-235	3.90E-10	1	2.88E-05	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.17E-03			0.00E+00

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
July, 1994

26-Jun-1995 11:03 AM

Item	TREATED (124525 liters) Concentration	Num	Total(Ci)	FINAL (128747 liters) Concentration	Num	Total(Ci)
ALPHA	2.00E-08	1	2.49E-03	0.00E+00	0	
BETA	6.70E-09	1	8.34E-04	0.00E+00	0	
GAMMA	1.20E-08	1	1.49E-03	0.00E+00	0	
TRITIUM	2.90E-07	1	3.61E-02	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.30E-08	1	1.62E-03	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	1.70E-02	1	2.12E+03	0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	4.00E-10	1	4.98E-05	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	1.50E-09	1	1.87E-04	0.00E+00	0	
Pu-239	3.30E-09	1	4.11E-04	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
July, 1994

Item	TREATED (124525 liters) Concentration	Num	Total(Ci)	FINAL (128747 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	2.00E-11	1	2.49E-06	0.00E+00	0	
Sr-90	1.10E-10	1	1.37E-05	0.00E+00	0	
Tl	5.00E-03	1	6.23E+02	0.00E+00	0	
TOTALPLUTONIUM	4.80E-09	1	5.98E-04	0.00E+00	0	
U	1.05E-01	1	1.31E+04	0.00E+00	0	
U-234	3.00E-09	1	3.74E-04	0.00E+00	0	
U-235	1.00E-10	1	1.25E-05	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			2.60E-03			0.00E+00

TA-21 DP-257

ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)

****

August, 1994

26-Jun-1995 11:03 AM

Item	TREATED (73871 liters) Concentration	Num	Total(Ci)	FINAL (146687 liters) Concentration	Num	Total(Ci)
ALPHA	1.50E-08	1	1.11E-03	0.00E+00	0	
BETA	1.00E-08	1	7.39E-04	0.00E+00	0	
GAMMA	1.20E-08	1	8.86E-04	0.00E+00	0	
TRITIUM	1.66E-07	1	1.23E-02	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	1.20E-08	1	8.86E-04	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	8.00E-03	1	5.91E+02	0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	3.00E-10	1	2.22E-05	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	9.00E-10	1	6.65E-05	0.00E+00	0	
Pu-239	1.30E-09	1	9.60E-05	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
August, 1994

Item	TREATED (73871 liters) Concentration	Num	Total(Ci)	FINAL (146687 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	2.00E-11	1	1.48E-06	0.00E+00	0	
Sr-90	9.00E-11	1	6.65E-06	0.00E+00	0	
Tl	5.00E-02	1	3.69E+03	0.00E+00	0	
TOTALPLUTONIUM	2.20E-09	1	1.63E-04	0.00E+00	0	
U	4.40E-02	1	3.25E+03	0.00E+00	0	
U-234	8.00E-10	1	5.91E-05	0.00E+00	0	
U-235	7.00E-11	1	5.17E-06	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			1.11E-03			0.00E+00

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
September, 1994

26-Jun-1995 11:03 AM

Item	TREATED (46433 liters) Concentration	Num	Total(Ci)	FINAL (0 liters) Concentration	Num	Total(Ci)
ALPHA	1.10E-08	1	5.11E-04	0.00E+00	0	
BETA	8.10E-09	1	3.76E-04	0.00E+00	0	
GAMMA	2.10E-08	1	9.75E-04	0.00E+00	0	
TRITIUM	9.20E-08	1	4.27E-03	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	7.20E-09	1	3.34E-04	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	7.00E-03	1	3.25E+02	0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	2.00E-10	1	9.29E-06	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	6.00E-10	1	2.79E-05	0.00E+00	0	
Pu-239	9.00E-10	1	4.18E-05	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
September, 1994

Item	TREATED (46433 liters) Concentration	Num	Total(Ci)	FINAL (0 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	2.00E-11	1	9.29E-07	0.00E+00	0	
Sr-90	8.00E-11	1	3.71E-06	0.00E+00	0	
Tl	5.00E-03	1	2.32E+02	0.00E+00	0	
TOTALPLUTONIUM	1.50E-09	1	6.96E-05	0.00E+00	0	
U	1.90E-01	1	8.82E+03	0.00E+00	0	
U-234	7.00E-10	1	3.25E-05	0.00E+00	0	
U-235	6.00E-11	1	2.79E-06	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			4.39E-04			0.00E+00

TA-21 DP-257

ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)

****

October, 1994

26-Jun-1995 11:03 AM

Item	TREATED (liters) Concentration	Num	Total(Ci)	FINAL (13719 liters) Concentration	Num	Total(Ci)
ALPHA	0.00E+00	0		0.00E+00	0	
BETA	0.00E+00	0		0.00E+00	0	
GAMMA	0.00E+00	0		0.00E+00	0	
TRITIUM	0.00E+00	0		0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	0.00E+00	0		0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	0.00E+00	0		0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	0.00E+00	0		0.00E+00	0	
Pu-239	0.00E+00	0		0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257

ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)

****

October, 1994

	TREATED (liters)			FINAL (13719 liters)		
Item	Concentration	Num	Total(Ci)	Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	0.00E+00	0		0.00E+00	0	
Sr-90	0.00E+00	0		0.00E+00	0	
Tl	0.00E+00	0		0.00E+00	0	
TOTALPLUTONIUM	0.00E+00	0		0.00E+00	0	
U	0.00E+00	0		0.00E+00	0	
U-234	0.00E+00	0		0.00E+00	0	
U-235	0.00E+00	0		0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			0.00E+00			0.00E+00

TA-21 DP-257,
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
November, 1994

26-Jun-1995 11:03 AM

Item	TREATED (61207 liters) Concentration	Num	Total(Ci)	FINAL (33770 liters) Concentration	Num	Total(Ci)
ALPHA	3.50E-09	1	2.14E-04	0.00E+00	0	
BETA	1.20E-08	1	7.34E-04	0.00E+00	0	
GAMMA	1.20E-08	1	7.34E-04	0.00E+00	0	
TRITIUM	8.30E-08	1	5.08E-03	0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	5.90E-09	1	3.61E-04	0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	5.00E-03	1	3.06E+02	0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	2.00E-10	1	1.22E-05	0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	3.50E-01	1	2.14E+04	0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	4.10E-09	1	2.51E-04	0.00E+00	0	
Pu-239	6.00E-10	1	3.67E-05	0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
November, 1994

Item	TREATED (61207 liters) Concentration	Num	Total(Ci)	FINAL (33770 liters) Concentration	Num	Total(Ci)
Sc-46	0.00E+00	0		0.00E+00	0	
Sc-48	0.00E+00	0		0.00E+00	0	
Se-75	0.00E+00	0		0.00E+00	0	
Sn-113	0.00E+00	0		0.00E+00	0	
Sr-82	0.00E+00	0		0.00E+00	0	
Sr-85	0.00E+00	0		0.00E+00	0	
Sr-89	2.00E-11	1	1.22E-06	0.00E+00	0	
Sr-90	5.00E-11	1	3.06E-06	0.00E+00	0	
Tl	1.00E-03	1	6.12E+01	0.00E+00	0	
TOTALPLUTONIUM	4.70E-09	1	2.88E-04	0.00E+00	0	
U	1.30E-01	1	7.96E+03	0.00E+00	0	
U-234	2.50E-10	1	1.53E-05	0.00E+00	0	
U-235	3.00E-11	1	1.84E-06	0.00E+00	0	
V-48	0.00E+00	0		0.00E+00	0	
Xe-133	0.00E+00	0		0.00E+00	0	
Y-88	0.00E+00	0		0.00E+00	0	
Zn-65	0.00E+00	0		0.00E+00	0	
Zr-85	0.00E+00	0		0.00E+00	0	
Zr-88	0.00E+00	0		0.00E+00	0	
Zr-95	0.00E+00	0		0.00E+00	0	
TOTAL ALPHA			6.66E-04			0.00E+00

TA-21 DP-257

ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)

****

December, 1994

26-Jun-1995 11:03 AM

Item	TREATED (liters) Concentration	Num	Total(Ci)	FINAL (44323 liters) Concentration	Num	Total(Ci)
ALPHA	0.00E+00	0		0.00E+00	0	
BETA	0.00E+00	0		0.00E+00	0	
GAMMA	0.00E+00	0		0.00E+00	0	
TRITIUM	0.00E+00	0		0.00E+00	0	
Am	0.00E+00	0		0.00E+00	0	
Am-241	0.00E+00	0		0.00E+00	0	
As-74	0.00E+00	0		0.00E+00	0	
Ba-140	0.00E+00	0		0.00E+00	0	
Be-7	0.00E+00	0		0.00E+00	0	
Ce-141	0.00E+00	0		0.00E+00	0	
Co	0.00E+00	0		0.00E+00	0	
Co-56	0.00E+00	0		0.00E+00	0	
Co-57	0.00E+00	0		0.00E+00	0	
Co-58	0.00E+00	0		0.00E+00	0	
Co-60	0.00E+00	0		0.00E+00	0	
Cr-51	0.00E+00	0		0.00E+00	0	
Cs-134	0.00E+00	0		0.00E+00	0	
Cs-137	0.00E+00	0		0.00E+00	0	
Eu-152	0.00E+00	0		0.00E+00	0	
Fe-59	0.00E+00	0		0.00E+00	0	
I-133	0.00E+00	0		0.00E+00	0	
Mn-52	0.00E+00	0		0.00E+00	0	
Mn-54	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
Na-22	0.00E+00	0		0.00E+00	0	
Nb-95	0.00E+00	0		0.00E+00	0	
Pu-238	0.00E+00	0		0.00E+00	0	
Pu-239	0.00E+00	0		0.00E+00	0	
Rb-83	0.00E+00	0		0.00E+00	0	
Rb-84	0.00E+00	0		0.00E+00	0	
Rb-85	0.00E+00	0		0.00E+00	0	
Sb-124	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
December, 1994

em	TREATED (liters) Concentration	Num	Total(Ci)	FINAL (44323 liters) Concentration	Num	Total(Ci)
-46	0.00E+00	0		0.00E+00	0	
-48	0.00E+00	0		0.00E+00	0	
-75	0.00E+00	0		0.00E+00	0	
-113	0.00E+00	0		0.00E+00	0	
-82	0.00E+00	0		0.00E+00	0	
-85	0.00E+00	0		0.00E+00	0	
-89	0.00E+00	0		0.00E+00	0	
-90	0.00E+00	0		0.00E+00	0	
	0.00E+00	0		0.00E+00	0	
TALPLUTONIUM	0.00E+00	0		0.00E+00	0	
	0.00E+00	0		0.00E+00	0	
234	0.00E+00	0		0.00E+00	0	
235	0.00E+00	0		0.00E+00	0	
48	0.00E+00	0		0.00E+00	0	
-133	0.00E+00	0		0.00E+00	0	
38	0.00E+00	0		0.00E+00	0	
-65	0.00E+00	0		0.00E+00	0	
-85	0.00E+00	0		0.00E+00	0	
-88	0.00E+00	0		0.00E+00	0	
-95	0.00E+00	0		0.00E+00	0	
TAL ALPHA			0.00E+00			0.00E+00

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
From January, 1994 to December, 1994

tem	TREATED (709162 liters) Average	Maximum	Minimum	Num	Total(Ci)	FINAL (707051 liters) Average	Maximum	Minimum	Num	Total(Ci)
PHA	1.59E-08	4.30E-08	0.00E+00	9	1.13E-02	0.00E+00			0	
TA	6.68E-09	4.30E-08	0.00E+00	9	4.74E-03	0.00E+00			0	
MMA	1.28E-08	4.30E-08	0.00E+00	9	9.06E-03	0.00E+00			0	
ITIUM	7.63E-07	1.65E-06	0.00E+00	9	5.41E-01	0.00E+00			0	
	0.00E+00			0		0.00E+00			0	
-241	9.64E-09	2.90E-08	2.50E-09	9	6.84E-03	0.00E+00			0	
-74	0.00E+00			0		0.00E+00			0	
-140	0.00E+00			0		0.00E+00			0	
-7	0.00E+00			0		0.00E+00			0	
-141	0.00E+00			0		0.00E+00			0	
	1.12E-02	1.70E-02	5.00E-03	6	7.92E+03	0.00E+00			0	
-56	0.00E+00			0		0.00E+00			0	
-57	0.00E+00			0		0.00E+00			0	
-58	0.00E+00			0		0.00E+00			0	
-60	0.00E+00			0		0.00E+00			0	
-51	0.00E+00			0		0.00E+00			0	
-134	0.00E+00			0		0.00E+00			0	
-137	3.44E-10	4.00E-10	2.00E-10	9	2.44E-04	0.00E+00			0	
-152	0.00E+00			0		0.00E+00			0	
-59	0.00E+00			0		0.00E+00			0	
133	0.00E+00			0		0.00E+00			0	
-52	0.00E+00			0		0.00E+00			0	
-54	0.00E+00			0		0.00E+00			0	
2-N	0.00E+00			0		0.00E+00			0	
3-N	3.50E-01	3.50E-01	3.50E-01	1	2.48E+05	0.00E+00			0	
-22	0.00E+00			0		0.00E+00			0	
-95	0.00E+00			0		0.00E+00			0	
-238	1.50E-09	4.30E-09	3.90E-10	9	1.06E-03	0.00E+00			0	
-239	2.29E-09	8.00E-09	6.00E-10	9	1.62E-03	0.00E+00			0	
-83	0.00E+00			0		0.00E+00			0	
-84	0.00E+00			0		0.00E+00			0	
-85	0.00E+00			0		0.00E+00			0	
-124	0.00E+00			0		0.00E+00			0	

TA-21 DP-257
ANALYSES OF COMPOSITE RADIOLOGICAL SAMPLES (Ci/L)
****
From January, 1994 to December, 1994

	TREATED (709162 liters)					FINAL (707051 liters)				
:em	Average	Maximum	Minimum	Num	Total(Ci)	Average	Maximum	Minimum	Num	Total(Ci)
-46	0.00E+00			0		0.00E+00			0	
-48	0.00E+00			0		0.00E+00			0	
-75	0.00E+00			0		0.00E+00			0	
-113	0.00E+00			0		0.00E+00			0	
-82	0.00E+00			0		0.00E+00			0	
-85	0.00E+00			0		0.00E+00			0	
-89	2.33E-11	4.00E-11	2.00E-11	9	1.65E-05	0.00E+00			0	
-90	1.00E-10	2.10E-10	5.00E-11	9	7.09E-05	0.00E+00			0	
	9.56E-03	5.00E-02	1.00E-03	9	6.78E+03	0.00E+00			0	
TALPLUTONIUM	3.79E-09	1.23E-08	1.50E-09	9	2.69E-03	0.00E+00			0	
	1.36E-01	2.22E-01	4.40E-02	9	9.64E+04	0.00E+00			0	
234	3.05E-09	1.10E-08	7.00E-11	9	2.16E-03	0.00E+00			0	
235	1.23E-10	3.90E-10	8.00E-12	9	8.73E-05	0.00E+00			0	
48	0.00E+00			0		0.00E+00			0	
-133	0.00E+00			0		0.00E+00			0	
38	0.00E+00			0		0.00E+00			0	
-65	0.00E+00			0		0.00E+00			0	
-85	0.00E+00			0		0.00E+00			0	
-88	0.00E+00			0		0.00E+00			0	
-95	0.00E+00			0		0.00E+00			0	
TAL ALPHA					1.18E-02					0.00E+00

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
January, 1994

Item	TREATED (69650 liters) Concentration	Num	Total(mg)	FINAL (6332 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	2.17E+02	1	1.51E+07	0.00E+00	0	
ALKALINITY-P	5.00E+00	1	3.48E+05	0.00E+00	0	
ALUMINUM	0.00E+00	0		0.00E+00	0	
ANTIMONY	1.20E-02	1	8.36E+02	0.00E+00	0	
ARSENIC	2.20E-02	1	1.53E+03	0.00E+00	0	
BARIUM	1.50E-01	1	1.04E+04	0.00E+00	0	
BERYLIUM	1.00E-02	1	6.96E+02	0.00E+00	0	
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	2.90E-02	1	2.02E+03	0.00E+00	0	
CALCIUM	1.30E+01	1	9.05E+05	0.00E+00	0	
CHLORIDE	6.10E+01	1	4.25E+06	0.00E+00	0	
COD	3.56E+02	1	2.48E+07	0.00E+00	0	
CONDUCTIVITY	8.00E+02	1		0.00E+00	0	
COPPER	3.30E-01	1	2.30E+04	0.00E+00	0	
CYANIDE	0.00E+00	0		0.00E+00	0	
FLUORIDE	8.72E+00	1	6.07E+05	0.00E+00	0	
IRON	3.20E+01	1	2.23E+06	0.00E+00	0	
LEAD	1.78E-01	1	1.24E+04	0.00E+00	0	
MAGNESIUM	5.00E+00	1	3.48E+05	0.00E+00	0	
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	7.00E-03	1	4.88E+02	0.00E+00	0	
MO3-N	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
NH3-N	9.30E+00	1	6.48E+05	0.00E+00	0	
NICKEL	2.71E-01	1	1.89E+04	0.00E+00	0	
NO2-N	2.70E-02	1	1.88E+03	0.00E+00	0	
NO3-N	2.30E+00	1	1.60E+05	0.00E+00	0	
pH	7.3	1		0.0	0	
PHOSPHATE	1.00E+01	1	6.96E+05	0.00E+00	0	
POTASSIUM	3.10E+01	1	2.16E+06	0.00E+00	0	
SELENIUM	4.00E-03	1	2.79E+02	0.00E+00	0	
SILVER	4.30E-02	1	2.99E+03	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
January, 1994

em	TREATED (69650 liters) Concentration	Num	Total(mg)	FINAL (6332 liters) Concentration	Num	Total(mg)
1	5.75E+01	1	4.00E+06	0.00E+00	0	
DIUM	6.80E+01	1	4.74E+06	0.00E+00	0	
3	4.84E+02	1	3.37E+07	0.00E+00	0	
TALCATIONS	7.73E+00	1		0.00E+00	0	
TALCHROMIUM	4.20E-02	1	2.93E+03	0.00E+00	0	
TALHARDNESS	1.80E+01	1	1.25E+06	0.00E+00	0	
S	2.68E+02	1	1.87E+07	0.00E+00	0	
NADIUM	0.00E+00	0		0.00E+00	0	
NC	1.01E+00	1	7.07E+04	0.00E+00	0	

TA-21 DP-257

ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)

****

February, 1994

26-Jun-1995 02:32 PM

Item	TREATED (liters) Concentration	Num	Total(mg)	FINAL (0 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	0.00E+00	0		0.00E+00	0	
ALKALINITY-P	0.00E+00	0		0.00E+00	0	
ALUMINUM	0.00E+00	0		0.00E+00	0	
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	0.00E+00	0		0.00E+00	0	
BARIUM	0.00E+00	0		0.00E+00	0	
BERYLIUM	0.00E+00	0		0.00E+00	0	
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	0.00E+00	0		0.00E+00	0	
CALCIUM	0.00E+00	0		0.00E+00	0	
CHLORIDE	0.00E+00	0		0.00E+00	0	
COD	0.00E+00	0		0.00E+00	0	
CONDUCTIVITY	0.00E+00	0		0.00E+00	0	
COPPER	0.00E+00	0		0.00E+00	0	
CYANIDE	0.00E+00	0		0.00E+00	0	
FLUORIDE	0.00E+00	0		0.00E+00	0	
IRON	0.00E+00	0		0.00E+00	0	
LEAD	0.00E+00	0		0.00E+00	0	
MAGNESIUM	0.00E+00	0		0.00E+00	0	
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	0.00E+00	0		0.00E+00	0	
MO3-N	0.00E+00	0		0.00E+00	0	
N02-N	0.00E+00	0		0.00E+00	0	
N03-N	0.00E+00	0		0.00E+00	0	
NH3-N	0.00E+00	0		0.00E+00	0	
NICKEL	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
pH	0.0	0		0.0	0	
PHOSPHATE	0.00E+00	0		0.00E+00	0	
POTASSIUM	0.00E+00	0		0.00E+00	0	
SELENIUM	0.00E+00	0		0.00E+00	0	
SILVER	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
February, 1994

em	TREATED (Concentration	liters) Num	Total(mg)	FINAL (Concentration	0 liters) Num	Total(mg)
4	0.00E+00	0		0.00E+00	0	
DIUM	0.00E+00	0		0.00E+00	0	
S	0.00E+00	0		0.00E+00	0	
TALCATIONS	0.00E+00	0		0.00E+00	0	
TALCHROMIUM	0.00E+00	0		0.00E+00	0	
TALHARDNESS	0.00E+00	0		0.00E+00	0	
S	0.00E+00	0		0.00E+00	0	
NADIUM	0.00E+00	0		0.00E+00	0	
NC	0.00E+00	0		0.00E+00	0	

TA-21 DP-257

ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)

****

March, 1994

-Jun-1995 02:32 PM

em	TREATED (130857 liters) Concentration	Num	Total(mg)	FINAL (135078 liters) Concentration	Num	Total(mg)
KALINITY-MO	1.55E+02	1	2.03E+07	0.00E+00	0	
KALINITY-P	5.00E+00	1	6.54E+05	0.00E+00	0	
UMINUM	0.00E+00	0		0.00E+00	0	
TIMONY	0.00E+00	0		0.00E+00	0	
SENIC	1.60E-02	1	2.09E+03	0.00E+00	0	
RIUM	1.10E-01	1	1.44E+04	0.00E+00	0	
RYLIUM	2.00E-03	1	2.62E+02	0.00E+00	0	
RON	0.00E+00	0		0.00E+00	0	
DMIUM	1.10E-02	1	1.44E+03	0.00E+00	0	
LCIUM	5.80E+01	1	7.59E+06	0.00E+00	0	
LORIDE	7.40E+01	1	9.68E+06	0.00E+00	0	
D	3.98E+02	1	5.21E+07	0.00E+00	0	
NDUCTIVITY	6.90E+02	1		0.00E+00	0	
PPER	2.07E-01	1	2.71E+04	0.00E+00	0	
ANIDE	0.00E+00	0		0.00E+00	0	
UORIDE	7.03E+00	1	9.20E+05	0.00E+00	0	
ON	1.07E+01	1	1.40E+06	0.00E+00	0	
AD	8.50E-02	1	1.11E+04	0.00E+00	0	
GNESIUM	5.00E+00	1	6.54E+05	0.00E+00	0	
NGANESE	0.00E+00	0		0.00E+00	0	
RCURY	9.20E-03	1	1.20E+03	0.00E+00	0	
03-N	0.00E+00	0		0.00E+00	0	
02-N	0.00E+00	0		0.00E+00	0	
03-N	0.00E+00	0		0.00E+00	0	
I3-N	5.00E+00	1	6.54E+05	0.00E+00	0	
CKEL	1.10E-01	1	1.44E+04	0.00E+00	0	
02-N	6.00E-02	1	7.85E+03	0.00E+00	0	
03-N	2.93E+00	1	3.83E+05	0.00E+00	0	
	7.7	1		0.0	0	
OSPHATE	1.60E+00	1	2.09E+05	0.00E+00	0	
TASSIUM	1.90E+01	1	2.49E+06	0.00E+00	0	
LENIUM	8.00E-03	1	1.05E+03	0.00E+00	0	
LVER	3.70E-02	1	4.84E+03	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
March, 1994

Item	TREATED (130857 liters) Concentration	Num	Total(mg)	FINAL (135078 liters) Concentration	Num	Total(mg)
SO4	5.10E+01	1	6.67E+06	0.00E+00	0	
SODIUM	5.50E+01	1	7.20E+06	0.00E+00	0	
TDS	5.30E+02	1	6.94E+07	0.00E+00	0	
TOTALCATIONS	6.81E+00	1		0.00E+00	0	
TOTALCHROMIUM	3.10E-02	1	4.06E+03	0.00E+00	0	
TOTALHARDNESS	6.30E+01	1	8.24E+06	0.00E+00	0	
TSS	2.60E+01	1	3.40E+06	0.00E+00	0	
VANADIUM	0.00E+00	0		0.00E+00	0	
ZINC	3.44E-01	1	4.50E+04	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
April, 1994

m	TREATED (63318 liters) Concentration	Num	Total(mg)	FINAL (59097 liters) Concentration	Num	Total(mg)
ALINITY-MO	1.65E+02	1	1.04E+07	0.00E+00	0	
ALINITY-P	5.00E+00	1	3.17E+05	0.00E+00	0	
MINUM	0.00E+00	0		0.00E+00	0	
IMONY	0.00E+00	0		0.00E+00	0	
ENIC	1.20E-02	1	7.60E+02	0.00E+00	0	
IUM	9.30E-02	1	5.89E+03	0.00E+00	0	
YLIUM	2.00E-03	1	1.27E+02	0.00E+00	0	
ON	0.00E+00	0		0.00E+00	0	
MIUM	1.82E-01	1	1.15E+04	0.00E+00	0	
CIUM	4.90E+01	1	3.10E+06	0.00E+00	0	
ORIDE	6.20E+01	1	3.93E+06	0.00E+00	0	
)	1.90E+02	1	1.20E+07	0.00E+00	0	
DUCTIVITY	6.80E+02	1		0.00E+00	0	
PER	1.60E-01	1	1.01E+04	0.00E+00	0	
NIDE	0.00E+00	0		0.00E+00	0	
ORIDE	5.37E+00	1	3.40E+05	0.00E+00	0	
)N	6.50E+00	1	4.12E+05	0.00E+00	0	
AD	8.40E-02	1	5.32E+03	0.00E+00	0	
GNESIUM	5.00E+00	1	3.17E+05	0.00E+00	0	
NGANESE	0.00E+00	0		0.00E+00	0	
RCURY	6.00E-03	1	3.80E+02	0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
2-N	0.00E+00	0		0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
3-N	4.02E+00	1	2.55E+05	0.00E+00	0	
CKEL	2.45E-01	1	1.55E+04	0.00E+00	0	
2-N	2.00E-02	1	1.27E+03	0.00E+00	0	
3-N	1.20E-01	1	7.60E+03	0.00E+00	0	
	7.2	1		0.0	0	
OSPHATE	4.20E+00	1	2.66E+05	0.00E+00	0	
TASSIUM	2.20E+01	1	1.39E+06	0.00E+00	0	
LENIUM	6.00E-03	1	3.80E+02	0.00E+00	0	
LVER	1.60E-02	1	1.01E+03	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
April, 1994

Item	TREATED (63318 liters) Concentration	Num	Total(mg)	FINAL (59097 liters) Concentration	Num	Total(mg)
SO4	3.80E+01	1	2.41E+06	0.00E+00	0	
SODIUM	5.80E+01	1	3.67E+06	0.00E+00	0	
TDS	4.28E+02	1	2.71E+07	0.00E+00	0	
TOTALCATIONS	6.20E+00	1		0.00E+00	0	
TOTALCHROMIUM	2.30E-02	1	1.46E+03	0.00E+00	0	
TOTALHARDNESS	5.40E+01	1	3.42E+06	0.00E+00	0	
TSS	2.40E+01	1	1.52E+06	0.00E+00	0	
VANADIUM	0.00E+00	0		0.00E+00	0	
ZINC	3.75E-01	1	2.37E+04	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
May, 1994

-Jun-1995 02:32 PM

em	TREATED (65429 liters) Concentration	Num	Total(mg)	FINAL (73871 liters) Concentration	Num	Total(mg)
KALINITY-MO	3.35E+02	1	2.19E+07	0.00E+00	0	
KALINITY-P	1.29E+02	1	8.44E+06	0.00E+00	0	
UMINUM	1.15E+00	1	7.52E+04	0.00E+00	0	
TIMONY	0.00E+00	0		0.00E+00	0	
SENIC	8.00E-03	1	5.23E+02	0.00E+00	0	
RIUM	1.37E-01	1	8.96E+03	0.00E+00	0	
RYLIUM	1.00E-02	1	6.54E+02	0.00E+00	0	
RON	0.00E+00	0		0.00E+00	0	
DMIUM	1.56E+00	1	1.02E+05	0.00E+00	0	
LCIUM	3.20E+01	1	2.09E+06	0.00E+00	0	
LORIDE	5.50E+01	1	3.60E+06	0.00E+00	0	
D	3.00E+03	1	1.96E+08	0.00E+00	0	
NDUCTIVITY	7.50E+02	1		0.00E+00	0	
PPER	2.50E-01	1	1.64E+04	0.00E+00	0	
ANIDE	0.00E+00	0		0.00E+00	0	
UORIDE	5.08E+00	1	3.32E+05	0.00E+00	0	
ON	7.70E+00	1	5.04E+05	0.00E+00	0	
AD	1.82E-01	1	1.19E+04	0.00E+00	0	
GNESIUM	4.00E+00	1	2.62E+05	0.00E+00	0	
NGANESE	0.00E+00	0		0.00E+00	0	
RCURY	5.50E-03	1	3.60E+02	0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
2-N	0.00E+00	0		0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
3-N	1.40E+01	1	9.16E+05	0.00E+00	0	
CKEL	1.36E+00	1	8.90E+04	0.00E+00	0	
2-N	2.00E-02	1	1.31E+03	0.00E+00	0	
3-N	3.60E-01	1	2.36E+04	0.00E+00	0	
	10.1	1		0.0	0	
OSPHATE	3.00E+00	1	1.96E+05	0.00E+00	0	
TASSIUM	1.50E+01	1	9.81E+05	0.00E+00	0	
LENIUM	6.00E-03	1	3.93E+02	0.00E+00	0	
LVER	1.50E-02	1	9.81E+02	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
May, 1994

Item	TREATED (65429 liters) Concentration	Num	Total(mg)	FINAL (73871 liters) Concentration	Num	Total(mg)
SO4	4.00E+01	1	2.62E+06	0.00E+00	0	
SODIUM	1.50E+02	1	9.81E+06	0.00E+00	0	
TDS	6.46E+02	1	4.23E+07	0.00E+00	0	
TOTALCATIONS	9.66E+00	1		0.00E+00	0	
TOTALCHROMIUM	5.80E-02	1	3.79E+03	0.00E+00	0	
TOTALHARDNESS	3.60E+01	1	2.36E+06	0.00E+00	0	
TSS	1.04E+02	1	6.80E+06	0.00E+00	0	
VANADIUM	4.80E-02	1	3.14E+03	0.00E+00	0	
ZINC	8.30E-01	1	5.43E+04	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
June, 1994

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em	TREATED (73871 liters) Concentration	Num	Total(mg)	FINAL (65429 liters) Concentration	Num	Total(mg)
KALINITY-MO	3.35E+02	1	2.47E+07	0.00E+00	0	
KALINITY-P	1.29E+02	1	9.53E+06	0.00E+00	0	
JMINUM	1.15E+00	1	8.50E+04	0.00E+00	0	
TIMONY	0.00E+00	0		0.00E+00	0	
SENIC	8.00E-03	1	5.91E+02	0.00E+00	0	
RIUM	1.37E-01	1	1.01E+04	0.00E+00	0	
RYLIUM	1.00E-02	1	7.39E+02	0.00E+00	0	
RON	0.00E+00	0		0.00E+00	0	
DMIUM	1.56E+00	1	1.15E+05	0.00E+00	0	
LCIUM	3.20E+01	1	2.36E+06	0.00E+00	0	
LORIDE	5.50E+01	1	4.06E+06	0.00E+00	0	
D	3.00E+03	1	2.22E+08	0.00E+00	0	
NDUCTIVITY	7.50E+02	1		0.00E+00	0	
PPER	2.50E-01	1	1.85E+04	0.00E+00	0	
ANIDE	0.00E+00	0		0.00E+00	0	
JORIDE	5.08E+00	1	3.75E+05	0.00E+00	0	
DN	7.70E+00	1	5.69E+05	0.00E+00	0	
AD	1.82E-01	1	1.34E+04	0.00E+00	0	
GNESIUM	4.00E+00	1	2.95E+05	0.00E+00	0	
NGANESE	0.00E+00	0		0.00E+00	0	
RCURY	5.50E-03	1	4.06E+02	0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
2-N	0.00E+00	0		0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
3-N	1.40E+01	1	1.03E+06	0.00E+00	0	
CKEL	1.36E+00	1	1.00E+05	0.00E+00	0	
2-N	2.00E-02	1	1.48E+03	0.00E+00	0	
3-N	3.60E-01	1	2.66E+04	0.00E+00	0	
	10.1	1		0.0	0	
OSPHATE	3.00E+00	1	2.22E+05	0.00E+00	0	
TASSIUM	1.50E+01	1	1.11E+06	0.00E+00	0	
LENIUM	6.00E-03	1	4.43E+02	0.00E+00	0	
LVER	1.50E-02	1	1.11E+03	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
June, 1994

Item	TREATED (73871 liters) Concentration	Num	Total(mg)	FINAL (65429 liters) Concentration	Num	Total(mg)
SO4	4.00E+01	1	2.95E+06	0.00E+00	0	
SODIUM	1.50E+02	1	1.11E+07	0.00E+00	0	
TDS	6.46E+02	1	4.77E+07	0.00E+00	0	
TOTALCATIONS	9.66E+00	1		0.00E+00	0	
TOTALCHROMIUM	5.80E-02	1	4.28E+03	0.00E+00	0	
TOTALHARDNESS	3.60E+01	1	2.66E+06	0.00E+00	0	
TSS	1.04E+02	1	7.68E+06	0.00E+00	0	
VANADIUM	4.80E-02	1	3.55E+03	0.00E+00	0	
ZINC	8.30E-01	1	6.13E+04	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
July, 1994

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em	TREATED (124525 liters) Concentration	Num	Total(mg)	FINAL (128747 liters) Concentration	Num	Total(mg)
KALINITY-MO	2.77E+02	1	3.45E+07	0.00E+00	0	
KALINITY-P	2.70E+01	1	3.36E+06	0.00E+00	0	
UMINUM	2.00E+00	1	2.48E+05	0.00E+00	0	
TIMONY	0.00E+00	0		0.00E+00	0	
SENIC	2.00E-02	1	2.49E+03	0.00E+00	0	
RIUM	1.60E-01	1	1.99E+04	0.00E+00	0	
RYLIUM	5.00E-03	1	6.23E+02	0.00E+00	0	
RON	0.00E+00	0		0.00E+00	0	
DMIUM	2.80E-01	1	3.49E+04	0.00E+00	0	
LCIUM	2.00E+01	1	2.49E+06	0.00E+00	0	
LORIDE	3.30E+01	1	4.11E+06	0.00E+00	0	
D	7.20E+01	1	8.97E+06	0.00E+00	0	
NDUCTIVITY	6.00E+02	1		0.00E+00	0	
PPER	2.61E-01	1	3.25E+04	0.00E+00	0	
ANIDE	0.00E+00	0		0.00E+00	0	
UORIDE	4.98E+00	1	6.20E+05	0.00E+00	0	
ON	2.40E+01	1	2.99E+06	0.00E+00	0	
AD	1.40E-01	1	1.74E+04	0.00E+00	0	
GNESIUM	2.00E+00	1	2.49E+05	0.00E+00	0	
NGANESE	0.00E+00	0		0.00E+00	0	
RCURY	6.00E-03	1	7.47E+02	0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
2-N	0.00E+00	0		0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
3-N	4.50E+00	1	5.60E+05	0.00E+00	0	
CKEL	5.35E-01	1	6.66E+04	0.00E+00	0	
2-N	1.55E+00	1	1.93E+05	0.00E+00	0	
3-N	1.30E+00	1	1.62E+05	0.00E+00	0	
	9.4	1		0.0	0	
OSPHATE	1.20E+00	1	1.49E+05	0.00E+00	0	
TASSIUM	9.00E+00	1	1.12E+06	0.00E+00	0	
LENIUM	4.00E-03	1	4.98E+02	0.00E+00	0	
LVER	1.40E-02	1	1.74E+03	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
July, 1994

Item	TREATED (124525 liters) Concentration	Num	Total(mg)	FINAL (128747 liters) Concentration	Num	Total(mg)
SO4	4.50E+01	1	5.60E+06	0.00E+00	0	
SODIUM	1.39E+02	1	1.73E+07	0.00E+00	0	
TDS	4.90E+02	1	6.10E+07	0.00E+00	0	
TOTALCATIONS	7.69E+00	1		0.00E+00	0	
TOTALCHROMIUM	1.33E-01	1	1.66E+04	0.00E+00	0	
TOTALHARDNESS	2.20E+01	1	2.74E+06	0.00E+00	0	
TSS	0.00E+00	0		0.00E+00	0	
VANADIUM	6.30E-02	1	7.85E+03	0.00E+00	0	
ZINC	6.00E-01	1	7.47E+04	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
August, 1994

em	TREATED (73871 liters) Concentration	Num	Total(mg)	FINAL (146687 liters) Concentration	Num	Total(mg)
KALINITY-MO	1.64E+02	1	1.21E+07	0.00E+00	0	
KALINITY-P	5.00E+00	1	3.69E+05	0.00E+00	0	
UMINUM	1.24E+00	1	9.16E+04	0.00E+00	0	
TIMONY	0.00E+00	0		0.00E+00	0	
SENIC	7.00E-03	1	5.17E+02	0.00E+00	0	
RIUM	9.10E-02	1	6.72E+03	0.00E+00	0	
RYLIUM	2.40E-02	1	1.77E+03	0.00E+00	0	
RON	0.00E+00	0		0.00E+00	0	
DMIUM	8.90E-02	1	6.57E+03	0.00E+00	0	
LCIUM	3.10E+01	1	2.29E+06	0.00E+00	0	
LORIDE	3.00E+00	1	2.22E+05	0.00E+00	0	
D	5.00E+01	1	3.69E+06	0.00E+00	0	
NDUCTIVITY	4.60E+02	1		0.00E+00	0	
PPER	4.60E-01	1	3.40E+04	0.00E+00	0	
ANIDE	0.00E+00	0		0.00E+00	0	
UORIDE	4.28E+00	1	3.16E+05	0.00E+00	0	
ON	6.65E+00	1	4.91E+05	0.00E+00	0	
AD	6.90E-02	1	5.10E+03	0.00E+00	0	
GNESIUM	3.00E+00	1	2.22E+05	0.00E+00	0	
NGANESE	0.00E+00	0		0.00E+00	0	
RCURY	2.00E-03	1	1.48E+02	0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
2-N	0.00E+00	0		0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
3-N	5.80E+00	1	4.28E+05	0.00E+00	0	
CKEL	3.00E-01	1	2.22E+04	0.00E+00	0	
2-N	2.00E-02	1	1.48E+03	0.00E+00	0	
3-N	1.40E+01	1	1.03E+06	0.00E+00	0	
	7.6	1		0.0	0	
OSPHATE	1.10E+00	1	8.13E+04	0.00E+00	0	
TASSIUM	1.00E+01	1	7.39E+05	0.00E+00	0	
LENIUM	2.00E-03	1	1.48E+02	0.00E+00	0	
LVER	8.00E-03	1	5.91E+02	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
August, 1994

em	TREATED (73871 liters) Concentration	Num	Total(mg)	FINAL (146687 liters) Concentration	Num	Total(mg)
4	5.00E+00	1	3.69E+05	0.00E+00	0	
DIUM	7.20E+01	1	5.32E+06	0.00E+00	0	
S	3.32E+02	1	2.45E+07	0.00E+00	0	
TALCATIONS	5.16E+00	1		0.00E+00	0	
TALCHROMIUM	3.70E-02	1	2.73E+03	0.00E+00	0	
TALHARDNESS	3.40E+01	1	2.51E+06	0.00E+00	0	
S	2.90E+01	1	2.14E+06	0.00E+00	0	
NADIUM	1.30E-01	1	9.60E+03	0.00E+00	0	
NC	3.55E-01	1	2.62E+04	0.00E+00	0	

TA-21 DP-257

ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)

****

September, 1994

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Item	TREATED (46433 liters) Concentration	Num	Total(mg)	FINAL (0 liters) Concentration	Num	Total(mg)
ALKALINITY-MO	1.15E+02	1	5.34E+06	0.00E+00	0	
ALKALINITY-P	5.00E+00	1	2.32E+05	0.00E+00	0	
ALUMINUM	1.02E+00	1	4.74E+04	0.00E+00	0	
ANTIMONY	0.00E+00	0		0.00E+00	0	
ARSENIC	8.00E-03	1	3.71E+02	0.00E+00	0	
BARIUM	1.10E-01	1	5.11E+03	0.00E+00	0	
BERYLIUM	2.00E-03	1	9.29E+01	0.00E+00	0	
BORON	0.00E+00	0		0.00E+00	0	
CADMIUM	7.00E-02	1	3.25E+03	0.00E+00	0	
CALCIUM	3.00E+01	1	1.39E+06	0.00E+00	0	
CHLORIDE	7.90E+00	1	3.67E+05	0.00E+00	0	
COD	1.14E+02	1	5.29E+06	0.00E+00	0	
CONDUCTIVITY	4.10E+02	1		0.00E+00	0	
COPPER	2.20E-01	1	1.02E+04	0.00E+00	0	
CYANIDE	0.00E+00	0		0.00E+00	0	
FLUORIDE	3.79E+00	1	1.76E+05	0.00E+00	0	
IRON	6.80E+00	1	3.16E+05	0.00E+00	0	
LEAD	1.50E-01	1	6.96E+03	0.00E+00	0	
MAGNESIUM	3.00E+00	1	1.39E+05	0.00E+00	0	
MANGANESE	0.00E+00	0		0.00E+00	0	
MERCURY	7.00E-03	1	3.25E+02	0.00E+00	0	
MO3-N	0.00E+00	0		0.00E+00	0	
NO2-N	0.00E+00	0		0.00E+00	0	
NO3-N	0.00E+00	0		0.00E+00	0	
NH3-N	2.70E+00	1	1.25E+05	0.00E+00	0	
NICKEL	2.10E-01	1	9.75E+03	0.00E+00	0	
NO2-N	2.68E-01	1	1.24E+04	0.00E+00	0	
NO3-N	2.60E+00	1	1.21E+05	0.00E+00	0	
pH	7.3	1		0.0	0	
PHOSPHATE	2.10E+00	1	9.75E+04	0.00E+00	0	
POTASSIUM	1.00E+01	1	4.64E+05	0.00E+00	0	
SELENIUM	2.00E-03	1	9.29E+01	0.00E+00	0	
SILVER	2.30E-02	1	1.07E+03	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
September, 1994

em	TREATED (46433 liters) Concentration	Num	Total(mg)	FINAL (0 liters) Concentration	Num	Total(mg)
4	2.20E+01	1	1.02E+06	0.00E+00	0	
DIUM	6.40E+01	1	2.97E+06	0.00E+00	0	
S	3.24E+02	1	1.50E+07	0.00E+00	0	
TALCATIONS	2.22E+00	1		0.00E+00	0	
TALCHROMIUM	7.80E-02	1	3.62E+03	0.00E+00	0	
TALHARDNESS	3.30E+01	1	1.53E+06	0.00E+00	0	
S	3.00E+00	1	1.39E+05	0.00E+00	0	
NADIUM	7.10E-02	1	3.30E+03	0.00E+00	0	
NC	6.50E-01	1	3.02E+04	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
October, 1994

tem	TREATED (liters) Concentration	Num	Total(mg)	FINAL (13719 liters) Concentration	Num	Total(mg)
LKALINITY-MO	0.00E+00	0		0.00E+00	0	
LKALINITY-P	0.00E+00	0		0.00E+00	0	
LUMINUM	0.00E+00	0		0.00E+00	0	
NTIMONY	0.00E+00	0		0.00E+00	0	
RSENIC	0.00E+00	0		0.00E+00	0	
ARIUM	0.00E+00	0		0.00E+00	0	
ERYLIUM	0.00E+00	0		0.00E+00	0	
ORON	0.00E+00	0		0.00E+00	0	
ADMIUM	0.00E+00	0		0.00E+00	0	
ALCIUM	0.00E+00	0		0.00E+00	0	
HLORIDE	0.00E+00	0		0.00E+00	0	
OD	0.00E+00	0		0.00E+00	0	
ONDUCTIVITY	0.00E+00	0		0.00E+00	0	
OPPER	0.00E+00	0		0.00E+00	0	
YANIDE	0.00E+00	0		0.00E+00	0	
LUORIDE	0.00E+00	0		0.00E+00	0	
RON	0.00E+00	0		0.00E+00	0	
EAD	0.00E+00	0		0.00E+00	0	
AGNESIUM	0.00E+00	0		0.00E+00	0	
ANGANESE	0.00E+00	0		0.00E+00	0	
ERCURY	0.00E+00	0		0.00E+00	0	
O3-N	0.00E+00	0		0.00E+00	0	
O2-N	0.00E+00	0		0.00E+00	0	
O3-N	0.00E+00	0		0.00E+00	0	
H3-N	0.00E+00	0		0.00E+00	0	
ICKEL	0.00E+00	0		0.00E+00	0	
O2-N	0.00E+00	0		0.00E+00	0	
O3-N	0.00E+00	0		0.00E+00	0	
H	0.0	0		0.0	0	
HOSPHATE	0.00E+00	0		0.00E+00	0	
OTASSIUM	0.00E+00	0		0.00E+00	0	
ELENIUM	0.00E+00	0		0.00E+00	0	
ILVER	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
October, 1994

Item	TREATED (liters) Concentration	Num	Total(mg)	FINAL (13719 liters) Concentration	Num	Total(mg)
SO4	0.00E+00	0		0.00E+00	0	
SODIUM	0.00E+00	0		0.00E+00	0	
TDS	0.00E+00	0		0.00E+00	0	
TOTALCATIONS	0.00E+00	0		0.00E+00	0	
TOTALCHROMIUM	0.00E+00	0		0.00E+00	0	
TOTALHARDNESS	0.00E+00	0		0.00E+00	0	
TSS	0.00E+00	0		0.00E+00	0	
VANADIUM	0.00E+00	0		0.00E+00	0	
ZINC	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
November, 1994

-Jun-1995 08:52 AM

em	TREATED (61207 liters) Concentration	Num	Total(mg)	FINAL (33770 liters) Concentration	Num	Total(mg)
KALINITY-MO	6.00E+01	1	3.67E+06	0.00E+00	0	
KALINITY-P	5.00E+00	1	3.06E+05	0.00E+00	0	
UMINUM	3.00E-01	1	1.84E+04	0.00E+00	0	
TIMONY	0.00E+00	0		0.00E+00	0	
SENIC	6.00E-03	1	3.67E+02	0.00E+00	0	
RIUM	6.70E-02	1	4.10E+03	0.00E+00	0	
RYLIUM	1.00E-03	1	6.12E+01	0.00E+00	0	
RON	0.00E+00	0		0.00E+00	0	
DMIUM	2.30E-02	1	1.41E+03	0.00E+00	0	
LCIUM	3.10E+01	1	1.90E+06	0.00E+00	0	
LORIDE	8.10E+01	1	4.96E+06	0.00E+00	0	
D	7.30E+01	1	4.47E+06	0.00E+00	0	
NDUCTIVITY	3.60E+02	1		0.00E+00	0	
PPER	1.30E-01	1	7.96E+03	0.00E+00	0	
ANIDE	0.00E+00	0		0.00E+00	0	
UORIDE	3.35E+00	1	2.05E+05	0.00E+00	0	
ON	4.10E+00	1	2.51E+05	0.00E+00	0	
AD	8.20E-02	1	5.02E+03	0.00E+00	0	
GNESIUM	7.00E+00	1	4.28E+05	0.00E+00	0	
NGANESE	0.00E+00	0		0.00E+00	0	
RCURY	5.00E-03	1	3.06E+02	0.00E+00	0	
3-N	0.00E+00	0		0.00E+00	0	
2-N	0.00E+00	0		0.00E+00	0	
3-N	3.50E-01	1	2.14E+04	0.00E+00	0	
3-N	7.00E+00	1	4.28E+05	0.00E+00	0	
CKEL	1.55E-01	1	9.49E+03	0.00E+00	0	
2-N	2.00E-02	1	1.22E+03	0.00E+00	0	
3-N	3.50E-01	1	2.14E+04	0.00E+00	0	
S	7.2	1		0.0	0	
OSPHATE	1.40E+00	1	8.57E+04	0.00E+00	0	
TASSIUM	1.30E+01	1	7.96E+05	0.00E+00	0	
LENIUM	2.00E-03	1	1.22E+02	0.00E+00	0	
LVER	2.10E-02	1	1.29E+03	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
November, 1994

em	TREATED (61207 liters) Concentration	Num	Total(mg)	FINAL (33770 liters) Concentration	Num	Total(mg)
4	8.90E+01	1	5.45E+06	0.00E+00	0	
DIUM	5.00E+01	1	3.06E+06	0.00E+00	0	
S	5.80E+02	1	3.55E+07	0.00E+00	0	
TALCATIONS	3.73E+00	1		0.00E+00	0	
TALCHROMIUM	7.60E-02	1	4.65E+03	0.00E+00	0	
TALHARDNESS	3.80E+01	1	2.33E+06	0.00E+00	0	
S	0.00E+00	0		0.00E+00	0	
NADIUM	5.90E-02	1	3.61E+03	0.00E+00	0	
NC	4.70E-01	1	2.88E+04	0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
December, 1994

-Jun-1995 08:52 AM

em	TREATED (liters) Concentration	Num	Total(mg)	FINAL (44323 liters) Concentration	Num	Total(mg)
KALINITY-MO	0.00E+00	0		0.00E+00	0	
KALINITY-P	0.00E+00	0		0.00E+00	0	
UMINUM	0.00E+00	0		0.00E+00	0	
TIMONY	0.00E+00	0		0.00E+00	0	
SENIC	0.00E+00	0		0.00E+00	0	
RIUM	0.00E+00	0		0.00E+00	0	
RYLIUM	0.00E+00	0		0.00E+00	0	
RON	0.00E+00	0		0.00E+	0	
DMIUM	0.00E+00	0		0.00E+00	0	
LCIUM	0.00E+00	0		0.00E+00	0	
LORIDE	0.00E+00	0		0.00E+00	0	
D	0.00E+00	0		0.00E+00	0	
NDUCTIVITY	0.00E+00	0		0.00E+00	0	
PPER	0.00E+00	0		0.00E+00	0	
ANIDE	0.00E+00	0		0.00E+00	0	
UORIDE	0.00E+00	0		0.00E+00	0	
ON	0.00E+00	0		0.00E+00	0	
AD	0.00E+00	0		0.00E+00	0	
GNESIUM	0.00E+00	0		0.00E+00	0	
NGANESE	0.00E+00	0		0.00E+00	0	
RCURY	0.00E+00	0		0.00E+00	0	
03-N	0.00E+00	0		0.00E+00	0	
02-N	0.00E+00	0		0.00E+00	0	
03-N	0.00E+00	0		0.00E+00	0	
I3-N	0.00E+00	0		0.00E+00	0	
CKEL	0.00E+00	0		0.00E+00	0	
02-N	0.00E+00	0		0.00E+00	0	
03-N	0.00E+00	0		0.00E+00	0	
I	0.0	0		0.0	0	
OSPHATE	0.00E+00	0		0.00E+00	0	
TASSIUM	0.00E+00	0		0.00E+00	0	
LENIUM	0.00E+00	0		0.00E+00	0	
LVER	0.00E+00	0		0.00E+00	0	

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
December, 1994

em	TREATED (liters) Concentration	Num	Total(mg)	FINAL (44323 liters) Concentration	Num	Total(mg)
4	0.00E+00	0		0.00E+00	0	
DIUM	0.00E+00	0		0.00E+00	0	
S	0.00E+00	0		0.00E+00	0	
TALCATIONS	0.00E+00	0		0.00E+00	0	
TALCHROMIUM	0.00E+00	0		0.00E+00	0	
TALHARDNESS	0.00E+00	0		0.00E+00	0	
S	0.00E+00	0		0.00E+00	0	
NADIUM	0.00E+00	0		0.00E+00	0	
NC	0.00E+00	0		0.00E+00	0	

TA-21 DP-257

ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)

****

From January, 1994 to December, 1994

-Jun-1995 01:47 PM

tem	TREATED (709162 liters) Average	Maximum	Minimum	Num	Total(mg)	FINAL (707051 liters) Average	Maximum	Minimum	Num	Total(mg)
KALINITY-MO	2.03E+02	3.35E+02	6.00E+01	9	1.44E+08	0.00E+00				0
KALINITY-P	3.50E+01	1.29E+02	5.00E+00	9	2.48E+07	0.00E+00				0
UMINUM	1.14E+00	2.00E+00	3.00E-01	6	8.10E+05	0.00E+00				0
TIMONY	1.20E-02	1.20E-02	1.20E-02	1	8.51E+03	0.00E+00				0
SENIC	1.19E-02	2.20E-02	6.00E-03	9	8.43E+03	0.00E+00				0
RIUM	1.17E-01	1.60E-01	6.70E-02	9	8.31E+04	0.00E+00				0
RYLIUM	7.33E-03	2.40E-02	1.00E-03	9	5.20E+03	0.00E+00				0
RON	0.00E+00			0		0.00E+00				0
DMIUM	4.23E-01	1.56E+00	1.10E-02	9	3.00E+05	0.00E+00				0
LCIUM	3.29E+01	5.80E+01	1.30E+01	9	2.33E+07	0.00E+00				0
LORIDE	4.80E+01	8.10E+01	3.00E+00	9	3.40E+07	0.00E+00				0
D	8.06E+02	3.00E+03	5.00E+01	9	5.72E+08	0.00E+00				0
NDUCTIVITY	6.11E+02	8.00E+02	3.60E+02	9		0.00E+00				0
PPER	2.52E-01	4.60E-01	1.30E-01	9	1.79E+05	0.00E+00				0
ANIDE	0.00E+00			0		0.00E+00				0
UORIDE	5.30E+00	8.72E+00	3.35E+00	9	3.76E+06	0.00E+00				0
ON	1.18E+01	3.20E+01	4.10E+00	9	8.36E+06	0.00E+00				0
AD	1.28E-01	1.82E-01	6.90E-02	9	9.08E+04	0.00E+00				0
GNESIUM	4.22E+00	7.00E+00	2.00E+00	9	2.99E+06	0.00E+00				0
NGANESE	0.00E+00			0		0.00E+00				0
RCURY	5.91E-03	9.20E-03	2.00E-03	9	4.19E+03	0.00E+00				0
03-N	0.00E+00			0		0.00E+00				0
02-N	0.00E+00			0		0.00E+00				0
03-N	3.50E-01	3.50E-01	3.50E-01	1	2.48E+05	0.00E+00				0
I3-N	7.37E+00	1.40E+01	2.70E+00	9	5.23E+06	0.00E+00				0
CKEL	5.05E-01	1.36E+00	1.10E-01	9	3.58E+05	0.00E+00				0
02-N	2.23E-01	1.55E+00	2.00E-02	9	1.58E+05	0.00E+00				0
03-N	2.70E+00	1.40E+01	1.20E-01	9	1.92E+06	0.00E+00				0
H	8.2	10.1	7.2	9		0.0				0
OSPHATE	3.07E+00	1.00E+01	1.10E+00	9	2.17E+06	0.00E+00				0
TASSIUM	1.60E+01	3.10E+01	9.00E+00	9	1.13E+07	0.00E+00				0
LENIUM	4.44E-03	8.00E-03	2.00E-03	9	3.15E+03	0.00E+00				0
LVER	2.13E-02	4.30E-02	8.00E-03	9	1.51E+04	0.00E+00				0

TA-21 DP-257
ANALYSES OF COMPOSITE MINERAL SAMPLES (mg/L)
****
From January, 1994 to December, 1994

tem	TREATED (709162 liters) Average	Maximum	Minimum	Num	Total(mg)	FINAL (707051 liters) Average	Maximum	Minimum	Num	Total(mg)
4	4.31E+01	8.90E+01	5.00E+00	9	3.05E+07	0.00E+00			0	
DIUM	8.96E+01	1.50E+02	5.00E+01	9	6.35E+07	0.00E+00			0	
S	4.96E+02	6.46E+02	3.24E+02	9	3.51E+08	0.00E+00			0	
TALCATIONS	6.54E+00	9.66E+00	2.22E+00	9		0.00E+00			0	
TALCHROMIUM	5.96E-02	1.33E-01	2.30E-02	9	4.22E+04	0.00E+00			0	
TALHARDNESS	3.71E+01	6.30E+01	1.80E+01	9	2.63E+07	0.00E+00			0	
S	7.97E+01	2.68E+02	3.00E+00	7	5.65E+07	0.00E+00			0	
NADIUM	6.98E-02	1.30E-01	4.80E-02	6	4.95E+04	0.00E+00			0	
NC	6.08E-01	1.01E+00	3.44E-01	9	4.31E+05	0.00E+00			0	

