



Low-Level Radioactive Waste Tracking - 2010

Annual Report

August 2015

Pursuant to California Health and Safety Code, section 115000.1, this report provides information regarding quantities of low-level radioactive waste generated in the state of California and aggregated by the county of generation for dissemination to the public.

Page intentionally left blank

Executive Summary

This report summarizes data for low-level radioactive waste (LLRW) generated in the state of California. LLRW is a byproduct of the beneficial uses of a wide range of radioactive materials. These uses include electricity generation, medical diagnosis and treatment, academic, industrial, biomedical and pharmaceutical research, and manufacturing. California Health and Safety Code section 115000.1 specifies the generation of an annual report summarizing, by type of generator and county within the state, the nature, characteristics, and quantities of LLRW generated in California.

During the 2010 reporting year, the LLRW generated in California totals 3405 cubic meters of radioactive waste. The waste disposal class further summarizes the LLRW data, with 3401 cubic meters of class A waste, 0 cubic meters of class B waste, and 4 cubic meters of class C waste.

The LLRW information presented in this report is comprised of data submitted and entered into the LLRW tracking database as of December 30, 2013. Additional data will be added to the database as it is received from the LLRW generators.

Acronym List

Acronym	Defined
CDPH	California Department of Public Health
LLRW	low-level radioactive waste
mR/hr	milli Roentgen per hour - a measure of radiation exposure rate
mrem/hr	milli REM per hour - a measure of radiation dose equivalent rate
mSv/hr	milli Sievert per hour - a measure of radiation dose equivalent rate
R	Roentgen - a measure of radiation exposure
REM or rem	Roentgen Equivalent Man - a measure of radiation dose equivalent
DOT	U.S. Department of Transportation
NRC	U.S. Nuclear Regulatory Commission
RHB	Radiologic Health Branch of the California Department of Public Health

Table of Contents

Introduction	1
Section 1: LLRW Transferred During the 2010 Reporting Year	4
Table 1-1 Total Volumes and Volume by Generator Category and Waste Class	4
Table 1-2 Total Activity and Activity by Generator Category and Waste Class	6
Table 1-3 Activity by Radionuclide	7
Section 2: Containers Used for Transfer of LLRW	12
Section 2.1: Types of Containers Used for Transport of LLRW	12
Table 2-1 Containers Used for Transport of LLRW.....	12
Section 2.2 Containers with Surface Radiation Levels Exceeding 2 mSv/hr	14
Table 2-2 Containers with Surface Radiation Levels Exceeding 2 mSv/hr.....	14
Table 2-3 Nuclides in Containers Exceeding 2 mSv/hr Surface Radiation Level	16
Section 3: Licensed LLRW Disposal Facilities Used by California Generators	22
Table 3-1 Licensed LLRW Disposal Facilities.....	22
Section 4: Transferred Source Material and Special Nuclear Material Information	23
Section 4.1: Transferred Source Material	23
Table 4-1 Weight of Transferred Source Material by County and Generator Category	23
Section 4.2: Transferred Special Nuclear Material	25
Table 4-2 Transferred Special Nuclear Material by County and Generator Category	25
Table 4-3 Weight of Special Nuclear Material Transferred	26
Section 5: LLRW Stored for Decay	28
Table 5-1 Total Volume and Volume by Class.....	28
Table 5-2 Total Activity and Activity by Class	31
Table 5-3 Activity by Radionuclide	33
Section 6: LLRW Stored for Later Transfer or Shipment	41
Table 6-1 Total Volume and Volume by Class.....	41
Table 6-2 Total Activity and Activity by Class	42
Table 6-3 Activity by Radionuclide	43
Section 7: LLRW Stored as Not Acceptable for Disposal at a Licensed LLRW Disposal Site	47
Table 7-1 Total Volume and Volume by Class.....	47
Table 7-2 Total Activity and Activity by Class	47
Table 7-3 Activity by Radionuclide	47
Appendix A: List of Container Type and Description as used by LLRW Generators	49
Appendix B: Radioisotope General Information	50
Appendix C: Health and Safety Code Section 115000.1	54
Appendix D: LLRW Waste Classification	57
Appendix E: Unit Conversions	61

Page intentionally left blank

Introduction

This report summarizes data for low-level radioactive waste (LLRW)¹ generated in the state of California aggregated by county. LLRW is a byproduct of the beneficial uses of a wide range of radioactive materials. These uses include electricity generation, medical diagnosis and treatment, academic, industrial, biomedical and pharmaceutical research, and manufacturing. The report uses information submitted annually by generators² to the California Department of Public Health (CDPH), Radiologic Health Branch (RHB). In September 2002, Senate Bill SB 2065 was approved, which added section 115000.1 to the California Health and Safety (H&S) Code relating to LLRW.

H&S Code section 115000.1 requires all generators of LLRW in the state to provide detailed information to the California Department of Health Services, now known as CDPH, for all LLRW that is:

- sent to licensed LLRW disposal facilities;
- stored for disposal by decay;
- stored for future transfer/disposal; or
- stored because the generator knows that the LLRW is not acceptable for disposal at licensed disposal facilities.

H&S Code section 115000.1(h) requires generators of LLRW to submit the following information to CDPH on an annual basis:

- information included on manifests³ related to LLRW transferred for disposal;
- information included on manifests related to LLRW stored for decay or later transfer.

H&S Code section 115000.1 et seq. requires CDPH to:

- maintain files related to LLRW transferred for disposal, stored for disposal by decay, or stored for later transfer;
- prepare a LLRW annual report, to be maintained by CDPH and make available upon request to any member of the Legislature; and
- publish a LLRW annual report with information aggregated by county, available to the public.

H&S Code section 115000.1 requires CDPH to prepare an annual report summarizing by type of generator and county of generation the nature, characteristics, and quantities of LLRW generated in California. There are seven sections in the report summarizing the data for the 2010 reporting year. Section 1 summarizes waste transferred for

¹ LLRW is a category of waste product produced through processes that use radioactive materials. In the United States, radioactive waste is classified into a number of different categories by federal law and U.S. Nuclear Regulatory Commission (NRC) regulations.

² Generator is defined in California H&S Code section 115000.1(a) (2) as “any person who, by his or her actions, or by the actions of his or her agent, employee, or independent contractor generates low-level radioactive waste in the state.”

³ NRC forms 540, 541, and 542.

disposal in 2010 with the waste volume and radioactivity⁴ by generator category, waste class, and the waste activity by isotope. Section 2 summarizes the type of containers used in 2010 with the type and number used, surface radiation levels and information specific to those containers that exceed a 2 mSv/hr surface dose rate with volume, radioactivity, and other characteristics. Section 3 lists the identity of the licensed LLRW disposal facilities. Section 4 summarizes source material waste and special nuclear material waste transferred in 2010 with the waste weight, isotopic radioactivity, and other characteristics. Section 5 summarizes waste held in storage for decay and subsequent disposal as non-radioactive waste as of December 31, 2010, with waste volume, radioactivity, and other characteristics. Such waste may still be subject to special disposal requirements due to other hazardous characteristics (e.g., regulated medical waste). Section 6 summarizes waste held in storage pending future disposal as of December 31, 2010, with waste volume, radioactivity, and other characteristics. Section 7 summarizes waste held in storage, as the generator knows the waste is not acceptable for disposal at a licensed LLRW disposal site with waste volume, radioactivity, and other characteristics.

During the 2010 reporting year, California generated 3405 cubic meters of LLRW. The waste disposal classes of LLRW as defined in the Code of Federal Regulations, Title 10 part 61 section 55 (10 CFR 61.55) divides the LLRW data, with 3401 cubic meters of class A waste (least radioactive), 0 cubic meters of class B waste, and 4 cubic meters of class C waste (most radioactive). The following two tables summarize the total volume and the total activity of LLRW generated in California by generator category and waste disposal class.

⁴ Radioactivity is the measure of a material's propensity to emit radiation, or the number of radiation-emitting events occurring each second.

Total Volume (m³) Summary

GENERATOR CATEGORY	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
ACADEMIA	31.92082396	31.92082396		
AEROSPACE	10.2802	10.2802		
INDUSTRIAL GAUGES	19.3433032	19.3433032		
MANUFACTURING	64.35418	64.35418		
MEDICINE	87.20231	87.20231		
NUCLEAR POWER PLANTS	2907.242	2907.242		
OTHER	135.6598	135.6598		
RESEARCH	148.9348128	145.1119728		3.82284
TOTAL FOR 2010	3404.93743	3401.11459		3.82284

Total Activity (MBq) Summary

GENERATOR CATEGORY	TOTAL ACTIVITY (MBq)	CLASS A (MBq)	CLASS B (MBq)	CLASS C (MBq)
ACADEMIA	62291.18263	62291.18263		
AEROSPACE	6.7192	6.7192		
INDUSTRIAL GAUGES	481564.0605	481564.0605		
MANUFACTURING	1088656.915	1088656.915		
MEDICINE	68302.78112	68302.78112		
NUCLEAR POWER PLANTS	67057.2131	67057.2131		
OTHER	590.1003	590.1003		
RESEARCH	553318.613	220318.613		333000
TOTAL FOR 2010	2321787.584	1988787.584		333000

In this report, volume is presented in units of cubic meters (m³) and radioactivity is presented in units of mega Becquerel (MBq). These units are consistent with NRC uniform LLRW manifest requirements. The “Unit Conversions” table (Appendix E) provides information for converting the reported units to the previously used units of cubic feet and curies.

Section 1: LLRW Transferred During the 2010 Reporting Year

This section summarizes the data for LLRW transferred during the 2010 reporting year as documented in the NRC Uniform Low-Level Radioactive Waste Manifest shipping paper (form 540) and NRC Uniform Low-Level Radioactive Waste Manifest container and waste description (form 541). The following tables detail by county, the volume and activity by waste classification of the LLRW transferred as reported by the generators on the NRC forms. Table 1-1 summarizes the transferred LLRW volume data by county, generator type, and waste class. Table 1-2 summarizes the transferred LLRW activity data by county, generator type, generator license number, and waste class. Table 1-3 summarizes the transferred LLRW data by county, radionuclide, and activity.

Table 1-1 Total Volumes and Volume by Generator Category and Waste Class

Table 1-1 Total Volumes and Volume by Generator Category and Waste Class					
COUNTY	GENERATOR	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
ALAMEDA	ACADEMIA	10.67059396	10.67059396		
	RESEARCH	0.2124	0.2124		
CONTRA COSTA	MANUFACTURING	0.21238	0.21238		
	MEDICINE	3.04582	3.04582		
	OTHER	135.4474	135.4474		
	RESEARCH	15.4881	15.4881		
FRESNO	RESEARCH	9.4192	9.4192		
HUMBOLDT	ACADEMIA	0.4248	0.4248		
	NUCLEAR POWER PLANTS	1626.575	1626.575		
LOS ANGELES	ACADEMIA	0.3601	0.3601		
	MANUFACTURING	47.5184	47.5184		
	MEDICINE	1.14705	1.14705		
	RESEARCH	58.4293	58.4293		
MONTEREY	ACADEMIA	0.019	0.019		
ORANGE	ACADEMIA	1.97415	1.97415		
	MANUFACTURING	8.0712	8.0712		
	MEDICINE	7.51965	7.51965		
	NUCLEAR POWER PLANTS	1280.667	1280.667		
	RESEARCH	16.54359	12.72075		3.82284
SACRAMENTO	ACADEMIA	0.038	0.038		
	AEROSPACE	10.2802	10.2802		
SAN BERNARDINO	MANUFACTURING	8.5522	8.5522		
	MEDICINE	0.4248	0.4248		
SAN DIEGO	ACADEMIA	11.18008	11.18008		
	MEDICINE	21.15849	21.15849		
	OTHER	0.2124	0.2124		
	RESEARCH	7.11534	7.11534		
SAN FRANCISCO	MEDICINE	0.671	0.671		
	RESEARCH	21.27241	21.27241		
SAN LUIS OBISPO	INDUSTRIAL GAUGES	4.36	4.36		
SAN MATEO	INDUSTRIAL GAUGES	14.9833032	14.9833032		
	MEDICINE	1.9314	1.9314		
	RESEARCH	10.05648	10.05648		

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 1-1 Total Volumes and Volume by Generator Category and Waste Class

COUNTY	GENERATOR	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
SANTA BARBARA	ACADEMIA	2.9884	2.9884		
	MEDICINE	0.15472	0.15472		
SANTA CLARA	ACADEMIA	0.8496	0.8496		
	MEDICINE	26.44838	26.44838		
	RESEARCH	9.3359928	9.3359928		
TULARE	RESEARCH	0.8496	0.8496		
VENTURA	MEDICINE	24.701	24.701		
YOLO	ACADEMIA	3.4161	3.4161		
	RESEARCH	0.2124	0.2124		

