RECEIVED

NOV 21 1995

OSTI

**Lawrence Livermore National
Laboratory Offsite Hazardous Waste
Shipment Data Validation Report**

**Radioactive Waste
Technical Support Program**

September 1995

**Lawrence Livermore National Laboratory
Offsite Hazardous Waste Shipment
Data Validation Report**

Published September 1995

**MSE, Inc.
330 Shoup Ave, Ste. 201
Idaho Falls, ID 83402**

**Prepared for
Lockheed Idaho Technologies Company
Under Subcontract No. C93-170420
and for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-94ID13223**

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MASTER

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

ABSTRACT

The U.S. Department of Energy Headquarters (DOE-HQ) requested this report to verify that Lawrence Livermore National Laboratory (LLNL) properly categorized hazardous waste shipped offsite from 1984 to 1991. LLNL categorized the waste shipments by the new guidelines provided by DOE-HQ on the definition of radioactive waste. For this validation, waste that has had no radioactivity added by DOE operations is nonradioactive. Waste to which DOE operations has added or concentrated any radioactivity is radioactive. This report documents findings from the review of available LLNL hazardous waste shipment information and summarizes the data validation strategy. The report discusses administrative and radiological control procedures in place at LLNL during the data validation period. It also describes sampling and analysis and surface survey procedures used in determining radionuclide concentrations for offsite release of hazardous waste shipments.

The evaluation team reviewed individual items on offsite hazardous waste shipments and classified them, using the DOE-HQ waste category definitions. LLNL relied primarily on generator knowledge to classify wastes. Very little radioanalytical information exists on hazardous wastes shipped from LLNL. Slightly greater than one-half of those hazardous waste items for which the documentation included radioanalytical data showed concentrations of radioactivity higher than the LLNL release criteria used from 1989 to 1991. Based on this small amount of available radioanalytical data, very little (less than one percent) of the hazardous waste generated at the LLNL main site can be shown to contain DOE added radioactivity. LLNL based the criteria on the limit of analytical sensitivity for gross alpha and gross beta measurements and the background levels of tritium. Findings in this report are based on information and documentation on the waste handling procedures in place before the start of the hazardous waste shipping moratorium in May 1991, not on current conditions at LLNL.

CONTENTS

ABSTRACT	iii
ACRONYMS	vii
1. INTRODUCTION	1-1
1.1 Purpose and Scope	1-1
1.1.1 LLNL Data Submittal	1-2
1.2 LLNL History and Missions	1-10
1.2.1 LLNL Missions	1-13
2. WASTE CATEGORY DEFINITIONS	2-1
2.1 Pre-moratorium Definitions	2-1
2.2 DOE-HQ Moratorium Definitions	2-1
2.2.1 Radioactive Waste	2-1
2.2.2 Clean Waste	2-3
2.2.3 Likely Radioactive Waste	2-3
2.2.4 Likely Clean Waste	2-3
3. LLNL WASTE HANDLING	3-1
3.1 Organization and Waste Handling	3-1
3.2 Waste Sampling and Analyses	3-5
3.2.1 Sampling Methods	3-5
3.2.2 Analytical Methods	3-7
3.3 Sample Collection Data	3-9
3.3.1 Analytical Data	3-10
3.4 WAA Administration	3-12
3.4.1 Training	3-14
3.4.2 Surveying	3-15
3.5 Waste Tracking and Documentation	3-17
3.6 HWM Repackaging and Manifesting	3-18
3.7 Treatment, Storage, and Disposal Facilities	3-24

3.7.1	Closed Treatment and Storage Facilities at LLNL	3-25
3.7.2	Currently Operating Treatment Facilities	3-28
4.	WASTE ITEM VALIDATION	4-1
4.1	Validation Procedure	4-1
4.2	Validation Results	4-3
4.2.1	Spot Check Results	4-3
4.2.2	Random Manifest Results	4-3
4.2.3	Biased H-Req Sample Results	4-4
5.	VALIDATION SUMMARY	5-1
6.	REFERENCES	6-1
APPENDIX A	LLNL TSDF Flowcharts	
APPENDIX B	Hazardous Waste Shipped Offsite, January 1990 to July 1991	
APPENDIX C	RMMA Table	
APPENDIX D	H-Req Data Summary	
APPENDIX E	H-Req Waste Designation	

FIGURES

1-1.	LLNL site map.	1-11
2-1.	DOE waste classification decision tree.	2-2
3-1.	LLNL organization chart.	3-2
3-2.	EPD organization.	3-3
3-3.	Weekly inspection checklist.	3-16
3-4.	General LLNL Hazardous Waste Facility schematic.	3-19
3-5.	General LLNL waste process flow chart.	3-20
3-6.	Example Toxic Waste Control Tag.	3-21
3-7.	Example Hazardous Waste Disposal Requisition.	3-22
3-8.	Hazardous Waste Information Database used in 1987.	3-25
3-9.	Hazardous Waste Information Database used in 1993.	3-26

TABLES

1-1.	Hazardous wastes shipped and incinerated from 1984 to 1991 (tons).	1-4
1-2.	Large waste streams at LLNL in 1990 and 1991.	1-4
1-3.	Commercial TSDFs used by LLNL.	1-5
3-1.	Possible attachments to requisitions.	3-23
4-1.	Randomly selected LLNL Uniform Hazardous Waste Manifests.	4-2

ACRONYMS

AEC	Atomic Energy Commission
ASTM	American Society for Testing and Materials
AVLIS	Atomic Vapor Laser Isotope Separation
COC	chain-of-custody
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy Headquarters
DOHS	Department of Health Services
DOT	Department of Transportation
EA	Environmental Analyst
EAS	Environmental Analytical Services
EM-30 DOE-HQ	Environmental Restoration and Waste Management Office of Waste Operations
EM-331	DOE-HQ Office of Waste Management Regulatory Compliance Division
EPA	U.S. Environmental Protection Agency
EPD	Environmental Protection Department
ES&H	Environmental Safety and Health
FSP	Facility Safety Procedures
H-Req	Hazardous Waste Disposal Requisitions
H&S	health and safety
HC	Hazards Control Department
HP	health physicist
HWM	Hazardous Waste Management Division
HWMDB	Hazardous Waste Management Database
IH	industrial hygienist
L-Req	Laboratory Waste Disposal Requisitions
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
LOS	level of sensitivity
M&O	Management and Operations
NAS	Naval Air Station
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
QA/QC	quality assurance/quality control
QAP	Quality Assurance Plan
R-Req	Radioactive Waste Disposal Requisitions
RCA	Radiological Control Area
RCRA	Resource Conservation and Recovery Act
RMMA	radioactive materials management area
SOP	Standard Operating Procedure
TSCA	Toxic Substance Control Act
TSDF	transfer, storage, and disposal facility
TWIMS	Toxic Waste Information Management System
UC	University of California
USGS	U.S. Geological Survey
WAA	Waste Accumulation Area
WAC	Waste Acceptance Criteria

Lawrence Livermore National Laboratory Offsite Hazardous Waste Shipment Data Validation Report

1. INTRODUCTION

On May 17, 1991, the U.S. Department of Energy Headquarters (DOE-HQ) Environmental Restoration and Waste Management Office of Waste Operations (EM-30) directed field offices to stop shipping Resource Conservation and Recovery Act (RCRA) and Toxic Substance Control Act (TSCA) wastes that could be contaminated with radioactive material. According to DOE-HQ, waste could be radioactively contaminated if it has been used or stored in a Radiological Control Area (RCA) that could contain unconfined radioactive material or where exposure to beams of particles that can cause activation is possible. DOE-HQ decided to stop hazardous waste shipments because DOE sites were using differing, and sometimes inappropriate, criteria for determining if a waste was suitable for offsite release. The moratorium on offsite hazardous waste shipments remains in effect at each DOE site until DOE-HQ reviews and approves the criteria and methods for offsite release.

Lawrence Livermore National Laboratory (LLNL) received final DOE-HQ approval to recommence offsite shipment of RCRA and TSCA wastes generated after the site trained all generators in December 1991. In January 1992, LLNL resumed shipping wastes generated before generator training (Crawford 1994). As part of the moratorium on the offsite shipments of RCRA/TSCA wastes, DOE-HQ, in a memorandum (called the data request) (Duffy 1991), requested DOE sites to provide DOE-HQ detailed information about past RCRA/TSCA offsite waste shipments.

1.1 Purpose and Scope

This data validation supports the DOE Office of Waste Management Regulatory Compliance Division (EM-331) by collecting and documenting radioanalytical data to find out if DOE sites have correctly categorized their hazardous waste shipments. The goal of this validation is, therefore, to find out if LLNL shipped hazardous waste containing DOE-added radioactivity offsite before the start of the moratorium. It is not to learn the absolute quantity or destination of all wastes or radioactivity that may have contained DOE-added radioactivity.

The LLNL offsite hazardous waste shipment data validation project examined shipment records for the requested period, 1984 through 1991, and decided if LLNL properly categorized items in offsite waste shipments, using the DOE-HQ waste category definitions from the data request. The evaluation team based this determination on whether DOE operations added radioactivity to the bulk or volume of the waste. A second criterion is whether the waste materials were shipped according to criteria for surface contamination in DOE Order 5400.5, "Radiation Protection of the Public and the Environment." (DOE 1993) The team conducted an onsite visit to LLNL in February and March 1995. The evaluation does not include other sites administered by LLNL, nor did it include the Sandia facility just north of LLNL.

The key elements presented in this data validation report are:

- Purpose and scope of the LLNL data validation effort
- Background information on LLNL
- Hazardous waste category definitions
- LLNL data submittal
- LLNL hazardous waste generators
- Treatment, storage, and disposal facilities (TSDFs) that received LLNL wastes
- Site-wide administrative procedures and controls
- Radiological control procedures
- Laboratory analysis and quality assurance/quality control (QA/QC) procedures
- Hazardous waste management procedures
- Waste handling and release criteria
- Data validation processes, including generator/shipper interviews and review of onsite and offsite shipment manifest records
- Traceability of individual radioassay sample results to onsite shipment manifests and then to offsite shipment manifests
- Data validation results
- Classification of validated items on offsite shipments using the data request criteria.

This report includes documentation necessary to support the data validation conclusions in appendices.

1.1.1 LLNL Data Submittal

In answer to the DOE-HQ data request and later modifications, LLNL prepared and submitted a summary of their hazardous waste shipments including waste types, amounts, and final TSDFs that received the waste. The term "data submittal" refers to the collection of information produced by LLNL for the data request and sent through a collection of letters, facsimile, and electronic submittals to the Radioactive Waste Technical Support Program (TSP). Hazardous waste shipments from LLNL from 1984 to 1991 included 2,205 manifests containing 4,906,858 kg of waste with a total volume of 18,936 m³.

For the reporting period 1984 to 1991, the LLNL reported 2,205 manifested waste shipments all of which they categorized as clean. The original data submittal listed more than 19,800 containers with more than 6,100 waste descriptions. Since LLNL labpacks or bulks much of its hazardous

waste, the number of waste descriptions and containers has little correlation with the number of manifests generated during any given period. Table 1-1 gives a general idea of the amounts of hazardous wastes generated during the validation time frame. Table 1-2 lists the largest quantity waste streams (with greater than 80,000 lbs generated in either 1990 or 1991) at the LLNL main site (LLNL 1991). While these waste streams are more than 70% of the total weight shipped during these years, they are only nine of the 156 waste streams listed for these years.

Sixty-two TSDF contractors provided prime disposal/brokerage services for LLNL. See Table 1-3 (Nakahara 1992). These prime TSDFs often shipped portions of the manifested waste to other TSDFs for further treatment or disposal. LLNL provided flowcharts to help identify final disposal TSDFs for the waste (Appendix A, Crawford 1992).

The data submittal contained a list of 76 waste items on which radioanalysis was done before its manifesting as hazardous waste from January 1990 through June 1991. See Appendix B. This corresponds to when routine shipments to the Nevada Test Site (NTS) stopped, making waste minimization, especially for radioactive waste, an immediate concern to all waste generators.

Before 1989, LLNL did not have local release criteria for waste disposal. Therefore, waste that had any potential, however small, of exposure to radioactivity was routinely shipped to the NTS for disposal. As the NTS Waste Acceptance Criteria (WAC) became more restrictive, and LLNL access to the NTS stopped for a time, LLNL began looking for ways to reduce the volume of material requiring disposal as radioactive waste. This led to establishing media-specific decision criteria for identifying material that contained radioactivity greater than detection limits or background. From 1989 to 1991 these criteria, by radiation type, were (Crawford, 1992):

Matrix	Gross Alpha LOS	Gross Beta LOS	Tritium
Aqueous	$2 \times 10^{-8} \mu\text{Ci/mL}$	$6 \times 10^{-8} \mu\text{Ci/mL}$	$3 \times 10^{-6} \mu\text{Ci/mL}$
Oil	$5 \times 10^{-7} \mu\text{Ci/mL}$	$2 \times 10^{-6} \mu\text{Ci/mL}$	$2 \times 10^{-5} \mu\text{Ci/mL}$
Soil and Sludge	$1 \times 10^{-6} \mu\text{Ci/g}$	$3 \times 10^{-6} \mu\text{Ci/g}$	$5 \times 10^{-6} \mu\text{Ci/g}$

Table 1-1. Hazardous wastes shipped and incinerated from 1984 to 1991 (tons).

Year	Shipped	Incinerated	Total
1984	1,760.0	69.5	1,829.5
1985	1,590.0	28.95	1,618.95
1986	1,750.0	6.4	1,756.4
1987	1,470.0	6.7	1,476.7
1988	1,360.0	15.0	1,375.0
1990	1240.4	0	1240.4
1991	1476.6	0	1476.6

Table 1-2. Large waste streams at LLNL in 1990 and 1991.

Waste Description	Waste Amount (tons)	
	1990	1991
Aqueous waste with low toxic organics.	216.8	129.5
Aqueous acidic solutions with metals.	77.4	65.9
Water from onsite cleanup of chemical spills and leaky drums.	2.5	102.4
Organic liquids from onsite research and maintenance operations.	46.1	29.2
Halogenated cleaning/degreasing solvents.	13.6	45.6
Soil and concrete from cleanup activities and soil investigations.	42.2	18.6
Empty metal containers from onsite research activities.	47.8	50.0
Inorganic aqueous solutions with high dissolved solids.	316.4	598.0
Labpacked surplus, out-of-date, or damaged packages of laboratory chemicals and discarded aerosol can from onsite research and maintenance activities.	107.7	27.6
TOTALS	870.5	1,066.8

Table 1-3. Commercial TSDFs used by LLNL.

Prime TSD Name	EPA ID No.	Service Type(s)	Waste (kg)							
			1984	1985	1986	1987	1988	1989	1990	1991
Altamont Sanitary Landfill Livermore, CA	CAD981382732	BROKR	0.00	0.00	2268	567	0.00	0.00	0.00	0.00
Anderson Solid Waste, Inc. Anderson, CA	CAD981388952	LFILL	0.00	0.00	0.00	0.00	567	0.00	0.00	0.00
Appropriate Technologies II Chula Vista, CA	CAT080010101	RMETL/OWSEP/STABL/ /NEUTR/BROKR	0.00	0.00	0.00	0.00	0.00	3263.1	6445.91	0.00
B&J Sanitary Landfill Vacaville, CA	CAD982042475	BROKR	0.00	0.00	0.00	0.00	0.00	0.00	486	0.00
Baron-Blakeslee Newark, CA	CAD074644659	BLEND/DISTL/RECYC	0.00	13124.2	1945.9	576.52	547.32	751.9	116.8	0.00
Battery Disposal Technology Clarence, NY	NYD000632372	INCIN/NEUTR/REDOX/ PYROL/RECYC	0.00	0.00	0.00	116.8	43.8	0.00	175.2	0.00
Broco, Inc. Rialto, CA	CAT080022148	DEACT/STABL/NEUTR/ /BROKR	0.00	0.00	0.00	0.00	0.00	0.00	80.3	0.00
California A.E.T.C. Richmond, CA	CAT080014079	BROKR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	248.2
California Oil Recyclers Newark, CA	CAD980695761	RECYC/THMTR/ BROKR	0.00	10774.7	9357.6	2673.6	0.00	0.00	0.00	0.00
Casmalia Resources Casmalia, CA	CAD020748125	LFILL/WETOX/STABL/ NEUTR/BROKR	4615.4	1912.6	0.00	0.00	0.00	0.00	0.00	0.00
Chemical Waste Management Emelle, AL	ALD000622464	RORGS/BLEND/LFILL/ STABL/NEUT	576.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical Waste Management Kettleman City, CA	CAT000646117	LFILL/NEUTR/STABL/ CNTRT/BROKR	59445.08	42868.80	23060.30	0.00	0.00	9090.4	10738.2	0.00
Chemical Waste Management Sauget, IL	ILD098642424	LFILL/TRTMT/INCIN/ BROKR	0.00	0.00	0.00	0.00	0.00	0.00	6304.9	0.00
Cylinder Recon Co. Kearny, NJ	NJD000632240	BROKR	0.00	0.00	0.00	214.2	0.00	0.00	0.00	0.00
Diversified Systems, Inc. Athens, TN	TND034547141	INCIN	0.00	0.00	0.00	0.00	0.00	0.00	3342	0.00
Drew Resources Berkeley, CA	CAD070148432	RECOV/TRTMT/ BROKR	0.00	0.00	0.00	0.00	0.00	416.1	810.3	14.6
EG&G Idaho, Inc. (U.S. DOE) Scoville, ID	ID4890008952	BROKR								
E.I. DuPont & Co. Deepwater, NJ	NJD002385730	BIODG/NEUTR/CARBON /OWSEP/PRECP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	668.4
Englehard Industries West, Inc. Anaheim, CA	CAD000612150	BROKR	0.00	0.00	0.00	7.3	0.00	14.6	29.2	7.3
ENSCO El Dorado, AR	ARD069748192	INCIN/BROKR	153.3	589.2	0.00	0.00	1156.1	29698.9	17914.43	3591.6
ENSCO Whitebluff, TN	TND980729305	BROKR	0.00	0.00	0.00	0.00	0.00	3460.4	0.00	0.00
Environmental Pacific Amity, OK	ORD980977334	RECYC/BROKR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1693.6
Envirosafe Services of Idaho Grandview, ID	IDD073114654	LFILL/STABL	0.00	0.00	32060	0.00	0.00	0.00	0.00	0.00

Table 1-3. Cont'd.

Prime TSD Name	EPA ID No.	Service Type(s)	Waste (kg)							
			1984	1985	1986	1987	1988	1989	1990	1991
Erickson, Inc. Richmond, CA	CAD009466392	RECYC/BROKR	0.00	0.00	0.00	0.00	0.00	0.00	1042.73	0.00
Eticam East Fernley, NV	NVD980895338	BROKR	0.00	0.00	0.00	0.00	0.00	2676.8	8590.2	2688.2
Evans Drum Co. Richmond, CA	CAD000415232	RECYC/BROKR	0.00	8085.5	4764	0.00	0.00	0.00	0.00	0.00
Evergreen Oil Newark, CA	CAD980887418	THMTR/RECYC/ BROKR	0.00	0.00	0.00	2673.6	4678.8	2005.2	1336.8	2005.2
Forward Incorporated Stockton, CA	CAD990794133	BROKR	0.00	7467.3	0.00	0.00	0.00	0.00	0.00	0.00
Gibson Oil and Refining Co. Bakersfield, CA	CAD980883177	BROKR	0.00	0.00	0.00	668.4	0.00	1336.8	668.4	0.00
GNB, Inc. Vernon, CA	CAD097854541	BROKR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.3
H&H Ship Service San Francisco, CA	CAD004771168	RECYC/BROKR	0.00	0.00	0.00	1701	0.00	481.26	401.05	0.00
Haz Control Inc. Gilroy, CA	CAD000628149	NEUTR/STABL/RMETL	0.00	0.00	0.00	0.00	0.00	0.00	843.6	0.00
IT Corporation Benecia, CA	CAD000060012	LFILL/BROKR	486	334044	2835	0.00	0.00	0.00	0.00	486
IT Corp Oil Reprocess Facility Martinez, CA	CAD000092619	BROKR	5347.2	668.4	0.00	0.00	0.00	0.00	0.00	0.00
IT Corporation Martinez, CA	CAD000094771	TRTMT/LFILL/BROKR	39450.2	519164.44	35425.21	0.00	0.00	0.00	0.00	0.00
Kinsbursky Anaheim, CA	CAD088504881	RECYC/INCIN/NEUTR/ LFILL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.3
Laidlaw Environmental Services Roebuck, SC	SCD981467616	INCIN/REDOX/NEUTR	0.00	0.00	0.00	0.00	0.00	0.00	2673.6	0.00
Laidlaw Environmental Services Greenbrier, TN	TND000645770	INCIN/LFILL/BLEND/ STABL/ BROKR	0.00	0.00	0.00	0.00	0.00	1861.5	6239.4	3620.8
LLNL Site 300 Tracy, CA	CA2890090002	BROKR								
LLNL Livermore, CA	CA2890012584	BROKR								
Micro Metalics Corp. San Jose, CA	CAD069124717	BROKR	0.00	0.00	0.00	0.00	0.00	7.3	0.00	0.00
Norris Industries Los Angeles, CA	CAD097030993	NEUTR/STABL/BROKR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2270.3
Oil Process Co. Los Angeles, CA	CAD050806850	NEUTR/CARBON/ CHOXD	0.00	0.00	0.00	0.00	0.00	0.00	6778.9	668.4
Omega Recovery Services Whittier, CA	CAD042245001	TRTMT/RECYC/OWSEP	0.00	0.00	668.4	668.4	0.00	0.00	0.00	0.00
Pen-Rob Corporation Landfill Joseph City, AZ	AZ0000000150	BROKR	0.00	0.00	0.00	0.00	0.00	0.00	2315	0.00

Table 1-3. Cont'd.