TA-50 WM-1
ROOM 116B
VACUUM FILTER OPERATIONS
****
CALENDAR YEAR, 1994

MON	NO. of DRUMS	TOTAL VOLUME (Liters)	GROSS WEIGHT (KG)	^{235}U (Curies)	^{238}Pu (Curies)	^{239}Pu (Curies)	^{241}Am (Curies)	TOTAL ACTY (nCi/gm)
JAN								
FEB								
MAR								
APR								
MAY								
JUN								
JUL	58	12,064	12,978	3.75 E-5	4.17 E-1	6.68 E-2	3.75 E-2	40
AUG								
SEP	20	4160	3988	7.86 E-6	8.85 E-2	1.67 E-2	7.86 E-3	28
OCT								
NOV								
DEC								
TOT	78	16,224	16,966	4.54 E-5	5.06 E-1	8.35 E-2	4.54 E-2	37

TA-50 WM-1
ROOM 60
PRETREATMENT OPERATIONS
****
CALENDAR YEAR, 1994

ONTH	PROCESS CAUSTIC (Liters)	$^{238,239,240}Pu$ (Curies)	^{241}Am (Curies)	GROSS ALPHA (Curies)	PROCESS ACID (Liters)	$^{238,239,240}Pu$ (Curies)	^{241}Am (Curies)	GROSS ALPHA (Curies)	TOTAL VOLUME (Liters)	TOTAL ALPHA (Curies)
JAN										
FEB										
MAR										
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC					9074	5.515	0.706	6.2 ~~2.221~~	9074	6.221 ~~2.221~~
OTALS					9074	5.515	0.706	6.221 2.221	9074	6.221 ~~2.221~~

TA-50 WM-1
ROOM 60
SLUDGE/CEMENT PASTE
****
CALENDAR YEAR, 1994

MON	NO. of DRUMS	SLUDGE SOLIDIFIED (Liters)	TOTAL VOLUME (Liters)	GROSS WEIGHT (KG)	^{235}U (Curies)	^{238}Pu (Curies)	^{239}Pu (Curies)	^{241}Am (Curies)
JAN								
FEB								
MAR								
APR								
MAY								
JUN								
JUL								
AUG								
SEP								
OCT								
NOV								
DEC								
TOT								

TA-21-DP-257
VACUUM FILTER OPERATIONS
****
CALENDAR YEAR, 1992

MON	NO. of DRUMS	TOTAL VOLUME (Liters)	GROSS WEIGHT (KG)	^{235}U (Curies)	^{238}Pu (Curies)	^{239}Pu (Curies)	^{241}Am (Curies)	TOTAL ACTY (nCi/gm)
JAN								
FEB								
MAR								
APR								
MAY								
JUN								
JUL	20	4160	3022	3.05 E-5	1.91 E-3	4.12 E-3	1.14 E-2	6
AUG								
SEP	37	7702	5904	6.05 E-5	3.79 E-3	8.18 E-3	2.27 E-2	6
OCT								
NOV								
DEC								
TOT	57	11,862	8926	9.10 E-5	5.70 E-3	1.23 E-2	3.41 E-2	6

TA-50 WM-1 & TA-21 DP-257
SUMMARY OF SOLID WASTES GENERATED
****
CALENDAR YEAR, 1994

	TA-50	TA-21-DP-257
PLANT SLUDGE	16,224 Liters	11,856 Liters
DRUMS OF SLUDGE (RETRIEVABLE)	0 bbl's	0 bbl's
DRUMS OF SLUDGE (NON-RETRIEVABLE.)	78 bbl's	57 bbl's
CEMENT PASTE	0 Liters	
DRUMS OF CEMENT PASTE (RETRIEVABLE.)	0 bbl's	
MISC. DRUMS (GRIT, ETC.) (RETRIEVABLE.)	0 bbl's	0 bbl's
PLANT SLUDGE ACTIVITY	TOTAL	TOTAL
^{235}U	4.54 E-5 Ci	9.10 E-5 Ci
^{238}Pu	5.06 E-1 Ci	5.70 E-3 Ci
^{239}Pu	8.35 E-2 Ci	1.23 E-2 Ci
^{241}Am	4.54 E-2 Ci	3.41 E-2 Ci
CEMENT PASTE ACTIVITY	TOTAL	
^{235}U	0 Ci	
^{238}Pu	0 Ci	
^{239}Pu	0 Ci	
^{241}Am	0 Ci	

TA-53

TANK DISCHARGES TO LAGOONS

****

CALENDAR YEAR, 1994

ONTH	FLOW (Liters)	^{3}H (Curies)	^{7}Be (Curies)	^{22}Na (Curies)	^{46}Sc (Curies)	^{51}Cr (Curies)	^{54}Mn (Curies)	^{56}Co (Curies)	^{57}Co (Curies)
AN	3789	7.31 E-4	9.47 E-4	1.82 E-5	8.71 E-5	1.59 E-4	1.71 E-4	1.36 E-5	1.67 E-4
EB	3789	4.40 E-3	4.93 E-4	9.85 E-6	5.68 E-5	7.58 E-5	1.10 E-4	9.47 E-6	7.96 E-5
IAR	3789	1.48 E-3	3.79 E-4	3.79 E-5	1.55 E-4	1.40 E-4	2.12 E-4	2.27 E-5	1.06 E-4
PR	6212	7.45 E-2	9.32 E-5	5.40 E-5	2.61 E-5		1.18 E-4	7.45 E-6	5.22 E-5
IAY	10,687	1.67 E-3	1.71 E-4	3.63 E-5	3.63 E-5		8.55 E-5		4.38 E-5
UN	20,656	0.34	2.07 E-2	9.50 E-4	1.49 E-4			1.24 E-3	9.30 E-3
JUL	20,656	0.11		6.82 E-3			7.85 E-3	4.34 E-4	3.92 E-3
AUG	20,656	0.74	2.89 E-3	1.51 E-3			6.40 E-3	3.10 E-4	3.10 E-4
SEP	20,656	3.08	3.72 E-3	8.68 E-5			1.40 E-3		9.30 E-4
OCT	20,656	3.45	0.16	5.99 E-3	8.68 E-4		3.92 E-2	2.89 E-2	9.91 E-3
NOV	20,656	3.26	5.58 E-2	2.27 E-3	4.54 E-4		1.01 E-2	8.88 E-4	2.48 E-3
DEC	20,656	2.66	9.50 E-2	3.51 E-3	3.72 E-4		1.28 E-2	2.89 E-3	8.06 E-3
OTAL	172,858	13.72	0.34	2.13 E-2	2.20 E-3	3.75 E-4	7.84 E-2	8.71 E-3	3.54 E-2

TA-53

TANK DISCHARGES TO LAGOONS

****

CALENDAR YEAR, 1994

MONTH	FLOW (Liters)	^{58}Co (Curies)	^{60}Co (Curies)	^{65}Zn (Curies)	^{75}Se (Curies)	^{83}Rb (Curies)	^{85}Sr (Curies)	^{88}Y (Curies)	^{88}Zr (Curies)	^{95}Nb (Curies)
JAN	3789	4.93 E-5	2.88 E-5			6.82 E-6	6.06 E-6			
FEB	3789	2.54 E-5	1.55 E-5							
MAR	3789	4.17 E-5	2.65 E-5							
APR	6212	2.73 E-5	2.67 E-5							
MAY	10,687	1.07 E-5	1.28 E-5							
JUN	20,656	4.13 E-3	1.05 E-3	2.27 E-4	8.47 E-5	8.26 E-5	2.69 E-4			
JUL	20,656	1.20 E-3	5.58 E-4							
AUG	20,656	8.88 E-4	5.37 E-4							
SEP	20,656	2.07 E-4	1.65 E-4							
OCT	20,656	5.99 E-3	2.27 E-3	3.72 E-4						
NOV	20,656	2.27 E-3	6.40 E-4	8.88 E-5	4.34 E-5	7.23 E-5		1.26 E-4	8.26 E-4	4.75 E-4
DEC	20,656	9.30 E-3	1.59 E-3	2.48 E-4		4.13 E-4		9.71 E-5	3.92 E-4	1.94 E-4
TOTAL	172,858	2.41 E-2	6.92 E-3	9.36 E-4	1.28 E-4	5.75 E-4	2.75 E-4	2.23 E-4	1.22 E-3	6.69 E-4

APPENDIX E

Hydrologic Setting of Mortandad Canyon

Mortandad Canyon is an east to southeast-trending canyon that heads on the western part of the plateau and is tributary to the Rio Grande to the east. The canyon is cut into the Bandelier Tuff. The canyon floor is narrow near the plant outfall and widens eastward. The canyon walls are steep, and in places are near vertical. The canyon contains a shallow body of ground water recharged by industrial effluent and runoff. The spatial extent of this saturation is within the Laboratory boundaries, extending from near the plant outfall on the west to near observation well MCO-8 (Figure 3.0). Transverse to the canyon axis, the saturation does not extend to the canyon walls.

The alluvium thickens eastward from less than 5 ft in the upper reach of the canyon to as much as 75 ft east of MCO-8. The shallow body of ground water in the alluvium occupies less than 10% of the volume of the alluvium. The greatest potential for the surface transport of contaminants from the area is with storm runoff, in solution or adsorbed on sediments. Due to the small drainage area and the large volume of unsaturated alluvium there has been no continuous surface runoff through the canyon extending off the Laboratory since hydrologic observations began in 1960. The largest runoff events have extended no further than a hundred or so meters past the sediment traps.

The canyon has been conceptually divided into three sections: Upper Canyon, Middle Canyon, and Lower Canyon. The hydrologic characteristics of each are slightly different: The upper canyon is narrow, and filled with underbrush, shrubs, pine, fir, box elder, and oak trees. The alluvium thickens eastward from less than 1 ft at the plant outfall to about 18 ft thick at MCO-4. The stream flow in this section is perennial from waste water and periodic releases of industrial effluents. The stream channel is entrenched. Major recharge to the shallow ground water occurs in the upper canyon. Large losses by evaporation occur in this section of the canyon due to the large amount of vegetation and to the water table being near the ground surface. The **middle canyon** widens and alluvium thickens from 18 ft at MCO-4 to 36 ft at MCO-6. The stream channel is well defined, but surface flow is intermittent.

The **lower canyon** becomes progressively wider and the alluvium continues to thicken to about 60 ft near MCO-8. The stream channel is discontinuous, braiding out on the canyon floor. The number of pines decrease eastward from the middle canyon with a transition to scattered pinion-juniper community. To prevent the transport of contaminants by storm

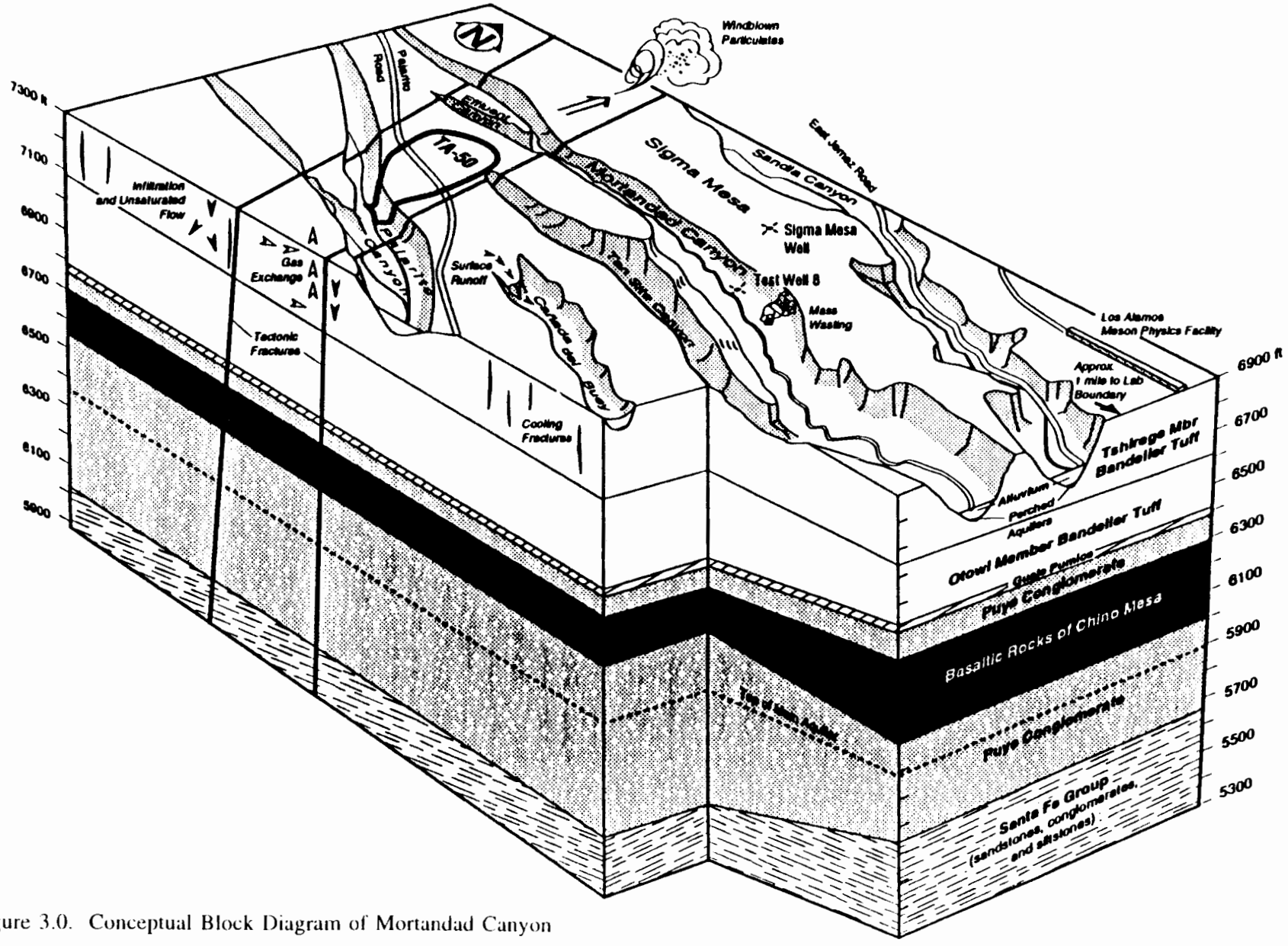

Figure 3.0. Conceptual Block Diagram of Mortandad Canyon

runoff out of the lower canyon, three sediment traps have been constructed b
7 and MCO-7.5. These traps have a capacity of about 1.2 million gallons.

Recharge by industrial effluents and waste water to the shallow ground water occur in the upper canyon. Storm runoff recharges the upper canyon and, dependent on the volume, may extend to the lower canyon. Long periods of snow-melt runoff or wastewater discharge will override the saturated section in the upper canyon and infiltrate along the saturated front. When discharge ends, the stream flow will retreat up the canyon and the front will break off and move as a groundwater mound down the canyon. The volume of recharge since 1960 has not been sufficient to significantly change the volume of the shallow ground water.

Extent of Saturation in Mortandad Canyon

The saturated canyon alluvium is of limited extent as the recharge (effluents, waste water, and storm runoff) is sufficient only to maintain a saturated zone in the alluvium extending about 2.2 mi downstream from the outfall location (about the edge of the conceptual illustration in Figure 3.0, near observation hole MCO-8). The eastern extent of saturation is about 1 mi west of the Laboratory boundary as observed in test holes on the Laboratory and San Ildefonso lands. The saturated thickness of the shallow aquifer varies dependent upon the amount of recharge. A typical saturated thickness is 10 feet.

Test holes drilled or cored through the alluvium indicate that the underlying tuff, weathered to silts and clays immediately below the alluvium, is not saturated. The saturated portion of the alluvium is perched on the weathered-unweathered tuff. Moisture content generally declines to less than 50 percent of saturation conditions both transverse to canyon axis and at depth. Test holes completed in the weathered tuff below the saturated alluvium will not yield free water.

Groundwater Flow

The direction of groundwater flow in the alluvium is to the southeast, paralleling the canyon bottom. The rate of groundwater flow depends on the hydrologic characteristics of the two distinguishable units of the zone of saturation. Ground water west of MCO-5 is in a sand unit and is transitional into a silty clay unit near MCO-6. East of MCO-6, the aquifer is in a silty clay unit (Baltz 1963, Purtymaun 1974, Stoker 1991). Tracer tests indicate that the velocity of ground water in the transition from the sand unit to the silty clay unit is 65 ft/day and in the silty clay unit of 6 to 14 ft/day (Purtymun, 1974). Based on velocity, the transit

time from the plant outfall to the eastern end of the zone of saturation is about one year. The direction of groundwater flow in the underlying regional aquifer is also to the southeast towards the Rio Grande. The rate of groundwater flow in the regional, or main, aquifer is estimated to be about 95 ft/year (Purtymun, 1984).

Groundwater Quality

Routine environmental monitoring has been conducted in Mortandad Canyon since 1960. The routine monitoring program includes regular collection and analysis of water and sediment samples from the canyon. The 1993 and 1994 Environmental Surveillance Reports contain data on samples collected in Mortandad Canyon. As industrial effluents are released into the canyon and move down gradient, radionuclides (except tritium) and some inorganic chemicals are adsorbed or bound to the bed sediments, reducing the amount of radionuclides or chemicals in the water or effluents. A high build up of radiochemicals or chemicals does not occur in the alluvium at the effluent outfall since periodic storm runoff transports sediments and contaminants down the channel in the canyon. Adsorption of contaminants reduces the concentrations in the perched ground water.

Ground water in the perched alluvium contains inorganic constituents listed in the NMWQCC 3103 Groundwater Standards, as expected from analysis of effluent quality. Nitrate (as nitrogen) concentrations in the alluvial groundwater typically range between 40 to 60 mg/L, reflecting the significant influence of the TA-50 effluent quality on the groundwater (See Appendix F for a 10-year summary of nitrate monitoring in Mortandad Canyon). Total dissolved solids concentrations typically range between 300 and 600 mg/L.

No organic chemical constituents (listed in RCRA Appendix IX) have been identified in the alluvial ground water (Purtymun, 1988). Similarly, no cores taken in or beneath the alluvium to depths of about 100 feet showed any detectable organic chemical (volatiles, semivolatiles, herbicides, pesticides, or PCBs) contaminants (Stoker et al. 1991).

Generally, more than 99 percent of the radioactive residuals from the treatment plan effluents are associated with sediments in or immediately adjacent to the stream channel. A small fraction of the residuals, on the order of 1 percent or less, are present in the perched water in the alluvium. Recent data indicates variable movement of contaminants into the unsaturated tuff beneath the saturated portion of the alluvium. Except for tritium,

radioactive constituents have apparently moved less than about 10 feet
zone, based on analysis of cores from two on-site coreholes (Stoker
contrast, the same boreholes showed migration of tritium, nitrate, and chl
at least 195 feet.

In 1993, trace levels (89 pCi/L) of tritium, as tritiated water, were detected in the main aquifer beneath Mortandad Canyon in Test Well 8. These levels are less than 1% of the EPA drinking water MCL of 20,000 pCi/L. The levels are significant nonetheless as they are indicative of recharge from the surface within the past four decades. Tritium is of great interest in evaluating the hydrologic process because tritium, the radioactive isotope of hydrogen, is chemically part of the water molecule and moves with water virtually unaffected by any geochemical processes such as ion exchange, chelation, or adsorption. Accordingly, it can be used as a fundamental conservative tracer to follow the movement of water.

A 1994 sampling of Test Well 8, a main aquifer well, showed a nitrate (as Nitrogen) value of 5.1 mg/L, while all other values since 1988 were 0.2 mg/L or less.

General Soil Distribution and Characteristics of Mortandad Canyon

Soils along Mortandad Canyon are spatially variable due in part to the steep and rugged topography of the canyon. Soils along this canyon have largely been mapped (Nyhan et al., 1978) as Rock outcrop, frigid (RF), Rock outcrop, steep (RS), and Typic Ustorthents-Rock outcrop complex (TS). The existing soils map for Mortandad Canyon should be considered only as a general estimation of soil cover; however, extreme variability in soil cover has been observed elsewhere within the Laboratory when more detailed soil surveys have been conducted. A more detailed and accurate determination of soil characteristics along this canyon will require additional mapping and description of soils.

Soils mapped by as RF largely consists of Bandelier Tuff rock outcrop. Soil cover in places may consist of either a (1) thin (<50 cm) covering of very shallow, poorly developed soils developed in sandy-gravely colluvium or (2) thin (<50 cm), moderately developed soils that have weakly developed Bt horizons (horizons that display an increase in silt and clay relative to the original parent material) and that may have silt loam to clay loam textures. Soils mapped as RS consist of slopes that exceed 30% and largely consists of Bandelier Tuff rock outcrop. Soils mapped as TS consist of rock outcrop and deep (>100 cm), poorly developed soils formed in sandy-gravely colluvium. TS soils generally have textures ranging from gravely loam to sand.

In places where soils have formed in colluvium that overlies the Bandelier Tuff along canyon walls, soil characteristics will also generally vary between north and south facing slopes. Soils on north facing slopes will generally have thicker A horizons (horizons where organic matter largely accumulates), including a greater accumulation of organic matter and forest litter, deeper soil profiles, and slightly finer textures (slight increase in silt and clay content) relative to soils formed on south facing slopes. In addition, soils will be generally be deeper along the lower footslopes of both north- and south-facing slopes relative to soil cover upslope.

Soils along canyon bottoms that have formed in young (Holocene, < ~10,000 years) alluvium are also be present although these soils were not specifically mapped by Nyhan et al. (1978). Soils formed in colluvium generally are deep (>100 cm), are poorly- to moderately-developed, have textures ranging from gravely loam to sand, and consists of simple A-Bw-C soil profiles (Bw horizons are weak B horizons where there is a slight increase in soil structure and/or accumulation of iron oxides relative to the parent material

(C horizon)). Soils formed in alluvium probably increase in abundance down canyon as width of the valley bottom increases.

Surface runoff will be extremely high for rock outcrop. Surface runoff will generally be poor to moderate, with moderate to high surface permeability for soils formed in colluvium along canyon walls depending on soil depth to bedrock. Permeability will be also generally be high for soils formed in alluvium along the canyon bottom. Soil cover along canyon walls will generally have a high potential for erosion due to steep slopes and generally thin soil depths and a variable cover of vegetation. Soils along canyon bottoms may be susceptible to erosion along active stream channels.

Bedrock Stratigraphy of Mortandad Canyon

The principal bedrock units in Mortandad Canyon consist of, in ascending order, 1) the Santa Fe Group (4 - 21 Ma, Manley, 1979), 2) the Puye Formation (1.7 - 4 Ma, Turbeville et al., 1989 and Spell et al., 1990) and interstratified basaltic rocks of the Cerros del Rio volcanic field (2-3 Ma, Gardner and Goff, 1984), 3) the Otowi Member of the Bandelier Tuff (1.613 ± 0.011 Ma, Izett and Obradovich, 1994), 4) epiclastic sediments and tephras of the Cerro Toledo interval, and 5) the Tshirege Member of the Bandelier Tuff (1.223 ± 0.018 Ma, Izett and Obradovich, 1994). The distribution of these geologic units is shown on several excellent geologic maps of the area (Baltz et al., 1963; Griggs, 1964; Rogers, 1995). Brief descriptions of the principal bedrock units are given below and illustrated in Figure 4.0.

Santa Fe Group

The Santa Fe Group consists of predominately fluvial slightly consolidated sedimentary rocks that crop out near the mouth of Mortandad Canyon in White Rock Canyon. Santa Fe Group sediments were penetrated in water supply well PM-5, located on the mesa south of Mortandad Canyon. The Santa Fe Group consists of, in ascending order, the Tesuque Formation, the Chamita Formation, and coarse-grained sedimentary rocks informally called the "Chaquehui Formation" by Purtymun (1995).

The Tesuque Formation consists of poorly consolidated buff, red, or gray arkosic sand, silt, clay, pebble beds, and thin, white or green ash beds derived primarily from Precambrian basement and Tertiary volcanic sources to the east and northeast of the Espanola basin. These clastic rocks range in age from about 21 to 7 Ma (Manley 1979; Cavazza, 1989). Cavazza (1989) states that the aggregate thickness of Tesuque Formation is >2000 m and shows the unit thickening to the west.

The Chamita Formation overlies and interfingers with Tesuque Formation. Chamita deposits are similar in appearance to Tesuque deposits, but the former reportedly contains a larger proportion of volcanic and granitic clasts in its gravel layers (Galusha and Blick, 1971) and Paleozoic limestone cobbles in its conglomerate layers (Dethier and Manley, 1985). The Chamita Formation contains lithologically distinct quartzitic gravels (Galusha and Blick, 1971). Upper layers of Chamita may contain cobbles of Jemez volcanic rocks, primarily andesites and dacites. However, because of similarities of appearance, obvious time overlaps, and interfingering relations, differentiation of Chamita from Tesuque

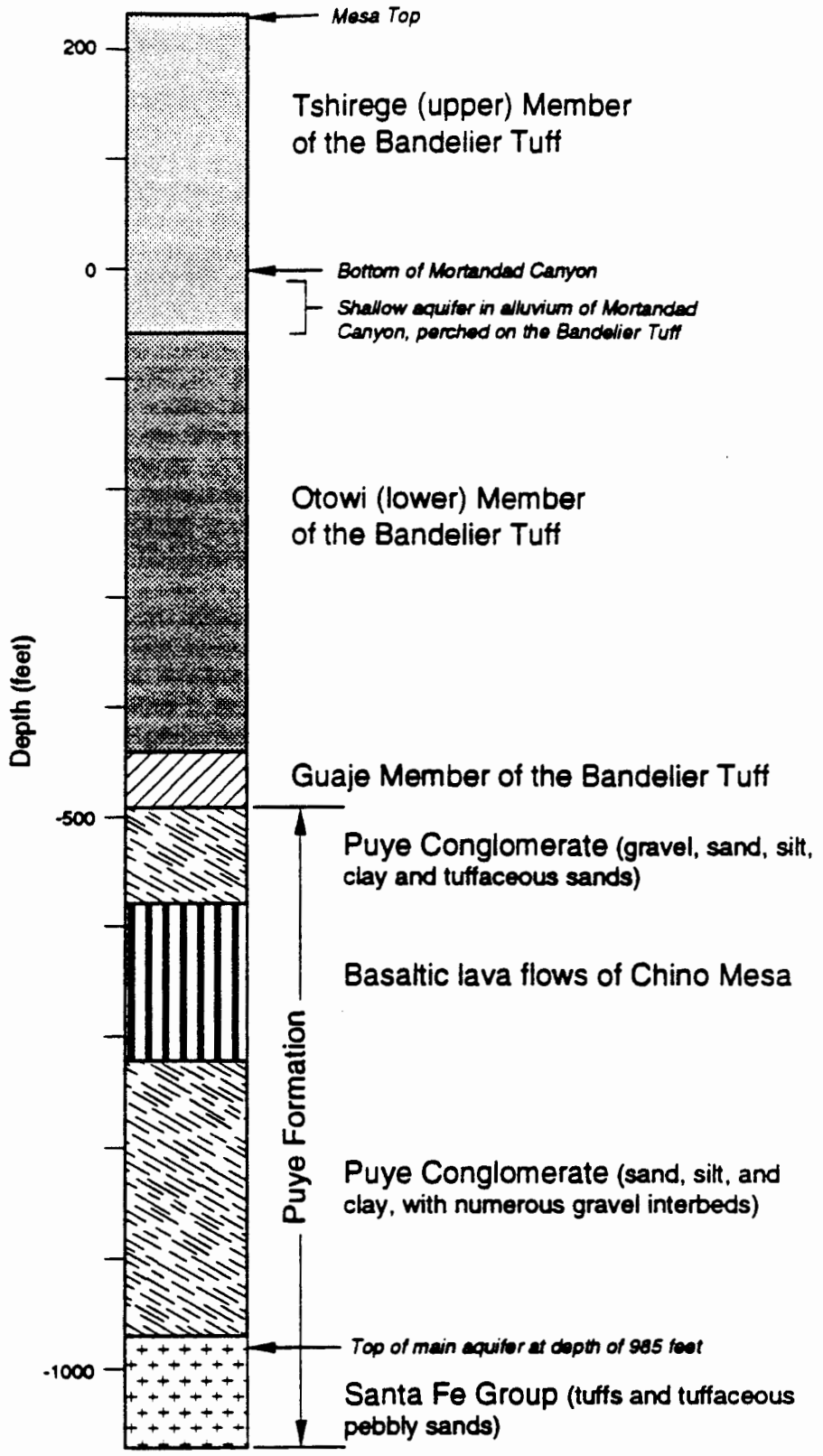

Figure 4.0. Simplified stratigraphy of Mortandad Canyon, based on cliff sections and Test Well 8 (from Baltz et al. 1963).

deposits is often difficult, particularly in borehole investigations. The Chamita Formation, if present, is less than 80 ft thick in the vicinity of well PM-5 (Purtymun, 1995).

Purtymun (1995) describes a trough of coarse-grained sediments at the top of the Santa Fe Group ("Chaquehui Formation") that would allow the development of high-yield, low-drawdown water supply wells. The trough is late Miocene in age (based on ca. 9 Ma basalts interlayered with the sediments in well Otowi-4 in Los Alamos Canyon; $^{39}Ar/^{40}Ar$ ages from A. W. Laughlin, unpubl. report for Los Alamos National Laboratory, 1993). This Miocene trough is about 4 km wide and extends at least 12 km from the northeast to the southwest, although subsurface data are not available to determine its full length. It is filled with coarse gravelly sediments, including volcanic, metamorphic, and sedimentary clasts which may have been derived from highlands to the north, east, and west. Approximately 1230 ft of this distinct coarse-grained facies of the upper Santa Fe Group was penetrated in well PM-5, and these deposits probably are present beneath the western half of Mortandad Canyon.

Basalt flows 50 to 480 ft thick were penetrated within the Santa Fe Group by water supply well PM-5 (Purtymun et al., 1995). Some of these basalt flows are probably present beneath Mortandad Canyon as well. Recent dating of these volcanic units shows that these basalt flows range in age from 9.8 to 11 Ma (WoldeGabriel et al., 1994).

Puye Formation

The Puye Formation is a fanglomerate deposit consisting of poorly sorted boulders, cobbles, and coarse sands made up of dacitic to latitic debris eroded from contemporaneous volcanism and erosion of the Tschicoma Formation. In the lower reaches of Mortandad Canyon and along the Rio Grande, the Puye Formation also contains basaltic debris derived from contemporaneous volcanism and erosion of the Cerros del Rio volcanic field. The Puye Formation contains numerous interbedded lapilli tuff beds and laharic deposits. Lacustrine deposits are volumetrically significant in the distal parts of the fan. The top of the main aquifer was encountered at a depth of 968 ft in fanglomerates of the Puye Formation in Test Well 8 in Mortandad Canyon (Baltz et al, 1963; Purtymun, 1995).

The lower part of the Puye Formation includes the Totavi Lentil, a deposit of well-round cobbles and boulders of Precambrian quartzites and crystalline rocks. The Totavi Lentil probably represents channel deposits of the ancestral Rio Grande, and it may interfinger with the fanglomerate facies of the Puye Formation beneath Mortandad Canyon.

Basaltic Rocks of the Cerros del Rio Volcanic Field

The basaltic rocks of the Cerros del Rio volcanic field (2.3-3.2 Ma; Manley, 1976 and 1979; Bachman and Mehnert, 1978; WoldeGabriel et al., 1994) include Pliocene olivine tholeiites, basaltic andesites, basanites, alkali olivine basalts, and hawaiites and erupted from vents east and west of the Rio Grande (Aubele, 1978, Baldridge, 1979; Dethier, in press). The main part of the volcanic field lies east of the Rio Grande, but outcrop and borehole data indicate that a major extension of the volcanic field lies buried beneath the Pajarito Plateau, including the area near Mortandad Canyon. Cerros del Rio basalts interfinger with fanglomerates of the Puye Formation in Test Well 8 and in well PM-5.

Otowi Member, Bandelier Tuff

The Otowi Member is a poorly consolidated ignimbrite penetrated by boreholes in Mortandad Canyon. The basal part of the Otowi Member includes the Guaje Pumice Bed, a thick series of well-stratified pumice-fall and ash fall-deposits that blanketed the pre-existing landscape before the overlying ignimbrites were erupted. Test Well 8 penetrated 430 ft of Otowi Member, including 45 ft of the basal Guaje Pumice Bed (Baltz et al, 1963).

The Otowi Member is made up of numerous stacked ash-flow tuffs, but it has a massive, homogenous appearance because of the lack of significant welding and because boundaries between individual flow units are often difficult to identify. The Otowi Member consists of light gray to orange pumice lapilli supported by a white to tan, ashy matrix. The matrix is made up of glass shards, broken pumice fragments, phenocrysts, and fragments of nonvesiculated perlite. Shards are glassy and show no evidence for either post-emplacement high-temperature devitrification or for subsequent low-temperature diagenetic alteration. Pumice lapilli typically make up 10 to 30% of the tuff and range from 0.5 cm to 6 cm in diameter. Pumices are larger (up to 20 cm) and more abundant (~40% of the rock) at the top of the unit which has a distinct a orange coloration due to the oxidation of iron by escaping vapors as the ash-flow sheet cooled or to incipient weathering of the top of the unit before deposition of overlying units.

Volcaniclastic Sediments and Tephras of the Cerro Toledo Interval

The Cerro Toledo interval is an informal name given to a sequence of epiclastic sediments and tephras of mixed provenance that lie between the two members of the Bandelier Tuff (Broxton and Reneau, 1995). Although not identified by earlier workers, the Cerro Toledo

interval is probably present beneath much of Mortandad Canyon. The Cerro Toledo interval normally contains well-stratified tuffaceous sandstones and siltstones and subordinate primary ash-fall and pumice-fall deposits. The Cerro Toledo interval also contains poorly-sorted sands, gravels, cobbles, and boulders derived from lava flows of the Tschicoma Formation. The Cerro Toledo interval is approximately 9 ft to 36 ft thick at TA-21 to the north of Mortandad Canyon and about 45 ft thick in upper Pueblo Canyon. In Mortandad Canyon, Cerro Toledo deposits were probably assigned to the lower part of the Tshirege Member by earlier workers.

Tshirege Member, Bandelier Tuff

The Tshirege Member is a multiple-flow ash-flow sheet that forms the prominent cliffs and flat mesa tops of the area around Mortandad Canyon. The Tshirege Member is a compound cooling unit whose physical properties vary vertically and laterally (Broxton et al, 1995). Variations in physical properties result from zonal patterns of welding and crystallization determined by emplacement temperature, thickness, gas content, and composition (Smith, 1960a,b). The Tshirege Member is approximately 300 ft thick in the vicinity of TA-50. The Tshirege Member can be divided into mappable subunits based on a combination of hydrologic properties and lithologic characteristics. These subunits are described below using the nomenclature of Broxton and Reneau (1995) which was adopted by the Environmental Restoration Project.

The Tsankawi Pumice Bed is the basal pumice fall of the Tshirege Member. This pumice bed is normally 1 to 2 ft thick. Pumices in the Tsankawi Pumice Bed are rhyolitic in composition and contain ~5 % phenocrysts, consisting of sanidine and quartz.

Unit 1g is the lowermost unit in the thick ignimbrite deposit of the Tshirege Member. This unit is poorly-indurated, but nonetheless forms steep cliffs because a resistant bench near the top of the unit forms a protective cap over the softer underlying tuffs. Qbt 1g is a porous, nonwelded, poorly sorted, vitric ignimbrite. A thin (10-25 cm) pumice-poor surge deposit is commonly found at the base of this unit.

Unit 1v forms a combination of cliff-like and sloping outcrops comprised of porous, nonwelded, devitrified ignimbrite. The base of unit 1v is thin, horizontal zone of preferential weathering that marks the abrupt transition from vitric tuffs below to devitrified tuffs above; this feature forms a widespread mappable marker horizon throughout Mortandad Canyon. The lower part of Qbt 1v is a resistant orange-brown

colonnade tuff that has distinctive columnar jointing. The colonnade tuff is overlain by a distinctive white band of slope-forming tuffs. The tuffs of Qbt 1v are commonly nonwelded and have an open, porous structure.

Qbt 2 forms a distinctive, medium-brown, vertical cliff that stands out in marked contrast to the slope-forming, lighter-colored tuffs above and below. This unit is the zone of greatest welding in the Tshirege Member with the degree of welding increasing up section through the unit. Because of its greater degree of welding, Qbt 2 is typically nonporous and probably has a low permeability relative to other units of the Tshirege Member. Vapor phase alteration is extensive in this unit.

Qbt 3 is a nonwelded to partially welded, vapor-phase altered ignimbrite. It consists of a basal, nonwelded tuff that forms a broad gently sloping bench on top of Qbt 2 and an upper partially welded tuff which forms the mesa top caprock.

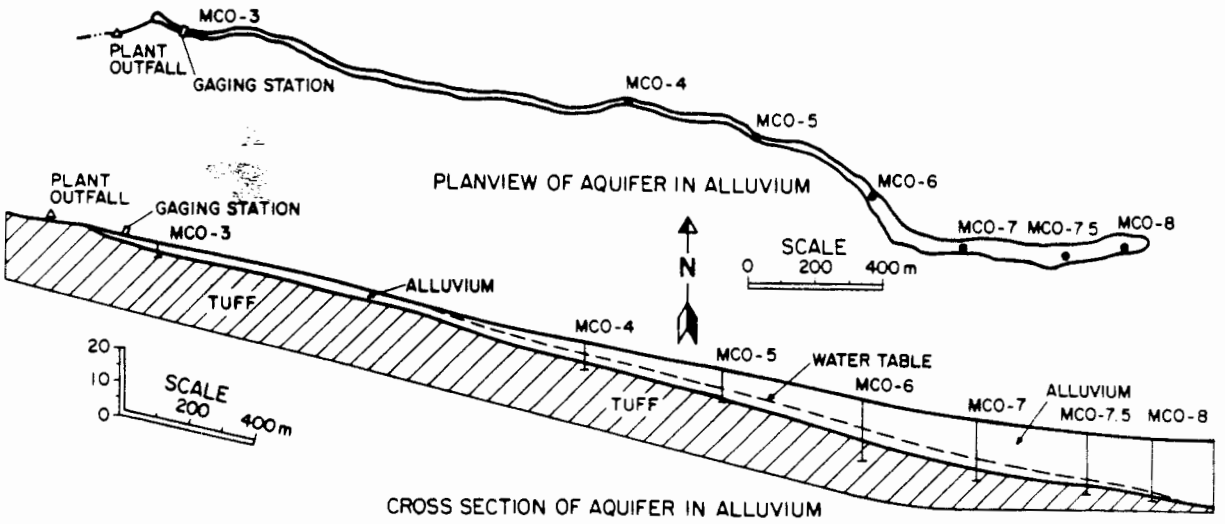

Fig. 1—Planview and cross section of aquifer in alluvium.

cess at this facility. Storm runoff adds to the surface flow in the canyon primarily during the spring and summer months. All of this water recharges a shallow aquifer that is perched in the alluvium on the underlying tuff (Fig. 1). Evapotranspiration and infiltration into the underlying tuff removes water from storage in the aquifer since the aquifer is not a part of the municipal or industrial water supply. The main aquifer which is the source of domestic and industrial water, lies at a depth of 293 m beneath the floor of the canyon. The two aquifers are separated by about 250 m of unsaturated strata.

The industrial liquid wastes collected at TA-50 contain varying amounts of chemical and radiochemical constituents. All of the influent wastes are subjected to a chemical-ion exchange treatment process. During treatment, various chemicals are added under controled conditions to enhance radionuclide decontamination factors. Some of the added chemicals remain in the effluent which is released when radioactivity is $< 10\%$ of the maximum permissible concentration (5). Records of volume of effluent released into the canyon are kept as part of the plant records.

The volume of surface water entering the canyon was determined from flow measurements obtained at a gaging station (Fig. 1). The station was equipped with a water-stage recorder on a 0.152-m (6-inch) modified Parshall flume (for low flow) overset with a 1.22-m (4-foot) wier (for large runoff events) and was rated using standard methods.

The volume of water in storage in the aquifer was determined from seven test holes across the canyon floor (Fig. 1). Water level measurements in the test holes were made in December to determine the volume of saturation at that time.

The chemical characteristics of TA-50 effluent were determined from composite samples of the wastes. Data from weekly composites were applied to release-volume and were averaged over the year. The chemical quality of water from the aquifer was determined 3-4 times annually and averaged for the year. Analytical methods used for various chemical constituents in the effluent and in the water from storage are outlined elsewhere (2).

RESULTS AND DISCUSSION

The volume of storm runoff and TA-48 water passing through the gaging station from 1962 through 1974 ranged from 25 X 10^3 m^3/year to 125 X 10^3 m^3/year for an average annual flow of about 58 X 10^3 m^3/year (Table 1). The volume of effluent released annually from TA-50 was less variable ranging from 40 X 10^3 m^3/year to 60 X 10^3 m^3/year. The dilution ratio (storm runoff and TA-48 water/TA-50 effluents) ranged from 0.6 to 1.7 from 1964-1974 and averaged about 1.0. The average annual volume of surface water (effluent and runoff) entering the canyon was about 105 X 10^3 m^3. There has been no surface flow out of the canyon during the period of study due to the rapid infiltration of surface water into the alluvium.

The volume of water in the aquifer in December was relatively constant from year to year (Table 1). Seasonal variations were observed with lowest volumes occurring during the winter and early spring and maximums occurring after spring snowmelt and storm runoff during the summer. The volume of water in storage at the end of each calendar year ranged from 19 X 10^3 m^3 to 30 X 10^3 m^3 during 1961-1974. Annual losses of water (i.e., added volume-storage volume) ranged from 65 X 10^3 m^3 to 146 X 10^3 m^3/year through a 13-year observation period and averaged 105 X 10^3 m^3 or about the same volume that entered the canyon each year. Water losses from the aquifer were attributed to infiltration and/or evapotranspiration. The losses attributed to evapotranspiration were estimated at about 15% based upon work described

Table 1—The estimated balance of water in the Mortandad Canyon watershed

Year	Effluent TA-50	Storm runoff and TA-48 water	Dilution ratio	Storage in aquifer†	Annual surface and ground water loss in canyon
	X 10^3 m^3			X 10^3 m^3	
1961	--	--	--	20	--
1962	--	70	--	20	70
1963	27‡	125	--	22	150
1964	51	59	1.2	24	108
1965	49	75	1.5	25	123
1966	53	35	0.7	20	93
1967	60	79	1.3	30	129
1968	60	52	0.9	24	118
1969	54	93	1.7	25	146
1970	53	50	0.9	20	108
1971	46	29	0.6	29	66
1972	57	26	0.5	23	89
1973	54	37	0.7	19	95
1974	40	25	0.6	19	65

† Storage as of December 31.
‡ Six months (July to December).

Table 2—Chemical quality of industrial effluent from TA-50; storm runoff and waste water from TA-48.

Effluent TA-50	Chemical constituents										Specific conductance at 25C	pH
	Calcium	Magnesium	Sodium	Carbonate	Bicarbonate	Chloride	Fluoride	Nitrate	Dissolved solids	Total hardness		
year	mg/liter										μmhos/cm	
1963†	52	1.4	188	302	376	28	1.7	63	830	135	1,730	11.6
1964	36	0.9	219	280	386	41	2.5	97	960	94	1,950	11.6
1965	40	0.8	196	278	367	30	2.2	131	860	109	2,070	10.9
1966	52	3.2	151	213	292	17	1.4	50	660	145	1,280	11.4
1967	110	3.1	120	226	306	21	2.3	55	570	289	1,520	11.2
1968	100	2.7	153	265	353	28	3.2	63	620	259	1,630	11.2
1969	91	2.3	286	300	428	34	2.7	131	940	235	1,990	11.2
1970	56	4.8	406	354	472	38	2.1	551	1,500	155	2,340	11.2
1971	42	3.9	433	218	641	169	2.7	372	1,590	120	2,450	9.2
1972	30	3.6	571	91	506	108	1.2	766	1,670	91	2,570	8.8
1973	33	5	310	52	331	60	1.5	310	1,150	105	1,530	9.0
1974	43	4	443	256	561	53	2.6	290	1,540	123	2,640	7.9
Storm runoff	29 (26)‡	3 (46)	22 (26)	0	102 (31)	9 (46)	0.3 (75)	0.5 (41)	174 (21)	103 (17)	192 (35)	8.7
Waste water TA-48	11 (28)	4.3 (77)	58 (49)	0	140 (34)	7.6 (45)	0.9 (33)	1.0 (53)	280 (47)	47 (43)	202 (44)	7.5

† Six months (July to December).
‡ Parenthetic values equal the coefficient of variation [(standard deviation/mean) × 100]; storm runoff means based on a sample size of 12, waste water (TA-48) on a sample size of 9.

elsewhere with infiltration accounting for the remainder (4).

The alluvium in Mortandad Canyon is derived from erosion and weathering of a rhyolite tuff. This alluvium is quite permeable; studies using tritium and chloride as tracers indicate water velocity in the aquifer ranges from 2 to 20 m/day with the higher velocity occurring in the upper reaches of the canyon. Total travel time from the effluent outfall to the eastern extent of the aquifer (about 3 km) is about 1 year (4).

The water from the cooling process at TA-48 originates from a supply which contains ambient levels of the various chemicals. Chemicals are not added during use of this water, thus, chemical quality has not changed significantly through the years (Table 2). Analysis of storm runoff indicates little chemical changes over a 12-year observation period as evidenced by the generally small coefficients of variation (Table 2).

Liquid effluents from TA-50 are the major source of chemicals entering Mortandad Canyon (Table 2). Most of the measured chemical concentrations generally averaged 2 to 20 times higher in TA-50 effluent than in the other two sources (TA-48 and runoff). One exception was magnesium, which averaged higher in storm runoff water. Many of the chemicals in the effluent from TA-50 have increased since 1963 although not in a consistent pattern. Parameters exhibiting increases include magnesium, sodium, bicarbonate, chloride, nitrate, dissolved solids, and conductivity. Relatively stable or decreasing values were observed for calcium, carbonate, fluoride, total hardness, and pH.

The release of industrial effluents into the canyon has changed the quality of the water in the aquifer (Table 3). The pH of the water has changed from 6 to 8 due to the alkaline nature of the liquid effluents. Most of the remaining chemical parameters have increased since 1962, although not consistently with time. The levels of fluoride and bicarbonate have approximately doubled, while for values for calcium, magnesium, sodium, chloride, nitrate, dissolved solids, and specific conductance have increased by factors of 3 to 7. Carbonates remained nondetectable in aquifer water through the entire observation period due to their conversion to HCO_3^- and CO_2 under the conditions in the aquifer.

Annual average concentrations of sodium, chloride, nitrate, and total dissolved solids in the effluent were compared with corresponding concentrations in solution in the aquifer to determine the relationship between

Table 3—Chemical quality of water in aquifer

Year	Chemical constituents										Specific conductance at 25C	pH
	Calcium	Magnesium	Sodium	Carbonate	Bicarbonate	Chloride	Fluoride	Nitrate	Dissolved solids	Total hardness		
	mg/liter										μmhos/cm	
1962	11	4	32	0	91	7	0.6	3.0	320	45	360	6.8
1963	14	5	53	0	90	9	0.5	16	310	67	360	7.2
1964	19	7	100	0	123	21	0.7	68	500	76	510	7.5
1965	16	5	99	0	143	13	0.7	40	400	59	440	7.6
1966	18	4	97	0	172	25	0.4	28	400	62	470	7.7
1967	21	7	140	0	147	16	0.7	15	340	82	400	7.7
1968	17	6	110	0	138	12	0.7	8	300	68	360	7.9
1969	23	5	140	0	129	11	0.5	25	370	81	410	8.2
1970	26	7	132	0	143	15	0.5	137	530	84	560	7.6
1971	44	11	228	0	176	54	0.9	366	990	153	1,130	7.7
1972	40	11	215	0	223	54	0.7	248	910	144	1,000	7.5
1973	33	7	164	0	221	34	1.0	204	786	112	910	7.7
1974	27	6	188	0	254	32	1.0	207	785	93	970	7.7

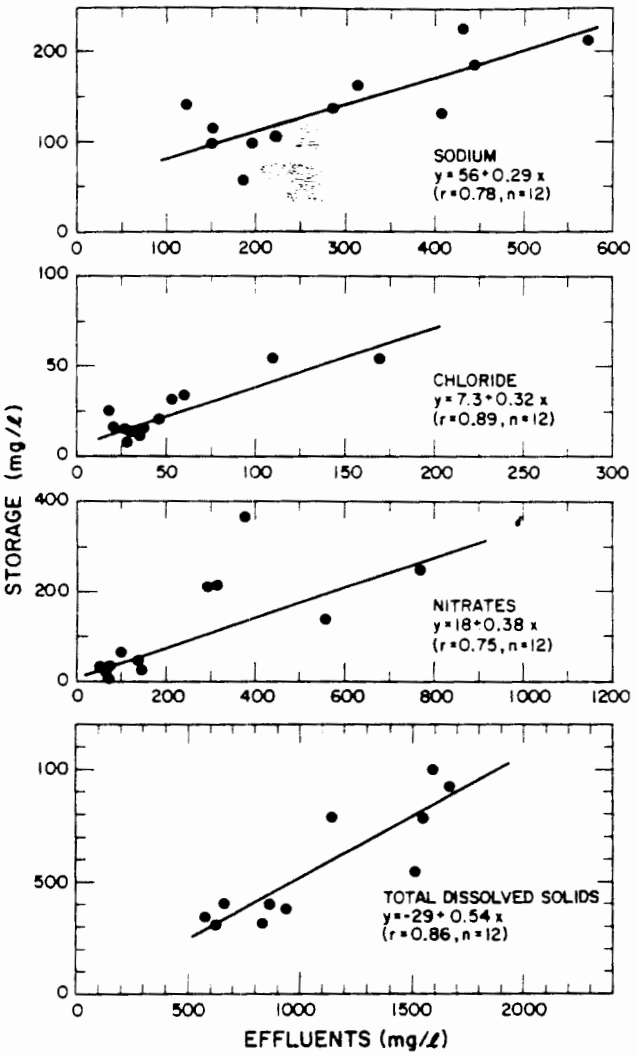

Fig. 2—The relationship of concentrations of sodium, chloride, nitrate, and total dissolved solids in treated effluent to corresponding concentrations in solution in the aquifer.

chemical release and levels appearing in the aquifer (Fig. 2). The linear least squares regressions were all highly significant ($P < 0.01$) with multiple correlation coefficients (r^2) ranging from 0.61 to 0.80.

The slopes of the four regression lines indicate that concentrations of the chemicals in solution in the aquifer averaged from 30–50% of those measured in the effluent when prerelease concentrations (i.e., intercept values) were taken into consideration. Recall that the chemical effluents from TA-50 are diluted with about equal volumes of storm runoff and TA-48 water. Thus, the reduction in chemical concentrations in the aquifer could be the result of dilution alone. The intercepts of the regression lines for sodium, chloride, and nitrate were not significantly different from pre-effluent release levels of chemicals in the aquifer indicating a rapid "turn-over" of the water in storage. This is supported by results of the tracer studies indicating water transit times of about 1 year (4).

Table 4—Mass inventory of chemicals released and in storage

Constituents	Effluents, TA-50 1963–1974	In storage 1962	In storage 1974
	kg × 10^3		
Calcium	35	0.2	0.5
Magnesium	1.8	0.08	0.1
Sodium	170	0.6	3.6
Carbonate	84	0	0
Bicarbonate	150	1.8	4.8
Chloride	31	0.1	0.6
Fluoride	1.3	0.01	0.02
Nitrate	150	0.06	3.9
Total dissolved solids	640	6.4	15

The mass of chemicals added to Mortandad Canyon was estimated from the concentration and volume data in Tables 1 and 2. Corresponding estimates for aquifer water were made from data in Tables 1 and 3. About 625,000 kg of the eight chemicals listed in Table 4 were released into Mortandad Canyon from 1963–1974. Nearly 90% of this mass consisted of nitrates, bicarbonates, carbonates, and sodium with calcium, magnesium, chloride, and fluoride comprising the remainder.

Mass inventories of most of the chemicals in solution in the aquifer during 1974 were higher by factors of 2 to 65 over pre-effluent release inventories (Table 4) and averaged 1–6% of the total chemical releases. The largest increases over prerelease inventories were noted for sodium and nitrate, reflecting relatively larger concentrations of these chemicals in TA-50 effluent.

Chemical concentrations in solution in the aquifer have increased over prerelease levels, however, there has not been a steady accumulation of these materials in the water with time. The rapid loss of water and its associated chemicals from the aquifer prevents chemical accumulation and indicates that cessation of effluent release to the canyon would rapidly improve the quality of water in the aquifer.