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 1-2 Total Activity and Activity by Generator Category and Waste Class

Table 1-2 Total Activity and Activity by Generator Category and Waste Class					
COUNTY	GENERATOR	TOTAL ACTIVITY (MBq)	CLASS A (MBq)	CLASS B (MBq)	CLASS C (MBq)
ALAMEDA	ACADEMIA	15195.42417	15195.42417		
	RESEARCH	22.237	22.237		
CONTRA COSTA	MANUFACTURING	20.96790773	20.96790773		
	MEDICINE	1143.391057	1143.391057		
	OTHER	516.1003	516.1003		
	RESEARCH	4339.686	4339.686		
FRESNO	RESEARCH	6564.920501	6564.920501		
HUMBOLDT	ACADEMIA	144.38762	144.38762		
	NUCLEAR POWER PLANTS	43473.0791	43473.0791		
LOS ANGELES	ACADEMIA	12.212	12.212		
	MANUFACTURING	1087814.937	1087814.937		
	MEDICINE	2464.015	2464.015		
	RESEARCH	10138.03959	10138.03959		
MONTEREY	ACADEMIA	0.2664	0.2664		
ORANGE	ACADEMIA	243.8326501	243.8326501		
	MANUFACTURING	75.3357	75.3357		
	MEDICINE	1199.91	1199.91		
	NUCLEAR POWER PLANTS	23584.134	23584.134		
	RESEARCH	484767.0996	151767.0996		333000
SACRAMENTO	ACADEMIA	49.5134	49.5134		
	AEROSPACE	6.7192	6.7192		
SAN BERNARDINO	MANUFACTURING	745.67439	745.67439		
	MEDICINE	0.001728	0.001728		
SAN DIEGO	ACADEMIA	4335.215852	4335.215852		
	MEDICINE	6646.405496	6646.405496		
	OTHER	74	74		
	RESEARCH	9446.322	9446.322		
SAN FRANCISCO	MEDICINE	789.58	789.58		
	RESEARCH	19333.98522	19333.98522		
SAN LUIS OBISPO	INDUSTRIAL GAUGES	388000	388000		
SAN MATEO	INDUSTRIAL GAUGES	93564.0605	93564.0605		
	MEDICINE	7419.24	7419.24		
	RESEARCH	9371.733256	9371.733256		
SANTA BARBARA	ACADEMIA	1098.9185	1098.9185		
	MEDICINE	2.51349	2.51349		
SANTA CLARA	ACADEMIA	177.3388	177.3388		
	MEDICINE	16154.07754	16154.07754		
	RESEARCH	7280.186637	7280.186637		
TULARE	RESEARCH	2054.203	2054.203		
VENTURA	MEDICINE	32483.6468	32483.6468		
YOLO	ACADEMIA	41034.07323	41034.07323		
	RESEARCH	0.20017	0.20017		

Table 1-3 Activity by Radionuclide

Table 1-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
ALAMEDA	Ac-227	0.01813
	C-14	815.042734
	Cl-36	0.185
	Co-60	0.0407
	H-3	14382.87209
	I-131	0.37
	Na-22	4.625
	Nat Th	0.2035
	Nat U	7.27679
	P-32	0.92352
	Pb-210	0.5439
	Po-210	0.1887
	S-35	3.138081
	Sr-90	0.0037
	Th-232	0.117179
	Tl-204	0.185
U-238	1.557145	
Zn-65	0.37	
CONTRA COSTA	Ac-228	5.02
	Ag-110m	0.00305139
	Ba-133	0.6956
	Be-7	0.165575
	Bi-212	0.212
	Bi-214	10.403
	C-14	4343.5306
	Co-57	0.0824175
	Co-58	10.84835634
	Co-60	3.18089
	Cr-51	3.5773857
	Cs-134	0.26043227
	Cs-137	0.778385707
	Fe-59	0.0088541
	H-3	1127.105657
	K-40	97.16035883
	Mn-54	0.5133972
	Nb-95	0.225848
	Ni-63	0.0185
	Pb-212	6.197
	Pb-214	12.467
	Ra-226	343.145
	Ra-228	4.79
	Sb-125	0.0364709
	Th-nat	12.552
	Tl-208	1.7028
	U-235	0.0040108
	U-238	10.67487
U-nat	21.2	
Zn-65	1.191511	
Zr-95	0.114293	
FRESNO	Am-241	0.00166648
	C-14	6564.91
	Sr-90	0.00149221
	Th-230	0.00734228
HUMBOLDT	Am-241	994.757771
	C-14	106.8255437
	Cl-36	0.00074
	Cm-243	6.1849173
	Cm-244	5.924840399
	Co-57	1.1692E-12
	Co-60	9114.181465
	Cs-137	10399.52325
	Eu-154	54.8
	Fe-55	3362.000336
	H-3	2272.648
	I-129	61.22987762
	Ni-59	640.0334098

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 1-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
HUMBOLDT (CONT)	Ni-63	5274.869146
	Pu-238	144.9664553
	Pu-239	224.013948
	Pu-240	690.371348
	Pu-241	5727.657074
	Pu-242	1.187
	Sr-90	211.7312619
	Tc-99	887.2729415
	Th-nat	0.632
	U-233	126.3776242
	U-234	3.2672
	U-238	140.4283452
	U-nat	0.0278
	Zr-95	36.9
LOS ANGELES	Ag-110m	2.1201
	Am-241	151.615795
	Am-243	0.058646
	Ba-133	1212.794808
	Be-7	5.328
	Bi-207	14.689196
	C-14	181.7744513
	Ca-45	3.72172
	Cd-109	62313.96374
	Ce-139	18.253519
	Ce-141	18.631417
	Cf-252	14.08703
	Cl-36	6.187577
	Cm-244	0.11211
	Co-56	7982.51986
	Co-57	346773.9332
	Co-58	22.794838
	Co-60	192.9731544
	Cr-51	29.550492
	Cs-134	11.50361
	Cs-137	12780.05293
	Eu-152	541.5615804
	Eu-154	1091.76973
	Eu-155	0.592000377
	Fe-55	47.40850957
	Fe-59	121.5391884
	Gd-148	0.02072
	Gd-153	465782.0838
	Ge-68	43081.51845
	H-3	2500.487277
	Hg-203	177.337981
	Ho-166m	0.95556
	I-125	10155.24948
	I-129	0.99641
	I-131	10.1643748
	Ir-192	6.323438
	Lu-177m	0.970747
	Mn-54	18.096138
	Na-22	485.116425
	Nat U	1.299995
	Nb-95	20.69151007
	Ni-63	83585.84358
	Np-237	0.0074
	P-32	13.1946148
	P-33	0.521804
	Pb-210	0.422355
	Pm-147	755.9659831
	Po-209	0.0052647
	Po-210	16.520003
	Pu-238	0.10002
	Pu-239	0.433633
	Pu-240	0.08124
	Pu-241	0.190881
Pu-242	0.01323	
Ra-226	12.9766648	
Ru-103	4.184591	
Ru-106	23.471192	
S-35	0.371106	

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 1-3 Activity by Radionuclide			
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)	
LOS ANGELES (CONT)	Sb-124	6.29	
	Sb-125	5.8793	
	Se-75	379.8354181	
	Si-32	0.03441	
	Sm-151	1.02442	
	Sn-113	24.617037	
	Sr-85	20.282078	
	Sr-89	1.597283	
	Sr-90	10.7988596	
	Ta-182	0.5069	
	Tc-95	0.0028	
	Tc-99	4.623074	
	Te-123m	6.623381	
	Th-228	0.4736	
	Th-229	0.042735	
	Th-230	0.12691	
	Th-232	0.000396	
	Tl-204	10.58004	
	U-232	0.07548	
	U-233	0.01609537	
	U-234	0.010508	
	U-235	0.01674307	
	U-236	0.035193	
	U-238	0.025223	
	Y-88	46.19412	
	Yb-169	35.44600216	
	Zn-65	56.36479803	
	Zr-95	32.76379	
	MONTEREY	Nat U	0.2627
		Pb-210	0.0037
ORANGE	Am-241	1.0264022	
	Ba-133	0.343952	
	C-14	251317.1494	
	Ce-144	32.576446	
	Cl-36	0.37	
	Co-57	22.326806	
	Co-58	1306.0516	
	Co-60	4655.20006	
	Cs-137	1623.893799	
	Eu-152	1.361	
	Fe-55	9820.404	
	Fe-59	31.160889	
	H-3	339224.3636	
	I-125	947.8896352	
	I-129	739.6626993	
	Mn-54	573.0573	
	Na-22	0.0420949	
	Nat U	75.3357	
	Nb-95	243.71478	
	Ni-63	5067.355	
	P-32	21.201	
	Pm-147	111	
	Pu-239	0.000037	
	Ra-226	0.37	
	S-35	5.402	
	Sb-125	166.40681	
	Sr-89	249.58642	
	Sr-90	38.2216512	
	Tc-99	1677.23818	
	Th-228	0.006808	
	Th-230	0.037	
	Th-232	0.8029	
	Tl-204	5.106	
	U-238	0.18907	
U-nat	29.6		
Zr-95	122.43664		
SACRAMENTO	C-14	37	
	Ce-144	0.037	
	Co-60	6.7562	

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 1-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
SACRAMENTO	Nat U	1.3098
	P-32	0.37
	Pb-210	0.37
	Po-210	0.037
	U-nat	9.9826
	Zn-65	0.37
SAN BERNARDINO	C-14	0.000036593
	H-3	0.00167967
	P-32	1.61359E-05
	Ra-226	174.172871
	Ra-228	55.347753
	Th-230	18.7628
	Th-232	15.0866
	U-nat	209.069
SAN DIEGO	C-14	2035.329337
	Ca-45	5.7387
	Cr-51	0.37
	Depleted U	238.313115
	Fe-55	1.11
	H-3	12201.64245
	I-125	3411.688489
	Na-22	22.2
	Nat U	18.89405
	P-32	765.604037
	P-33	1132.459
	Rb-86	0.74
	S-35	849.2997
U-238	206.3641108	
SAN FRANCISCO	C-14	1362.451
	Ca-45	0.01
	H-3	7937.739537
	I-125	5904.3416
	I-131	4.84848
	In-111	0.074
	Nat U	0.037
	P-32	188.219
	P-33	82.769
	Rb-86	7.4
	S-35	955.599
	U-238	0.0222
	Zr-89	0.0074
SAN LUIS OBISPO	Am-241	0.1928
	C-14	234.3
	Cm-242	0.2999
	Cm-243	0.1379
	Cm-244	0.1367
	Co-57	746.8
	Co-58	1078
	Co-60	33530
SAN LUIS OBISPO	Cs-134	1572.9
	Cs-137	2994.8
	Fe-55	58490
	H-3	200400
	I-129	0.000273
	Mn-54	611.5
	Ni-59	422.9
	Ni-63	89000
	Np-237	0.000176
	Pu-238	0.1895
	Pu-239	0.1582
	Pu-240	0.1582
	Pu-241	28.45
	Pu-242	0.001929
	Sb-125	857
	Sr-89	0.10878
Sr-90	5.839	

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 1-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
SAN LUIS OBISPO	Tc-99	0.0006146
	Zn-65	1515
SAN MATEO	C-14	47666.2632
	Cr-51	787.841
	H-3	53528.7761
	I-125	7418.5
	P-32	106.227
	P-33	1452.47496
	S-35	881.8025
SANTA BARBARA	Ba-133	0.0185
	C-14	261.7158
	Co-60	2.22
	Cs-137	0.2442
	Depleted U	0.0337
	H-3	834.2427
	Na-22	0.037
	Nat U	2.139792
	Ra-226	0.074
	U-nat	0.703
SANTA CLARA	Ba-133	0.03404
	C-14	788.5852513
	Cl-36	0.0003145
	Co-57	0.15651
	Co-60	0.04329
	Cs-137	5.57997
	H-3	8375.427337
	I-125	620.453
	I-129	0.00481
	Na-22	0.04847
	P-32	71.4396
	P-33	5318.7389
	Pb-210	0.0005106
	Pm-147	0.0003589
	Ra-226	0.0333
	S-35	23.0695
	Si-32	0.0019721
	Sr-90	0.0003404
	Tc-99	0.000407
	Th-232	0.296
U-238	5106.4403	
TULARE	C-14	2054.203
VENTURA	C-14	22118.2448
	Ca-45	3531.021
	H-3	6579.044
	I-125	4.107
	P-32	15.355
	P-33	254.375
YOLO	C-14	749.8061137
	Ca-45	3.7
	Co-57	21.1959791
	Co-58	83.25
	Co-60	166.537
	H-3	39610.79086
	Mn-54	83.25
	P-32	15.2736
	Ra-226	1.0397
	Rb-86	20.65192
	S-35	0.1628
	Sn-117m	20.35
	Th-232	0.111
	U-238	0.037
	U-nat	81.092048
	Y-88	0.0074851
	Zn-65	6.80874
	Zr-88	0.0091649

COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
YOLO (CONT)	Zr-89	170.2

Section 2: Containers Used for Transfer of LLRW

This section summarizes data submitted to CDPH by LLRW generators by the types of containers used for shipping LLRW. Section 2.1 summarizes the transferred LLRW data by county, generator category, type of container, and quantity of containers used. Section 2.2 summarizes the data on those containers with a reported surface radiation level exceeding 2 mSv/hr. Information included in the table are the type of container, the surface radiation level, waste volume and classification, the nuclides in the containers with the activities of each, and in the case of special nuclear material the gram weights of each.