Prime TSD Name	EPA ID No.	Service Type(s)	Waste (kg)							
			1984	1985	1986	1987	1988	1989	1990	1991
Petroleum Recycler Corp. Patterson, CA	CAD083166728	RECYC/BROKR	0.00	0.00	0.00	0.00	0.00	0.00	21.9	0.00
Quicksilver Brisbane, CA	CAD981424732	RMETL/BROKR	0.00	0.00	0.00	0.00	0.00	0.00	318.9	124.1
R&D Fabricating and Manufacturing Colfax, LA	LAD981055791	INCIN	0.00	0.00	0.00	21.9	0.00	219	146	0.00
Ramos Environmental Services West Sacramento, CA	CAD044003556	BROKR	0.00	0.00	0.00	0.00	0.00	0.00	668.4	0.00
Rollins Environmental Services Deer Park, TX	TXD055141378	INCIN/LFILL/OWSEP/ FSUB/RECYC	5718.5	0.00	49319.2	883.3	0.00	0.00	1708.2	0.00
Romic Chemical Corp. East Palo Alto, CA	CAD009452657	NEUTR/DISTL/EVAPR/ LLEXT/ BLEND	1336.8	2968.8	1036.6	7907.2	4484.9	6456.8	6550.8	668.4
Ross Electric of Washington, Inc. Chehalis, CA	CAD980835268	BROKR	0.00	0.00	0.00	0.00	0.00	671.6	3061.3	0.00
Safety Kleen Oakland, CA	CAD053044053	BROKR	0.00	0.00	0.00	0.00	0.00	313.9	2168.1	868.7
Safety Kleen Rancho Cordova, CA	CAT000613950	BROKR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.6
Safety Kleen Salida, CA	CAT000613968	BROKR	0.00	0.00	0.00	0.00	0.00	0.00	43.8	80.3
Solvent Services, Inc. San Jose, CA	CAD059494310	BROKR	0.00	0.00	0.00	0.00	0.00	6172.1	45557.18	34150
U.S. Ecology Beatty, NV	NVT330010000	STABL/INCIN/NEUTR/ LFILL	0.00	7776	0.00	0.00	0.00	0.00	0.00	0.00
USPCI Clive, UT	UTD991301748	RMETL/INCIN/RECYC/ LFILL/RORGS	0.00	0.00	28497.51	74373.15	47497	49382.49	44402.2	12016
USPCI Waynoka, OK	OKD065438376	LFILL/EVAPR/NEUTR/ STABL REDOX	0.00	0.00	0.00	0.00	0.00	3342	0.00	0.00
Waste Oil Reprocess Facility Oakland, CA	CAD000626515	BROKR	1336.8	1336.8	0.00	0.00	0.00	0.00	0.00	0.00
West Contra Costa Sanitary Landfill Richmond, CA	CAD041844002	BROKR	50	1575.7	115	0.00	0.00	0.00	0.00	0.00
Western Drums, Inc. Hayward, CA	CAD087210399	RECYC/BROKR	0.00	0.00	0.00	17447	4022.3	5080.8	0.00	1562.2
TOTALS			118515.98	952356.44	191352.72	110499.4	62997	126703	181979.7	67461

LLNL listed all 76 of the items for they could easily obtain radioanalysis results as "suspect." All but three of the 76 items had either gross alpha, gross beta, or tritium levels greater than the criteria in force at the time. LLNL established these criteria at the level of sensitivity (LOS) (or at background for tritium in water) for each of these measurements. LLNL shipped a total of 16,235 items between January 1990 and June 1991. Based on the radioanalysis results of the 76 items, LLNL characterized 0.47% of the 16,235 items as suspect. This classification assumes all other items shipped were clean, even if a particular waste item came from the same process or location as waste identified as suspect based on radioanalysis results.

1.2 LLNL History and Missions

LLNL is about 40 miles east of San Francisco at the southeast end of the Livermore Valley in Southern Alameda County (Energy & Technology 1994; University of California 1994a; University of California 1994b). The Laboratory was founded in 1952 with its primary mission to conduct nuclear weapons and controlled thermonuclear reaction research. Today, LLNL devotes much of its resources to defense programs, which include weapons and laser fusion research. Other major areas of focus are magnetic fusion energy, laser isotope separation, chemistry, engineering and physics research, biomedical and environmental sciences, applied energy technology, and work for other governmental agencies.

LLNL occupies essentially all (1.6 mi) of Section 12, T3S, R3E of the U.S. Geological Survey (USGS) Altamont Quadrangle, California (Figure 1-1). Agriculture remains the major land use east of the LLNL, but land to the north and west is being developed for residential and light industrial uses. The LLNL shares East Avenue with Sandia National Laboratory, with which it also shares facilities such as fire protection, a cafeteria, parking lots, and utilities. The City of Livermore is about 3 mi to the west.

LLNL also manages Site 300, which is an 11-mi² test facility about 18 miles southeast of the LLNL main site in the Diablo mountain range. It was set up as a remote explosives facility to support theoretical and developmental work performed at the LLNL main site. Portions of Site 300 used to support these activities include the firing and test areas, chemistry and process areas, and general administration and support areas. The area surrounding Site 300 is sparsely populated, with most of the land used to support sheep and cattle ranching operations.

Before 1942, the property presently occupied by LLNL was part of the Wagoner Ranch and used for grain production and cattle grazing. In 1942, the U.S. Department of the Navy bought the property to develop Livermore Naval Air Station (NAS) and an adjoining ancillary gunnery range. The missions of the NAS included flight-training, aircraft assembly, and repair work activities. These missions continued until October 1946 when the Livermore NAS was deactivated following the end of World War II. In 1950, the Navy permitted the Atomic Energy Commission (AEC) to conduct research operations on the property, and formally transferred it to the AEC in January 1951. In September 1952, the site was established as the Livermore Branch of the University of California (UC) Radiation Laboratory. In December 1979, the Congress renamed the site the Lawrence Livermore National Laboratory.

Legend

	Badge Office
	Gate
	Cafeteria
	Parking

Figure 1-1. LLNL site map.

back of fold out

1.2.1 LLNL Missions

Over the years, the LLNL mission has evolved to include many activities:

- Research, development, and test activities associated with all phases of the nuclear weapons life cycle and related tasks
- Strategic defense research emphasizing kinetic- and directed-energy weapons
- Inertial confinement fusion for weapons physics research and civilian energy applications
- Atomic vapor laser isotope separation for defense and commercial applications
- Magnetic fusion, including leadership of the United States effort on the International Thermonuclear Experimental Reactor
- Other energy research in basic energy sciences, atmospheric sciences, fossil energy, and commercial nuclear waste, biological, ecological, atmospheric, and geophysical science
- Charged-particle beam and advanced laser and optical research for defense and energy applications.

Current major programs are defense and related programs, laser fusion, laser isotope separation, magnetic fusion energy, biomedical and environmental research, energy and resources, and Environmental Restoration and Waste Management. We briefly describe these programs below (Energy & Technology 1994; University of California 1994a; University of California 1994b) to aid in the understanding of the processes that generate hazardous waste at the LLNL.

1.2.1.1 Defense Programs. The defense program develops and maintains the capabilities and technologies required to offer the range of options for future weapons systems and provides technical support for national goals in verification and arms control. The following paragraphs describe the major LLNL defense program elements.

Nuclear Design

This subprogram carries out theoretical and experimental research in the physics of fission and thermonuclear explosives. It is responsible for exploring new ideas for advanced development of nuclear explosives and maintaining a basic understanding of weapons phenomena.

Nuclear Test—Experimental Science

This subprogram is responsible for conducting experimental underground detonations of nuclear weapons designs at the NTS safely. It also performs physics experiments and measurements, including radiochemical measurements in support of these experiments.

Military Applications

This subprogram is responsible for the advanced development of weapons systems, including physics and engineering, and surveillance in production, stockpile, and retirement. It is also

responsible for the Advanced Conventional Weapons Program and analysis related to nuclear and conventional weapons systems.

Strategic Defense Initiative

The mission of this project is to conduct research for the technological advancement of a strategic defense system known as Brilliant Pebbles. This defense concept would place small spacecraft into a low earth orbit. These spacecraft could detect and destroy ballistic missiles through high velocity collisions.

1.2.1.2 Laser Fusion. In laser fusion, an array of high-power lasers focuses on a tiny sphere containing a mixture of deuterium and tritium gases. The goal is to compress the gases to a high enough temperature for a long enough time for the deuterium and tritium nuclei to fuse and release significantly more energy than contained in the high-powered lasers. The near-term mission of the laser fusion program is to provide a laboratory capability to study problems important to thermonuclear weapons design and performance. The long-term goal is to develop Inertial Confinement Fusion reactors for commercial power, space propulsion, and other military and civilian applications. The areas investigated include details of thermonuclear burn, the radiation, thermodynamic, and hydrodynamic properties of materials at high temperatures and densities, physics principles of advanced nuclear weapons concepts, physics of nuclear effects, and vulnerability of mechanical and electrical systems to those nuclear effects.

1.2.1.3 Laser Isotope Separation. The goal of the Atomic Vapor Laser Isotope Separation (AVLIS) program is to develop and demonstrate a process for the separation of isotopes of various materials. In this process, a material consisting of a mixture of isotopes is heated and vaporized. Laser light directed on the vapor selectively ionizes isotopes of interest, which are collected on electrically charged plates. DOE is studying additional applications for AVLIS technologies in the general areas of isotope separation, beam separators, lasers, and electro-optics with the key aim of commercializing these technologies.

1.2.1.4 Magnetic Fusion Energy. The magnetic fusion energy program helps in the development of magnetic fusion technology as part of an effort to harness thermonuclear fusion for energy production. In magnetic fusion, electromagnetic induction heats a cold plasma of ions and electrons confined by magnetic fields. If a plasma of deuterium and tritium can be kept at a sufficiently high temperature for a long enough period, their nuclei will fuse and yield energy. The primary thrust of fusion development is to achieve the successful confinement of a burning thermonuclear plasma under conditions expected in a power-producing fusion reactor.

1.2.1.5 Biomedical and Environmental Research. The mission of the biomedical and environmental research program is to understand the potential health and environmental effects of developing and using various energy sources. In particular, LLNL is finding ways to identify and measure genetic damage as an indicator of human health effects. LLNL is also examining local- and global-scale environmental changes involving the atmosphere and studying a variety of ecological effects resulting from energy production and use. An area of growth in current biological research is the human genome initiative, an international effort to map the human genetic code.

2. WASTE CATEGORY DEFINITIONS

2.1 Premoratorium Definitions

From 1984 to 1991, DOE required generators to survey wastes to be sure no detectable external radiation or surface contamination existed as defined in DOE Order 5400.5. Before imposing the moratorium in May 1991, DOE had not established an acceptable limit of detectable radioactivity within the waste volume or bulk. Because no complex-wide limits existed, DOE Management and Operations (M&O) contractors at each site set up their own procedures for determining whether a waste package was suitable for offsite shipment as nonradioactive waste.

2.2 DOE-HQ Moratorium Definitions

The DOE-HQ moratorium data request asked the DOE sites to categorize the waste shipments as known radioactive, clean, likely radioactive, or likely clean using the criteria in the following subsections. The data request provided guidance for assigning these categories. Figure 2-1 illustrates the process for classifying these wastes.

2.2.1 Radioactive Waste

Radioactive waste is any waste with radioactivity added to the volume or bulk of the waste because of DOE operations. The addition of radioactivity may be shown by (a) material use history (i.e., use in a radioactive system or radioactive spill recovery), (b) sampling and analysis results showing radioactivity above background (background includes natural levels of radiation in materials), or (c) waste that has excessive surface contamination due to DOE operations as shown by surface survey results. Waste suspected to be radioactively contaminated through material use history must be sampled to find out the activity content of the sample. For many wastes, internal contamination by radioactivity is unlikely, but they are in radioactive materials management areas (RMMAs) where external contamination is possible. For these wastes, a surface contamination survey must be done, with results compared to surface contamination limits in DOE Order 5400.5. DOE-HQ defined a nonradioactive waste as a waste that meets the following conditions (DOE 1993):

- The waste contains no added radioactivity (at a 95% confidence level above background) in volume or bulk resulting from DOE operations [except wastes specifically exempted by the U.S. Environmental Protection Agency (EPA), DOE, or Nuclear Regulatory Commission (NRC) regulations]
- The waste has no surface radioactivity above limits established in DOE Orders or guidance [e.g., surface contamination limits and requirements of DOE Order 5400.5, II.5.c.(1)].

2.2.2 Clean Waste

Many DOE operations do not occur in an RMMA or have the potential for adding radioactive contamination to waste material. Clean waste is waste that comes from outside an RMMA and has surface contamination levels less than DOE Order 5400.5 guidelines. Clean wastes can include wastes that come from within an RMMA if documented evidence of administrative controls, process knowledge, or sampling and analysis results can prove these wastes clean, showing no activity above background levels. Sampling and analysis results, survey results, or administrative and material history documentation are necessary to characterize a waste as radioactive or clean.

Figure 2-1. DOE waste classification decision tree.

2.2.3 Likely Radioactive Waste

Likely radioactive wastes are wastes shipped from LLNL that have limited retrievable documentation of sampling and analysis, survey results, administrative control, or material history documentation to enable classification of the waste as either radioactive or clean. Wastes classified as likely radioactive waste are wastes that are similar in form or type and originate from the same process or area as wastes classified as known radioactive. Wastes classified as likely radioactive mean that DOE operations may have added radioactivity to the volume or bulk of the waste or that surface contamination may exceed DOE Order 5400.5 guidelines.

2.2.4 Likely Clean Waste

Similar to likely radioactive waste, likely clean waste is waste from an RMMA and similar in form or type and origin to wastes classified as clean. For these wastes, documented evidence of administrative controls, process knowledge, or analytical data is not available to show DOE operations added no radioactivity to the waste bulk or volume. Nor does evidence exist to verify the surface contamination is less than DOE Order 5400.5 guidelines.

3. LLNL WASTE HANDLING

The evaluation team determined the correct categories of hazardous wastes shipped from LLNL before the moratorium in two ways. First, the team examined the processes and procedures used for classifying and handling wastes generated from 1984 through 1991. Second, specific waste shipments with available radioanalysis results were investigated. Section 3 looks at organization, waste handling practices, and sampling and analysis procedures; Section 4 describes the investigation of specific shipment items. Information on processes and procedures is inexact as they changed significantly through the validation period (1984 to 1991) and continued to change through today. Issues raised, therefore, reflect conditions at LLNL during the premoratorium validation time-frame and not present conditions or practices.

3.1 Organization and Waste Handling

Waste management at LLNL relied not only on the generator but also contributions from services provided throughout the site. Waste management technical support comes from, among others, safety professionals, health physics, and laboratory analysis organizations. Figure 3-1 shows the LLNL organization in 1989, midway through the validation period. Figure 3-2 is the current organization for the Environmental Protection Department (EPD). The Hazardous Waste Management (HWM) Division of the EPD has primary control of hazardous waste management.

The HWM Division staff performs the following functions:

- Processes, stores packages, solidifies, treats, and prepares waste for shipment and disposal or recycling
- Tracks and documents the movement of hazardous, mixed, and radioactive waste from Waste Accumulation Areas (WAAs) to final disposal, both on and offsite
- Helps the programs in evaluating waste for waste minimization through reduction of wastes generated, substitution of materials, and recycling
- Decontaminates laboratory equipment
- Meets with Federal, State and local regulators about the permitting and compliance of hazardous waste management facilities
- Ensures containers for shipment of wastes meet Department of Transportation (DOT) and other regulatory specifications
- Responds to emergencies and participates in the cleanup of hazardous and radioactive spills at the Livermore Site and Site 300
- Prepares the annual LLNL Waste Management Plan.

The HWM Quality Assurance Plan (QAP) describes approval authority for waste management. Many other documents guide and support the waste management program at LLNL, including Federal and State regulations, DOE Orders, and LLNL program plans and procedures.

Figure 3-1. LLNL organization chart.

ENVIRONMENTAL PROTECTION DEPARTMENT

Department Head: Harry L. Galles
Deputy Department Head: Ellen Raber

Environmental Duty Officer

Resource Manager:	G. Chaffins
Training Manager:	S. Goodwin
Administrative Operations Manager:	J. Ingledue
Assurance Manager:	L. Pendexter
Waste Certification Officer	R. Fischer
Superintendent:	C. Valente

*GL - Group Leader
**AGL - Acting Group Leader

94-33/b
12/1/94

Figure 3-2. EPD organization.

Much of the waste generated at LLNL for disposal as hazardous waste is the result of the experimental laboratory operations at the site discussed in Section 1.2. These operations are very diverse and variable, resulting in hazardous waste streams that are also numerous, diverse, and variable. Much of the individual wastes from LLNL laboratories are generated in small quantity and laboratory packaged (lab packed) with wastes from other labs for shipment to a TSDF. Large scale waste streams at LLNL are acids, bases, solvents, and rinse waters from metal treatment operations (including radioactive metals).

Currently, the waste generator classifies the waste stream using process knowledge or sampling and analysis results, and fills out the required paperwork with health and safety (H&S) technicians, health physicists (HPs), or HWM technicians. Small volume wastes then go to a WAA for temporary storage before transfer to HWM facilities for repackaging (as required), manifesting, and shipment to commercial TSDFs. Large volume wastes (e.g., hazardous retention tank waste waters) are manifested and shipped directly from the point of origin. The remainder of Section 3 discusses details, exceptions, and changes to this general waste handling procedure over the validation time frame.

LLNL developed RMMAs in 1991 after DOE enacted the shipping moratorium. Before 1991, Radioactive Material Areas were designated to monitor radioactive exposure to personnel but were not intended to manage whether radioactivity was added to waste by DOE operations. A database was started in July 1991 to track the rooms in buildings designated as RMMAs. This database is updated monthly as RMMA designations change periodically. Appendix C contains a list of buildings and rooms that contained RMMAs in 1991. The appendix also includes a list made in 1991 of buildings that contained RMMAs, or may have contained RMMAs, in the years before creation of the list.

The facility manager establishes individual RMMAs by requesting that an area be designated an RMMA. Then the H&S team for that facility reviews the request. An HP from H&S will inspect the new RMMA and will establish both radiation controls for personal exposure and review controls for waste handling and disposition. H&S techs will visit the new RMMA regularly to survey for radioactivity and take swipes for contamination control.

Each H&S team has an action plan that is a controlled document to establish the routines for surveys, swipes, contamination control and waste disposition. Only one copy of each team action plan is available. Included in this team action plan are procedures to remove waste and materials from an RMMA for free release or controlled release. The HP, the facility manager, closes out an RMMA by using process information, collecting smears, and performing surveys to show that radioactive contamination is not present above known background. These procedures for establishing an RMMA and certifying each RMMA closed were formalized in 1991. Before that time Radioactive Material Areas designated locations where radioactive material was present. Formalized procedures for the closeout of an RMMA may have been lacking because the DOE-HQ Tiger Team audit findings suggested that many laboratory experiments were left in place long after the experimenter had ended a specific program.

3.2 Waste Sampling and Analyses

Before the shipping moratorium in 1991, procedures for waste sampling and analysis were not well documented. Waste generators historically had the duty of deciding if a waste could potentially contain added radioactivity. Before 1991, the generator made requests for sample analyses on wastes. The sample analyses requested by the generator often did not include radiological analyses, most likely because of generator process knowledge. Analytical results were

most often requested on liquid wastes intended to be released to the City of Livermore sewage system.

From 1984 to 1991, sampling and analysis of waste streams to detect the presence and quantify hazardous and radioactive constituents were not consistent throughout LLNL. The waste generators provided much of the knowledge about the waste streams without sampling data and consistent review by HWM or Hazards Control Department (HC). The basis of this determination is internal LLNL audit reports including the *Independent Environmental Safety and Health (ES&H) Review Team Findings* from October 1989 (an audit in preparation for the DOE-HQ Tiger Team) and the DOE-HQ Tiger Team findings.