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APPENDIX F

Mortandad Canyon Alluvial Wells

Mortandad Canyon Alluvial Wells (mg/L)																											
Location	Date	Code	Ag	Al	As	B	Ba	Cd	Cl	CN	Co	Cr	Cu	F	Fe	Hg	Mn	Mo	Ni	Pb	Se	SO_4	U	Zn	TDS[a]	pH[b]
MCO-3	4/2/81													3.8								128	0.0041		2632	9
MCO-3	10/26/81													3.9								36			732	10.2
MCO-3	4/21/82								33					2.9											1648	9.4
MCO-3	11/15/82																						0.0025			
MCO-3	3/30/83								17					3.1								14	0.001		468	7.9
MCO-3	10/31/83																						0.0206			
MCO-3	4/10/84								1					0.4								15	0.123		345	7.7
MCO-3	9/19/84																						0.123			
MCO-3	4/10/85								16					3.2								17	0.0054		322	8.7
MCO-3	9/23/85																						0.0026			
MCO-3	3/3/86								6					3.4								3	0.0002		175	8.6
MCO-3	9/15/86																						0.004			
MCO-3	3/1/87	no sample date							28					1.2								25			426	7.8
MCO-3	3/24/87								40					7.7								102	0.0038		963	7.9
MCO-3	11/6/87																						0.001			
MCO-3	4/7/88		< 0.001		0.003		0.031	< 0.001	17			0.014	0.01	1.1	0.46		0.104	0.003		0.002	0.002	12	0.001	0.009	247	7.7
MCO-3	4/26/89								294					6.4								102	0.004		1700	8
MCO-3	5/8/90		0.0002	0.456	0.001	0.14	0.0308	0.0005	11			0.0014	0.011	1.2	0.45	0.0002	0.025		0.0062	0.0005	0.001	18	0.0012	0.0092	352	8.3
MCO-3	8/28/91		< 0.0005	1	0.002	0.03		< 0.0005	7	0.017	< 0.03	0.0064	0.006	0.3	0.89	< 0.0002	0.044	0.059	< 0.01	0.004	0.05	5		0.032	250	7.5
MCO-3	10/29/92		< 0.03	0.72	< 0.002	0.07	0.04	< 0.01	16		< 0.004	< 0.02	0.04	1.1	0.57	0.0002	< 0.002	0.94	0.01	< 0.008	< 0.002	21	0.0025	< 0.006	468	8.1
MCO-4	4/2/81													3.2								73	0.0084		1100	8.2
MCO-4	10/26/81													4.2								78			1444	8.1
MCO-4	4/21/82								45					7.5								60	0.0036		1207	9.3
MCO-4	6/2/82					0.2		0.002	22			< 0.005	0.23	5.6		0.0001				0.031		60		0.437	1250	9.2
MCO-4	11/15/82																						0.0045			
MCO-4	1/1/83	no sample date				0.1		0.05				< 0.01	< 0.001			< 0.0001				0.01				0.07		
MCO-4	3/24/83								27					6.3								33	0.0023		788	7.5
MCO-4	10/31/83																			0.01			0.0371			
MCO-4	4/10/84								34					3.2								61	0.0115		1067	8.9
MCO-4	9/19/84																						0.0159			
MCO-4	4/11/85								31					4.7								27	0.0069		642	7.7
MCO-4	9/24/85																						0.0078			
MCO-4	3/3/86				< 0.002	0.18	0.08	< 0.001	29			< 0.005	0.093	4	0.428	< 0.0001	0.008			0.004	0.008	44	0.0097	0.05	944	7.7
MCO-4	9/15/86																						0.006			
MCO-4	3/1/87	no sample date							38					3.9								60			551	9.9
MCO-4	3/23/87								30					2.4								24	0.0024		601	8.4
MCO-4	11/6/87																						0.004			
MCO-4	4/11/88				0.003		0.218	< 0.001	38			0.002	0.01	2.9	0.23		0.018	0.006		0.002	0.001	50	0.006	0.014	1041	7.9
MCO-4	4/26/89								54					1.7								105	0.003		1060	7.5
MCO-4	5/8/90		0.0002	0.126	0.001	0.14	0.106	0.0005	29			0.051	0.0293	1.7	0.33	0.0002	0.0031		0.121	0.0036	0.001	53	0.0048	0.0866	910	7.8
MCO-4	8/28/91		< 0.0005	2.4	0.006	0.11		0.0006	29	0.034	< 0.03	0.0122	0.051	1.4	1.3	< 0.0008	0.268	0.01	< 0.01	0.016	0.09	30		0.07	500	7
MCO-4	11/6/92		< 0.03	1.07	< 0.002	0.096	0.16	< 0.01	15		< 0.004	< 0.02	< 0.03	1.6	0.7	0.0003	< 0.002	0.2	0.01	< 0.008	< 0.002	22	0.0038	0.03	614	7.5
MCO-4	7/19/93		< 0.01	9.6	0.002	0.1	0.22	< 0.003	19	0.03	< 0.004	0.02	0.035	1.2	6.8	0.0005	0.32	0.21	< 0.01	0.025	< 0.002	19	0.0052	0.06	724	7.4
MCO-4	6/23/94		< 0.02	2.2	0.002	0.053	0.076	< 0.003	12	< 0.01	< 0.004	0.028	0.02	1.8	1.4	0.0002	0.17	0.25	< 0.01	< 0.006	< 0.002	11	0.0018	0.043	396	7.8
MCO-5	4/2/81													1.9								72	0.0079		1066	8.3
MCO-5	4/21/82								34					2.3									0.0036		947	7.4
MCO-5	11/15/82																						0.0016			
MCO-5	3/29/83								28					6.1								42	0.0033		874	8.3
MCO-5	10/31/83																						0.0038			
MCO-5	4/10/84								39					4.2								79	0.0092		1190	7.7
MCO-5	9/19/84																						0.022			
MCO-5	4/11/85								37					1.5								36	0.0015		659	7.3
MCO-5	9/24/85																						0.0043			
MCO-5	3/3/86								29					4								53	0.0087		1071	7.7
MCO-5	9/15/86																						0.002			
MCO-5	3/1/87	no sample date							37					3								48			548	7.5
MCO-5	3/23/87								28					1.9								21	0.0017		1010	7.7
MCO-5	11/6/87																						0.004			
MCO-5	4/11/88				0.004		0.219	< 0.001	35			0.002	0.008	2.8	0.21		0.025	0.006		0.002	0.001	43	0.006	0.012	1086	7.6
MCO-5	4/26/89								66					1.6								100	0.003		1000	7.4

[a] Total Dissolved Solids

Mortandad Canyon Alluvial Wells

Mortandad Canyon Alluvial Wells (mg/L)

Location	Date	Code	Ag	Al	As	B	Ba	Cd	Cl	CN	Co	Cr	Cu	F	Fe	Hg	Mn	Mo	Ni	Pb	Se	SO_4	U	Zn	TDS[a]	pH[b]
MCO-5	5/8/90		0.0002	1.1	0.001	0.14	0.18	0.0005	31			0.0125	0.0167	1.9	1.3	0.0002	0.0259		0.0085	0.0027	0.001	51	0.0029	0.041	982	7.5
MCO-5	8/28/91		< 0.0005	0.2	0.006	0.1		< 0.0005	31	0.033	< 0.03	0.0122	0.037	1.4	0.04	0.0009	0.309	0.011	< 0.01	0.02	0.08	31		0.063	488	7
MCO-5	11/6/92		< 0.03	1.08	< 0.002	0.089	0.1	< 0.01	13		< 0.004	< 0.02	< 0.03	1.9	0.24	0.0003	< 0.002	0.08	0.01	< 0.008	< 0.002	17	0.0021	0.007	400	8.1
MCO-5	7/19/93		< 0.01	7.3	0.002	0.07	0.21	< 0.003	17	0.02	< 0.004	0.013	0.031	1.2	5.7	< 0.0002	0.17	0.14	< 0.01	0.034	< 0.002	14	0.0027	0.13	574	7.2
MCO-5	6/23/94		< 0.02	2.9	< 0.002	0.05	0.12	< 0.003	16	< 0.01	< 0.004	< 0.004	0.013	1.9	1.8	0.0001	0.045	0.26	< 0.01	< 0.002	< 0.002	13	0.0021	0.034	506	7.6
MCO-5	8/1/95		< 0.01	0.38	0.006	0.054	0.078	< 0.004	18	< 0.01	< 0.004	< 0.004	< 0.004	1.5	0.25	< 0.0002	0.004	0.13	< 0.01	< 0.002	0.002	16	0.00144	< 0.02	406	7.27
MCO-6	4/2/81													2.4								69	0.0075		1192	7.8
MCO-6	10/26/81													2.2								72			1090	7.2
MCO-6	4/21/82								35					2.9									0.0042		1100	7.3
MCO-6	11/15/82																						0.0042			
MCO-6	3/29/83								25					5.1								44	0.0037		899	7.5
MCO-6	10/31/83																						0.007			
MCO-6	4/10/84								51					5.1								94	0.0212		1459	7.9
MCO-6	9/19/84																						0.013			
MCO-6	4/11/85								34					1.4								32	0.0031		618	7.4
MCO-6	9/24/85																						0.006			
MCO-6	3/3/86								29					2.9								52	0.0092		1037	7.8
MCO-6	9/15/86																						0.012			
MCO-6	3/1/87	no sample date							39					3.3								53			775	9
MCO-6	3/23/87								29					2.3								29	0.0027		751	7.6
MCO-6	11/6/87																						0.004			
MCO-6	4/12/88				0.004		0.206	< 0.001	30			0.001	0.014	2	1.1		0.145	0.006		0.006	< 0.001	20	0.003	0.025	338	6.8
MCO-6	4/26/89								27					1.9								38	0.004		782	7.3
MCO-6	5/8/90		< 0.0002	2.99	0.0019	0.14	0.184	0.0017	27			0.005	0.0114	1.9	2	0.0002	0.137		0.0109	0.0082	0.001	41	0.0059	0.045	1	7.4
MCO-6	8/28/91		< 0.0005	3.7	0.005	0.11		< 0.002	23	0.011	< 0.03	0.011	0.068	1.3	3.1	0.0009	0.293	0.015	0.03	0.016	0.07	30		0.089	584	2.2
MCO-6	11/5/92		< 0.03	0.1	< 0.002	0.083	0.1	< 0.01	16		< 0.004	< 0.02	< 0.03	2	0.05	0.0001	< 0.002	0.06	< 0.01	< 0.008	< 0.002	18	0.0022	0.009	378	8.3
MCO-6	7/19/93		< 0.01	12	< 0.002	0.08	0.29	< 0.003	19	0.02	0.006	0.011	0.026	1.2	8.1	< 0.0002	0.67	0.19	< 0.01	0.038	< 0.002	13	0.004	0.089	602	7.2
MCO-6	6/27/94		< 0.01	0.025	< 0.002	0.08	0.14	< 0.003	20	< 0.01	< 0.004	< 0.004	< 0.004	1.8	0.05	< 0.0001	< 0.002	0.25	< 0.01	< 0.002	< 0.002	16	0.0027	< 0.02	296	7.5
MCO-6	3/31/95	f	< 0.09	0.17	< 0.003	0.051	0.073	< 0.02	12.9	< 0.01	< 0.004	< 0.01	0.011	2.04	< 0.1	< 0.0002	< 0.003	0.19	< 0.01	< 0.002	< 0.002	15.7	0.00149	< 0.02	204	8.03
MCO-6	3/31/95	f d	< 0.09	1.3	< 0.003	0.05	0.074	< 0.004	13.1	< 0.01	< 0.004	< 0.009	< 0.01	2.12	< 0.1	< 0.0002	< 0.003	0.21	< 0.03	< 0.002	0.002	15.6	0.00146	< 0.02	370	7.78
MCO-6	3/31/95	uf	< 0.09	0.35	< 0.003	0.048	0.077	< 0.004	13.3	< 0.01	< 0.008	< 0.004	< 0.01	1.97	0.17	< 0.0002	< 0.02	0.21	< 0.02	< 0.002	0.003	15.7	0.00152	< 0.02	302	7.77
MCO-6	3/31/95	uf d	< 0.09	0.46	< 0.003	0.052	0.077	< 0.015	13.4	< 0.01	< 0.01	< 0.006	< 0.07	2.06	0.3	< 0.0002	0.033	0.2	< 0.01	< 0.002	0.002	15.7	0.00149	0.18	372	7.74
MCO-6	6/27/95	f	< 0.0111	0.267	< 0.0022	0.0589	< 0.0833	< 0.0033		< 0.00001	< 0.0044	< 0.0044	< 0.0044	1.86	0.133	< 0.0002	< 0.0033	0.144	< 0.0111	< 0.0022	< 0.0012	18.8	0.00203	< 0.0222		
MCO-6	6/27/95	f d	< 0.0111	0.256	< 0.0022	0.0589	< 0.0822	< 0.0033		< 0.00001	< 0.0044	< 0.0056	< 0.0044	1.86	0.111	< 0.0002	< 0.0033	0.156	< 0.0111	< 0.0022	< 0.0011	18.8	0.00187	< 0.0222		
MCO-6	6/27/95	f d D1								0.00001				1.876												
MCO-6	6/27/95	uf	< 0.0111	0.444	< 0.0022	0.0589	< 0.0822	< 0.0033		< 0.00001	< 0.0044	< 0.0067	< 0.0044	1.86	0.2	< 0.0002	< 0.0033	0.156	< 0.0111	< 0.0022	< 0.0011	18.8	0.00184	< 0.0222		
MCO-6	6/27/95	uf d	< 0.0111	0.389	< 0.0022	0.0589	< 0.0844	< 0.0033		< 0.00001	< 0.0044	< 0.0044	< 0.0044	1.88	0.189	< 0.0002	< 0.0033	0.156	< 0.0111	< 0.0022	< 0.0011	18.8	0.00183	< 0.0222		
MCO-7	4/2/81													0.8								38	0.0021		354	7.1
MCO-7	10/26/81													0.4								40			406	6.7
MCO-7	4/21/82								22					0.7									0.0016		383	7
MCO-7	11/15/82																						0.0011			
MCO-7	3/29/83								30					0.6								39	0.0022		688	7.5
MCO-7	10/31/83																						0.0032			
MCO-7	4/10/84								44					0.4								42	0.0011		422	6.8
MCO-7	9/19/84																						0.0025			
MCO-7	4/11/85								46					1.5								63	0.0058		1040	7.4
MCO-7	9/23/85																						0.0081			
MCO-7	3/3/86				< 0.002	0.13	0.12	< 0.001	32			< 0.005	0.063	2	0.02	< 0.0001	0.022			0.001	0.005	41	0.0047	0.08	854	7.4
MCO-7	9/15/86																						0.003			
MCO-7	3/1/87	no sample date							35					3.3								40			777	7.6
MCO-7	3/23/87								30					2.4								37	0.0056		622	8.3
MCO-7	11/6/87																						0.003			
MCO-7	4/11/88				0.003		0.195	< 0.001	36			0.002	0.004	2.8	0.27		0.116	0.02		0.004	0.001	41	0.002	0.025	968	7.5
MCO-7	4/26/89								33					1.5								39	0.004		762	7.8
MCO-7	5/8/90		0.0002	7.4	0.0031	0.2	0.115	0.0005	28			0.0052	0.0306	1.9	3.9	0.0002	0.214		0.0082	0.0115	0.001	21	0.0013	0.047	1	7.1
MCO-7	8/28/91		0.001	3.2	0.006	0.11		< 0.002	23	0.011	< 0.03	0.0184	0.041	1.7	2.6	0.0019	0.687	0.015	0.03	0.029	0.07	30		0.078	444	6.9
MCO-7	11/4/92		< 0.03	0.16	0.0024	0.089	0.18	< 0.01	27		< 0.004	< 0.02	< 0.03	1.5	0.09	0.0003	< 0.002	< 0.03	< 0.01	< 0.008	< 0.002	38	0.0004	0.006	376	7.6
MCO-7	7/19/93		< 0.01	44	0.007	0.08	0.74	< 0.003	25	0.02	0.008	0.027	0.07	1	31	< 0.0002	0.65	0.031	0.03	0.041	< 0.002	17	0.0041	0.17	644	7.1
MCO-7	6/27/94		< 0.01	9.14	0.004	0.085	0.4	< 0.003	19	< 0.01	< 0.004	0.02	0.1	1.3	7.63	0.0001	0.187	0.05	< 0.01	0.027	< 0.002	19	0.0046	0.0525	509	7.2

[a]TDS Total Dissolved Solids

[b]Standard Units

Codes D1 lab duplicate

f field replicate

d field duplicate

f filtered uf unfiltered

Mortandad Canyon Alluvial Wells

Mortandad Canyon Alluvial Wells (mg/L)																											
Location	Date	Code	Ag	Al	As	B	Ba	Cd	Cl	CN	Co	Cr	Cu	F	Fe	Hg	Mn	Mo	Ni	Pb	Se	SO_4	U	Zn	TDS[a]	pH[b]
MCO-7	3/30/95	f	< 0.08	0.42	0.004	0.056	0.16	< 0.004	11.7	< 0.01	0.006	0.006	< 0.007	1.76	0.2	< 0.0002	< 0.003	0.18	< 0.03	< 0.002	< 0.002	12.7	0.00126	< 0.02	324	7.69
MCO-7	3/30/95	f d	< 0.08	< 0.3	0.004	0.058	0.15	< 0.015	11.7	< 0.01	< 0.007	< 0.007	0.008	1.83	0.15	< 0.0002	< 0.003	0.16	< 0.03	< 0.002	< 0.002	12.6	0.0013	< 0.02	304	7.67
MCO-7	3/30/95	uf	< 0.07	1	0.003	0.061	0.17	< 0.004	11.7	< 0.01	< 0.004	< 0.009	< 0.012	1.79	0.58	< 0.0002	0.032	0.18	< 0.03	< 0.002	< 0.002	12.7	0.00134	< 0.02	312	7.68
MCO-7	3/30/95	uf d	< 0.07	3	0.008	0.073	0.2	< 0.004	11.9	< 0.01	< 0.004	0.015	0.013	0.82	1.4	< 0.0002	0.033	0.21	< 0.03	< 0.002	< 0.002	12.8	0.00122	< 0.02	164	7.47
MCO-7	3/30/95	uf d R1	< 0.07	3.1	0.004	0.06	0.17	< 0.004			< 0.004	0.006	0.02		1.4		0.029	0.19	< 0.03	< 0.002	< 0.002			< 0.02		
MCO-7	6/28/95	f	< 0.01	1.87	< 0.0034	0.0632	< 0.152	< 0.0033		< 0.01	< 0.0044	< 0.0049	< 0.0044	1.96	0.972	< 0.0002	< 0.007	0.18	< 0.0111	< 0.0022	< 0.0011	16.6	0.00178	< 0.0222		
MCO-7	6/28/95	uf	< 0.01	21.5	< 0.0073	0.0722	0.268	< 0.0033		< 0.01	< 0.0071	0.0232	0.0332	1.95	12	< 0.0002	0.209	0.188	< 0.0111	0.0156	< 0.0027	17.4	0.00223	0.0699		
MCO-7	8/10/95	f	< 0.01	0.1	0.004	0.07	0.15	< 0.003	16	< 0.01	< 0.004	< 0.004	0.005	1.89	0.1	0.0002	< 0.002	0.15	< 0.01	0.001	< 0.001	19	0.00182	0.02	440	7.45
MCO-7	8/10/95	uf	< 0.01	13	0.007	0.08	0.24	< 0.003	15	< 0.01	< 0.004	0.009	0.019	1.88	6.7	< 0.0002	0.15	0.15	0.01	0.01	0.001	19	0.0024	0.04	434	7.3
MCO-7.5	4/2/81													0.7								23	0.0012		268	7.1
MCO-7.5	10/26/81																						0.0011			
MCO-7.5	6/2/82					0.1		0.002	22			< 0.005	0.13	0.7		0.0005				0.08		76		0.168	938	6.8
MCO-7.5	11/15/82																						0.0023			
MCO-7.5	1/1/83	no sample date				0.09		0.09				< 0.01	0.007			< 0.0001				< 0.01				0.25		
MCO-7.5	3/29/83								30					0.6								51	0.0032		964	7.8
MCO-7.5	10/31/83																			< 0.01			0.0023			
MCO-7.5	4/10/84								42					0.8								42	0.0057		959	7.5
MCO-7.5	4/11/85								49					1.3								63	0.0077		1049	7.4
MCO-7.5	9/23/85																						0.0028			
MCO-7.5	3/3/86								32					2.7								41	0.0066		850	7.4
MCO-7.5	9/15/86																						0.005			
MCO-7.5	3/1/87	no sample date							35					3.2								40				7.7
MCO-7.5	3/23/87								30					2.5								38	0.0057		592	8.3
MCO-7.5	11/6/87																						0.003			
MCO-7.5	4/11/88				0.004		0.288	< 0.001	36			0.001	0.007	2.8	0.61		0.308	0.015		0.007	< 0.001	41	0.002	0.026	938	7.3
MCO-7.5	4/26/89								26					1.6								40	0.004		770	7
MCO-7.5	5/8/90		0.0002	4.5	0.001	0.17	0.245	0.0005	28			0.0047	0.0074	1.45	3.3	0.0002	0.156		0.0071	0.0063	0.001	41	0.0022	0.021	792	7.1
MCO-7.5	8/28/91		0.001	3	0.006	0.1		< 0.002	23	0.011	< 0.03	0.0177	0.025	1.2	2.4	0.001	0.29	0.014	0.03	0.017	0.08	29		0.058	446	7.1
MCO-7.5	11/4/92		< 0.03	0.13	< 0.002	0.1	0.16	< 0.01	24		< 0.004	< 0.02	< 0.03	1.5	0.08	0.0003	< 0.002	< 0.03	< 0.01	< 0.008	< 0.002	23	0.0015	< 0.006	492	8.4
MCO-7.5	6/27/94		< 0.01	15	0.002	0.08	0.54	< 0.003	22	< 0.01	0.005	0.017	0.022	1.1	13	0.0001	0.29	0.06	< 0.01	0.02	< 0.002	15	0.001	0.08	480	7.1
MCO-7.5	8/1/95		0.011	1	< 0.002	0.07	0.14	< 0.01	13.6	< 0.01	< 0.01	< 0.004	< 0.004	1.38	0.55	< 0.0002	0.016	0.04	< 0.01	< 0.002	0.001	14	0.00148	< 0.02	414	7.51

[a]TDS-Total Dissolved Solids
[b]Standard Units
(dea) Lab duplicate
(R) Lab replicate
(F) Field duplicate
(f) Filtered or (uf) unfiltered

APPENDIX G

LOS ALAMOS
NATIONAL LABORATORY
CST-13

RLWTF OPERATIONS MANUAL

TA-50-1 MAIN RADIOACTIVE LIQUID WASTE TREATMENT PLANT

RLW-CST13-DOP-0902

Effective Date: April 18, 1995

ROYBAL, AMY
CST-13
E518

Detailed Operating Procedures

TA-50-1
MAIN RADIOACTIVE LIQUID WASTE TREATMENT PLANT

Radioactive and Industrial Wastewater Sciences Group

Prepared By: _____ 4/14/95
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Steve Hanson, CST-13 Date
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Detailed Operating Procedures
TA-50-1
Main Radioactive Liquid Waste Treatment Plant
Radioactive and Industrial Wastewater Sciences Group

Contents

3. Plant Daily Activities Sheet
4. Plant Daily Log Sheet
5. Log sheet for Alpha Counter
6. Anthrafilter Operation Worksheet
7. Sludge Drum Data Sheet

Detailed Operating Procedures
TA-50-1
Main Radioactive Liquid Waste Treatment Plant
Radioactive and Industrial Wastewater Sciences Group

1.0 PURPOSE

This detailed operating procedure (DOP) ensures the quality of operation at the TA-50-1 Main Plant and the safety of personnel. The TA-50-1 Main Plant is one of three plants owned and operated by the Radioactive and Industrial Wastewater Sciences Group (CST-13) and treats industrial low-level radioactive wastewater from Los Alamos National Laboratory (LANL) facilities.

2.0 SCOPE

This DOP describes procedures for the processes directly involved in the operation of this plant and applies to all CST-13 personnel and technicians working in operations at the TA-50-1 Main Plant. Procedures in this document include

- routine treatment of liquid waste through the radioactive liquid waste treatment plant, and
- routine rotary vacuum filter operations.

Routine procedures. This DOP describes sampling as it relates to running the TA-50-1 Main RLWTP and does *not* describe other routine daily, weekly, or monthly samples or sampling procedures related to the Main Plant facility. Procedures for other routine sampling are found in LW-CST13-DOP-08, "Sampling Associated with TA-50-1 Main Plant Operations."

Procedures for other facilities. Procedures for operating the TA-21-257 plant and the TA-50-1 pretreatment plant are *not* included in this document.

Training and safety requirements. This DOP does *not* detail training and safety requirements for operation of the TA-50-1 Main RLWTP. Detailed safety and training requirements are specified in LW-CST7-SOP-9, "Safe Operating Procedures (SOP) for the TA-50-1 Main Radioactive Liquid Waste Treatment Plant" which should be used in conjunction with this DOP.

3.0 REFERENCES

The following documents cover areas related to or directly affecting the subjects covered in this DOP:

- "Safe Operating Procedure (SOP) for the TA-50-1 Main Radioactive Liquid Waste Treatment Plant" (SOP-09); LW -EM7-SOP-09 (most recent revision);
- "DOP for TA-50-1 Sampling" (DOP-08), LW-CST13-DOP-08 (most recent revision);
- "SOP for TA-50-1 Sampling" (SOP-08), LW-CST13 SOP-08 (most recent revision);
- "SOP for TA-50-1 Solid Waste Disposal" (SOP-11), LW-EM7-SOP-11 (most recent revision);
- Plant G2 Users System Guide (most recent revision);
- "Cross-Country Waste Line Operations," LW-CST13-SOP-8 (most recent revision);
- LW-CST13-DOP-4, "Alarms" (most recent revision)

Personnel should use these documents with this DOP.

4.0 DEFINITIONS AND ACRONYMS

4.1 Definitions

CST-13 personnel or technicians	Persons who are either employed by CST-13 or are resident contractors dedicated to CST 13 operations.
final effluent	Water flowing from either effluent holding tank to the outfall for discharge to the environment.
gravity filter effluent	Water flowing from the discharge side of the gravity filter.
Main Plant	The treatment plant located at TA-50 that treats low-level radioactive wastewater.
raw feed	Water pumped from either influent holding tank to flash mixers.
raw influent	Water entering the TA-50-1 main plant through the RLWCS. Raw influent is stored in the raw influent holding tanks at WM-2.

4.2 Acronyms

CST-13	Chemical Science and Technology, CST-13
DOP	detailed operating procedure
LANL	Los Alamos National Laboratory
RLWTP	Radioactive Liquid Waste Treatment Facility
SOP	safe operating procedure

STE #1		settling tank #1
STE #2		settling tank #2
WM-2		TA-50-2

5.0 CONTROLS

5.1 Control Locations for Wastewater Treatment

Wastewater treatment operations are controlled from the following locations:

- Main Control Panel on the south wall, Room 116C,
- Motor Control Center north and west of the plant operator's desk, Room 116C,
- Gravity Filter Control Panel south of the gravity filter, Room 116;
- control panel on the column northwest of the gravity filter; Room 116
- computer at the plant operator's desk, Room 116C;
- feeder control panels at the chemical feeders, Room 116 and
- locally at the operation being performed.

See Attachment 2 for a floor plan showing locations of control panels.

5.2 Control Locations for Sludge Operation

Rotary vacuum filter operations are controlled from the following locations in Room 116B:

- MCC-A panel north of the vacuum filter on the vacuum filter platform;
- precoat control panel on the column north of the stairs; and
- locally at the operation being performed.

See Attachment 2 for a floor plan with locations of control panels.

5.3 Control Indicators

The following table summarizes the meanings of control indicators.

This colored light near the operated control . . .	means this . . .
green	generally, an operation, such as a pump or valve, is closed or off.
red	the operation is open or on.

For information about status indicators for valves and pumps on G2, view the help screens or review the *Plant G2 Users System Guide* in Room 114. Generally, open valves on G2 will be green and closed valves will be black.

6.0 PRESTART CHECK (INITIAL VALVE SETTINGS)

Before starting the plant, verify that specific valves are in the correct position for plant operation. These valves will normally be in their correct position when the plant is not being operated.

6.1 Valves Normally Closed

The following valves must be *closed* (green light).

Location	Valve	Comment
main control panel, Room 116C	EFF V14	labeled "outlet valve to canyon"
	ESW V16	labeled "outlet valve effluent tank 1 to surface wash"
	EFF V17	labeled "outlet to service pumps"
	DIS V18	always locked and closed *
	SUC V19	always locked and closed*
	ESW V22	labeled "outlet valve effluent tank 2 to surface wash."
gravity filter control panel, Room 116	V1	ion exchange columns; not in service
	V3	surface spray
	V4	for backwashing only; see Section 9.0
	V5	for backwashing only; see Section 9.0
	V8	surface spray
	V9	for backwashing only; see Section 9.0

*The Building Manager has access to the keys for V18 and V19.

6.2 Parallel and Series Operation

The TA-50-1 Main RLWTP is designed so the flash mixers and flocculators may be operated in either series or parallel. Before operating the plant, visually check the preset valves to ensure that the valves are in the proper operating position. The table below lists the valve positions for series and parallel operations. Currently, the plant is normally operated in *series* mode and should be valved for this configuration. (See Attachment 1, Schematic 2.)

Valve Positions for Parallel and Series Operation.

Valve	Location	Series (position)	Parallel (position)
STE V18	flash mixer, Room 116	closed	open
STE V19	flash mixer, Room 116	open	open
STE V01	Room 16	open	closed
STE V02	Room 16	open	closed
STE V03	Room 16	closed	open

7.0 STARTING UP PLANT OPERATIONS

The TA-50-1 main plant treats wastewater in batches rather than running 24-hours a day, and so the plant must be started up and shut down each day. The general order of actions for starting up the plant are to

- lower the level of water in the gravity filter,
- begin the transfer of water from the primary clariflocculator (STE #1) to the secondary clariflocculator (STE #2), and
- bring raw influent into STE #1 from the raw influent holding tanks.

These are steps explained in detail in this section.

7.1 Influent Tank Mixers

Raw influent in the raw influent holding tanks must be well mixed before starting treatment.

Step	Action	Comment
1	Check the level of the influent holding tank to ensure the tank is more than 20% full so the mixers are completely submerged in water.	The level is indicated on the computer in Room 116C and on the wall gauge in Room 116C.
2	*IF . . .*	*THEN . . .*
	the tank is more than 20% full	start the influent holding tank mixer (red light = on) for the tank that you are using
	the level of the influent holding tank goes below 20% at any time during plant operations	turn off the mixer

The following table summarizes the main control panel labels for the influent tanks in Room 116C.

Influent Holding Tank	Label
75,000-gal. tank (75K tank)	north mixer
25,000-gal. tank (25K tank)	south mixer

7.2 Opening the Gravity Filter

Before moving water through the clariflocculators, lower the water level in the gravity filter by opening the gravity filter effluent valves and allowing water to flow through the gravity filter to the effluent holding tanks.

The following table summarizes the procedure.

Step	Action	Comment
1	Add CO_2 to the gravity filter by opening the turn valve above the gravity filter one-quarter turn past full on the rotameter.	The pH of treated water discharging from the gravity filter is generally about 7.0 ± .6.
2	Allow flow from the gravity filter to the effluent tank by opening the following valves on the gravity filter control panel in Room 116: • V2, • V5, and • V6.	red light = open. **V5 is a throttling valve, do not open full.** Use this valve to control the level of the gravity filter during operations.

7.3 Gravity Filter Effluent Sampling

A continuous stream of gravity filter effluent is pumped to a sample station and a timed, composite sample of the gravity filter effluent is collected for the duration of plant operations. The sampling station is in the sink along the south wall in Room 116.

Step	Action	
1	Verify that the collection bottles for gravity effluent sampling are in place and properly labeled.	
2	*IF . . .*	*THEN . . .*
	gravity filter effluent is going to the north tank	then the bottle labeled "North" should be in position under the sample port
	gravity filter effluent is going to the south tank	the bottle labeled "South" should be in position under the sample port.
3	Turn on the gravity filter effluent sample pump at the control box on the wall east of the sink.	
4	Verify that the sampling timer on the wall behind the sink is correctly set. The outside arm of the timer dial should be set at one minute; the inside arm of the timer dial should be set at seven minutes.	
Step	**Action**	
5	Turn on the timer switch on the wall behind the sink.	
6	Open the main valve for gravity filter effluent on the sample panel and adjust valves for continuous and timed streams as necessary. DOP-08 details the procedure for submitting samples for analysis.	

LW-CST-13-DOP-08 details the procedure for submitting samples for analysis.

7.4 Moving Water from STE #1 to STE #2

After the level of water in the gravity filter has gone down to a level in the range of 40 to 70% full, water can be transferred from STE #1 to STE #2. The water will be pumped from the effluent weir of STE #1 into Flash Mixer #2, which flows directly into STE #2. Schematic 2 contains a flow diagram for the operations listed in this subsection.

Step	Action
1	Push the "start" button for Pump PWT-8 (red light = on) at the Motor Control Center in Room 116C to allow flow from STE #1 to flash mixer #2.

7.5 Chemical Feed Start-Up

As soon as PWT-8 has been turned on, the chemical feeding and mixing processes can be started.

The following table summarizes the procedure.

Step	Action	Comment
1	In Room 116C, turn on feeder vibrator for each chemical feeder by turning each vibrator to "hand" for five seconds and then setting on "automatic."	The controls are labeled "Vibrator No. 3" and "Vibrator No. 4" on the Motor Control Center.
2	In Room 116, turn on the flocculator arms for STE #1 and STE #2 by pushing the "flow" buttons on the control panel northwest of the gravity filter.	The control panel for STE #1 is labeled "Flocculation and Sedimentation Basin No. 1." The other control panel is not labeled. A green light on the Main Control Panel in Room 116C indicates that the flocculators are on. The flocculators are normally operated at a slow speed.
3	In Room 116, start the mixers for both flash mixers by pushing the "start" buttons on the control panels labeled "Flashmixer No. 1" and "Flashmixer No. 2."	The buttons are on the control panel northwest of the gravity filter

Step	Action	Comment
4	In Room 116, turn on both the northwest Ferri-Floc iron feeder and the northeast lime feeders. Turn on the water valve. Turn on the feeder mixer switch. Turn on the feeder control panel.	Controls for each feeder are located at the feeders themselves.
5	Check the augers for each feeder to make sure the chemicals are continually feeding.	
6	Check the operating speed for each of the chemical feeders.	

7.6 Bringing Raw Influent from the Raw Influent Holding Tanks to STE #1

Once water is draining from the STE #1 effluent weir, water can be brought from the raw holding tanks into the plant for treatment. Raw influent will be pumped from WM-2 to Flash Mixer #1, where it will flow into STE #1. This process is started after the chemical feed process and *before* the STE #1 effluent weir is emptied. If the effluent weir is emptied before water can be pumped to STE #1, PWT-8 must be turned off temporarily so that it will not run dry. It can be turned back on as soon as water is flowing steadily into STE #1.

The following table summarizes the procedure.

Step	Action		Comment
1	After the chemical feed process is started and before STE #1 effluent weir is emptied, open the following valves:		
	Room	*Valve*	
	116, gravity filter control panel	V10 (16-INF-V10)	red light = open

Step	Action		Comment
1 (cont)	*Room*	*Valve*	
	116; gravity filter control panel	V11 (16-INF-V11)	**This is a throttling valve; do not open full.**
	116C, main control panel	V11, 75K influent tank (WM2-INF-V11) outlet valve or V12, 25K influent tank (WM2-INF-V12) outlet valve	red light = open
2	Pump wastewater from the influent holding tank to the flash mixers by turning on the following pumps at the main control panel: • Pump No. 3 (WM2-INF-P3) and • Pump No. 4 (WM2-INF-P4).		red light = on
	Adjust the flow of raw influent into Flash Mixer #1 by adjusting valve V11 (16-INF-V11) at the gravity filter control panel in Room 116.		Flow into the plant is monitored on the large, flow meter dial-face at the northwest corner of the gravity filter and is generally run in the range of 100–130 gpm (between 10 and 13 on the flow meter).
	Log the service pump startup time in the plant daily log sheet (Attachment 4) at the operator's desk in Room 116C.		
	Check the plant. Check all flows, sampling sink, and chemical feeders to assure that operations are smooth. Make adjustments as needed.		Chemicals are added to the chemical feeders through hoppers in the penthouse, Room 216. Adding chemicals to feeders requires two operators to be present at all times.

7.7 Raw Feed Sampling

A continuous stream of raw influent is pumped to the sampling station in Room 116 by the same pumps (P3 and P4) that pump raw influent from the holding tanks to Flash Mixer #1. From this stream a timed, composite sample of the "raw feed" is collected for the duration of plant operations. The sampling station is in the sink along the south wall in Room 116.

The following table summarizes the procedure.

Step	Action	Comment
1	Verify that the collection bottle for raw feed sampling is in place.	
2	Open the main valve for raw feed on the sample panel and adjust valves for continuous and timed streams as necessary.	DOP-08 details the procedure for submitting samples for analysis.

7.8 Sludge Recirculation

Sludge is usually recirculated from the bottom of each clariflocculator to the flashmixer for that clariflocculator during plant operation. This assists the chemical flocculation process and increases the efficiency of treatment.

Step	Action	Comment
1	At the motor control center in Room 116C, verify that the sludge recirculation pumps are in the "forward" position: • PWT-4 and • PWT-5.	The sludge recirculation pumps are usually operated in the forward position; however, in unusual circumstances, such as for unclogging the sludge return lines, the sludge recirculation pumps can be operated briefly in the reverse position.
2	Recirculate sludge by pushing the "start" button for each of the sludge return pumps.	red light – on.
3	Visually check for flow.	

7.9 Polyelectrolyte Addition

Occasionally, a polyelectrolyte is used to enhance treatment; however, using polyelectrolyte is not part of routine operations. If polyelectrolyte is being used, turn on the polyelectrolyte pump in Room 116 and check for flow.

8.0 PLANT OPERATIONS

While the plant is operating, it should be checked routinely.

8.1 Routine Checks

While the plant is running, periodically check operations for the following:

- the dial for flow coming into Flash Mixer #1 is between 10 and 13,
- the gravity filter does not become empty or overflow,
- the sampler is working correctly,
- the flash mixers do not overflow,

- the chemicals are continually feeding,
- the pH in the effluent tank is within range (6.5–8.5), and
- all equipment is operational.

8.2 Filling Effluent Tanks

As the plant is running, the effluent tanks will fill up with treated water. Water enters the effluent tanks from the discharge side of the gravity filter and is controlled by valves which direct flow alternately into the north or south effluent tank. The tanks share a common wall and overflow into one another. When one effluent tank is full, the operator switches the valves so that gravity filter effluent will flow into the empty tank.

The following table summarizes the procedure.

Step	Action	Comment
1	As an effluent tank nears full, watch the level on the computer screen or on the LED readout on the Main Control Panel wall (Room 116C).	
2	Switch the valves when the level in the empty tank begins to rise.	The rising level indicates that the level in the full tank has reached the overflow and is beginning to fill the empty tank. At this point, the full effluent tank can be considered full. If something should block the overflow between the tanks, a high level alarm will be triggered when the water rises above the overflow level.
3	*IF . . .*	*THEN . . .*
	the north effluent tank is full	• open valve EFF-V10-WM2 (red = open) at the main control panel and • close valve EFF-V9-WM2 (green = closed) at the main control panel.
	the south effluent tank is full,	• open valve EFF-V9-WM2 (red = open) at the main control panel and • close valve EFF-V10-WM2 (green = closed) at the main control panel.
4	At the sample station in Room 116, remove the full gravity filter effluent bottle from the sample port for gravity filter effluent and replace it with the empty bottle.	One of the bottles is labeled "North," and the other is labeled "South."

Step	Action	Comment
4	*IF...*	*THEN...*
	the south effluent tank is filling	put the "South" bottle under the sample port.
	the north effluent tank is filling	put the "North" bottle under the sample port.
5	Set the full bottle aside. Do **NOT** dump the contents of this bottle.	

8.3 Testing a Full Effluent Tank

Once a tank is full, the operator tests the tank for gross alpha. A composite gravity filter effluent sample is continually collected at the sampling sink in Room 116 while the plant is in operation. If the activity of the gravity filter effluent is less than 4000 disintegrations per minute per liter (1,000 counts per minute/liter) the treated wastewater may be discharged to Mortandad Canyon.

The following table summarizes the procedure.

Step	Description	Action	Comment
1	background count	Run a 30-minute background count on the alpha counter. Record the results in the log (Attachment 5) by the alpha counter.	The reading is usually between 15 and 30 counts per minute (cpm).
2	standard count	Run an 8500 dpm ^{239}Pu standard for one minute on the alpha counter. Record the results in the log (Attachment 5) by the alpha counter.	The reading is usually about 3500–3,600 cpm.

Step	Description	Action	Comment
3	sample analysis	. Using a 10-milliliter (ml) disposable pipette, take a 10-ml sample from the jug containing the composite sample from the full tank. . Place the liquid on a 2-1/4 inch planchette. . Turn on the heat lamp and allow the liquid to completely evaporate. . Using long tongs, heat the planchette over the Bunsen burner until it is dark brown. . Allow the planchette to cool. . Place the planchette in the counter and run a 10-minute count. . Subtract background from the 10-minute count. . Record the count in the log (Attachment 5) by the alpha counter and adjust for background.	Before the effluent can be discharged to the canyon, the alpha count must be below 1000 cpm/l. The planchette is heated to afix the dried sample to the planchette.

8.4 Monitoring pH

The NPDES permit requires that effluent discharged to Mortandad Canyon be within a pH range of 6–9. The pH in each effluent tank can be monitored by computer or by the LED readouts on the main control panel in Room 116C. A tank should not be discharged if the pH is below 6.5 or above 8.0. A tank with a pH of less than 6.5 or greater than 8.0 can be adjusted by the operator.

Adjusting a pH of less than 6.5. The following table summarizes the procedure for adjusting a pH of less than 6.5.

Step	Action	Comment
1	In Room 16, close valves • CTL-V16, • CTL-V17, • CTL-V18, and • CTL-V19. Open valves CTL-V37 and CTL-V38. *Future Procedure: on G2, actuate CTL-V37 (a three-way valve) so that it is open to the gravity filter effluent line and closed to the 75K influent line (which runs through Room 60).*	To adjust a pH of less than 6.5, sodium hydroxide (NaOH) can be added to the effluent tank. **This adjustment must be made while the tank is filling.**
2	In Room 116C, verify that the valve is open to the effluent tank with the pH that must be adjusted. ***North tank.*** Open valve EFF-V9-WM2. ***South tank.*** Open valve EFF-V10-WM2.	Flow must be moving through the line into the appropriate tank for this operation to work.
3	In Room 116C, turn on sodium hydroxide pump No. 3 PA-3, at the motor control panel. Let it run for about 10–30 seconds. Turn it off.	
4	Return all the above valves to their former positions.	
5	In Room 116, open the quarter-turn valve on the CO_2 line above the gravity filter, 16-CO2-V03.	Add CO_2 to the tank to provide mixing. CO_2 will **lower** the pH in the tank. Do not use more than is needed to mix the tank thoroughly.
6	On the computer in Room 116C, open the CO_2 valve to the appropriate effluent tank. ***North tank.*** Open WM2-CO2-V0. ***South tank.*** Open WM2-CO2-V1.	

Step	Action	Comment
7	Allow the tank to mix for 3-5 minutes.	
8	Close the CO_2 valve—WM2-CO2-V0 or WM2-CO2-V1—to the effluent tank.	
9	In Room 116, close the quarter-turn valve on CO_2 line above the gravity filter, 16-CO2-V03.	
10	Monitor the pH briefly to ensure that it is within range before discharging.	

Adjusting a pH greater than 8.0. Carbon dioxide can be added to the effluent tank to lower a pH that is greater than 8.0. The following table summarizes the procedure.

Step	Action
1	In Room 116, open the quarter-turn valve on the CO_2 line above the gravity filter, 16-CO2-V03.
2	In Room 116C, on the computer, open the CO_2 valve to the appropriate effluent tank. *North tank.* Open WM2-CO2-V0. *South tank.* Open WM2-CO2-V1.
3	Allow the tank to mix until the pH in the tank is 7–8.
4	Close the CO_2 valve—WM2-CO2-V0 or WM2-CO2-V1—to the effluent tank,.
5	In Room 116, close the quarter-turn valve on CO_2 line above the gravity filter, 16-CO2-V03.

8.5 Checking pH of the effluent

This check is needed to purge the discharge sampling line and ensure accuracy of the pH reading by allowing the reading to stabilize.

1. Open one of the following valves from the main control panel in Room 116C to discharge effluent from the appropriate tank.

effluent tank	*valve*	*label on the control panel*
south	EFF-V20	south outlet valve
north	EFF-V21	north outlet valve, effluent tank 2 to service pumps 1 and 2.

2. Open valve labeled Final Effluent Main Valve above the sample sink in Room 116C.

3. Turn on the sample pump in Room 116C.

4. Run this pump for at least three minutes, longer if needed to stabilize the pH reading.

5. On the Plant Daily Log, note the pH of the sample, the time started and completed, and initial the entry.

If the pH is between 6.5-8.5, proceed to section 8.6 and follow the procedure to discharge to Mortandad Canyon.

If the pH is below 6.5, adjust the pH following the procedures in section 8.4 "Adjusting a pH of less than 6.5". Then repeat section 8.5 above.

If the pH is above 8.5, adjust the pH following the procedures in section 8.4 "Adjusting a pH of greater than 8.0". Then repeat section 8.5 above.

8.6 Discharging to Mortandad Canyon

If the alpha count and pH are within the appropriate range, the full effluent tank can be discharged to Mortandad Canyon.

Step	Action		Comment
1	From the main control panel, open one of the following valves to discharge effluent from the appropriate tank by opening one of the valves listed below. When the valve is completely open, place the valve controller in the "remote" position (straight up and down).		red light = open
	effluent tank	***valve***	***label on control panel***
	south	EFF V20	south, outlet valve
	north	EFF V21	north, outlet valve, effluent tank 2 to service pumps 1 and 2
2	Allow discharge to Mortandad Canyon by opening valve EFF V14, labeled "outlet valve to Canyon" at the main control panel. When the valve is completely open, place the valve controller in the "remote" position (straight up and down).		red light = open
3	From the main control panel, pump treated wastewater from the effluent tanks to the canyon by turning on the following pumps: Service Pump No. 1 Service Pump No. 2		red light = on
4	Verify that • sample station in Room 116 is on, • the valves for the final effluent sample lines are open, and • flow is running.		The pH probe for continuous monitoring is located in this sample loop, and the pH of effluent being discharged to Mortandad Canyon can be viewed on the digital readout at the main control panel in Room 116C.

5	When the volume in effluent tanks has decreased to a set level and the service pumps (Pumps No. 1 and No. 2) automatically turn off, close the following valves from the main control panel: • EFF V14, labeled "outlet to canyon"; • EFF V20 for the south tank, labeled "outlet valve, south"; *or* • EFF V21 for the north tank, labeled "outlet valve, north, effluent tank 2 to service pumps 1 and 2."	green light = closed, off
6	Record the discharge data on the plant daily log sheet (Attachment 4).	

9.0 SHUT-DOWN OPERATIONS

The general order for shutting down plant operations is to fill the gravity filter and STE #2, and then to fill STE #1. These steps are explained in detail in this section.

9.1 Sludge Recirculation

At the motor control center, stop the recirculation of the sludge approximately 10 minutes prior to turning off PWT-8 (see 9.3) by pushing the "stop" button for the following pumps:

- PWT-4 and
- PWT-5.

The sludge recirculation pumps need to be turned off prior to PWT-8 in order to allow the sludge recirculation lines to flush so that sludge does not settle in the lines.

9.2 Filling the Gravity Filter

The following table summarizes the procedure for filling the gravity filter.

Step	Action	Comment
1	From the gravity filter control panel, stop the flow from the gravity filter into the effluent tanks by closing the following valves: • V2, • V5, and • V6.	green light = closed
2	Turn off the gravity filter effluent sampling pump on the sampling panel east of the sampling sink and allow the gravity filter to fill up.	The water level is determined visually and by computer. The gravity filter and STE#2 will equalize. When the gravity filter is full, the effluent wier of STE#2 will also be full.

9.3 Shutting Down Chemical Feeds and Filling STE #1

The following table summarizes the procedure for shutting down chemical feeds and filling STE #1.

Step	Action
1	When the gravity filter is full, turn off pump WT-8 (green light = off) at the motor control center in Room 116C.
2	In Room 116C, turn off the feeder vibrators from the controls on the motor control center labeled "Vibrator No. 3" and "Vibrator No. 4."
3	In Room 116, at each chemical feeder: • turn off the feeder control panel, • turn off the feeder mixer switch, and • turn off the water valve.
4	In Room 116, close the CO_2 turn valve above the gravity filter to stop the addition of CO_2 into the gravity filter.
5	If the polyelectrolyte pump is on, turn off the pump.
6	Turn off both Flocculators No. 1 and 2 from the control panel northwest of the filter control panel.
7	Turn off both flash mixers by pushing the "stop" button on the control panel northwest of the gravity filter.

9.4 Shutting Down Raw Feed

The following table summarizes the procedure for shutting down the raw feed.

Step	Action
1	When the effluent weir in STE #1 is full, discontinue pumping wastewater from the influent holding tanks to Flash Mixer #1 by turning off the following pumps from the main control panel (green light = off) in Room 116C (Schematic 1): • pump No. 3 and • pump No. 4
2	Stop the applicable mixer (green light = off).
	Close the influent holding tank valve by closing V11 or V12 (green light = closed.

tank	*mixer label*	*valve*	*valve label*
75K	north	WM2-INF V11	outlet valve
25K	south	WM2-INF V12	outlet valve

3	From the gravity filter control panel (green = closed), close the valves to Flash Mixer #1: • V10 (16-INF-V10) and • V11 (16-INF-V11).
4	Turn off the automatic sampler at the sample control panel in Room 116.
5	Record the plant shut down time on the plant daily log sheet (Attachment 4) at the operator's desk in Room 116C.

10.0 SAMPLING

The following samples are collected during plant operations:

- plant influent from the radioactive liquid waste collection system (RLWCS),
- raw feed from the influent holding tanks,
- gravity filter effluent,
- gamma sampling from the RLWCS,
- TA-55 industrial waste line,
- samples required under the National Pollutant Discharge Elimination System (NPDES), and
- sludge sample.

For detailed information on these samples, see LW-CST13-DOP-08, "DOP for TA-50-1 Sampling for Main Plant Operations."

11.0 BACKWASHING THE GRAVITY FILTER

The gravity filter is backwashed approximately once a month. A log of the cumulative number of hours during the filter is in operation and of the number of liters treated through the filter is kept to indicate when the filter should be backwashed (see Attachment 6, Anthracite Filter Operation).

11.1 Draining the Gravity Filter

Before the backwashing can begin, the filter must be completely empty of water. The following table summarizes the procedure for draining the gravity filter. *Always* drain the gravity filter in this manner; *never* drain the entire contents of the gravity filter through the V7 drain valve.

Step	Action	Comment
1	Allow water to drain from the gravity filter to the effluent tanks by opening the following valves from the gravity filter control panel: • V2, • V5, and • V6.	red light = open **V5 is a throttling valve; do not open full.**
2	Visually check the level of the gravity filter.	
3	When the gravity filter is drained, close the following valves from the gravity filter control panel: • V2, • V5, and • V6.	green light = closed
4	Verify the following valves are closed: from the gravity filter control panel: • V4 and • V9; computer in Room 116C (G2 "Backwash System" screen): • WM2-INW-V2 and • WM2-INW-V4.	green light = closed

Step	Action	Comment
5	Drain center trough of gravity filter using valve V7 inside the gravity filter control panel. Open and close the valve quickly several times to slow the flow rate of the water as it drains. Leave the valve open for backwashing.	2 position = open This trough must be drained slowly to prevent the drain lines from backing up. The timing and duration of these cycles is based on operator judgment and must be controlled by experienced operators. **ALWAYS** drain ***only*** the trough through this valve. Do not attempt to drain the the entire contents of a full gravity filter through this drain line.

11.2 Level in the 75K Influent Holding Tank

Because backwash water drains through V7 into the 75K influent holding tank, the level in this tank is used to determine the volume of water used for the backwash.

Step	Action
1	Take a reading of the 75K influent tank level at the computer in Room 116C.

11.3 Backwashing the First Side of the Gravity Filter Bed

Each side of the gravity filter is backwashed separately.

The following table summarizes the procedure for backwashing the first side of the gravity filter bed.

Step	Action	Comment
1	When draining is completed, open inlet valve V4.	
2	Open valve INW-V3 (Schematic 1) at the Computer in Room 116C to allow industrial water to flow into the backwash system	
3	**To prevent water hammer, SLOWLY** open valve V12 (16-BKW-V12) at the gravity filter control panel to allow flow into the gravity filter by turning the flow control dial below the V12 control on the Gravity Filter Control Panel.	red light = open The flow should allow the filter media to expand but should not be so high that it washes the media out of the filter. Currently, pressure in the industrial water line is insufficient to cause a filter wash-out, and so V12 should be opened completely.

Step	Action	Comment
4	Allow flow to continue until the trough in the first side is full and the flow is clear, approximately 15 minutes. Keep track of the time.	

11.4 Backwashing the Second Side of the Gravity Filter Bed

The following table summarizes the procedure for backwashing the second side of the gravity filter bed.

Step	Action
1	When the water in the first side of the gravity filter is clear, do the following . open inlet valve V9 to the second side of the gravity filter and after it is full open . close the inlet valve V4 to the first side of the gravity filter.
2	Allow flow to continue until the second side is full and the flow is clear, approximately 15 minutes. Keep track of the time.
3	**To prevent water hammer, SLOWLY** close valve V12 (16-BKW-V12) by turning the dial below the V12 control on the gravity filter control panel (green light = closed).
4	Close inlet valve V9 at the Gravity Filter Control Panel (green light = closed).
5	Close valve INW-V3 (Schematic 1) at the computer in Room 116C.
6	Using the final level of the 75K Influent Tank, calculate and record the volume of water used for the backwash on the Daily Log sheet as a "miscellaneous influent" (see Attachment 4). Log the backwash in the log for anthracite filter operation (Attachment 6).

11.5 Starting Up the Plant

The plant must be run after the gravity filter is backwashed.

The following table summarizes the procedure for starting up the plant.

Step	Action	Comment
1	Transfer water from STE #1 to STE #2 and start the chemical feed processes. Bring raw influent into the plant from the raw holding tanks	See also Subsections 7.4 and 7.5. See also Subsections 7.1, 7.6, 7.7, and 7.8 and Sections 7.0, 8.0, and 9.0.
2	Close V7 on the Gravity Filter Control Panel to ensure that the trough at the bottom of the gravity filter is thoroughly rinsed.	Before the gravity filter effluent valves are opened and normal treatment operations started, the gravity filter should be filled above the backwashing troughs (see also Subsections 7.2 and 7.3).
3	Run the plant as usual	See also Sections 8.0 and 9.0.

12.0 DRAWING SLUDGE FROM CLARIFLOCCULATORS (STE #1 AND STE #2)

Drawing sludge from clariflocculators requires at least two operators, one in the plant operation area and another at WM-2. The two operators communicate by phones, radios, or by the paging system.

12.1 Initial Operations in Room 116C

The following table summarizes the procedure for initial operations in Room 116C.

Step	Action	Comment
	Turn both clariflocculator mixers on to "high" by pushing the following buttons on the control panel on the column northwest of the gravity filter: . "Low" then . "Medium" then . "High."	One set of controls is labeled "Flocculation and Sedimentation Basin No. 1"; the other set of controls is labeled "STE #2 Clariflocculator Mixer." A green light will be lit by the label "Flocculation and Sedimentation Basin No. 1" on the Main Control Panel and the Motor Control Center lights will be lit by the label "Flocculation and Sedimentation Basin No. 1 or No. 2."

12.2 Initial WM-2 Operations

The following table summarizes the procedure for the initial WM-2 operations.

Step	Action
1	Open the hatch of the sludge tank and measure the current level of sludge in the tank with the special tape measure kept for this purpose in WM-119. Measure from the top of the hatch to the surface of the sludge.
2	Call the operator in Room 116 to report the current level of sludge in the holding tank in feet and inches to the operator, so that the operator can record this information on the Daily Log sheet (Attachment 4).

12.3 Drawing Sludge

The following table summarizes the procedure for drawing sludge.

Step	Action
1	In Room 116, manually open the sludge drain valve south of the clariflocculator that you will draw sludge from first: • STD V01 for Flocculator No. 1 *or* • STD V05 for Flocculator No. 2
2	At WM-2, allow sludge to flow from the clariflocculators into the sludge holding tank by opening the quarter-turn valve, outside and south of the motor control center, on top of WM-2.
3	When the desired volume of sludge has been drained from the first clariflocculator, close the sludge drain valve opened in Room 116. Open the drain valve for the other clariflocculator.
4	When the desired volume of sludge has been drained from the second clariflocculator, close the sludge drain valve in Room 116.

12.4 Final WM-2 Operations

The following table summarizes the procedure for final WM-2 operations.

Step	Action	Comment
	Close the quarter-turn valve that you opened in step 3 in Subsection 12.3.	
	Measure the ending level of sludge in the tank with a tape measure and call the plant operator in Room 116 to report the final sludge level. The operator in Room 116 will record the final level on the plant daily log sheet (Attachment 4).	

12.5 Starting Up the Plant

The following table summarizes the procedure for starting up the plant.

Step	Action	Comment
1	Bring raw influent from the raw holding tanks into STE #1.	See also Subsections 7.1, 7.6 and 7.7.
	Start the chemical feed process.	See also Subsection 7.5.
	Start the sludge recirculation pump for STE #1.	See also Subsection 7.8.
2	When STE #1 is full and begins to overflow into the outer weir, begin transferring water from STE #1 to STE #2.	See also Subsection 7.4.
	Start the sludge recirculation pump for STE #2.	See also Subsection 7.8.
3	When STE #2 is near full, begin to lower the gravity filter.	See also Subsections 7.2 and 7.3.
4	Operate the plant as usual.	See also Sections 8.0 and 9.0.

13.0 ROTARY VACUUM FILTER OPERATIONS

Generally vacuum filter operations take up to eight hours. Because many operations related to preparation of vacuum filter cake are based on operator experience and judgment, these operations should be done only by experienced operators.