Only for those generators who have shipped LLRW and documented the shipment with the NRC form 540, 541, and 542 will have indicated the type of container used. The generators that store LLRW for decay prior to disposal do not give adequate information regarding the type of container used to store the LLRW prior to disposal.

Section 2.1: Types of Containers Used for Transport of LLRW

Each LLRW package of Class 7 (radioactive) materials offered for transportation must be designed and prepared for shipment in U.S. Department of Transportation (DOT) approved types of containers⁵. Each type of package/container used by the LLRW generators for the LLRW shipped during the reporting year along with the quantity of each type of container is itemized in Table 2-1 of this report. As part of the information itemized in Table 2-1 the maximum surface radiation level of all packages/containers offered for shipment by the generator during the reporting year is included.

Table 2-1 Containers Used for Transport of LLRW

COUNTY	GENERATOR TYPE	TOTAL # of CONTAINERS	MAX SURFACE RADIATION LEVEL	1 - Wood Box or Crate	2 - Metal Box	2 - OP - Metal Box	3 - OP - Plastic Drum or Pail	3 - Plastic Drum or Pail	4 - Metal Drum or Pail	4 - OP - Metal Drum or Pail	5 - Metal Tank or Liner	7 - Polyethylene Tank or Liner	8 - Fiberglass Tank or Liner	11 - Bulk Unpackaged Waste	13 - High Integrity Container	13 - OP - High Integrity Container	19 - Other
ALAMEDA	ACADEMIA	40	0.015					2									6
	RESEARCH	1	0.0003														
CONTRA COSTA	MANUFACTURING	1	0.017														
	MEDICINE	16	0.005			1											4
	OTHER	22	0.25			18		1									2
	RESEARCH	77	0.0003							3							
FRESNO	RESEARCH	49	0.0003	48													
HUMBOLDT	ACADEMIA	2	0.0003														
	NUCLEAR POWER PLANTS	117	0.9		19									83			1

⁵ See Appendix A for description of identified containers.

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 2-1 Containers Used for Transport of LLRW																	
COUNTY	GENERATOR TYPE	TOTAL # of CONTAINERS	MAX SURFACE RADIATION LEVEL	1 - Wood Box or Crate	2 - Metal Box	2 - OP - Metal Box	3 - OP - Plastic Drum or Pail	3 - Plastic Drum or Pail	4 - Metal Drum or Pail	4 - OP - Metal Drum or Pail	5 - Metal Tank or Liner	7 - Polyethylene Tank or Liner	8 - Fiberglass Tank or Liner	11 - Bulk Unpackaged Waste	13 - High Integrity Container	13 - OP - High Integrity Container	19 - Other
LOS ANGELES	ACADEMIA	7	0.0002				2										
	MANUFACTURING	174	6	6			5										1
	MEDICINE	12	0.0002														9
	RESEARCH	276	0.0002				1										
MONTEREY	ACADEMIA	1	0.0003				1										
ORANGE	ACADEMIA	8	0.005				1										1
	MANUFACTURING	38	0.004														
	MEDICINE	63	0.0002				1										37
	NUCLEAR POWER PLANTS	58	0.82		18		1						30				
	RESEARCH	80	0.005				4		8	1							14
SACRAMENTO	ACADEMIA	2	0.0003					2									
	AEROSPACE	1	0.0003		1												
SAN BERNARDINO	MANUFACTURING	41	0.01														
	MEDICINE	2	0.0002														
SAN DIEGO	ACADEMIA	65	0.005				9			1							54
	MEDICINE	83	0.005				1		10								33
	OTHER	1	0.0002														
	RESEARCH	40	0.5				3		1								11
SAN FRANCISCO	MEDICINE	5	0.0003														
SAN FRANCISCO	RESEARCH	127	0.03				2		25	9	1					16	
SAN LUIS OBISPO	INDUSTRIAL GAUGES	1	13							1							
SAN MATEO	INDUSTRIAL GAUGES	67	0.005														1
	MEDICINE	10	0.0003				1										
	RESEARCH	53	0.0003				15		3								
SANTA BARBARA	ACADEMIA	15	0.01														
	MEDICINE	4	0.005				2										2
SANTA CLARA	ACADEMIA	4	0.0003				2		1								
	MEDICINE	64	0.005				1			1							35
	RESEARCH	55	0.0085				9	1	2								1
TULARE	RESEARCH	4	0.0003														
VENTURA	MEDICINE	133	0.0002														
YOLO	ACADEMIA	27	0.0011				14										1

Section 2.2 Containers with Surface Radiation Levels Exceeding 2 mSv/hr

DOT stipulates the radiation level outside of the package or container of radioactive material during shipping. The Code of Federal Regulations (CFR), specifically Title 49 part 173 section 441 (49 CFR 173.441), that sets the radiation level limitations and exclusive use provisions for shipping containers states, “Except as provided in paragraph (b) of this section, each package of Class 7 (radioactive) materials offered for transportation must be designed and prepared for shipment, so that under conditions normally incident to transportation, the radiation level does not exceed 2 mSv/hr (200 mrem/hr) at any point on the external surface of the package, and the transport index does not exceed 10.”

H&S Code section 115000.1 (c) (3) (C) states, “include the maximum surface radiation exposure level on any single container of LLRW transferred, the number of disposal containers that exceed 200 mR/hour, and the volume, class, and activity by radionuclide.” This information is found on NRC form 541 box number 9, and is summarized in Table 2-2 of this report. The isotopic information for the identified package/container is summarized in Table 2-3.

Please note that there is a difference between H&S Code section 115000.1 and the information provided by the generators via the NRC forms 540, 541, and 542. The H&S Code mentions a radiation level of 200 mR/hr while the CFR and the NRC forms use 2 mSv/hr. The first, mR/hr is a radiation exposure level while the second, mSv/hr is a radiation dose level. The two units are not equivalent. The information gathered in this report is supplied by LLRW generators on the NRC forms 540, 541, and 542 in the units of mSv/hr.

Table 2-2 Containers with Surface Radiation Levels Exceeding 2 mSv/hr

COUNTY	GENERATOR TYPE	CONTAINER ID	CONTAINER TYPE	SURFACE RADIATION LEVEL (mSv/hr)	WASTE VOLUME IN CONTAINER (cubic meters)	WASTE CLASSIFICATION
Los Angeles	Manufacturing	T2638-D03	4 - Metal Drum or Pail	2.2	0.2124	AU
		T2638-D04	4 - Metal Drum or Pail	6	0.2124	AU
		T2707-D04	4 - Metal Drum or Pail	4.2	0.2124	AU
		T2707-D05	4 - Metal Drum or Pail	4.9	0.2124	AU
		T2707-D06	4 - Metal Drum or Pail	4.6	0.2124	AU
		T2760-D04	4 - Metal Drum or Pail	3.5	0.2124	AU
		T2760-D05	4 - Metal Drum or Pail	4.05	0.2124	AU
		T2760-D07	4 - Metal Drum or Pail	2.8	0.2124	AU
		T2760-D12	4 - Metal Drum or Pail	2.5	0.2124	AU
		T2815-D07	4 - Metal Drum or Pail	2.4	0.2124	AU

Low-Level Radioactive Waste Tracking – Annual Report for 2010

COUNTY	GENERATOR TYPE	CONTAINER ID	CONTAINER TYPE	SURFACE RADIATION LEVEL (mSv/hr)	WASTE VOLUME IN CONTAINER (cubic meters)	WASTE CLASSIFICATION
Los Angeles	Manufacturing	T2904-D04	4 - Metal Drum or Pail	4.3	0.2124	AU
		T2904-D06	4 - Metal Drum or Pail	4.4	0.2124	AU
		T2948-D03	4 - Metal Drum or Pail	3.4	0.2124	AU
		T2948-D04	4 - Metal Drum or Pail	3.2	0.2124	AU
		T2948-D06	4 - Metal Drum or Pail	4.9	0.2124	AU
		T2987-D03	4 - Metal Drum or Pail	3.85	0.2124	AU
		T2988-D04	4 - Metal Drum or Pail	2.5	0.2124	AU
		T3055-D02	4 - Metal Drum or Pail	2.9	0.2124	AU
		T3055-D03	4 - Metal Drum or Pail	4.8	0.2124	AU
		T3055-D05	4 - Metal Drum or Pail	3.4	0.2124	AU
		T3112-D06	4 - Metal Drum or Pail	3.8	0.2124	AU
		T3112-D07	4 - Metal Drum or Pail	3.7	0.2124	AU
		T3229-D05	4 - Metal Drum or Pail	2.5	0.2124	AU
		T3229-D06	4 - Metal Drum or Pail	3.7	0.2124	AU
		T3229-D08	4 - Metal Drum or Pail	3.4	0.2124	AU
San Luis Obispo	Industrial Gauges	1	5 - Metal Tank or Liner	13	4.36	AU

Table 2-3 Nuclides in Containers Exceeding 2 mSv/hr Surface Radiation Level

CONTAINER	CONTAINER ID	RADIONUCLIDE	ACTIVITY (MBq)	SNM WEIGHT (gm)		
4 - Metal Drum or Pail	T2638-D03	Ba-133	48.47			
		Cd-109	49.95			
		Cf-252	4.662			
		Co-56	2.627			
		Co-57	3341.1			
		Co-58	0.37			
		Co-60	1.258			
		Cs-137	16.021			
		Gd-153	366.3			
		Ge-68	214.23			
		Nb-95	0.111			
		Ni-63	3.4595			
		Pm-147	0.0296			
		Ru-106	5.55			
		Y-88	10.619			
Zr-95	0.074					
	T2638-D04	Cd-109	13.32			
		Co-56	0.703			
		Co-57	395.9			
		Co-58	0.037			
		Co-60	13.098			
		Cs-137	0.592			
		Eu-152	60.31			
		Gd-153	30081			
		Ge-68	691.9			
		Na-22	0.888			
		Ni-63	6.364			
		Pm-147	12.395			
		Y-88	5.698			
			T2707-D04	Ba-133	1.295	
				Cd-109	139.49	
Cf-252	0.0185					
Co-56	1.665					
Co-57	3566.8					
Co-58	0.074					
Cs-137	1.221					
Eu-152	190.92					
Eu-154	5.254					
Gd-153	20128					
Ge-68	843.6					
Na-22	10.36					
Ni-63	6.475					
Zn-65	1.073					
	T2707-D05			Co-56	11.359	
		Co-57	9805			
		Co-58	1.776			
		Cs-137	0.296			
		Gd-153	117.66			
		Ge-68	928.7			
		Na-22	24.679			
	T2707-D06	Ba-133	0.925			
		Cd-109	144.3			
		Cf-252	0.1295			
		Co-56	6.29			
		Co-57	5180			
		Co-58	0.333			
		Cs-137	6.771			
		Gd-153	16835			
		Ge-68	1013.8			
		Ni-63	1424.5			
		Sn-113	4.07			
Zn-65	3.367					
	T2760-D04	Ba-133	16.28			
		Co-56	0.962			
		Co-57	1550.3			
		Co-58	0.111			