Sampling and analysis were used sometimes to characterize waste streams. The evaluation team examined the sampling and analysis methods along with analytical results to provide an assessment of the quality of hazardous waste characterization. The sampling and analysis program did not include procedures to determine background concentrations of naturally occurring radionuclides or develop guidelines for developing sampling criteria and procedures. Nor were there procedures to establish a basis for sample frequency, definition of allowable error, or specification of a confidence interval.

In 1989, the HWM Control Lab, predecessor to Environmental Analytical Services (EAS), was formed to provide consistent sampling and analysis techniques for waste. EAS began by preparing procedures for sampling various waste streams, using SW-846 procedures for analysis of hazardous wastes and to send samples for radioassay to the HC or HWM laboratories. EAS only sent those samples to radioassay if the generator requested it or if surveys of the sample showed the presence of radioactivity above the field survey threshold.

3.2.1 Sampling Methods

Sampling methods are an important part of waste characterization. Since LLNL had no consistent sampling methods, the evaluation team is concerned that waste streams were not sampled or were sampled improperly. Sampling error contributes significantly to the total error in sampling and analysis. The team recognizes that in some waste streams achieving representative samples is difficult. An example is laboratory wastes, which comprised many identified waste streams. LLNL was developing consistent sampling methods in 1989 and 1990, but these were not used for the entire laboratory until after the DOE-HQ Tiger Team visit in 1990.

Identification of wastes that require sampling is an important part of waste characterization. Identification of wastes requiring sampling was also inconsistent and largely dependent on the generator of the waste. Waste profiling characterized a waste stream or process knowledge identified the waste. The profile was used for all waste generated by this process. Without periodic sampling or consistent sampling methods, these waste profiles could have been in error. In 1991, a waste characterization profile verification sampling and analysis program was started where wastes are periodically sampled independently to ensure waste profiles are up-to-date.

On-the-job training was given to technicians who collected tank samples. However, audits conducted by on- and off-site personnel during the time of interest suggested that samples from tanks were often collected without a consistent sampling approach and without mixing the tank contents to gain a representative sample. Samples collected from tanks without mixing or without collecting samples at various depths can lead to large errors attributable to sampling methods.

Knowledge of the waste characteristics at LLNL is very dependent on the waste generator to

supply information to HWM for disposal. The dependence on generators at LLNL to be the primary contact for waste characteristics has many limitations. Many findings by the DOE-HQ Tiger Team showed the dependence on generator knowledge limited LLNL's ability to characterize waste adequately. The findings listed below are from the DOE-HQ Tiger Team audit of LLNL. This is not a complete listing of findings on waste characterization, but shows the LLNL process during 1990.

- LLNL does not have methods, facilities, equipment, or procedures to segregate contaminated waste from clean waste after the waste has been generated.
- LLNL did not have a laboratory-wide closeout procedure for individual laboratories when researchers left or when experiments ended. The research at LLNL involved many individual researchers and experiments. Often when a researcher leaves or when the project ends, the used or unused chemicals and radioactive materials were simply left behind in the laboratory. The chemicals, if the original researcher did not dispose of them, may remain for years. If personnel other than the researcher disposed the waste, it may result in improperly characterizing waste as hazardous, radioactive or mixed waste.
- Neither the existing HWM QAP nor any other LLNL QAP establishes methods for review and evaluation of the waste characterization done by the generator. The HWM qualitatively reviews the completed requisition forms and associated analysis, if any, to identify obvious and gross characterization problems. However, this provides no quantitative indication of the accuracy and completeness of the generator's characterization effort. LLNL has neither required nor performed routine audits and surveillance of generator waste characterization activities. QC checks are not performed to verify the accuracy and completeness of generator characterization by opening, sampling, and analyzing a fraction of all waste containers received. No other types of waste characterization QC checks are performed.
- The indirect methods used to characterize low-level waste (LLW) are not defined and documented by waste stream. Methods, associated documentation, and quality assurance are not adequate to prove the indirect methods can be correlated with actual measurements. The generator can obtain assistance in LLW characterization from the HWM and the building HP; however, there are no specific requirements about this involvement. Building H&S technicians may also help in the characterization process, but their role is not explicitly defined.
- A formal program for the characterization of LLW does not exist, and there are no specific documentation requirements. No specific guidance exists that requires sampling and analysis of all LLW. Nor is there any mechanism to identify and approve waste streams for exemption from sampling and analysis. No mechanism exists to evaluate the adequacy of indirect quantification methods for waste streams exempted from sampling and analysis.
- Hazardous waste, mixed waste, LLW, and clean waste containers or some combination of these are often found in the same area in some buildings. The generator is responsible for determining in which receptacle each waste belongs and for characterizing that waste; however, there are no established formal methods or procedures to ensure these activities are performed in a way that meets the performance objectives. Personnel are trained in this area and waste types are often discussed in the Facility Safety Procedures (FSPs), but there are no performance indicators or QAPs that verify the effectiveness of this training or the FSP.

3.2.2 Analytical Methods

At most DOE facilities, procedures for analytical methods for any given year are not easily available because outdated procedures must go to a central records repository. This is also the case for LLNL. Three methods the evaluation team used to review analytical procedures are: (1) reviewing audit findings on old procedures, (2) interviewing personnel familiar with the procedures, and (3) using existing procedures as an indicator of past practice.

The HC laboratory or Nuclear Chemistry analyzed samples of hazardous waste material for offsite shipment. The HC laboratory continues to operate but the laboratory analysis procedures used between 1984 and 1991 were unavailable to the validation team during the site visit. Procedures and QA/QC requirements have changed since the laboratory began operation. We assume in this report that the historical analytical procedures used by the two laboratories were similar. Analyses performed at the HC laboratory included gross alpha/beta and tritium analysis. Gross alpha/beta analysis was performed on solid and liquid samples.

The validation team used information from the DOE-HQ Tiger Team audit of 1990 and LLNL internal audits performed during 1989 and 1990, interviews with analytical personnel at HC and HWM and Nuclear Chemistry, and a review of existing procedures. Interviews with analytical chemistry personnel suggested the analytical procedures in use today are probably similar to those used in the past. Very few personnel had direct experience with radioanalytical procedures before 1991. The only changes in procedures were thought to have been in QA/QC elements in each method or QA/QC elements of the laboratory. This is based on interviews with personnel at LLNL.

A review of analyses of wastes dated in the premeratorium time frame suggested the LOS of the analytical methods was marginal for some sample matrices. The gross alpha LOS of 20 pCi/mL could be as low as 10 pCi/mL, based on measurements using comparable instruments. The LOS reported in 1992 as representative of LOS from 1984 to 1991 may be very good for some analyses and marginal for others. The gross alpha analysis LOS for water is 20 pCi/L, 5 pCi/L greater than the Safe Drinking Water Act standard [40 Code of Federal Regulations (CFR) 141]. The gross alpha analysis for soil is very good at 1 pCi/g. Very little alpha spectroscopy analysis was performed on any waste samples to verify the gross alpha analysis.

The gross alpha LOS is significant because only once in review of the data from Hazardous Waste Disposal Requisitions (H-Reqs) did the validation team find any isotopic analysis. The validation team found many examples where, when samples were greater than the LOS, the associated wastes were shipped offsite without isotopic analysis to differentiate between DOE-added radioactivity and natural background. This suggests that other analytical techniques were not used to distinguish between naturally occurring and anthropogenic radionuclides.

Several deficiencies identified in previous audits of counting labs that were part of HC and HWM or performed work for HC and HWM from 1989 and 1990 include:

- The person performing the calibration did not sign calibration logs
- Incoming samples were placed on a bench top in an unsupervised area
- The analyst did not always sign analytical log sheets, which does not allow clear traceability of changes or deletions
- No formal procedure existed for validation of all analytical data generated

- Spiked, blank, and duplicate samples were used as QC checks, but the results were not trended, and there were no formally defined acceptance criteria.
- No documentation specified a minimum number of QC samples, and no definition of what QC samples were required by sample and analysis results.
- QC samples were not processed as blind samples.

These audit findings suggest procedural changes were needed to provide reliable data. Although these audit findings are important for laboratory operations, they do not much affect the validation team's effort to categorize waste because LLNL collected so little data on hazardous waste shipments. The reliance on process knowledge from generators reinforced the lack of radioanalytical data. The validation team did find sampling and analysis of tank waste was performed frequently and sampled more than other waste streams. Sampling and analytical QA/QC problems identified would have a much greater chance of affecting the final disposal choice for tank wastes.

3.3 Sample Collection Data

To be sure the sampling, analytical, and QA/QC procedures were adequate, the validation team revised a checklist from the EPA document *Guidance for Data Useability in Risk Assessment (Part B)* (EPA 1992). This document provides concise guidance for the analysis of radionuclides and the QA/QC requirements for this type of data, also providing supplemental information about the useability of the data. References used for preparation of the *Guidance for Data Useability in Risk Assessment (Part B)* include American Society for Testing and Materials (ASTM) Standards, DOE Radiation Measurements Procedures Manuals, and EPA Radiochemical Analytical Procedures. The QA/QC requirements that relate directly to the Superfund Program were dropped from the checklist, so only standard QA/QC criteria were included. The following is the modified checklist.

Sample Collection

- Q. How were samples collected?
Were Standard Operating Procedures (SOPs) developed?
Were the samples representative?
- A. Information about sample collection techniques used by generators was lacking. There were no formalized procedures for sample collection, as noted in an audit of the HWM and HC programs before the DOE-HQ Tiger Team visit. Serious problems may result if the collected sample is not representative of the material to be released from radiological controls. No documentation was found to show adequate field sampling protocols were developed or reporting forms were used during the period between 1984 and 1990. Sampling protocols were established and consistently followed in 1991.

Shipping/Transmittal Forms

- Q. Were shipping forms used?
- A. Shipping/transmittal [sample chain-of-custody (COC)] forms between the field sampling personnel and laboratory are available for only part of the samples from the time frame in question. Sample COC forms include the sample identification number, sampler, sample description, and generator record.

Sample Receipt Logs

- Q. Were sample receipt logs kept?
- A. It is clear from internal auditor remarks and references in some SOPs that samples were logged in and numbered in the years from 1987 to 1991.

Laboratory Analysis Request and Distribution Forms

- Q. Were analysis request forms used by samplers?
- A. Laboratory analysis request forms were prepared for the submitted samples during the years of 1989 to 1991. For other years, the analysis to be performed was verbally communicated to laboratory personnel and then written in the sample receipt logbooks.

Radiation Screening Information

- Q. Was radiation screening information provided to the laboratory?
- A. The team found no evidence that field screening information was passed on to the laboratory regularly, although radiological survey information was collected and entered into health physics logbooks. If the generator knew the waste was potentially contaminated based on process knowledge, or the field survey detected radioactivity greater than background, it was shipped as radioactive waste to the NTS. Minimal analysis was performed.

3.3.1 Analytical Data

Standards Preparation and Traceability

- Q. Were SOPs for standards preparation available and were the standards traceable to a national standard?
- A. Standards were initially prepared in the laboratory using laboratory SOPs, but some standards were not traceable to a national standard.

Calculation of Efficiencies

- Q. Were efficiencies of instruments calculated and at what frequency?
- A. The efficiency of detectors was calculated and reported to internal auditors. It was suggested quarterly efficiency and weekly calibration checks be performed by the laboratory.

Concentration/Dilution Factors

- Q. Were concentration or dilution factors noted as necessary for specific analyses?
- A. SOPs for instrument operation suggest calculations accounted for samples that required concentration or dilution.

Evidence of Preparation of Counting Aliquots

- Q. Were counting aliquots prepared?
- A. SOPs for instrument calibration and operation were available and show the laboratory QA/QC procedures included the preparation of counting aliquots.

Dates and Times of Processing and Separations

- Q. Were logs kept of dates and times of sample preparation?
- A. The team found no documentation to suggest the dates and times of sample preparation were logged. However, analysts' notes usually contain this information. Official laboratory records are not complete about the actual activity of a sample. Records received from the laboratories document the actual raw activity of the sample being analyzed, but some data are simply given as less than values, for example, <10 or <20 $\mu\text{Ci/mL}$. These few instances were always associated with difficult sample matrices such as sludge. Unfortunately, a sample cannot be classified as not containing radioactivity from DOE operations if the actual activity is not known.

SOPs Used for Analysis

- Q. Were SOPs in place for analytical procedures and for standards preparation, background counting, etc.?
- A. Copies of SOPs for analytical procedures for 1984 to 1991 were not available. Audit reports from the DOE-HQ Tiger Team show that *requirements for periodic counter calibrations, background measurements, functional checks, and source checks and efficiency checks were not formalized and minimum intervals were not established.*

Sample Counts

- Q. Were sample counts made available?
- A. Previous audit criteria did not suggest a lack of instrument operation and reporting sample counts on sample analysis sheets. It is assumed sample counts were available.

Background Counts

- Q. Were background counts performed and at what interval?
- A. Background counts were done per instrument calibration, but the procedures were not formalized. The interval for background counts was instrument dependent, based on the manufacturer's recommendations and not a referenced SOP.

Dates and Times of All Counting

- Q. Were logs kept that showed the dates and times samples were counted?
- A. As stated by employees interviewed, the time and date of analysis were kept on the instrument's microprocessor and were part of the entry commands to begin analysis.

Identification of Analysis

Q. Was the type of analysis noted on the sample report?

A. The analysis type was noted on the sample result report.

Identification of Counters Used

Q. Was the instrument identified on the sample report?

A. The instrument used to count radioactivity levels was not recorded on the sample reports made available.

Analogous Data for Appropriate QC Samples

Q. Was similar data provided for samples also available for the QC samples?

A. Methods for investigation, resolution, and documentation of anomalous measurements and QC sample data that exceed acceptance criteria were not formally documented.

Calculated Results, Propagated Errors, Detection Limits

Q. Were calculations and detection limits shown on the sample report and errors propagated to calculate uncertainties?

A. The sample reports reviewed show counting calculations, detection limits, and propagation of errors were documented.

3.4 WAA Administration

After characterization at the point of generation, wastes go to a WAA for temporary storage. Use of WAAs has been described in the documentation since 1987. Before 1987, generators were instructed to arrange for waste pickup during the weekly waste run by Toxic Waste Control (the hazardous waste management organization in at the time) (Kahn 1985).

A WAA is an official accumulation area designed for the temporary storage of hazardous, radioactive, or mixed radioactive hazardous waste in drums or other containers between the time it is generated and the time it is picked up by HWM for transfer to the Building 612 or 693 yard for later disposal. The programmatic organization that generates waste is responsible for organization, construction, and maintenance of a WAA for the waste it generates. The waste generating organization appoints an individual as the WAA administrator, who is responsible for all activities in the organization's WAA (LLNL 1989b).

The waste generating organization has appointed the WAA administrator as the individual responsible for overall maintenance of a WAA and for operation of the WAA in a way that ensures proper handling of hazardous waste. The WAA administrator performs informal WAA inspections and maintains WAA records (including current contingency plans, an operations log, inspection logs, and summary reports of incidents) (LLNL 1989b and WAA Personnel Training 1992).

Other support personnel/organizations have responsibilities at a given WAA. They include:

- **HWM** HWM is responsible for picking up waste from the WAAs and later treatment or packaging and disposal of waste. HWM helps in training other WAA personnel in their areas of responsibility.
- **Generator** Identify hazardous wastes produced by an operation or experiment, place all wastes in the WAA, notify the H&S or HWM technician of the amount and type of waste taken to the WAA, and use correct packaging, labeling, and waste preparation procedures.
- **Environmental Analyst** An Environmental Analyst (EA) is a member of the Guidance and Monitoring Division of the EPD. The EA is responsible for interpreting environmental requirements and providing compliance guidance. This includes review and interpretation of environmental regulations, approval of WAA construction design, identification of the amounts and types of wastes generated, providing guidelines for preparing and storing waste in the WAA, and training other WAA personnel about regulations and procedures of proper hazardous waste management. The EA also acts as the interface between the operating organization and regulators during inspections and approves and updates WAA contingency plans.
- **H&S Technician** The H&S technician is a member of the HC Safety Team and aids organizations in managing hazardous waste, operating WAAs and in the construction of a WAA by gathering information on the types, amounts, and locations of wastes being generated. The H&S technician also inspects and approves containers for transport to HWM, surveys all radioactive waste containers, may perform weekly inspections of the WAA, and verify HWM has removed all waste from the WAA. The H&S technician is an employee of the Hazards Control Department.
- **HWM Technician** Some HWM technician responsibilities parallel those of the H&S technicians. HWM technician responsibilities include gathering information on the types, amounts, and locations of wastes generated; inspect and approve containers for transport to HWM; and maintain a logbook of all activities related to the WAA. HWM technicians were available during the entire validation time but were used only on request before 1991 when they became more integrated into the generators process for properly characterizing, labeling, and shipping the waste.

WAA personnel are accountable for WAA operating records. These records include the operations log that contains a description, quantity, container type, and date of all waste received; dates of storage and the date of its transfer by HWM; and the location of each waste container in the WAA. WAA personnel must also maintain waste requisitions with available analysis information, inspection logs, the WAA Contingency Plan, and incident summary reports.

Required inspections/surveys for each WAA include a daily walk-through to look for obvious in-use discrepancies. Weekly inspections are performed to look for malfunctions and deterioration of equipment and wastes/packaging, operator errors, and conditions that may lead to releases of hazardous materials. Common weekly inspection items include posting and labeling of the WAA and the waste in the WAA, waste secondary containment adequacy, condition of emergency equipment, and appropriateness of waste segregation and packaging. Weekly inspection checklists (Figure 3-3) document the conduct and results of the inspection. The H&S technician surveys and smears items entering and exiting WAAs that originated in an RMMA for radioactivity. Lastly, the Environmental Operations Group inspects WAAs internally biweekly for similar issues.

3.4.1 Training

H&S technicians are trained to work as HP technicians, industrial hygiene (IH) technicians, and fire protection personnel. The H&S technicians are required to go through several training courses provided by the EPD and included EP0006 "Hazardous Waste Generation and Certification," and EP0110 "Low Level Waste Generation and Certification." The H&S technicians also receive training for taking swipe samples per guidance from the LLNL Swipe Manual.

Training for generators of wastes was limited before 1990. During 1990, HWM started training generators of wastes as described in the Hazardous Waste Management Plan (LLNL 1989) to allow them to make informed decisions for identification of wastes. Until this time, the generator had the "primary responsibility for identifying hazardous waste produced by an operation or experiment." The generator could contact the EA or H&S technician to ensure waste preparation procedures used at the time met the environmental standards. The generator was responsible for placing all waste in the WAA and notifying the H&S technicians of the amount and type of waste taken to the WAA. However, the DOE-HQ Tiger Team has noted that HWM did not perform QC checks on the waste characterization and quantification performed by the generator.

3.4.1.1 HWM Technicians The HWM technician position became more involved with hazardous waste generators and management in about 1988. The duties of the HWM technician paralleled those of the H&S technician and received similar training. The HWM technician is a member of the HWM Division. This technician is responsible for helping organizations in managing their hazardous waste and operating their WAAs.

3.4.1.2 WAA Administrators. Administrators of WAAs were operators or experimenters who worked with HC and HWM to site and construct the WAAs and were responsible for the waste until HWM delivered the waste to Building 612 for storage or packaging. WAA administrators had some training about RCRA hazardous waste, TSCA wastes, and radioactive wastes but evidence of waste minimization, waste characterization, and waste segregation was small. During the years 1990 and 1991, WAA administrators had much more thorough training.

3.4.2 Surveying

The H&S technicians survey waste using smear samples and measure the surface contamination using field radiation equipment. Once surveyed, The H&S technicians transfer custody of the waste to waste technicians who deal with all waste issues. Written procedures for surveying wastes were developed in 1988. Each H&S technician group has a controlled copy of the standard operations manual. These manuals are specific to each team, and only one individual makes changes to the controlled copy. The H&S technicians do not determine what area/room is an RMMA. On the HPs who classify and declassify RMMAs can make this determination. The H&S technicians take the swipes or external radiation reading and give this information to the HP.

WEEKLY INSPECTION CHECKLIST

WASTE ACCUMULATION AREA

Date _____ Bldg _____ Inspector _____

Time _____

General

Yes	No*	
_____	_____	Area posted with appropriate hazard and cautionary signs.
_____	_____	Area free of spills.
_____	_____	Secondary containment basin free of liquid and debris.
_____	_____	Emergency equipment present and in operating condition.
_____	_____	Proper use of Hazardous Waste Management requisition form.
_____	_____	Current contingency plan posted.

Containers

Yes	No*	
_____	_____	All containers labeled with <u>completed</u> and <u>dated</u> Hazardous Waste Labels.
_____	_____	No waste containers present over the 90-day storage limit. Note: If any waste containers are over the 90-day storage limit, contact your Environmental Analyst immediately.
_____	_____	Containers compatible with waste being stored.
_____	_____	Containers closed except when adding wastes.
_____	_____	Containers in good condition, free of leaks and deterioration.
_____	_____	Adequate separation of incompatible waste.
_____	_____	Ignitable waste isolated from sources of ignition and at least 50' from property line (perimeter fence).