Rotary vacuum filter operations are done in Rooms 116B and 216 (the penthouse). Unless otherwise specified, procedures outlined in this section are done in Room 116B. See Subsections 2.2 and 2.3 for control panel locations and the significance of the control panel indicator lights. Unless otherwise specified, equipment, pumps, and valves in the following subsections are shown on Schematic 3 in Attachment 1. Attachment 2 contains a floor plan with equipment and control panels for sludge operations.

13.1 HEPA filters and CAMs

Room 116B is equipped with high-efficiency particulate air (HEPA) filters and continuous air monitors (CAMs) with alarms. The filter is enclosed and under a vacuum that is vented through a HEPA filter.

13.2 Exhaust Fan

A red light on the panel on the west wall indicates that the exhaust fan, FE-25, is on; a green light on the panel that indicates the fan is off.

WARNING: When entering Room 116B, ensure that the exhaust fan, FE-25 is on. If the fan is off, do not continue operations. Leave the room and contact the building manager.

13.3 Protective Clothing

The personal protective clothing specified in SOP-06 is required for vacuum filter operations.

WARNING: When sludge is exposed to the atmosphere, you must wear a respirator.

13.4 Drum Preparation

White steel 55-gallon drums are used to package the vacuum filter cake. These drums are usually prepared in Room 16 on the day before the drums are filled. Drums are obtained from the LANL stock and, before they are prepared, are stored near the elevator entrance on the north side of Room 16.

The following table summarizes the procedure for drum preparation.

Step	Action
1	Visually inspect the drum for any damage, such as dents.
2	Place a 90-mil polyethylene liner inside the dry empty drum.
3	Place a plastic bag inside the lined drum. Drape the sides of the bag over the sides of the drum.
4	Stencil the words "Radioactive Material" on the drum lid with an indelible marker.
5	Place the drum on the reusable drum dolly.
6	Place the drum dolly and drum in the elevator. Move them to Room 116B.

13.5 Tank Preparation for Seal Water in the Vacuum Pump

The following table summarizes the procedure for preparing the tank for seal water in the vacuum pump.

Step	Action
1	Open valve INW-V13 (Schematic 1) on the east wall behind the vacuum pump.
2	Fill the tank to overflowing, when liquid flows out of the outlet at the bottom of the tank.
3	When the tank is full, adjust INW-V13 down to an appropriate flow. Use your judgment to determine the proper flow rate.

13.6 Lubricating the Vacuum Pump

The following table summarizes the procedure for lubricating the vacuum pump.

Step	Action	Comment
1	Verify that there is enough oil in the oilers for the vacuum filter operation.	
2	If oil is needed, use SAE-30WT oil.	There are two oilers for the pump bearings; one on the shaft and the other on the drive end cap.
3	After the motor starts, grease the fittings at the two zirc locations.	Use two strokes of the grease gun at each location.

13.7 Precoat Operations

The following table summarizes the procedure for precoat operations. A eye wash spray nozzle is located beside precoat bin in the penthouse.

Step	Location	Action	Comment
1	Room 116B	Open industrial water valve, INW-V03 above the precoat tank, TK-15.	
2	Room 116B	Add water to the precoat tank until you see that the water is above the second mixer blade.	
3	Room 116B	Close valve INW-V03 to discontinue the flow of water to the precoat tank.	
4	penthouse	Push the "start" button on the panel labeled "TK-15 Mixer" on the GMS-A Panel. Run the mixer at least 30 minutes. Turn off the mixer at the end of the vacuum filter operation.	A red light on the panel indicates that the mixer has started.
5	penthouse	Turn on the precoat bin ventilation fan switch labeled CD-1 on the south wall.	

Step	Location	Action	Comment
6	penthouse	Open the precoat hopper bin vent valve directly above the opening of the precoat tank. Close all other ventilation valves in the room to permit increased ventilation in the precoat bin.	
7	penthouse	Add approximately 125 pounds of dry Perlite®—2-1/2 50-lb. bags—natural silica or precoat to the precoat mixing tank by pouring it into the hopper bin.	This quantity should last about 6 hours. The quantity of precoat required may vary and is based on the length of the run, quality of sludge to be treated, and the amount of vacuum supplied to the drum.
8	penthouse	Use a long poker to clear the chute at the bottom of the precoat bin.	
9	penthouse	After adding the required amount of precoat, rinse the bin and transfer chute.	The water valve and hose are located in Room 216A.
10	penthouse	Turn off the water. Shut the bin vent valve.	
11	Room 116B	Turn off the ventilation fan, CD-1.	

13.8 Vacuum Filter Operation

Some functions may be controlled from either the precoat control panel or the GMC-A panel. Control panel indicator lights on the precoat control panel verify the position (on–off or open–closed) of functions controlled at both the precoat control panel and the MMC-A panel. A mirror is positioned so the operator can simultaneously control operations from the MMC-A panel and watch the indicator lights on the precoat control panel to ensure that the required operation are completed

The following table summarizes the procedure for operating the vacuum filter.

Step	Action	Comment
1	Unlock all controls at the bottom of the Precoat Control Panel.	
2	Push the "start" button for "panel activation" on the Precoat Control Panel.	An amber light will light up on the panel when it is activated.
3	. Start the vacuum filter by doing the following at the MMC-A panel. . Push the "start" button at the bottom of the panel labeled "drum drive" to start drum rotation (red light = open). . Push the "start" button at the bottom of the panel labeled "agitator drive" to start filter agitator (red light = open). . Start the vacuum by unlocking the control and pushing the "start" button under the label "vacuum pump" (red light = open). . Push the "start" button at the bottom of the panel labeled "Filtrate Pump P22" to start vacuum receiver pump (red light = open).	Indicator lights are on the precoat control panel.
4	Check the knife position for knife valve VFP-V06.	
5	Manually open gate valve VFP-V05 east of precoat tank all of the way to allow precoat to enter the filter basin.	
6	Start the precoat feed pump by putting the control labeled "Precoat Level" on the MMC-A Panel to the "auto" position.	
7	**Warning:** Use a respirator for this step. After the precoat is applied to the drum, stop the precoat feed pump at the MMC-A panel. Close valve VFP-V05.	The amount of precoat applied is based on your experience and judgment.

Step	Action	Comment
8	Start the knife advance on the vacuum filter by engaging the gear box that is north of the vacuum filter.	The settings for this operation are based on your experience and judgment.
9	Send sludge to the filter basin by doing the following: • manually open valve VFS-V02 located directly under the filter basin platform. • start Pumps 6 West (PW-6W) and 7 East (PW-7E) by flipping the switches to the "auto" position and turning the dial to the "forward" position on the Precoat Control Panel.	Pumps 6 West and 7 East are also labeled Pump 1 and Pump 2, respectively, on the control panel. Level detectors in the filter basin control the sludge level by starting and stopping the pumps.
10	If necessary, adjust the knife advance and drum rotation speed at the gear box north of the vacuum filter.	Knife advance and drum rotation speed are based on your judgment and experience.

13.9 Filling Drums with Sludge

Warning: You must wear a respirator during this operation.

The following table summarizes the procedure for filling drums with sludge.

Step	Action	Comment
1	If a drum is not already under the collection chute, position an empty prepared drum on a dolly under the collection chute to catch filter shavings while the Perlite and water slurry are mixing.	
2	Put a layer of cement powder—about three full shovels of cement powder—in the bottom of the empty-lined drum.	
3	Lower the flexible end of the chute into the drum.	
4	Open knife valve VFP-V06.	
5	Fill the drum.	
6	Close knife valve VFP-V06.	

Step	Action	Comment
7	Raise the flexible end of chute and roll out the drum to have enough room to package the waste in the drum.	If the last drum of the day is not full, the drum will generally be left under the chute to be filled during the next vacuum filter operations.
8	If the sludge is too wet (that is, the percentage of solids is less than 26-30%), • turn off the vacuum pump and • drain the sludge back into the sludge holding tank. Begin the operation at Subsection 11..	The percentage of solids is a visual determination made by experienced operators.
9	Put a layer of cement powder—about three full shovels—on top of the sludge.	
10	Repeat steps 1–9 in Subsection 11.10 for each additional drum to be filled.	

13.10 Packaging the Sludge in Drums

Warning: You must wear a respirator while performing this operation.

The following table summarizes the procedure for packaging the sludge in drums.

Step	Action
1	Close the plastic bag in the filled drum. Tape the bag shut with duct tape.
2	Place the plastic lid for the 90-ml plastic liner over the sealed bag. Put the rubber stopper into the hole in the middle of the lid.
3	Put the drum lid and locking ring on the drum. Tighten the lock nut.
4	Weigh the drum and write the weight on the lid.
5	Place a Radioactive Material Tag on the drum.
6	Put a brass number tag on the drum.

Step	Action
7	On the sludge drum data sheet (Attachment 7) at the operator's desk in Room 116A record the following: • weight, • number on the number tag, and • date.
8	Lower drums to the less-than-90-day storage area using the hoist in Room 116 Arrange the drums for easy access to and inspection of the drum and its markings and labels.

13.11 Rinsing the Sludge Line

The following table summarizes the procedure for rinsing the sludge line.

Step	Action
1	Flip the switch to "auto." Turn the dial to the "reverse" position for Pumps PW-6W and 7E (Schematic 3) on the precoat control panel.
2	Attach the hose connected to the water outlet by valve INW-V04 east of the precoat tank to the water outlet by the sludge line.
3	Confirm the positions for the following manual valves under the platform: **Valve** **Position** VFS-V02 closed VFS-V03 closed VFS-V04 open
4	Open industrial water valve INW-V04 east of the precoat tank.
5	After the sludge line has been rinsed, close valves INW-V04 and VFS-V04. Unhook the hose. Replace the hose as you found it.

13.12 Washing the Filter Basin

The following table summarizes the procedure for washing the filter basin.

Step	Action
1	Disengage the gear box south of the vacuum filter to retract the knife.
2	Flip the switch for pumps PW-6W and PW-7E to "auto." Turn the dial for these pumps to reverse on the precoat control panel.

Step	Action
3	Confirm that gate-valve INW-V10 (Schematic 3) south of the filter basin is open.
4	Use the hand-held sprayer south of the vacuum filter to clean the drum and knife advance.
5	Wash the filter basin. Turn off pumps PW-6W and PW-7E. Close valve INW-10.

13.13 Stopping the Vacuum Filter

Unless otherwise specified, all controls listed in this subsection are at the GMC-A panel. The following table summarizes the procedure for stopping the vacuum filter.

Step	Action	Comment
1	Push the "stop" button at the bottom of the panel labeled "Filtrate Pump P22" to start vacuum receiver	green light = off
2	Start vacuum by unlocking the control and pushing the "stop" button under the label "vacuum pump"	green light = off
3	Push the "stop" button at the bottom of the panel labeled "agitator drive" to start the filter agitator.	green light = off
4	Push the "stop" button at the bottom of the panel labeled "drum drive" to start the drum rotation.	green light = off
5	Push the "stop" button for "panel activation" on the Precoat Control Panel.	The amber light on the panel will turn off.
6	Lock all controls at the bottom of the precoat control panel.	

13.14 Transporting Drums

This DOP does not cover the required documentation, monitoring, labeling, and transport requirements for drum transportation. Transportation requirements are specified in LW-EM7-SOP-11, "SOP for TA-50-1 Solid Waste Disposal." Before transporting drums, personnel involved in the transportation of drums must read this SOP and have passed a quiz on its contents before doing any of these operations.

14.0 RECEIVING TRANSFERS THROUGH THE CROSS-COUNTRY WASTE LINE

Water can be transferred to the TA-50-1 facility from TA-21-257 or TA-2-53 through the Cross-Country Waste Line. The Cross-Country Waste Line enters TA-50-1 in WM2 where the flow passes through a three-way valve and can be directed either to the 25K raw influent tank or the south effluent tank. An operator must be present at TA-50-1 to verify the position of valves and to monitor transfer progress during the transfer. Refer to LW-CST13-SOP-8 (most recent revision) for safety and training requirements.

14.1 Setting up for a Transfer

Before a transfer can be made, the CST-13 Group Leader or his or her designee must analyze the material and approve it for transfer. A copy of the analysis and the approval signature are placed in the Daily Operations Log Book kept in Room 116C.

14.2 Starting a Transfer

An operator must be at TA-50-1 during a transfer, and must always be able to communicate readily with the operator at either TA-21-257 or TA-21 during the transfer.

The following table summarizes the procedure for starting a transfer.

Step	Action	Comment
1	Verify that the transfer has been approved.	
2	Verify that the three-way valve WM2-CCL-V1, which you can view on G2 on the "DP Transfer" screen, is in the desired position.	This valve will direct the incoming flow to either the 25K influent holding tank or the south effluent tank. Transfers will generally be sent to the 25K influent holding tank. Currently, all transfers through this line are treated through the TA-50-1 main plant before they are discharged to the canyon.
3	For a transfer from TA-21-257, note on the daily log • the beginning levels of the tanks which water will be transferred from and • the destination of the water once it reaches TA-50.	

Step	Action	Comment
4	When contacted by the operator at TA-21-257 or TA-2 that he or she is ready to transfer from the operator's location, start the computer program to monitor the transfer.	This program can be accessed on G2 on the "DP Transfer" screen.
5	Using the mouse, • click once on the blue "DP Transfer" button in the top left-hand corner of the screen. • indicate the destination of the transfer by clicking once in the circle next to the correct option; and • click once in the circle next to the option "Begin Transfer."	A screen will indicate that the monitoring program has begun. You can watch this screen during the transfer or close it and reopen it as needed.
6	When the computer program is running, tell the operator at TA-21-257 or TA-2-53 that you are ready to receive water.	The operator at the other facility will start the pumps that will send water through the cross-country line.
7	Within five minutes you should notice an increase in the tank level receiving the flow, Tell the operator at the other facility that you are receiving flow. If flow is not apparent within ten minutes, • notify the other operator and • stop the pumps until the situation is evaluated.	

14.3 Monitoring a Transfer

The operator at TA-50-1 must monitor the transfer while it is in process. The following table summarizes the procedure for monitoring a transfer.

Step	Action	Comment
1	Verify that flow is continuous by • observing tank level increases and/or • watching the computer-generated monitoring screen on G2.	
2	If you notice a sudden change in the incoming flow rate, • immediately notify the operator at the other facility and • stop the transfer pumps until the situation has been evaluated.	If during a transfer from TA-21-257, the difference between the volume sent and the volume received reaches a threshold of 5%, G2 will generate an alarm to alert you. The 5% threshold is a computer-calculated figure based on tank levels at both ends of the transfer and is intended to notify you to observe the process. The alarm alone does not indicate that there is a leak or any other malfunction, because it is well within the standard 10% margin of error common with telemetry instrumentation. A comparable alarm system is not available for transfers from TA-2-53.

14.4 Ending a Transfer

When a transfer is complete, the operator at TA-21-257 or TA-2 will notify the operator at TA-50-1 that the transfer is complete and that the pumps have been turned off. At this time, the operator at TA-50-1 can end the transfer process at TA-50-1.

The following table summarizes the procedure for ending a transfer.

Step	Action	Comment
1	Shut down the computer-monitored transfer process: Using the mouse, • click once on the blue "DP Transfer" button in the top left-hand corner of the screen and • click once in the circle next to the option "End Transfer."	This step ends the program that monitors the transfer and sends a computer-generated report to the printer in Room 114.

Step	Action	Comment
2	For a transfer from TA-21-257, note in the daily log the ending levels of the tanks that water was transferred from.	
3	Get the computer-generated report from Room 114. Attach it to the analysis and approval for transfer filed in the daily operations log book. For a transfer from TA-2-53, enter the total volume transferred under "miscellaneous influent" in the daily log.	

15.0 RECORDKEEPING

The following TA-50-1 Main RLWTP records are located in Room 116C.

Record all log entries in blue or black ink. Cross out mistakes with a single line and initial them; do not erase or otherwise obliterate them with "white-out" products.

This log book . . .	includes this information

daily operations	for each day of the current month • a daily operational log, • a daily activities log, • a plot of effluent discharged to the canyon (flow and pH), • plots of the STE#1 effluent wier and the gravity filter levels • a sign-off form for the daily plant check, and • a computer-generated flows report for the current month • a batch waste received log and • analysis and approval forms for any batch wastes received records of transfers through the cross-country waste line

This log book . . .	includes this information
G2 log book	for each day of the current month a computer generated daily log, selected plots, and a computer generated report of high/low/average values for all devices.
inspection log book for Room 60	
inspection log book for WM-114	
log book for laboratory analysis results	
two binders for SOPs, DOPs and other documents pertaining to procedures at TA-50-1	
log book for excavation permit records	
log book for Call-Out records (see LW-CST13-DOP-4, "Responding to Hard Alarms")	
binders for Material Safety Data Sheets	

16.0 DISTRIBUTION

A copy of this DOP is available at the following places at TA-50-1:

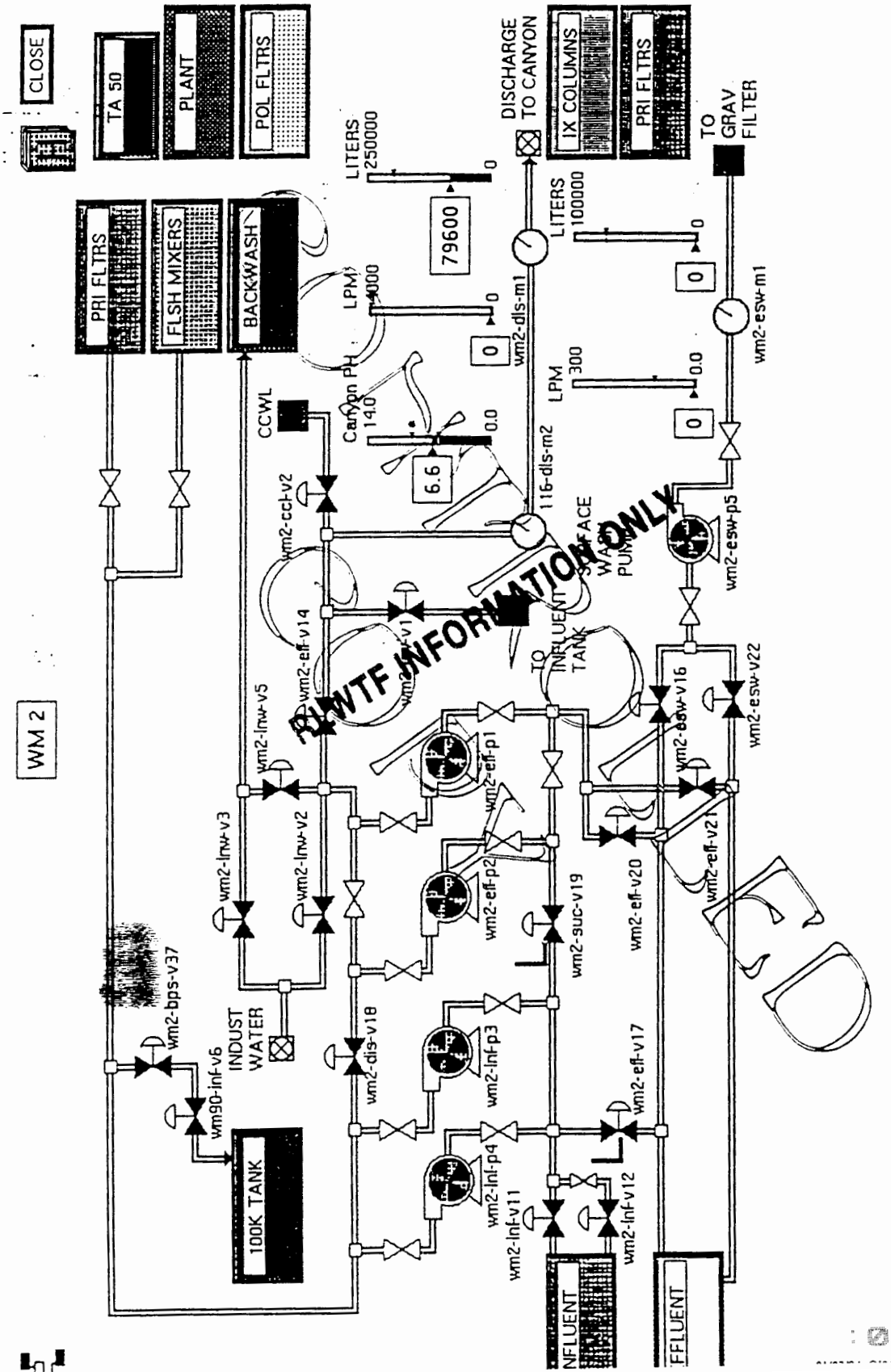
- Document Control Room, Room 108;
- Control Room, Room 116C;
- Room 113; and
- Sludge Operations Office, Room 116A.

17.0 ATTACHMENTS

1. Plant Schematics
   - Schematic 1: WM-2 - Pumps and Valves
   - Schematic 2: Radioactive Liquid Waste Treatment Operations (in series)
   - Schematic 3: Sludge Handling System
2. Floor Plans
   - Rooms 116 and 116C - Wastewater Treatment Operations
   - Floor Plan for Room 116A and 116B - Rotary Vacuum Filter Operations
3. Radioactive Liquid Waste Treatment Plant Daily Activities Sheet
4. Plant Daily Log Sheet
5. Log Sheet for Alpha Counter
6: Anthracite Filter Operation Worksheet
7: Sludge Drum Data Sheet

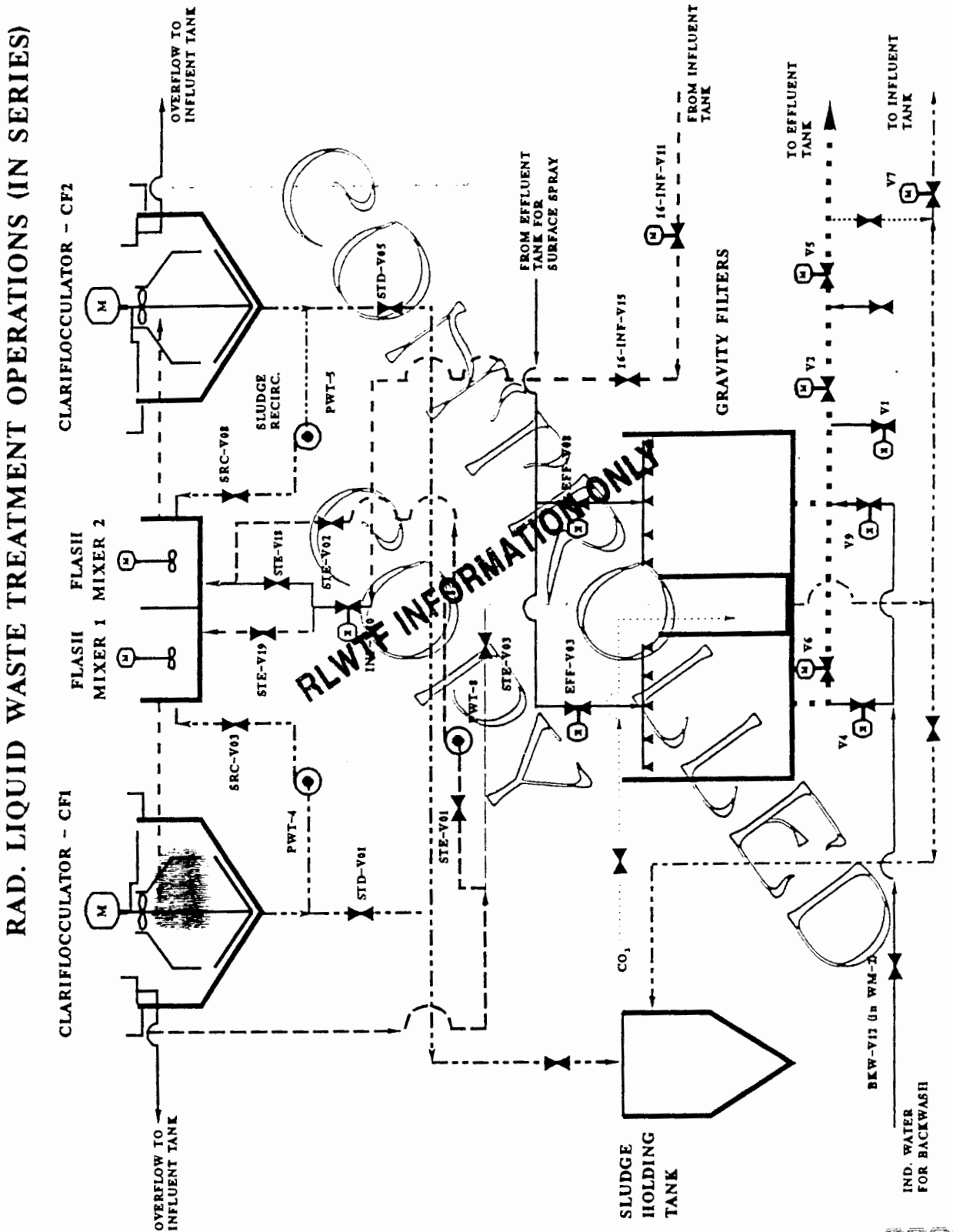
Attachment 1: Plant Schematics

Schematic 1: WM-2 - Pumps and Valves



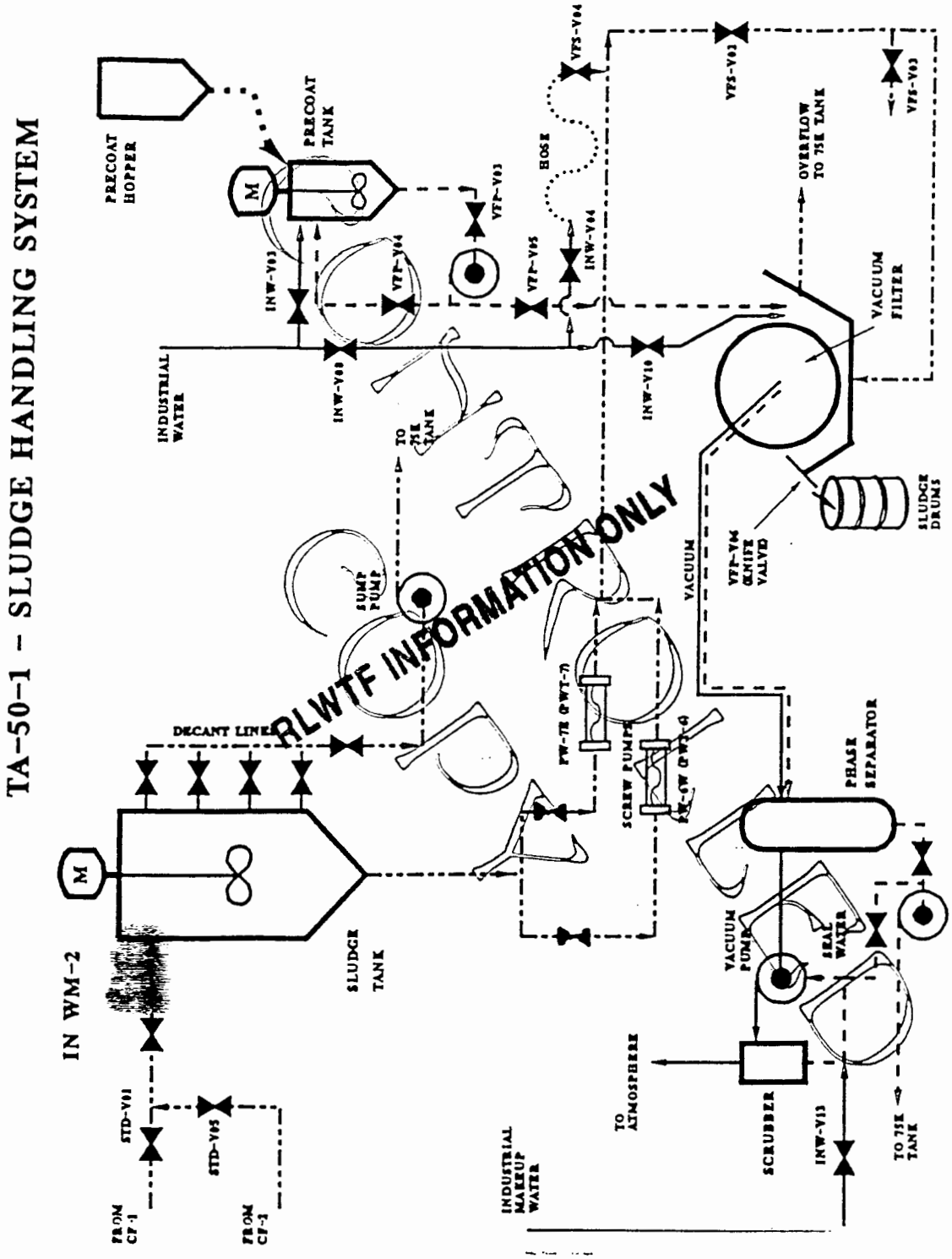
Attachment 1: Plant Schematics

Schematic 2: Wastewater Treatment Operations

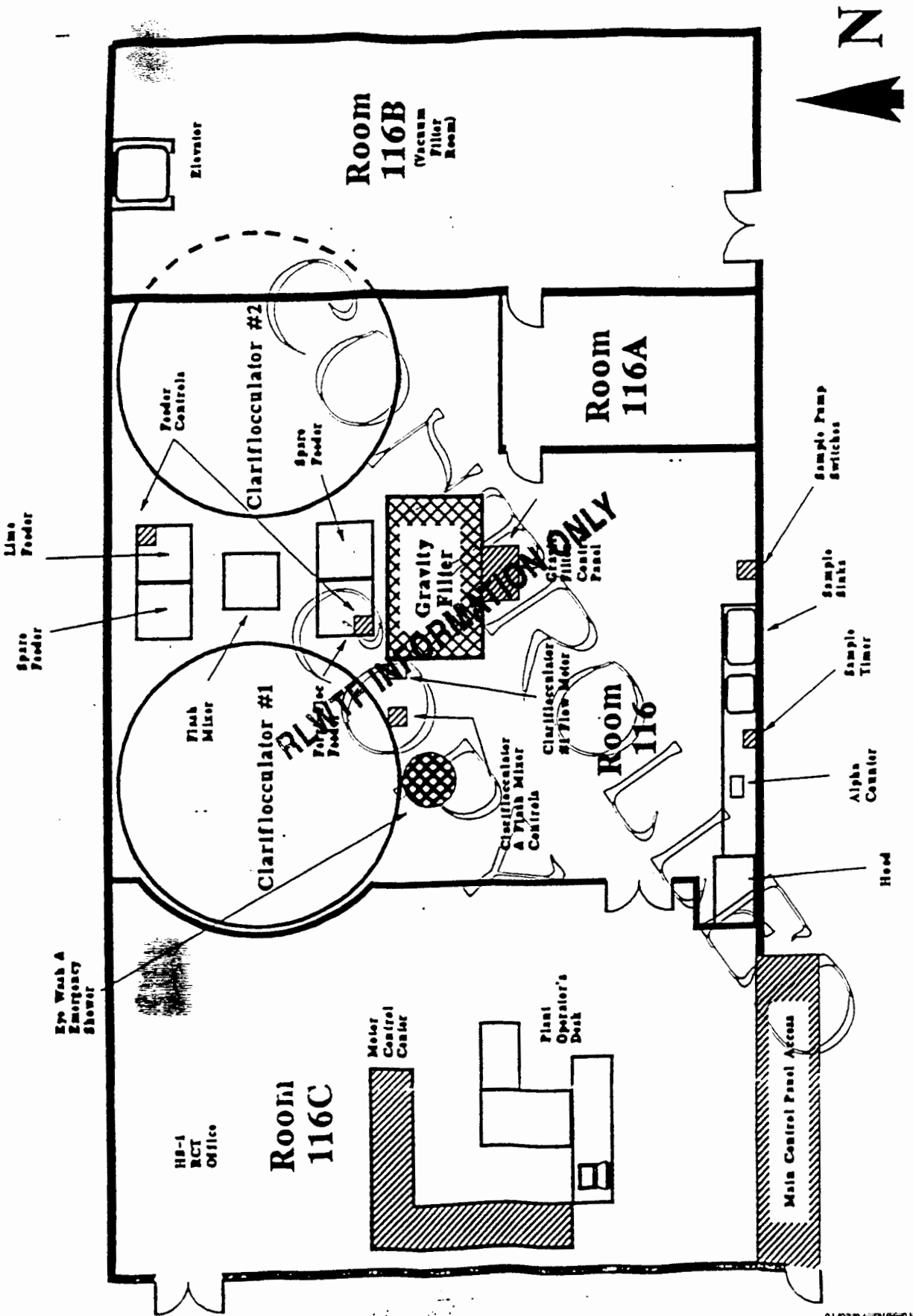


Attachment 1: Plant Schematics

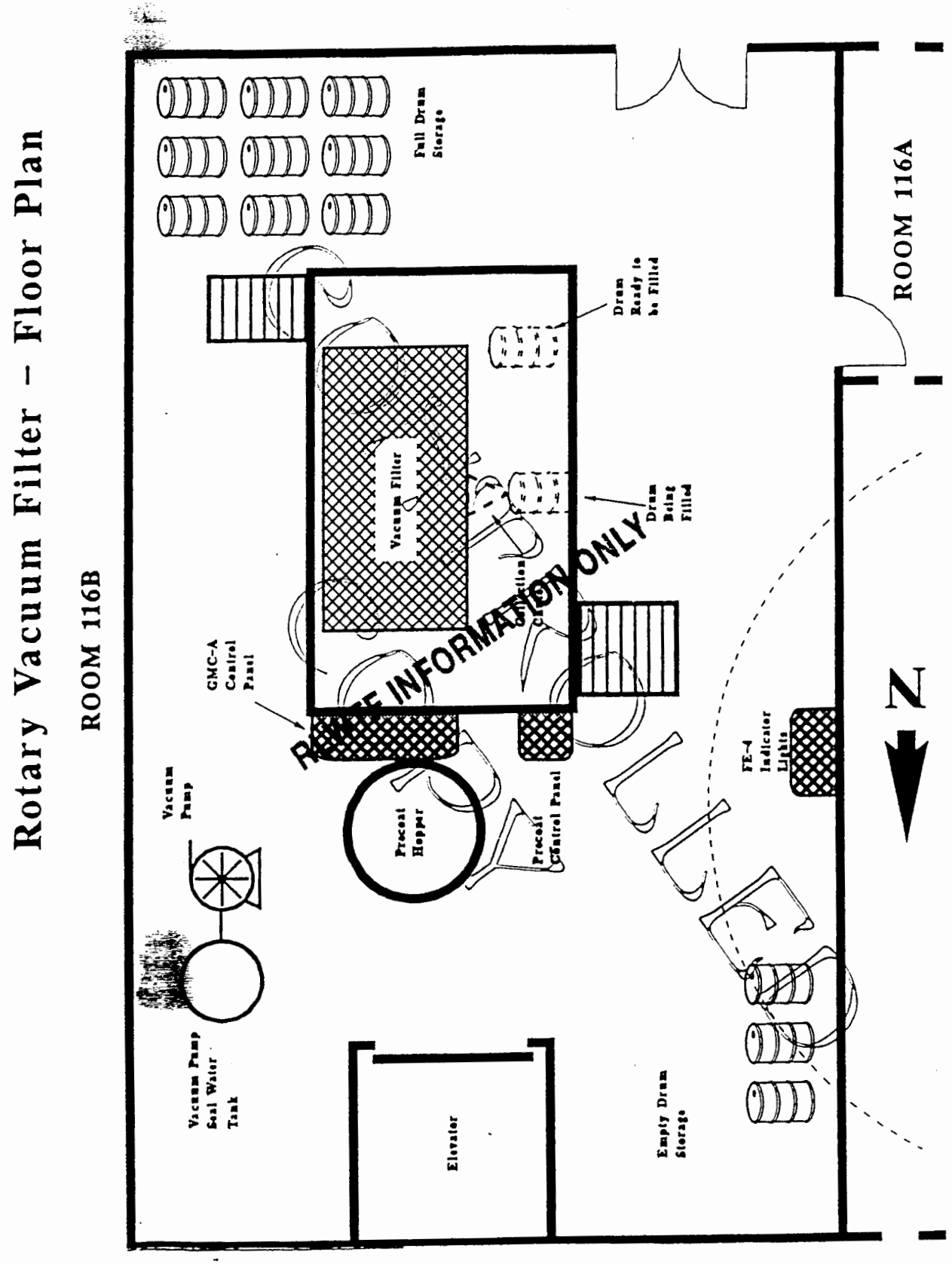
Schematic 3: Sludge Operations



Attachment 2: Floor Plan for Rooms 116 and 116C - Wastewater Treatment Operations



Attachment 2: Floor Plan for Room 116A and 116B-Rotary Vacuum Filter Operations



Attachment 3: Plant Daily Activities Sheet

Radioactive Liquid Waste Treatment Plant
DAILY ACTIVITIES

IDENTIFIER #:_____
DATE:_____

INSTRUCTIONS: List your comments/activities. Note the time of your entry and initial your comments when complete.

Status Changes:

CAS clear & notified:_____
Operator Signature_____ Time_____

Page _____ of _____

Attachment 4: Plant Daily Log Sheet

TA-50-WM 1
DAILY LOG

DATE: _____ DAY: _____

INFLUENT TANK LEVELS (Percent)

	0800	1700	pH	NEXT DAY
TANK #1				
TANK #2				
TANK #3				

MISC. INFLUENT VOLUME _____ Liters
RECIRCULATED VOLUME _____ Liters
OMEGA VOLUME _____ Liters

SLUDGE DRAWOFF BEGINNING LEVEL _____ Ft _____ In
ENDING LEVEL _____ Ft _____ In

WAS THE PLANT OPERATED? _____

WAS A FINAL TANK DRAINED OR WAS THERE A TRANSFER FROM DP? _____

PLANT START-UP TIME				FILTER SHUT-DOWN TIME				PLANT SHUT-DOWN TIME			
	HRS		MIN	00	HRS	00	MIN		HRS		MIN
	HRS		MIN	00	HRS	00	MIN		HRS		MIN
	HRS		MIN	00	HRS	00	MIN		HRS		MIN

EFFLUENT TANK LEVELS (Meters)

	BEGINNING LEVEL	ENDING LEVEL	RECIRC.?
TANK #1 SOUTH			
TANK #2 NORTH			

PLWTF INFORMATION ONLY

Plant Daily Log Sheet (continued - page 2)

WAS FLOW RECEIVED FROM DP? ☐

IF ROOM 60 WAS RUN, ENTER WM-66 TANK VOLUMES (Liters).

	BEGINNING	ENDING
ACID		
CAUSTIC		

NOTE: Record this data daily, but enter the data ONLY if Room 60 is operated.)

CHEMICAL USAGE
(Lbs for TA-50, Kg for DP-257)

	ON	OFF	ADDED
LIME			
IRON			
BETZ			

POLYELECTROLYTE USAGE
(Inches for TA-50, Kg for DP-257)

BEGINNING ☐ ENDING ☐ ADDED ☐

FLOW DISCHARGED FROM DP-257 (Percent)

WEST TANK:	BEGINNING		ENDING	
EAST TANK:	BEGINNING		ENDING	

BLWTF INFORMATION ONLY

ENTER THE NUMBER CORRESPONDING TO THE DESTINATION OF THE FLOW: ☐

1) INFLUENT TANKS
2) EFFLUENT TANKS
3) CANYON

FLOW RECEIVED FROM DP
EFFLUENT TANK LEVEL (Meters)

BEGINNING		ENDING	
BEGINNING		ENDING	

COMMENTS:

SAMPLES (TYPE & TIME):

OPERATOR(S):

Attachment 5: Log sheet for Alpha Counter.

α COUNTER DATA SHEET

DATE	SAMPLE	nil	MIN	GROSS COUNT	GROSS C/M	NET C/M	FACTOR	C/M/L	REMARKS

COUNTLOG.DOC; Rev. 08-31-93

Attachment 6: Anthracite Filter Operation Worksheet

ANTHRAFILT FILTER OPERATION
TA-50-WM-1

MONTH OF_____, 19____

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
DATE	RUN NO.	START	STOP	HOURS OF OPERATION DAILY TOTAL	HOURS OF OPERATION RUN CUMULATIVE	VOL. FILTERED (Liters) DAILY TOTAL	VOL. FILTERED (Liters) RUN CUMULATIVE	FILTRATION RATE (LPM/M²)	BACKWASH SUMMARY VOLUME (Liters)	BACKWASH SUMMARY RATE (LPM/M²)

RLWTF INFORMATION ONLY

Anthracite Filter Operation Worksheet (continued - page 2)

[1] DATE	[2] RUN NO.	[3] START	[4] STOP	[5] HOURS OF OPERATION DAILY TOTAL	[6] HOURS OF OPERATION RUN CUMULATIVE	[7] VOL. FILTERED (Liters) DAILY TOTAL	[8] VOL. FILTERED (Liters) RUN CUMULATIVE	[9] FILTRATION RATE (LPM/M^2)	[10] BACKWASH SUMMARY VOLUME (Liters)	[11] BACKWASH SUMMARY RATE (LPM/M^2)
MONTHLY TOTALS										

$$\text{AVG. HRS./RUN} = \frac{\text{COL[6]}}{\text{COL[2]}} = \quad \text{HRS.}$$

$$\text{FILT. RATE} = \frac{\text{COL[8]}}{\text{COL[6]} \times 60 \times 8.36} = \quad \text{LPM/M}^2$$

$$\text{\% WASHWATER} = \frac{\text{COL[10]}}{\text{COL[8]}} \times 100 = \quad \%$$

$$\text{AVG. HRS./RUN} = \frac{\text{COL[6]}}{\text{COL[2]}} = \quad \text{HRS.}$$

$$\text{FILT. RATE} = \frac{\text{COL[8]}}{\text{COL[6]} \times 60 \times 8.36} = \quad \text{LPM/M}^2$$

$$\text{\% WASHWATER} = \frac{\text{COL[10]}}{\text{COL[8]}} \times 100 = \quad \%$$

Attachment 7: Sludge Drum Data Sheet

TA -50-WM-1
VACUUM FILTER OPERATIONS WORKSHEET

DATE: _____ , 19 ____

_____ DRUMS

	Lbs ÷ 2.2 = Kg			
	Lbs/Drum	Kg/Drum	TOTAL (Lbs)	TOTAL Kg
GROSS WEIGHT				
TARE WEIGHT	(-) 75.9	(-) 34.5		
SOLIDS WEIGHT				

RLWTF INFORMATION ONLY

VOLUME: 55 Gal/Drum = 208 Liters/Drum:

208 Liters/Drum X ____ Drums = _____ TOTAL Liters

SOLIDS: (Weight) _____ Kg*(/Drum)* X (% Solids) _____ X 10^3 gm/Kg =

_____ E ____ Average gm Solids*(/Drum)*

ACTIVITY (Ci/gm)	X	SOLIDS (gm/Drum)	=	TOTAL CURIES (per Drum)	(per Run)
^{235}U:				E	E
± E				± E	± E
^{238}Pu:				E	E
± E		E		± E	± E
^{239}Pu:				E	E
± E				± E	± E
^{241}Am:				E	E
± E				± E	± E

[(^{235}U) _____ + (^{238}Pu) _____ + (^{239}Pu) _____ + (^{241}Am) _____] X 10^9 ÷ [(TOTAL Kg) _____ X 10^6]

= _____ nCi/ mg

00376

LOS ALAMOS
NATIONAL LABORATORY
CST-13

RLWTF OPERATIONS MANUAL

SAMPLING ASSOCIATED WITH TA-50-1 MAIN PLANT OPERATIONS

LW-CST-13-DOP-0802

Effective Date: February 2, 1996

ROYBAL, AMY
CST-13
E518

Detailed Operating Procedure

SAMPLING ASSOCIATED WITH TA-50-1 MAIN PLANT OPERATIONS

Radioactive & Industrial Wastewater Sciences Group

Prepared By: _____ 2/2/96
Debora Lim, CST-13. Date
Technical Facilities Operator

Reviewed By: _____ 2/2/96
Rick Alexander, CST-13 Date
Technical Facilities Operator

_____ 2/2/96
Wm. David Moss, CST-13 Date
Building Manager/Operations Team Leader

Approved By: _____ 2-2-96
Steve Hanson, CST-13 Date
Group Leader

Detailed Operating Procedure
Sampling Associated With TA-50-1 Main Plant Operations
Radioactive & Industrial Wastewater Sciences Group

Table of Contents

Detailed Operating Procedure
Sampling Associated With TA-50-1 Main Plant Operations
Radioactive & Industrial Wastewater Sciences Group

1.0 PURPOSE

The purpose of this detailed operating procedure (DOP) is to ensure the quality of sampling operations and safety of personnel. This document describes sampling procedures at the TA-50-1 Main Radioactive Liquid Waste Treatment Plant (RLWTP), which is operated and managed by the Radioactive and Industrial Wastewater Sciences Group (CST-13).

2.0 SCOPE

This document applies to all CST-13 personnel or technicians collecting samples associated with the TA-50-1 Main RLWTP. Types of samples covered in this document include:

- routine, operational samples
- volatile & semi-volatile samples
- National Pollutant Discharge Elimination System (NPDES) samples
- gamma & LEL samples
- TA-55 industrial wasteline samples
- sludge samples

Sampling procedures pertaining to the operation of the TA-21-257 RLWTP and TA-50-1 Pretreatment Plant are *not* included in this DOP.

This document does not cover sample analysis procedure.

This DOP gives detailed instructions for sampling but does *not* detail training and safety requirements. Detailed training and safety requirements are specified in LW-CST7-SOP-16, "Safe Operating Procedures (SOP) for Sampling Associated with TA-50-1 Main Radioactive Liquid Waste Treatment Plant Operations," which should be used in conjunction with this DOP.

3.0 REFERENCES

Procedures in this DOP specific to NPDES sampling are guided by the current NPDES permit requirements for Los Alamos National Laboratory (LANL) (NM0028355), specific to the #051 outfall. LW-CST7-AP06,R00, the administrative procedure for TA-50 NPDES sampling, also addresses this requirement.

Other requirements and information related to this DOP, including safety and training information, may be found in LW-CST7-SOP16, "SOP for Sampling Associated with TA-50-1 Main Radioactive Liquid Waste Plant Operations."

For information relating to TA-50-1 Main RLWTP operations, refer to LW-CST7-DOP-06, "DOP for TA-50-1 Main Radioactive Liquid Waste Treatment Plant."

4.0 DEFINITIONS AND ACRONYMS

4.1 Definitions

composite sample	A sample containing a homogenous mixture of separate volumes of a singular stream that is collected at preset intervals and represents the general characteristics of the waste stream over a period of time.
CST-13 personnel or technicians	Persons who are either employed by CST-13 or are resident contractors dedicated to CST-13 operations.
grab sample	A sample of a single volume of waste taken at neither a set time nor flow and representing the characteristics of the waste at the time the sample was taken.
final effluent	Water flowing from either effluent holding tank to the outfall for discharge to the environment.
gravity filter effluent	Water flowing from the discharge side of the gravity filter to the effluent holding tanks
Liquid Waste Facility (LWF)	The three RLWTPs managed and operated by CST-13: TA-50-1 Main RLWTP; TA-50-1 Pretreatment Plant, and TA-21-257 RLWTP.
National Pollutant Discharge Elimination System (NPDES) Permit	A permit issued by the US Environmental Protection Agency (EPA) under the Clean Water Act (CWA) authorizing a facility to discharge effluent to the environment under prescribed conditions. The permit for the LWF's Mortandad Canyon outfall (#051) includes criteria for the characteristics of effluent discharged to the outfall and sampling requirements.

outfall	A point of discharge into the environment.
Radioactive Liquid Waste Collection System (RLWCS)	A network of buried pipelines and associated equipment that transfer liquid waste discharged from waste generators at LANL to the LWF. The RLWCS was formerly referred to as the Acid or Industrial Waste Line.
raw feed	Water pumped from either influent holding tank to the flash mixers.
raw influent	Water entering the TA-50-1 Main RLWTP through the RLWCS. Raw influent is stored in the raw influent holding tanks at WM-2.

4.2 Acronyms

AP	adminiatrative procedure
CWA	Clean Water Act
DOP	detailed operating procedure
EPA	Environmental Protection Agency
LANL	Los Alamos National Laboratory
LEL	lower explosive limit
LWF	Liquid Waste Facility
NPDES	National Pollutant Discharge Elimination System
RCT	Radiation Control Technician
RLWCS	Radioactive Liquid Waste Collection System
RLWTP	Radioactive Liquid Waste Treatment Plant
SOP	safe operating procedure
SVOC	semi-volatile organic compounds
TCLP	Toxicity Characteristic Leachate Procedure
TTO	total toxic organics
VOC	volatile organic compounds
WM-2	TA-50-2

5.0 ROUTINE, OPERATIONAL SAMPLES

Routine, operational samples are taken from a variety of locations and include samples taken of raw influent as it enters the the facility from the RLWCS, samples of raw feed and treated effluent taken while the plant is in operation, and samples collected on weekends and holidays.

NOTE: Protective clothing (lab coats, rubber gloves and safety glasses) must be worn while collecting samples and during sampling procedures conducted in laboratories. When entering controlled areas, signs requiring additional protective clothing such as booties must also be observed. ESH-1 self-monitoring procedures must be observed when exiting a controlled area.

5.1 Raw Influent Sample

The raw influent sample is collected by a Manning autosampler located in Room 16. This sampler takes a continuous, raw influent composite sample of the waste entering the main RLWTP through the RLWCS. One sample from the Manning is collected and submitted for analysis each day that the plant is operated or checked, usually in the morning at approximately 8:00 a.m.

5.1.1 Supplies

The following is required to take samples from the Manning sampler:

- 2-gallon Nalgene (polyethylene) raw influent sample bottle

5.1.2 Sampling Procedure

- In Room 16, turn on the sampler mixer and run at medium speed for at least 3 minutes.
- Fill a 2-gallon Nalgene raw influent sample bottle with sample.
- Drain the remaining sample from the sampler. Rinse the tank, and drain and close all drain valves after the tank is empty.

5.1.3 Sample Submittal

- Take the sample to the laboratory, Room 130.
- Using the grease pencil at the counter by the pH meter, mark the sample bottle with the previous day's date.
- Leave the sample on the counter near the grease pencil.

5.2 Raw Feed Composite Sample

Raw feed from the influent holding tank(s) is collected by an automatic sampler in Room 116 during plant operation. This sampler is turned on by the plant operator each time the plant is started up and turned off each time the plant is shut down. The composite sample is submitted for analysis the morning following each run.

5.2.1 Supplies

The following is needed to collect and submit a raw feed sample for analysis:

- one 1,000-ml Nalgene (polyethylene) raw influent sample bottle.

5.2.2 Sampling Procedure

On the morning after the plant has been run:

- In Rooom 116, take an empty 1,000-ml Nalgene bottle from above the sink and fill it with a composite raw feed sample from the 2-gallon Nalgene sampler collection bottle for raw feed. To collect a representative sample, allow some of the sample to go to the drain while you are filling the bottle.

- After filling the 1,000-ml Nalgene bottle, completely drain the collection bottle and place it back into position for the next collection cycle.

5.2.3 Sample Submittal

- Take the raw feed sample to the laboratory, Room 130, and place it on the counter by the grease pencil, next to the raw influent sample from the Manning.

- Mark the sample with the date the plant was last operated.

- Take an empty 1000 ml replacement bottle from Room 130 and place it in Room 116 where you found the previous bottle.

5.3 Gravity Filter Effluent Composite Sample

This sample is collected from the stream leaving the gravity filter and going to the effluent holding tanks. The sample is collected by an automatic sampler which is turned on by the plant operator each time the plant is started up and turned off each time the plant is shut down. This composite sample is submitted for analysis the morning following each run.

NOTE: This is the same sample source from which a 10-ml sample is taken, dried, and counted before discharging to the canyon to determine if radionuclide concentrations are below the allowed 2,000 dpm/l. Sampling and analysis procedures for this sample are specified in LW-CST7-DOP-06, "DOP for TA-50-1 Main Radioactive Liquid Waste Treatment Plant."

5.3.1 Supplies

The following is needed to collect and submit gravity filter effluent sample for analysis:

- one 2-gallon Nalgene (polyethylene) effluent sample bottle,

5.3.2 Sampling procedure

On the morning after an effluent tank has been discharged to the canyon:

- In Room 116, pour the gravity filter effluent composite sample *from the tank that was discharged* into a 2-gallon "Effluent" Nalgene bottle. The composite holding bottles are labeled "North" and "South." A 2-gallon bottle will hold complete samples from two discharges.

5.3.3 Sample Submittal

- Take the effluent sample to the laboratory, Room 131, mark the sample with the date the plant was last operated, and leave on the back counter.

- Take an empty 2-gallon "Effluent" replacement bottle from Room 131 and place it in Room 116 where you obtained the previous bottle.

5.4 Weekend/Holiday Sampling

5.4.1 If the Plant is Not Operated

When the plant is being inspected on the weekend and the plant WILL NOT be operated, collect samples from the Manning as described in Section 5.1.

5.4.2 If the Plant is Operated

When the plant is operated on a weekend or holiday, collect samples from the Manning as described in Section 5.1 and collect Plant samples as described in Sections 5.2 and 5.3.

6.0 VOLATILE & SEMI-VOLATILE ORGANICS SAMPLES

Volatile and semi-volatile organics (VOC and SVOC) analyses are run on samples collected once weekly from the raw influent and the raw feed streams. This weekly set of samples is collected and submitted from both sources on the same day.

NOTE: Protective clothing (lab coats, rubber gloves and safety glasses) must be worn while collecting samples and during sampling procedures conducted in laboratories. When entering controlled areas, signs requiring additional protective clothing such as booties must also be observed. ESH-1 self-monitoring procedures must be observed when exiting a controlled area.

6.1 Raw Influent Volatile & Semi-Volatile Organic Samples

The refrigerated, ISCO autosampler in Room 16 collects a raw influent, composite sample of the waste entering the TA-50-1 main RLWTP through the RLWCS. Samples from the ISCO are submitted for analysis randomly, one day per week, on days that the plant is operated. Four (4) samples are collected and submitted for analysis. This sampler must be turned on by an operator approximately 24 hours before sample collection. After a 24-hour composite has been drawn, the sample is collected and the sampler turned off. To approximate similar parameters for a "day" as other samples, this sample is ordinarily set up to be collected in the morning when other daily, routine samples are collected.

6.1.1 Supplies

The following supplies are required to sample for VOC/SVOC constituents:

- three 40-ml clear glass sample vials,
- one 1-liter amber glass sample bottle,
- CST-13 sample labels,
- "caution radioactive material" labels,
- hydrochloric acid (HCl),
- nitric acid (HNO_3),
- 3-ml disposable pipettes, and
- CST-13 Chain-of-Custody record form(s) (Attachment 1).

6.1.2 Sampling Procedure

Approximately twenty-four (24) hours before you intend to collect VOC/SVOC samples from the ISCO (usually around 8:00 a.m.), turn on the sampler:

- press the "ON" button and
- press the "START SAMPLE" button.

After twenty-four hours, collect the sample taken by the ISCO:

- halt the sampler by pressing the "HALT SAMPLE" button,
- replace the full ISCO jug with an empty one,
- turn the sampler off by pressing the "OFF" button, and
- take the jug to the laboratory, Room 130.

NOTE: *Where acids must be added to preserve a sample,* label and add the acids to the empty bottles *prior* to collecting the sample. Acids for VOC and SVOC samples are located in Room 130, under the hood (hood #10100).

Collect the following samples from the sample jug.

Sample 1, SVOC sample:

- Mark one 1,000-ml amber, glass with an identification label (Immyy.dd);
- fill the 1,000-ml amber-glass bottle with the contents of the jug;
- attach a "caution radioactive material" sticker to the bottle.