Low-Level Radioactive Waste Tracking – Annual Report for 2010

CONTAINER	CONTAINER ID	RADIONUCLIDE	ACTIVITY (MBq)	SNM WEIGHT (gm)
4 - Metal Drum or Pail	T2760-D04	Cs-137	3163.5	
		Eu-152	6.734	
		Gd-153	584.6	
		Ni-63	2.59	
		Pm-147	370	
		Zn-65	0.814	
	T2760-D05	Co-56	1.221	
		Co-57	1043.4	
		Co-58	0.111	
		Co-60	3.182	
		Cs-137	691.9	
		Gd-153	18019	
		Ge-68	1121.1	
		I-125	1.295	
		Ni-63	7.77	
		P-32	1.11	
		Pm-147	0.037	
		Sr-85	0.925	
		Zn-65	0.814	
		T2760-D07	Cd-109	197.21
	Ce-141		18.13	
	Co-56		5.883	
	Co-57		3470.6	
	Co-58		1.258	
	Co-60		51.06	
	Cs-137		1.221	
	Gd-153		20979	
	Ge-68		392.2	
	Zn-65		0.703	
	T2760-D12	Ba-133	18.5	
		Cs-137	222	
		Eu-152	25.9	
		Ge-68	44.4	
	T2815-D07	Ba-133	7.77	
		Ce-139	4.218	
		Co-56	2.368	
		Co-57	2197.8	
		Co-58	0.185	
		Co-60	0.666	
		Cr-51	9.25	
Cs-137		30.007		
Gd-153		24124		
Ge-68		629		
Mn-54		5.365		
Na-22		7.289		
Nb-95		13.764		
Ni-63		4.81		
Sb-124		4.514		
Se-75		12.173		
T2904-D04	Sr-85	2.22		
	Zn-65	7.178		
	Zr-95	23.495		
	Cd-109	59.2		
	Co-57	316.72		
	Cs-137	68.08		
	Eu-152	21.46		
	Gd-153	25382		
	Ge-68	965.7		
	Nb-95	2.553		
T2904-D06	Ni-63	14.245		
	Zr-95	3.848		
	Am-241	0.0074		
	Cd-109	9620		
	Co-56	0.888		
	Co-57	958.3		
	Co-58	0.222		
	Co-60	7.289		
Cs-137	3659.3			

Low-Level Radioactive Waste Tracking – Annual Report for 2010

CONTAINER	CONTAINER ID	RADIONUCLIDE	ACTIVITY (MBq)	SNM WEIGHT (gm)
4 - Metal Drum or Pail	T2904-D06	Eu-152	34.04	
		Fe-59	24.531	
		Gd-153	2956.3	
		Ge-68	110.26	
		Mn-54	0.962	
		Na-22	1.184	
		Nb-95	0.592	
		Ni-63	13.135	
		Pm-147	0.037	
		Po-210	0.0037	
		Ra-226	0.0148	
		Th-228	0.074	2.47E-09
		U-232	0.074	8.93E-08
		U-235	0.0074	0.0926
		Zn-65	6.697	
Zr-95	0.74			
T2948-D03	T2948-D03	Am-241	1.184	
		Cd-109	2160.8	
		Co-56	0.74	
		Co-57	891.7	
		Co-58	0.037	
		Cs-134	0.666	
		Cs-137	1705.7	
		Gd-153	13357	
		Ge-68	791.8	
		Na-22	0.407	
		Ni-63	384.8	
T2948-D04	T2948-D04	Cd-109	440.3	
		Co-56	0.555	
		Co-57	395.9	
		Co-58	0.037	
		Co-60	4.958	
		Cs-137	0.481	
		Gd-153	1.295	
		Ge-68	297.11	
		Na-22	117.66	
		Nb-95	1.702	
		Ni-63	8.88	
		Zn-65	5.254	
		Zr-95	1.739	
T2948-D06	T2948-D06	Cd-109	25.9	
		Co-57	79.18	
		Gd-153	15762	
		Ge-68	499.5	
		Na-22	69.93	
Ni-63	14.06			
T2987-D03	T2987-D03	Am-241	0.185	
		Am-243	0.0037	
		Ba-133	9.435	
		Cd-109	1824.1	
		Co-56	2.627	
		Co-57	2597.4	
		Co-58	0.185	
		Cs-137	45.51	
		Gd-153	14023	
		Ge-68	1535.5	
		Na-22	30.303	
		Ni-63	2.886	
		Pu-240	0.037	0.0000044
Y-88	0.888			
T2988-D04	T2988-D04	Am-241	0.0111	
		Ba-133	0.037	
		Bi-207	0.1998	
		Cd-109	0.074	
		Ce-139	0.037	
		Co-56	1.07522	
		Co-57	2028.80842	
		Co-58	0.3034	
		Co-60	0.111	

Low-Level Radioactive Waste Tracking – Annual Report for 2010

CONTAINER	CONTAINER ID	RADIONUCLIDE	ACTIVITY (MBq)	SNM WEIGHT (gm)
4 - Metal Drum or Pail	T2988-D04	Cs-137	0.0555	
		Hg-203	0.037	
		Mn-54	0.19869	
		Sn-113	0.037	
		Sr-85	0.037	
		Sr-90	0.481	
		Te-123m	0.0037	
		Y-88	0.074	
		T3055-D02	Am-241	13.468
	Ba-133		14.43	
	Cd-109		29.97	
	Co-56		1.184	
	Co-57		1265.4	
	Co-58		0.814	
	Co-60		5.92	
	Cs-137		26.566	
	Gd-153		466.2	
	Ge-68		943.5	
	T3055-D03	Na-22	0.629	
Ni-63		3774		
Po-210		16.28		
Ra-226		0.111		
U-235		0.0074	0.0926	
Zn-65		0.777		
Am-241		7.844		
Cd-109		170.57		
Co-56		0.444		
Co-57		699.3		
T3055-D05	Cs-137	2.701		
	Gd-153	21127		
	Ge-68	462.5		
	Na-22	2.479		
	Ni-63	0.444		
	Ra-226	0.074		
	Am-241	29.23		
	Ba-133	8.88		
	Cd-109	5476		
	Co-56	5.402		
T3112-D06	Co-57	5439		
	Co-58	1.036		
	Co-60	3.293		
	Cs-137	12.21		
	Eu-152	8.51		
	Gd-153	26344		
	Ge-68	595.7		
	Na-22	16.761		
	Ni-63	28.675		
	Ra-226	0.37		
T3112-D07	Ba-133	11.803		
	Cd-109	24.05		
	Ce-139	5.217		
	Co-56	1.036		
	Co-57	10064		
	Co-58	0.999		
	Co-60	11.137		
	Cs-137	233.84		
	Fe-59	33.226		
	Gd-153	8066		
T3112-D07	Ge-68	1380.1		
	Hg-203	125.06		
	Mn-54	1.924		
	Se-75	125.43		
	Zn-65	11.655		
	Ba-133	138.75		
	Co-56	0.666		
	Co-57	751.1		
	Co-58	0.037		
	Cs-137	68.45		
Gd-153	15836			

Low-Level Radioactive Waste Tracking – Annual Report for 2010

CONTAINER	CONTAINER ID	RADIONUCLIDE	ACTIVITY (MBq)	SNM WEIGHT (gm)			
T3055-D05	T3112-D07	Ge-68	363.34				
		Hg-203	8.917				
		Na-22	0.185				
		Ni-63	7.4				
	T3229-D05		Co-57	595.7			
			Cs-137	53.65			
			Gd-153	3848			
			Ge-68	518			
			Na-22	9.398			
			Ni-63	20757			
			Y-88	1.48			
			Zn-65	0.37			
	T3229-D06		Ba-133	21.978			
			Cd-109	499.5			
			Co-56	4.07			
			Co-57	3437.3			
			Co-58	1.221			
			Co-60	1.998			
			Cs-137	101.01			
			Eu-152	28.12			
			Gd-153	8510			
			Ge-68	421.8			
			Nb-95	0.481			
			Ni-63	3.7			
			Yb-169	35.446			
			Zr-95	0.74			
			T3229-D08		Ba-133	0.185	
					Ce-139	2.516	
	Co-56	0.555					
	Co-57	1110					
	Cs-137	1.776					
	Gd-153	25234					
	Ge-68	284.53					
	Na-22	5.698					
	Ni-63	10.36					
	5 - Metal Tank or Liner	1			Am-241	0.171	
			Am-241	0.0218			
			C-14	25.3			
			C-14	209			
			Cm-242	0.279			
Cm-242			0.0209				
Cm-243			0.123				
Cm-243			0.0149				
Cm-244			0.122				
Cm-244			0.0147				
Co-57			688				
Co-57			58.8				
Co-58			914				
Co-58			164				
Co-60			3530				
Co-60			30000				
Cs-134			82.9				
Cs-134			1490				
Cs-137			2980				
Cs-137			14.8				
Fe-55			52500				
Fe-55			5990				
H-3			176000				
H-3			24400				
I-129			0.000273				
Mn-54			82.5				
Mn-54			529				
Ni-59			377				
Ni-59			45.9				
Ni-63			11700				
Ni-63	77300						
Np-237	0.000157						
Np-237	0.000019						
Pu-238	0.169	3.26E-08					
Pu-238	0.0205	0.000000268					

Low-Level Radioactive Waste Tracking – Annual Report for 2010

CONTAINER	CONTAINER ID	RADIONUCLIDE	ACTIVITY (MBq)	SNM WEIGHT (gm)
5 - Metal Tank or Liner	1	Pu-239	0.141	0.0000615
		Pu-239	0.0172	0.00000746
		Pu-240	0.141	0.00000204
		Pu-240	0.0172	0.0000168
		Pu-241	25.4	0.0000668
		Pu-241	3.05	0.00000802
		Pu-242	0.000209	0.0000115
		Pu-242	0.00172	0.00000139
		Sb-125	113	
		Sb-125	744	
		Sr-89	0.107	
		Sr-89	0.00178	
		Sr-90	5.81	
		Sr-90	0.029	
		Tc-99	0.000548	
		Tc-99	0.000666	
		Zn-65	165	
		Zn-65	1350	

Section 3: Licensed LLRW Disposal Facilities Used by California Generators

Table 3-1 lists information of the licensed LLRW disposal facilities as defined in H&S Code section 115000.1 (a)(8); Licensed LLRW disposal facility means any of three disposal facilities located at Barnwell, South Carolina; Clive, Utah; or Richland, Washington.

LLRW categorized as class A, B, or C waste was established by 10 CFR 61, Licensing Requirements for Land Disposal of Radioactive Waste. Class A waste contains the lowest concentration of short- and long-lived radioactive materials and represents the largest waste class by volume produced in California. Class C waste contains the greatest concentration of long-lived radioactive material. While class C is normally the smallest in terms of volume generated, it usually contains the greatest amount of radioactivity. Class B waste, as the name suggests, is an intermediate category.

While the Barnwell facility accepts all classes of LLRW, the Clive and Richland facilities are more restrictive. The Clive facility can accept most class A waste, but cannot accept class B or C waste. The Clive facility can also accept, treat, and dispose of most solid, mixed waste (i.e., LLRW that also contains other hazardous constituents) that meets the site's radioactivity concentration limits. The Richland facility is authorized to accept class A, B, and C waste and limited volumes of radioactive waste containing small quantities of naturally occurring radioactive material (e.g., radium, uranium, thorium) from California.

Table 3-1 Licensed LLRW Disposal Facilities

Name	Address	City	State	Zip
Energy Solutions, Formerly Envirocare	Interstate 80, Exit 49	Clive	UT	84029
Barnwell Waste Management Facility (Chem-Nuclear)	740 Osborne Road.	Barnwell	SC	29812
Hanford Waste Facility (US Ecology)	1777 Terminal Drive	Richland	WA	99354

Section 4: Transferred Source Material and Special Nuclear Material Information

Section 4.1 summarizes data for the transferred LLRW identified as source material listing the total weight of source material and the weight by isotope of the source material in units of kilograms. Section 4.2 summarizes data for the transferred LLRW identified as special nuclear material, listing the total weight and isotopic weight in units of grams. The summarized data is grouped by county and generator category.

Section 4.1: Transferred Source Material

Source material is defined in 10 CFR 20.1003 as (1) Uranium or thorium or any combination of uranium and thorium in any physical form; or (2) Ores that contain, by weight, one-twentieth of one percent (0.05 percent), or more, of uranium, thorium, or any combination of uranium and thorium. Source material does not include special nuclear material. Table 4-1 summarizes data by county and by generator category giving the total weight and the weight of the source material isotopes.