* Describe corrective action needed

_____
_____
_____
_____

Date corrective action completed: _____

Figure 3-3. Weekly inspection checklist.

3.5 Waste Tracking and Documentation

For wastes generated by laboratory operations, generator knowledge was, and continues to be, the primary method for determination of whether a given waste is industrial, hazardous, radioactive, or mixed radioactive and hazardous waste. Using generator knowledge, supplemented by chemical and radiological analysis results if requested by the generator, the waste is placed in a WAA as either hazardous or radioactive or sent directly to Building 612 for handling by HWM. Before HWM will move or accept hazardous waste, an H-Req must be completed and signed by the waste generator. After receipt by HWM, the hazardous waste will be labpacked or repackaged as needed, manifested, and transported by a contractor to a TSDF appropriate for any given waste description. This general description of the current waste and documentation path for hazardous wastes has not been static during the time frame of this premonitorium data validation and has changed significantly since 1985. Figures 3-4 and 3-5 are diagrams illustrating the waste process flow during the validation period.

In 1985, the procedure required the generator to identify the waste (radioactive and hazardous) on a Toxic Waste Control Tag (Figure 3-6), which was superseded by a Hazardous Waste Management Tag but contained the same information. The generator then notified the Toxic Waste Control group for pickup, which used the information on the tag to decide the classification of waste, compatibility requirements, onsite treatment options, or to fill out the shipping manifest.

The Hazardous Waste Management Tags were used to track onsite waste streams between the period of 1979 to 1988. Each tag contained an identification number and identified the waste generator, building number, date, onsite storage area, waste form, and sometimes contained radiological survey and analytical results when requested by the generator. The HWM tags did not reference the offsite shipping manifest, nor did they contain complete waste characterization information, so tracking offsite shipments back to generators between 1979 and 1988 would be extremely difficult. A VAX database was the primary link between the manifest and the HWM tags. Many the LLNL onsite and offsite shipping manifest records between 1984 and 1989 did not contain various pieces of the documentation required to track a sample from the generator to the TSDF.

H-Reqs were first used in 1988. The H-Reqs list the waste generator, building, WAA number, waste form, process generating waste, and quantity of waste (Figure 3-7). Information commonly attached to the H-Reqs included sample number and analytical results, Process Knowledge Generator Forms, and information on the document number of the Uniform Hazardous Waste Manifest derived from the tracking database. Documentation accompanying an individual H-Req may include any, all, or none of the items listed in Table 3-1.

Starting in 1991, the H-Req number was routinely recorded on the Uniform Hazardous Waste Manifest, and the waste stream could easily be tracked from the waste generator all the way to the offsite TSDF. Before 1991, while H-Reqs were used to track and transport wastes onsite at LLNL, they were not uniformly used as an inventory list attached to the manifest. From the start of H-Req use, they can be tracked to their shipping manifest by use of the electronic databases used for tracking waste at LLNL.

Many wastes generated at LLNL contained small volumes of laboratory wastes that were placed into laboratory packs once the wastes were received at Building 612. The H-Reqs for the laboratory packs listed all the individual H-Reqs for waste placed into the lab pack. Lab packs were also cross-referenced using Laboratory Waste Disposal Requisitions (L-Reqs).

Wastes known to contain radioactivity were tracked using Radioactive Waste Disposal Requisitions (R-Reqs). These requisition forms are similar to the H-Reqs, and tracking the waste stream from the waste generator to the waste disposition is possible.

A collection of several databases was in use for hazardous and radioactive waste management before 1988 and was called the VAX-INGRES Computer Database. Figure 3-8 is a schematic of the hazardous waste information database(s) used in 1987. The various databases used in 1987 had different goals, contained different although overlapping information, and came into existence at various times before 1987. From 1988 through 1993, electronic tracking of hazardous waste was done with the Hazardous Waste Management Database (HWMDB). The Total Waste Management System (TWMS) superseded HWMDB in 1994. A map of the HWMDB database is presented in Figure 3-9. HWMDB data from 1988 to 1989 is in archive tables while data from 1994 on has been mapped to the TWMS database and is, therefore, more readily available. HWMDB information was complete enough to track wastes from their origin to their disposition, i.e., the uniform hazardous waste manifest number used for shipment to a TSDF. The database contained little waste profile or manifest shipment information.

3.6 HWM Repackaging and Manifesting

After pickup from the WAAs, HWM delivers wastes to Building 514 for treatment or to another facility for repackaging, manifesting, and shipment. While in storage, the wastes are segregated, inspected, and surveyed. This monitoring includes surface radiation surveys for compliance with DOE Order 5400.

HWM maintains Uniform Hazardous Waste Manifests in a central locked storage room. As expected, the condition of the manifests and their content has improved significantly between 1985 and 1991. Early in the validation time frame, the manifests contain very little characterization data or information on the generator/generating process. From approximately 1988 to the present, the manifests frequently list profile sheet code numbers for wastes shipped on that particular manifest. These profiles are separate from, but are based on, those described earlier and contain a chemical description of the waste. LLNL or the TSDF generates them for the TSDF receiving the waste. HWM maintains copies of most profiles; they are also available from the TSDF that received the waste.

Figure 3-5. General LLNL waste process flow chart.

☐ SPECIAL
HAZARDS

(Use Reverse)

TWC ID NO.

PKG. WT. 9.8

(TWC Use Only) 5/5

DATE: 3/16/87

TOXIC WASTE CONTROL TAG

NO. 009991

TO: NAME T.W.C.

BLDG. 612

REC. SIG. _____

FROM:

PROGRAMMATIC ORIGINATOR Biomed

NAME Pat Lewis

SIGNATURE Pat Lewis

LIVE ☐ SITE 300 ☐ BLDG. 366 RM. 102

AUTHORIZED RELEASE _____

DATE: 3/16/87

CONTAINER: DRUM ☐ CARBOY ☐ CAN ☐ 7A BOX ☒ 1000 GAL. TANK ☐

OTHER _____

WASTE FORM: DRY SOLID ☒ LIQUID ☒ SLUDGE ☐ GAS ☐ FINE POWDER ☐
PRESSURIZED VOLATILE LIQUID ☐

DESCRIPTION OF ITEM Dry carcinogen waste (carcinogenic aromatic amines) less than 1% from list 1, also some residual liquid

SERIAL / CERTIFICATION NO. _____

RADIOACTIVE MATERIAL ☒ YES ☐ COMPACTIBLE ☐ NON-COMPACTIBLE ☐

NUCLIDE _____ CI _____ GM _____ CI _____ GM
_____ CI _____ GM _____ CI _____ GM

EXT. DOSE RATE (mr/hr): CONTACT β, γ _____ η _____ @ 1 m β, γ _____ η _____

SWIPE SURVEY RESULTS (DPM/cm²): α _____ β, γ _____ H-3 _____

NON- RADIOACTIVE MATERIAL NO ☐ YES ☒

SAMPLE NO. _____ DATE SUBMITTED _____ / _____ / _____

TICH _____ APPROX. AGE OF MATERIAL _____ pH _____ FLASH POINT _____

CARCINOGEN - PC ☒ ORGANICS ☐ * CORROSIVES ☐ CAUSTICS ☐ CONC. ACIDS ☐ RESINS ☐

PCB ☐ ALKALI METALS ☐ MOCK HE ☐ VOLATILE ☐ CHLORINATED HYDROCARBONS ☐ †

MATERIALS (BRACKET COMPONENTS OF MIXES)

AMT. gal ltr lb gm % ppm

AMT.	gal	ltr	lb	gm	%	ppm
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐

PH REQUIRED

* FLASH POINT REQUIRED FOR LIQUIDS

†TICH (total integrated chlorinate hydrocarbons) required for mixture

Figure 3-6. Example Toxic Waste Control Tag.

Completed
H 006703 JUL 22 1988 872

LAWRENCE LIVERMORE NATIONAL LABORATORY
HAZARDOUS WASTE DISPOSAL REQUISITION

DATA ENTRY
JUN 24 1988 JUN 28 1988
JUN 24 1988

Program: C&MS	Bldg.: 332	Account No.:	Waste Form: ☐ DRY SOLIDS ☒ LIQUID ☐ SLUDGE ☐ POWDER ☐ GAS ☐ PRESSURIZED LIQUID ☐ OTHER ☐
Container: ☐ DRUM ☐ CARBOY ☐ CAN ☐ 7A BOX ☐ TANK ☒			Other Container:
Hazard: ☐ FLAMMABLE ☐ EXPLOSIVE ☐ ORGANIC ☐ TOXIC ☒			Other Hazard:
			Waste Stream: Bldg Retention system
			Analysis Sample No.: 8804157C thru H
			HWM Pick Up Date: 6/30/88

HWM USE ONLY

ITEM	CHEMICAL/PHYSICAL DESCRIPTION	WEIGHT		Doc#	HAZARD CLASS	PRE CUR	EPA#	DOHS#	TREATMENT			LOCATION	DRUM #	DISPOSITION
		Quantity	Units						No.	Date	By			
1	Cu	3.06	mg/l	NA 9/88	ORM-E 17	N	0007	132	501	7/6/88	BR	62E	58877	
2	Cr	20.2	mg/l						D81	7/21/88	BR	NA		M 87250869
3	Ni	0.06	mg/l											
4	Zn	4.02	mg/l											
5	Ag	0.14	mg/l											
	pH = 7.6													
	remainder - water													
	The portable tank contains approx 700 gallons		99%											

USE CONTINUATION FORM FOR ADDITIONAL ITEMS

Originator Name (Print): Paul Silveira	L-Code: 360	Ext.: 3668	Hazards Control Name (Print): Willie Thompson
Signature: Paul Silveira	Date: 6-21-88	Signature: Willie Thompson	Date: 6-21

DISTRIBUTION: SEND WHITE - Hazardous Waste Management
PLACE GREEN - Containment
KEEP BLUE - Waste Origin

Figure 3-7. Example Hazardous Waste Disposal Requisition.

Table 3-1. Possible attachments to requisitions.

---

612 Requisition Update Form
90-day Waste Acceptance
Addendum
Analytical Request Form
Analytical Results
Hazardous Req Screen Dump
Hold for Pending Analysis
Hold for Verification
HWM Division Waste Embargo Shipping Authorization
HWM Overpack Discrepancy Form
HWM Requisition/Label Discrepancy Form
HWM Sample Custody Record
HWM Swipe Raw Data
Lab Pack Certification
Lab Pack Screen Dump
Land Disposal Restriction Notification Form
LLNL Radiological Survey Log Sheet
Manifest Records
Moratorium/Non-moratorium Waste Item Declaration
Packing List
Rad Screening Form
Radio. Screening Form
RCO Problem Form
Release From Pending Analysis
Req. Front
Request for EAS Sampling
Review of Radiochemical Data
RMMA/Non-RMMA Waste Item Declaration
Roll-Off Bin
RSDR
Contamination (EAS 306-1)
Swipe Results
Unlabpacked Update Form
USPCI Lad Ticket
Verification Failure
Verification Release
Waste Acceptance Request
Waste Run Inventory
WIS History

3.7 Treatment, Storage, and Disposal Facilities

Hazardous and radioactive waste at the LLNL is treated onsite and treated and disposed at offsite TSDFs. If the level of contaminants in wastewater is below acceptance limits, the material is released to the sanitary sewer. The sewer limits for radioactivity are 5×10^{-3} $\mu\text{Ci/mL}$ for tritium, 3×10^{-7} $\mu\text{Ci/mL}$ for alpha, and 3×10^{-6} $\mu\text{Ci/mL}$ for beta (Appendix H, LLNL Hazardous Waste Management Plan). The LLNL sewer permit (LLNL 1985) contains sewer limits for other contaminants, such as metals and biological oxygen demand. Otherwise, the material is labeled, placed into portable tanks or carboys and taken to either Building 514 (Liquid Waste Treatment Facility) or Building 612 (Solid Waste Treatment Facility).

The discussion in Section 2 on the LLNL data submittal gives waste types shipped to offsite TSDFs, which we will not further discuss here. The LLNL currently treats waste at one (or more) of the following facilities: Building 514 facility, Building 612 facility, Building 693 facility, or Building 233 facility (RCRA 1994).

3.7.1 Closed Treatment and Storage Facilities at LLNL

Other hazardous and mixed waste management units at the LLNL main site have operated in the past. These waste management units and their status now are as follows:

- Building 419, Size Reduction Unit and Solidification Unit has ceased operations and will be closed. Size reduction operations, which formerly occurred in Building 419, are now conducted at Building 612 and 514 while solidification operations at Building 513 have supplanted the Building 419 solidification activities.
- Area 612-3, Drum/Container Storage Unit was certified closed in 1993. The operation of Building 693 Container Storage Unit has replaced the storage capacity eliminated by the closure of Area 612-3.
- During the time of interest for this data validation, LLNL also operated an incinerator in Building 624 and drum/container storage operation in Area 612-613. Solid and liquid materials containing trace quantities of tritium, C-14, P-32, and S-35 were incinerated. LLNL operated the incinerator under an interim status document issued by the Department of Health Services (DOHS). A "Part B" application was filed with the EPA for the incinerator, and a trial burn was conducted in 1988. Later, changes to the incinerator injection system were made and retesting of the incinerator was completed in 1989. However, it was decided not to restart the incinerator. The State of California certified it closed in 1993.

Figure 3-8. Hazardous Waste Information Database used in 1987.

Figure 3-9. Hazardous Waste Information Database used in 1993.

Figure 3-9. Cont'd.

3.7.2 Currently Operating Treatment Facilities

LLNL now operates four HWM facilities at the Livermore site. These are the Area 514 facility, Area 612 facility, Building 233 facility, and Building 693 facility. The Areas 514 and 612 facilities contain treatment and storage units for hazardous and mixed wastes; the Building 233 and 693 facilities are container storage units for hazardous and mixed waste.

HWM facility operations at the LLNL are subject to Federal, State, regional, and local environmental requirements. Hazardous and mixed waste operations at the HWM facilities include the safe and proper handling, storage, treatment, packaging, and disposition of hazardous and mixed waste generated by the LLNL and affiliated generators. Depending on type, the waste may be chemically or physically treated or reclaimed. Onsite treatment methods include neutralization, flocculation, reduction, oxidation, precipitation, separation, filtration, solidification, silver recovery, size reduction, crushing, compaction, shredding, adsorption, blending, bulking, centrifugation, and evaporation. Wastes are stored in appropriate units onsite until shipped offsite for treatment or disposal.

The principal treatment technique for wastewater (Building 514) involves chemical precipitation followed by vacuum filtration through diatomaceous earth on a rotary drum filter. The filter cake is collected in plastic-lined drums and sent to Building 612. Other liquid waste with known contaminants may be treated by methods more suitable for that material. Liquid waste remaining after treatment is retreated or released to the sewer (if it is below prescribed guidelines). If the retreated water is still above guidelines, it is stored in a retention tank awaiting retreatment.

The following hazardous waste treatment system is currently used at Building 514: (LLNL 1994)

- Liquid waste retention tanks are at various laboratory facilities. The tanks may contain radioactive, corrosive, or other hazardous materials. HWM personnel routinely remove the contents of these tanks upon request from the waste generator or representative. Following the removal of the waste liquid from the tank, HWM either ships the material offsite for disposal, transports the material to the 514 Complex for treatment, or after getting signed approval from the EPD Guidance and Monitoring Division, discharges the material to the sanitary sewer. In each case, HWM personnel obtain a copy of an analysis of the tank contents before responding to a service request. The EPD EA provides guidance to the waste generator about the specific analysis to request from the analytical laboratory based on an assessment of the potential contaminants in the program's waste stream.
- Containerized and bulk liquid wastes are transferred into one of the six 1,800-gal. treatment tanks and chemically treated with hazardous materials. Each batch treatment is limited to approximately 1,500 gal. Following treatment, HWM personnel gather a representative sample of the treated liquid waste and analyze it at an approved analytical laboratory for pH, metals, gross alpha and beta, tritium when appropriate, and other possible contaminants as necessary (dependent on the waste's Profile Sheet). The lab sends analytical results to the EPD Guidance and Monitoring Division for review. If the review shows the contents of a treatment tank are below established discharge limits, the Guidance and Monitoring Division issues a signed approval for releasing the liquid to the sanitary sewer.
- Photographic processing shops at Livermore and Site 300 produce waste liquids that

contain recoverable amounts of silver in solution. After analysis the waste is sent to the HWM Silver Recovery Area where HWM Operations technicians operate equipment that removes the silver. The silver recovery operation consists of the following steps: pumping the contents of each waste container into an electroplating tank; electroplating the silver onto a cathode in the tank; pumping the solution from the electroplating tank into a filter feed tank; allowing the solution to gravity drain from the filter feed tank through a series of ion exchange filters into an effluent recovery drum; sampling the contents of each effluent recovery drum and submitting the sample for analysis; closing and labeling the drum for shipment to the Building 612 Complex for offsite shipment; retrieving the electroplated silver and the silver-laden filter cartridges from the equipment; and transferring these items to Materials Management.

- The Dorr-Oliver unit (Building 514, Room 108) filters precipitate wastes from the tank farm chemical treatments. The operation consists of the following steps: creating a filter cake by coating a rotating drum with a slurry of diatomaceous earth; depositing the precipitate on the absorbent filter cake; capturing the filtrate in a retention tank; removing and packaging the spent, contaminated cake; obtaining a representative sample of the filtrate and submitting it for analysis; and, depending on the Guidance and Monitoring Division review, either discharging the filtrate to the sanitary sewer or retreating it.

Building 612 operations include waste receiving, segregation, lab packing, size reduction, storage, and drum crushing. Preparation and manifesting of waste shipments to commercial TSDFs occur at Building 612. The Building 693 and 233 facilities are also waste storage facilities.

4. WASTE ITEM VALIDATION

A review of available documentation for radioanalytical results for hazardous wastes found, consistent with the original LLNL submittal, such data rarely exists. The vast majority of waste categorized as clean is based on generator knowledge. This places the responsibility on the generator to have significant knowledge of the waste stream process knowledge and its radioactive content. The nonreliance on analytical data also puts a border on the waste handling system, i.e., the procedures used and training of individuals assigned to use the procedures. As such, Section 3 of this report describes aspects of the waste handling process used at LLNL. This section will describe the validation process used and list the validation results.

4.1 Validation Procedure

The validation team examined H-Reqs that were in use between 1988 and the hazardous waste shipping moratorium in 1991. Tracking and documentation of waste disposition was greatly improved over that found from the period of 1984 to 1988. During 1984 to 1988 Toxic Waste Control Tags tracked both radioactive and hazardous waste. A spot check of tags used for hazardous waste revealed few, if any, contained radioanalytical data.

The goal of the validation was to decide if LLNL had shipped DOE-added radioactivity to offsite TSDFs. Thus, the identification of wastes that had the greatest potential to contain radioactivity and the tracking of waste from radioanalytical data to the TSDF was a primary focus of the validation team. The focal point of tracking hazardous waste at the LLNL is the more than 70,000 H-Reqs archived by EPD for wastes generated from 1988 to 1991. More specifically, the validation team looked for wastes with radioanalytical results associated with H-Reqs that could then be tracked to an offsite shipment.

Since looking at all the H-Reqs for radioanalytical information was not possible, the evaluation team used three separate methods to examine a cross-section of the large number of available H-Reqs. The first method involved spot-checking H-Reqs from the records holding area to check if radioanalytical data existed, if the waste originated from an RMMA, or the waste was designated as non-radioactive based on generator knowledge. This first method served to familiarize the validation team with amounts and types of information available for different wastes. This method also included investigation of items encountered during conduct of the other two methods, which were outside the scope of the other two methods.

The second method was to select shipping Uniform Hazardous Waste Manifests containing wastes generated before the shipping moratorium in buildings containing RMMAs randomly. This consisted of using a random number generator to select offsite shipping manifests from the HWMDB with H-Reqs containing waste generated in buildings containing RMMAs (tracking waste from the manifest back to the generator). The team identified buildings assumed to have RMMAs for the manifest selections from tabulated information compiled by LLNL in 1991 showing which buildings then contained RMMAs and which had contained RMMAs in the previous five years (see Appendix C).

Manifests were randomly selected for examination using an EXCEL spreadsheet list of H-Reqs (and their associated manifests) that contained wastes generated from buildings containing RMMAs between 1984 and 1991. Table 4-1 lists the selected manifests. Originally 25 H-Reqs were selected for investigation. As two of the rows selected corresponded to the same manifest, the team subsequently investigated only 24. For a random sampling of a population, any sample greater than

20 will give a picture of the entire population with a reasonable confidence. Five-digit numbers listed in Table 4-1 are a manifest's document number while the 8-digit numbers are the more commonly tracked State manifest document number. Those manifests selected with a 5-digit manifest document number was more difficult to track to the shipping manifest as most information is kept by the 8-digit State manifest document number.