Samples 2 and 3, VOC samples:

- Mark two 40-ml glass vials with identification labels (Immyy.dd);
- in Room 130, add 3 to 4 drops of HCl to each 40-ml vial;
- fill each bottle to the top with sample from the collection jug;
- screw on the bottle lids and invert the bottles to ensure that no air bubbles are trapped in the bottles (VOC samples must contain no air bubbles);
- attach "caution radioactive material" stickers to the bottles.

Sample 4, Radiological Screening Sample:

- With an indelible marker, write the following information on a 40-ml glass vial:

  - TA-50, ISCO
  - date
  - "TERRY",

- add 3 to 4 drops of HNO_3 to the vial;
- fill the bottle with sample from the collection jug;
- tightly screw on the bottle lid and attach a "caution radioactive material" sticker to the vial.

Pour the remaining sample in the ISCO collection jug into an approved drain. Rinse out the jug and place it upside down on the drying rack to dry.

6.1.3 Sample Submittal

- Place the sample in the 1-liter, glass amber bottle and the two 40-ml samples preserved with HCl in the refrigerator in the hallway next to Room 130. Generally the 40-ml vials are placed in a plastic beaker to keep them upright.

- Record sample information on the chain-of-custody form (Attachment 1) inside the refrigerator. Fill out one form for the 1-liter amber bottle and mark the form "SVOC." Fill out a separate form for the two 40-ml vials and mark the form "VOC."

- Place the 40-ml sample preserved with HNO_3 under the hood in Room 130 where the HNO_3 and HCl are located (hood #10100).

- When the screening results for the samples are complete, fax Sample Management (667-9863) the sample numbers, descriptions, and screening results for the samples needing to be picked up.

6.1.4 Sample Transfer

Personnel from Sample Management will retrieve and deliver the samples placed in the refrigerator. When they do:

- open the refrigerator and give the samples and the radiological screening results to Sample Management personnel;

- write the sample number assigned to the samples by Sample Management on the chain-of-custody form;

- complete chain-of-custody form by filling out signature, date, and time spaces at the bottom of the forms;

- make a copy of the chain-of-custody forms and give the original to Sample Management. File the copy in Room 116C.

6.2 Raw Feed Volatile & Semi-Volatile Organics Samples

Raw feed samples are submitted for VOC/SVOC analysis randomly, one day per week, *on the same day* that the ISCO VOC/SVOC samples are submitted. The raw feed samples are grab samples. They *must be taken during plant operation* from a continuous feed sample stream in the sample sink, Room 116. Four (4) samples are collected and submitted for analysis.

6.2.1 Supplies

See subsection 6.1.1 for supplies required.

6.2.2 Sampling Procedure

NOTE: *Where acids must be added to preserve a sample*, label and add the acids to the empty bottles *prior* to collecting the sample. Acids for VOCand SVOC samples are located in Room 130, under the hood (hood #10100).

Collect the following samples at the same time, from the sample sink in Room 116.

Sample 1, SVOC Sample:

- Mark one 1,000-ml amber, glass with an identification label (Pmmyy.dd);
- in Room 116, fill the bottle from the Raw Feed continuous feed sample stream at the sample sink;
- attach a "caution radioactive material" sticker to the bottle.

Samples 2 & 3, VOC Samples:

- Mark two 40-ml glass vials with identification labels (Pmmyy.dd);
- in Room 130, add 3 to 4 drops of HCl to each 40-ml vial;
- in Room 116, fill each bottle to the top from the Raw Feed continuous feed sample stream at the sample sink;
- screw on the bottle lids and invert the bottles to ensure that no air bubbles are trapped in the bottles (VOC samples must contain no air bubbles);
- attach "caution radioactive material" stickers to the bottles.

Sample 4, Radiological Screening Sample:

- with an indelible marker, write the following information on a 40-ml glass vial:

  -TA-50, Plant
  - date
  -"TERRY",

- in Room 130, add 3 to 4 drops of HNO_3 to the vial;
- in Room 116, fill the bottle from the Raw Feed continuous feed sample stream at the sample sink;
- screw on the bottle lid and attach a "caution radioactive material" sticker to the vial.

6.2.3 Sample Submittal

- Place the 1-liter, glass amber bottle and the two 40-ml samples preserved with HCl in the refrigerator in the hallway next to Room 130. Generally the 40-ml vials are placed in a plastic beaker to keep them upright.
- Record sample information on the chain-of-custody form (Attachment 1) inside the refrigerator. Record the Raw Feed SVOC sample on the same chain-of-custody form as the ISCO SVOC sample for that day. Record the Raw Feed VOC samples on the same chain-of-custody form as the ISCO VOC samples for that day.
- Place the 40-ml samples preserved with HNO_3 under the hood in Room 130 where the HNO_3 and HCl are located (hood #10100).

6.2.4 Sample Transfer

Same procedure as for ISCO VOC/SVOC samples. See subsection 6.1.4.

7.0 NPDES SAMPLES

NPDES samples are collected and tested to verify that the plant is operating in compliance with the limits permitted for discharging treated effluent to the environment. NPDES samples are collected routinely and submitted for analysis or for shipment off-site. The two kinds of NPDES samples taken, weekly and monthly, are tested for different parameters (see summary tables 7.1.4 and 7.2.4).

> ***NOTE:*** Protective clothing (lab coats, rubber gloves and safety glasses) must be worn while collecting samples and during sampling procedures conducted in laboratories. When entering controlled areas, signs requiring additional protective clothing such as booties must also be observed. ESH-1 self-monitoring procedures must be observed when exiting a controlled area.

7.1 Weekly Samples

This set of samples is taken one day per week from one tank discharged that day to Mortandad Canyon. While discharging to the canyon, effluent is continuously pumped through the final effluent sample line to the main plant sample sink in Room 116 where the samples are collected.

7.1.1 Supplies

The following supplies are required for collecting weekly NPDES grab samples:

- HNO_3 (nitric acid),
- H_2SO_4 (sulfuric acid),
- three 1000-ml cubitainers, and
- NPDES Industrial Discharge Monitoring Form (Attachment 2).

7.1.2 Sampling Procedure

- Ensure that someone from the analytical laboratory at TA-50-1 Room 130 will be available to receive the samples and take the pH of the sample within 15 minutes of the sample collection time.

- Label each cubitainer using an indelible marker with the following information:

  - sampling number/date (NPDESmmyy.dd),
  - sampling time,
  - purpose of sample (e.g., "weekly or monthly grab"),
  - type of preservative used, if applicable.

- Add sample preservative to two of the cubitainers; the third sample does not require a preservative. Preservatives may be obtained in the analytical laboratory, room 130. Acids for weekly NPDES samples are located under the hood (hood #10060) and have Repipet Dispensers set for NPDES weekly volumes.

  The two samples that require preservative must be preserved with the following acids:

  - cubitainer 1: 2.5-ml H_2SO_4 and
  - cubitainer 2: 4.5-ml HNO_3

- After discharge pumps have been turned on, wait for 5 minutes before taking the samples.

- In Room 116, collect the samples by filling each container from the Final Effluent continuous sample stream at the sample sink.

- Mark each container with a "caution radioactive material" sticker.

- Fill out the appropriate sections of the NPDES Industrial Discharge Monitoring Form (Attachment 2). This form serves as a chain-of-

custody and accompanies the samples when they are delivered to the analytical laboratory.

7.1.3 Sample Submittal

- Deliver the samples with chain-of-custody information to the TA-50-1 analytical laboratory, Room 130.
- Ensure that personnel take the pH of the samples within 15 minutes of the sample collection time.
- Sign the appropriate section of the NPDES Industrial Discharge Monitoring Form (Attachment 2) and record the date and time of transferral. Ensure that the person receiving the samples also signs, dates, and records the time of transfer on this form.
- Record the following in the TA-50-1 Plant Daily Log:
  - time the samples were collected,
  - sampler's name,
  - sample pH, and
  - reading from the plant pH meter on the main control panel in Room 116C.

7.1.4 Weekly NPDES sample collection summary table

Container	Parameter	Preservative	Notes
1-liter cubitainer	pH, TSS	N/A	sample to Room 130
1-liter cubitainer	metals	HNO_3 (<2)	"
1-liter cubitainer	COD	H_2SO_4 (<2)	"

7.2 Monthly Samples

This set of samples is taken one time each month at the same time an NPDES weekly set of samples is drawn. It is preferred that this sample be drawn the first week of the month and within the first part of that week to allow for ample analytical time.

7.2.1 Supplies

The following supplies are required for collecting monthly NPDES grab samples:

- HNO_3 (nitric acid),
- HCl (hydrochloric acid),
- H_2SO_4(sulfuric acid),
- two 1- gallon cubitainer,
- nine 1- liter, amber, glass bottles,
- three 40-ml, clear, glass bottles
- two NPDES Industrial Discharge Monitoring Forms (Attachment 2).

7.2.2 Sampling Procedure

- Mark each container with the following information:

  - sample number/date (**NPDES**mmyy.dd)
  - sample description ("monthly grab") & outfall number (051)
  - sampling time
  - preservative & test parameter

- Add sample preservative to the appropriate containers. Preservatives may be obtained in the TA-50-1 analytical laboratory, Room 130.

  The samples requiring preservative are as follows:

  - two 1-gallon cubitainers: 18-ml each HNO_3
  - two 40-ml glass vials: 3-4 drops each HCl
  - one 40-ml glass vial: 3-4 drops HNO_3

  The method for adding acids to the 40-ml vials is identical to that used for preserving VOC samples (see subsection 6.1.2 (acids under hood #10100). The simplest method for adding acid to the 1-gallon cubitainer is to use the HNO_3 for weekly NPDES samples that is set up with a Repipet Dispenser (acid under hood #10060).

- After discharge pumps have been turned on, wait 5 minutes before taking the samples.

NOTE: 40-ml vials preserved with hydrochloric acid (HCl) are for Volatile Organics analysis and must contain no air bubbles.

- In Room 116, collect the samples by filling each container from the Final Effluent continuous sample stream at the sample sink.

- Mark each container with a "caution radioactive material" sticker.

- Fill out the appropriate sections of the NPDES Industrial Discharge Monitoring Form (Attachment 2). This form serves as a chain-of-custody and accompanies the samples when they are delivered to Sample Management.

- Note on daily log that the monthly NPDES sample has been taken.

7.2.3 Sample Submittal

The monthly Radium 226 & 228 and Total Toxic Organic (TTO) samples are sent by Sample Management to a laboratory off-site for analysis. It is our responsibility to have a radiological screening done on these samples and to arrange for their transportation to Sample Management for shipment. The monthly Nitrate/Nitrite/NH_3-N analysis is performed by the analytical laboratory at TA-50-1.

- Place the Radium 226 & 228 and TTO samples in the refrigerator outside Room 130 (place 40-ml bottles in a plastic beaker to keep them upright.) Place NPDES Industrial Discharge Monitoring Form with the samples.

- Place the 40-ml radiological screen under the hood in Room 130 and notify personnel that a screening needs to be performed.

- When radiological screening is complete, notify Sample Management that monthly samples have been collected and arrange for transportion of the samples to Sample Management. If samples are to be transported by CST-13 personnel, follow the packaging and transportation guidelines specified in the document "CST-13 Safe Operating Procedure for Transportation of Samples Associated with CST-13 Operations" (LW-CST13-SOP-06). (Samples are transported per DOT regulatory requirements, 173.421 for Radioactive Material, Excepted Package, Limited Quantity of Material, UN2910.)

- Upon transfer of samples to Sample Management, sign the appropriate section of the NPDES Industrial Discharge Monitoring Form (Attachment 2) and record the date and time of transfer. Ensure that the person from Sample Management receiving the samples also signs, dates and records the time of transfer on this form. Make a copy of all records to place in files at TA-50-1.

- Record in the TA-50-1 Plant Daily Log that samples were transferred.

7.2.4 Monthly NPDES sample collection summary table

Container	Parameter	Preservative	Notes
none beyond weekly*	Nitrate/Nitrite/NH_3-N	H_2SO_4 (<2)	sample to Room 130
2 1-gallon cubitainer	Radium 226 & 228	HNO_3 (<2)	refrigerate, transport
2 40-ml clear glass	TTO (VOC)	HCl (<2)	refrigerate, transport
3 1-liter amber glass	TTO (SVOC)	N/A	refrigerate, transport
3 1-liter amber glass	Dioxin	N/A	refrigerate, transport
3 1-liter amber glass	Pesticide	N/A	refrigerate, transport
1 40-ml clear glass	radiological screen	HNO_3 (<2)	sample to Room 130

* The sample volume taken for weekly samples preserved with sulfuric acid is sufficient in volume to run both weekly COD and monthly Nitrate/Nitrite/NH_3-N.

8.0 LEL AND GAMMA SAMPLES

Lower Explosive Limit (LEL) and Gamma samples are both raw influent samples collected from the head of the pH Neutralization chamber in Room 16. They are collected by an automatic sampler only when a sensor for either of these

parameters reaches a certain threshold. When the threshold is reached, the sampler takes a grab sample and an alarm is triggered to notify an operator.

> ***NOTE:*** Protective clothing (lab coats, rubber gloves and safety glasses) must be worn while collecting samples and during sampling procedures conducted in laboratories. When entering controlled areas, signs requiring additional protective clothing such as booties must also be observed. ESH-1 self-monitoring procedures must be observed when exiting a controlled area.

8.1 LEL

The LEL sensor at the head of the pH Neutralization Chamber is set to alarm and collect a grab sample at 10% of the LEL. When an LEL sample is collected by the sampler, the operator on-duty must retrieve the sample and submit it for VOC analysis.

8.1.1 Supplies

The following is required for collection of an LEL sample:

- one 1000-ml Nalgene bottle,
- three 40-ml clear, glass vials,
- HCl (hydrochloric acid),
- HNO_3 (nitric acid),
- disposable 3-ml pipettes,
- CST-13 Chain-of-Custody Record form (Attachment 1).

8.1.2 Sampling Procedure

- Using a grease pencil, label a 1000-ml Nalgene bottle with the date and "LEL, raw influent, TA-50-1."

- Collect the sample from the sampler in Room 16. Drain sampler.

- Take the sample to the laboratory, Room 130.

- Mark two of the 40-ml clear, glass vials with labels (LELmmyy.dd) and add 3 - 4 drops of HCl to each vial. Fill each vial with sample, tightly cap and invert each vial to ensure that there are *no air bubbles*.

- Mark one of the 40-ml clear, glass vials with the date, time, and "LEL sample", and add 3 - 4 drops of HNO_3. Fill the vial with sample.

- Mark each vial with "caution radioactive material" stickers.

- Pour the remainder of the sample down a radioactive drain and rinse the container.

8.1.3 Sample Submittal

- Place the two 40-ml samples preserved with HCl in the refrigerator in the hallway next to Room 130. Generally the 40-ml vials are placed in a plastic beaker to keep them upright.

- Record sample information on a blank chain-of-custody form (Attachment 1) inside the refrigerator.

- Place the sample in the 40-ml glass vial preserved with HNO_3 under the hood in Room 130 where the HNO_3 and HCl are located.

- When the screening results for the samples are complete, fax Sample Management (667-9863) the sample numbers, descriptions, and screening results for the samples needing to be picked up.

8.1.4 Sample Transfer

Personnel from Sample Management will retrieve and deliver the samples placed in the refrigerator. When they do:

- open the refrigerator and give the samples and the radiological screening results to Sample Management personnel;

- write the sample number assigned to the samples by Sample Management on the chain-of-custody form;

- complete chain-of-custody form by filling out signature, date, and time spaces at the bottom of the forms;

- make a copy of the chain-of-custody forms and give the original to Sample Management. File the copy in Room 116C.

8.2 Gamma

The gamma spike detector at the head of the pH Neutralization Chamber is set to alarm and collect a grab sample at 1,450 cpm. When a gamma sample is collected by the sampler, the operator on-duty must retrieve the sample and submit it for analysis.

8.2.1 Supplies

The following is required for collecting a gamma sample:

- one 1000-ml Nalgene bottle,
- one Laboratory Analysis form (Attachment 3).

8.2.2 Sampling Procedure

- Using a grease pencil, mark a 1000-ml Nalgene bottle with the date and "Gamma, raw influent, TA-50-1."

- Collect the sample from the sampler in Room 16. Drain, rinse and reset sampler.

8.2.3 Sample Submittal

- Take the sample to the TA-50-1 analytical laboratory, Room 130, and fill out a Laboratory Analysis form (Attachment 3) for alpha, beta and gamma testing.

- Leave the sample and the analysis request on the counter by the grease pencil.

9.0 TA-55 INDUSTRIAL WASTE SAMPLES

> ***NOTE:*** An ESH-1 Radiation Control Technician (RCT) MUST be present while this sample is being collected.

The raw influent from the TA-55 industrial waste line is sampled and analyzed for radionuclide constituents. An automatic sampler collects a continuous, composite sample of the waste as it passes through the pipeline in WM-107 above WM-66.

> ***NOTE:*** Protective clothing (lab coats, rubber gloves and safety glasses) must be worn while collecting samples and during sampling procedures conducted in laboratories. When entering controlled areas, signs requiring additional protective clothing such as booties must also be observed. ESH-1 self-monitoring procedures must be observed when exiting a controlled area.

9.1 Weekly

One 250-ml grab sample is collected from the sampler in WM-107 once a week, on a random basis. The sample is analyzed for gross alpha, ^{241}Am, and pH.

9.1.1 Supplies

- one 250-ml Nalgene bottle,
- one plastic bag and tape,
- TA-55 Industrial Waste Laboratory Analyses form (Attachment 4).

9.1.2 Sampling Procedure

- Mark one 250-ml Nalgene bottle with the date and "WM-107, industrial raw, TA-50."
- Notify a RCT that you will be sampling and arrange for an RCT to accompany you.
- Turn on the sampler mixer in WM-107 and let the sample mix for approximately 2 minutes.
- Open the drain valve approximately 1/8 turn.
- Allow the sample to drain for a few seconds, then place the open sample bottle under the drain and collect a sample.
- When the bottle is almost full, remove the bottle, allow the sampler to drain completely empty, and cap the bottle.
- Allow the RCT to monitor the bottle for radioactive contamination.
- Place the bottle in a plastic bag and tape the bag closed.
- Close the drain valve.

9.1.3 Sample Submittal

- Take the sample to the TA-50-1 analytical laboratory in Room 130 and fill out the date and time on a TA-55 Industrial Waste Laboratory Analyses form (Attachment 4).
- Leave the sample and the form on the counter by the grease pencil.

10.0 SLUDGE SAMPLES

For transportation, storage, and disposal purposes, treated sludge is tested for VOC, SVOC, TCLP and radiological constituents.

NOTE: Protective clothing (lab coats, rubber gloves and safety glasses) must be worn while collecting samples and during sampling procedures conducted in laboratories. When entering controlled areas, signs requiring additional protective clothing such as booties must also be observed. ESH-1 self-monitoring procedures must be observed when exiting a controlled area.

10.1 Dewatered Sludge Samples

Three grab samples of dewatered sludge from the vacuum filter cake are collected for each batch of sludge treated while the filter is running. These samples are random samples; however, generally they are collected a few days after drawing sludge from the clariflocculators to ensure that the sample will be as well mixed and representative as possible.

10.1.1 Supplies

The following supplies are required for collection of sludge samples:

- two 80-ml glass bottles,
- one 500-ml Nalgene bottle,
- CST-13 Chain-of-Custody Record form (Attachment 1),
- Vacuum Filter Solids Laboratory Analysis form (Attachment 5).

10.1.2 Sampling Procedure

The samples are analyzed for the following constituents:

one 500-ml sample	radiological and TCLP testing
one 80-ml sample	VOC
one 80-ml sample	SVOC

These samples are grab so preservatives are not added.

- Mark two (2) 80-ml glass sample bottles and one (1) 500-ml Nalgene sample bottle with the date and sample source (50Smmyy.dd).

- While the vacuum filter is running, collect the samples from the barrel that the dewatered sludge is falling into.

- Place "caution radioactive material" stickers on each container.

10.1.3 Sample Submittal

Secure the two samples in glass bottles in the upstairs CST-13 refrigerator in the hallway next to Room 130.

- Record sample information on the chain-of-custody form (Attachment 1) inside the refrigerator. Mark one form "VOC" and the other "SVOC."

- Take the 500-ml sample for radiological and TLCP analysis to the laboratory in Room 130 and fill out a Vacuum Filter Solids Laboratory Analysis form (Attachment 5). Leave the sample on the counter by the grease pencil. A radiological screening for the refrigerated samples will be done from the 500-ml sample and the results placed in the refrigerator.

- When the screening results for the samples are complete, fax Sample Management (667-9863) the sample numbers, descriptions, and screening results for the samples needing to be picked up.

10.1.4 Sample Transfer

Personnel from Sample Management will retrieve and deliver the samples placed in the refrigerator. When they do:

- open refrigerator and give the samples and the radiological screening results to Sample Management personnel;
- write the sample number assigned to the samples by Sample Management on the chain-of-custody form;
- complete the chain-of-custody form by filling out signature, date, and time spaces at the bottom of the forms; and
- make a copy of the chain-of-custody forms and give the original to Sample Management. File the copy in Room 116C.

11.0 SUMMARY CHART

Sample Type	Location in DOP	Frequency Drawn	Draw Point	Off-Site Transfer
raw influent	5.1	daily	Room 16	none
raw feed	5.2	every day the plant is run	Room 116	none
gravity filter effluent	5.3	when an effluent tank is discharged	Room 116	none
VOC, raw influent	6.1	one time weekly	Room 16	Sample Management
VOC, raw feed	6.2	one time weekly	Room 116	Sample Management
NPDES, weekly	7.1	one time weekly	Room 116	none
NPDES, monthly	7.2	one time monthly	Room 116	Sample Management
LEL	8.1	when in alarm state	Room 16	Sample Management
gamma	8.2	when in alarm state	Room 16	none
TA-55 industrial	9.1	one time weekly	WM-107	none
sludge	10.1	for each batch run	Room 116 B	Sample Management

12.0 DISTRIBUTION

This document will be available in the following places at TA-50-1:

- document control room 101A and
- control room 116C.

13.0 ATTACHMENTS

Attachment 1: CST-13 Chain-of-Custody Record form
Attachment 2: NPDES Industrial Discharge Monitoring form
Attachment 3: Laboratory Analysis form
Attachment 4: TA-55 Industrial Waste Laboratory Analyses form
Attachment 5: Vacuum Filter Solids Laboratory Analysis form

CST-13 CHAIN OF CUSTODY RECORD

AMPLING LOCATION (TA/BLDG/ROOM): _____ SAMPLE TYPE: _____

ST-13 SAMPLE #	SAMPLED BY (Signature)	TIME	SECURED BY (Signature)	DATE	TIME	CST-9 SAMPLE #	RAD CHECK

RLWTF INFORMATION ONLY

ceived By (print)/Group	Signature	Date	Time

linquished By (print)/Group	Signature	Date	Time	Received By (print)/Group	Signature	Date	Time

eviewed By: _____ Review Date: _____

C_O_C.DOC; Rev. 10-20-94

Attachment 2: NPDES Industrial Discharge Monitoring form

NPDES Industrial Discharge Monitoring

EPA Serial No.: 051051 Sample No.: _____
TA/Building: TA-50-1
Date Sampled: _____ Sampled by: _____
Flow: _____(liters/day) ☐ estimated ☐ measured

Discharge Description:
color:_____ foam or floating solids:_____ odor:_____
comments:_____
_____

Preservatives Added: ☐ HNO3 (<2) ☐ H2SO4 (<2) ☐ HCl (<2) ☐ Refrigeration

☐ Weekly Sample

Analysis	Results/Concentration	Time Collected	Date Began	Time Began	Method	Analyzed By
pH					150.1	
TSS					160.2	
C.O.D					410.4	
Cd(T)					213.2	
Pb(T)					239.2	
Cu(T)					200.7	
Fe(T)					200.7	
Zn(T)					200.7	
Hg(T)					245.2	
Cr(T)					200.7	
Ni(T)					200.7	

RLWTF INFORMATION ONLY

☐ Monthly (Submit to TA-50)

Analysis	Results/Concentration	Time Collected	Date Began	Time Began	Method	Analyzed By
Total N					351.3	
Nitrate-Nitrite (as N)					353.3	
Ammonia (as N)					350.1	

☐ Monthly (Submit to Sample Management for shipping)

Analysis	Results/Concentration	Time Collected	Date Began	Time Began	Method	Analyzed By
TTO*	----------	--------	--------	-------	40 CFR 136	----------
Ra 226 & 228					903.1	

Assigned Sample Numbers

Sample Number	Assigned By	Date	Organization

Chain-Of-Custody Record

Relinquished By (Signature)	Date	Time	Received By (Signature)

Remarks: _____

_____

_____

_____

Reviewed by _____ Date _____ (CST-9)
Reviewed by _____ Date _____ (ESH-18)

LABORATORY ANALYSES

SAMPLE SUBMITTED BY:		DATE:								
ORIGIN OF SAMPLE(S)										
DATE SAMPLED		DATE BEGUN	METHOD	ANALYZED BY	DESCRIPTION		DATE BEGUN	METHOD	ANALYZED BY	
Test/Analysis	Result/Conc				Test/Analysis	Result/Conc				
REMARKS:										

RLWTF INFORMATION ONLY

APPROVED: _____ DATE: _____
Chief Chemist

H7-LAB-35A

Lab Copy

Attachment 4: TA-55 Industrial Waste Analyses form

TA-55 INDUSTRIAL WASTE LABORATORY ANALYSES

SAMPLE SUBMITTED BY:			DATE:	
ORIGIN OF SAMPLE: *TA-55 Industrial Waste*			TIME SAMPLED:	
DESCRIPTION: *TA-55 Industrial Waste Sampled at TA-50-WM-66*				
LABORATORY I.D. NUMBER:				
TEST/ ANALYSIS	RESULT/CONCENTRATION	TIME BEGUN	METHOD	ANAL. BY
Gross ALPHA			ALPHA	
^{241}Am			NaI	
pH			GE	
REMARKS:				
APPROVED BY:			DATE:	

Attachment 5: Vacuum Filter Solids Laboratory Analysis form

VACUUM FILTER SOLIDS
LABORATORY ANALYSES

SAMPLE SUBMITTED BY:	DATE:
ORIGIN OF SAMPLE: *TA-50 / DP-257*	DATE SAMPLED::
DESCRIPTION: *Radiochemical Analyses of Vacuum Filter filtercake.*	
TA-50 (50S) / DP-257 (21-257S)	
LABORATORY I.D. NUMBER:	

	TEST/ ANALYSIS	RESULT/CONCENTRATION	DATE BEGUN	METHOD	ANAL. BY
	Gross ALPHA			ALPHA	
	^{234}U			RAS	
	^{235}U			RAS	
	^{238}Pu			RAS	
	^{239}Pu			RAS	
	^{241}Am			RAS	
	% Solids			Grav.	
E P T O X	Ag			272.2	
	As			206.2	
	Ba			208.1	
	Cd			213.2	
	Cr			218.2	
	Hg			245.1	
	Ni			249.1	
	Pb			239.2	
	Se			270.2	
	Tl			279.2	

RLWTF INFORMATION ONLY

REMARKS:	
APPROVED BY:	DATE:

LAB35B; Rev. 09-07-94

LOS ALAMOS
NATIONAL LABORATORY
CST-13

CONTROLLED DOCUMENT
(Uncontrolled Document: If not printed in red)

Users have the ultimate responsibility to ensure that they are working with the latest revision of the controlled document.	Copy Number 1

RLWTF OPERATIONS MANUAL

RESPONDING TO HARD ALARMS (INCLUDES RESPONDING TO RLWCS ALARMS)

LW-CST-13-DOP04-r01

Effective Date: May 1, 1996

ROYBAL, AMY
CST-13
E518

CST-13

RADIOACTIVE AND INDUSTRIAL WASTEWATER SCIENCES GROUP

DETAILED OPERATING PROCEDURE

for

RESPONDING TO HARD ALARMS (Includes Responding to RLWCS Alarms)

Prepared by: Lonnie Theye — Date: 4/30/96
Lonnie Theye, CST-13
Staff Member

Reviewed by: Jeffrey Scott — Date: 5/1/96
Jeffrey Scott, CST-13/RRA
Computer Technologist

William David Moss — Date: 4/30/96
William David Moss, CST-13
Team Leader/TA-50-1 Building Manager

Approved by: Steven W. Hanson — Date: 5·1·96
Steve Hanson, CST-13
Group Leader

CST-13
Detailed Operating Procedure
for
Responding to Hard Alarms
(includes responding to RLWCS Alarms)

Table of Contents

CST-13
Detailed Operating Procedure
for
Responding to Hard Alarms
(includes responding to RLWCS Alarms)

1.0 INTRODUCTION

The Radioactive and Industrial Wastewater Sciences Group (CST-13) of the Chemical and Science Technology (CST) Division manages and operates three radioactive liquid waste treatment plants (RLWTPs) and a radioactive liquid waste collection system (RLWCS) associated with these plants. CST-13 bought a computerized alarm system written in G2 format and installed it on its computer system. These alarms notify personnel when a situation in operations requires their attention.

1.1 Purpose

This detailed operating procedure (DOP) ensures

- consistency of operations,
- health and safety of personnel,
- protection of the environment,
- exposure to radiation is kept as low as reasonably achievable (ALARA), and
- compliance with applicable federal and Los Alamos National Laboratory (LANL) requirements.

1.2 Scope

This DOP outlines the proper response to all TA-50-1 hard alarms including RLWCS alarms, that do not occur during normal working hours. It applies to all persons who may respond to alarms during off-normal working hours.

2.0 DEFINITIONS AND ACRONYMS

2.1 Definitions

acknowledge (an alarm)	A signal on G2 that a qualified person observed the alarm. The icon will stop flashing and remain on continuously after acknowledgement.
Central Alarm Station (CAS)	Emergency personnel reached when dialing 911.
CST-13 personnel	A CST-13 employee or an on-site contractor dedicated to CST-13 operations.
G2	An intelligent programmable system sold by Gensym Corporation and used by CST-13 for monitoring and controling systems associated with RLWCS and RLWTP operations.

hard alarms	Alarms on G2 signifying a potentially urgent situation within the plant or the collection systems that may require immediate attention. These alarms send a message to the computer at the operator's desk in Room 116C or Room 114 t initiate an audible alarm with flashing warning lights.
icon	A picture or symbol on the computer screen that initiates an action if selected.
inhibit (an alarm)	To deactivate an alarm on G2.
operational alarms	Alarms indicating changes to the status of systems used during routine plant operations (i.e.: liquid levels in tanks). These alarms do not signify an urgent situation.
Utilities	The Utilities Control Center (UCC), an alarm-monitoring station operated by Johnson Controls World Services, Inc. (JCI) to monitor hard alarms activated by G2 24 hours a day. Utilities is referred to as CAS on the computer.
Radioactive Liquid Waste Collection System	A system of pipelines and associated equipment designated for the transfer of radioactive liquid waste and managed and operated by CST-13.
radioactive liquid waste treatment plants	Either or all of three RLWTPs managed and operated by CST-13: the Main RLWTP at TA-50; the Pretreatment Plant in Rooms 60 and 60A at TA-50- and the RLWTF at TA-21-257.
unacknowledged (alarm)	An alarm that has not been recognized.

2.2 Acronyms

CAS	central alarm station (in this case Utilities but referred to as CAS on the computer)
CST-13	Radioactive and Industrial Wastewater Sciences Group
DOP	detailed operating procedure
PLC	programmable logic controller
RCT	radiological control technician
RLWCS	Radioactive Liquid Waste Collection System
RLWTP	radioactive liquid waste treatment plant
SOP	safe operating procedure

3.0 ALARMS

Two types of alarms, hard and operational, are on G2. These are defined in Section 2.2. Alarms on G2 include, but are not restricted to

- G2 failure;
- tank level alarms that alarm when the level in a tank is outside of a preset range;
- pH alarms that alarm when the pH in a tank is outside of a preset range;
- leak detection alarms for RLWCS vaults and buildings connected to the RLWCS (see Section 5.0 for more information);
- radiation alarms, such as continuous air and neutron monitors;
- exhaust fan alarms;
- high flow alarms; and
- power outages.

4.0 HARD ALARMS

At least two people should be present when responding to a hard alarm.

4.1 G2 Operations Manual

Instructions for operating G2 are in the *Plant G2 Operational Manual* in the computer room, Room 114. This manual includes instructions for all G2 functions, including action to take to

- determine the source of an alarm,
- acknowledge an alarm, and
- inhibit an alarm when the alarm does not require immediate attention.

4.2 Responding to an Alarm

If G2 alarms, a message is sent both to the operator's desk in Room 116C and to Utilities. During off-normal working hours when no one is at the operator's desk, Utilities notifies someone from the TA-50-1 Call Out List (see Attachment 1). Follow these steps if you receive a call from Utilities.

4.2.1 Contact another person on the TA-50-1 Call Out List and meet at TA-50-1.

4.2.2 Go to the computer in either Room 114 or 116C to confirm the cause of the alarm.

4.2.3 To identify the alarm source, at the top of the computer screen the alarm is flagged with an icon that contains the name of the device in alarm. Clicking on the icon takes you to the computer screen where the device is located. More specific information is found by

- referring to the alarm summary page on the computer and
- referring to the unacknowledged summary page on the computer.

4.2.4 Determine the alarm condition.

4.2.5 Complete the Computer Alarm Checklist (see Attachment 2).

4.2.6 If you are trained and qualified, use discretion in taking appropriate action, such as

- acknowledge the alarm and fix the problem activating the alarm, (If necessary, notify an appropriately trained person to correct the specific problem.)
- inhibit the alarm and note it in the operator journal on the G2 screen, or
- temporarily stop the alarm by changing an alarm setting on G2 so it alarms again before the situation becomes urgent or some similar response.

4.2.7 Call Utilities at 667-6191 to ensure that the CAS alarm has cleared.

4.2.8 Put the completed Computer Alarm Checklist in a location that is visible on the CST-13 operator's desk in Room 116C to ensure that an operator sees it when reporting to work the next day and becomes aware of the alarm's occurrence.

4.3 Computer Alarm Icons

A red alarm CAS icon will appear at the top of the screen each time the computer detects a hard alarm. Additional icons indicating alarm locations will appear next to the CAS icon. As additional alarms are detected, click on the icon for the additional alarms at the top of the screen. When an alarm is acknowledged, the associated alarm icon on top of the screen disappears.

4.4 Computer-controlled Relays

The computer-controlled relays for the computer alarm are located in back of programmable logic controller (PLC)2 in Room 16.

If G2 determines the criticality of an alarm to be "hard," it causes PLC2 to trigger an alarm relay. If the computer loses contact with PLC2 for more than 60 seconds, PLC2 will automatically initiate a computer alarm. Power failure at PLC2 will de-energize and open the computer alarm relays. This causes an immediate alarm condition.

5.0 RLWCS ALARMS

Radioactive liquid waste generated at TA-48, TA-55, TA-59, TA-53, TA-35, and TA-3 will flow to TA-50-1 through the RLWCS. If wastewater enters the secondary containment, it flows by gravity to the next vault. A leak detection system is inside the vaults in the RLWCS and in trenches inside the buildings connected to the RLWCS. Leaks are detected when probes in the vaults contact liquid outside of the primary containment, creating a short that initiates a hard alarm on the computer at the operator's desk in Room 116C and in the computer room, Room 114.

5.1 Responding to RLWCS Alarms

Vaults in the RLWCS are confined spaces. Consequently if entering a vault, refer to safe operating procedure (SOP) LW-CST13-SOP04, the "SOP for Entry and Work in Confined Spaces Associated with CST-13 Operations." This document is kept in the CST-13 truck dedicated to confined space operations and contains a map of all RLWCS vaults.

Use the following procedure if an alarm is activated from the RLWCS.

5.1.1 Confirm the cause of the alarm at the computer in Room 114 or 116C.

5.1.2 Complete the Computer Alarm Checklist (see Attachment 2).

If the alarm is from a single isolated vault, ascertain that an alarm upstream has not been activated or inhibited within the last 24 hours and proceed to step 5.1.3.

If two or more alarms in a series are in alarm *AND* the alarms were not caused by a power outage, contact the CST-13 Group Leader or a team leader to decide whether the situation is urgent and requires immediate attention. Proceed to either step 5.1.3 or 5.1.4, depending on the decision.

5.1.3 The situation is not urgent (i.e.; an alarm due to rainwater leaking around the vault cover or from a single isolated vault), so inhibit the alarm and wait until normal working hours to correct the situation. See the *Plant G2 Operations Manual.* Do *NOT* proceed to step 6 of these instructions.

5.1.4 The situation is urgent and the vaults require immediate inspection.

- Go to the vault immediately upstream from the alarm and determine the reason for the alarm by visually inspecting the inside of the vault from the outside.
- If radiological support is needed, contact the Health Physics Operations (ESH-1) radiological control technician (RCT) that is on call. Instructions for contacting the on-call RCT are posted in the RCT's office at TA-50-1, Room 116C.

If no water is present,

- inhibit the alarm at TA-50-1.
- enter the incident in the G2 operator journal on the G2 screen.
- during normal working hours, determine the cause of the alarm.

If the alarm is due to surface water leaking around the vault cover or groundwater infiltration, the problem can generally be corrected during normal working hours if the flow rate into the vault is not critical.

If the cause of water in the vault is indeterminate *OR* is caused by leaking pipes or equipment, visually monitor the rate of flow into the vault to determine if the flow rate is critical.

If water is flowing into the vault at a critical rate,

- take action to stop the flow, such as stopping the flow from leaking pipes;
- notify the CST-13 Group Leader/designee;
- contact the Manager of the facility where the alarm condition exists; and
- contact FSS-9 coordinators in the affected areas and request assistance to control the flow from the source.

If the alarm may be caused by something other than water in the vault;
check for obvious causes such as power outages, failed pumps, etc; and notify the Manager of the facility where the alarm was triggered.

5.2 G2 Color Codes

Various color/blink attributes for manhole icons indicate the status condition of the related point. The following color/blink attributes have been assigned:

Condition	Attribute
normal	wheat background
alarm	flashing red triangle inside
acknowledged alarm	red triangle inside
return to normal, but alarm unacknowledged	flashing green triangle inside
scan disabled	red circle with slash through it
alarm inhibited	red circle with slash through it

6.0 CONTACTS

6.1 Call Out List

See Attachment 1.

6.2 Other Contacts

Position	Name	Office	Home	Pager
Landlord	Alex Gancarz	7-4457	988-4037	
Group Leader	Steve Hanson	7-4301	672-1686	
Building Manager	David Moss	7-4301	662-5124	
Safety Officer	Bob Weeks	7-7391	828-2935	104-2304
Utilities		7-7191		
ESH-1 Supervisor	Brian Scott	7-4093	753-7204	118-272

7.0 REFERENCES

LW-CST13-SOP04, "Safe Operating Procedure for Entry and Work in Confined Spaces Associated with CST-13 Operations"; (most recent revision)

Plant G2 Operations Manual, CST-13 document, (most recent revision)

8.0 DISTRIBUTION AND POSTING

The most recent version of this DOP is available through the CST-13 Document Control Manager in TA-50-1, Room 101A and for reference in the following places at TA-50-1:

- Room 101A, document control room;
- Room 116C, control room;
- Room 116C, Call Out Logbook;
- Room 114, computer room.

9.0 REQUIRED RECORDS

9.1 Computer Alarm Checklist

Always complete the Computer Alarm Checklist (Attachment 2) when responding to a hard alarm that does not occur during normal working hours. The forms are in the white Call Out Logbook that is kept by the operators desk in Room 116C.

9.2 Operator Journal

Always complete the operator journal on the G2 screen when leaving the operating systems in an off-normal state, for example, when inhibiting an alarm or changing alarm settings. See also the *Plant G2 Operations Manual* in the computer room, Room 114.

10.0 ATTACHMENTS

1. TA-50-1 Call Out List
2. Computer Alarm Checklist

ATTACHMENT 1

TA-50-1

CALL OUT LIST

David Moss	662-5124
(or Cellular)	1(505)699-4062
Rob Harris	662-3324
Ed Freer	672-0316
Davy Sparks	662-4613
Scott Volz	672-[illegible]1
Debora Hall	[illegible]2-4329
Dave Knapp	662-0573
Jeff Scott	672-1332
Barry Bryan	672-3024
Steve Hanson	672-1686
Dave Salazar	1(505)852-3602
Steve Gomez	1(505)753-7504
Rick Alexander	1(505)753-4431

RLWTF INFORMATION ONLY

EMO (emergency on-call 24-hours).....667-6211

Steven W. Hanson
Group Leader

12.22.95
Date

Wm. David Moss
Building Manager/Operations Team Leader

12-22-95
Date

ATTACHMENT 2

COMPUTER ALARM CHECKLIST

Date: _____ Time: _____ Operators: _____

INFORMATION FROM THE COMPUTER SYSTEM:

Location of the Alarm: _____

Time of Alarm: _____

Other Observations: _____

_____

FIELD VERIFICATION:

☐ YES ☐ NO

Comments: _____

_____

_____

OTHERS CALLED: COMMENTS:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

ACTIONS TAKEN:

Comments/Description: _____

_____

_____

_____

Alarm Clear?	☐ YES	☐ NO
Computuer Alarm reset and armed?	☐ YES	☐ NO
Utilities Office Contacted? (7-6191)	☐ YES	☐ NO

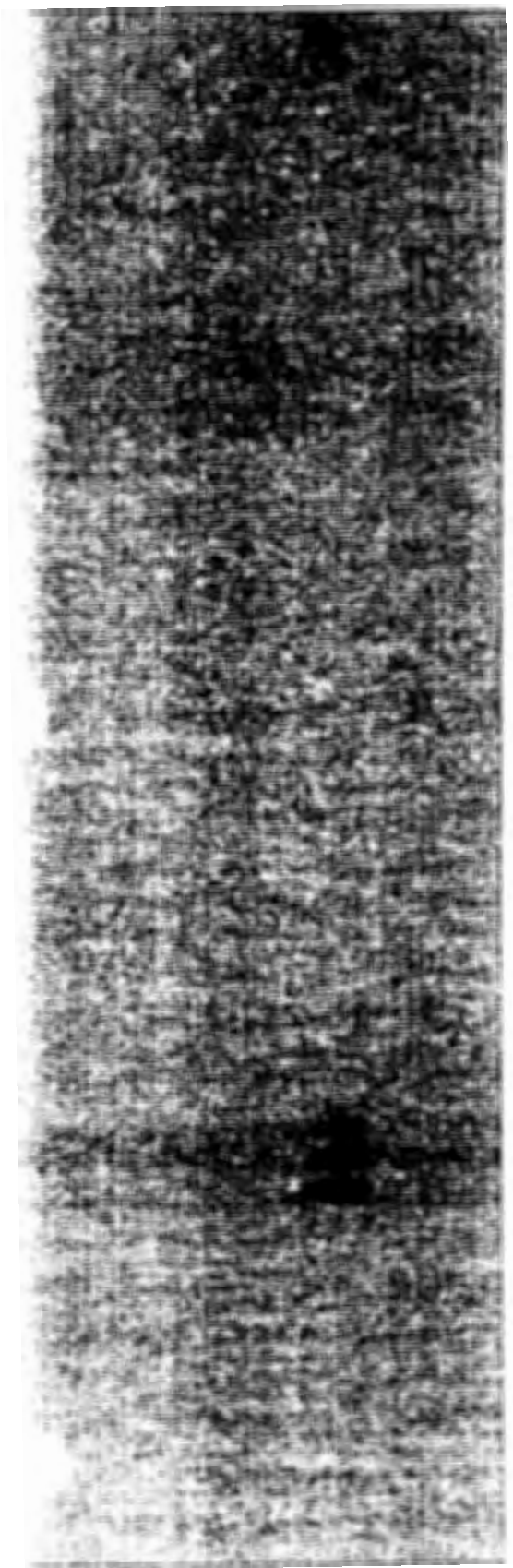
Follow-Up Needed: _____

_____

SIGNATURES: _____

LA-12900

Official Use Only



Los Alamos National Laboratory Emergency Management Plan

Los Alamos
NATIONAL LABORATORY

Los Alamos National Laboratory is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.

1.0 INTRODUCTION

1.1 PURPOSE OF EMERGENCY MANAGEMENT PLAN

The Laboratory has developed this Emergency Management Plan to assist in emergency planning, preparedness, and response to anticipated and actual emergencies. It establishes guidance for ensuring safe Laboratory operation, protection of the environment, and safeguarding Department of Energy property. The Emergency Management Plan and Emergency Management Plan Implementing Procedures may be used to assist in resolving emergencies including but not limited to fires, high-energy accidents, hazardous material releases (radioactive and non-radioactive), security incidents, transportation accidents, electrical accidents, and natural disasters.

The Emergency Management Plan complies with the following: Department of Energy Orders 5500.1B, 5500.2B, 5500.3A, 5500.10, and 5000.3B; Federal Regulation 29 CFR 1910.120; Title 40-Protection of Environment Part 300 of the Code of Federal Regulations; and Department of Energy Albuquerque Operations Office and Los Alamos Area Office attachments and updates (pertaining to emergency operations). The Laboratory Emergency Management Plan and its Implementing Procedures establish an emergency management program that

- Assigns responsibilities;
- Guides in categorization and classification;
- Outlines necessary notifications for emergency response personnel and the public;
- Outlines the assessment of Laboratory and offsite hazardous materials conditions during and/or following an emergency;
- Outlines an effective course of action to protect the public and Laboratory personnel in the event of an emergency;
- Provides for implementation of protective actions;
- Guides mitigation of the hazardous materials consequences; and
- Outlines necessary training for emergency response personnel.

1.2 UPDATE OF THE EMERGENCY MANAGEMENT PLAN

The Emergency Management Plan will be reviewed annually and updated when significant changes are required. The update will include corrections for internal and external audit findings, drill and exercise findings, and changes to Laboratory operations and hazards.

2.0 EMERGENCY RESPONSE ORGANIZATION

The Emergency Response Organization is composed of both dedicated emergency organizations and individuals, and those specifically designated to assume emergency duties in the time of an emergency. The Emergency Response Organization may include on- and offsite elements. They may be either specifically preplanned or integrated into the Emergency Response Organization upon arrival on the scene. In unique situations, additional resources may interface with the Emergency Response Organization but not become an integrated element of the Emergency Response Organization.

The Emergency Response Organization has overall responsibility for coping with and minimizing or mitigating the effects of any emergency at the Laboratory. This responsibility includes the following functions:

- Incident categorization and emergency classification;
- Notifications;
- Protective actions and protective action recommendations;
- Incident management and decision making;
- Onsite emergency resource coordination and incident mitigation;
- Consequence assessment;
- Medical operations;
- Public information;
- Security;
- Communications;
- Recovery and reentry;
- Administrative support; and
- Onsite support, coordination and liaison.

Successful Emergency Response Organization operation is dependent on

- Coordination among on-scene Emergency Response Organization elements,
- Smooth integration of offsite resources into the Emergency Response Organization, and
- Close cooperation between on-scene and Emergency Operations Center operations.

This Emergency Management Plan, with its associated implementing procedures, is intended to provide for coordination, integration, and cooperation between the Laboratory Emergency Response Organization, offsite emergency resources, Department of Energy field elements, and the Department of Energy national response assets identified in Section 2.1.

3.0 OFFSITE RESPONSE

The potential magnitude of some emergencies may warrant the interface, coordination, and utilization of offsite individuals, organizations, and agencies at the federal, state, tribal, and local level. Since it is imperative that these support groups be available on short notice, written agreements have been entered into with some offsite organizations.

3.1 OVERVIEW

The Department of Energy Los Alamos Area Office, with assistance from the Emergency Management and Response Office, initiates, coordinates, reviews, and renews all agreements. In the written agreements the offsite organizations outline their resources and responsibilities, assuring their response to a call for aid. Copies of these agreements reside on file at the Department of Energy Los Alamos Area Office with copies in the Emergency Management and Response Office. The request for emergency assistance may be initiated by the Incident Commander or Emergency Director. For federal response the Department of Energy Los Alamos Area Office Manager makes the requests. However, in the event the Department of Energy Los Alamos Area Office Manager cannot be reached, in an emergency, the Emergency Management and Response Office may directly contact the necessary organizations for emergency assistance. The Department of Energy Los Alamos Area Office will be notified as soon as possible if emergency assistance is requested by the Emergency Management and Response Office directly.

The Laboratory will use the Incident Command System which enables the Emergency Response Organization to participate with a minimum of confusion and hesitation. Participating agencies should have a clear understanding of their responsibilities and coordination within the Incident Command System.

Communication with participating response agencies should be clear using limited (and well understood) acronyms, **NO** code words or brevity codes, and **NO** chemical, fire, or police jargon. Radio call signs for organizations should be functional.

State, local, and tribal governments are encouraged to prepare their own response plans for those areas where the Laboratory Emergency Planning Zone extends beyond Department of Energy property. These governments participate in Laboratory drills and exercises.

4.0 OPERATIONAL EMERGENCY EVENT CLASSES

The Laboratory encourages a positive attitude toward assessing and reporting occurrences to ensure that management is kept informed of events that may

- Affect or endanger the health and safety of employees or the public;
- Seriously impact the intended purpose of the Laboratory's facilities or programs; or
- Have a significant adverse effect on the environment.

Emergencies will be reviewed for categorization in accordance with Department of Energy Order 5500.2B. Emergencies are grouped into three broad categories;

- Operational emergencies;
- Energy emergencies; and
- Continuity-of-government emergencies.

Energy and continuity-of-government emergencies are handled by the Department of Energy Headquarters; however, Laboratory support for these may be provided upon request by the Department of Energy. Only operational emergencies will be addressed in this document. Information in this section may be used as guidance for assessing the problems, classifying an operational emergency, and determining the necessary response to mitigate the event.

4.1 DEFINITIONS

Operational emergencies are defined as significant accidents, incidents, events, or natural phenomena which have, or can, seriously degrade the safety or security of facilities. Operational emergencies apply to

- Reactors;
- Buildings involved with hazardous material;
- Nuclear weapons, components, or test devices;
- Safeguards and security events; and
- Transportation accidents involving hazardous material under Laboratory control.

Operational emergencies are further divided into classes by degree of severity depending on the actual or potential consequence of the emergency situation. The three classes of emergencies in order of increasing severity are defined as:

- Alert;
- Site Area Emergency; and

5.0 NOTIFICATION AND COMMUNICATIONS

Recognition of emergencies and the importance of timely notification and communication is the responsibility of Laboratory employees, contractors, and visitors. Limited emergency information and telephone numbers are provided on a card attached to security badges of all Laboratory personnel and visitors (10 days or more). Additionally, each Laboratory telephone book has emergency numbers and information.

Each building entrance and entrance to rooms used for storage, equipment, or computers must be posted with the Environment, Safety, and Health Responsibility Sign. Information on the sign must be reviewed annually by the cognizant line manager.
Laboratory personnel discovering or reporting an emergency or incident should

- Call 911;
- Pull an alarm box for fire or smoke;
- Ensure notification of line management; and
- Ensure that the Emergency Management and Response Office is notified at 667-6211.

A 911 caller should stay on the telephone until released by the operator. If possible, someone must be directed to meet the arriving emergency response unit(s) to assist them in getting into the proper location and brief them on the emergency. When dialing 911 or using a pull alarm box, the Central Alarm Facility (which is staffed on a 24-hour basis) may initiate emergency response, notify the Emergency Management and Response Office, or notify the duty Emergency Manager. The duty Emergency Manager will determine what additional resources are needed.

Building personnel upon hearing a fire alarm, shall evacuate to the appropriate designated area. A designated person shall initiate a 911 call to report the alarm condition. If time permits, personnel should quickly secure all classified documents and exit with necessary personal belongings (purse, keys, coat, etc.). For criticality alarms, all personnel must immediately evacuate.

Personnel on Laboratory property have "stop work authority" and should make appropriate notifications as outlined in the Laboratory Administrative Manual and discussed in Section 1.3 of this Emergency Management Plan.

6.0 CONSEQUENCE ASSESSMENT

Consequence Assessment evaluates and interprets hazardous materials measurements or other information to provide a basis for decision making. Planning, preparedness, and response identify provisions and chronological steps for a consequence assessment capability.

6.1 CONSEQUENCE DETERMINATION

Upon arrival at the scene of an emergency, the Emergency Manager is briefed by the initial Incident Commander, Facility Emergency Coordinator, and first responder(s). The Emergency Manager assumes the Incident Command and immediately assesses the emergency to determine the response and resources necessary to bring the emergency under control. The Hazardous Materials Response Team or technical experts provide technical assistance to the Incident Commander in identifying, both qualitatively and quantitatively, the material involved, the hazards associated with that material, and recommending necessary protective actions.

The initial requirements for consequence assessment shall be determined by the accident sequences and potential consequences of the releases. Initially, consequence assessment may be relatively simple, providing timely information for the classification and initial protective action decision making. The Emergency Technical Support Center provides large-scale consequence assessments (i.e. within and beyond the emergency planning zone) and/or long-time release data of hazardous materials. Specific procedures and methodology are found in the Emergency Management Plan Implementing Procedures.

On-scene initial consequence assessment will involve analysis of physical indicators, and simple gaussian dispersion modeling performed on a portable computer. The Emergency Technical Support Center will utilize real-time meteorological data and documented hazards assessment for the specific facility involved to perform dispersion calculations. Specific procedures and methods are found in the Emergency Management Plan Implementing Procedures.

6.1.1 CONTINUED CONSEQUENCE ASSESSMENT

The Incident Commander continues the assessment of the emergency which may include:

- Calling for additional qualified emergency personnel and equipment to assist in determination of the appropriate assessment and protective action decisions, including projections of Laboratory and offsite

7.0 PROTECTIVE ACTIONS

The Los Alamos National Laboratory is responsible for ensuring that timely recommendations for specific protective actions are taken in response to emergency conditions involving hazardous materials (radiological and non-radiological) at the Laboratory. The Laboratory is responsible for alerting personnel, informing offsite populace, recommending sheltering or evacuation, or taking other remedial or protective actions as the emergency demands.

In an emergency, the risk to personnel or to the public is not under control. Exposure may be limited by some form of intervention or protective action. The Protective Action Guides and Emergency Response Planning Guidelines provide guidance to the decision maker as to what essential protective actions are required. Further, the Protective Action Guides and Emergency Response Planning Guidelines discourage those protective actions which would result in net harm to personnel. The recommended protective action will most likely be made under emergency conditions, yet based on the risks and costs incurred by taking the action.

Provisions are in place for specific actions to be taken in response to emergency conditions. These are discussed in Section 2.3. To protect Laboratory personnel and the public, the following provisions have been made for protective actions.

- The Emergency Management and Response Office will make timely recommendations through appropriate routes to notify federal, state, tribal, or local authorities of protective actions, such as sheltering or evacuation for the general public. These procedures are detailed in the Emergency Management Implementing Procedures.

- The Protective Action Guides and Emergency Response Planning Guidelines are prepared in conformance with Department of Energy approved guidance. These are applicable to the actual or potential release of hazardous materials to the environment and may be used in protective action decision making. These are presented in Tables 7-1 through 7-6.

- Limited on-scene hazardous material decontamination is provided by the Hazardous Materials Response Team. Extensive decontamination is available at area medical facilities by trained medical personnel with assistance from trained Environment, Safety, and Health Division personnel. Contaminated equipment may be properly packaged and transported to TA-50 to the decontamination facility.

- Any personnel contamination determinations made by the Hazardous Materials Response Team or other Environment, Safety and Health Division responders will be documented and the results transmitted to the appropriate medical facility.

- If the Resource Conservation Recovery Act applies to the incident, the Los Alamos National Laboratory Hazardous Waste Facility Permit, Attachment D (Contingency Plan) will be invoked.

8.0 MEDICAL SUPPORT

Medical support at the Laboratory encompasses immediate medical care, transportation of injured persons to medical facilities, and provisions for offsite care and treatment. Medical support at the Laboratory is provided by the Occupational Medicine Group in the Environment, Safety and Health Division. The Occupational Medicine Group is located in the onsite Occupational Medicine Facility (TA-3-409).