Table 4-1 Weight of Transferred Source Material by County and Generator Category

Table 4-1 Weight of Transferred Source Material by County and Generator Category							
COUNTY	GENERATOR CATEGORY	TOTAL Weight (kg)	Natural U (kg)	Depleted U (kg)	Natural Th (kg)	U-238 (kg)	Th-232 (kg)
ALAMEDA	ACADEMIA	0.015				0.015	
		0.077719166				0.06124565	0.016473516
CONTRA COSTA	MANUFACTURING	3.85588E-05				3.85588E-05	
	MEDICINE	0.8200333				0.8200333	
	OTHER	3.6299328	0.7400408		2.889892		
HUMBOLDT	ACADEMIA	9.31				9.31	
	NUCLEAR POWER PLANTS	1.969626672			4.72E-16	1.969626672	
LOS ANGELES	ACADEMIA	0					
	MANUFACTURING	0.0020973				0.0020047	0.0000926
ORANGE	RESEARCH	1.355910503	1.14			0.014997761	0.200912742
SAN BERNARDINO	MANUFACTURING	11.66517	7.95846				3.70671
SAN DIEGO	ACADEMIA	0.006752941				0.006752941	
	MEDICINE	33.22218		16.3279		16.89428	
SAN FRANCISCO	RESEARCH	0.001764706				0.001764706	
SANTA BARBARA	ACADEMIA	0.027062	0.02706	0.000002			
SANTA CLARA	MEDICINE	0.07301935					0.07301935
		0.005588235				0.005588235	
	RESEARCH	406				406	

Low-Level Radioactive Waste Tracking – Annual Report for 2010

COUNTY	GENERATOR CATEGORY	TOTAL Weight (kg)	Natural U (kg)	Depleted U (kg)	Natural Th (kg)	U-238 (kg)	Th-232 (kg)
YOLO	ACADEMIA	3.13931	3.109			0.00294	0.02737

Section 4.2: Transferred Special Nuclear Material

Special nuclear material is defined in 10 CFR 20.1003 as “(1) Plutonium, uranium-238, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the Commission, pursuant to the provisions of section 561 of the Atomic Energy Act of 1954, as amended, determines to be special nuclear material, but does not include source material or (2) any material artificially enriched by any of the foregoing but does not include source material.”

Table 4-2 summarizes data by county and by generator category giving the total weight and the weight of the transferred special nuclear material isotopes. Table 4-3 summarizes data on transferred special nuclear material by county, by container, and weight by isotope.

Table 4-2 Transferred Special Nuclear Material by County and Generator Category

Table 4-2 Transferred Special Nuclear Material by County and Generator Category					
COUNTY	GENERATOR	TOTAL WEIGHT (g)	URANIUM 233 (g)	URANIUM 235 (g)	PLUTONIUM (g)
CONTRA COSTA	MANUFACTURING	0.0040108		0.0040108	0
HUMBOLDT	NUCLEAR POWER PLANTS	6912.029149	126.3776242		6785.651525
LOS ANGELES	MANUFACTURING	0.13151244	0.01609537	0.01674307	0.098674
ORANGE	ACADEMIA	0.000037			0.000037
SAN LUIS OBISPO	INDUSTRIAL GAUGES	28.9559			28.9559

Table 4-3 Weight of Special Nuclear Material Transferred

Table 4-3 Weight of Special Nuclear Material Transferred			
COUNTY	CONTAINER ID	RADIONUCLIDE	WEIGHT (g)
CONTRA COSTA	10-000801 (D-84)	U-235	4.92727E-05
HUMBOLDT	1	Pu-238	0.003700852
		Pu-239	31.42667503
		Pu-240	0.378576608
		Pu-241	0.011605388
		U-233	29.21768636
	10	Pu-238	8.25E-10
		Pu-239	0.000000277
		Pu-240	7.57E-08
		Pu-241	2.45E-09
		U-233	0.00000836
	2	Pu-238	5.27002E-05
		Pu-239	0.017500057
		Pu-240	0.004790016
		Pu-241	0.000120001
		U-233	0.00000172
	3	Pu-238	0.000181
		Pu-239	0.060000038
		Pu-240	0.01640001
		Pu-241	0.000411
		U-233	0.00000114
	4	Pu-238	0.000117
		Pu-239	0.038700057
		Pu-240	0.010600016
		Pu-241	0.000265001
		U-233	0.00000172
	5	Pu-238	0.000177
		Pu-239	0.058600047
		Pu-240	0.016000013
		Pu-241	0.000401
		U-233	0.00000143
	6	Pu-238	1.902E-10
		Pu-239	6.36E-08
		Pu-240	1.741E-08
		Pu-241	5.67E-10
		U-233	0.000001923
	7	Pu-238	3.27E-13
		Pu-239	1.1E-10
		Pu-240	3E-11
		Pu-241	9.64E-13
		U-233	3.32E-09
8	Pu-238	6.46E-10	
	Pu-239	0.000000217	
	Pu-240	5.94E-08	
	Pu-241	1.91E-09	
	U-233	0.00000656	
9	Pu-238	2.93E-10	
	Pu-239	9.83E-08	
	Pu-240	2.69E-08	
	Pu-241	8.66E-10	
	U-233	0.00000297	
LOS ANGELES	1	Pu-238	0.000000129
		Pu-239	0.0000386
		Pu-240	0.000000529
		Pu-241	3.04E-09
		U-233	2.19E-08

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 4-3 Weight of Special Nuclear Material Transferred			
COUNTY	CONTAINER ID	RADIONUCLIDE	WEIGHT (g)
LOS ANGELES	T2637-D03	Pu-238	7.65E-09
	T2706-D03	Pu-238	5.88E-09
		Pu-239	0.0000161
		U-235	0.00463
	T2706-D06	Pu-239	0.0000129
	T2708-D01	Pu-238	2.54E-09
		Pu-241	9.32E-10
	T2760-D03	Pu-239	3.22E-08
	T2816-D01	Pu-239	0.00000965
		Pu-241	1.94E-09
		U-233	0.0000226
	T2816-D05	U-233	1.03E-09
		U-235	0.0000231
	T2903-D08	Pu-239	8.85E-08
	T2904-D06	U-235	0.0926
	T2947-D02	Pu-239	0.000000037
	T2987-D03	Pu-240	0.0000044
	T2988-D01	Pu-239	0.0000171
		U-235	0.00833
	T3023-D01	Pu-241	4.37E-09
		U-235	0.00278
	T3055-D02	U-235	0.0926
	T3056-D04	Pu-239	0.0000644
	T3113-D01	Pu-240	0.000000333
		U-235	0.00000273
	T3114-D06	Pu-239	0.0000273
		Pu-241	3.98E-08
		U-235	0.000594
	T3231-D02	Pu-238	1.18E-08
		Pu-239	0.00000241
U-235		0.00463	
T3231-D06	Pu-238	1.76E-09	
T3279-D04	U-235	0.00324	
T3279-D05	U-233	0.000000206	
ORANGE	10-003178	Pu-239	1.61E-08
SAN LUIS OBISPO	1	Pu-238	3.006E-07
		Pu-239	0.00006896
		Pu-240	0.00001884
		Pu-241	0.000007482

Section 5: LLRW Stored for Decay

This section summarizes data reported by the generators on LLRW stored for decay as of December 31, 2010. Many generators in the state store LLRW to allow its radioactivity to diminish to levels that permit disposal as non-radioactive waste (i.e., storage for decay). LLRW in storage for decay is normally held for ten half-lives or until radioactivity has diminished to a level that is indistinguishable from background radiation levels. Although approved off-site facilities may be used, most generators hold LLRW in storage for decay at their own facilities. Table 5-1 summarizes the volume of LLRW stored for decay by county and generator category giving the total volume and volume by waste class of the LLRW. Table 5-2 summarizes the radioactivity of LLRW stored for decay by total activity and activity by waste class of the LLRW. Table 5-3 summarizes the activity of LLRW stored for decay by county, nuclide, and isotopic activity.

Table 5-1 Total Volume and Volume by Class

Table 5-1 Total Volume and Volume by Class					
COUNTY	GENERATOR CATEGORY	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
ALAMEDA	ACADEMIA	8.75187012	8.75187012		
	MANUFACTURING	0.000254824	0.000254824		
	MEDICINE	6.299397683	6.299397683		
	RESEARCH	0	0		
AMADOR	MEDICINE	0.02831684	0.02831684		
BUTTE	MEDICINE	0.005	0.005		
CALAVERAS	MEDICINE	0.056771584	0.056771584		
CONTRA COSTA	MANUFACTURING	3.54	3.54		
	MEDICINE	2.930957274	2.930957274		
	OTHER	0.02831685	0	0.02831685	
DEL NORTE	MEDICINE	0.071641621	0.071641621		
EL DORADO	MEDICINE	0.056633693	0.056633693		
FRESNO	ACADEMIA	0.284	0.284		
	MEDICINE	0.086707776	0.086707776		
HUMBOLDT	MEDICINE	0.255021551	0.255021551		
IMPERIAL	MEDICINE	0.16990128	0.16990128		
INYO	MEDICINE	0.00001	0.00001		
KERN	MEDICINE	4.593105094	4.593105094		
LAKE	MEDICINE	0.08495054	0.08495054		
LASSEN	MEDICINE	0.03	0.03		
LOS ANGELES	ACADEMIA	28.03915317	28.03915317		
	INDUSTRIAL GAUGES	0	0		
	MANUFACTURING	56.63	56.63		
	MEDICINE	29.93919608	29.93919608		
	OTHER	0.00002	0.00002		
	RESEARCH	0.0362101	0.0362101		

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-1 Total Volume and Volume by Class					
COUNTY	GENERATOR CATEGORY	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
MARIN	MEDICINE	4.007079212	4.007079212		
MENDOCINO	MEDICINE	0.08431745	0.08431745		
MERCED	ACADEMIA	0.149155024	0.149155024		
	MEDICINE	0.05615646	0.05615646		
MONTEREY	MEDICINE	6.15018245	6.15018245		
NAPA	MEDICINE	1.114158424	1.114158424		
NEVADA	MEDICINE	0.004247527	0.004247527		
ORANGE	ACADEMIA	11.48997446	11.48997446		
	MEDICINE	14.43006219	14.43006219	0	
	OTHER	0.0000002	0.0000002		
	RESEARCH	0.01	0.01		
PLACER	MEDICINE	0.11326738	0.11326738		
RIVERSIDE	MEDICINE	19.18164971	19.18164971		
SACRAMENTO	MEDICINE	2.083872701	2.083872701		
SAN BERNARDINO	MEDICINE	24.7119493	23.4619493	0.45	0.8
	OTHER	0	0		
SAN DIEGO	ACADEMIA	5.903977147	5.903977147		
	MANUFACTURING	0.27	0.27		
	MEDICINE	9.611443439	9.611443439		
	RESEARCH	61.77802989	61.77802989		
SAN FRANCISCO	MEDICINE	2.905621885	2.905621885		
	OTHER	0	0		
	RESEARCH	1.44983	1.44983		
SAN JOAQUIN	ACADEMIA	0	0		
	MEDICINE	0.14158424	0.14158424		
SAN LUIS OBISPO	MEDICINE	3.0000011	3.0000011		
SAN MATEO	INDUSTRIAL GAUGES	2.73519983	2.73519983		
	MEDICINE	1.001070882	1.001070882		
	RESEARCH	0.023	0.023		
SANTA BARBARA	ACADEMIA	0	0		
	MEDICINE	0.0000841	0.0000841		
SANTA CLARA	MANUFACTURING	1.15	1.15		
	MEDICINE	254.6193199	254.6193199		
	RESEARCH	1.540876952	1.540876952		
SANTA CRUZ	MEDICINE	0.7	0.7		
	RESEARCH	2.31	2.31		
SHASTA	MEDICINE	2.679	2.679		
SOLANO	MEDICINE	0.21415842	0.21415842		
SONOMA	MEDICINE	1.92489035	1.92489035		
	OTHER	0.1	0.1		
STANISLAUS	MEDICINE	0.085233708	0.085233708		

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-1 Total Volume and Volume by Class

COUNTY	GENERATOR CATEGORY	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
TULARE	MEDICINE	1.195	1.195		
TUOLUMNE	MEDICINE	0.02831685	0.02831685		
VENTURA	MEDICINE	7.329154082	7.329154082		
YOLO	MEDICINE	0.022653474	0.022653474		
YUBA	MEDICINE	0.003398022	0.003398022		

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-2 Total Activity and Activity by Class