Table 4-1. Randomly selected LLNL Uniform Hazardous Waste Manifests.

89930234	89413395	AR461957	90895298	97096
89930252	89413243	AR461962	91760005	87250946
89930254	89413247	90271799	91760105	87250956
89930279	AR145188	90271803	90157	IL3243667
89930586	AR461921	90895294	89136	

The third method used was to recognize some facilities, due to their purpose, had a higher likelihood of generating hazardous waste on which radioanalysis had been conducted. The team examined a sample of H-Reqs for wastes generated or shipped from Building 332 (plutonium facility), Building 331 (tritium facility), Building 419 (decontamination facility), Building 514 (waste treatment facility), and Building 612 (storage and packaging facility).

This validation (all three methods) was done on a manifest and H-Req basis rather than by number of items or weight because a manifest may have one to hundreds of individual items weighing from ounces to thousands of pounds. For example, a manifest may be for a tank pumpout of 1,500 or more gallons of wastewater (one item) or for tens or hundreds of lab pack drums containing many individual packages. The definition of an item on a manifest may be a single lab pack drum; while for waste characterization, it may be the multiple packages inside the drum or the collection of packages containing identical material inside the drum.

The H-Reqs were checked for analytical data, generator process knowledge, waste stream information, and disposition/treatment of waste. The evaluation team reviewed analytical results to identify waste that possibly contained levels of radioactivity above the LLNL release criteria or above background levels. The sample or H-Req number may then be used to track the waste through the HWM tags or H-Reqs to the waste disposition.

4.2 Validation Results

This section reports results of the portion of the validation that looked for radioanalytical data associated with waste on H-Reqs and manifests. Appendix D is a summary of available information on the various H-Reqs examined, including radioanalytical data. Appendix E contains results of waste designation per the DOE postmortem definitions described in Section 2. While results of direct or swipe radiation surveys of the packaged waste (as required by DOE Order 5400.5) are rarely found in the archived documentation, it is believed these surveys were routinely conducted at the WAA or when in storage before offsite shipment. Using the three methods described in section 4.1, the validation team investigated about 700 H-Reqs.

4.2.1 Spot Check Results

The spot-checked H-Reqs were selected either because they contained radioanalysis data, as examples of commonly found H-Reqs, or were somehow atypical of most of the H-Reqs investigated. Of the 85 spot-checked H-Reqs, 52 contained sample radioanalytical analysis results. Thirty-six of the 52 with analysis results had concentrations in excess of one of the LLNL release criteria.

4.2.2 Random Manifest Results

Of these randomly selected manifests, four included H-Reqs with radioanalytical results while three listed package swipe or direct survey results. All four items (and manifests) that included radioanalytical data showed radioactivity in excess of either the LLNL release criteria cited in the data submittal or had a radioanalytical LOS significantly greater than the criteria. The data in these manifests came from four of the more than 330 H-Reqs making up the randomly selected manifests. Waste tracked through the LLNL waste handling system does not require all items on a H-Req go to a TSDF on a single manifest. Waste items on a single H-Req may be shipped on multiple manifests. Many H-Reqs describing waste on these random manifests could not be checked for radioanalytical data as they were being microfiched. All other wastes on H-Reqs checked because of the random manifest selection are considered clean or likely clean.

Several H-Reqs (H028227 to H028235) were shipped on manifest 89930254, which available documentation shows contained sludge from drain lines in Building 222 and 227 (chemistry). A sample of the sludge contained elevated levels of mercury, chromium, lead, nickel, and gross alpha and gross beta concentrations of 5×10^{-6} and 1.5×10^{-5} $\mu\text{Ci/g}$, respectively. These gross radioactivity levels are slightly in excess of the sludge release criteria of 1×10^{-6} $\mu\text{Ci/g}$ gross alpha and 3×10^{-6} $\mu\text{Ci/g}$ gross beta. Sludge is often a difficult matrix to analyze, however, the radioanalytical results had reasonable detection limits and the release criteria reflect potential matrix specific analysis problems.

Strip tank sediment waste from Building 322 (the plating shop) described on H045030 was shipped on manifest AR461921. Radioanalytical results show gross beta concentrations of 4.5×10^{-6} $\mu\text{Ci/g}$, slightly above the LLNL release criteria for sludges of 3×10^{-6} $\mu\text{Ci/g}$ and must be considered likely radioactive. While this is a difficult matrix to analyze, as the results were in excess of the criteria, an additional alternate analysis technique could have been employed to find out the origin of the activity.

Manifest 89413395 contained caustic etch bath from Building 322 (H-Req 14042). This aqueous solution had gross alpha beta analysis results of $<2.7 \times 10^{-7}$ $\mu\text{Ci/ml}$ (270 pCi/L MDA) and $<2.4 \times 10^{-7}$ $\mu\text{Ci/ml}$ (240 pCi/L MDA), respectively, an order of magnitude greater than the 10^{-8} release criteria for these analytes. While the plating shop probably would not contain significant

amounts of radioactivity, the presence of radioanalytical data would suggest the generator had some idea that the solution was potentially contaminated. Under these circumstances further analysis could have decided if the contamination levels were below the release criteria. Similarly, manifest 90271803 contained a small amount of pump oil from Building 251 (nuclear chemistry) with a gross beta content of 2.5×10^{-6} $\mu\text{Ci/ml}$. This is just slightly above the LOS release criterion for oil of 2×10^{-6} $\mu\text{Ci/ml}$.

All four sets of the data found for wastes in the randomly selected manifests had results greater than the criteria listed above for gross alpha or beta analysis. These four H-Reqs with data were 1.2% of the number of H-Reqs represented on the 24 manifests, or less than 1% on an item basis. Whether this shows the amount of waste containing DOE-added radioactivity cannot be determined. These manifests documented wastes from buildings containing RMMAs, potentially biasing the results high for the LLNL as a whole. However, the fact that all those items containing data exceeded the release criteria may suggest that wastes were not analyzed often enough to ensure generator knowledge was adequate to be sure LLNL shipped no DOE-added radioactivity offsite. This is especially uncertain for items from the same location or with the same waste description as those items for which data could be found.

4.2.3 Biased H-Req Sample Results

Less than 5% of the approximately 700 biased H-Reqs examined contained radioanalytical data. Of the 32 that did, 17 exhibited gross alpha, gross beta, or tritium levels in excess of the LLNL release criteria for the particular waste matrix. Most of these did not appear to contain significant amounts of activity.

5. VALIDATION SUMMARY

The primary purpose of the LLNL offsite hazardous waste shipment data validation project is to examine shipment records from 1984 through 1991 to decide whether items in offsite waste shipments were properly categorized according to the DOE-HQ moratorium waste category definitions. These definitions were not in place at the time the waste was generated but are based on whether activity was added to the bulk or volume of the waste through DOE operations.

This validation examined two facets of waste generation and shipment at LLNL. The first was an examination of procedures used at LLNL to decide if a waste was radioactive and how hazardous wastes were handled from the point of generation to the final disposal. The second portion of the validation was a survey of documentation on hazardous wastes generated before the moratorium, especially wastes for which radioanalytical data was available, to decide if LLNL properly categorized wastes.

Results of the analysis of LLNL procedures in place at the time show that, consistent with the LLNL data moratorium data submittal, generator knowledge was almost exclusively used to decide whether a waste was radioactive. Available procedures discussed how to handle radioactive waste or hazardous waste, but did not describe how to decide if a waste was radioactive.

Consistent with DOE-HQ Tiger Team findings, the validation team noted that for most of the validation period, consistent procedures for when and how a sample should be taken were not in place. Also, coordination between analysts and waste generators on how to read radioanalytical results (when obtained) was ineffectual. Additionally, the reliance on gross alpha and gross beta measurements was excessive (the team identified no spectrometric analysis results for potentially contaminated hazardous waste).

Tracking documentation improved significantly over the validation period. The use of H-Reqs starting in 1988 and their progressively more common usage improved the tracking of wastes at LLNL substantially. The use of H-Req numbers as a register of wastes shipped on manifests late in the validation period extended this tracking improvement. Database tracking of waste was present for the entire validation period and its usability increased as time went on.

Procedures for when onsite treatment (Building 514) is appropriate were incomplete for the validation period as they can be construed to allow disposal by dilution to the sanitary sewer of wastes that contain activity levels that otherwise would not allow them to be disposed as hazardous waste. Single systems treated radioactive, hazardous, or mixed waste simultaneously or consecutively. Effluents were released to the municipal sewer system when they met discharge gross alpha/beta limits higher than the LLNL limits in place for hazardous wastes to be shipped to commercial TSDFs. Wastes were passed through the treatment system multiple times until they met these gross alpha/beta limits. Identical effluents from individual batches passed through the treatment systems were disposed on a batch basis as radioactive, hazardous, or industrial (sewerable) waste.

The investigation of H-Reqs showed that, as stated in the LLNL data submittal, radioanalytical data for hazardous wastes rarely exist. The team chose to examine H-Reqs that were more likely to contain radioanalytical data. When such data were found, results were compared with LLNL LOS/background release criteria limits used from 1989 through 1991 described in the LLNL data submittal. Less than 5% of the H-Reqs examined for waste generated at buildings containing RMMAs contained radioanalytical data. About half the radioanalytical data attached to H-Reqs had gross alpha, gross beta, or tritium levels in excess of the criteria, generally by a small amount. In agreement with the LLNL data submittal, this shows that a very small percentage (<1%) of hazardous waste generated at the LLNL main site can be shown to contain DOE-added radioactivity.

6. REFERENCES

- Adams, Sheryl D., Science Applications International Corporation, letter to Dan Hoyt, Lawrence Livermore National Laboratory, "DOE Order 5400.5 Additions to LLNL Waste Management Plan (WMP)," September 26, 1990.
- Crawford, Richard, Lawrence Livermore National Laboratory, letter to Mike Rohe, EG&G Idaho, "Comments on Lawrence Livermore National Laboratory Data Regarding Offsite Shipments of Hazardous Wastes," May 27, 1992.
- DOE Office of Environmental Guidance (EH-23), *Safe Drinking Water Act*, ORNL/M-1899, Revision 6, September 15, 1992.
- DOE, Environmental Restoration and Waste Management Office of Waste Operations (EM-30), *Performance Objective for Certification of Non-Radioactive Hazardous Waste*, Draft, April 6, 1993.
- Duffy, Leo P., "Data Requirements on Past Shipments of Hazardous/Toxic Wastes Potentially Contaminated with Radioactivity," DOE Internal Memorandum, August 26, 1991.
- Edwards, Chip, Radiation Analytical Sciences, memo to Howard Hall, "RAS Assessment Number 94-AST-03 Records Control," October 26, 1994.
- Energy & Technology Review, *The State of the Laboratory*, January/February 1994.
- Environmental Protection Agency, *Guidance for Data Useability in Risk Assessment (Part B)*, Publication 9285.7-09B, PB92-963362, May 1992.
- ES&H Review Team Findings, ES&H89-06, November 29, 1989.
- Hazardous Waste Shipment Data Validation Work Scope*, Final Comment Memorandum.
- Kahn, James S., Lawrence Livermore National Laboratory, letter to Dwight Hoenig, Department of Health Services, "Transmittal of LLNL Operation Plan, EPA ID No. CA2890012584," March 27, 1985.
- Lawrence Livermore National Laboratory, Ordinance No. 1134, Relating to Control and Operation of the Sewage Collection and Treatment System, April 1985.
- Lawrence Livermore National Laboratory, Environmental Protection Guidance and Monitoring Series, *Guidelines for Waste Accumulation Areas*, UCAR-10192, March 1987.
- Lawrence Livermore National Laboratory, Environmental Protection, *Preparation Guide for Generators of Hazardous Chemicals and Radioactive Waste at LLNL*, March 1987.
- Lawrence Livermore National Laboratory, Environmental Protection Hazardous Waste Management Division, *Hazardous Waste Management Plan*, UCAR 10264, September 1989.
- Lawrence Livermore National Laboratory, Environmental Protection Guidance and Monitoring Division, *Guidelines for Waste Accumulation Areas*, UCAR 10192, Rev. 1, March 1989.

Lawrence Livermore National Laboratory, DOE-HQ Tiger Team Report, 1990.

Lawrence Livermore National Laboratory, Environmental Protection Department, Hazardous Waste Management Division, *The 1991 Hazardous Waste Report - Mainsite (Biennial Report)*, April 1991.

Lawrence Livermore National Laboratory, Environmental Protection Department, *Technical Implementing Procedure*, "Sample Receipt, Handling, and Disposal in the HWRL," TIP-RAS-110, November 11, 1993.

Nakahara, Dan, DOE-SF, memo to Lisa Page, EG&G-ID, "Data Request on Past Shipments of Waste," January 28, 1992.

RCRA Part B Permit Application, Vol. 1, Part IV, March 1994.

Steiner, Steve, Lawrence Livermore National Laboratory, memo to Keith Gilbert, "HWM Training," December 21, 1989.

Science Applications International Corporation, *Waste Sampling Strategy Plan for Verification of Waste at the Lawrence Livermore National Laboratory*, UCRL-CR-105452, December 1990.

Waste Accumulation Area Personnel Training, Lesson 2, "Waste Handling Practices at the Waste Accumulation Area (WAA)," EP0053, July 6, 1992.

University of California, Lawrence Livermore National Laboratory, *1993 Report for the Regents*, UCAR-10223-93, April 1994.

University of California, Lawrence Livermore National Laboratory, *Framing the Laboratory's Future*, UCRL-AR-117362, June 1994.

APPENDIX A

LLNL TSDF Flowcharts

APPROPRIATE TECHNOLOGIES II

Waste Stream: LABPACKS

Transporters: MP Vacuum Truck Service

BARON-BLAKESLEE

Waste Streams: Freon TF

Transporters: Baron-Blakeslee

BATTERY DISPOSAL TECHNOLOGIES (BDT)

Waste Streams: Reactives
Transporters: GSX, HazMat

DREW RESOURCES

Waste Streams: Silver-bearing Filter Cartridges

Transporters: LLNL

ENGLEHARD INDUSTRIES

Waste Streams: Gold, Gold Cyanide, and Gold Acid Solutions

Transporters: GSX, Englehard

ENSCO, INC. (Incinerator)

Waste Streams: Lab Packs, Organics, PCBs

Transporters: GSX, Tri-State Motor Transit

ETICAM

Waste Streams: Photochemicals, acids, bases, cyanides

Transporters: GSX, ExcelTrans

EVERGREEN OIL

Waste Streams: Oil

Transporters: Evergreen Oil

GSX, Greenbrier

Waste Streams: Lab Packs, Organics, Acids, Bases, and Reactives

Transporters: GSX

IDAHO NATIONAL ENGINEERING LABORATORY
for the U. S. DEPARTMENT OF ENERGY

Waste Streams: Mixed Radioactive Waste (one approved waste stream)
Transporter: Tri-State Motor Transport

INTERSTATE NUCLEAR SERVICES (INS)

Waste Streams: Radioactive Laundry

Transporter: Interstate Nuclear Services

OIL PROCESS COMPANY (OPC)

Waste Streams: Acids, Bases

Transporters: GSX, ExcelTrans, Tri-State Motor Transit

QUICKSILVER PRODUCTS, INC.

Waste Streams: Fluorescent tubes, metallic mercury

Transporters: IT Corp.

REYNOLDS ELECTRIC & ENGINEERING CO., INC. NEVADA TEST SITE
for the U. S. DEPARTMENT OF ENERGY

Waste Streams: Radioactive Waste

Transporter: Tri-State Motor Transport

ROLLINS ENVIRONMENTAL SERVICES, TEXAS

Waste Streams: Labpacks

Transporter: Tri-State Motor Transit Co.

ROMIC CHEMICAL CORPORATION

Waste Streams: Organics, and Aqueous wastes with Organics

Transporters: Romic, GSX Services, and Excel Trans

SAFETY KLEEN

Waste Streams: Petroleum Naphtha

Transporters: Safety-Kleen

SOLVENT SERVICES

Waste Streams: Labpacks, Organics, Corrosives, and Aqueous wastes

Transporters: Solvent Services, IT Corporation

US POLLUTION CONTROL, GRASSY MOUNTAIN FACILITY

Waste Streams: Inorganic Aqueous wastes, Paints, Oils, Asbestos, Oxidizers
PCB contaminated debris, RCRA contaminated debris, and
Non-RCRA contaminated debris

Transporter: US Pollution Control

US POLLUTION CONTROL, LONE MOUNTAIN FACILITY

Waste Streams: Aqueous wastes with Organics, Solvent contaminate Soil
and Aqueous wastes with cyanides

Transporter: US Pollution Control

APPENDIX B

**Hazardous Waste Shipped Offsite
January 1990 to July 1991**

Hazardous Waste to off-site disposal following Radioanalysis,
January 1, 1990 to July 1, 1991

30-Jul-91

	Req Number	FORM	QUANTITY Gal. • Lbs.	ALPHA	BETA / GAMMA	TRITIUM	MANIFEST No.	TSDF	SHIPPING DATE	BLDG	ROOM
1	H044481	LIQUID	6	4.86E-08	LOS	LOS	89930309	SSI	4/25/90	332	ret. tank
2	H044482	LIQUID	4	4.86E-08	LOS	LOS	89930309	SSI	4/25/90	332	ret. tank
3	H033106	LIQUID	55	5.20E-09	2.60E-09	9.90E-05	90271701	SSI	7/29/90	212	ret. tank
4	H033107	LIQUID	55	5.20E-09	2.60E-09	9.90E-05	90271701	SSI	7/29/90	212	ret. tank
5	H037388	LIQUID	55	2.80E-08	1.50E-07	•	90271701	SSI	7/29/90	321A	1000
6	H037389	LIQUID	55	6.90E-09	8.30E-08	•	90271701	SSI	7/29/90	321A	1000
7	H048642	LIQUID	50	1.80E-08	1.30E-07	•	89930570	SSI	9/19/90	321C	1437
8	H060463	LIQUID	50	4.20E-08	6.30E-08	•	89930570	SSI	9/19/90	321C	1000
9	H060464	LIQUID	50	5.00E-08	1.60E-07	•	89930570	SSI	9/19/90	321C	1000
10	H060465	LIQUID	50	3.00E-08	2.20E-08	•	89930570	SSI	9/19/90	321C	1000
11	H060467	LIQUID	50	4.10E-08	1.60E-07	•	89930570	SSI	9/19/90	321C	1000
12	H060468	LIQUID	50	7.10E-07	5.00E-06	•	89930570	SSI	9/19/90	321C	1000
13	H060469	LIQUID	50	9.80E-08	1.50E-07	•	89930570	SSI	9/19/90	321C	1000
14	H060471	LIQUID	50	3.10E-08	1.70E-07	•	89930570	SSI	9/19/90	321C	1000
15	H060472	LIQUID	50	9.20E-07	8.50E-07	•	89930570	SSI	9/19/90	321C	1000
16	H060473	LIQUID	50	8.70E-07	1.20E-06	•	89930570	SSI	9/19/90	321C	1000
17	H048650	LIQUID	50	2.60E-07	4.50E-06	•	90271621	SSI	10/17/90	321C	1437
18	H048913	LIQUID	4	1.50E-07	2.30E-07	•	90271621	SSI	10/17/90	241	high-bay
19	H060742	LIQUID	55	7.80E-07	4.00E-07	•	90271621	SSI	10/17/90	231	1600
20	H060743	LIQUID	55	1.80E-06	LOS	•	90271621	SSI	10/17/90	231	1600
21	H060744	LIQUID	55	5.00E-08	1.00E-07	•	90271621	SSI	10/17/90	231	1600
22	H060746	LIQUID	55	1.20E-07	4.70E-07	•	90271621	SSI	10/17/90	231	1600
23	H033217	SOLID	15	6.40E-07	4.00E-07	•	00223160	RT	10/19/90	322	100
24	H049688	LIQUID	5	2.90E-08	4.00E-07	3.80E-05	89561619	SSI	10/23/90	226	110
25	H049689	LIQUID	5	LOS	6.30E-07	1.99E-03	89561619	SSI	10/23/90	226	110
26	H052174	SOLID	10	•	6.11E-07	•	90271651	USPCI	11/14/90	151	B140
27	H048659	LIQUID	42	2.60E-07	3.10E-07	•	90271701	SSI	11/29/90	321C	1437
28	H048660	LIQUID	42	2.60E-07	3.10E-07	•	90271701	SSI	11/29/90	321C	1437
29	H048661	LIQUID	42	2.60E-07	3.10E-07	•	90271701	SSI	11/29/90	321C	1437
30	H048662	LIQUID	50	3.00E-07	2.50E-08	•	90271701	SSI	11/29/90	321C	1437