8.1 SYSTEM

Occupational Medicine provides emergency treatment to employees of the Laboratory, security services, support services, and the Department of Energy Los Alamos Area Office. Other personnel including contract personnel, visitors, and the public are treated at the Los Alamos Medical Center. Additionally, Occupational Medicine may respond to the scene of an emergency. Occupational Medicine may consult with offsite medical personnel concerning follow-up treatment of patients treated offsite for job incurred injuries or illnesses.

The Emergency Management and Response Office notification procedure includes alerting Occupational Medicine in the event of emergencies involving Laboratory personnel in work-related accidents or hazardous releases. In an off-hours Laboratory emergency, the Incident Commander will notify the on-call Occupational Medicine representative for response, assistance, or advice as the emergency warrants. Responders will be responsible to and receive their assignment from the Incident Commander.

The Laboratory has one clinic, the Occupational Medicine Facility, equipped to deal with injuries or illnesses. Hours are 8:00 am to 5:00 pm daily and the telephone number is 667-0660. Patients requiring extended observation or treatment will be sent to local hospitals.

There are two first aid stations onsite which are equipped to handle minor injuries and illnesses. The locations are as follows.

- TA-16-193, Room 124, S-Site area, open daily from 12:00 pm to 4:00 pm. The telephone number is 667-6408.
- TA-55-3, Room 142, open from 1:00 pm to 5:00 pm daily. The telephone number is 667-2310.

Evaluation and treatment for accidents involving hazardous material (radiological and non-radiological) contamination is provided by the

9.0 REENTRY AND RECOVERY

In the period immediately following an emergency, initial hazardous material monitoring involves only gross hazard assessment. This immediate surveillance is used to provide the basic initial information for reentry and/or recovery operations. All reentry actions conducted prior to the termination of the emergency must be authorized by the Incident Commander with concurrence by the Emergency Director (if the Emergency Operations Center is activated). Reentry shall be made with the utmost care given to health and safety of all emergency responders. Reentry operations shall use radio communications and/or the "buddy system" for safety. After a facility has been brought to a stable or shutdown condition, recovery actions are those taken to return the facility to normal operation.

9.1 DOWNGRADE/TERMINATION OF AN EMERGENCY

Downgrading the categorization or terminating an emergency requires the approval of the Incident Commander and concurrence of the Emergency Director (if the Emergency Operations Center is activated). Notifications of downgrade or termination shall be made to the Laboratory management, Department of Energy Los Alamos Area Office Manager, and Department of Energy Headquarters. The following criteria shall be accomplished before downgrading or terminating an emergency and initiating recovery operations:

- Hazardous material exposure levels are within acceptable limits;
- Releases of hazardous materials to the environment have ceased or are controlled;
- Fire or other emergency conditions no longer constitute a hazard;
- Affected building is in a stable condition and can be maintained in that condition indefinitely;
- Incident scene can be preserved until cognizant investigative authority concurs that recovery or normal operations may be resumed;
- Crime scene can be preserved and sufficient number of security services personnel are available to staff posts;
- Contaminated and injured personnel have been removed;
- Protective actions have been downgraded or lifted, if appropriate;
- Required notifications have been made;
- Offsite conditions do not limit access of personnel and support resources; and
- Discussions with Laboratory emergency organizations and appropriate offsite agencies do not identify a valid reason to continue in any emergency mode.

10.0 PUBLIC INFORMATION

The Laboratory Emergency Management Plan provides guidance in the development of the Public Affairs Emergency Plan. The Public Affairs Emergency Plan provides a framework for the coordinated, accurate, and timely release of information to the Laboratory and offsite. The coordination of the Public Affairs response with the Emergency Response Organization prevents the release of confusing, conflicting, damaging, and potentially erroneous information. Procedures are in place for the release of accurate information to the news media and the coordination of this information with the Department of Energy Los Alamos Area Office and the Emergency Operations Center Notification Specialist.

As required by Department of Energy Order 5500.4, the Public Affairs Emergency Plan and its Implementing Procedures establish an ongoing public information program in conjunction with state, tribal, and local government and the news media. The Laboratory drills and exercise program provides opportunities for Public Affairs involvement.

10.1 PUBLIC INFORMATION ORGANIZATION

Release of emergency information (evacuation routes, sheltering recommendations, and other protective actions), exchanging information with spokespersons of federal, state, tribal, and local organizations, disseminating information to the news media, and managing public inquiries are the responsibilities of the Public Affairs Office. The Public Affairs Office designates a spokesperson for the Laboratory, the Public Affairs Officer.

The level of public and news media interest may vary greatly requiring significant public affairs activity. If an event occurs at the Laboratory categorized below the emergency Alert level (see Section 4), the duty Emergency Manager may notify the Laboratory Public Affairs Officer of public or media concern. The Laboratory Public Affairs Officer will assess reporting requirements and public information needs resulting from the event.

The Emergency Management and Response Office or Duty Emergency Manager will notify the Public Affairs Office of activation of the Emergency Operations Center. The Public Affairs Officer or alternate will go to the Emergency Operations Center and determine what level of public affairs response is required, including possible activation of the Emergency Media Center. Additional Public Affairs Officers may be sent to the scene at the request of the Incident Commander, the Emergency Director, or the Public Affairs Officer. Media releases and interviews will be approved by the

11.0 EMERGENCY FACILITIES AND EQUIPMENT

Adequate and readily available emergency facilities, equipment, and materials provide the support necessary to successfully respond to and mitigate an emergency. Emergency resources are prearranged with offsite organizations to compliment onsite resources. Laboratory offsite response to offsite events is documented in Memorandums of Understanding.

Emergency response personnel will have security clearances adequate to respond to all areas of the Laboratory. The cost of acquiring and updating the badges will be the responsibility of the individuals' assigned groups.

11.1 EMERGENCY FACILITIES

The Laboratory has extensive, dedicated onsite emergency facilities, equipment, and materials. The Laboratory Emergency Operations Center and alternate are dedicated areas for conducting, evaluating, coordinating, and managing the Emergency Response Organization. The Emergency Technical Support Center, Emergency Media Center, Central Alarm Facility, decontamination facilities, and medical facilities provide specific response activities.

The Los Alamos County and New Mexico State Memorandums of Understanding provide the Laboratory with additional offsite resources. These resources may be requested by the Incident Commander or Emergency Director.

11.1.1 EMERGENCY OPERATIONS CENTER

The Laboratory's primary Emergency Operations Center is located at TA-59-1 in the northeast secured basement area. The area has filtered inlet air. The Emergency Operations Center provides designated space and equipment for the Emergency Management Team, administrative support personnel, the Emergency Technical Support Team, and the Emergency Operations Center Library.

The library contains about a hundred documents such as the following: current shipping manifests, Emergency Management Plan Implementing Procedures, limited personnel information, structure location maps, limited Department of Energy documents, landlord and building manager listings, and current Laboratory Memorandums of Understanding. The library contents are numbered and an index is

12.0 TRAINING

At the Laboratory, performance-based operational emergency training and related drills and exercises are an integral part of the team-building effort necessary for effective coordination of Laboratory personnel, Emergency Response Organization personnel, and emergency resources. The Emergency Management and Response Office supports all levels of training for the Emergency Response Organization, both individual and team. This training includes hands-on experience and evaluation of performance for achieving and maintaining an effective response capability.

Training shall be provided annually to all Laboratory employees who may have to take protective actions (e.g., assembly, evacuation) in the event of an operational emergency. Training objectives are to

- Instruct personnel regarding their responsibilities during an emergency;
- Inform personnel of any weaknesses detected during drills and exercises, changes to plans and procedures, and lessons learned from emergencies at the Laboratory or other Department of Energy facilities, and training needed to remedy these situations;
- Provide building-specific training based on employee and emergency responder tasks to be performed during an emergency; and
- Develop training with emphasis on team training.

The Laboratory Emergency Managers and other emergency response units/teams may participate in the Fire Department and security services training exercises. In turn, Fire Department and security services personnel may be asked to participate in Laboratory training, drills, and exercises.

The Emergency Management and Response Office Director is responsible for the planning, organizing, directing, and controlling of the emergency training program. The Emergency Management and Response Office will review regulations and policies for training requirements. Commitment from line management is necessary for emergency preparedness training to be a success.

12.1 COURSES

Table 12-1 presents the Laboratory emergency training courses. The specialized teams will be responsible for their particular training program which enables them to remain current in their field.

13.0 DRILLS AND EXERCISES

The goal of drills and exercises is to develop, maintain, and demonstrate skills, expertise, and emergency response capability. Additionally, drills and exercises build teamwork, trust, and confidence. In support of that goal, drills and exercises may

- Reveal planning weaknesses;
- Reveal resource gaps;
- Improve coordination;
- Clarify roles and responsibilities;
- Improve individual performance and experience;
- Improve operations;
- Improve emergency decision-making and planning skills;
- Improve effectiveness and skills of the Emergency Response Organization; and
- Validate adequacy of facilities, equipment, plans, and procedures.

Drills and exercises shall be used as a unifying force between various emergency response units. Major Laboratory exercises are coordinated with the Department of Energy Los Alamos Area Office, Department of Energy Albuquerque, and appropriate Department of Energy Headquarter elements. Federal, state, tribal, and county emergency response units shall be encouraged to participate in Laboratory exercises. Exercises and drills afford an opportunity to involve offsite agencies. These agencies and related personnel shall be involved as much as possible to build the interactive skills of the Emergency Response Organization.

At the Laboratory, an extensive program of drills and exercises is an integral part of the emergency management program. Drills and exercises are conducted in a manner which emphasizes possible building- or structure-specific emergency events. Additionally, they validate and exercise the facility systems and the Emergency Response Organization. Critiques, evaluations, findings, corrective actions, and written reports complete the drill or exercise.

The Emergency Management and Response Office Director has overall responsibility for managing a coordinated program of drills and exercises. Laboratory management is responsible for providing resources and personnel to implement drills and exercises as scheduled. Laboratory personnel are required to participate in drills and exercises in a safe and realistic manner.

The "Laboratory Drill and Exercise Manual" (LA-12355-M) shall be used as a tool for any drill or exercise. For Laboratory-wide or full-scale exercises, the Emergency Management and Response Office is responsible for developing a scenario, establishing an exercise schedule, identifying participants and evaluators, and training controllers and evaluators.

14.0 PROGRAM ADMINISTRATION

The administration of the Laboratory emergency management program is accomplished on a continuing basis and in accordance with Department of Energy orders. This chapter summarizes the responsibilities of the administration of the Laboratory emergency management program.

14.1 EMERGENCY MANAGEMENT PROGRAM ADMINISTRATION

The Laboratory Director has designated the Laboratory Emergency Management and Response Office Director as the individual to administer the Laboratory emergency management program. This individual's responsibilities include:

- Ensuring an adequate emergency management program is developed and maintained;
- Writing, maintaining, updating, and issuing the Emergency Management Plan, Emergency Management Plan Implementing Procedures, and the Emergency Readiness Assurance Plan;
- Ensuring the Emergency Management Plan and associated Implementing Procedures are reviewed by a derivative classifier for classified and Unclassified Controlled Nuclear Information, and the reviews are documented;
- Administering the Building Emergency Plan program;
- Ensuring emergency response coordination;
- Maintaining the Emergency Operations Center in a ready condition;
- Developing, directing, and reviewing emergency response training and exercises for the Laboratory;
- Maintaining all emergency records, including operator logs and documentation produced by the emergency response organization during an emergency;
- Ensuring adequate emergency management resources and their coordination; and
- Coordinating assessment activities and related documentation.

14.2 DOCUMENT CONTROL

The Laboratory Emergency Management Plan shall be a Laboratory-controlled document. The plan will be distributed to controlled document stations throughout the Laboratory in accordance with the established Laboratory

CONTINGENCY PLAN

GENERAL INDEX
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LIQUID WASTE MANAGEMENT
GROUP CST-7

APPENDICES

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CONTINGENCY PLANS
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NOTE: An asterisk (*) at a Contingency Plan item indicates that the item includes measure which may be implemented immediately.

EXECUTIVE SUMMARY

This document attempts to detail contingency plans for emergencies that may occur within the areas of responsibility of the Liquid Waste Section of Group CST-7. The number of Plans required is large because the activities of the Liquid Waste Section involve waste generators at numerous sites throughout LANL, an extensive waste collection system monitored continuously for leakage, several liquid radioactive waste treatment facilities, and a computer control system which oversees much of the total operation.

Waste generator sites can include Section equipment such as pumps, valves, storage tanks, level measurement, level alarms, pH and floor measurement devices, and the electronics for transmitting the information to the computer control system at TA-50-1.

The main waste collection system is a double-contained line, pipe within a pipe, of about 25,000 ft. of polyethylene, stainless steel and fiberglass reinforced pipe (FRP). It includes 61 state of the art manholes which permit monitoring for leakage and maintenance of the system. Other, much shorter systems include ones at TA-21 and TA-53. A separate system of double-contained lines is dedicated to transferring TA-55 wastes to TA-50 and a single-contained line delivers treated TA-21 wastes and stored, untreated TA-2 wastes cross-country about 2.5 miles to TA-50-2.

The sites served by the Section include:

TA-3	12 buildings
TA-16	1 building
TA-21	A waste treatment plant serving numerous buildings at DPE and DPW
TA-35	2 buildings
TA-48	2 buildings
TA-50	3 buildings
TA-53	3 waste storage areas serving numerous facilities with wastes pumped to a lagoon system
TA-55	2 buildings
TA-59	1 building

The Plans herein describe actions which should be taken as soon as possible. Some involve little cost or effort while others will require a considerable amount of time and line item funding. In any case, it should be recognized that all of the described actions are necessary, and that efforts, some of which are already underway, to provide these safety measures, must be included in the near to long term planning of the Section.

CONTINGENCY PLANS
LIQUID WASTE MANAGEMENT SECTION
GROUP CST-7

INTRODUCTION

This document lists Contingency Plans that should be adopted to mitigate the effects of emergencies that may occur in areas of responsibility of the Section.

To understand how the Contingency Plans were developed, it is advisable to review first the background information in Appendix C. Here the areas of responsibility are delineated and a free-swinging imagination is applied to attempt to list all ordinary and incredible emergencies that may occur at these locations. The relatively important Contingency Plans listed were derived in sifting through Appendix C. Many other Plans can be recognized in this manner and Appendix C may be developed further as more thought and imagination are applied.

Appendix A lists various steps, from posting notices to rebuilding entire treatment plants, that could be taken to lessen or mitigate the emergencies of the Contingency Plans. Most of the steps listed would reduce possibilities of accidents and contamination of personnel and/or the environment.

Appendix B briefly outlines the necessary steps to provide the mitigating actions, attempts to designate the sources of funding, and suggests the responsible group/division and construction contractor.

I. Contingency Plans for Fire

*1. Provide a clear diagram at all Liquid Waste Section facilities throughout the Lab (at waste sources, treatment facilities and storage facilities) which shows the locations of fire alarms and fire extinguishers.

*2. Near the diagram in 1. above, list locations of the nearest telephones.

*3. Near the diagram in 1. above, provide an instruction sheet giving the phone number 9-911 (or 911 as appropriate), a list of data to be provided when the emergency number is called, and steps to be taken after a fire alarm is sounded.

*4. Maintain all Liquid Waste Section areas throughout the Lab in a clean, uncluttered state. Properly dispose of any materials brought to the location for sampling, adjustment, repair, etc.

5. Contact the building manager for removal of materials mistakenly stored in or near Liquid Waste Section areas of responsibility.

*6. Verify that the nearest fire extinguisher(s) has been checked by the Fire Dept. in accordance with its routine schedule. Where testing is behind schedule, contact the building manager to have it done.

*7. Train all section operators involved in inspection and sampling activities of local and remote sites in the location of remote controls of electric motors and systems so that they may cut off power in the event of a fire in the equipment.

*8. Train section personnel to avoid smoke-filled areas unless they are wearing appropriate breathing protection and sufficient visibility exists so that exits are easily noted.

*9. Instruct section personnel on proper disposal of rags which may have been wetted with acid, particularly HNO3.

*10. If TA-50-1 must be evacuated during a fire and the operator is running the main plant from the control station, he should be trained to turn off the raw feed pump, the chemical feeders and the treated waste pump before leaving. If he is not at the control station, he should leave the building immediately with all other personnel.

*11. If TA-50-1 must be evacuated during a fire and the vacuum filter is being operated with the operator on hand, he should be trained to shut off the sludge feed pump and the knife advance mechanism before he leaves. If he is not at the vacuum filter station, he should leave the building immediately with all other personnel.

*12. If the TA-50-1, room 60, pretreatment plant is being operated when a fire alarm sounds, personnel at the plant should be trained to turn off all transfer pumps and to close the sludge draw-off valve before leaving.

*13. If a fire should occur at the TA-21-257 plant while the operator is at the desk at the control console, he should be trained to shut off the raw feed pump, the pressure filter feed pump, the sludge pump, the cross-country waste transfer pumps, and to close the sludge transfer valve before leaving. If not at this post, he must not reenter the area.

*14. If a fire should occur at TA-53-1 while an operator is transferring wastes from the basement sump, he should be trained to shut off the transfer pump before leaving. If not in the vicinity of the pump controls, he should evacuate the building immediately.

*15. If an electrical fire in a motor control center at TA-50-1 or TA-50-2 should prevent operation of the main treatment plant for an extended period, an up-to-date list of contacts with authority to cease discharges to the collection system should be available. Notices should be prepared and immediately available to alert the contacts of the problem and to advise them of possible loss of service to assure that no waste will drain to TA-50.

*16. Should a fire in TA-21-257 make it impossible to operate the plant for an extended period, the following alternatives must be considered:

a. If the cross-country line is a single welded steel line as constructed originally, flows to the plant from DPE and DPW must be stopped if the waste cannot meet NPDES limits, activity levels exceed DOE limits, and the raw waste storage tank levels approach overflow. A list of contacts in the operating groups should be available. Flows to the plant may continue uninterrupted if the wastes in storage meet NPDES and DOE limits. Raw waste storage tanks must be alternately filled and analyzed.

The wastes would be transferred to the treated waste storage tanks and pumped to TA-50-2 for treatment or disposal.

b. If the cross country line is double-contained, and waste radioactivity does not exceed established levels for discharge to the collection system, wastes would be transferred the DP-257 treated waste storage tanks and pumped to TA-50-2 for treatment or disposal. If radioactivity levels are too high, waste flows to DP-257 must be stopped before storage tank overflow levels are reached.

17. If a fire should occur in room 60, TA-50-1, or in WM-66 and resulting damage prevent their use for an extended period, flows through the process waste lines from TA-55-4 would need to be stopped until the facilities could be returned to operation. It is possible that the damage in WM-66 would not affect the flow in the industrial waste line. It if did, however, control of this flow from its many sources in TA-55-4 would be difficult. An up-to-date list of personnel to be contacted in the event of a disruption of service at WM-66 or the pretreatment plant should be available. Repairs would need to be scheduled under emergency conditions and costs for the work would need to be reviewed with group/division leaders at TA-55.

II. Contingency Plans for Earthquakes

1. See the Contingency Plans for Fire for any fires that may occur due to earthquakes.

2. No damaged facilities should be entered until a Lab appointed structural inspection person or team declares the facility safe or outlines conditions for safe entry.

*3. All section personnel should be familiar with the "Emergency Procedure for Earthquakes at LANL" as published in the Lab telephone directory.

4. As soon as possible after being made aware of a break in the main collection system, rupture of both inner and outer line, proceed to the nearest manhole upstream from the break and close the valves to prevent flow. Contact facilities tied to the system upstream from this manhole to alert them that the system is inoperable. Notify the CST and ESH Division offices of the occurrence and request EMO, ESH-8, and ESH-1 assistance.

   Should only the inner line or the outer line rupture, proceed as above. However, ESH-1 and ESH-8 assistance may not be necessary until replacement of the line is undertaken.

5. Earth tremors could rupture tanks and lines at any or all of the waste treatment facilities rendering the plants completely inoperable. Waste sources would need to be cut off from collection systems in a time frame dependent upon available, safe storage. All sources closed off would need to be notified to discontinue discharge of wastes. If either the TA-21-257 or the TA-50-1 treatment plant remained operable, temporary adjustments could be made to transfer all wastes for treatment through the three inch cross-country line from the inoperable to the operable plant.

   If the room 60, TA-50-1, pretreatment plant were rendered inoperable, temporary adjustments could be made to treat the process wastes in the TA-50-1 main plant. This would not be done unless advantages outweighed disadvantages and adequate additional ESH-1 support were available. Treated wastes would need to be recycled two or three times and plant operation might need to be placed on a two or three shift schedule. All sludge generated would become TRU waste.

Should an earthquake destroy the lagoon systems at TA-53, operations generating any liquid waste would need to be halted. If any one of the lagoons remained operable, temporary corrections involving reduced generation of all liquid waste and rerouting of all wastes to the operable lagoon could be accomplished. In this case, if effluent activities exceed NPDES and/or DOE guide-lines, the flows would need to be discontinued.

6. If an earthquake should rupture both raw waste storage tanks at TA-50-2,

   a. the 100,000 gal. emergency storage tank could be used until repairs were made,

   b. piping modifications could be made to permit use of one of the treated waste storage tanks for raw waste.

7. Should an earthquake damage the DPE waste storage tanks at TA-21-257, existing piping permits routing these wastes to the DPW concrete storage tanks; if either of the concrete raw waste tanks is damaged, piping modifications permit pumping the waste to the DPE tanks.

8. If the treated waste storage tanks at DP-257 were damaged, piping modifications could permit use of one of the DPE waste storage tanks for treated waste. In this case, the treatment plant could not be in operation while treated waste was drained to the pumping station at the treated waste tanks.

9. Should the 4000 gal. HN03 tank and its concrete basin be ruptured with acid flowing to the environment.

   a. CST-7 personnel, until police or emergency personnel arrive, should halt traffic on Pecos Drive to keep people from passing through nitrogen oxide fumes,

   b. the TA-50 site should be evacuated,

   c. at least two CST-7 operators should don air-supplied acid resistant suits to assist with any treatment plant problems, traffic control, diversion of the acid flow, or requests from emergency management personnel.

10. If the three-inch cross-country pipeline is ruptured, wastes treated at TA-21-257 may be discharged temporarily to DP Canyon or to the NE waste absorption bed. It would be preferred, however, to shut down all rad waste generating operations at TA-21, after storage tanks are full until the line is repaired. In addition, the NPDES permit for discharge to DP Canyon will not be removed after it expires in early 1993. TA-2 wastes, after storage is exhausted, may, under emergency conditions, be discharged to Los Alamos Canyon. However, in this instance also, it would be preferable politically to shut down all waste generating operations until the line is operable. All wastes discharged directly to the canyons must be sampled prior to discharge, then analyzed for radioactive and mineral constituents. However, if at all possible, it would be preferalbe to shut down all waste producing operations until the cross-country line waste returned to service.

11. If process waste discharged at TA-55-4 did not arrive at TA-50-66, immediate measures to locate the leak would need to be taken. The area of the break would need to be excavated to remove all contaminated soil. The standby double-contained line could be placed in service so there would be little interruption in TA-55-4 activities. If all three process waste lines were damaged, temporary arrangements could probably be made to deliver process wastes to TA-50-66 by tank trailer.

12. If discharge lines from TA-53-68, 69 or TA-53-144, 145 to the radioactive waste lagoon were damaged, fire hoses or tank trailers could serve until repairs were completed.

13. If both clariflocculators at TA-50-1 were damaged by earthquake, wastes could be filtered and treated by ion exchange on a temporary basis.

If only one of the clariflocculators were taken out of service, wastes could be treated chemically through the remaining unit at a reduced rate of 125 gals./min. This effluent could be further treated by ion exchange.

14. Should an earthquake damage much of TA-50-1 with little or no damage to the main treatment plant, plant areas should be checked for structural stability by engineers to establish areas to be avoided or where minor modifications in the structure could improve safety. The plant would be operated while improvements to the building were made. Weather could be a consideration if no heat were available from the boilers. Some type of mobile heating units could be employed where needed.

15. If any MUXs or interconnecting wiring were damaged in an earthquake, the Liquid Waste Section personnel must be prepared to provide manual services to collect the data not provided electronically. This involves operating pumps and valves, measuring depths of liquid, inspecting manholes and taking flow measurements at the source.

*16. Where established roadways suffer serious damage in an earthquake, section personnel must have available a cross-country vehicle, 4x4 pickup or Hummer, to maintain the collection system, pumping stations, etc.

17. Should telephone communications be out of service for an extended period, the section must be able to establish radio contact with the division office, the emergency management office, and between section personnel at TA-50-1 and the waste sources at a minimum.

III. Contingency Plans for Power Failure

1. The TA-50 waste treatment facilities, under normal conditions, could withstand a power failure for sites along Pajarito Road for several days with no adverse effects. However, during this time, if the outage appeared to be protracted, efforts would be made to obtain a mobile generator unit which could be connected at the transformer station to supply power to operate motors necessary for treatment plant operation, as a minimum. (A 240/480V generator is immediately available to permit pumping wastes to the 100,000 gal. storage tank). Under the worst conditions, that is with all storage tanks full at the time of the outage, immediate steps would need to be taken to stop all discharges to the collection system. This situation could not arise if permanent emergency power were immediately available at TA-50 sufficient, at a minimum to operate the plant.

2. Because power requirements would be much lower, outages at the TA-21-257 or TA-53 waste handling operations would be more easily resolved with mobile generators.

3. A protracted power outage affecting the entire Lab would shut down all operations except those with emergency power and those with high priority on the load shedding list for support by the TA-3 steam plant. The search for mobile units would be intensive, possibly requiring a Director's Office designee to allocate the resources. Though TA-55 has emergency power, operations which produce liquid radioactive waste at the site would need to be curtailed when storage was exhausted and emergency power was unavailable at TA-50.

*4. Small portable generator units should be on hand at TA-50-1 to provide power for field operations: emergency lighting, power tools, pumps and other motorized equipment.

5. Waste storage facilities such as those at TA-2 and TA-53 would need to be monitored manually to forestall overflow. Sources of waste would need to be cut off as the tanks approached high levels.

6. A "post power failure recovery" check list should be developed and maintained to serve to assure that the building is safe return to normal operation is complete. A rought draft of such list is provided on the following pages.

7. When power has been restored, ESH-1 personnel must survey areas in which contaminated or radioactive materials were present to certify safe reentry for operating personnel. This would include smear checks of surfaces which may have become contaminated.

POST POWER FAILUARE RECOVERTY

CHECKLIST, TA-50 BUILDING 1

This checklist is aimed at mitigating the initial effects of a total power failure at TA-50, Liquid Waste Treatment Facility. This document will also formalize a post power failure recoverty checklist that will be completed immediately following the power failure and return of power service.

This post recovery walk-through will be completed by the building managers, assistant building manager or their designees.

Immediately upon occurence of the power failure the following items must be completed.

1) Post all doors to normally ventilated rooms and laboratories with "Do not enter signs" as required in LW-HSE7-AD-15, R00, July 1991.

All personnel will evacuate from affected rooms and labs a proceed to the front office areas and wait until they are given permission by the building manager to re-enter their areas.

2) Room 116: If main treatment plant is in operation,

a) turn off water located at Iron & Lime Feed Stations, and,

b) turn off Iron and Line Feed Stations and chemical transfer belts,

3) The following equipment will be checked and returned to the indicated operating status.

CHECKOFF_ROOM/DESTINATION_NORMAL OPS.
STATUS_POS/SPEED__READING__EXHAUST
SYSTEMS_____ 060 - FE-4 *
060 - FE-6 *
060A - FE-17 *
030 - FE-2 *
014 - FE-1 *
016 - FE-19 *
016 - FE-23 *
WM-66 - FE-2 *
116B - FE-25 *_ON/24 HOURS PER DAY
ON/24 HOURS PER DAY
ON/24 HOURS PER DAY
ON/24 HOURS PER DAY
ON/24 HOURS PER DAY
ON/24 HOURS PER DAY
ON/24 HOURS PER DAY
NORMALLY OFF
ON LINE/24 HOUR/DAY_ N/A
N/A
N/A
HIGH
HIGH
N/A
N/A
N/A
N/A____SUPPLY FANS/
VENTILATION_____ 014 - HV6
014 - HV7
014 - HV8
014 - HV9_ON LINE/24 HOURS/DAY
ON LINE/24 HOURS/DAY
ON LINE/24 HOURS/DAY
ON LINE/24 HOURS/DAY_ HIGH
HIGH
HIGH
HIGH
____pH METERS_____ 016_ON LINE/24 HOURS/DAY_
N/A____PHONE SYSTEM_____ ON LINE_____PAGING
SYSTEM_____ ON LINE_ N/A____COMPUTER_____
ON LINE_ N/A____

IV. Contingency Plan for Bomb Threats

*1. All section personnel should be familiar with the "Bomb Threat Call Checklist" in the Lab telephone directory. The document should be reviewed at a section meeting at least semi-annually with one of the meetings scheduled when most of the temporary summer help is on hand.

2. Section personnel should in no case investigate the area threatened. This will be accomplished through the Emergency Management Office (EMO).

3. Personnel in the area threatened should be evacuated immediately if the caller states that the bomb is scheduled to explode on the date of the call. If the threat is for a later date, access to the area would be prohibited on that date as coordinated by the Emergency Management Office.

4. As soon as the Section becomes aware of a bomb threat for a specific location, it should begin preliminary arrangements to implement measures, in the event the bomb explodes:

- to limit environmental contamination,
- to return service to the affected area as soon as possible,
- to provide replacement equipment, temporary or permanent, for equipment in the specific area which may be damaged or destroyed in an explosion,
- to maintain contact, either radio or phone, with the EMO in the event assistance is required, and
- to keep the Group Office informed.

5. As soon as possible after a bomb explosion, the Section should inventory damage to its property and provide a copy of this information to the Group Office.

*6. Section personnel should be trained to provide immediate first aid to the injured while awaiting ambulance service.

*7. The Section should be prepared to photograph damaged plant and equipment related to Section responsibilities.

V. Contingency Plan for Terrorist Attack

1. Terrorists generally will have carefully planned, well-rehearsed activities they intend to complete according to a tight time schedule. Any Section personnel in an area threatened by terrorists should refrain from attempts at heroics because the terrorists are usually committed to kill to prevent interference.

2. A threat of terrorist activity should be communicated to EMO ASAP.

3. Section personnel must avoid an area under terrorist attack even though areas of Section responsibility are involved.

4. The Section should begin preliminary planning for corrective actions when made aware of terrorist activity in an area of Section responsibility.

5. A complete inventory of Section property damaged in an attack should be made as soon as entry into the affected area is permitted.

6. Section personnel should be trained to provide immediate first aid for the injured, when possible, while awaiting ambulance service.

*7. As soon as entrance to a damaged area is permitted, the Section should be prepared to photograph physical damage to plant and equipment in the area of Section responsibility.

VI. Contingency Plan For Emergencies at TA-2-53

*1. Following pumpdown of the waste storage tanks (Omega 54, 55, 56) at TA-2, the check valve on the discharge line of the pump could stick open. If the operator had departed after shutting off the pump, backflow into the storage tanks would not be noticed. The tanks would fill and overflow through the vent lines, contaminating the area around the tanks and flowing to the stream in Los Alamos Canyon before high level alarms could be investigated. Because waste radioactivity is generally very low, temporarily restricting access to the area for persons without protective clothing might be the only precaution necessary. After a brief period of several days, most radioactivity would decay to background levels.

*2. The waste storage tanks are made of stainless steel and are buried directly in the ground with no possibility of inspection for leakage. Small leaks would probably go unnoticed for years. One of the more feasible solutions to this problem is the replacement of the three units with a new, fully inspectable set (two or three) of tanks in a vault near the present site. A less acceptable but much more economical solution would be to equip the existing storage tanks with level indicators with graphical printout at TA-50. Flow to the tanks would be alternated daily and the graphic printout would be studied daily to detect any drop in water level. Evidence of a leak would need to be investigated immediately and corrective action initiated.

VII. Contingency Plan for Emergencies at TA-3-29

A. Criticality in a Wing 4 or Wing 5 pumping station.
1. All personnel in the area of the tanks should leave immediately and distance themselves from the area.

2. Cut off power to the mixer and pumps at the MCC at rooms 4034, wing 4, and 5034, wing 5.

3. Call the EMO from a remote phone and advise them of the incident.

4. Call 9-911 (or 911) from a remote phone for an ambulance for any personnel who may have received high radiation dosages.

5. Due to the high heat and radiation levels, it is unlikely that the equipment involved could be of continued service. The Section should be prepared to restore service to the wing affected as soon as feasible, possibly with temporary measures while permanent restoration is underway.

6. Flow to the waste disposal units in the affected wing must be stopped until the system has been rendered operable again. Downtime would include time for extensive investigation into causes and recommendations for changes to prevent future occurrences.

B. Restriction of access to one or more basement wings.
1. Determine reasons for the restrictions.

2. Apply for limited access by two Section maintenance personnel under prescribed conditions on a low frequency basis.

3. If limited access by Section personnel were denied, determine who had been approved for access. One of these persons could be contacted for assistance with mechanical or electronic maintenance problems which might arise.

C. Leakage from one of the concrete 5000 gal. storage tanks.
1. Should one of the 5000 gal. tanks be returned to service and in some manner be determined to be leaking, it could in most cases be taken out of service and drained.

2. If an inspection of the tank interior revealed cracks, they could be pressure injected with plastic and the whole interior coated with a layer or more of Plasite or similar enamel.

3. If no cracks were evident, the tank interior could be cleaned and repainted with several coats of an appropriate acid-resistant material.

D. Rupture of the main pumping station in wing 4 or 5.
1. Switch the waste flow to the 5000 gal. storage tanks while the sources of the waste are contacted to cut off flow.

2. Take measures to have the wetted floor areas cleaned and decontaminated.

3. Take measures to repair or replace the damaged tank.

VIII. Contingency Plan for Emergencies at TA-3-39

1. The grease trap at SM-39 is equipped with an electronic device to alarm high levels. Should the device malfunction and the trap clog, wastes could be backed up out of the floor drains in the building. The using group would probably have the trap cleaned and notify EM-7.

2. Floor areas wetted due to waste back-up would need to be cleaned, but decontamination would not be required in most cases.

IX. Contingency Plan for Emergencies for TA-3-66

1. If a gold, silver, or other precious metal plating solution from electro-chemistry were lost to waste, it could be captured in a basement storage tank to which it would drain.

* Because the basement tank is emptied based on water level, immediate steps would need to be taken by electrochemistry personnel to shut off the pump. If a pump control switch were provided in the electrochemistry office, time could be saved.

*2. Though the chance of losing a cyanide plating solution to an unneutralized acid waste and or an acid solution to the cyanide tank at a time that it contained cyanide solution is extremely slim, it could happen and HCN fumes would be generated. If the situation were unknown to electrochemistry personnel, the lives of any people in the basement would be at risk. A cyanide alarm in the area of the tanks would serve to alert personnel when a danger existed and steps to ventilate the area could be taken. Neutralization of acid solutions before discharge to waste would forestall the possibility of acidification of cyanide solution.

3. Flake caustic is used to prepare a solution for neutralization of the acid waste. Rubber gloves, head cover, shoe covers, body cover such as a Tyvek or Saranex suit, and a face shield must be the minimum protection for the person preparing the solution. These items should be available at the location. No skin surfaces should be unprotected from either the flake dust or the prepared solution. A lab apron or coveralls should be used to protect clothing and an emergency shower should be located in the vicinity in the event of an accident. Depending on the extent of a NaOH burn, the affected person, after deluge washing, should be taken to ESH-2 or be picked up by ambulance for delivery to the Los Alamos Hospital emergency room.

X. Contingency Plan For Emergencies at TA-3-102

1. The basement oil trap on the waste line in SM-102 has a steel lid fastened with screws and a sonic flume on the discharge. If the lid were left unfastened, and the outlet became plugged, wastes would overflow to the floor area until user or CST-7 personnel relieved the plug or stopped the flow. The basement would need to be decontaminated, but with the plug removed, the line could be returned to service immediately.

If the lid were fastened at the time of a line plug, the waste would back up until the alarm summoned personnel to correct the problem.

A sign at the oil trap should advise that "THE LID MUST BE FASTENED AT ALL TIMES EXCEPT FOR MAINTENANCE OR INSPECTION".

2. Solid wastes removed during cleaning must be packaged for disposal at TA-54.

XI. Contingency Plan for Emergencies at TA-3-141

1. Failure of the pumps on the waste sump at TA-3-141 would result in the waste level rising until the high level alarm was triggered. If the alarm were inoperative, wastes would fill the tank, back up the waste line, and overflow through the tank vent into the pit. It is unlikely that the pit could fill to overflowing before the problem was recognized because a graph of liquid level is collected at the control center in TA-50-1 and reviewed by an operator on a daily basis. Cleaning and decontaminating the pit would not be difficult because waste radioactivity is usually very low. No waste would escape to the environment.

*2. Because the pit at TA-3-141 is inspected infrequently, a small leak in the steel waste tank could go unnoticed for a long time. A careful study of the liquid level graph could raise suspicions but under certain conditions, the leakage could go unnoticed for a long time. Waste levels in the pit would be influenced by levels in the tank eventually with flow through the leak reversing direction as the level inside the tank changed. When water depth reached the electrical equipment shorts would develop and the resultant shut down of the electronics would be signaled at the TA-50-1 control center. For a much earlier warning of tank leakage, a liquid detector similar to the devices in use in the manholes could be installed in a small sump within the pit.

XII. Contingency Plan for Emergencies at TA-3-154

*1. The plumbing arrangements for low level waste from Wing 9, CMR Building, permit directing waste either to storage tanks at SM-154 or directly to the collection system. The latter alternative is the usual choice because the concrete tanks are not fully inspectable for leakage. If the tanks were in use and should develop a small leak, the problem could not become known until the operator at TA-50-1 noted the unusual changes in level or until the leakage surfaced and was traced to its source. Wastes would be redirected to the collection system connection; the magnitude of the clean-up effort would depend upon the volume of waste lost and its level of radioactivity.

Because of their lack of inspectability, the tanks could be permanently disconnected from the system without affecting service to the SM-154 programs.

2. Failure of the low level waste pump and the high level alarm systems on the low level waste tanks would result in the tanks flooding when in use and overflowing to the underground control room over the tanks because no overflow to the collection system is provided. It is unlikely that wastes would escape from the control room unless it also filled to overflowing. At this point it would be noticed at floor drains within Wing 9.

*3. Leaving the high pressure steam line open to SM-154 for periods of a day or longer will result in steam condensate soaking all electrical and electronic equipment in the main control room.

Damage could be very extensive. When it becomes necessary to use the steam in SM-154, procedures should require that the person opening the valve in the basement of Wing 9 remain at that location until transfers have been completed within SM-154 and the valve may be closed.

*4. Hot cell wastes from Wing 9 are directed to either of two stainless steel waste storage tanks in SM-154. Should either tank develop a slow leak, it is likely that the condition would go unnoticed for a long time. Waste from the leak would accumulate in the below-ground room in which the tanks are located. If highly acidic, the waste would erode the walls of the room. The extent of any clean-up due to the leakage would depend upon the volume and level of radioactivity of the waste. Because the wastes come from hot cells, they are likely to be highly radioactive. A liquid sensing device could be installed to alarm presence of liquid on the floor upon which the tanks stand.

XIII. Contingency Plans for Emergencies At TA-3-1264

Should the 4700 gal. fiberglass storage tank develop a leak while it contained waste, the computer at TA-50-1 would indicate a falling level with the discharge valve closed. Also, a small sump in the floor of the vault would collect the leakage and a probe in the sump would signal an alarm. If the electronics were inoperative at this time, water level would rise in the vault till it equalized with the level in the tank. Further filling of the tank would cause the water level to rise to the overflow. It would remain at this level until the electronics were repaired and the condition was noted at TA-50-1 operations. In correcting the situation, water should be removed from the vault before the valve is opened to drain the tank. Uplift forces could possibly damage the tank or its appurtenances when vault water level is above tank water level.

XIV. Contingency Plan for Emergencies at TA-21-223

1. If the pumps in TA-21-223 fail to operate, the sump will overflow to one of two stainless steel tanks, DP-346, in a bermed location north of the road. The overflow pipe is made up of about 50 feet of vitrified clay pipe (VCP) and about 50 feet of galvanized steel pipe. All other piping at the tanks is stainless steel. The tanks are stainless steel because they were obtained as "used" tanks from DP West, not because the waste might be acidic. Normally they are not.

As with most VCP, there is likely to be some leakage at many of the joints, especially in older lines. At present, no attempt is made to determine the existence or extent of leakage.

* To conform to the present design requirements for waste collection systems and protection of the environment, the existing overflow line to DP 346 should be replaced with a double-contained line and wastewater levels in the DP 346 tanks should be monitored with readout at the TA-50-1 control center.

*2. The pump sump at DP-223 is constructed of concrete with no provision for inspectability. A slow leak over the years could contaminate a large underground area with tritium, possibly surfacing somewhere in DP Canyon. The facility should be replaced with one in which the pump sump is fully inspectable for leakage.

XV. Contingency Plan for Emergencies at TA-21-257

*1. In 1992, this facility was 25 years old. The raw waste storage tanks, flash mixer tank, sedimentation tank, filter feed tank and sludge storage tank are concrete units set directly into the ground with no provision for inspectability. Slow leakage from any of the tanks would probably be undetected, contaminating large underground areas at the site.

Feasible solutions for meeting present standards for waste control are (a) replacement of the entire facility or (b) double-encasing the cross-country line, adding monitoring manholes at maximum 500 ft. spacing and providing only a pumping station at DP West in place of the treatment plant.

*2. A major leak from any of the waste treatment tanks would require taking the plant out of service. Until repairs could be made, a connection from the raw waste storage pumps discharge line to the line between the pressure filter and treated waste storage tanks would permit pumping the wastes to TA-50-2 for treatment in TA-50-1. A connection instead to the filter sump would permit removal of settleable solids before discharge to TA-50-2.

*3. Aerosols from the open flash mixer and sedimentation tank could contain radioactivity and/or various chemicals. To protect operators from continuous exposure, the area of the flash mixer - sedimentation tank should be enclosed and provided with its own ventilation.

*4. The backwash sump at the pressure filter should also be enclosed and vented to the out-of-doors.

*5. Some type of grating or improved fencing should be provided so that falling into the sedimentation tank would be considered impossible.

*6. A major break in the force main between DP-223 and DP 257 would require temporary use of a tank truck for transferring the wastes between the two locations or restriction of activities by the programs which generate the wastes until repairs were made.

*7. To detect possible leakage from the sedimentation tank, hook gage readings over periods of plant shutdown could be of help. Evaporation would need to be considered.

XVI. Contingency Plan for Emergencies at TA-48-1, 45

* The double-encased waste lines from the north, center, and south wings of TA-48-1 begin in pits or sumps in the basement floor. The sumps for the center and south wings are relatively large while the pit at the north wing is small. The space between inner and outer lines is open at the upstream end and should the pit or sumps fill with water, it will flow within the outer line to the first and succeeding manholes.

Sealing the space between the lines at the upper end should not affect any functions of the system and possibilities of manhole flooding would be avoided. The same approach should be applied throughout the collection system where the outer line might be partly submerged due to operations or accidents not related to waste discharges. This solution would be more economical than installing high level alarms in the sumps.

XVII. Contingency Plan for Emergencies at TA-50-1, 2, 66

1. The clariflocculators and the gravity filter are set on the ground with no means of inspection for leakage from the bottom of the tanks. Large leaks would be evident in lowered water levels after periods when the plant was not operated.
* For minor leaks , a hook gage in each tank, set as soon as the plant shut down and checked before restarting the following day or days would help in detection. (Evaporation would need to be taken into account.)

2. Should the 50% NaOH storage tank in room 16, TA-50-1 basement become empty due to leakage, late delivery or other reasons, it would be possible to temporarily utilize 50 lb. bags of flake caustic. Several days supply of the flake should be maintained in the penthouse chemical storage area.

* Clean up instructions emphasizing safety for major NaOH spills in room 16 should be on hand at the plant operators desk in room 116.

3. For actions to be taken during a major leak from the 4000 gal. HNO3 storage tank, refer to Contingency Plan II, item 9.

4. Under certain conditions, the CO2 used in room 116 for recarbonation of gravity filter influent may accumulate in pockets within the plant operations area so that it constitutes a threat to life.

* Strategically placed CO2 sensors with alarms would warn operations personnel should this conditions develop.

5. Should it be necessary to take the force main which delivers raw waste from TA-50-2 to the flash mixers in TA-50-1, room 116, out of service due to a break or leak, several steps should be taken while awaiting repair. These include:

- alerting all sources of waste to temporarily reduce or stop discharges to the collection system,
- alerting ESH-8 to begin efforts to determine the extent of travel of the leaked waste,
- alerting ESH-1 for assistance in managing removal of contaminated soil and equipment, and
- treating the wastes alternatively in the 75,000 gal. raw waste tanks.

After sedimentation with the mixer(s) off, a portable pump would need to be provided to transfer supernatant to the treated waste storage tanks. Another portable unit could transfer the accumulated sludge periodically to the sludge storage tank.

Group and Division offices would have been notified as soon as the problem became known.

6. It is possible to fall into the clariflocculator. If the plant were in operation, a person falling into the flocculator would receive serious physical injury from being trapped between the stationary and the rotating arms. A person falling into either section of the unit would suffer whole body contamination but no injury due to acidity or alkalinity of the solution.

* Removable aluminum grating would prevent any fall. A person retrieved from the unit would need to be stripped as soon as possible and thoroughly washed under an emergency shower, then again under a change room shower. After toweling, the person should don coveralls and be taken to the emergency room at the hospital.

7. There is no control over the vapors and aerosols emanating from the open surfaces of the flash mixers, clariflocculators, and gravity filter. Lack of control of discharge to the collection system can result in volatile organics being mistakenly discharged. For positive protection of treatment plant operators, the flash mixers, clariflocculators, and gravity filter should be covered in a manner to permit operation and maintenance and should be individually ventilated.

*8. Wastes flowing into the sample sink and accumulations of solids in the sink from possibly weeks or months of operation can create an inhalation hazard. The sink should be covered and a method designed to permit transfer of samples from the sink collection bottles to "clean" bottles without exposing the collection to the sink atmosphere.

*9. The possibility of a spill or serious leak involving untreated waste or process sludges in certain rooms of TA-50-1, 2, and 66 is relatively high. One of the most effective means of preventing spread of contamination beyond the room in which the emergency occurred is the use of air locks on the entrance/exit. This is of particular importance for rooms 16, 60 and 116B in TA-50-1 and for the access to TA-50-66.

*10. In the event of a major spill in room 60, TA-50-1, any personnel in the room should:

- immediately remove any clothing contaminated by the spill,
- leave the room and wash thoroughly at the emergency shower in room 60A if wetted by the waste,
- contact ESH-1 personnel in room 116 by phone if none are at the site,
- have the incident reported to the section and group offices,
- obtain coveralls, booties, etc., and go to the change room for a much more thorough washing in one of the showers if wetted by waste, and
- initiate measures for clean-up of the spill and repair of any equipment involved.

*11. Controls on the two natural gas fired boilers in room 14, TA-50-1, should be updated to meet Standard 85A, National Fire Protection Association (NFPA). This includes installing an additional natural gas block valve in the gas lines to the boilers and providing an infrared or ultraviolet flame detector for monitoring the presence of flame.

XVIII. Contingency Plan For A Criticality in Rooms 60 or 60A, TA-50-1, or in TA-50-66

1. Occurrence of a criticality event is more possible in TA-50-66 than in rooms 60 or 60A at TA-50-1 but injury to personnel is much more likely at the time of an event in the TA-50-1 rooms because they are more likely to be manned. Personnel seldom enter TA-50-66.

*2. Any person entering TA-50-66 should be in harness with a line to a second person on the outside. The person on the outside must be able to assist the person on the inside to vacate the enclosure without needing to stand over the access hatch. A motorized hoist with controls at least 30 feet from the structure should be provided.

3. Any personnel in rooms 60 or 60A at the first possible indication of a criticality event must evacuate the area immediately and warn anyone in adjoining rooms to leave the building.

4. After the criticality event has ended and it is deemed by ESH-1 personnel to be safe to approach the area of the event, assistance should be given in roping off the area.

5. Notifications must be made to CST, section, group, division, and Director offices and to DOE Albq. and Headquarters.

6. Assistance must be requested of ESH-1 and ESH-6.

XIX. Contingency Plan for Emergencies at TA-53-1 Waste Storage Tank

1. The electronic system provides a readout of waste tank depth and alarms high level at the computer center at TA-50-1. If the electronics were inoperative for an extended period, the tank would overflow to the basement floor until detected by user personnel or a repaired signal. Clean-up would be confined to the basement. A battery operated back-up high level alarm system with read-out in one of the offices in the building would serve to assure notification of high level.

*2. A leak in the force main from the waste tank pump to a transfer vehicle should be noted by an operator shortly after it developed and the pump would be turned off. Depending upon the amount of space remaining in the waste tank, users may need to curtail operations until repairs are made. The ESH-1 office should be notified and arrangements made to have the affected area decontaminated.

3. If a spill should occur at the transfer vehicle while loading, a relatively large area would be affected because the transfer station is at the top of a hill. ESH-1 and Emergency Management would need to be contacted immediately and vehicles in the area of the spill, if their tires had been wetted, would need to be prevented from moving until decontamination. Other vehicles would need to be guided out of the area to prevent their being driven through wetted surfaces.

4. Notification to MP Division Office, CST-7 Group Office, CST-DO, ESH-1 and the ENG-5 section office.

5. EM-7 Liquid Waste Section should review the occurrence and recommend corrections that would prevent the spill from happening in the future.

XX. Contingency Plan for Emergencies at TA-53-68, 69, or TA-53-144, 145

1. Failure of the electronics systems to alarm high levels in the MPF-68, 69 or 144, 145 storage tanks would result in the tanks overfilling and eventually backing up in the waste lines until becoming visible at the lowest level floor drain. When the user, ESH-1, or ENG-7 became aware of the problem, the tanks would be sampled, pumped out and any areas wetted would be decontaminated. Depending upon waste flow, the tanks could probably remain in service while the electronics were repaired.

2. Should any or all of the waste storage tanks MPF-68, 69 or 144, 145 develop a leak, it would probably go unnoticed, if minor, for a long period of time. Large leaks might be noticed at the TA-50-1 control center as tanks levels decreased without pumping or at TA-53 as the waste surfaced at some down hill location. Because the tanks are not inspectable for leakage, correction of a leakage problem would entail removal of the tanks and reinstallation of inspectable units. Removal of contaminated soil probably would not be required due to the short half-lives of the radioisotopes in the waste unless the waste surfaced. In this event, perhaps a foot (+/-) of contaminated soil would be removed and the area backfilled with clean soil. The volume of traffic in the contaminated area would be a major influence in deciding the depth of soil to be removed. Depending upon the size of the leak(s), it may be possible to keep one or both tanks of the pairs in operation while replacement storage facilities are under construction. If not feasible, all waste-producing operations would need to be curtailed until waste storage facilities were available.

3. The lines carrying wastes to storage in MPF-68, 69 are single contained. Any leaks would go undetected for a very long period of time, if ever. To be detected, a leak would need to be traced back to its origin from a point where the waste has surfaced.

*4. The force mains carrying wastes from MPF-68, 69 and MPF-144, 145 to the radioactive waste lagoon are double-contained and monitored electronically for leakage. Depending upon the location of a break or leak in the inner line, whether it is before or after the juncture of the force mains, one or both of the storage systems may need to be removed from service until repairs are made. Because the lines are plastic and no metal wire tracers were installed in the trenches above the lines, they may be difficult to locate when repairs are necessary. Before this happens, it might be advisable to run a temporary wire through the force mains or other lines between manholes and, with the use of a locator at ground surface, install permanent markers at the surface above the lines.

XXI. Contingency Plan for Emergencies at the Radioactive Waste Lagoon, TA-53-1148

*1. Because there is no flow meter on the force main from MPF-68, 69 and 144, 145, there is no accurate check on the volume of waste transferred from the storage tanks to the lagoon. Installation of such meter near the lagoon with readout at TA-50-1 would be advisable.

2. The lagoon has a staff gauge to indicate depth of waste. This is the only indicator of possible leakage through cuts or holes in the hypalon liner. Because of the very large surface area and the evaporation factor, a leak would need to be very significant before its presence were suspected.

* At the least, a depth indicator with readout at the TA-50-1 control center should be provided. The operator at TA-50-1 should have at hand average/maximum evaporation rates for the four seasons to aid in detecting unusual losses.

*3. The radioactive waste lagoon is surrounded by a four foot fence to discourage access by persons not on official business. Although the gate is locked and the keys are controlled, the four foot height is not a serious deterrent to access by unauthorized persons. Some type of intrusion alarm to security offices and night lighting would improve deterrence to entry.

*4. No authorized personnel should visit the lagoon area without a back-up person. Should an operator or other person slip and fall into the lagoon, assistance of another person would be required. An unlocked first-aid box located within the fenced area should be equipped with 100 ft. of sturdy rope, several sizes of dungarees, knee-high booties, a large jacket, towels, large trash bags. The person, after drying off and changing clothing, should be taken to an emergency shower and ESH-1 should be called.

*5. Should very high velocity winds occur in the area, operators should contact ESH-8 and ESH-1 to attempt to determine the extend of contamination of the surrounding area by wind-carried wastes. Access to the contaminated area would need to be restricted until affected soils were removed or the contamination had decayed to background levels.

*6. It is likely that ESH-1 personnel would be aware of any wastes of unusually high radiation levels that were pumped to the rad waste lagoon. Should this occur, the road to the lagoons would be posted and any persons who needed to visit the lagoons would be accompanied by a health physics surveyor. The surveyor would advise on safe distances and assure that the visitor wore a dosimeter and film badge.

XXII. Contingency Plan for Emergencies Within The Main Collection System

*1. Should the inner line leak, wastes flow via the outer line and drain to the nearest downstream manhole. The presence of liquid in the manhole would alarm at the control center and operations personnel would investigate. Repairs under emergency conditions would need to be made. Users discharging through the affected section of line would need to be cut off until repairs were completed. The line between two manholes would need to be removed and repaired or replaced; removal and replacement should be possible without excavating the line. Maintaining a stock of about 1000 ft. of polyethylene inner line of various sizes would serve to expedite repairs.

2. Should the outer line be damaged or develop a leak, groundwater could enter, flow to the nearest downstream manhole, and alarm at the TA-50-1 control center. The situation would be considered an emergency, but users would not be affected until actual construction of repairs began. In most cases, it would be impossible to determine the location of the leak and the entire line between manholes would need to be excavated. With the line uncovered but in place, it is very possible that the point of leakage could be determined and checked by testing. When located, the point of leakage would be repaired in place without removal from the ground.

3. Damage to both inner and outer lines at the same point would require immediate shut down of all discharges to the system carried by that section of line. If caused by heavy equipment operations, notification of CST-7 could be immediate. However, it is possible that if it was not detected at the time of occurrence, a large area could become contaminated. If not immediately evident, attempts should be made to locate the point of the break without excavating the entire section between manholes. When located, it is likely that the breaks could be patched satisfactorily without replacement of the entire section.

4. Plugging of the inner line could be corrected by applying air pressure to the line at the upstream manhole and removing the plugging material through a valve with operator removed on the line in the downstream manhole. Operators at the downstream manhole would need to take precautions against splashing and airborne contamination.

*5. Theft of manhole covers, particularly when the manholes are in areas of very little traffic, could go undetected for an extended time, creating a major hazard especially after dark. One or two of the covers should be stocked so that replacement could be immediate. An electronic system, interconnected with the liquid detection equipment, could alarm whenever the cover is not in place. A single signal would alarm either presence of liquid or removal of the manhole cover.

Lab Security and LAPD should be notified at the time of discovery of the theft.

XXIII. Contingency Plan for Emergencies Within the TA-21 Collection System.

*1. Leaks in the waste line from the DP West facility to DP-257 could go undetected for a very long time, perhaps never if the liquid did not surface in the area. The line is not double-contained. If a leak were discovered, sources of waste would need to be closed off until repairs were made. If the site is to remain in use, all underground waste lines between DP West buildings and DP-257 should be replaced with double-contained lines with leakage monitoring.