Table 5-2 Total Activity and Activity by Class					
COUNTY	GENERATOR	TOTAL ACTIVITY (MBq)	CLASS A ACTIVITY (MBq)	CLASS B ACTIVITY (MBq)	CLASS C ACTIVITY (MBq)
ALAMEDA	ACADEMIA	964.1157291	964.1157291		
	MANUFACTURING	2861759.819	2861759.819		
	MEDICINE	4150.68114	4150.68114		
	RESEARCH	18.5	18.5		
AMADOR	MEDICINE	11.1	11.1		
BUTTE	MEDICINE	777.37	777.37		
CALAVERAS	MEDICINE	7.40000111	7.40000111		
CONTRA COSTA	MANUFACTURING	5516	5516		
	MEDICINE	4255.4722	4255.4722		
	OTHER	2738	0	2738	
DEL NORTE	MEDICINE	1113.811	1113.811		
EL DORADO	MEDICINE	832.833	832.833		
FRESNO	ACADEMIA	0.116	0.116		
	MEDICINE	2604.843934	2604.843934		
HUMBOLDT	MEDICINE	716.59972	716.59972		
IMPERIAL	MEDICINE	467.2010312	467.2010312		
INYO	MEDICINE	4680.537	4680.537		
KERN	MEDICINE	3003.845821	3003.845821		
KINGS	MEDICINE	0	0		
LAKE	MEDICINE	8.2436	8.2436		
LASSEN	MEDICINE	2	2		
LOS ANGELES	ACADEMIA	50474.0552	50474.0552		
	INDUSTRIAL GAUGES	0	0		
	MANUFACTURING	32589.92	32589.92		
	MEDICINE	2041304.817	2041304.817		
	OTHER	6.743361	6.743361		
RESEARCH	40453.15746	40453.15746			
MADERA	MEDICINE	185	185		
MARIN	MEDICINE	2782.712	2782.712		
MENDOCINO	MEDICINE	160.84998	160.84998		
MERCED	ACADEMIA	188.7	188.7		
	MEDICINE	758	758		
MONTEREY	MEDICINE	7507.897068	7507.897068		
NAPA	MEDICINE	926.40925	926.40925		
NEVADA	MEDICINE	2410.1948	2410.1948		
ORANGE	ACADEMIA	1910.088	1910.088		
	MEDICINE	2616487.427	2607968.529	8518.898433	
	OTHER	602	602		

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-2 Total Activity and Activity by Class

COUNTY	GENERATOR	TOTAL ACTIVITY (MBq)	CLASS A ACTIVITY (MBq)	CLASS B ACTIVITY (MBq)	CLASS C ACTIVITY (MBq)
ORANGE	RESEARCH	37000	37000		
PLACER	MEDICINE	8560.9453	8560.9453		
RIVERSIDE	MEDICINE	11041.26775	11041.26775		
SACRAMENTO	MEDICINE	1281627.104	1281627.104		
SAN BERNARDINO	MEDICINE	17642.00826	16907.00826	415	320
	OTHER	0	0		
SAN DIEGO	ACADEMIA	6615.745	6615.745		
	MANUFACTURING	420	420		
	MEDICINE	1716614.51	1716614.51		
	RESEARCH	39832.27341	39832.27341		
SAN FRANCISCO	MEDICINE	7884.2466	7884.2466		
	OTHER	28.71765811	28.71765811		
	RESEARCH	1541.457	1541.457		
SAN JOAQUIN	ACADEMIA	9.25	9.25		
	MEDICINE	269.45139	269.45139		
SAN LUIS OBISPO	MEDICINE	240.5	240.5		
SAN MATEO	INDUSTRIAL GAUGES	18205.99	18205.99		
	MEDICINE	6657.07996	6657.07996		
	RESEARCH	44.3	44.3		
SANTA BARBARA	ACADEMIA	0	0		
	MEDICINE	2770.2	2770.2		
SANTA CLARA	MANUFACTURING	1696	1696		
	MEDICINE	2916186.1	2916186.1		
	RESEARCH	103.32	103.32		
SANTA CRUZ	MEDICINE	118.71	118.71		
	RESEARCH	531	531		
SHASTA	MEDICINE	2294.18	2294.18		
SISKIYOU	MEDICINE	2.749100126	2.749100126		
SOLANO	MEDICINE	904.7	904.7		
SONOMA	MEDICINE	3210.60772	3210.60772		
	OTHER	0.17	0.17		
STANISLAUS	MEDICINE	52.06455	52.06455		
TULARE	MEDICINE	287.78	287.78		
TUOLUMNE	MEDICINE	0.5698	0.5698		
VENTURA	MEDICINE	3831.113162	3831.113162		
YOLO	MEDICINE	1.924	1.924		
	RESEARCH	1470.75	1470.75		
YUBA	MEDICINE	111	111		

Table 5-3 Activity by Radionuclide

Table 5-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
ALAMEDA	Ba-133	2.96
	Cd-109	0.196219311
	Co-56	0.00137
	Co-57	1.073338505
	Cr-51	23.088
	F-18	20.0037
	Fe-55	0.00213
	Ga-67	24.07074
	I-125	0.015762
	I-131	615
	In-111	85.67074
	Ir-192	2861379.836
	Mn-54	0.00100944
	Nb-94	0.0303833
	Nb-95	0.0247
	P-32	328.8306871
	P-33	1741.22
	S-35	908.18128
	Sm-153	0.00074
	Sr-89	0.00074
	Tc-99m	2301.15074
Tl-201	373.70074	
Xe-133	7.4	
Y-90	24.05	
Zn-65	0.47327248	
AMADOR	Cs-137	3.7
	Tc-99m	7.4
BUTTE	F-18	0.37
	I-125	0
	Mo-99	333
	Tc-99m	444
CALAVERAS	Co-57	0.00000111
	Tc-99m	7.4
CONTRA COSTA	Cr-51	3.7
	F-18	9.2537
	Ga-67	138.5
	I-123	30
	I-125	3.7
	I-131	559.2
	In-111	76.9
	Sm-153	172
	Sr-90	2738
	Tc-99m	7303.0185
	Tl-201	323.2
	Xe-133	1130
Y-90	22	
DEL NORTE	Co-57	3.811
	Tc-99m	1110
EL DORADO	Co-57	3.626
	Sr-90	791.06
	Tc-99m	38.147
FRESNO	Ba-133	1.42709
	Co-57	7.104
	Co-60	0.12247
	Cs-137	12.68434
	Eu-152	0.0185
	Ga-67	29.6
	Gd-153	0.06808

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-3 Activity by Radionuclide

COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
FRESNO	I-125	0.116
	I-129	0.00037
	In-111	33.3
	Ra-226	0.00083509
	Sr-90	2224.292
	Tc-99m	265.11
	Tl-201	31.117
HUMBOLDT	Ba-133	0.0148
	Co-57	8.991
	Cs-137	4.588
	I-131	0.0037
	In-111	0.00185
	Tc-99m	703
	Tl-201	0.00037
IMPERIAL	Co-57	0.00103119
	Tc-99m	448.7
	Tl-201	18.5
INYO	Ga-67	25.9
	I-123	0.037
	In-111	14.8
	Tc-99m	4625
	Tl-201	14.8
KERN	Co-57	0.01295
	Eu-152	0.0000074
	Eu-154	0.000518
	Eu-155	0.00008584
	Ga-67	10
	I-131	0
	In-111	24.8
	Mo-99	36.1
	Tc-99m	1091.06154
	Tl-201	40
	Xe-133	1218.87472
KINGS	Tc-99m	
LAKE	Co-57	0.1295
	Cs-137	0.7141
	Tc-99m	7.4
LASSEN	Tc-99m	2
LOS ANGELES	Ag-110	0.63
	Al-26	0.04
	Am-241	156.073548
	Ba-133	22.86196478
	Be-7	30.47
	C-14	168.9901
	Ca-45	7.212
	Cd-109	3.88
	Ce-141	1.9499
	Co-56	27.33
	Co-57	1316.530644
	Co-58	14.28
	Co-60	14690.36081
	Cr-51	2089.4462
	Cs-137	22130.67846
	Eu-152	0.0272579
	F-18	37152.0787
	Ga-67	24282.607
	Gd-153	6499.689286
	H-3	653.60736
	I-123	3511.2185
I-125	65799.6672	
I-129	0.009731	
I-131	474493.6619	

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
LOS ANGELES	In-111	35858.668
	Ir-192	28934
	Kr-85	38.93325
	Mn-54	7.84
	Na-22	4.013905
	Nb-94	0.68
	Nb-95	0.37629
	Ni-63	31.45
	P-32	2454.1665
	P-33	23.674
	Pd-103	19903.47418
	Ra-226	1.10418878
	Re-188	48.3
	Ru-106	0.17
	S-35	2338.7459
	S-36	3473
	Sm-153	520313.37
	Sr-89	130
	Sr-90	6586.54538
	Ta-182	0.86
	Tc-99	14.46
	Tc-99m	825899.7188
	Th-229	0.888
	Tl-201	17134.8237
Tm-170	1.196	
U-238	1.122	
Xe-133	9428.005	
Y-90	57989.6	
Zn-65	4.47	
MADERA	Tc-99m	185
MARIN	Ba-133	2.22
	Co-57	1.11
	In-111	4.684
	Sr-90	185
	Tc-99m	2265.698
	Tl-201	250
	Xe-133	74
MENDOCINO	Co-57	12.728
	Ga-67	0
	Gd-153	0.01998
	I-123	0
	I-131	0.034
	In-111	0.068
	Tc-99m	37
	Tl-201	111
MERCED	I-125	188.7
	In-111	0
	Tc-99m	758
	Tl-201	0
MONTEREY	Co-57	136.505321
	Cs-137	7244.895719
	F-18	0.05
	Ga-67	0.1
	I-131	0.1
	In-111	0.1
	Ra-226	0.046028
	Tc-99m	107.5
	Tl-201	18.6
NAPA	Co-57	0.00925
	F-18	37
	I-125	370
	I-131	37
	In-111	18
	Tc-99m	427.4

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
	Tl-201	37
NEVADA	I-125	5.18
	Tc-99m	2405.0148
ORANGE	Am-241	33.3
	Au-195	76.04314
	Ba-133	22.4503648
	Cm-244	7.363
	Co-57	206.4521545
	Co-60	0.485
	Cr-51	44.4
	Cs-137	12614.48385
	F-18	37526.75
	Ga-67	21117.75
	Gd-153	14.21254656
	Ge-68	68.04781
	H-3	37
	I-123	5402
	I-125	469.345
	I-131	1393140.659
	In-111	25568.68557
	Ni-63	526.88
	P-32	897.546
	P-33	7.4
	S-35	844.192
	Sm-153	296
	Sr-85	13.43599241
	Sr-89	18.5
	Sr-90	1534.67231
	Tc-99	37
	Tc-99m	1064018.014
	Tl-201	27483.23
	Xe-133	50714.75004
	Y-90	31735.5
PLACER	Co-57	88.8
	Cr-51	0.02923
	Ga-67	159.655
	I-125	875.938
PLACER	In-111	5.9385
	Ra-223	0.481
	Tc-99m	7422.163
	Tl-201	0.09657
	Xe-133	7.844
RIVERSIDE	Ba-133	3.418171
	Co-57	201.808101
	Cs-137	6.29148
	F-18	300
	Ga-67	74
	I-125	0.4
	I-131	150
	In-111	19.8
	Pd-103	110
	Sm-153	30
	Tc-99m	9588.55
	Tl-201	462
	Xe-133	95
SACRAMENTO	Am-241	427.72
	Ba-133	3.885
	Co-57	43.1772055
	Cr-51	719
	Cs-137	117.96636
	F-18	37000
	Ga-67	1373
	Gd-153	0.000185
	I-123	926
	I-125	2037.405

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
SACRAMENTO	I-131	46250
	In-111	18610.56
	Sm-153	0.74
	Sr-89	37.74
	Tc-99m	1038021.25
	Tl-201	43558.66
	Xe-133	92500
SAN BERNARDINO	Ag-110	8.3825
	Al-26	0.3593
	Ba-133	3.469601
	Be-7	2492.1085
	Cd-109	2.3431
	Co-56	737.3405
	Co-57	3822.242274
	Co-58	1618.7606
	Co-60	8.8919
	Cr-51	2E-21
	Cs-137	3773.776
	F-18	300
	Ga-67	100
	I-123	120
	I-125	0.139
	I-131	329.5
	In-111	1.1100002
	Mn-54	217.3075
	Na-22	9.9606
	P-32	0.034000015
	Re-184	2631.4611
	S-35	3.603E-08
	Sm-153	70
	Ta-182	0.0096
	Tc-99	41.4
	Tc-99m	1106.17
	Tl-201	175
Xe-133	42.47407	
Y-90	1.5E-77	
Zn-65	57.885	
SAN DIEGO	Ba-133	
	C-14	28.34
	Co-57	7.68999786
	Cr-51	122.891
	Cs-131	0
	Cs-137	
	F-18	37158
	Fe-59	2.78
	Ga-67	3389.2
	H-3	491.8500022
	I-123	1866.4
	I-125	4876.99919
	I-131	1401735.73
	In-111	13986.42
	P-32	2890.558414
	P-33	1639.324003
	Pd-103	0
	Rb-86	1.48
	S-35	2119.76537
	Sm-153	10.5
Tc-99m	287385.1	
Tl-201	3767	
Xe-133	370	
Y-90	1150	
SAN FRANCISCO	C-14	36.48365424
	Co-57	7.215
	Co-60	0.6216
	Cs-137	4.736
	F-18	0
	Ga-67	4
	H-3	70.93300387