31	H048664	LIQUID	50		2.50E-07	3.70E-07	.		90271701	SSI	11/29/90	321C	1437
32	H060741	LIQUID	55		5.00E-08	1.00E-07	.		90271701	SSI	11/29/90	231	1600
33	H045269	SOLID	10		LOS	7.70E-08	1.80E-06		90271728	USPCI	12/6/90	298	outside
34	H049687	LIQUID	5		8.20E-08	1.50E-06	1.35E-03		00223157	RT	12/7/90	226	110
35	H049690	LIQUID	5		2.00E-07	3.10E-06	.		00223157	RT	12/7/90	222	1405
36	H048671	LIQUID	50		LOS	2.50E-07	.		90271772	SSI	12/12/90	321C	1437
37	H048672	LIQUID	50		LOS	2.80E-07	.		90271772	SSI	12/12/90	321C	1437
38	H048673	LIQUID	50		LOS	3.00E-07	.		90271772	SSI	12/12/90	321C	1437
39	H048674	LIQUID	50		9.60E-08	1.40E-07	.		90271772	SSI	12/12/90	321C	1437
40	H048675	LIQUID	50		9.60E-08	1.40E-07	.		90271772	SSI	12/12/90	321C	1437
41	H052176	LIQUID	4		LOS	LOS	8.10E-06		AR461930	ENSO	12/21/90	151	B140
42	H028742	LIQUID	2		LOS	1.02E-06	.		90271782	GXS	1/2/91	251	
43	H042325	LIQUID	5		LOS	7.50E-08	.		90271791	ETICAM	1/10/91	322	100
44	H034172	LIQUID	50		1.20E-07	4.10E-07	.		90271806	SSI	1/17/91	321C	1437
45	H049686	LIQUID	5		1.30E-08	2.80E-07	3.20E-07		AR485422	ENSO	1/25/91	222	1228
46	H049701	LIQUID	5		5.20E-09	8.50E-08	3.10E-07		AR485422	ENSO	1/25/91	222	1228
47	H054147	LIQUID	5		5.50E-08	6.10E-07	1.40E-06		AR485422	ENSO	1/25/91	222	1228
48	H042317	LIQUID	3		LOS	7.50E-08	.		90271833	SSI	2/1/91	322	100
49	H042318	LIQUID	3		LOS	7.50E-08	.		90271833	SSI	2/1/91	322	100
50	H042319	LIQUID	3		LOS	7.50E-08	.		90271833	SSI	2/1/91	322	100
51	H042320	LIQUID	3		LOS	7.50E-08	.		90271833	SSI	2/1/91	322	100
52	H037428	LIQUID	50		LOS	1.50E-07	.		90271891	SSI	4/5/91	321A	1000
53	H037432	LIQUID	55		LOS	2.50E-07	.		90271891	SSI	4/5/91	321A	1000
54	H037433	LIQUID	55		LOS	9.20E-07	.		90271891	SSI	4/5/91	321A	1000
55	H037434	LIQUID	55		LOS	9.20E-07	.		90271891	SSI	4/5/91	321A	1000
56	H037435	LIQUID	55		LOS	9.20E-07	.		90271891	SSI	4/5/91	321A	1000
57	H037440	LIQUID	55		LOS	3.00E-07	.		90271891	SSI	4/5/91	321A	1000
58	H048654	LIQUID	50		2.20E-07	5.80E-07	.		90271891	SSI	4/5/91	321C	1437
59	H048663	LIQUID	42		4.10E-07	6.30E-07	.		90271891	SSI	4/5/91	321C	1437
60	H048670	LIQUID	50		LOS	5.60E-07	.		90271891	SSI	4/5/91	321C	1437
61	H048689	LIQUID	50		LOS	4.50E-07	.		90271891	SSI	4/5/91	321C	1437
62	H048690	LIQUID	50		LOS	5.20E-07	.		90271891	SSI	4/5/91	321C	1437
63	H048699	LIQUID	50		1.60E-07	2.20E-07	.		90271891	SSI	4/5/91	321C	1437
64	H048702	LIQUID	50		7.60E-08	4.30E-07	.		90271891	SSI	4/5/91	321C	1437
65	H048703	LIQUID	50		1.90E-08	4.40E-07	.		90271891	SSI	4/5/91	321C	1437

66	H060747	LIQUID	55	4.50E-08	7.10E-08	•	90271891	SSI	4/5/91	231	1600
67	H064403	LIQUID	55	LOS	9.70E-08	•	90271891	SSI	4/5/91	321A	1000
68	H048704	LIQUID	5	5.20E-07	2.00E-07	•	90271902	USPCI	4/12/91	321C	1437
69	H049604	LIQUID	5	LOS	1.10E-06	3.00E-06	90271902	USPCI	4/12/91	226	110
70	H061777	LIQUID	5	LOS	5.70E-07	1.80E-05	90271902	USPCI	4/12/91	222	1228
71	H066801	LIQUID	40	•	5.50E-07	•	90271905	SSI	4/16/91	321C	1000
72	H048684	LIQUID	50	1.70E-07	2.60E-07	•	90271926	SSI	4/25/91	321C	1437
73	H048685	LIQUID	50	2.70E-07	3.90E-07	•	90271926	SSI	4/25/91	321C	1437
74	H034174	LIQUID	50	9.10E-08	2.60E-07	•	90271932	SSI	5/2/91	321C	1437
75	H052202	SOLID	15	3.60E-08	LOS	•	90271939	USPCI	5/8/91	151	1130
76	H034156	LIQUID	5	2.50E-09	1.60E-07	•	90271966	NORRIS	6/20/91	254	113
TOTAL			15748	50							

LOS Below the Limit Of Sensitivity

- Designates zero or no analysis available

All Radioactivity values are $\mu\text{Ci/ml}$ for Liquids and $\mu\text{Ci/gm}$ for Solids.

ETICAM ETICAM
2095 Newlands Drive East, Fernley, NV 89408

GSX GSX SERVICES INC.
3815 Old Greenbrier Pike, Greenbrier, TN 37073

NORRIS NORRIS ENVIRONMENTAL SERVICES
5215 South Boyle Avenue, Los Angeles, CA 90058

OPC OIL PROCESS COMPANY
1848 East 55th Street, Los Angeles, CA 90058

RT ROLLINS ENVIRONMENTAL SERVICES
2027 Battleground Road, Deerpark, TX 77536

SSI SOLVENT SERVICES INC.
1021 Berryessa Road, San Jose, CA 95133

TOC LAIDLAW ENVIRONMENTAL SERVICES, Inc.

APPENDIX C

RMMA Table

Interdepartmental letterhead

Health Physics Group
Hazards Control Department

Mail Station L 384

Ext. 2-5143

October 18, 1991

Conrad
P.
T. H.
T. H.
Cherry
11-2-91
CELOS

TO: Joel Wong

FROM: Dave Myers

James M. Meozzi
FS
Dave Myers

SUBJECT: List of Access Control Areas

Attached is a current list of access control areas at LLNL where there is some potential for radioactive contamination. The potential for radioactive contamination exists in those areas where unencapsulated material is handled or where there is the potential for the production of activation products from high energy accelerators. This list was extracted from the master set of facility drawings which delineate all of the radiological and access control areas at LLNL which is maintained in the Health Physics Group Office. This list replaces the previous master list dated 10/04/91.

This list is also being submitted to the Group Leader of Environmental Operations in the Environmental Protection Department. Additions are in **bold** print, deletions are in ~~bold~~ print marked with a "strikethru" symbol.

If I can provide any additional information, please let me know.

DSM:agm
DSM/Wong911018

Attachment

cc: J. Elliott, L-545
K. Gilbert, L-620
J. Hirabayashi, L-633

University of California

Lawrence Livermore
National Laboratory

Access Control Areas and Radiological Areas in LLNL Facilities With Potential for Contamination or Activation

Bldg.	Room
131	1221
	1221P
	1222
	1224
	1228
	1230
	1234
	1234A
	1236
	1238
	1240
	1259
	1259A
	1341
	1341A
	1345
	1345A
	1349
	1431
	1439
	1441
	1450
	1450A
	1450C
	1460
	1471
	1481
	2228
	2234
	2238
	2240
	2240A
	2246
	2250
	2329
	2333A
	2335
	2347
131	2351
	2357
	2431
	2440
	2450

151	1033
	1034
	1034B
	1039
	1040
	1041
	1043
	1043A
	1123
	1138
	1140
	1318
	1322
	1326
	1326A
	1330
	1334
	1334B
	2103
	2107
	2109
	2117
	2121
	2125
	2125A
	2131
	2302
	2302A
	2308
	2312
	2314
	2318
	2318A
151	2322
	2322A
	2326
	2326A
	2330
171	107
	111
175	100
	103
	112
	124
	128

177	1000
	1010
	1014
	1020
	1021
	1024
	1025
179	1027
190	1000
	1000A
194	1131
	1300
	B122A
	B130
212	B132
212	174
	184
222	1105B
	1106
	1117B
	1118
	1118B
	1154
	1216
	1216B
	1223
	1228
	1228B
	1365
	1365B
222	1421
	1506B
	1511
	1511B
	1514
	1515
226	1515B
	1520
	1520B
	1524B
226	106
	109
	110
	113

231	~~1318~~
	1330
	1351
	1427
	1712
	1737
	1841
	1900HB
	1944A
	1944B
	1945
	1945A
	1945B
	1945C
	1945D
	1945E
233	1956A
	1956B
	1963
	2934
233	1100
235	1100
	1101
	1107
	1109
	1121
	1122
	1123
	1125
	1131
	1133
	1133A
	1133B
	1136
	1138
	1206
	1222
	1224
	1226
	1235
	1251
241	B200B
	B200D
	B200F
	B200G
241	1600
	1686
	1858A
	1887
243	
	2018

Master List — 10/18/91
Access Control Areas and Radiological Areas in LLNL Facilities With Potential for Contamination or Activation

251	1001B
	1001C
	1003
	1027
	1035
	1047
	1048
	1053
	1102
	1117
	1142
	1150
	1211
	1212
	1232
	1234
	1235
	1310
	1314
	1354
	1363
	1364
	2122
253	1708
	1708A
	1708B
	1712
	1716
	1722A
	1726
	1732
	1734
	1903
	1906
	1909
	1910
	1913
	1913A
	1914
254	105
	109
	113
255	179
	180
281	1305
	1307
	1311
	1319
	1323
282	1000

292	1200
	1202
	1402
	1404
	1406
	1407
298	112
	142
	143
	144
	145
	146
	147
	148
	149
	161
	164
	181
	181A
	182
	183
	189
321	1001
	1001A
	1142
	1142A
	1144
	1144A
	1148
	1148B
	1152
	1152A
321	1152B
	1152C
	1152D
	1153
	1318B
	1318D
	1347
	1351
	1352
	1352A
	1352B
	1437
	1437A
	1439
	1439A

331	127
	130
	131
	134
	135
	138
	139
	142
	143
	144
	144A
	144B
	145
	146
	148
	149
	149A
	149B
	150
	153
	153A
	153B
	154
	157
	158
	161
	1001
	1005
	1009
	1011
	1013
	1015
	1016
	1017
	1018
	1019
	1020
	1021
	1022
	1023
	1024
	1025
	1027
	1029
	1035
	1037
	1045
	1047
	1049
	1051
	1100
	1101
	1103

331	1104
	1105
	1107
	1108
	1117
	1119
	1121
	1123
	1124
	1126
	1128
	1200
	1200A
	1210
	1215
	Yard
332	1005
	1005A
	1006
	1006A
	1009
	1010
	1013
	1050
	1051
	1313
	1313A
	1313B
	1314
	1314A
	1321
	1321A
	1322
	1322A
	1322B
	1322C
	1329
	1330
	1330A
	1337
	1337A
	1337B
	1338
	1345
	1346
	1353
	1354
	1354A
	1361
	1362
	1369
	1370
	1377
	1378
	2300
	B100

Master List — 10/18/91

Access Control Areas and Radiological Areas in LLNL Facilities With Potential for Contamination or Activation

341	1003 1005 1009
361	1245 1342 1346 1347 1445 1446 1542 1564 1635 1642 1649 1664 1658C 1742 1745
363	1008
365	104 109 112
366	103
377	1003 1028
378	120
381	B150 B154 B156
391	Nova Target Chamber
412	1246
419	124 155 167
490	1061
493	1000
513	1000 1002
514	108 110 124
594	110

612	100 612-4
614W	1001
624	612-2
625	1000
801	125 Firing Table
804	Open Area Staging Area
810A	109 121 133
810B	100
818	101
851	215 Firing Table
857	100
2581	101 104

RMMA Classification by Building

Never	None in the last 5 yrs	None in the last 2 yrs	Possible in the last 2 yrs	Current RMMA
3				
4				
5				
6				
41				
41A				
42				
	111			
112				
113				
115				
116				
117				
118				
119				
	121			
122				
123				
125				
				131
132				
	141			
				151
152				
153				
154				
160				
		161		
			162	
163				
164				
	165			
		166		
	168			
	169			
169A				
169B				
169C				
170				
				171
	173			
			174	
				175
	176			
				177

Never	None in the last 5 yrs	None in the last 2 yrs	Possible in the last 2 yrs	Current RMMA
271				
272				
273				
				281
				282
283				
291				
				292
				293
	294			
295				
297				
				298
	298A			
299				
	310			
311				
312				
313				
	314			
	315			
	316			
317				
318				
	319			
				321
				322
323				
	324			
325				
	326			
	327			
328B				
328C				
328				
			329	
				331
				332
			334	
			335	
336				
337				
				341
	343			
	344			
	345			

RMMA Classification by Building

Never	None in the last 5 yrs	None in the last 2 yrs	Possible in the last 2 yrs	Current RMMA
452				
470				
481				
482				
				490
			491	
492				
				493
494				
510				
	511			
512				
				513
				514
515				
	516			
517A				
	517			
518				
519				
520				
522				
523				
531				
533				
543				
551				
574				
581				
	592			
	593			
				594
				595
596				
597				
598				
599				
611				
				612A
				612
				614
615				
	616			
	618			
			619	
622				

RMMA Classification by Building

Never	None in the last 5 yrs	None in the last 2 yrs	Possible in the last 2 yrs	Current RMMA
837				
838				
	840			
841				
843				
845				
			850	
				851
852				
	854			
	855			
856				
				857
	858			
859				
			865	
870				
871				
872				
873				
874				
875				
876				
877				
878				
879				
880				
882				
883				
				2581
8656				
8658				

APPENDIX D

H-Req Data Summary

Table D-1. Spot checked H-Req data summary.

Spot Checked from files														Aqueous,
												Radiological Analysis		Oil, solid,
H-Req #	Bldg #	Room #	RMMA?	H-Req Date	Manifest #	Manifest Date	Sample #	Swipe/Survey	Process Knowl	Comments	Gross Alpha	Gross Beta	H-3	sludge
H00517	161	Tank	Not listed	1/19/89	M87250958	1/31/89	8801778	No	No	-	3.9E-9 uCi/ml	3.5 E-8 uCi/ml	No	A
H00518	169	Not listed	Not listed	2/9/89	Not listed	Not listed	8801654	No	No	No manifest listed	9.9E-9 uCi/ml	1.5E-8 uCi/ml	No	A
H00530	169	Not listed	Not listed	2/9/89	See comment	2/21/89	8801772	No	No	Put on Req H4692	7.5E-8 uCi/ml	ND	ND	A
H00559	490	Not listed	Not listed	2/9/89	M87250967	3/3/89	8900033	No	No	Not released to sewer-excessive green color	ND	1.6E-8 uCi/ml	No	A
H00568	612	NA	Not listed	2/8/89	M88610723	6/1/89	8801621	No	No	Part of overpack	No	No	No	O
H01296	B-177	Tank	Not listed	2/23/89	M89413382	2/24/90	8900125	No	No	-	4.1E-8 uCi/ml	1.1E-7 uCi/ml	No	A
H02819	151	Not listed	Not listed	12/15/88	See comment	2/2/89	8801545	No	No	Placed on Req H4633	No	No	No	A
H02820	151	Not listed	Not listed	12/15/88	See comment	2/2/89	8801547	No	No	Put on Req H4638	No	No	No	
H02828	151	Not listed	Not listed	1/12/89	See comment	1/17/89	Not listed	No	No	Put on Req H4636	No	No	No	
H04637	612	NA	Not listed	2/3/89	M89561609	2/13/90	None	No	No	Overpack of other waste	No	No	No	
H04670	612	NA	Not listed	4/26/89	M89413242	8/8/89	None	No	No	Overpack	No	No	No	-
H04845	361	1747	Not listed	8/3/89	See comment	Not listed	None	No	No	No manifest attached	No	No	No	
H05000	298	Not listed	Not listed	10/12/89	M8913265	12/11/89	8901190	No	No	-	1.5E-8 uCi/ml	5.0E-8 uCi/ml	2.9E-5 uCi/ml	A
H05153	177	Not listed	Not listed	2/9/89	See comment	10/26/89	8801774	No	No	Placed on Req H39080	1.1E-7 uCi/ml	2.8E-7 uCi/ml	No	A
H05154	177	Not listed	Not listed	2/9/89	See comment	9/12/89	8801774	No	No	Placed on Req H35100	1.1E-7 uCi/ml	2.8E-7 uCi/ml	No	A
H06723	332	1256	Not listed	1/11/90	AR278445	3/27/90	8901159	No	No	Ref. to Req H34343, went to AR278445	2.7E-3 uCi/ml	1.2E-1 uCi/ml	No	A
H06734	332	Ret. tank 2	Not listed	1/9/89	M88610495	4/17/89	8801795	No	No	-	1.7E-8 uCi/ml	2.5E-8 uCi/ml	6.2E-6 uCi/ml	A
H06743	332	Basement	Not listed	12/22/88	See comment	4/6/89	8801371	No	No	Placed on req 4670	2.8E-7 uCi/ml	3.9E-7 uCi/ml	No	O
H06750	332	1313	Not listed	12/15/88	See comment	3/10/89	8801528	No	No	Placed on req 8963	3.4E-6 uCi/ml	1.8E-6 uCi/ml	No	A
H08857	612	NA	Not listed	5/28/89	M89413246	8/10/89	None	No	No	Overpack	No	No	No	-
H08859	612	NA	Not listed	5/28/89	M89413246	8/10/89	None	No	No	Overpacking of acids	No	No	No	-
H08878	612	NA	Not listed	5/26/89	M89413245	8/10/89	None	No	No	Overpack	No	No	No	-
H09327	624	Not listed	Unknown	7/8/89	M89413265	12/11/89	8901392	No	Unknown	Drum of rain water	1.7E-9 uCi/ml	8.8E-9 uCi/ml	No	A
H15971	141	Not listed	Not listed	6/8/89	See comment	Not listed	8900526	No	No	Acid waste rinse water - put into Req 35029	2.2E-8 uCi/ml	2.1E-7 uCi/ml	No	A
H17385	514	Not listed	Not listed	1/25/89	M89561609	2/13/90	8900006	No	No	Placed on Req H4637, went to 89561609	1.2E-7 uCi/ml	2.4E-6 uCi/ml	3.1E-3 uCi/ml	A
H17386	514	Not listed	Not listed	11/30/88	See comment	2/2/89	8801521	No	No	Put into Req H4635	9.1E-7 uCi/ml	9.5E-7 uCi/ml	1.3E-4 uCi/ml	A
H17386						2/2/89	8801522	No	No	Put into Req H4635	3.7E-6 uCi/ml	4.4E-6 uCi/ml	5.4E-5 uCi/ml	A
H17386	514	Not listed	Not listed	1/25/89	See comment	2/2/89	8900006	No	No	Put into Req H4635	1.2E-7 uCi/ml	2.4E-6 uCi/ml	3.1E-3 uCi/ml	A
H17386						2/2/89	8900007	No	No	Put into Req H4635	1.4E-6 uCi/ml	2.0E-6 uCi/ml	1.2E-4 uCi/ml	A
H19701	514	Not listed	Not listed	6/22/88	S 514SRV-1	6/22/88	4581	No	No	Released to sewer	1.7E-8 uCi/ml	2.8E-8 uCi/ml	No	A
H19805	514	Not listed	Not listed	12/23/88	M89413242	8/8/89	8800922	No	No	Placed on Req H4670, went to 89413242	Not listed	Not listed	2.9E-5 uCi/ml	O
H19807	514	Not listed	Not listed	12/23/88	See comment	12/26/88	8801332	No	No	Placed on Req H63635	1.1E-6 uCi/ml	1.4E-6 uCi/ml	No	O
H19808	514	120	Not listed	4/20/89	See comment	5/17/89	8900344	No	No	Placed on Req H8857, went to 89413246	7.2E-8 uCi/ml	3.3E-6 uCi/ml	1.3E-6 uCi/ml	A
H19809	514	120	Not listed	4/20/89	M89413246	8/10/89	8900293	No	No	Placed on Req H8859, went to 89413246	ND	4.2E-7 uCi/ml	5.3E-7 uCi/ml	A
H19810	514	120	Not listed	4/20/89	M89413246	8/10/89	8900390	No	No	Placed on Req H8859, went to 89413246	1.5E-6 uCi/ml	2.5E-5 uCi/ml	1.3E-4 uCi/ml	A
H19811	514	Not listed	Not listed	12/12/88	M89561609	2/13/90	8801671	No	No	Placed on Req H4637, went to 89561609	5.0E-9 uCi/ml	1.4E-6 uCi/ml	2.3E-5 uCi/ml	A
H19812	514	Not listed	Not listed	12/12/88	M89561609	2/13/90	8801670	No	No	Put into Req 4637, went to M89561609	1E-6 uCi/ml	4E-6 uCi/ml	1.4E-5 uCi/ml	A
H19812						2/13/90	8801671	No	No	Put into Req 4637, went to M89561609	5E-9 uCi/ml	1.4E-6 uCi/ml	2.3E-5 uCi/ml	A

Table D-1. Spot checked H-Req data summary.