*2. Similarly, leaks in the force main from the DP-223 pumping station at DPE could go undetected for a long time. However, because it is a pressure line, a leak is more apt to be discovered in a shorter time. Here too, plans should be made to replace the line with one that is double-contained. Should the force main leak, power to the pump should be cut off and the station allowed to overflow to the overflow waste tanks until storage became very limited. At this point, waste sources would need to discontinue discharges.

XXIV. Contingency Plan for Emergencies Within the TA-53 Collection System

*1. Force mains from MPF-68, 69 and MPF-144, 145 are double contained so any leaks that might develop in an inner line would be detected in a reasonable period of time. However, if both inner and outer lines were nicked or developed leaks, it is possible that the problem would go undetected for a long time. Installation of flow meters in the force mains at the pumps and at the discharge to the lagoon would permit a comparison of amounts pumped and discharged which would highlight possible leaks in the systems.

2. The original gravity flow waste pipe lines which drain to MPF-68, 69 are single contained. Should leaks develop, particularly slow leaks, they would go undetected for a long time, probably not until the liquid surfaced. It would then be extremely difficult to locate the source of the leaks. Dyes, isotope tagging, or the use of small drilled holes in the soil to trace increasing percentages of soil moisture could be used.

3. Tank truck transfer of wastes from MPF-1 to the lagoon or to TA-50-1 is a cause for concern if the tank is involved in an accident and the waste is released to the environment. To assure that such an accident cannot be caused by another vehicle in traffic, roads used for the transfer, despite the relatively low level of radioactivity of the waste, should be closed to other traffic during the transfer.

XXV. Contingency Plan for Emergencies Within the Cross-Country Pipe Line

*1. This line is a single-contained, three-inch mild steel welded line about 13000 ft long. Small holes could develop in the line due to corrosion even though it was coated or small leaks could develop at the vents or canyon bottom drain pits. Large losses can be detected at the TA-50-1 control center by comparing volume pumped from DP-257 to volume received at TA-50-2, but small losses would be difficult to note. For this purpose, routine physical inspection of the line on a monthly basis should be required. Clean-up at leak locations may be necessary, but ESH-1 and ESH-8 should be contacted for their recommendations.

2. Soil erosion may result in exposure of a segment of the line to the weather with resultant freezing of the segment in the winter. After thawing and repair of the line, measures would need to be taken to assure adequate cover or insulation.

3. Valves on the three vents are locked in a closed position and must be kept locked when waste is transferred. They may become difficult to operate due to lack of use, so should be inspected and opened on a routine basis, perhaps monthly, when no wastes are being transferred.

*4. When flow in the line is stopped, settleable solids will descend to the lowest parts of the line. Though the wastes should contain few solids, over a period of time they could accumulate to restrict and eventually plug the line. To prevent this from occurring, the drain arrangements in the canyon bottoms should be used periodically to flush a small amount of waste into a tank which would be decanted at TA-50-2. Experience would dictate the length of time between flushings, but it would be on the order of once or twice a year.

XXVI. Contingency Plan for Emergencies Within the TA-55 Collection System

1. Should the double-contained process acid and/or caustic waste lines from TA-55-4 to TA-50-66 be ruptured, possibly by construction equipment, the following steps would need to be taken:
a. Alert TA-55-4 personnel to stop all discharges to the lines,
b. Call Emergency Management,
c. Call ESH-1 and ESH-8,
d. Advise the Group Office,
e. Provide assistance as necessary in roping off the affected area,
f. Assure that personnel involved in rupturing the line(s) are checked for contamination and directed to change stations if necessary.

2. If it is determined that leakage of either inner process waste line is occurring, its use should be discontinued immediately and steps should be taken to place the spare line into service in its stead. No other emergency measures should be necessary at this time, but investigations should begin to try to identify the cause of the leakage and the first steps in planning a replacement line should be undertaken.

3. Solids in the caustic process wastes crystallize out in the transfer pipe line and tend to plug it. The use of high pressure steam to redissolve the crystals causes damage to the line due to expansion of the stainless steel. To prevent crystallization within the line, the waste solution should be more dilute; to remove crystallization, a dilute mineral acid may be effective.

XXVII. CONTINGENCY PLAN FOR EMERGENCIES AT THE AREA A GENERAL'S TANKS

*1. Maintain covers on the openings into the tank and routinely ensure they are in place.

2. When it is necessary to inspect, sample, or otherwise look into a tank, two persons must be involved, one to assist the other in the event of an emergency.

*3. A system of boreholes extending beneath the tanks should be provided for the purpose of routine sampling as a check for possible leakage.

*4. Because the tank contents are TRU wastes, they should be removed and packaged for transfer to the WIPP.

5. After the tank contents have been removed, consideration should be given to increasing the size of openings and filling the tanks with low level wastes. However, if it is found that the tanks have leaked, they must be removed and any TRU soils below the tanks must be removed and packaged for transfer to the WIPP.

6. Any small animals which may have fallen into one of the tanks should be removed and sent to TA-54, Area G.

7. If a large volume of rainfall runoff or snowmelt should enter one or both tanks, it should be pumped to DP-257 for treatment. The sludges from treatment would be checked to determine whether they are TRU.

8. In line with the eventual decommissioning of TA-21, planning for removal of the General's tanks to Area G, TA-54 should be underway.

XXVIII. CONTINGENCY PLANS FOR EMERGENCIES AT AREA T, TA-21

1. Wetting of the Area T absorption beds and the buried vertical cement paste cylinders (4 to 8 ft diam x 15 to 60 ft long) results in radioactivity being carried in all directions by underground pathways.

* Tritium has been surfacing in DP Canyon, but the alpha emitters are of more concern. Because of the relatively high level of activity of the wastes in Area T, consideration should be given to covering the area. This will not prevent intrusion of underground streams originating outside Area T, but it will reduce the volume of water passing through.

* In consideration of the longer term goal of decommissioning all of TA-21, planning should be underway for removal of the absorption beds and all of the cement paste cylinders of Area T to Area G, TA-54. (This effort should also include Areas A, U, and V.)

XXIX. CONTINGENCY PLANS FOR A TRANSPORTATION ACCIDENT INVOLVING A SPILL OF LIQUID WASTES

1. Within one of the LANL sites:

a. Render first aid to any injured personnel, particularly in stopping any bleeding. Do not move injured personnel unless necessary to prevent further injury.

b. Call 9-911 or 911 as appropriate.

c. Do not move any of the vehicles or obstructions involved.

d. Notify EMO, CST Division Office, and the Group Office by radio or phone.

e. Assist any uninjured personnel wetted by waste to an emergency shower.

f. As much as possible, take measures to prevent other vehicles from driving through areas wetted by waste.

g. Take initial measures if possible, to limit the area wetted by waste .

h. Assist EMO personnel as requested.

2. On LANL or county roads between sites:

a. Same as (a) through (h) above. EMO or 911 will contact the LAPD.

b. If another vehicle involved is a private vehicle, request that it not be moved until EMO and/or LAPD personnel arrive. Obtain the name of the owner if the private vehicle, its license number, and the insurance carrier. Make a sketch of the scene before anything is moved to assure accuracy in the accident report.

APPENDIX A
ACTIONS TO MITIGATE EMERGENCIES

1. In the area of CST-7 equipment at waste sources throughout the Lab (e.g. basement wings of SM-29, basement wings (3) of RC-1, etc.) post a clear diagram indicating the location of fire alarms, fire extinguishers, nearest telephones, names and phone numbers of the building manager and ENG-5 representative. Adjacent to the diagram, provide a list of data to be given when 911 or 9-911 is called.

2. Institute a monthly inspection of the locations in (1) above to assure that they are in a clean, uncluttered state and that fire extinguisher inspection is current.

3. At the locations mentioned in (1) above, provide a list of personnel and phone numbers to be called to implement cessation of all discharges to the radioactive waste collection system from the particular facility. A master list for all Lab facilities should be maintained at the control center at TA-50-1.

4. Schedule bimonthly reading/discussion of "Emergency Procedure for Earthquakes at LANL" and "Bomb Threat Call Checklist", both in the Lab telephone directory, at a Section meeting.

5. Provide valved piping to permit discharge of the process acid and caustic wastes stored in WM66 to the main plant raw waste storage tanks in WM-2, TA-50.

6. Provide valved piping to permit discharge of DPE radioactive waste directly into the main plant concrete storage tanks at TA-21-257.

7. Adjust the capacity of the pressure filter sump pump at DP-257 and provide valved piping to permit use of the DPE waste storage tanks for treated waste storage. Piping would also need to be provided to permit draining these tanks to the pumping station at the treated waste storage tanks north of DP-257. This latter connection could be used to transfer low-activity DPE waste directly, without treatment, to the pumping station.

8. The Section should rent a well-equipped Hummer for use in emergencies and maintenance of off-road collection system appurtenances.

9. The Section should have on hand several portable generator units capable of powering equipment such as pumps, power tools, lighting in field operations.

10. Provide a cyanide alarm near the waste storage tanks in the basement of SM66 with readout in electrochemistry and in the control center at TA-50-1.

11. Provide an additional check valve on the pump discharge line at the TA-2 waste pumping station.

12. Provide a vault for the Omega 54, 55, 56 waste storage tanks to permit full inspectability.

13. Provide a sign at the oil trap in the basement of SM102 which states " The lid must be fastened at all times except for maintenance or inspection."

14. Install a liquid level alarm in the concrete pit west of SM-141.

15. Set up procedures for the use of steam in SM-154 which will assure that the steam line is shut off when the work in SM-154 is completed.

16. Install a liquid level alarm in the high level waste storage pit at SM-154.

17. Replace the overflow waste line from TA-21-223 to TA-21-346 with a double-contained line.

18. Replace the TA-21-223 pump pit with one that is fully inspectable for leakage.

19. Replace the TA-21-257 plant with fully inspectable waste storage tanks and a neutralization/pumping station. Replace the cross-country pipeline with a double-contained line monitored electronically for leakage.

20. Install a valved piping connection between the raw waste storage pumps discharge line at TA-21-257 and the pressure filter discharge line to permit bypassing treatment and pumping filtered wastes to treated waste storage for further transfer to TA-50-2.

21. Replace the force main from DP-223 to DP-257 with a monitored, double-contained line.

22. Enclose and provide separate ventilation for the area including the flash mixer, flocculator, sedimentation tanks, and pressure filter at TA-21-257 if "Action" number 19 above is not implemented.

23. Provide complete grating, removable in sections, over the entire top of the flash mixer, flocculator and sedimentation tank at TA-21-257.

24. Seal the space between the inner and outer waste lines where the double-contained lines begin in the three locations in the basement of TA-48-1.

25. Install hook gages in the sedimentation tanks in the TA-21-257 plant and the TA-50-1 plant.

26. Provide clean-up instructions, with an emphasis on safety, for spills of 50% NaOH in room 16 at TA-50-1.

27. Install CO2 alarms in dead spaces in room 116, TA-50-1.

28. Provide removable light-weight grating over the clarifloccculators in room 116, TA-50-1.

29. Provide covers and separate ventilation systems for open waste-water surfaces in room 116, TA-50-1.

30. Provide a cover and sample removal system for the sample sink in room 116, TA-50-1, which will protect the operator from the atmosphere at the sink.

31. Because storage tanks and treatment units in TA-50-1, 2 are not fully inspectable for leakage, plans for their replacement incorporating the latest technology should be expedited.

32. Provide air locks on entrances to rooms 16, 60 and 116B in TA-50-1, the entrance to the pumping station in TA-50-2, and on the entrance to TA-50-66.

33. Replace the waste storage tanks at TA-53-1, 68, 69, 144, 145 with fully inspectable units.

34. Determine the horizontal location of the underground force mains from pumps at MPF-68, 69, 144, 145 TA-53, to the waste lagoon and provide permanent markers at the surfaces.

35. Investigate the possibility of replacement of the radioactive waste drain lines to MPF-68, 69 at TA-53 with double-contained or visually inspectable lines.

36. Install a flow meter on the waste discharge line to the radioactive waste lagoon at TA-53 and a depth gage in the lagoon, both with readout at the TA-50-1 control center.

37. Provide an intrusion alarm with read-out at TA-53 security on the access to the radioactive waste lagoon.

38. Provide an unlocked first-aid box at the radioactive waste lagoon at TA-53 and furnish it with first aid equipment, changes of clothing and other essentials to assist any person who may have been wetted by lagoon water.

39. Provide a "high wind" alarm on the road approach to the radioactive waste lagoon at TA-53 to warm visitors that they could be contaminated by wind carry of wastes in the vicinity of the lagoon.

40. Stock two collection system manhole covers to permit immediate replacement in the event of theft.

41. Provide an electronic alarm at each manhole, interconnected with the liquid detection alarm, to alert operators at the TA-50-1 control center that either liquid is present in a manhole or the cover has been removed.

42. Replace the gravity waste line from DP West to DP-257 at TA-21 with a double-contained or visually inspectable line.

43. Install flow meters in the pump discharge lines at TA-53-68, 69 and TA-53-144, 145.

44. Institute routine monthly physical inspection of the cross-country pipe line including vent valve operation.

45. Twice per year, flush a small amount of waste and accumulated solids from the cross-country waste line at the drain points in the canyon bottoms.

46. Provide a system of boreholes beneath the General's tanks in Area A, TA-21, to permit routine monitoring for leakage.

47. Eventually remove all radioactive wastes from the General's tanks and either fill the tanks with low level wastes as a temporary measure or remove the tanks and any contaminated soil in the vicinity to Area G, TA-54.

48. Cover the Area T absorption beds and cement paste cylinders with a material to prevent penetration by rainfall or snowmelt. Construct barriers to prevent runoff intrusion into the area.

49. Provide the necessary valved connections between the process waste lines and industrial waste line with the spare line at both TA-55-4 basement and TA-50-66 to permit an immediate substitution of the spare line for a damaged operating line.

50. Provide a two-way radio for any vehicle transporting any quantity of waste.

51. Install an additional block valve in the natural gas pipe line to each of the boilers in room 14, TA-50-1 and change the flame detection system for each boiler from the thermocouple to an infrared or ultraviolet flame detector.

52. Implement a plan for routine periodic inspection of above-ground storage tanks.

53. Provide a wind sock for a muster area on the east side of TA-50.

54. Install cathodic protection along the cross-country pipe line to provent corrosion of the line.

APPENDIX B
ACTION PLANS TO IMPLEMENT CORRECTIONS

The Contingency Plans at the beginning of this document describe actions to be taken in the event of various possible emergencies that may occur throughout areas in which the Liquid Waste Section, CST-7, has responsibility. Appendix A describes steps that may be taken to prevent or mitigate emergency conditions that occur. In this appendix, B, the necessary steps to implement the corrective actions, including the probable source of funding, are outlined in a table which follows.

APPENDIX C
BACKGROUND INFORMATION TO
DEFINE THE CONTINGENCY PLANS

INDEX

APPENDIX C
BACKGROUND INFORMATION TO DEFINE THE CONTINGENCY PLANS

I. Consider types of emergencies at specific locations.
   A. At the source of the wastes.
      1. TA-2-53.
      2. TA-3,29, 34, 39, 66, 102, 154, 1264.
      3. TA-16-205.
      4. TA-21-155.
      5. TA-35-213.
      6. TA-43-1.
      7. TA-48.
      8. TA-50-1, 2, 37, 69.
      9. TA-53-1, 68, 69, 144, 145.
      10. TA-44-4.
      11. TA-59-1.

   B. Within the collection system.
      1. Involving the inner or outer pipeline or the 3 in. steel line.
      2. Involving the manholes.
      3. Involving the valves.
      4. Involving the electronic monitoring.

   C. At waste storage facilities.
      1. TA-16-205 Raw Waste Storage tanks.
      2. At TA-21.
         a. Raw waste storage tanks for DPW wastes.
         b. Raw waste storage tanks for DPE wastes.
         c. Treated waste storage tanks.
         d. Sludge storage tank.
         e. Overflow storage tanks for DP-223.
      3. At TA-50.
         a. Raw waste tanks, TA-50-2.
         b. Treated waste tanks, TA-50-2.
         c. Sludge storage tanks, TA-50-2.
         d. Bldg. 66 acid and/or caustic process waste tanks.
         e. 100,000 gallon raw waste tank.
         f. 30,000 gallon waste tank.
      4. At TA-53.
         a. TA-53-1 waste storage.
         b. Beam channel waste storage tanks MPF-68, 69.
         c. WNR and NPB waste storage tanks WNR-144, 145.

D. At chemical storage facilities.
   1. At TA-50.
      a. 4000 gallon HNO3 storage tank.
      b. 4000 gallon NaOH storage tank.
      c. CO2 storage tank.
      d. Penthouse dry chemical storage.
   2. At TA-21-257.
      a. NaOH storage tank.
      b. Dry chemical storage.
   3. At TA-3-66.

E. Within liquid waste treatment facilities.
   1. At TA-50 main and pretreatment plants.
      a. Tanks.
      b. Plumbing.
      c. Electronics.
      d. Pumps.
   2. At TA-21-257.
      a. Tanks.
      b. Plumbing.
      c. Electronics.
      d. Pumps.
   3. At TA-53.
      a. Pumps.
      b. Plumbing.
      c. Lagoon.

F. Within other areas utilized by the Liquid Waste Section.
   1. At TA-50.
   2. At TA-21.
      a. General's tanks.
      b. Area T.
   3. At TA-53.
      a. Building MPF-1.
      b. Area at MPF-68, 69.
      c. Area at WNR-144, 145.

II. Consider the types of emergencies that may occur at the source.
A. Emergencies applicable to most waste sources.
   1. Power failure.
   2. Tank rupture.
   3. Pipeline rupture.
   4. Failure of the electronics monitoring systems.
   5. Exceptionally high volumes of waste flow.
   6. Tank overflows.
   7. Unusually high levels of radioactivity.
   8. Pump failure.
   9. RCRA wastes discharged to the system.

10. Fire.
11. Earthquakes.
12. Bomb threats.
13. Civil disturbance.
14. Terrorist activity.

B. Emergencies applicable to specific waste sources.
   1. TA-2-53.
      a. Check valve failure so that the storage tanks flood and overflow with wastes from the 3 in. steel force main crossing Los Alamos Canyon.
      b. Freezing of the 3 in. steel so that TA-2 waste may not be injected.
   2. TA-3-29.
      a. Criticality in a Wing 4 or 5 pumping station wet well.
      b. Closure of one or more basement wings due to high air count.
   3. TA-3-34.
      a. Failure of basement sump pump.
   4. TA-3-39.
      a. Stoppage in the grease trap.
   5. TA-3-66.
      a. Loss of a large volume of precious metals in wastes to the system.
      b. Accidental combination of cyanide waste solutions with acid in the basement tanks.
   6. TA-3-102.
      a. Stoppage in the grease trap.
      b. Oil interceptor overflow.
      c. Criticality in the grease trap or oil interceptor.
   7. TA-3-154.
      a. Steam line rupture.
      b. High gamma level, high level side.
   8. TA-3-1264.
      a. Major spill during unloading.
   9. TA-16-205.
      a. Major spill during transfer from storage tanks to the tank truck.
      b. Tank overflow.
   10. TA-21-155.
      a. Exceptionally high HTO levels in wastes.
   11. TA-35-213.
      a. Connection of sanitary wastes to the industrial systems.

12. TA-43-1.
    a. Spill of portable container of wastes being transferred to a truck for delivery to TA-50-2 with contamination of floor and equipment.
    b. Spill as above with personnel contamination also.
13. TA-48.
    a. Basement flooding in the north, central or south wings of RC-1 would permit water to enter the space between inner and outer pipelines.
    b. Failure or mismanagement of the duct washer system in the central wing of RC-1 could result in very large volumes of water to be discharging to the collection system.
    c. Accidental discharge of very high level
        • wastes from the north wing hot cells of RC-1.
14. TA-50 - See IV. E., V.C., VI.A.,B.
15. TA-53-1, 68, 69, 144, 145.
    a. Major spill during waste transfer
    b. Traffic damage to pump motors at MPF-68, 69 or WNR 144, 145.
16. TA-55-4.
    a. Plugging of the filter in the industrial waste line.
    b. Physical damage to the process caustic waste line due to attempts at steam cleaning.
17. TA-59-1.
    a. The sump pump for wastes generated in basement labs may fail.
    b. Should the glass drain pipe at the basement ceiling be broken accidentally, basement floor areas would be wetted.

III. Consider emergencies within the collection systems.
    A. The main collection system servicing TA-3, TA-48, TA-50, TA-59.
        1. A rupture in the inner and or outer line between manholes or between building and first manhole.
        2. Infiltration or exfiltration at manholes.
        3. Plugging of the inner line between manholes or between the building and the first manhole.

4. Loss of manhole covers.
5. Loss of signal from manholes relating to monitoring for presence of moisture.
6. Loss of operations of a MUX.
7. Failure of one or more of the valves in a manhole.
    a. Sticking shut.
    b. Unable to operate.
    c. Leaking.
    d. Physical damage.

B. The collection system serving DPE and DPW, TA-21.
1. Rupture of a gravity line at DPE or DPW.
2. Failure of the pump at DP-223.
3. Failure of the force main from DP-223.
4. Plugging of a gravity or pressure line.
5. Failure of the electronics monitoring systems.

C. The cross-country pipe line.
1. Failure of the 3" line in canyon bottom or on mesa top.
2. Plugging of the line before or after the juncture with the force main from TA-2 by freezing or by an obstruction in the line.
3. Failure of the pumps at DP-257 or TA-2.

D. The collection system serving TA-53.
1. Rupture of a gravity flow line to one of the storage tanks.
2. Rupture of a force main while transferring waste from storage to the lagoon.
3. Pump failure at MPF-1; MPF-68, 69; or WNR-144, 145.
4. Exceedingly high activity levels at the pumping stations.
5. Vehicle accident during truck transfer of waste.
6. Stoppage of plug in a gravity flow line to storage.
7. Failure of the electronics monitoring systems.

E. The collection system serving TA-55.
1. Rupture of the inner and/or outer line of either/both of the process waste lines.
2. Rupture of the inner and/or outer line of the industrial waste line.
3. Plugging of the three lines.

F. The collection system serving TA-2.
   1. Rupture of the line.
   2. Plugging of the line.

IV. Consider types of emergencies at waste storage facilities.

A. At TA-2.
   1. Tank rupture.
   2. Valve failure
   3. Pump failure/overflow.
   4. Electronics failure (pump control, tank levels, etc.).
   5. High radiation levels.

B. At TA-3-29.
   1. Tank rupture, Wings 4, 5.
   2. Valve failure.
   3. Electronics failure.
   4. Pump failure.
   5. High radiation levels.
   6. Tank overflow.
   7. Criticality.

C. At TA-3-154.
   1. Tank rupture, high or low level sides.
   2. High radiation levels.
   3. Pump failure.
   4. Valve failure.
   5. Electronics failure.
   6. Personnel steam burns.

D. At TA-16-205.
   1. Major spill during transfer from storage tanks to the tank truck.
   2. Tank overflow.

E. At TA-21.
   1. Rupture of the raw waste storage tanks for DPW wastes, the steel storage tanks for DPE wastes, the treated waste storage tanks, the sludge transfer tank, or the sludge storage tank, all at DP-257.
   2. Rupture of the overflow waste storage tank for DP-223 at DPE.
   3. Electronics failure.
   4. Failure of the raw waste tanks, sludge storage tank, or treated waste storage tank pumps
   5. Valve failures.
   6. Overflow of the tanks.
   7. High radiation levels.

F. At TA-50.
   1. Leakage from or rupture of the TA-50-2 raw waste, treated waste, or sludge storage tanks.
   2. Rupture of or leakage from the 100,000 gallon raw waste storage tank.
   3. Leakage from or rupture of the process waste storage tanks at WM-66.
   4. Pump or valve failures.
   5. Electronics failure.
   6. High radiation levels.
   7. Criticality, TA-50-66 tanks.
   8. Personnel falling into one of the TA-50-2 tanks or the 100,000 gallon tank.
   9. Rupture of or leakage from the 30,000 gallon storage tank.
   10. Failure of mixers for tanks at WM-66, WM-2
   11. Tank overflows at WM-2; 100,000 gallon tank; 30,000 gallon tank.
   12. Damage to WM-66 due to a truck or trailer collapsing the roof and falling into the structure.

G. At TA-53.
   1. Rupture at MPF-1; MPF-68, 69 or WMR-144, 145.
   2. Electronics failure.
   3. Pump or valve failure at MPF-1, MPF-68, 69 or WNR-144, 145.
   4. High radiation levels.

V. Consider emergencies at chemical storage facilities
A. At TA-3-66 basement.
   1. Failure of depth monitoring.
   2. Spill of NaOH flakes or solution.

B. At TA-21-257.
   1. Failure of the CO2 systems.
   2. Ca (OH)2, Fe2, (SO4)3, (precoat) spills.
   3. Failure of depth monitoring systems of liquid chemicals.

C. At TA-50-1.
   1. Overflow, leakage or rupture of 4000 gallon concentrated HNO3 storage tank.
   2. Overflow, leakage or rupture of the 4000 gallon 50% NaOH storage tank.
   3. Leakage of the CO2 storage tank.
   4. Overflow, leakage or rupture of the dilute (6N) HNO3 storage tank.
   5. Overflow, leakage or rupture of the 1000 gallon dilute NaOH storage tank.

6. spill of Ca (OH)2 or Fe2 (SO4).
    a. in the elevator.
    b. in the penthouse.

VI. Consider emergencies within liquid waste treatment facilities.
A. At the TA-50-1 main plant.
1. Breakdown of raw feed and/or treated waste pumps in TA-50-2.
2. Rupture of the force main from the raw feed pumps to the flash mixers.
3. Breakdown of the mixers for the raw waste storage tanks, TA-50-2.
4. Rupture of the concrete walls of the flash mixers, clarifloccculators and/or gravity filters.
5. Failure of any or all of the chemical feeders.
6. Extended interruption of the building water supply.
7. Failure of the heating system.
8. Failure of one or more units of the supply air system.
9. Failure of one or more of the exhaust air systems.
10. Extended interruption of the natural gas Supply.
11. Breakdown of the vacuum filter.
12. Failure of the plant electronic monitoring system.
13. Leakage or failure of the ion exchange column tanks.
14. Ion exchange column resin loss due to fire, explosion, spill.
15. Extended influent channel overflow to the basement.
16. Failure of flocculator and/or clarifier scraper in one or both tanks.
17. Personnel falling into a flocculator or clarifier.
18. Personnel collapse due to oxygen depletion in TA-50-2 pumping station.
19. Personnel injury due to severe electric shock.
20. Extensive sludge spill in room 116B.
21. Solidification of or loss of all gravity filter media.
22. Unpleasant/dangerous atmosphere in the plant due to organics in waste in the clarifiers.

B. At the TA-50-1 pretreatment plant.
   1. Leakage or rupture of any of the plant tanks, room 60, 60A.
   2. Criticality.
   3. Failure of a drum of cemented sludge.
   4. Failure of the treated waste pump.
   5. Major spill.
      a. Liquid Waste.
      b. Sludge.
   6. Failure of the tumbler air exhaust system.
   7. Personnel contamination accident.

C. At the TA-21-257 plant.
   1. Breaching of a clarifier or filter feed tank wall.
   2. Breakdown of the sedimentation tank scraper.
   3. Breakdown of the filter feed, sludge tanks or backwash pumps.
   4. Complete plugging of the pressure filter.
   5. Failure of the building heating system.
   6. Extended interruption of the water supply.
   7. Extended interruption of the natural gas supply.
   8. Breakdown of the vacuum filter.
   9. Failure of the electronic monitoring system.
   10. Rupture of the DPE force main within the building.
   11. Personnel falling into the sedimentation tank.
   12. Failure of one or more of the chemical feeders.
   13. Personnel injury due to severe electrical shock.
   14. Unpleasant/dangerous atmosphere due to organics in waste in the sedimentation tanks.

D. At the TA-53 facilities.
   1. Major rupture in a lagoon berm.
   2. Slow leak through the lagoon bottom or berms.
   3. Personnel fall into the lagoon.
   4. Large animal trapped in the lagoon.
   5. Lagoon overflow.
   6. Dislocation of lagoon liner by high winds.
   7. Excessive radiation levels near the lagoon.
   8. Excessive solids accumulation in the lagoon.
   9. Problems due to icing.
   10. Contamination of the environment near the lagoon due to the wind.

VII. Consider types of emergencies in other areas utilized by the Liquid Waste Section.
   A. General's tanks Area A.

1. Personnel fall into one of the tanks.
2. Overflow of one of the tanks due to influx of rainfall runoff.
3. Small animals trapped in one of the tanks (squirrel, raccoons, skunks, snakes, etc.).
4. Tank leakage due to corrosion.

B. Building WM-114, TA-50.
1. Accidental storage of material with alpha contamination.
2. Physical injury during storage operations.

C. Transportation accidents.
1. Loss of a dumpster tank or tuff tank waste during transportation.
2. Automobile or truck accident.
   a. Involving another GSA vehicle with or without personal injury.
   b. Involving a private vehicle, in state or out-of-state, with or without personal injury.
   c. Involving a deer or elk.
3. Vehicle breakdown while enroute.
4. Vehicle mired down or stuck during off-road travel.

D. Area T, DPW, TA-21.
1. Contaminated seepage into DP canyon from Area T.
2. Extensive flooding with contaminated runoff.
3. Unauthorized excavation.

VIII. Effects of emergencies that occur at the source
A. TA-2-53.
1. Check valve failure such as being stuck open would permit wastes from the 3 inch depressed line from DPW to backflow and flood the storage tanks. Wastes would contaminate the environment around the tanks and eventually drain to the stream in Los Alamos Canyon.
2. Freezing in the 3-inch cross-country line would prevent injection of the TA-2 wastes. Wet wells would fill and a high level alarm would be sounded.
3. Failure of the electronic systems would prevent the discharge pumps from starting at high water level, stopping at low water level, or sounding high level alarms. The wet well tanks could overflow or back waste up the line. The pump could be damaged by continuing to operate after it lost suction.

B. TA-3-29.
   1. A criticality incident in a wet well pumping station, Wing 4 or Wing 5, could result in:
      a. death of personnel,
      b. major injury to personnel,
      c. high levels of contamination in the area affected,
      d. temporary closure of SM-29,
      e. extended closure of operations which discharge wastes to the affected system,
      f. adverse national publicity,
      g. review of operations by the Lab, DOE Albq., DOE Washington, D.C., and others,
      h. high activity levels in much of the acid waste line and at TA-50-1, 2.
   2. Closure of one or more of the basement wings, if for an extended period, would result in lack of equipment maintenance and possible equipment down time. The pumping stations must be kept in operation even if air-supplied suits would be required.

C. TA-3-34.
   1. Should basement sump pumps fail to operate, wastes would back up until noticed by users and the problem would be corrected.

D. TA-3-39.
   1. A stoppage in the grease trap would result in backup of the waste line. Wastes could back up through floor drains and wet much of the surrounding area. However, waste activity is very low and clean-up would propose few problems.

E. TA-3-66.
   1. Loss of a gold, silver or other precious metal plating solution would result in a monetary loss.
   2. Loss of acid and cyanide plating solutions with their subsequent mixing in the basement would generate deadly HCN fumes. Results could include:
      a. Death of personnel.
      b. Injury to personnel.
      c. Extended closure of SM-66.
      d. Adverse national publicity.
      e. Numerous investigations - Lab, DOE Albq., DOE Washington, D.C., State of NM, others.

F. TA-3-102.
   1. A stoppage in the grease trap would result in overflow to the basement floor and subsequent mild contamination.
   2. Oil interceptor flow would have similar effects.
   3. A criticality in either trap would have very serious repercussions.
      a. Possible death or severe injury to personnel.
      b. Extended closure of SM-102.
      c. Adverse national publicity.
      d. Numerous investigations - Lab, DOE Albq., DOE Washington, D.C., State of NM, others.

G. TA-3-154.
   1. Whenever Wing 9 wastes are directed to SM-154 and a power failure occurs, the low level waste tanks could fill and overflow to the below-ground operating room above the tanks. This room could also fill and wastes would flow through the manhole covers to the area surrounding the tanks. The stainless steel high level waste tanks would fill and waste would back up in the system until it was noticed in Wing 9.
   2. Failure of the electronics systems depth indicators and high level alarms, if unnoticed at the central computer facility in TA-50-1, would have results similar to (1) above
   3. Release of high activity gamma wastes to the high level side would require that the facility be isolated a distance sufficient to limit effects on passers-by.

H. TA-3-1264.
   1. A power outage would prevent use of the motorized valve on the storage tank discharge line.
   2. A major spill within the building should be controlled by the floor drain. If this drain is plugged or sealed, the waste would flow through the door and contaminate the environment in the vicinity of the building.

I. TA-16-205.
   1. Because the steel storage tank is located in a concrete vault, overflow or leakage to the vault is pumped back into the tank. Cleanup of the low level contamination (tritium) should not be difficult.

2. If a spill should occur while loading the tank truck, the drain in the pad on which the truck sits would return the waste to the storage tank. Cleanup should not be difficult.

J. TA-21-155.

1. High HTO levels in wastes from TSTA (DP-155) would result in high atmospheric HTO levels at the DP-223 wet well and at the sedimentation tank in DP-257, in the tanks in TA-50-2, and in the discharge to Mortandad Canyon. The TA-50-1 clarifiers would not be affected if the DP-257 discharge was directed to treated waste storage in TA-50-2. If directed to raw waste storage, room 116, TA-50-1 might need to be evacuated. Personnel would be susceptible to inhalation of HTO before becoming aware of the problem.

K. TA-35-213.

1. If someone mistakenly valves the sanitary waste flow to the industrial waste system, human organic waste will be injected into the system. Odor problems, sludge management problems and excessive NPDES discharge permit levels would develop.

L. TA-43-1.

1. Radioactivity levels of wastes collected from HRL-1 are usually very low. However, a spill of a container of waste could contaminate a relatively large area and a cleanup could be very time consuming.
2. A spill of a container of wastes while loading it into a truck would contaminate the truck and surrounding area requiring roping off the area and truck until they were decontaminated.
3. Contamination of personnel or clothing would not be too serious with respect to radioactivity but may be hazardous with respect to pH or chemical nature. Emergency shower and eye wash stations are available at the Labs.

M. TA-48-1.

1. Water flowing between the inner and outer pipeline from basement flooding in the north, central, or south wings of RC-1 would reach the first downstream manhole and cause the conductivity alarm to sound at the control center in TA-50-1.

2. Discharge of very active (β - τ) wastes from hot cells in the north wing of RC-1 could create problems in shielding at TA-50-1, particularly in room 116 and in the pumping station in TA-50-2.
3. Very high flows of waste from the duct washing systems in the central wing basement could require over-time operation of the TA-50-1 main treatment plant.

N. TA-50.
(Refer to: X.E., XI.C., XII.A., B., XIII.B.)

O. TA-53.
1. If a spill occurs while loading waste into a tank truck at MPF-1, the area surrounding the loading pad will be contaminated.
2. If pump motors at WNR-144, 145 are damaged by vehicle traffic, flow to the tanks may need to be restricted.
3. An extended power interruption at TA-53 would prevent pumping out waste tanks at MPF-1, 68, 69, 144, and 145. It would be necessary to restrict flow to the tanks or suffer overflow and basement contamination at MPF-1 and backup of waste at MPF-68, 69, 144, 145. If the electronics are inoperative, overflows and backup may also occur.

P. TA-55-4.
1. If the screen in the filter in the industrial waste line in the basement of TA-55-4 plugs, wastes will back up until the problem is noticed.
2. Serious physical damage of the process caustic waste line, constructed of PVC, may occur if dissolution of crystallization in the line is attempted with high pressure steam. The line then may become unuseable until repaired, seriously affecting operations.

IX. Possible effects of emergencies within the collection systems.
A. The main collection system serving TA-3, TA-48, TA-59.
1. Rupture of the inner polyethylene line between manholes would result in waste flow via the outer polyethylene line to the downstream manhole and alarm.

2. Rupture of the outer polyethylene line between manholes would result in infiltration of ground water which would flow to the downstream manhole and alarm.
3. Rupture of both inner and outer polyethylene lines would result in waste flow to the environment.
4. Consequences of rupture to the inner and/or outer FRP lines would be similar to that for polyethylene lines but in most cases environmental contamination would be confined within the site.
5. Plugging of the inner line would result in the backup of wastes to the source if it occurred ahead of the first junction manhole. Any plug downstream of junction manholes would back waste up into all sources connected to the system to that point. Flooding would occur at many sources if the stoppage was not detected in a timely manner.
6. Loss of manhole covers.
   a. Entrapment of small animals.
   b. Possible serious injury to personnel who might fall into the manholes.
   c. Possible damage to vehicles and their passengers if they unknowingly hit the opening.
   d. Infiltration of storm runoff with subsequent alarm at the TA-50 computer.
7. Failure of the moisture sensing mechanism in a manhole.
   a. No difficulty under normal conditions of no leakage to the manhole.
   b. Leakage of ground water through wall joint or around pipe openings would result in a rising water level in the manhole with little effect other than possible damage to the paint on the walls and floor.
   c. Flow into the manhole due to an upstream rupture of the inner or outer line would result in eventually filling the manhole above the vent opening of the downstream outer line and the waste would flow to the next downstream manhole causing an alarm to be indicated at the TA-50 computer. A rupture of the outer line might not be discovered until groundwater due to heavy rains was at a level in the trench to infiltrate.

B. The collection systems serving TA-2 and TA-21.
   1. Leakage from a gravity waste line at DPE or DPW would result in underground contamination which could go undetected for a long time.
   2. Failure of the DP-223 pumps would cause the station sump to overflow to the overflow storage tanks to the north. The high level alarm would alert personnel to the problem in time to permit corrective action before the overflow tanks filled.
   3. A rupture or leak in the DP-223 force main to DP-257 should be identified at the control center at TA-50-1 and should be observed in the field. Large areas at the leak would be contaminated with low levels of tritium
   4. Should the TA-2 force main leak or rupture before its juncture with the cross-country line, TA-2 waste and the TA-21 waste draining from the cross-country line would contaminate a large area before it was detected. Detection would probably not occur until visually spotted at TA-2 or until the operator at the TA-50-1 control center noted that much of the TA-21 waste being pumped to TA-50-2 never arrived.
   5. Plugging of the cross-country line by accumulations of solids at low points should be noted almost immediately by the TA-50-1 control center operator involved in transferring wastes from TA-2 or TA-21.

C. The collection system serving TA-53.
   1. Leakage from or rupture of a gravity flow line to storage at MPF-68, 69 or MPF-144, 145 would contaminate a large area with low levels of (β - τ) wastes. Small leaks would be very difficult to detect.
   2. Because the force mains from the two storage locations to the lagoon are double-contained, leaks of the inner line would be alarmed in a relatively short period of time. If both lines were cut or punctured at the same location, it is likely that inner line waste would flow to the outer line and the problem would be alarmed.
   3. High radioactivity levels in wastes stored at MPF-1, 68, 69 or 145 would be detected when sampled and analyzed prior to transfer.

D. The collection system serving TA-55.
   1. Steam cleaning of the process caustic waste line can cause major deformation of the line due to expansion. The deformation may cause a break in the line and would contribute to plugging.
   2. Because all of the waste lines from PF-4 to WM-66 are double-contained (stainless steel in PVC), any leak in an inner line would be detected at TA-50-57/106 by the conductivity probe.
   3. It would be very unusual that both inner and outer lines were ruptured or punctured, but if it happened, the loss of waste should be noted by the control center operator at TA-50-1 at the time of a transfer. Loss of process wastes at a break would create a major problem in clean-up.
   4. Should one of the operating three lines become plugged, the standby 2 inch line could be placed in service.

X. Effects of emergencies that occur at radioactive waste storage facilities.
   A. At TA-2.
      1. If the storage tanks/wet wells overflow or rupture, radioactive wastes, generally very dilute with short half-life isotopes of nuclides, will contaminate the environment in the vicinity of the tanks. Depending on the volume released, the waste could reach the stream and contaminate the flow all the way to the Rio Grande.
      2. Wastes in the storage tanks at TA-2 are sampled and analyzed before being pumped to the 3 in. cross-country line. The 3 in. line discharges to raw waste storage at TA-50-2 and will be treated through the TA-50-1 main plant. If it would become necessary to treat these wastes before they had decayed to low levels, additional precautions for plant operation would be necessary.

   B. At TA-3-29.
      1. Rupture, leakage or overflow of the wet well tanks in the wings 4 and 5 would result in contamination of the basement floor area and restriction of activity in the area until clean-up had been completed. Activities of the groups which discharge wastes to these tanks would be interrupted for an extended period. Tank overflows due to power failure would have similar effects.

2. Accumulation of SNM material in one of the pump wet wells could cause a criticality with subsequent injury to personnel and serious repercussions throughout DOE and the media.
3. High radiation levels in one of the fiberglass wet wells in Wings 4 or 5 would prevent maintenance of associated pumps and plumbing and require an investigation into the cause of the high levels.
4. Should it be necessary to utilize one of the concrete storage tanks in Wing 2, 3, 4, 5, or 7 and the tank was leaking, the ground below the tanks would be contaminated and depending upon fissures in the tuff, a relatively large area could become contaminated.

C. At TA-3-154.
1. Should either or both of the low level concrete tanks leak or rupture during use, it is unlikely that the problem would be detected for a long time. The underground area in the tank vicinity would become contaminated. Depending upon the presence of fissures or utility trenches in the area, contamination could be widespread, extending beyond site boundaries. Leakage from the stainless steel tanks of the high level side would be contained in the concrete vault holding the tanks. Should the vault permit leakage to the environment, ground contamination would be similar to that in (1) above.
2. Rupture of a high pressure steam line during waste transfer operations could result in personnel injury from burns. Should the valve in the Wing 9 basement on the steam line be left open and the line fail in SM 154, the structure would fill with condensate and much of the electrical and electronic equipment would be damaged.
3. Pump or valve failure would be noticed at the TA-50-1 computer because waste transfers or discharges would not be indicated by changing levels.

D. At TA-16-05.
(Refer to VIII.I.)

E. At TA-21.

1. Rupture or leakage of the outer wall of the concrete raw waste storage tanks or the vertical sides of the DPE or treated waste steel tanks would result in contamination of the environment, largely within DPW. However, the treated waste tanks, being relatively close to the canyon edge, could release wastes to DP Canyon. Rupture or leakage of other side of the concrete raw waste tanks, or the bottom of the steel DPE or the treated waste storage tanks would not be immediately noticeable if the leaks were minor. The leakage would contaminate the underground area in the vicinity of the tanks and would extend outward for a distance determined by fissures or other pathways in the tuff.
2. Should the overflow waste storage tanks for the pumping station at DPE leak or rupture while waste is stored in it, HTO - contaminated waste would be contained within the asphalted depression in which the tank sits.
3. Overflow of any of the storage tanks should signal or alarm at the TA-50-1 computer. The extent of the area contaminated would depend upon whether the electronic alarm system is functioning and the length of time the computer operator takes in noticing the alarm and implementing corrective action.
4. High radiation levels in the raw waste storage tanks, due to other than HTO, would produce high air counts inside DP-257. Personnel may be affected before HS-1 is aware of the situation. If HTO is involved, it is unlikely that the condition would be known and any personnel in the building at that time would become contaminated.

F. At TA-50.

1. Leakage from or rupture of the TA-50-2 raw waste or sludge storage tanks, if relatively slow, may escape detection for a long time. In any case, the underground area at the tanks would become contaminated with flow possibly in the direction of Ten Site Canyon.
2. Leakage from or rupture of the 100,000 gallon raw waste storage tank or the 30,000 gallon tank in TA-50-1, room 70A, should be contained in the concrete enclosures in which the tanks are located.

3. Leakage from or rupture of either of the process waste storage tanks in WM-66 would result in very serious contamination of the interior of the structure with no loss to the environment. Operations at TA-55-4 which discharge the process wastes would need to be curtailed until clean-up was effected and the damaged tank replaced. This would be a long period of time.
4. Should a truck or trailer collapse the roof and fall into WM-66, extensive damage to the electronics, electrical, plumbing and pumping systems would result. It is likely that the vehicle would suffer extensive contamination which might necessitate its disposal. All operations at TA-55-4 which discharge process waste would need to be halted until the WM-66 facility was restored to its condition prior to the accident. This would be a very long period of time.
5. If a criticality should occur in one of the process waste tanks in WM-66, personnel injury other than to an occasional passerby would be unlikely because the facility is unmanned except for brief occasional periods. Physical damage to the installation would be minor, but effects on operations at TA-55-4 would be very serious and prolonged.
6. Personnel accidentally falling into one of the TA-50-2 or the 100,000 gallon storage tanks could result in death or serious contamination depending upon the length of time before the accident was discovered.
7. Because facilities at TA-50 are monitored electronically to a high degree, equipment failures are evident shortly after they occur and remedial measures are initiated in a timely manner. Many of the functions may be halted awaiting repair.

G. At TA-53
1. If one of the storage tanks should leak or rupture, awareness of the problem would be dependent on the rate of leakage. Slow leaks could go undetected for a long period of time. Ground in the vicinity of the leaking tanks would be contaminated, probably with short half-life radioisotopes. Depending upon the geology near the leak site, contamination could become extensive, reaching Los Alamos or Sandia Canyon.

2. High radiation levels in the storage tanks at MPF-1 would be a problem to personnel who may need to work in the area and to those involved in transferring the waste to the lagoon. Storage tanks at MPF-68, 69 and WNR-144, 145 are buried and should be no problem until transferred to the lagoon.
3. TA-53 storage tank depths are monitored routinely at the TA-50-1 control center. Overflow problems would occur only under conditions of high flow when the electronics are inoperative. Wastes would back up until evident at floor drains except at MPF-1 where they would flow out immediately to the basement floor.

XI. Effects of emergenices that occur at chemical storage facilities.

A. TA-3-66.

1. A supply of flake NaOH is maintained at the basement waste storage tanks to permit neutralization of acid wastes. Should the flake become unobtainable in Los Alamos, other neutralizing agents would need to be used. Problems arise if cyanide solutions are lost to the caustic waste storage tank and its contents are then mixed with acid wastes. The HCN gas produced, even in very low concentrations, is extremely toxic.
2. A spill of NaOH flake or solution should cause no serious problems unless they contact skin surfaces or the respiratory systems of personnel involved. In that case, injuries due to burns are serious.

B. TA-21-257.

1. High concentrations of CO2 within a tightly closed building could be lethal to personnel entering or working within the facility.
2. Spills of lime or ferric sulfate should cause no injury if not inhaled or left in contact with the skin.

C. TA-50-1.

1. Overflow, leakage or rupture of the 4000 gallon HNO3 tank would result in large brown clouds of nitrogen oxide being swept by the wind into populated areas. The concentrated acid otherwise would be contained in the outdoor pit in which the tank is located.

Direct contact with the acid by personnel not adequately protected would result in burns. Inhalation of the fumes could cause respiratory damage.

2. Because of the CO2 storage tank is outdoors, leakage would not be harmful to anyone. However, leakage from the pipeline in the building could accumulate in poorly ventilated areas and constitute a threat of suffocation.
3. Leakage or rupture of the indoor 4000 gallon NaOH (50%) storage tank, if minor, would damage any painted areas it contacted (floors) and would raise the pH of the raw waste when washed to the floor drains. A large leak or rupture would do more extensive damage to painted surfaces, would be more difficult and hazardous to clean up because it would render floor surfaces very slippery, and it would have a major effect on the pH of raw wastes. Skin contact would result in difficult, painful chemical burns. Loss of the dilute NaOH from the indoor 1000 gallon storage tank would have very similar effects.
4. Leakage or rupture of the indoor dilute (6N) HNO3 storage tank would cause nitrogen oxide fumes through room 16, would damage the floor paint and create a very difficult clean-up situation. Skin contact would result in burns and fume inhalation would injure respiratory tracts. It would create acid conditions if washed to the raw waste storage tanks and significantly increase nitrate levels in treatment plant discharges.
5. Spills of hydrated lime or ferric sulfate, either in the elevator or penthouse storage, would require isolation of the affected areas until clean-up was completed. Personnel in proper protective clothing would have little risk of injury during clean-up.

XII. Effects of emergencies that occur within liquid waste treatment operations.

A. At the TA-50-1 main plant.

1. If the raw feed or treated waste pumps broke down, it would be necessary to use the remaining operating pump(s) for both purposes, preventing simultaneous operation of both functions.

2. If the force main from the raw feed pumps to the plant ruptured underground between building 1 and 2, a significant volume of contaminated waste would be injected into the area before the problem became apparent. The waste would probably flow in a southeasterly direction, possibly into Ten Site Canyon. The treatment plant would be shut down until repairs were made, requiring that discharges to the collection system be curtailed. Clean-up operations would be extensive and the Lab would receive a large volume of adverse publicity.
3. Failure of the raw waste storage tank mixers could go undetected for a long period of time if the failure was in the coupling between motor and shaft. The motors would be running but no mixing would be detected. Motor failure would be detected immediately as the indicator lights on the room 116 panel would not light up when the operator attempted to start the mixers. However, a short in the electrical system might cause the operator to believe that the mixers were operating when they were not, or vice versa. In any case, no serious problems would result if the mixers were not operating for a few months. The pH and activity levels of raw waste to the treatment plant would vary more and settleable solids in would accumulate the raw waste storage tanks. Over an extended period, solids accumulations could create significant treatment, mixer maintenance, and solids removal problems.
4. Minor ruptures in the concrete walls of the flash mixers, clarifiers, or filter would result in contamination of walls/floors in room 16, TA-50-1, and could necessitate removing a unit from operations until problems were corrected. Major ruptures would seriously affect plant operations requiring total shutdown for a long period of time, major clean-up operations, operation of the plant at a reduced treatment rate for a long time with concomitant necessary overtime operation. Operations of all LANL programs which generate radioactive wastes would be affected.

5. Chemical feeder failure would have very minor effects on plant operations because temporary corrections are relatively easy to institute.
6. Extended interruption of the TA-50-1 water supply would:
    - prevent regeneration of the ion exchange columns, filter backwash, and treatment chemical make-up,
    - make general decontamination operations including hand washing and showers difficult or impossible,
    - negate use of emergency eyewash and shower stations,
    - require emergency provision of drinking water and toilet facilities,
    - prevent use of sprinkler systems in the event of a fire,
    - prevent use of fire hydrants in the vicinity of TA-50-1 if the interruption extended to the mains near the building,
7. Without heat for and extended period in extremely cold weather:
    - waste pipelines could freeze and rupture, taking the plant out of service for a long time,
    - potable water lines could freeze and rupture, resulting in the problems listed in G. above,
    - necessitate use of winter clothing, including gloves, by plant operating personnel,
    - waste and potable wastes lines, before rupture, would suffer stoppages from ice blocks,
    - waste pumps in room 16, TA-50-1 could freeze and be damaged,
    - hot water heat exchangers in the supply air systems would freeze and rupture,
    - water lines in the boilers would freeze and rupture.
8. Should one or more of the air supply units fail:
    - the wing of TA-50-1 being served by that unit would be unheated,
    - one or more exhaust fans may need to be shut down, probably requiring shut down of the affected operation.
9. Failure of one or more of the exhaust air systems:

- would require shutting down one or more of the supply air systems to prevent air pressure
- imbalances causing air to flow from zones of greater radioactivity to those of lesser,
- would require shutting down certain operations, such as vacuum filter,
- would require use of supplied air suits for entrance into certain areas such as TA-50-66, TA-50-1, rooms 60, 60A; the TA-50-2 pumps room and possibly several other areas,
- would seriously affect the heating of rooms 16 and 116, TA-50-1

10. Extended interruption of the natural gall supply would result in all of the problems listed under the loss of heat in 7 above.
11. Vacuum filter breakdown should create no serious problems if the TA-50-2 sludge storage tank were only partially full at the time of the breakdown. If the storage tank were full, it would be impossible to drain sludge from the clarifiers in TA-50-1. Accumulating sludge in the bottom of the clarifiers would eventually stop the operation of the sludge scraping mechanism and the flocculator. The plant would need to be shut down until the clariflocculator was returned to operation.
12. Failure of the operating panel in room 116, TA-50-1, would have only minor repercussions if the PDP-11 computer system remained operative. Pumps, valves and mixers would require manual operations, but status of pumps and valves would be indicated in the computer.
13. Failure or leakage of the ion exchange column tank or tanks would create a floor contamination problem in an enclosed area in TA-50-1. It would prevent use of the column(s) until the problems were corrected. The plant would operate without the columns and there would be no interruption in service to the waste generators.
14. Major loss of ion exchange resin by fire or explosion would have effects similar to 13 above, but damage and clean-up would be much more extensive. Serious personnel injuries would be possible. Chemical treatment of the wastes would probably not be affected.

15. Influent channel overflow to room 60, TA-50-1, would create serious clean-up problems. If the overflow were undetected for a long period of time, the wastes could contaminated not only the central wing of TA-50-1 but also the north and south wings and the outside area around the building. Floor drains in a number of the rooms such as 14 would serve to limit the spread of the overflow. Clean-up would be very difficult and offices in the north and south wings might need to be closed, but operators, with extra protection, could continue to treat wastes.
16. Flocculator failure would seriously affect the efficiency of treatment of the wastes and require that the unit be removed from service. Clarifier scraper failure would permit use of the tank until sludge build-up reached a level where it would overflow to the filter.
17. A person falling into the flocculator could be injured seriously by the rotating paddles or between the rotating and fixed paddles. Falling into either the flocculator or clarifier would result in total external contamination and possible damage to the digestive tract if any of the high pH solution were ingested. Drowning would be unlikely unless the person were very small and became terrified.
18. Should the TA-50-2 pumping station ventilation fan fail and an operator collapse within the station due to lack of oxygen, it is likely that the operator would not survive.
19. Injury due to severe electric shock can vary from various degrees of burn to fatality. In TA-50-1 and TA-50-2, the highest levels of hazard are in the motor control centers, but even the 110V circuits can cause injury.
20. An extensive sludge spill in the 116B, TA-50-1, would require a major clean-up and cessation of operations until decontamination was complete. Some of the spillage could flow into room 116 and could also drop down the elevator shaft. Treatment plant operation would not be affected unless sludge storage tank capacity was inadequate to survive the filter downtime.

21. If both gravity filters became inoperable, treatment efficiency would be reduced and treated waste storage tank contamination increase. If only one of the filters became inoperable, adjustments could be made to operate the plant with the other filter. Repair of one or both filters is a messy operation that requires a considerable period of time and generates a large volume of solid radioactive waste.
22. Should a waste source on the collection system discharge a relatively large volume of volatile organic waste to the system, electrical sparks from equipment at TA-50-1 or 2 could ignite the gas with resulting explosion and physical damage to personnel and/or property. Breathing of the compound by operations personnel in room 116, TA-50-1, could result in headaches, nausea, or more serious illness. The treated waste discharges would constitute mixed wastes subject to EPA RCRA regulations. Sludge concentrates would also become mixed wastes.

B. At the TA-50-1 pretreatment plant
1. Leakage or rupture of any of the tanks containing wastes would be very serious with degree of seriousness directly proportional to the length of time that the leakage was undetected. This waste has a much higher level of radioactivity than that of the main plant. Because of floor construction at the exits none of the waste should be able to leave the building. Clean-up would be difficult and time consuming, requiring that the plant remain inactive. This would effect operations at TA-55-4 which generate the wastes. The leaking tank would need to be repaired or replaced and it is likely that affected areas, after clean-up, would need to be painted.
2. A criticality in the pretreatment plant could only occur where solids are concentrated such as in the sludge storage tank in room 60. Any personnel in the area at the time would receive excessive doses of radiation, and, depending on their location with respect to distance and shielding, the dosage could be fatal.