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
SAN FRANCISCO	I-125	982.424
	I-131	3.256
	In-111	14.329
	P-32	29.489
	P-33	235.727
	Rb-86	0.111
	S-35	210.789
	Sr-90	537.314
	Tc-99m	6966.66
	Xe-133	350
Zr-89	0.333	
SAN JOAQUIN	Ba-133	5.994
	Co-57	12.839
	Cs-137	6.364
	H-3	9.25
	I-125	222
	P-32	
	Pd-103	0.05439
	Tc-99m	22.2
	Tl-201	0
SAN LUIS OBISPO	F-18	0
	Tc-99	111
	Tc-99m	129.5
SAN MATEO	Am-241	6.10796
	Cr-51	18.5
	Ga-67	0.37
	I-123	0
	I-125	1097.57
	I-131	5.032
	In-111	0.37
	P-32	112.1
	S-35	17022.12
	Tc-99m	6604.5
	Tl-201	40.7
	Y-90	0
SANTA BARBARA	F-18	18.5
	Ga-67	0
	I-123	37
	I-131	0
	In-111	40.85
	P-32	325.6
	S-35	162.8
	Sm-153	0
	Tc-99m	2671.9
	Tl-201	2.35
	Y-90	0
SANTA CLARA	Am-241	3.56532
	Au-196	2
	Ba-133	13.85502
	Bi-207	0.056758
	C-14	2483.44
	Ca-45	4.8174
	Cd-109	3.7148
	Cl-36	83.583
	Cm-244	0.0196544
	Co-57	252.3737221
	Co-58	2
	Co-60	1.5
	Cr-51	3601.254
	Cs-137	1743.839718
	Eu-152	0.0185
	Eu-154	0.0185
	F-18	37000
	Fe-55	13.4976
	Ga-67	1174.07
	Gd-153	

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
SANTA CLARA	Ge-68	55.1945169
	H-3	711880
	I-123	12
	I-125	2017.9434
	I-131	1395527.745
	In-111	4644.3737
	Kr-85	49.617
	Mn-54	3
	Na-22	4.5251
	Ni-63	55.278
	P-32	11367.621
	P-33	1.18659E-05
	Pb-210	0.10989
	Pm-147	4.5066
	Ra-226	0.47841
	Rb-86	1.94842E-58
	S-35	3327.04
	Sm-153	555127
	Sr-89	148
	Sr-90	414.31675
	Tc-99	7.474
Tc-99m	191959.4537	
Th-228	0.0149073	
Th-229	1.71643E-05	
Th-232	7.844	
Tl-201	2144.1537	
U-235	0.037037	
U-238	14.9887	
W-181	20	
Xe-133	162	
Y-88	6.7673E-13	
Y-90	4	
SANTA CRUZ	I-131	50
	In-111	0.84
	P-32	481
	Tc-99m	79.67
	Tl-201	38.2
SHASTA	Ga-67	0.37
	I-123	10
	I-131	37
	In-111	22
	Mo-99	370
	Sm-153	0.37
	Tc-99m	1850
	Tl-201	3.7
Xe-133	0.74	
SISKIYOU	Ba-133	1.4763
	Co-57	0.7955
	Cs-137	0.4773
	I-125	1.258E-07
SOLANO	Pd-103	37
	Tc-99m	793.7
	Tl-201	74
SONOMA	Ba-133	2.516
	C-14	0.04
	Ga-67	15
	H-3	0.13
	I-125	0.02072
	Pd-103	2593.071
	Tc-99m	600
STANISLAUS	Co-57	0.26455
	Tc-99m	51.8
TULARE	Ga-67	1.54

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 5-3 Activity by Radionuclide

COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
TULARE	I-123	7.4
	I-131	1.16
	In-111	4.66
	Tc-99m	123.82
	Tl-201	149
	Y-90	0.2
TUOLUMNE	Tc-99m	0.5698
VENTURA	Co-57	105.80631
	Cs-137	1814.48
	Fe-59	0.001082254
	Ga-67	92.5
	Ge-68	0.0037
	I-125	122.3733042
	I-131	37
	In-111	148
	P-32	213.12
	P-33	151.8031659
	S-35	0.3256
	Sm-153	18.5
	Tc-99m	973.7
	Tl-201	55.5
Xe-133	98	
YOLO	Co-57	0.666
	P-32	1470.75
	Tc-99m	1.258
YUBA	Tc-99m	111
	Tl-201	0

Section 6: LLRW Stored for Later Transfer or Shipment

This section summarizes the data reported by generators that store LLRW pending future transfer or shipment for disposal at a licensed LLRW disposal facility as of December 31, 2010. Table 6-1 summarizes the volume of LLRW stored for later transfer by county and generator category giving the total volume and waste class of the LLRW. Table 6-2 summarizes the radioactivity of LLRW stored for later transfer by total activity and activity by waste class. Table 6-3 summarizes the radioactivity of LLRW stored for later transfer by county, radionuclide, and isotopic activity.

Table 6-1 Total Volume and Volume by Class

Table 6-1 Total Volume and Volume by Class					
COUNTY	GENERATOR CATEGORY	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
ALAMEDA	ACADEMIA	4134.099364	4134.099364		
	MEDICINE	730.38	730.38		
	RESEARCH	354.682	354.682		
CONTRA COSTA	RESEARCH	0.491	0.491		
FRESNO	ACADEMIA	18.87	18.87		
	RESEARCH	55.5	55.5		
LOS ANGELES	ACADEMIA	20292.72043	20292.72043		
	MANUFACTURING	52796.944	52796.944		
	MEDICINE	31059.05573	31059.05573		
	REACTOR VENDORS OR DESIGNERS	66600	0	66600	
	RESEARCH	16325.17707	14495.17707	1830	
ORANGE	MANUFACTURING	0.0037	0.0037		
	MEDICINE	217.19	217.19		
	RESEARCH	176.97137	176.97137		
SACRAMENTO	MEDICINE	137.0702	137.0702		
SAN BERNARDINO	MEDICINE	343.8303	343.8303		
SAN DIEGO	ACADEMIA	22009.4958	22009.4958		
	MEDICINE	1788.832	1788.832		
	OTHER	370.111	370.111		
	RESEARCH	23136.234	23136.234		
SAN FRANCISCO	ACADEMIA	25.863	25.863		
	MEDICINE	11.1	11.1		
	RESEARCH	648.65	648.65		
SAN MATEO	INDUSTRIAL GAUGES	1679.78968	1679.78968		
SANTA BARBARA	MANUFACTURING	800	800		
	MEDICINE	697902.88	697902.88		
SANTA CLARA	ACADEMIA	0.263995	0.263995		
	MEDICINE	204.13122	204.13122		
	RESEARCH	2266.3548	2266.3548		
SANTA CRUZ	ACADEMIA	426.24	426.24		
	MEDICINE	10352.6	10352.6		
SOLANO	MANUFACTURING	370	370		
	MEDICINE	1032.3	1032.3		
VENTURA	MEDICINE	2795.5461	2795.5461		

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 6-1 Total Volume and Volume by Class

COUNTY	GENERATOR CATEGORY	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
YOLO	ACADEMIA	17512.10299	17512.10299		
	RESEARCH	0.20017	0.20017		

Table 6-2 Total Activity and Activity by Class

Table 6-2 Total Activity and Activity by Class

COUNTY	GENERATOR CATEGORY	TOTAL ACTIVITY (MBq)	CLASS A (MBq)	CLASS B (MBq)	CLASS C (MBq)
ALAMEDA	ACADEMIA	4134.099364	4134.099364		
	MEDICINE	730.38	730.38		
	RESEARCH	354.682	354.682		
CONTRA COSTA	RESEARCH	0.491	0.491		
FRESNO	ACADEMIA	18.87	18.87		
	RESEARCH	55.5	55.5		
LOS ANGELES	ACADEMIA	20292.72043	20292.72043		
	MANUFACTURING	52796.944	52796.944		
	MEDICINE	31059.05573	31059.05573		
	REACTOR VENDORS OR DESIGNERS	66600	0	66600	
	RESEARCH	16325.17707	14495.17707	1830	
ORANGE	MANUFACTURING	0.0037	0.0037		
	MEDICINE	217.19	217.19		
	RESEARCH	176.97137	176.97137		
SACRAMENTO	MEDICINE	137.0702	137.0702		
SAN BERNARDINO	MEDICINE	343.8303	343.8303		
SAN DIEGO	ACADEMIA	22009.4958	22009.4958		
	MEDICINE	1788.832	1788.832		
	OTHER	370.111	370.111		
	RESEARCH	23136.234	23136.234		
SAN FRANCISCO	ACADEMIA	25.863	25.863		
	MEDICINE	11.1	11.1		
	RESEARCH	648.65	648.65		
SAN MATEO	INDUSTRIAL GAUGES	1679.78968	1679.78968		
SANTA BARBARA	MANUFACTURING	800	800		
	MEDICINE	697902.88	697902.88		
SANTA CLARA	ACADEMIA	0.263995	0.263995		
	MEDICINE	204.13122	204.13122		
	RESEARCH	2266.3548	2266.3548		
SANTA CRUZ	ACADEMIA	426.24	426.24		
	MEDICINE	10352.6	10352.6		
SOLANO	MANUFACTURING	370	370		
	MEDICINE	1032.3	1032.3		
VENTURA	MEDICINE	2795.5461	2795.5461		
YOLO	ACADEMIA	17512.10299	17512.10299		
	RESEARCH	0.20017	0.20017		

Table 6-3 Activity by Radionuclide

Table 6-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
ALAMEDA	Am-241	0.00007807
	Ba-133	1.15107
	C-14	445.712
	Ca-45	0.03515
	Cd-109	0.02146
	Co-60	0.111185
	Cr-51	3.105455335
	Cs-137	1.6021
	Eu-152	0.213934
	Eu-154	0.00925
	Fe-55	74.37
	Gd-153	0.16724
	H-3	649.86087
	I-125	666.06919
	I-131	0.064935
	Na-22	0.197617
	Nat U	2989.23
	Ni-63	227.18
	Np-237	0.00000407
	P-32	44.7692449
	P-33	0.074
	Pb-210	0.001184
	Ra-226	0.003663
	Rb-86	5.587E-32
	S-35	48.766
	Tc-99	0.00000407
	Th-232	6.839191
	U-235	0.212232
	U-238	59.088926
	U-nat	0.2959667
Zn-65	0.00615458	
CONTRA COSTA	Co-57	0.488
	I-125	0.003
FRESNO	C-14	55.5
	H-3	18.87
LOS ANGELES	Ag-110m	1.147
	Am-241	0.8905
	Ba-133	54.3799
	Bi-207	0.185
	Bi-210	0.00024
	C-14	17159.21547
	Ca-41	5.55
	Ca-45	31.67217
	Cd-109	8921.0737
	Ce-139	0.0148
	Cl-36	23.33511
	Co-56	339.9671
	Co-57	20302.1441
	Co-58	0.481
	Co-60	1.5871
	Cr-51	3.284
	Cs-137	3355.9928
	Depleted U	13801.84019
	Eu-152	178.18201
	Eu-154	24.864
	Fe-55	28
	Gd-153	19442.76
	Ge-68	2352.9299
	H-3	98768.09801
	Hg-203	0.0185
	I-125	42.23
	I-129	2.1803
	I-131	0.0536
	Mn-54	0.01591