Spot Checked from files															
H-Req #	Bldg #	Room #	RMMA?	H-Req Date	Manifest #	Manifest Date	Sample #	Swipe/Survey	Process Knowl	Comments	Gross Alpha	Gross Beta	H-3	sludge	
H19812						2/13/90	8801672	No	No	Put into Req 4637, went to M89561609	3E-6 uCi/ml	1.8E-4 uCi/ml	1.1E-2 uCi/ml	A	
H19813	514	Not listed	Not listed	12/23/88	See comment	10/18/89	8801670	No	No	Placed on Req H38365	1.0E-6 uCi/ml	4.0E-6 uCi/ml	1.4E-5 uCi/ml	A	
H19814	514	Not listed	Not listed	12/22/88	S 612SRV-4	12/23/88	8801673	No	No	Released to sewer	2.4E-8 uCi/ml	4.8E-8 uCi/ml	4.5E-6 uCi/ml	A	
H19815	514	Not listed	Not listed	4/20/89	M89413246	8/10/89	8900391	No	No	Placed on Req H8859, went to 89413246	1.5E-6 uCi/ml	2.5E-5 uCi/ml	1.3E-4 uCi/ml	A	
H19816	514	Not listed	Not listed	5/17/89	See comment	7/6/89	8900523	No	No	Placed on Req H23062	7.8E-9 uCi/ml	1.1E-6 uCi/ml	7.4E-5 uCi/ml	A	
H19821	514	Not listed	Not listed	7/13/89	S 514SRV-1	7/6/89	8900756	No	No	Released to sewer	2.3E-10 uCi/ml	3.1E-9 uCi/ml	2.7E-6 uCi/ml	A	
H19893	514	Not listed	Not listed	5/17/89	See comment	7/6/89	8900522	No	No	Placed on Req H23062	1.9E-8 uCi/ml	9.2E-6 uCi/ml	7.4E-5 uCi/ml	A	
H20439	141	Tank	Not listed	1/11/90	M89413326	8/29/89	8910888	No	No	Cross references H Req H20440	No	No	No	A	
H20440	141	Tank	Not listed	1/4/90	M89413326	8/29/89	8901645	No	No	Cross references H Req H20439	3.8E-8 uCi/ml	3.1E-8 uCi/ml	No	A	
H22200	212	Outside	No	3/11/92	M91760064	3/11/92	198918	No	No	Mineral oil, no rad data	No	No	No	O	
H23472	131	Not listed	Not listed	4/14/90	IL4128169	4/14/90	No	No	No	Labpack - numerous other reqs attached	No	No	No	A	
H23473	131	Not listed	Not listed	4/14/90	IL4128169	4/14/90	No	No	No	Labpack - numerous other reqs attached	No	No	No	A	
H23490	341	Not listed	Not listed	4/12/90	M89930389	6/4/90	No	No	No	-	No	No	No	A	
H23518	612	NA	Not listed	12/14/89	M89413375	2/23/90	9000068	No	No	R' Req put in with this H Req	No	No	No	S	
H23740	511	Not listed	Not listed	8/16/90	M89930556	8/23/90	9001439	No	No	-	No	No	No		
H25705	361	1745	Not listed	3/15/90	See comment	3/28/90	No	No	No	Put on Req H57567	No	No	No	A	
H25822	141	Not listed	Not listed	5/17/90	M89930393	6/6/90	9000706	No	No	No rad data	No	No	No	A	
H25998	888	843C	Not listed	10/25/90	Not listed	Not listed	9001484	< 300 dpm/ml	No	No rad data	No	No	No	SI, A	
H26000	888	843	Not listed	10/25/90	Not listed	Not listed	9001484	< 300 dpm/ml	No	No rad data	No	No	No	A	
H26543	321A	1237	No	6/27/91	M91760291	9/22/92	9101254	No	No	Discrepancies on RMMA status, etc.	5.7E-8 uCi/ml	< 2.6E-8 uCi/ml	No	O	
H26543							9202188	No	No		ND	ND	ND		
H27001	511	Not listed	Not listed	8/10/89	AR395954	8/22/89	Not listed	No	No	-	No	No	No		
H28411	514	Not listed	Not listed	4/12/90	See comment	6/1/90	8901014	No	No	Placed on Req H55289, see U, Pu, Am results	No	No	No	SI	
										1.1E-7 uCi/g U-238					
										3.3E-7 uCi/g Pu-239/240					
										1.7E-8 uCi/g Am-241/Pu-238					
H28412	514	Not listed	Not listed	4/12/90	See comment	6/1/90	8901013	No	No	Placed on Req H55289, see U, Pu, Am results	No	No	No	SI	
										3.9E-6 uCi/g U-238					
										2.3E-6 uCi/g Pu-239/240					
										3.9E-7 uCi/g Am-241/Pu-238					
H28487	514	Not listed	Not listed	7/12/89	See comment	7/12/89	9100186	No	No	No rad data, but turned to Req R019733	see comment	see comment	see comment		
H28489	514	Tank	Not listed	4/1/91	B 91114	4/2/91	9100358	No	No	Not sure of "B" designation for deposition	2.6E-8 uCi/ml	7.0E-8 uCi/ml	3.9E-5 uCi/ml	A, S	
H28490	514	Tank	Not listed	4/1/91	B91114	4/2/91	9100386	No	No	Unsure of "B" manifest meaning	1.3E-8 uCi/ml	7.0E-8 uCi/ml	1.5E-5 uCi/ml	S, A	
H28605	141	Tank	Not listed	1/11/90	See comment	4/10/90	8901645	No	No	References H Reqs H20439 and H204440	No	No	No		
H28671	141	Not listed	Not listed	1/11/90	M89413326	1/16/90	8901755	No	No	-	2.2E-8 uCi/ml	1.9E-8 uCi/ml	No	A	
H28742	251	Not listed	Not listed	9/27/90	M90271782	1/2/91	9001734	No	No	-	ND	1.0E-6 uCi/ml	No	A	
H28743	251	Not listed	Not listed	9/27/90	See comment	10/8/90	9001733	No	No	Placed on Req H54314	No	3.3E-7 uCi/ml	No	A	
H28749	151	Not listed	Not listed	5/10/90	See comment	5/18/90	900229	No	No	Placed on Req H54980	No	No	No	O	
H30852	231	1100	Not listed	2/26/90	M89930363	5/24/90	8901240	No	No	-	1.6E-7 uCi/ml	1.0E-04 uCi/ml	No	A	

Table D-1. Spot checked H-Req data summary.

Spot Checked from files														Aqueous, Oil, solid, sludge
H-Req #	Bldg #	Room #	RMMA?	H-Req Date	Manifest #	Manifest Date	Sample #	Swipe/Survey	Process Knowl	Comments	Gross Alpha	Gross Beta	H-3	
H30996	231	Not listed	Not listed	Not listed	Not listed	Not listed	9101887	No	No	H Req not attached, but sample data is	ND	< 3.8E-8 uCi/ml	3.6E-5 uCi/ml	A
H31202	361	1664	Yes	1/30/92	M91760205	7/2/92	No	No	Yes	No rad data, based on Gen. knowledge	No	No	No	A
H31222	361	1745	Yes	2/14/91	M91760040	2/7/92	No	No	Yes	No rad data, based on Gen. knowledge	No	No	No	A
H31225	361	1745	Yes	5/19/91	M91760054	2/28/92	No	No	Yes	No rad data, based on Gen. knowledge	No	No	No	A
H40189	511	Not listed	Yes	4/25/91	B 92103	3/19/92	None	Swipe < bckd	Yes	Fluorescent lights	No	No	No	S
H41055	531	Not listed	Not listed	4/3/91	M90271967	6/20/91	No	Yes - < bckgrd	No	-	No	No	No	A
H44431	332	Not listed	Not listed	5/10/90	AR425188	7/3/90	Not listed	No	No	Placed on req 55017	ND	Not listed	Not listed	
H46142	332	Not listed	Not listed	8/26/91	S 612SRV-4	9/26/91	9101697	No	No	Released to sewer, **data is total sol. & liq.	2.9E-8 uCi/ml	9.5E-9 uCi/ml	3.6E-6 uCi/ml	A
H48674	321C	E Yard	No	11/29/90	M90271772	12/12/90	9001996	No	No	Coolant - trimsol	9.6E-8 uCi/ml	1.4E-7 uCi/ml	No	A
H48690	321C	Not listed	Not listed	2/7/91	M90271891	4/5/91	9002302	No	No	Coolant wash water	< 7.3E-8 uCi/ml	5.2E-7 uCi/ml	No	A
H55227	612	NA	Not listed	5/23/90	M89930386	5/30/90	Not listed	No	No	Numerous H Reqs listed, part of overpack	No	No	No	
H62807	361	1342	Yes	2/28/91	M91760025	1/24/92	Not listed	No	Yes	Aqueous solution, no rad data	No	No	No	A
H70086	175	Not listed	Not listed	6/13/91	S612SRV-4	9/19/91	9100797	No	No	Released to sewer	< 3.5E-9 uCi/ml	< 9.4E-9 uCi/ml	5.5E-7 uCi/ml	A
Not listed	322	E Yard	Not listed	Not listed	Not listed	Not listed	8901210	No	No	No req attached	< 2.7E-7 uCi/ml	< 2.4E-7 uCi/ml	No	A
Not listed	490	Not listed	Not listed	Samp. 3/4/91	Not listed	Not listed	9100410	No	No	No H Req attached to sample results	1.0E-7 uCi/ml	1.8E-7 uCi/ml	6.3E-5 uCi/ml	O
											Key: Before moritorium After moritorium			

Table D-2. Random H-Req data summary

H-Req #	Bldg #	Room #	RMMA?	H-Req Date	Manifest #	Manifest Date	Sample #	Swipe/Survey Data	Process Known	Comments	Gross Alpha	Gross Beta	H-3	Aqueous, oil solid, sludge
H6758	332	Not listed	Not listed	3/22/90	See comment	Not listed	No	No	No	Waste from vac. pump - put into Req 51368	No	No	No	S, O
H8831	151	Not listed	Not listed	9/28/89	M91760005	1/7/92	No	Screening form	No	No screening levels listed beside bkcd level	No	No	No	S
H9308	612	NA	NA	7/3/89	M89413243	8/8/89	NA	No	Unknown	Contains several sub Reqs	No	No	No	A
H10452	332	Not listed	Not listed	3/24/90	See comment	Not listed	No	No	No	(leaded glass) Put into Req 51368	No	No	No	S
H12405	241	Not listed	Not listed	9/14/89	M91760005	1/7/92	No	No	No	Lab Waste	No	No	No	Sl, A
H14042	322	Not listed	Not listed	12/21/89	M89413395	3/13/90	8901210	No	No	Reqs H14043-H14048 put on this req	2.7E-7 uCi/mL	2.4E-7 uCi/ml	No	A
H20811	175	Not listed	Not listed	3/22/90	See comment	Not listed	No	No	No	Mechanical pump oil - put into Req 51368	No	No	No	O
H22230	391-W	Not listed	Not listed	3/22/90	See comment	Not listed	No	No	No	Ethyl Alc. 5 gal. empty can - put into Req 51368	No	No	No	A
H24081	490	Not listed	Not listed	3/24/90	See comment	Not listed	No	No	No	Oil soaked rags - put into Req 51368	No	No	No	S, O
H25103	361	1664	Not listed	7/30/89	M89930279	4/12/90	No	No	No	Cleanup of spill waste	No	No	No	S
H25357	113	Not listed	Not listed	12/13/90	See comment	Not listed	NA	No	Unknown	Sent for silver recovery, put into H63908	No	No	No	A
H28227	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28228	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28229	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28230	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28231	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28232	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28233	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28234	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28235	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H28434	514	Not listed	Not listed	8/22/90	M90895294	8/16/91	9101425	No	No	Kodak silver recovery (data not attached)	ND	ND	ND	S
H31531	366	Not listed	Not listed	3/29/90	M89930254	4/4/90	NA	No	No	Part of lab pack, medical waste	No	No	No	S
H33181	322	Not listed	Not listed	8/2/90	AR461921	11/2/90	9001060	No	No	Cross-referenced to H45030	3.6E-7 uCi/g	4.5E-6 uCi/g	No	S
H45900	251	Not listed	Not listed	12/20/90	M90271799	1/14/91	9002024	No	Unknown	Included into Req 63908 for disposition	6E-8 uCi/ml	2.5E-6 uCi/ml	No	O
H48458	235	1100	Yes	8/1/91	M91760105	4/3/92	NA	No	Yes	RMMA/Non-RMMA decl.	No	No	No	S
H49908	222	1520B	Yes	4/4/91	M91760107	4/3/92	NA	No	Yes	RMMA/Non-RMMA decl.	No	No	No	S, A
H49908					M90895389	4/1/92								
H51368	612	NA	NA	3/20/90	89930234	4/4/90	NA	No	Unknown	Contained > 100 sub Reqs	No	No	No	S
H55497	612	NA	NA	6/8/90	Not listed	Not listed	No	No	Unknown	Over pack of lab packs	No	No	No	A
H59861	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H59862	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H59863	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H59864	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H59872	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H59873	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H59874	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H59875	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H59876	222	Exterior	Not listed	Not listed	M89930254	4/4/90	8901306	No	No	No req forms, numerous reqs listed on results	5.0E-06 uCi/g	1.5E-05 uCi/g	No	SI
H60911	612	Not listed	Not listed	1/7/91	M91760005	1/7/92	NA	No	No	Misc. liquids into labpacks	No	No	No	A
H63659	612	NA	NA	11/5/90	MAR461962	10/4/91	NA	No	Unknown	Over pack of chemicals	No	No	No	S
H63851	612	NA	NA	1/7/91	M91760005	1/7/92	No	No	No	Over pack of lab packs (from H39432)	No	No	No	A

Table D-2. Random H-Req data summary

[illegible]

Table D-3. Biased H-Req data summary

Biased H-Reqs											Radiological Analysis			Aqueous, oil solid, sludge
H-Req #	Bldg #	Room #	RMMA?	H-Req Date	Manifest #	Manifest Date	Sample #	Swipe/Survey Data	Process Knowledge	Comments	Gross Alpha	Gross Beta	H-3	
H2820	151	Not listed	Not listed	12/15/88	See comment	2/2/89	8801547	No	No	Put on H-Req H4638 for disposition	No	No	No	A
H2828	151	Not listed	Not listed	1/12/89	See comment	1/17/89	None	No	No	Put on H-Req H4636 for disposition	No	No	No	A
H6703	332	Ret. tank 2	Not listed	6/30/88	M87250869	7/21/88	8804157	No	No	-	6.7E-8 uCi/ml	5.0E-8 uCi/ml	2.8E-6 uCi/ml	A
H6728	332	Ret. tank 1	Not listed	2/23/89	M87250967	3/3/89	8801665	No	No	-	1.3E-8 uCi/ml	4.7E-7 uCi/ml	5.9E-6 uCi/ml	A
H6741	332	Ret. tank 1	Not listed	2/23/89	M87250967	3/3/89	8801665	No	No	-	1.3E-8 uCi/ml	4.7E-7 uCi/ml	5.9E-6 uCi/ml	A
H6903	419	Not listed	Not listed	7/22/88	M87250898	10/19/88	NA	No	No rad in waste	HWM Tag attached	No	No	No	S
H6963	419	Not listed	Not listed	5/14/89	M88610723	6/1/89	8801390	No	Not listed	-	1.6E-6 uCi/ml	2.2E-6 uCi/ml	No	A
H6964	419	Not listed	Not listed	5/4/89	M88610723	6/1/89	8801390	No	Not listed	-	1.6E-6 uCi/ml	2.2E-6 uCi/ml	No	A
H6968	419	Not listed	Not listed	6/29/89	M89413293	10/9/89	8900662	No	Unknown	55 gal. drum of liq. waste	2.8E-9 uCi/ml	ND	No	A
H15180	332	Ret. tank	Not listed	11/9/89	M89413273	11/22/89	8901134	No	No	-	6.6E-9 uCi/ml	3.2E-7 uCi/ml	5E-7 uCi/ml	A
H17388	514	Not listed	Not listed	1/25/89	See comment	2/2/89	8900007	No	No	Put on H-Req H4634 for disposition	1.4E-6 uCi/ml	2.0E-6 uCi/ml	1.2E-4 uCi/ml	A
H19803	514	Tank	Not listed	4/17/89	S 514SRV-2	5/1/89	8900345	No	No	Released to sewer	1.7E-8 uCi/ml	6.0E-8 uCi/ml	2.2E-6 uCi/ml	A
H19804	514	120	Not listed	1/12/88	See comment	4/20/89	8801743	No	No	Placed on Req H8878, went to 89413245	3.4E-6 uCi/ml	6.8E-6 uCi/ml	1.0E-4 uCi/ml	A
H19819	514	Not listed	Not listed	10/12/89	M89413286	11/6/89	8900672	No	No	-	1.9E-8 uCi/ml	1.3E-8 uCi/ml	2.1E-4 uCi/ml	A
H22129	419	Not listed	No	1/24/91	M90895339	10/30/91	NA	No	Empty Batteries	Moratorium sheet attached	No	No	No	S
H22186	419	Not listed	Not listed	12/20/90	M90271966	6/20/91	9002327	No	Battery acid	No rad anal. requested	No	No	No	A
H22754	514	Not listed	Not listed	12/7/89	M89413262	12/11/89	8901287	No	No	Units for rad not clear on H Req	see comment	see comment	see comment	
H22755	514	Not listed	Not listed	12/7/89	M89413262	12/11/89	8901287	No	No	Only gives total currie content, no conc.	See comment	See comment	ND	A
H26133	331	Not listed	Yes	1/24/91	M91760025	1/24/92	9102552	Unknown	Unknown	Rad added to waste	ND	ND	2.8E-5 uCi/ml	A
H26133					M90271913	Not listed								
H26140	331	Yard	Yes	3/21/91	MAR517595	2/14/92	NA	No	Unknown	Cert. Form	No	No	No	A
H26161	331	Not listed	Yes	4/4/91	M91760025	1/24/92	I1301	Yes (unattached)	Unknown	Det. non rad	Yes (1 b&g, 1 H-3) not att.			
H26175	331	154	Yes	3/21/91	M91760049	2/21/92	NA	No	No rad in waste	Cert. Form	No	No	No	S
H44443	332	Not listed	Not listed	7/12/90	Not listed	Not listed	9001291	No	No	Several reqs bulked. No manifest or req listed	ND	No	No	A
H46126	332	1369	Yes	11/21/91	M92258846	10/27/92	Swipe only	Swipe (-cbkd)	No	-	ND (Swipe data)	8.3E-3 dpm/cm2 (swipe)	8.6E-2 dpm/cm2 (swipe)	
H46143	332	1321/1329	Yes	10/10/91	See comment	Not listed	None	No	No	No manifest, sample data included with Req	No	No	No	
H62222	331	Unknown	Unknown	Unknown	IL4128151	4/14/90	NA	No		Lab Pack	No	No	No	A
H69411	514B	105	Yes	9/11/91	90895373	12/16/91	9101579	No	No	-	< 6.6E-8 uCi/ml	3.1E-6 uCi/ml	ND	A
H70085	514	Not listed	Not listed	8/4/88	M90271926	4/25/91	9100147	No	No	-	< 3.1E-8 uCi/ml	< 3.4E-8 uCi/ml	5.8E-5 uCi/ml	A
Key: Before moratorium After moratorium														

APPENDIX E

H-Req Waste Designation

DOE-HQ Moratorium Definitions

The DOE-HQ moratorium data request asked the DOE sites to categorize the waste shipments as known radioactive, clean, likely radioactive, or likely clean using the criteria in the following subsections. The data request provided guidance for assigning these categories. The process for classifying these wastes is illustrated in Figure E-1.