The criticality excursion would continue until its own heat altered conditions to sub-critical. The plant would be shutdown for clean-up and investigations for a long period of time, probably years, and emergency planning would commence immediately to provide a substitute facility for managing the wastes at TA-50 or TA-55. Adverse publicity could temporarily halt all TA-55 operations until investigations were complete.

3. Failure of a drum of sludge/cement within the tumbler would probably require that the entire unit within its enclosure be removed and replaced. If the waste and cement had been well mixed before the drum failure occurred, a clean-up could be attempted after the mixture had set. If waste and cement had not yet mixed clean-up would be more difficult.
4. If the treated waste pumps for the room 60 plant failed, the plant would be shut down until the pump were repaired or replaced
5. A major spill in room 60 or 61 would prevent the plant from being operated and require cessation of activities which generate the waste at TA-55-4 when the TA-50-66 storage tanks were full. Clean-up would be very difficult. (See also 1. above).
6. If the tumbler filtered air exhaust system failed, it would necessitate shutting down tumbling operations until the system has been repaired or replaced. It would be possible to risk use of the tumbler without the air exhaust system under emergency conditions with little danger of contamination of the environment.
7. A personnel accident with wastes in room 60 could result in acid burns, caustic burns, skin contamination and contamination of the respiratory tract. Plutonium and americium would be the principal nuclides of concern.

C. At the TA-21-257 plant

1. A breached clarifier or filter feed tank wall could result in waste flow to the environment possibly to the road along the north side of DPW and over or under the road to DP Canyon. the plant would be put out of operation and all contaminated soil would need to be removed. Operations at DPE and DPW could be affected if the waste activity was too high to risk sending it without treatment to TA-50-2 through the 3 in. cross-country line.

2. Should the sedimentation tank scraper fail, sludge would accumulate in the bottom of the tank until it began to carry over the weirs with eventual plugging of the pressure filter. The plant would need to remain inoperative until the scraper was repaired. Operations of groups at TA-21 could be affected if repairs required an inordinate amount of time.
3. For the plant to operate, the filter feed pumps must operate. The sludge transfer pump and filter backwash pump, however, need operate only when these functions become necessary.
4. If the pressure filter became plugged and the condition did not respond to acid wash, it could become necessary to remove the media or replace the unit entirely. The plant would be inoperable during this period with possible interruption of activities of programs at TA-21.
5. Loss of the TA-21-257 heating system in severely cold weather could result in freezing and rupture of pipelines. The plant would be shut down for repairs, and if the waste was too radioactive to be pumped through the 3" cross-country pipeline to TA-50-2, programs at TA-21 would be affected.
6. Extended interruption of the water supply would:
    - prevent preparation of chemical feed solutions
    - eliminate the supply of drinking water
    - eliminate the supply of water for washing, showers
    - eliminate the supply of water for pressure filter backwashing
    - eliminate the supply of water for precoat filter washdown,
    - eliminate the supply of water for decontamination operations
    - eliminate the supply of water for fire protection
7. If the natural gas supply were cut off for an extended period in a severe cold spell, pipe lines within the plant could freeze and break. The plant would be out of service for a long time, affecting programs at TA-21, particularly DPW.

8. If the sludge storage tank at DP-257 were only partly filled at the time of a breakdown of the vacuum filter, it would provide sufficient space for additional sludge to permit a reasonable period of time for filter repair. If the sludge storage tank were full when the filter broke down, it would be impossible to draw sludge from the sedimentation tank, and treatment operations would be restricted after sludge accumulations reached a point where scraper operation was affected. Treatment operations could normally be delayed without adverse repercussions if adequate capacity for raw waste storage were available.
9. Because DP-257 is not manned continually, failure of the electronics systems (depth, flow rate, etc.) would require more frequent visits by operations personnel until systems were repaired. It is unlikely that any emergencies would arise due to the failure.
10. Should the DPE force main rupture within DP-257, would probably go unnoticed for a number of days resulting in a wetting of some of the north end of the building by slightly tritiated water. The building would be closed to any use until clean-up was completed, the time required being determined partly by the level of contamination. It is unlikely that DPW programs would be affected but waste flow from DPE would need to be curtailed until the line was repaired. A rupture of the force main between DPE and DPW would probably go undetected until the static levels in the storage tanks at DP-257 came into question or the physical presence of the rupture came to the attention of a passer-by. Contamination of the environment would be very extensive and the extent of clean-up operations would depend upon the level of detectable tritium. Adverse national publicity could result. Operations generating liquid radioactive waste at DPE could be affected while repair and clean-up were underway.
11. A person falling into the sedimentation tank at DP-257 should be able to keep from drowning by clinging to the scraper mechanism, the weir or the overflow pipe. However, the person would suffer total body external alpha contamination, and if any of the waste were ingested, respiratory and/or digestive tract contamination would result. Cuts and bruises could result from the fall into the tank making body decontamination more difficult.

12. Chemical feeder failure could be resolved by temporary measures until repairs were completed or new equipment installed.
13. Serious injury or death could result from electrical shock.
14. A large volume of volatile organic waste could result in an explosive atmosphere in DP-257 or cause any personnel within the plant to become ill from inhalation.

D. At the TA-53 facilities.
1. A rupture in the berm of the lagoon which stores radioactive waste would permit the escaping waste to contaminate the ground near the lagoons and probably the wall of the canyon to the south. The extent of the clean-up would depend upon the level of activity in the waste, normally very low. Immediate repairs would be necessary and adverse publicity would result. Minor interruption of TA-53 programs might by required until repairs were completed.
2. A slow leak from the lagoon might not be detected for a very long time. Discovery would probably be the result of drilling in the area or questioning appearance of a surface of a surface stream in an unlikely area. Affected areas would be contaminated but levels would be very low with no long-lived alpha activity. Locating the leak site and clean-up of the contaminated soil could be very difficult. Interruption of beam operation would be likely.
3. A person falling into the radioactive waste lagoon would suffer total external body contamination of very low levels with possible respiratory and digestive tracts contamination if submersion occurred. The lagoon is shallow and drowning is unlikely. If the person were alone and used a vehicle to bet to a shower and change of clothing, the vehicle would also require decontamination.
4. A large animal in the radioactive waste lagoon could leave under its own power and, in most cases, its intrusion would never be known. If for some reason it drowned, the carcass would be removed and sent to burial at TA-54.
5. Overflow of the radioactive waste lagoon enters normal runoff channels and drops into Canyon and streams along East Jemez Road. No NPDES permit has been approved for such

discharge. The overflow would contain very small amounts of radioactivity primarily 7Be and 8H and it is unlikely that clean-up would be required.

6. With a low water level in the radioactive waste lagoon and a very high wind, 70-90+ mph, over it, physical damage to the hypalon liner may result. The liquid contents could be blown over the surrounding area and the liner could be torn. Operations generating waste for the lagoon would need to be curtailed until repairs were completed. It is unlikely that a general clean-up of the surrounding area would be necessary.
7. Excessive radiation levels from the lagoon contents would be unlikely to occur because all stored wastes are sampled and analyzed before being pumped to the lagoon. If a combination of errors permitted this to happen, the situation would probably go unnoticed for a very long period of time. Personnel working in the area would be subject to the radioactivity and the exposure would be evident when their film badges were read.
8. Should excessive solids accumulate in the lagoon, steps would need to be taken to clean them out. (The solids could consists of settleable materials in the waste, algae growths, plant growth, etc.) The operation would require that no wastes be pumped to the lagoon during the cleaning, possibly affecting some programs. The solids would need to be dewatered as much as possible and packaged for transfer to TA-54 for burial as low level waste.
9. Icing of the lagoon in the wintertime interferes with evaporation and can result in water levels reaching overflow outlets. Repercussions would be as in 5. above.

XIII. Effects of emergencies that occur in other areas utilized by the Liquid Waste Section.

A. At the General's tanks, Area A

1. A person falling into either of the tanks would become highly contaminated with alpha radioactivity. If the person were unaccompanied, escape would not be possible and the imprisonment could extend for a long period of time. The high alkalinity of the waste could cause some physical injury. Clean-up after rescue would need to be very thorough.

2. If either of the tanks filled and overflowed due to rainfall runoff or snowmelt, the area in the vicinity of the tanks, most likely only within Area A, would be contaminated with alpha radioactivity. Despite being contained in Area A, it would need to be cleaned up to prevent its distribution by winds. Should the overflow extend beyond Area A, it could contaminate the road to the north and run into DP Canyon. Clean-up would be much more extensive.
3. Any small animals which might fall into either tank would probably die due to drowning, ingestion of the waste, or starvation. Any such animals rescued from either tank would need to be decontaminated before release to the environment.
4. Should either or both tanks be found to be leaking, attempts would need to be made to discover the extent of the travel of the radioactivity and to prevent further leakage. The work should not affect ongoing programs because the tanks have not been in use.

B. At TA-50-114
1. Storage of any contaminated items in this building could result in the contamination of other items stored there and also in the unknowing contamination of personnel. It is possible that personnel could carry this contamination off-site, affecting private vehicles, their homes, anything or anyone in whom they come in contact. Clean-up could be difficult and costly to trace and accomplish.
2. Many types of physical injury could occur while storing or removing items from WM-114. Many of the items are bulky, heavy or with sharp corners or edges. Back injuries, cuts, eye injuries, puncture wounds, smashed toes or fingers are possible. Injured personnel could require anything from simple first aid to extended hospitalization.

C. In transportation accidents:
1. The spill of a truckload of radioactive waste during transfer between sites would necessitate closing of the roadway while clean-up operations were underway. Because of limits to the degree of radioactivity of liquid wastes for truck transport the level of contamination would be low.

It is likely, however, that portions of the roadway would need to be removed and replaced. Depending upon the location of the spill, the road closure could have relatively serious affects on traffic patterns.

2. Accidents between GSA vehicles where no injuries are sustained required that the personnel involved obtain identifications and data on the accident as in an accident between private vehicles. Group offices should be notified and standard ESH-3 accident forms must be completed and forwarded. Where injuries are sustained, Los Alamos police should be notified and injured personnel should be transported to the Los Alamos Medical Center. Where private vehicles are involved, Los Alamos Police should be called regardless of where the accident occurs, whether on County roads or in Lab areas.
3. Should GSA vehicles driven by Liquid Waste Section personnel breakdown between sites or get stuck during off-road travel, the operator will need to walk to the nearest telephone to advise the group leader of the dilemma and to contact GSA for assistance with the vehicle.

D. At Area T, DPW TA-21

1. Seepage from Area T has been observed, sampled, and analyzed by ESH-8 for many years. To date, the only radionuclide involved has been tritium. However, with many eight foot diameter by up to 60 feet deep cement paste columns contaminated with plutonium and uranium still in place, the seepage may eventually contain alpha contamination. Removal of all of the columns, a difficult, messy job, may be required.
2. Extensive flooding of Area T could result in alpha-contaminated water flowing over the road to the north into DP Canyon. Extensive clean-up operations would be required. Contaminated roadway would need to be removed and replaced; canyon wall decontamination could be difficult. The operations might attract adverse publicity.
3. Should unauthorized excavation occur in Area T in the vicinity of the buried columns of cement paste, excavating equipment would become contaminated and the personnel involved would need to be checked for nasal and clothing contamination. The ground surface in the area affected would require decontamination.

APPENDIX D

REFERENCES

"Occurrence Reporting and Processing of Operations Information with Attachment 1. Categorization of Occurrences by Group", Department of Energy Order 5000.3A (date)

"Final Occurrence Report Checklist", Department of Energy Order 5000.3B (date)

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"Planning and Preparedness for Operational Emergencies", Department of Energy Order 5500.3A (date)

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Spill Report, HS Form No. 9-4A (3(87)

APPENDIX F

DIRECTORY OF SENIOR MANAGERS

Associate Director at Large (ADAL)			
John Hopkins, TA-3, SM-43, Room D-422A	A112	7-1678	5-4370
Chemistry and Materials (ADCM)			
Eugene Wewerka, TA-3, SM-43, Room A346	A102	7-5893	7-1139
Computational and Information Sciences			
John Browne, TA-3, SM-43, Room A422	A110	7-8682	7-0407
Controller (CONT)			
Terry Gibbs, Acting, TA-3, SM-43, Room A422	A119	7-3848	5-4410
Energy and Environment (ADEE)			
Michael Stevenson, TA-3, SM-43, Room 340	A107	7-3880	5-2964
Research and Education (ADREE)			
Warren "Pete" Miller, TA-3, SM-43 Room D315A	A104	7-7978	5-6163
Human Resources (DHR)			
Frances Menlove, TA-3, SM-43, Room D-315A	A124	7-1887	5-5728
Laboratory Development (ADLD)			
Robert Selden, TA-3-SM-43, Room A410	A113	5-6564	5-4092
Nuclear Weapons Technology (ADNWT)			
John Immele, TA-3, SM-43, Room A410	A105	7-6120	5-3283
Operations (ADO)			
Allen Tiedman, TA-3, SM-43, Room D-426	A120	7-9390	5-4521
Physics and Life Sciences (ADPLS)			
Fred Morse, TA-3, SM-43, Room C-301A	A114	7-1600	5-3858
Quality, Policy and Performance (ADQPP)			
John Whetten, TA-3, SM-43, Room C315	A108	7-1101	7-1115
Laboratory Counsel (LC)			
William Hughes, TA-3, MS-43, Room D410	A183	7-3970	5-2301
Public Affairs Office (PAO)			
Scott Duncan, TA-3, SM-100, Room-119	A118	7-5679	7-9994

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Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

AUG 16 1996

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Ms. Dale Doremus
Program Manager
Ground Water Pollution Prevention Section
New Mexico Environment Department
P. O. Box 26110
Santa Fe, NM 87502

Dear Ms. Doremus:

Subject: Ground Water Discharge Plan Application, Technical Area (TA) 50 Radioactive Liquid Waste Treatment Plant

Enclosed are three copies of the Ground Water Discharge Plan Application with supporting documents for Los Alamos National Laboratory's (LANL) Radioactive Liquid Waste Treatment Plant at TA-50. Also enclosed is the $50.00 filing fee required by the New Mexico Water Quality Control Commission Regulations.

Please call Bob Beers of LANL's Water Quality and Hydrology Group, ESH-18, at 667-7969, or Ken Zamora of my staff at 665-5047, if you desire any additional information concerning this Discharge Plan Application.

Sincerely,

G. Thomas Todd
Area Manager

LAAMEP:3KZ-006

Enclosures:
1 - Application (3)
2 - Filing Fee

cc:
See page 2

cc w/1 copy of Application:
J. Vozella, AAMEP, LAAO
K. Zamora, AAMEP, LAAO
T. Baca, EM, LANL, MS-J591
D. Erickson, ESH-DO, LANL, MS-K491
A. Gancarz, CST-DO, LANL, MS-J515
D. Christensen, NMT-DO, LANL, MS-E500
T. George, LC GENERAL, LANL, MS-A187
K. Hargis, EM/WM, LANL, MS-J552
S. Rae, ESH-18, LANL, MS-K497
S. Hanson, CST-13, LANL, MS-E518
K. McAda, EPD, AL

State of New Mexico
ENVIRONMENT DEPARTMENT
Ground Water Protection and Remediation Bureau
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2918 phone
(505) 827-2965 fax

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

M E M O R A N D U M

TO: James Bearzi, Manager, District 2

FROM: Dale M. Doremus, Program Manager
Ground Water Pollution Prevention Section

RE: New Discharge Plan

DATE: August 26, 1996

Enclosed is a copy of the latest discharge plan application which the NMED Ground Water Pollution Prevention Section has received for your district. It is for:

DP-1132 LANL/TA-50 Radioactive Liquid Waste Treatment Facility

Plans and specifications are included for review by the District Engineer.

Please call Phyllis Bustamante of the Ground Water Pollution Prevention Section at 827-0166 if you would like additional information on this facility.

Enclosure(s)

cc: Glenn Saums, Program Manager, Surface Water Section
Ron Kern, Technical Supervisor, NMED Hazardous Materials Program
Edward Gonzales, District Engineer, NMED Dist. 2 (same office)
Discharge Plan File

State of New Mexico
ENVIRONMENT DEPARTMENT
Santa Fe Field Office
525 Camino De Los Marquez, Suite 4
Santa Fe, New Mexico 87502
(505) 476-8538
Fax: (505) 476-8541

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

October 2, 1996

To: Phyllis Bustamante
Water Resource Specialist

From: Courte Voorhees
Health Program Manager
Santa Fe Field Office of District 2

Re: DP1132 LANL/TA50

# #

I have reviewed the latest discharge plan application form and have no comments at this time. Thank you for the opportunity to review the document.

If I can be of further assistance, please contact me at 476-8537.

CV/cv

cc: James Bearzi, District 2 Manager
John Pijawka, Environmentalist
Dale Doremus, Program Manager

FIELD TRIP REPORT

GROUND WATER POLLUTION PREVENTION SECTION

Date: 11-12-96 **Inspector(s):** P. Bustamante
L. Quemada

FACILITY

Facility Name: LANL -TA-50 Contact: Bob Beers

Location: Los Alamos

Discharge Plan Number: DP- 1132 UIC Related? (Yes/(No)): _____

Type of Operation: radioactive liquid waste treatment

INSPECTION SUMMARY

Purpose:

✓ a. Evaluation of Proposed Discharge Plan

____ b. Compliance Inspection (Complete Checklist on Reverse Side)

____ c. Other (specify): _____

ACTIVITIES

a. Inspection of (Facilities) or Construction (specify): Toured mortandad canyon and check location and condition of monito wells - toured wwtp

Flow Measurement: Type: influent meters Condition: good

b. Effluent Sample(s) (provide sampling location): _____

No. of Ponds: 0 No. in Use: 0 Condition of Ponds: _____

Condition of Pond Liner (s): _____

c. Ground Water Sample(s) (provide well name and location): _____

No. of Monitor Wells: ____ Well Condition: mws-3 & 4 were not in good shape -

d. Other (specify): _____

OBSERVATIONS AND INFORMATION OBTAINED

Mortandad Canyon - at outfall, water enters effluent canyon (tributary to mortandad). Water mixes with water from upstream. This water may get in from TA-48. Don't have WQ Data from upstream. - Gauging station - Surface water at gauging station is combination of water from mortandad and effluent canyons - need to know what other sources contribute to water at this point. Monito wells - MW-#3 - well leaning down stream with boards up against it. MW #4 outer casing dropped below PVC - not covered. #5 good cond. - all other wells inspected in good shape - Not sure wells are close enough to discharge point for monitoring - Tour of plant - saw treatment process.

CTION REQUIRED

Send Additional info Letter

:00541

WATER QUALITY INSPECTION & SAMPLING CHECKLIST
Reference: Regulation No. HED 86-14 (EID)

ENTRY CONFERENCE:

_____ Was facility representative informed of EID's right of entry and authority: (To access records, inspect monitoring equipment or methods and sample effluents under Section 74-6-9.E of the New Mexico Water Quality Act (NMSA 1978)?

_____ Was EID identification presented?

_____ Were potential or suspected violations which prompted inspection listed?

_____ During the inspection, was the facility representative immediately advised or addition potential violations?

EXIT CONFERENCE

_____ Were the preliminary inspection results summarized?

_____ Was the facility representative advised if violations discussed during the entry conference remain under investigation?

_____ Were other potential violations discovered during the inspection discussed?

_____ Was a date provided as to when EID expects to complete consideration of potential violations.

WATER QUALITY SAMPLING

_____ Was the facility representative offered a reasonable opportunity to obtain split/replicate samples, perform simultaneous tests, measurements or photographs?

_____ Were copies of EID's results (sampling, testing, photos) requested? If yes, copies must be provided within ten working days after such results are in EID's possession.

STATE OF NEW MEXICO COUNTY OF LOS ALAMOS

IN TH. FIRST JUDICIAL DISTRICT COURT

AFFIDAVIT OF PUBLICATION

STATE OF NEW MEXICO)
) ss.
COUNTY OF LOS ALAMOS)

RECEI...
DEC 0 9 1996

THE LOS ALAMOS MONITOR
LOS ALAMOS, NEW MEXICO

Evelyn Vigil, being duly sworn, declares and says that she is the Editor of the Los Alamos Monitor, a newspaper published and having a general fully paid circulation and second-class postal privilege in the County of Los Alamos, State of New Mexico.

Affiant further states that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 14-11 N.M.S.A, 1978 Compilation and was so qualified at the time of all publications in reference hereto.

Affiant further states that the publication, a copy of which hereto affixed, was published in said paper, in the regular and entire issue of each number of the paper, during the period and time of publication and that the notice was published in the newspaper proper and not in a supplement, for 1 consecutive weeks, the first publication being on the 15 day of November, 1996, and the subsequent consecutive publications on ____ and ____, 19__.

Subscribed and sworn before me this 22 day of November, 1996.

Notary Public
My Commission Expires: October 17, 2000

104 PUBLIC NOTICES

PUBLIC NOTICE

NEW MEXICO ENVIRONMENT DEPARTMENT

Notice is hereby given that, pursuant to New Mexico Water Quality Control Commission Regulations, the following proposed discharge plans have been submitted for approval to the New Mexico Environment Department. The information in this notice generally has been supplied by the applicant and many not have been confirmed by the NM Environment Department.

DP-1132, LOS ALAMOS NATIONAL LABORATORY, RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (TA-50), Mr. Tom Todd, Area Manager, DOE Los Alamos Office, 528 35th Street, Los Alamos, New Mexico 87544 proposes to continue the discharge of up to 41,770 gallons per day of treated effluent. The facility is located approximately 1 mile from Los Alamos townsite in Section 22, T19N, R6E, Los Alamos County. Up to 41,770 gallons per day of radioactive liquid waste is treated by the following process: wastewater is conveyed to the Radioactive Liquid Waste Treatment facility, TA-50, by a gravity filter and collected in effluent holding tanks for pH and radioactivity measurements. Treated effluent is then discharged into Mortandad Canyon. Sludge from the clarifier is transferred to a sludge holding tank then filtered by a rotary vacuum filter. Filter cake from the process is placed in drums and disposed of at TA-54, Area G. Excess water form the sludge holding tank, and the rotary vacuum filter is returned to the influent holding tanks.

Any interested person may obtain further information from the Ground Water Pollution Prevention Section of the NM Environment Department,telephone (505) 827-2900, and may submit written comments to the Ground Water Section, NM Environment Department, P.O. Box 26110, Santa Fe, NM 87502. Prior to ruling on any proposed discharge plan or its modification, the ;NM Environment Department wil allow thirty (30) days after the date of publication of this notice to receive written comments and during which a public hearing shall set forth the reasons why the hearing should be held. A hearing will be held if the NM Environment Department determines that there is significant public interest.

DATE OF PUBLICATION:
NOVEMBER 15, 1996

00544

STATE OF NEW MEXICO
County of Bernalillo SS

Bill Tafoya being duly sworn declares and says that he is Classified Advertising manager of **The Albuquerque Journal**, and that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Session Laws of 1937, and that payment therefore has been made of assessed as court cost; that the notice, copy of which is hereto attached, was published in said paper in the regular daily edition, for one times, the first publication being of the 17 day of Nov, 1996, and the subsequent consecutive publications on _____, 1996 Bill Tafoya

Sworn and subscribed to before me, a notary Public in and for the County of Bernalillo and State of New Mexico, this 17 day of Nov 1996

PRICE 37.65

Statement to come at end of month.

PUBLIC NOTICE
NEW MEXICO ENVIRONMENT DEPARTMENT

Notice is hereby given that, pursuant to New Mexico Water Quality Control Commission Regulations, the following proposed discharge plans have been submitted for approval to the New Mexico Environment Department. The information in this notice generally has been supplied by the applicant and may or may not have been confirmed by the NM Environment Department.

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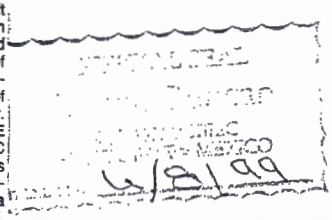

man AFB in Section 32, T16S, R6E, Otero County. Domestic waste is treated in an activated sludge package plant followed by gravity clarification. The treated wastewater is discharged to an unlined lagoon. Ground water below the site is at a depth of 3 feet and has a total dissolved solids concentration of 60,000 milligrams per liter.

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Ground water below the site is at a depth of approximately 20 feet and has a total dissolved solids concentration of approximately 700 milligrams per liter.

Any interested person may obtain further information from the Ground Water Pollution Prevention Section of the NM Environment Department, telephone (505) 827-2900, and may submit written comments to the Ground Water Section, NM Environment Department, P.O. Box 26110, Santa Fe, NM 87502. Prior to ruling on any proposed discharge plan or its modification, the NM Environment Department will allow thirty (30) days after the date of publication of this notice to receive written comments and during which a public hearing shall set forth the reasons why the hearing should be held. A hearing will be held if the NM Environment Department determines that there is significant public interest.

Journal: November 17, 1996.

: 00546

State of New Mexico
ENVIRONMENT DEPARTMENT
Ground Water Protection and Remediation Bureau
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2918 phone
(505) 827-2965 fax

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

P 332 407 597

US Postal Service
Receipt for Certified Mail
No Insurance Coverage Provided.
Do not use for International Mail (See reverse)
Sent to
Mr. Tom Todd, Area Manager
LANL, Radioactive Liquid Waste Tre
DOE Los Alamos Area Office
528 35th Street
Los Alamos, NM 87544
Street & Number
Post Office, State, & ZIP Code
Postage $
Certified Fee

DP-1132 (PB)

November 19, 1996

Mr. Tom Todd, Area Manager
LANL, Radioactive Liquid Waste Treatment Facility (TA-50)
DOE Los Alamos Area Office
528 35th Street
Los Alamos, New Mexico 87544

Dear Mr. Todd:

Enclosed is a copy of the public notice pertaining to your proposed discharge plan(s) which is being published by the New Mexico Environment Department in a newspaper of general circulation.

If you have any questions, please do not hesitate to contact me at the address listed below or at 827-2900.

Sincerely,

Dale M. Doremus
Program Manager
Ground Water Pollution Prevention Section

DMD:cjm

Enclosure

State of New Mexico
ENVIRONMENT DEPARTMENT
Ground Water Protection and Remediation Bureau
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2918 phone
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GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

P 332 407 605

US Postal Service
Receipt for Certified Mail
No Insurance Coverage Provided.
Do not use for International Mail (See reverse)

Sent to	Lawry Mann, Council Chair
Street & Number	PO Box 30
Post Office, State, & ZIP Code	Los Alamos, New Mexico 87544
Postage	$
Certified Fee	
Special Delivery Fee	

DP-1132 (PB)

November 18, 1996

Lawry Mann, Council Chair
P.O. Box 30
Los Alamos, New Mexico 87544

Dear Lawry Mann:

Enclosed is a copy of the public notice which includes notice of a proposed discharge plan(s) for one or more operations in or near your city which is being published by the New Mexico Environment Department in a newspaper of general circulation.

If you have any questions, please do not hesitate to contact me at the address listed below or at 827-2900.

Sincerely,

Cecilia Mendoza for

Dale M. Doremus
Program Manager
Ground Water Pollution Prevention Section

DMD:cjm

Enclosures

State of New Mexico
ENVIRONMENT DEPARTMENT
Ground Water Protection and Remediation Bureau
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2918 phone
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GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

P 332 407 615

US Postal Service
Receipt for Certified Mail
No Insurance Coverage Provided.
Do not use for International Mail *(See reverse)*

Sent to
Board of County Commissioners
Los Alamos County Courthouse
Street & Number
PO Box 30
Post Office, State, & ZIP Code
Los Alamos, New Mexico 87544

Postage	$
Certified Fee	

DP-1132 (PB)

November 19, 1996

Board of County Commissioners
Los Alamos County Courthouse
P.O. Box 30
Los Alamos, New Mexico 87544

Board of County Commissioners:

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Sincerely,

Cecilia Mendoza for

Dale M. Doremus
Program Manager
Ground Water Pollution Prevention Section

DMD:cjm

Enclosure

TO BE PUBLISHED ON OR BEFORE NOVEMBER 20, 1996

PUBLIC NOTICE

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NEW MEXICO
ENVIRONMENTAL LAW CENTER

December 17, 1996

Ground Water Bureau
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, N.M. 87502

Hand delivered

Re: Proposed ground water discharge plan 1132

Dear Sir or Madam:

I write on behalf of the Pueblo of San Ildefonso (the Pueblo) to request that the Environment Department conduct a public hearing on the proposed discharge plan 1132 for the Los Alamos National Laboratory radioactive liquid waste treatment facility.

This request is made pursuant to the New Mexico Water Quality Act and the Water Quality Control Commission Regulations as well as the public notice published in the Albuquerque Journal on November 17, 1996.

This request is made on the grounds that the discharge plan is a matter of great interest to the Pueblo and its members because the Los Alamos National Laboratory radioactive liquid waste facility discharges treated effluent into Mortendad Canyon, a Canyon that leads directly to the Pueblo's reservation. That effluent therefore may affect the surface water in the Canyon, soils and surface water on the reservation, and the ground water beneath the Canyon and the reservation.

The Pueblo therefore requests that the Department conduct a public hearing and provide the Pueblo with at least 30 days notice prior to that hearing.

Please do not hesitate to contact me if you have any questions about this request.

Yours truly,

Douglas Meiklejohn
Attorney

pc: The Honorable Elmer Torres
Governor
Pueblo of San Ildefonso

1405 Luisa St., Suite 5 Santa Fe, N.M. 87505
(505) 989-9022 FAX (505) 989-3769

State of New Mexico

ENVIRONMENT DEPARTMENT

FAX TRANSMITTAL

DATE: 12-13-96 **TIME:** 4:30 **PAGE:** 1 **OF** 3

PLEASE DELIVER THE FOLLOWING PAGES TO:

TO: Doug Mcklejohn

AGENCY/LOCATION: New Mexico

TELEPHONE: 989-9022 **FAX:** 989-3769

FROM: P. Bustamante

AGENCY/LOCATION: NMED, Ground Water Quality Bureau

TELEPHONE: 827-0166 **FAX:** (505) 827-2965

COMMENTS:

The public Notice for TA-50 was published in the Alb. Journal on Nov. 17, 1996. Thirty days from that date is Dec. 18, 96.

Received
12/13
4:45
DB

DRUG FREE

Harold Runnels Building • 1190 St. Francis Drive • P.O. Box 26110 • Santa Fe, New Mexico 87502
(505) 827-2850 FAX (505) 827-2836

p. by 1110

I

December 14, 1996

Ms. Marcie Levitt Bureau Chief
Ground Water Quality B.
fax 827-2965

Dear Ms. Levitt,

I am requesting a hearing on Discharge Plan 1132 since the comment period is nearly over and the public has not had substantial public comment time.

Among many reasons for the hearing are:

- Does the plan eliminate the discharge of radionuclides and bring the release of nitrates within acceptable levels?
- Does the plan address the extent of past contamination & possible remediation efforts?
- What volumes of radioactive sludge are being projected for future burial at TA-54?

In addition I want to be informed by the GWQB whether a hearing is scheduled.

Sincerely,

Susan Dwyer
POB 9855, SF, NM 87504
(505-699-0195)

Pi'ee Quiyo Inc.
Rt. 5 Box 442-B
San Ildefonso Pueblo
Española, New Mexico 87532

phyllis 2

RECEIVED
DEC 17 1996
GROUND WATER BUREAU

Dec. 17,1996

From: Kathy Sanchez
President

To: Ms. Marcie Levitt, Bureau Chief
Ground Water Quality Bureaul,NMED

Subject: LANL'S RADIOACTIVE LIQUID WASTE TREATMENT FACILITY

The new discharge plan-1132 needs more public input and time is needed for us to tell our side of the impact. We definitely feel a need to have a public hearing. Here are some of the questions which we would like to have discussed.

Does the plan eliminate the discharge of radionuclides and bring the release of nitrates to within acceptable levels?

Does the plan address the extent of past contamination and possible remediation efforts?

Have adequate waste stream characterizations been performed for liquid volumes coming into RLWTF?

What volumes of radioactive sludge are being projected for future burial at TA-54,Area G ?

There are many more such questions or areas of concern for us as community Pueblo people who live below Los Alamos. Our safety should not be put at risk.

Please do keep us informed as to whether a hearing is scheduled.

Thank you.

Kathy Sanchez

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GROUND WATER BUREAU

Rte. 5 Box 298
Santa Fe, New Mexico 87501
(505) 753-6277

Fax page 1 of 1

Dec. 17,1996

From: Joey Natseway
Tewa Women United

To: Ms. Marcie Levitt, Bureau Chief
Ground Water Quality Bureaul,NMED

Subject: LANL'S RADIOACTIVE LIQUID WASTE TREATMENT FACILITY

The new discharge plan-1132 has taken us by surprise. We definitely feel a need to have a public hearing. Here are some of the questions which we would like to have discussed.

Does the plan eliminate the discharge of radionuclides and bring the release of nitrates to within acceptable levels?

Does the plan address the extent of past contamination and possible remediation efforts?

Have adequate waste stream characterizations been performed for liquid volumes coming into RLWTF?

What volumes of radioactive sludge are being projected for future burial at TA-54,Area G ?

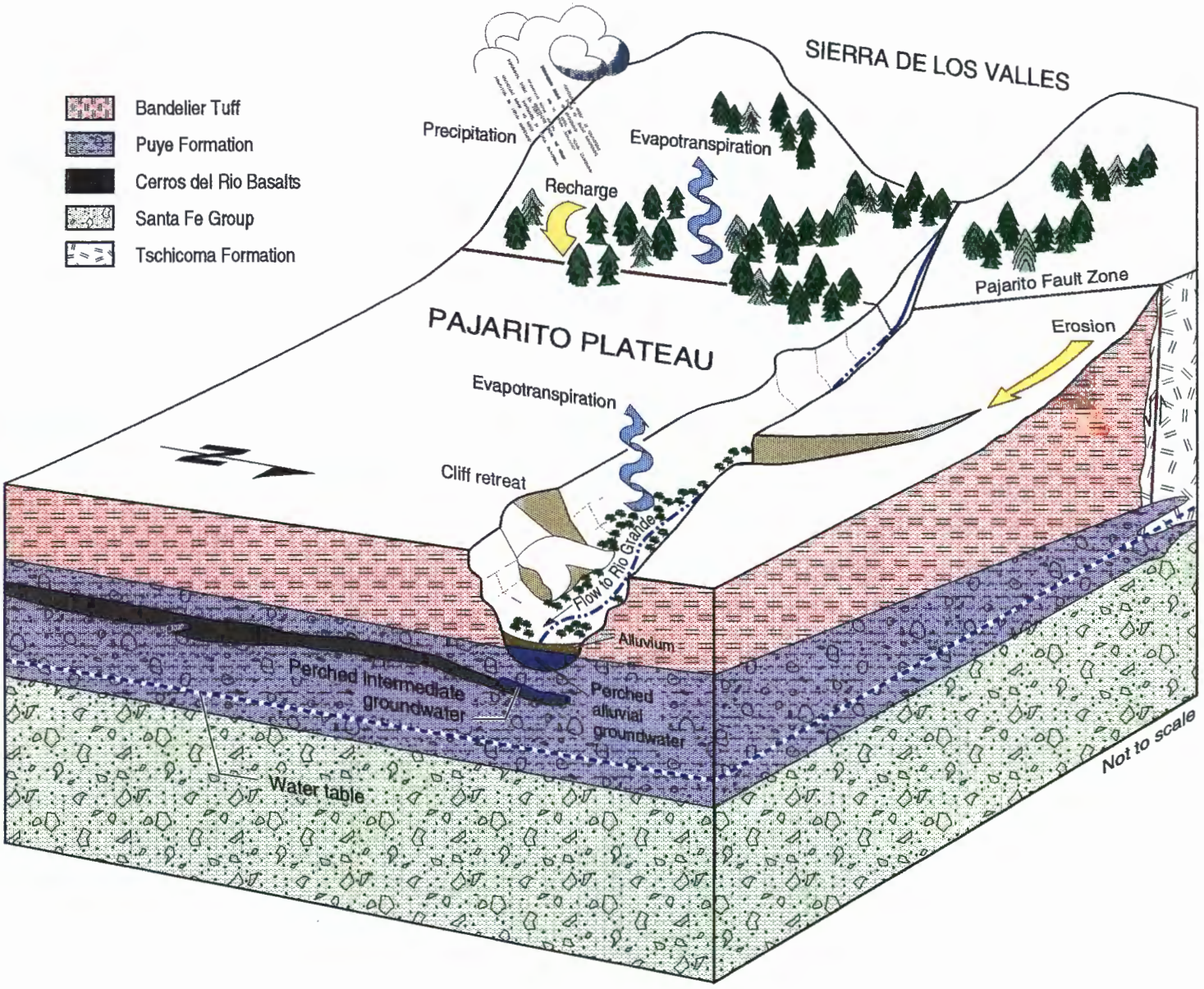
There are many more such questions areas of concern for us.

Please do keep us informed as to whether a hearing is scheduled.

Thank you.

Hydrogeologic Workplan

Los Alamos National Laboratory



Draft Revision 1.0

December 6, 1996

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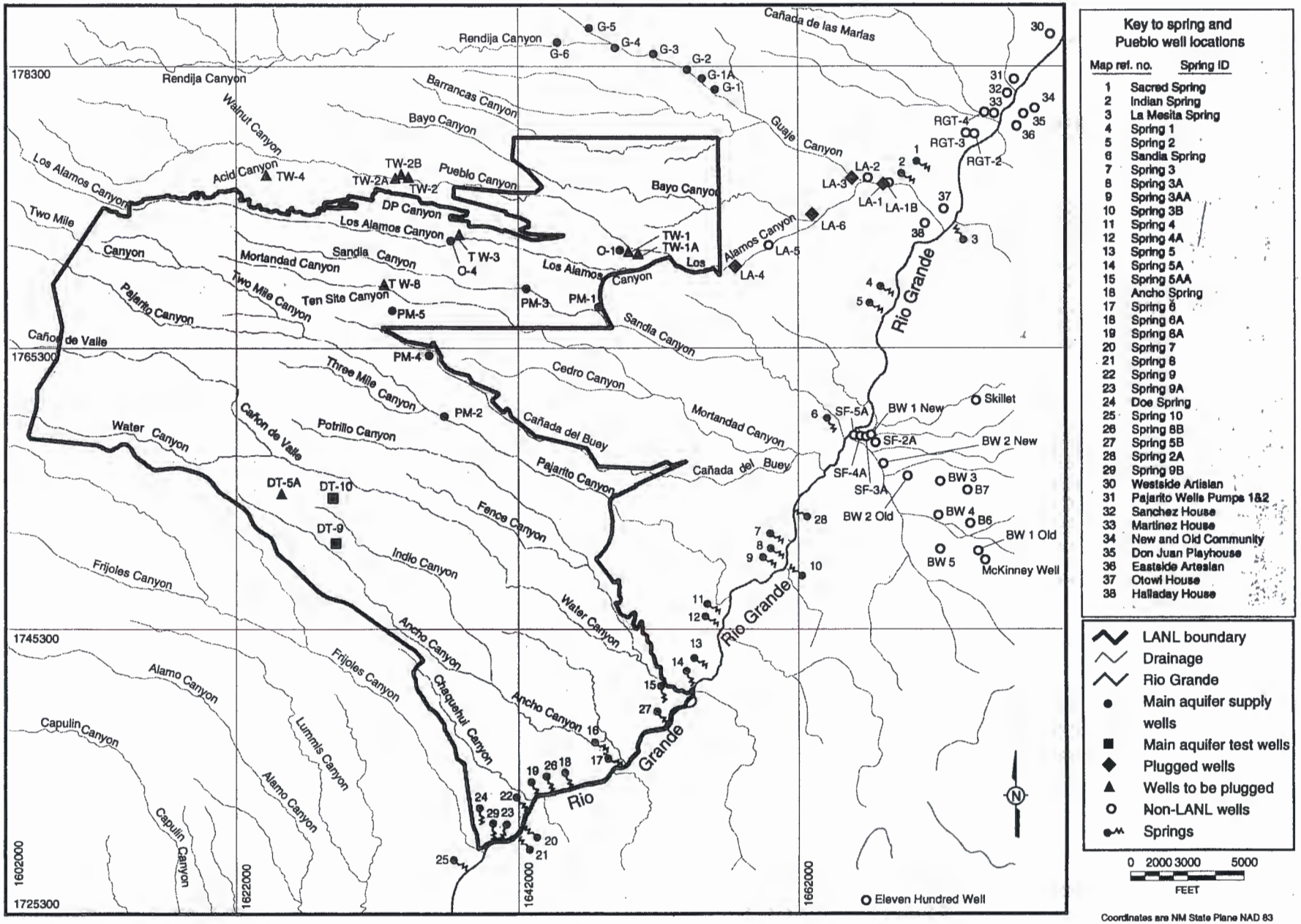

Figure 2-8. Regional aquifer supply and test well locations, and locations of wells to be plugged.

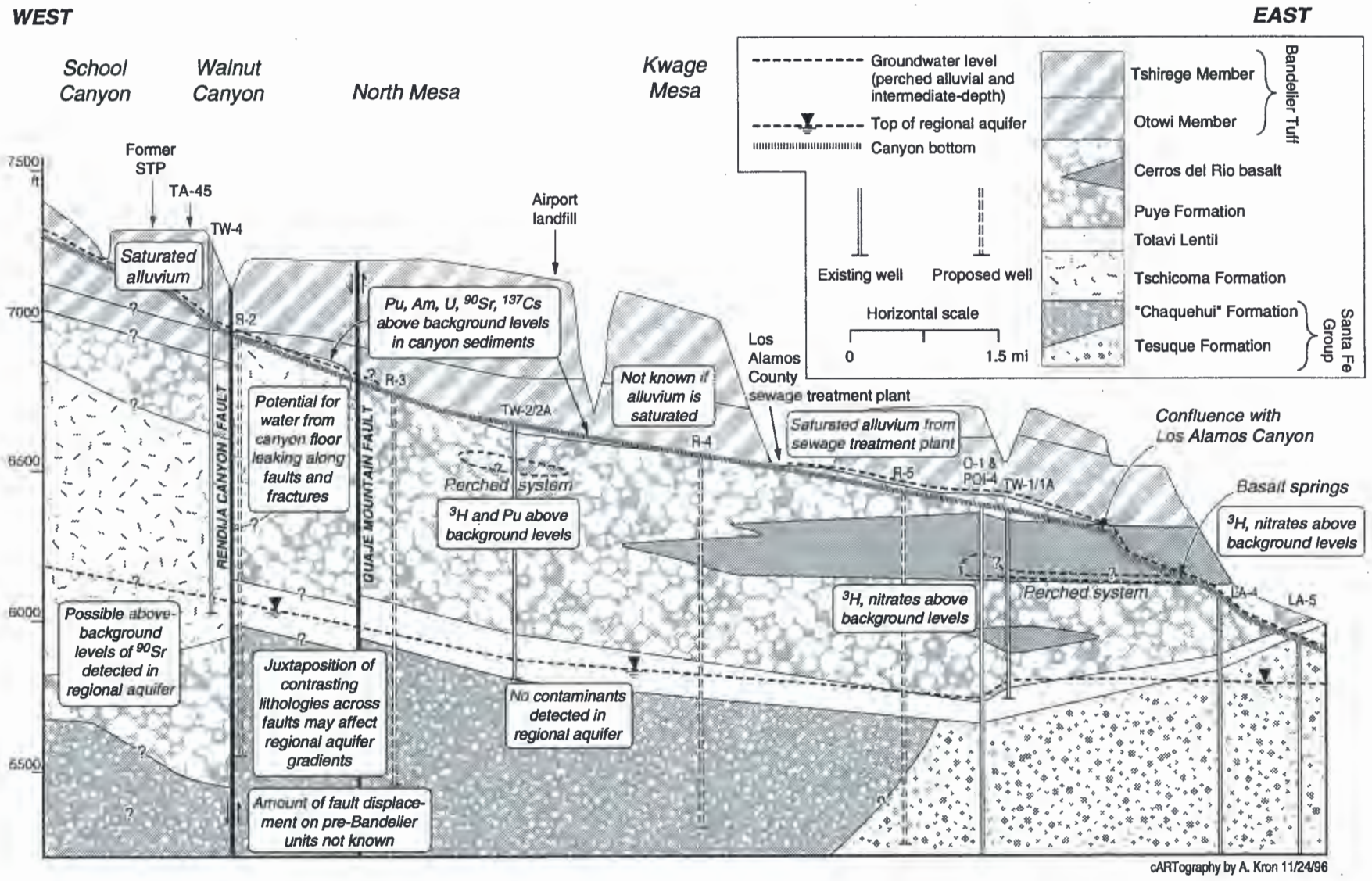

Figure 4-9. Schematic cross section showing conceptual model and proposed regional aquifer wells for Pueblo Canyon.

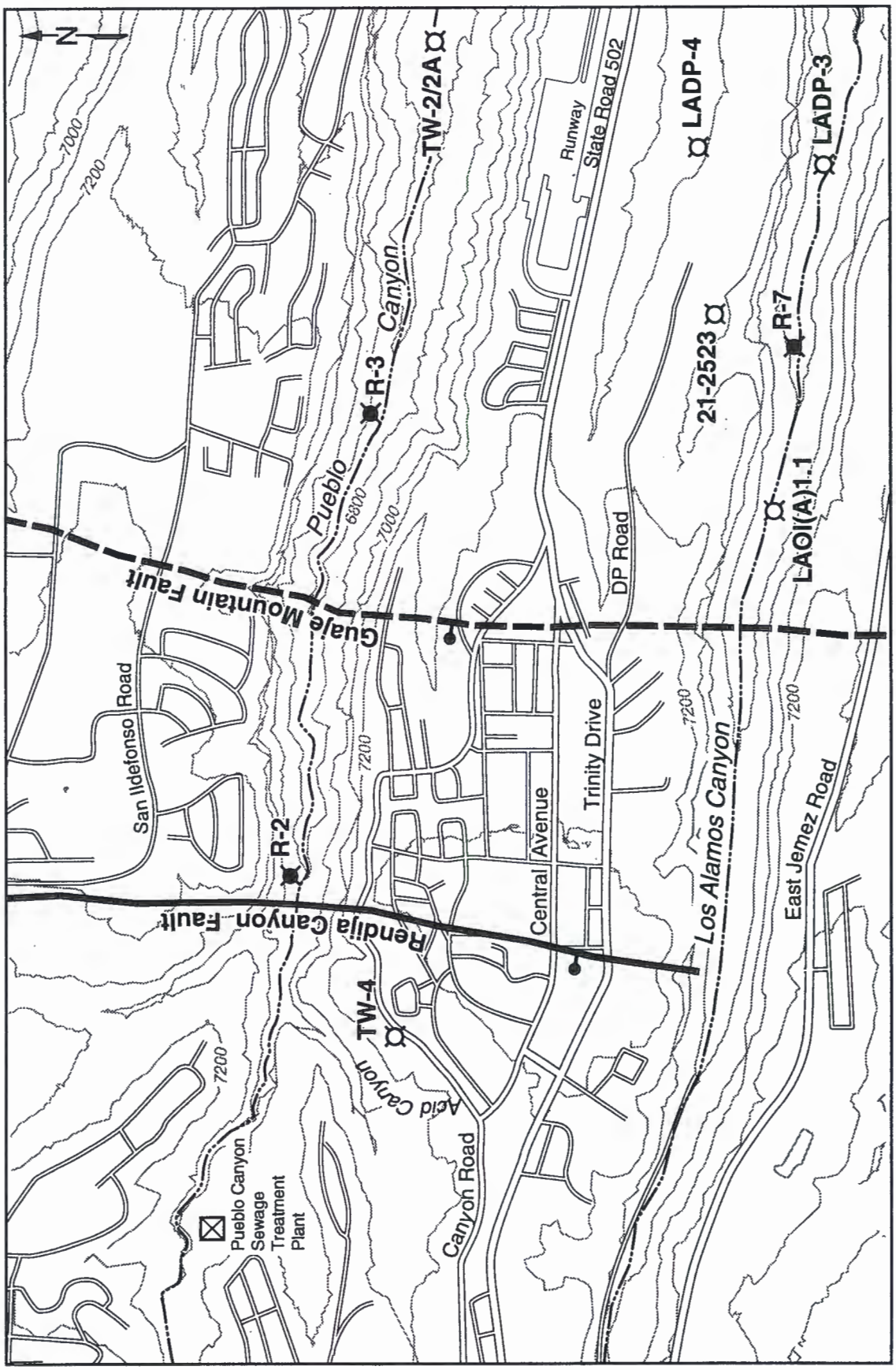

Figure 4-11. Map for part of Aggregate 1 showing location of proposed wells relative to the Rendija Canyon and Guaje Mountain faults.

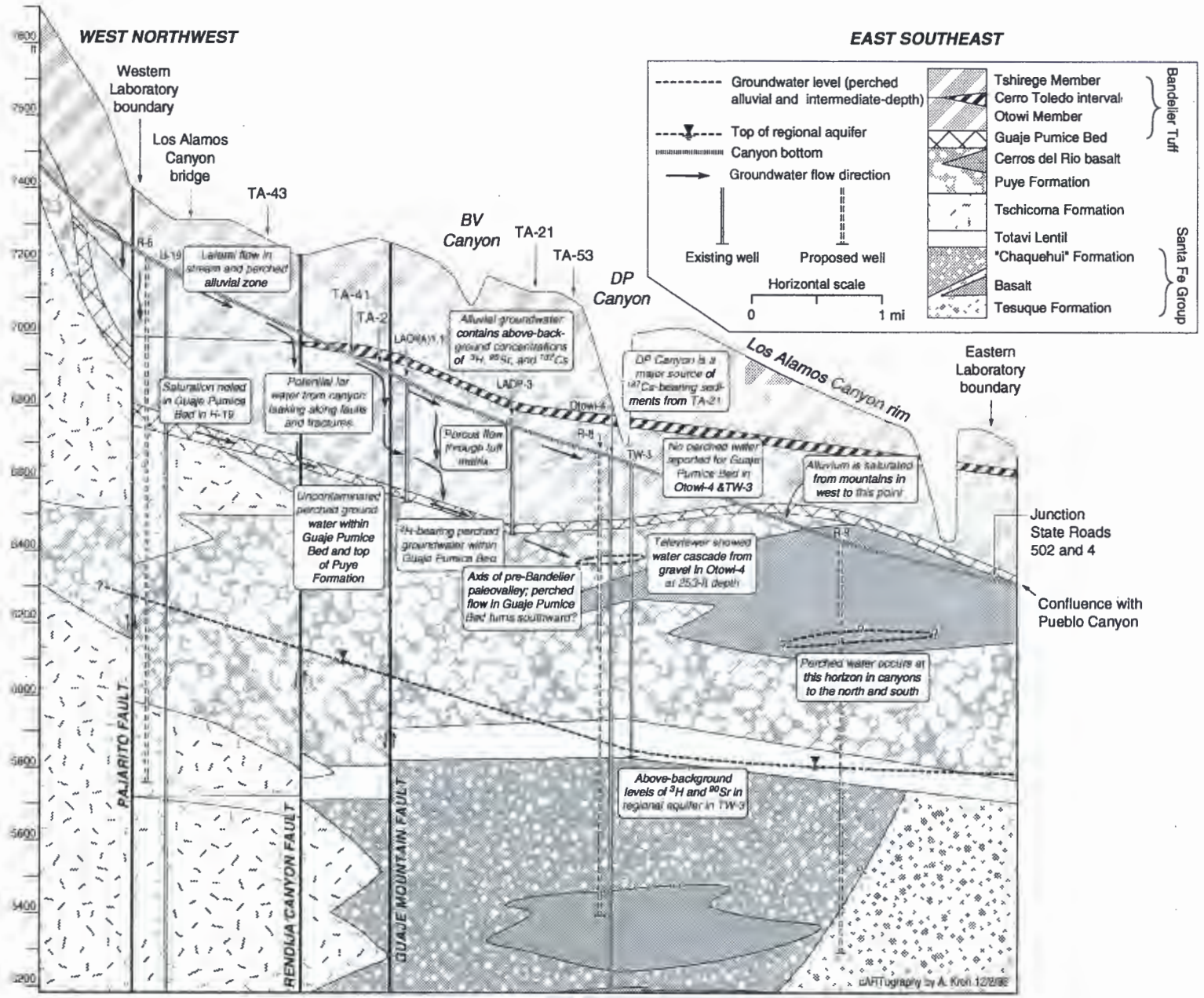

Figure 4-12. Schematic cross section showing conceptual model and proposed regional aquifer wells for upper Los Alamos Canyon.

State of New Mexico

ENVIRONMENT DEPARTMENT

FAX TRANSMITTAL

DATE: 12-19-96 TIME: 11:00 PAGE: 1 OF 4

PLEASE DELIVER THE FOLLOWING PAGES TO:

TO: Jay Cogman

AGENCY/LOCATION: Concerned Citizens with Nuclear Safety

TELEPHONE: 986-1973 FAX: 986-0997

FROM: Phyllis Bustamante

AGENCY/LOCATION: NMED, GWQB

TELEPHONE: 827-0166 FAX: (505) 827-2965

COMMENTS:

Here is some information for getting a copy of the discharge permit application for TA-50. You can receive a copy of our response-request for additional information when it has been finalized. If you need more information, please call me or come in.

Phyllis

Faxed 12/19/96 1:07pm

DRUG FREE

Harold Runnels Building • 1190 St. Francis Drive • P.O. Box 26110 • Santa Fe, New Mexico 87502
(505) 827-2850 FAX (505) 827-2836

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Appendix C

What You, as a Requestor of Records, Should Know

1. You should contact the person specified in the letter you have been sent to schedule an appointment to review the records that are being made available for your inspection. He or she, on behalf of the New Mexico Environment Department ("NMED"), will try to schedule the appointment as soon as reasonably possible and with consideration of your own time commitments. Similarly, you should realize that he or she must schedule appointments with consideration of NMED personnel availability.

2. When you come to review the records, an NMED staff person will be present to supervise your review and to help arrange for any copies that you may want. If you should want to make a large number of copies, the NMED staff person may request that the copies be made at a local copy service. If that should happen, you must make arrangements to pay the copy service directly for all copies, and NMED will make arrangements for delivery of the documents to and from the copy service. You may never take documents outside of NMED for copying. Furthermore, please do not take any documents from the files because in many instances they will be the only copy of that document in NMED's possession.

3. You may wish to ask NMED to send you copies of documents, instead of coming to NMED to review them. While NMED has no obligation to mail copies of documents, NMED tries to comply with these requests when it would not amount to a considerable burden for NMED personnel <u>if you agree to pay for all copy charges and mailing costs.</u> Mailing Charges will be assessed according to the Mailing Charge Schedule set forth below. Before mailing any copies to you, NMED personnel will contact you to give you an estimate of the number of copies and the corresponding charge.

4. NMED will make [15] copies for you free of charge; however, if you want to make more copies at NMED, you will have to pay thirty-five (35) cents per copy. NMED will also charge fees for any computer-generated data. Those charges will vary depending upon the type of computer involved.

5. NMED may reduce or waive the copy (and mailing) charges if such a reduction or waiver would serve the public interest. If you want a reduction or a waiver, you must ask the person who sent you the letter which accompanies these procedures.

6. All fees should be paid by check or money order made payable to the State of New Mexico. NMED cannot accept any cash.

7. If NMED has not been able to make available to you all the documents that you requested, then you have the right to request further review of your claim from the applicable Director within NMED. Kindly contact the person who sent you the attached letter to find out who that Director is. All requests for further review

should be made within thirty (30) days of your receipt of the attached letter. If you fail to request additional review within this 30-day time period, then you will lose your right to such a review; however, you may still have the right to file a lawsuit. You should consult a lawyer about your rights.

8. **NMED is honoring your request with the understanding that the material requested will be used by you for a lawful purpose.**

***

Mailing Charge Schedule

# of Pages	Cost
0 - 5	$0.29
5 - 10	$0.52
11-25	$1.21
26-50	$2.36
51-200	$2.90 (Sent by Priority Mail)[1]
201-300	$4.10 (Sent by Priority Mail)

[1] Priority mail is cheaper than first class at the corresponding weights.