Radioactive Waste

Radioactive waste is any waste with radioactivity that was added to the volume or bulk of the waste as a result of DOE operations, as indicated by (a) material use history (i.e., use in a radioactive system or radioactive spill recovery), (b) sampling and analysis results showing radioactivity above background (background includes natural levels of radiation in materials), or (c) waste that has excessive surface contamination due to DOE operations as shown by surface survey results. Waste known to be potentially radioactively contaminated through material use history must be sampled to determine the activity content of the sample. Many wastes have no potential for being internally contaminated by radioactivity, but are present in radioactive materials management areas (RMMAs) where the potential for external contamination is present. For these wastes, a surface contamination survey must be performed, with results compared to surface contamination limits in DOE Order 5400.5. DOE-HQ has defined a nonradioactive waste as a waste that meets the following conditions (DOE 1993):

- The waste contains no added radioactivity (at a 95% confidence level above background) in volume or bulk resulting from DOE operations [except wastes specifically exempted by the U.S. Environmental Protection Agency (EPA), DOE, or Nuclear Regulatory Commission (NRC) regulations]
- The waste has no surface radioactivity above limits established in DOE Orders or guidance [e.g., surface contamination limits and requirements of DOE Order 5400.5, II.5.c.(1)].

Clean Waste

Many DOE operations do not occur in an RMMA or have the potential for adding radioactive contamination to waste material. Clean waste is waste that originates outside an RMMA and has surface contamination levels less than DOE Order 5400.5 guidelines. The classification of clean waste can be broadened to include wastes that originate within an RMMA if these wastes can be verified clean by documented evidence of administrative controls, process knowledge, or sampling and analysis results showing no activity above background levels. Sampling and analysis results, and/or survey results, or administrative and material history documentation is required to characterize a waste as radioactive or clean.

Figure E-1. DOE waste classification decision tree.

Likely Radioactive Waste

Likely radioactive wastes are wastes shipped from LLNL that have limited retrievable documentation of sampling and analysis, survey results, administrative control, or material history documentation to enable classification of the waste as either known radioactive or clean. Wastes classified as likely radioactive waste are wastes that are similar in form/type and originate from the same process/area as wastes classified as known radioactive. Wastes classified as likely radioactive wastes imply a DOE operation may have added radioactivity to the volume or bulk of the waste or that surface contamination levels may exceed DOE Order 5400.5 guidelines.

Likely Clean Waste

Similar to likely radioactive waste, likely clean waste is waste originating from an RMMA and similar in form/type and origin as wastes classified as clean. For these wastes, documented evidence of administrative controls, process knowledge, or analytical data are not available to show DOE operations added no radioactivity to the waste bulk or volume, nor does evidence exists to verify the surface contamination is less than DOE Order 5400.5 guidelines.

Table E-1. Spot checked H-requisition waste designation.

Spot-check Reqs							
H-Req	Manifest	RMMA	Manifest Date	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H2820	H4638	Yes	12/15/88			X (To TSD?)	
H2828	H4636	Yes	1/12/89			X (To TSD?)	
H6703	87250869	Yes	7/21/88	X			
H6728	87250967	Yes	3/3/89	X			
H6741	87250967	Yes	3/3/89	X			
H6903	87250898	Yes	10/19/88		X		
H6963	88610723	Yes	6/1/89	X			
H6964	88610723	Yes	6/1/89	X			
H6968	89413293	Yes	10/9/89		X		
H15180	89413273	Yes	11/22/89	X			
H17388	H4634	Yes	2/2/89	X (To TSD?)			
H19803	S 514SRV-2	Yes	5/1/89		X		
H19804	89413245	Yes	8/10/89	X			
H19819	89413286	Yes	11/6/89	X			
H22129	90895339	Yes	10/30/91				X
H22186	90271966	Yes	6/20/91				X
H22754	89413262	Yes	12/11/89	X			
H22755	89413262	Yes	12/11/89	X			
H26133	91760025	Yes	1/24/92	X (To TSD?)			
H26140	AR517595	Yes	2/14/92				X
H26161	91760025	Yes	1/24/92		X		
H26175	91760049	Yes					X
H44443	Not listed	Yes	Not listed				X (To TSD?)
H46126	92258846	Yes	10/27/92		X		
H46143	Not listed	No (room)	Not listed				X (To TSD?)
H62222	IL4128151	Yes	4/14/90				X
H69411	90895373	Yes	12/16/91	X			
H70085	U H70012	Yes	8/24/91	X (To TSD?)			
H517	87250958	No	1/31/89		X		
H518	87250967	No	3/3/89		X		
H530	H4692	No	2/21/89	X (To TSD?)			
H559	87250967	Yes	3/3/89		X		
H568	88610723	Yes (612)	6/1/89				X
H1296	89913382	Yes	2/24/90	X			
H2819	H4633	Yes	2/2/89			X (To TSD?)	
H4845	89143	No (Room)	11/21/89				X
H5000	89413265	Yes	12/11/89	X			
H5153	H39080	Yes	10/26/89	X (To TSD?)			
H5154	H35100	Yes	9/12/89	X (To TSD?)			
H6723	AR278445	Yes	1/11/90	X			
H6734	88610495	Yes	4/17/89	X			
H6743	H4670	Yes	4/6/89	X (To TSD?)			
H6750	H8963	Yes	3/10/89	X (To TSD?)			
H9327	89413265	Yes (612)	12/11/89		X		
H15971	H35029	No	9/7/89	X (To TSD?)			
H17386	H4635	Yes	2/2/89	X (To TSD?)			

Table E-1. Spot checked H-requisition waste designation (cont'd).

Spot-check Reqs							
H-Req	Manifest	RMMA	Manifest Date	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H19701	S 514SRV-1	Yes	6/22/88		X		
H19803	S 514SRV-2	Yes	5/1/89		X		
H19804	89413245	Yes	8/10/89	X			
H19805	89413242	Yes	8/8/89	X			
H19807	U H63635	Yes	12/26/88	X (To TSD?)			
H19808	89413246	Yes	8/10/89	X			
H19809	89413246	Yes	8/10/89	X			
H19810	89413246	Yes	8/10/89	X			
H19815	89413246	Yes	8/10/89	X			
H19811	89561609	Yes	2/13/90	X			
H19812	89561609	Yes	2/13/90	X			
H17385	89561609	Yes	2/13/90	X			
H19813	H38365	Yes	10/18/89	X (To TSD?)			
H19814	S 612SRV-4	Yes	12/23/88	X			
H19816	H23062	Yes	7/6/89	X (To TSD?)			
H19821	S 514SRV-1	Yes	7/6/89		X		
H19893	H23062	Yes	7/6/89	X (To TSD?)			
H22200	91760064	No	3/11/92		X		
H23472	IL4128169	Yes	4/14/90				X
H23473	IL4128169	Yes	4/14/90				X
H23490	89930389	Yes	4/13/90				X
H23518	89413375	Yes (612)	2/23/90			X	
H23470	89930556	No	8/23/90		X		
H25705	H57567	Yes	3/28/90				X
H25822	89930393	No	6/6/90		X		
H25998	Not listed	No	Not listed		X		
H26543	91760291	No	9/22/92	X			
H27001	AR395954	Yes	8/22/89				X
H28411	89930399	Yes	6/12/90	X			
H28412	89930399	Yes	6/12/90	X			
H28487	R19733	Yes	7/12/89			X	
H28489	B91114	Yes	4/2/91	X (To TSD?)			
H28490	B91114	Yes	4/2/91	X (To TSD?)			
H28605 H20439 H20440	89413326	No	8/29/89	X			
H28671	89413326	No	8/29/89	X			
H28742	90271782	Yes	1/2/91	X			
H28743	H54314	Yes	10/8/90	X (To TSD?)			
H28749	H54980	Yes	5/18/90			X	
H30852	89930363	Yes	5/24/90	X			
H30996	Not listed	Yes	Not listed	X (To TSD?)			
H31202	91760205	Yes	7/2/92		X		
H31222	91760040	Yes	2/7/92				X

Table E-2. Biased H-requisition waste designation.

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H1907	89413280	No				X
H1909	88610504	Yes				X
H1915	87250917	Yes				X
H1916	87250928	Yes				X
H1917	87250921	Yes				X
H1918	87250646	Yes				X
H14601	87250928	Yes				X
H14602-H14603	LA1152283	Yes				X
H14605	LA1020677	Yes				X
H14629	LA1020677	Yes				X
H14630	LA1020677	Yes				X
H14648	88461308	Yes				X
H14649	89413244	Yes				X
H14656	89413233	Yes				X
H14659	89413233	Yes				X
H14663	AR461929	Yes				X
H14667	90271760	Yes				X
H26136	90271902	Yes				X
H26139	90271967	Yes				X
H26141-H26142	AR517595	Yes				X
H26144-H26145	90271976	Yes				X
H26156-H26157	91760040	Yes				X
H26160	90271968	Yes				X
H26162	90271969	Yes				X
H26166	91760025	Yes				X
H26167	AR517595	Yes				X
H26168	90895389	Yes				X
H26169	90271913 91760040	Yes				X
H26176	91760049	Yes				X
H31552	AR517587	Yes				X
H31692	90271913 90271968 90895372	Yes				X
H31719	89930556	Yes				X
H61571-H61573	88411082	Yes				X
H61901-H61904	IL3237944	Yes				X
H61964-H61987	IL4128151	Yes				X
H62140	IL4128248	Yes				X
H62147-62150	IL3237945	Yes				X
H62189-62195	IL3237942	Yes				X
H62196-H62200	IL3237944	Yes				X
H62223-H62224	IL4128151	Yes				X
H62619-H62622	88655972	Yes				X
H62714-H62729	IL4128191	Yes				X
H66701	90895389	Yes				X
H519	88610728	Yes		X		

Table E-2. Biased H-requisition waste designation (cont'd).

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H6901	87250898	Yes		X		
H6902	87250872 87250891	Yes		X		
H6904	87250900	Yes		X		
H6906	87250876	Yes		X		
H6951-H6953	89413211	Yes		X		
H6955	87250960	Yes		X		
H6956	89413247	Yes		X		
H6966	89413247	Yes		X		
H6969-H6970	L89088	Yes		X		
H6973-H6974	89413247	Yes		X		
H8844	88461313	Yes		X		
H19783-H19784	87250960	Yes			X	
H22103	90271810	Yes		X		
H22110	89930464	Yes		X		
H22111	90271810	Yes		X		
H22114	90271810	Yes		X		
H22125	90271944	Yes		X		
H22130	90895339	Yes		X		
H22131	91760025	Yes		X		
H22132	90895339	Yes		X		
H22150	90895329	Yes		X		
H22163	90271935	Yes		X		
H22165-H22166	90895339	Yes		X		
H22168	90895303	Yes		X		
H22169-H22171	90895372	Yes		X		
H22203	90895303	Yes		X		
H22204-H22205	90895355	Yes		X		
H22207	90895372	Yes		X		
H22222	90271810	Yes		X		
H22223	90271935	Yes		X		
H22224	90271810	Yes		X		
H23423-H23424	89930389	Yes			X	
H23454	89930354	Yes		X		
H19004	87250672	Yes				X
H13927-H13928	87250960	Yes				X
H13941	88610504	Yes				X
H13967	87250646	Yes				X
H44447-H44448	89930488	Yes		X		
H44481-H44482	89930309	Yes	X			
H46125	97091	Yes		X		
H46132	91760186	Yes		X		
H46133	91760222	Yes		X		
H46144	Not Listed	Yes		X		
H6702	87250904	Yes				X

Table E-2. Biased H-requisition waste designation (cont'd).

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H6705	87250879	Yes				X
H6706	87250869	Yes				X
H6709	87250963	Yes				X
H6714	87250876	Yes				X
H6718	89413222	Yes				X
H6732	872507895	Yes				X
H6735	87250943 87250962	Yes				X
H6736	87250940	Yes				X
H6737	87250917	Yes				X
H6739	87250928	Yes				X
H6744	L-89087	Yes				X
H6748	87250963	Yes				X
H6751	88461298 88610922	Yes				X
H6799	87250956 87250962	Yes				X
H7002	87250951 87250962	Yes			X	
H7003	87250951 87250962	Yes				X
H7004	87250956 87250962	Yes				X
H10430	89413242 89413244	Yes				X
H10449	88461298	Yes			X	X
H19610	87250868	No		X		
H26201	AR517588	Yes				X
H26790	89930321	Yes				X
H26824	89930556	Yes				X
H44418	90271952	yes				X
H46126	92258817 92258846	Yes				X
H46135	91760205	No		X		X
H46145	90895351	No		X		X
H46156	91760147	Yes				X
H46157	91760213	Yes				X
H46158	90271975	Yes				X
H46159	90895367	Yes				X
H46160	91760068	Yes				X
H39391	89930543	Yes				X
H39395-H39410	89413382	Yes				X
H23457	89930389 89930495	Yes				X
H23862-H23865	89930495	Yes				X
H23867-H23869	89930495	Yes				X
H33937	AR269314	Yes				X
H33979	90271898	Yes				X

Table E-2. Biased H-requisition waste designation (cont'd).

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H44968	AR485808	Yes				X
H44969	AR461930	Yes				X
H44970	90271772	Yes				X
H44971	AR485422	Yes				X
H44972	89986276	Yes				X
H44974	223157	Yes				X
H44975	AR461930	Yes				X
H44976	AR485808	Yes				X
H44977-H44978	AR461930	Yes				X
H46476	91760128	No		X		
H55676	89930389	Yes				X
H55677	89930440	Yes				X
H55691	89930354	Yes				X
H55692	89930440	Yes				X
H55693	89930389	Yes				X
H55695	89930354	Yes				X
H55696-H55698	89930389	Yes				X
H55700	89930468	Yes				X
H64001	90895372	No			X	
H71467	9170244	No			X	
H72407-H72408	91760025	No			X	
H559	87250967	No			X	
H513	87250951	No			X	
H2333-H2334	89413252	No			X	
H4113	87250933 87250950	No			X	
H6623	89413280	No			X	
H6628	89413233	No			X	
H6633	89413233	No			X	
H6637	89413241	No			X	
H6640	89413244	No			X	
H6641-H6642	89413227	No			X	
H6676	89413241	No			X	
H6678	89413293	No			X	
H6700	89413241	No			X	
H7001	87250951 87250962	No			X	
H7005	87250956 87250962	No			X	
H7006	87250956 87250962	No			X	
H7007	87250956 87250962	No			X	
H7008	87250956 87250962	No			X	
H7009	87250956 87250962	No			X	

Table E-2. Biased H-requisition waste designation (cont'd).

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H7010	87250956	No			X	
H7011	87250939	No			X	
H7012	87250956 87250962	No			X	
H7013	87250956 87250962	No			X	
H7014	87250956 87250962	No			X	
H7015	87250956 87250962	No		X		
H7016	87250956 87250962	No		X		
H7017	87250956 87250962	No		X		
H7018-H7023	87250960	No		X		
H7024	87250956 87250962	No		X		
H7025	87250956 87250962	No		X		
H7026	87250956 87250962	No		X		
H7027	87250956 87250962	No		X		
H7028	87250956 87250962	No		X		
H7029	87250956 87250962	No		X		
H7030	87250956 87250962	No		X		
H7031	87250956 87250962	No		X		
H7032	87250956 87250962	No		X		
H7033	87250956 87250962	No		X		
H7034	87250956 87250962	No		X		
H7035	87250956 87250962	No		X		
H7036	87250956 87250962	No		X		
H7037	87250956 87250962	No		X		
H7038	87250956 87250962	No		X		
H7039	87250956 87250962	No		X		
H7040	87250956 87250962	No		X		
H7041	87250956 87250962	No		X		
H7042	87250956 87250962	No		X		

Table E-2. Biased H-requisition waste designation (cont'd).

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H7044	87250956 87250962	No		X		
H7045	87250956 87250962	No		X		
H7046	87250956 87250962	No		X		
H7047	87250956 87250962	No		X		
H7048	87250956 87250962	No		X		
H7049	87250956 87250962	No		X		
H7050	87250956 87250962	No		X		
H7051	87250956 87250962	No		X		
H7052	87250956 87250962	No		X		
H7053	87250956 87250962	No		X		
H7055	88461299 88601502	No		X		
H7056	88461299 88601502	No		X		
H7057	88461299 88601502	No		X		
H7058	88461299 88601502	No		X		
H7059	88461299 88601502	No		X		
H7060	88461299 88601502	No		X		
H7062	88461299 88601502	No		X		
H7063	88461298 88601501	No		X		
H7064	88461298 88601501	No		X		
H7065	88461298 88601502	No		X		
H7066	88461298 88601502	No		X		
H7067-H7074	89413293	No		X		
H7075	89413280 89413293	No		X		
H7076-7089	89413293	No		X		
H7090-7094	89413265	No		X		
H8880	88461308	No		X		
H13113	88413252	No		X		
H13135	88413252	No		X		
H13152-H13157	87250899	No		X		
H13158	87250939	No		X		

Table E-2. Biased H-requisition waste designation (cont'd).

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H13159-H13160	87250899	No		X		
H13164-13178	87250885 87250890	No		X		
H13182-13186	87250885 87250890	No		X		
H13188	87250885 87250890	No		X		
H13189-H13190	87250960	No		X		
H13191-13199	87250885 87250890	No		X		
H13201-13225	87250921	No		X		
H13241-H13243	87250956 87250962	No		X		
H13244	87250672 88535038	No		X		
H13245	88610723	No		X		
H13253-H13254	89413211	No		X		
H13256	89413286	No		X		
H13260	89413233	No		X		
H13276	87250672 88535038	No		X		
H13278-H13280	88461298 88601501	No		X		
H13294-H13299	88610503	No		X		
H69490	91760126	Yes		X		
H6911-H69612	89413256	Yes				X
H6924	89930218	Yes				X
H6927	89413284	Yes				X
H6934-H6938	89413286	Yes				X
H6940-6945	89413286	Yes				X
H6950	88610495	Yes				X
H9723	89413344	Yes				X
H17309-H17312	87250898	Yes				X
H17312	87250927	Yes				X
H17316	87250927	Yes				X
H19670	87250927	Yes				X
H19785	89413252	Yes				X
H19789-H19791	89413252	Yes				X
H19806	87250956	Yes				X
H19820	885345038	Yes				X
H19823-H19826	89413286	Yes				X
H19827	89413222	Yes				X
H19828	89413286	Yes				X
H19830-H19831	89930218	Yes				X
H19833	88610495	Yes				X
H19835	87250957	Yes				X
H19891	88461302	Yes				X

Table E-2. Biased H-requisition waste designation (cont'd).

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H19895	89413244	Yes				X
H19900	88461313	Yes				X
H19956	87250927	Yes			X	
H22730	89930218	Yes				X
H22756	89930279	Yes				X
H28402-H28403	89930218	Yes				X
H28406-H28409	89930586	Yes				X
H28414-428415	89930586	Yes				X
H28421	89930543	Yes				X
H28422	89930586	Yes				X
H28424	89930543	Yes				X
H28426	89930581	Yes				X
H28427	89930586	Yes				X
H28428	89930581	Yes				X
H28432	89930581	Yes				X
H28434	90895294	Yes				X
H28435	90271904	Yes				X
H28460	90895359	Yes				X
H28461	90271904	Yes				X
H28462	90895369	Yes				X
H28463	90271755	Yes				X
H28464-H28465	90271754	Yes				X
H28466	90271904	Yes				X
H28467-H28468	90895369	Yes		X		
H28482	90271868	Yes		X		
H28483	90895369	Yes		X		
H28485	90895369	Yes				X
H28486	90271940	Yes				X
H28491-H28492	9071940	Yes				X
H28493-H28497	90271967	Yes				X
H28500	89930218	Yes				X
H28523	89930218	Yes				X
H28553	90895369	Yes				X
H28554	90271961	Yes				X
H28555-H28556	90271967	Yes				X
H44967	AR485808	Yes		X		
H44973	AR461930	Yes		X		
H69402	90271969 90271975	Yes				
H69403	91760147	Yes				
H69409	91760209	Yes				
H69410	91760147	Yes				
H69413-H69414	91760147	Yes		X		
H69415	91760199	Yes		X		
H69416	91760110	Yes		X		

Table E-2. Biased H-requisition waste designation (cont'd).

Biased Reqs						
H-Req	Manifest	RMMA	Known Radioactive	Clean Waste	Likely Radioactive	Likely Clean
H69417	AR557561	Yes		X		
H69478	90895275	Yes		X		
H69479	90895369	Yes		X		
H69480	91760147	Yes		X		
H69481	90895351	Yes		X		
H69482-H69483	AR517587	Yes		X		
H69484	91760110	Yes		X		
H69485-H69486	91760171	Yes		X		
H69487	91760110	Yes		X		
H69488	91760244	Yes				X
H69488	AR517584 AR517587	Yes				X
H4634-H4651	89561609	Yes (612)	X			
H8964	89561609	Yes (612)				X
H23054-H23057	89561609	Yes (612)				X
H23065-H23068	89561609	Yes (612)				X
H23073	89561609	Yes (612)				X
H23514-H23516	89561609	Yes (612)				X
H58408	89561609	Yes (612)				X
H58411	89561609	Yes (612)				X
H58415-H58419	89561609	Yes (612)				X
H58422	89561609	Yes (612)				X
H58450	89561609	Yes (612)				X
H58455	89561609	Yes (612)				X
H58458	89561609	Yes (612)				X
H58476-H58477	89561609	Yes (612)				X