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 6-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
LOS ANGELES	Mo-99	4.45
	Na-22	160.5576676
	Ni-63	1351.415
	P-32	15.137
	Pm-147	111
	Pu-239	0.0067
	Ra-226	3.77
	S-35	47.58
	Sn-113	0.0222
	Sr-85	0.07955
	Sr-90	236.96755
	Ta-182	0.555
	Tc-99	0.000171
	Te-123m	0.7178
	Th-232	0.74
	Tl-204	0.037
	U-232	3.9014
	U-235	0.000444
	U-238	13.254
	U-nat	16.05
W-181	1.11	
Y-88	0.6512	
Zn-65	242.074	
ORANGE	C-14	0.037
	Cd-109	1.369
	Co-56	122.1
	Co-57	6.142
	Cs-137	0.00037
	H-3	27583763.44
	U-nat	1.073
SACRAMENTO	Cd-109	2.96
	Co-56	83.62
	Co-57	8.88
	H-3	37
	Mn-54	0.0222
	Ta-182	0.74
	W-181	3.7
	Zn-65	0.148
SAN BERNARDINO	C-14	1.9
	Co-57	111.9
	Cs-137	10
	Ga-67	1.6E-239
	H-3	220
	I-125	4.8E-16
	In-111	9.6E-276
	P-32	0.0023
	Sm-153	3.7E-288
	U-238	0.028
	Xe-133	1.2E-148
	Y-90	3.3E-208
SAN DIEGO	Am-241	0.9953
	Ba-133	37.222
	C-14	7679.674
	Ca-45	16.539
	Cd-109	3.7
	Co-56	207.2
	Co-57	9.9715
	Fe-55	22.237
	Fe-59	3.7
	Ge-68	0.037
	H-3	38656.05
	I-125	446.951
	Mn-54	0.037
	Na-22	26.27
	Nat U	1.48
	Ni-63	7.4
	P-32	10.072
	P-33	0.999

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 6-3 Activity by Radionuclide

COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
SAN DIEGO	Pb-210	37
	Po-210	48.1
	Ra-226	0.037
	S-35	12.65
	Th-Nitrate	0.021
	U-238	0.0777
	U-acetate	0.13
	U-Nitrate	0.032
Zn-65	48.1	
SAN FRANCISCO	C-14	96.237
	Cd-109	4.366
	H-3	369.889
	I-125	74.962
	In-111	0.296
	Ni-63	0.037
	P-32	8.362
	P-33	16.058
	Rb-86	0.074
	S-35	141.747
	U-238	0.148
	Zn-65	0.185
SAN MATEO	C-14	248.74096
	H-3	1242.0638
	I-125	96.709
	S-35	42.698
SANTA BARBARA	Co-57	0
	Gd-153	0
	Ge-68	119.88
	H-3	800
	I-125	0
	Mo-99	32597
	Pd-103	0
	Tc-99	633403
Tc-99m	31783	
SANTA CLARA	C-14	68.277025
	Cd-109	3.7
	Co-56	88.06
	Co-57	1.295
	H-3	295.26777
	Mn-54	0.00222
	P-33	0.074
	U-238	1940
	W-181	0.074
Zn-65	74	
SANTA CRUZ	Ca-45	66.6
	Cs-131	0
	Cs-137	9986.3
	I-125	0
	Mn-54	33.3
	P-32	293.04
	Pd-103	366.3
S-35	33.3	
SOLANO	Depleted U	370
	Tc-99m	862.1
	Tl-201	170.2
VENTURA	C-14	1400.3871
	Ca-45	342.25
	H-3	1052.909
YOLO	C-14	465.11057
	Cd-109	296.37
	Co-57	12.395
	Cr-51	6.81
	Cu-64	0

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 6-3 Activity by Radionuclide

COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
YOLO	Cu-67	0
	Eu-152	0.037
	Fe-59	51.541
	H-3	3367.873
	I-125	5586.047
	I-131	741.01
	In-111	155.4
	Mn-54	0
	Na-22	11.285
	P-32	3171.85837
	Rb-86	885.595
	S-35	2594.105
	Sn-113	0.629
	Sn-117m	0
	Sr-85	0.0213
	Th-232	11.655
	Tl-201	0.00122
	U-238	1.85
	Y-88	0.0847
	Y-90	0
Zn-65	4.033	
Zr-89	148.592	

Section 7: LLRW Stored as Not Acceptable for Disposal at a Licensed LLRW Disposal Site

This section summarizes the data reported by generators for LLRW known to the generator as not acceptable for disposal at a licensed LLRW disposal facility (i.e., waste that does not meet the waste acceptance criteria of any disposal facility). Table 7-1 summarizes the volume of LLRW stored as not acceptable for disposal by county and generator category giving the total volume and waste class of the LLRW. Table 7-2 summarizes the radioactivity of LLRW stored as not acceptable for disposal by total activity and activity by waste class. Table 7-3 summarizes the radioactivity of LLRW stored as not acceptable for disposal by county, radionuclide, and isotopic activity.

Table 7-1 Total Volume and Volume by Class

Table 7-1 Total Volume and Volume by Class					
COUNTY	GENERATOR CATEGORY	TOTAL VOLUME (m ³)	CLASS A (m ³)	CLASS B (m ³)	CLASS C (m ³)
LOS ANGELES	ACADEMIA	2,888,318.7	0		2,888,318.7
	MANUFACTURING	0	0		
<hr/>					
SAN DIEGO	ACADEMIA	0	0		

Table 7-2 Total Activity and Activity by Class

Table 7-2 Total Activity and Activity by Class					
COUNTY	GENERATOR CATEGORY	TOTAL ACTIVITY (MBq)	CLASS A (MBq)	CLASS B (MBq)	CLASS C (MBq)
LOS ANGELES	ACADEMIA	370,989	0		370,989
	MANUFACTURING	180,460.1	180,460.1		
<hr/>					
SAN DIEGO	ACADEMIA	930,453.8	930,453.8		

Table 7-3 Activity by Radionuclide

Table 7-3 Activity by Radionuclide		
COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
LOS ANGELES	Am-241	52,384.6
	Am-243	144.3
	Ba-133	625.3
	Bi-207	0
	Bi-212	114.7
	Bi-214	240.5
	C-14	0
	Cd-109	296
	Cf-252	11.1
	Cm-244	25,796.4
	Co-57	825.1
	Co-60	370,003.7
	Cs-134	3.7
	Cs-137	82,366.8
	Fe-55	59.2
	Fe-59	0
	Gd-148	0
	Gd-153	3,030.3
	Ge-68	7.4
	I-125	529.1
	Na-22	11.1
	Pa-231	37
	Pb-212	114.7
	Pb-214	218.3
	Ra-226	62.9
	Ra-228	196.1
	Sr-90	143.19

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Table 7-3 Activity by Radionuclide

COUNTY	RADIONUCLIDE	ACTIVITY (MBq)
SAN DIEGO	Tl-208	48.1
	Cs-137	8584
	Ni-63	555
	Ra-226	165.538

Appendix A: List of Container Type and Description as used by LLRW Generators

Type	Description
1	Wooden Box or Crate
2	Metal Box
3	Plastic Drum or Pail
4	Metal Drum or Pail
5	Metal Tank or Liner
6	Concrete Tank or Liner
7	Polyethylene Tank or Liner
8	Fiberglass Tank or Liner
9	De-mineralizer
10	Gas Cylinder
11	Bulk, Unpackaged Waste
12	Unpackaged Components
13	High Integrity Container
19	Other ⁶

For container/waste requiring disposal in an approved structural overpack the numerical code must be followed by “-OP” to designate an overpack used. An overpack is an enclosure used by a single consignor to provide protection or convenience in handling of a package or to consolidate two or more packages.

⁶ Other is defined as any other container type that has not been given a specific description in the table.

Appendix B: Radioisotope General Information

Radioisotope General Information						
Isotope Symbol	Element Name	Mass Number	Atomic Number	Atomic Half Life ⁷	Time factor	Comments
Ac-225	Actinium	255	89	100	d	
Ac-225	Actinium	255	89	100	d	
Ag-108m	Silver	108	47	127	a	
Ag-110m	Silver	110	47	249.85	d	
Am-241	Americium	241	95	432.2	a	
Am-243	Americium	243	95	7.38E+03	a	
Au-196	Gold	196	79	6.183	d	
Au-198	Gold	198	79	2.696	d	
Ba-133	Barium	131	56	11.8	d	
Bi-207	Bismuth	207	83	33.4	a	
Bi-210	Bismuth	210	83	5.013	d	
Bi-212	Bismuth	212	83	60.55	m	
Bi-214	Bismuth	214	83	19.9	m	
C-14	Carbon	14	6	5.70E+03	a	
Ca-45	Calcium	45	20	162.7	d	
Cd-109	Cadmium	109	48	464	d	
Ce-139	Cerium	139	58	137.66	d	
Ce-141	Cerium	141	58	32.5	d	
Cf-252	Californium	252	98	2.639	a	
Cl-36	Chlorine	36	17	3.01E+05	a	
Cm-242	Curium	242	96	163.2	d	
Cm-244	Curium	244	96	18.11	a	
Co-56	Cobalt	56	27	78.76	d	
Co-57	Cobalt	57	27	270.9	d	
Co-58	Cobalt	58	27	70.8	d	
Co-60	Cobalt	60	27	5.271	a	
Cr-51	Chromium	51	24	27.704	d	
Cs-131	Cesium	131	55	6.475	d	
Cs-134	Cesium	134	55	2.062	a	
Cs-137	Cesium	137	55	30.17 a	a	
DU	Depleted Uranium	***	92	***		U-234 & U-238 with a much reduced abundance of U-235
Eu-152	Europium	152	63	13.6	a	
Eu-154	Europium	154	63	8.8	a	

⁷ Note: m - minutes, h - hours, d - days, a – years

*** see specific isotopic information for atomic half-life data.

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Radioisotope General Information						
Isotope Symbol	Element Name	Mass Number	Atomic Number	Atomic Half Life ⁷	Time factor	Comments
Eu-155	Europium	155	63	4.96	a	
F-18	Fluorine	18	9	109.74	m	
Fe-55	Iron	55	26	2.7	a	
Fe-59	Iron	59	26	44.63	d	
Ga-67	Gallium	67	31	3.261	d	
Gd-148	Gadolinium	148	64	75	a	
Gd-153	Gadolinium	153	64	241.6	d	
Ge-68	Germanium	68	32	288	d	
H-3	Hydrogen (Tritium)	3	1	12.28	a	
Hg-203	Mercury	203	80	46.6	d	
Ho-166	Holmium	166	67	26.8	h	
I-123	Iodine	123	53	13.13	h	
I-125	Iodine	125	53	60.14	d	
I-129	Iodine	129	53	1.57E+07	a	
I-133	Iodine	133	53	20.8	h	
In-111	Indium	111	49	2.83	d	
In-114m	Indium	114	49	49.51	d	
Ir-192	Iridium	192	77	74.02	d	
Kr-85	Krypton	85	36	10.72	a	
Lu-177	Lutetium	177	71	6.71	d	
Mn-54	Manganese	54	25	312.7	d	
Mo-99	Molybdenum	99	42	66.02	h	
Na-22	Sodium	22	11	2.602	a	
Nat Th	Natural Thorium	***	90	***		Th-229, Th-230 & Th-232 in abundances as found in nature
Nat U	Natural Uranium	***	92	***		U-234, U-235, U-238 in abundances as found in nature
Nb-94	Niobium	94	41	2.03E+04	a	
Nb-95	Niobium	95	41	35.06	d	
Nd-144	Neodymium	144	60	2.38E+15	a	
Ni-59	Nickel	59	28	7.50E+04	a	
Ni-63	Nickel	63	28	100.1	a	
Np-237	Neptunium	237	93	2.14E+06	a	
P-32	Phosphorous	32	15	14.29	d	
P-33	Phosphorous	33	15	17.4	d	
Pa-231	Protactinium	231	91	3.28E+04	a	
Pa-234	Protactinium	234	91	6.7	h	
Pb-210	Lead	210	82	22.26	a	
Pb-212	Lead	212	82	10.643	h	

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Radioisotope General Information						
Isotope Symbol	Element Name	Mass Number	Atomic Number	Atomic Half Life ⁷	Time factor	Comments
Pb-214	Lead	214	82	26.8	m	
Pd-103	Palladium	103	46	16.961	d	
Pm-143	Promethium	143	61	265	d	
Pm-144	Promethium	144	61	363	d	
Pm-147	Promethium	147	61	2.623	a	
Po-210	Polonium	210	84	138.378	d	
Pu-238	Plutonium	238	94	87.75	a	
Pu-239	Plutonium	239	94	2.41E+04	a	
Pu-241	Plutonium	241	94	14.4	a	
Ra-226	Radium	226	88	1.60E+03	a	
Ra-228	Radium	228	88	5.75	a	
Rb-86	Rubidium	86	37	18.66	d	
Re-188	Rhenium	188	75	16.98	h	
Ru-103	Ruthenium	103	44	39.35	d	
Ru-106	Ruthenium	106	44	368.2	d	
S-35	Sulfur	35	16	87.44	d	
Sb-124	Antimony	124	51	60.2	d	
Sb-125	Antimony	125	51	2.77	a	
Sc-46	Scandium	46	21	83.8	d	
Se-75	Selenium	75	34	119.78	d	
Si-32	Silicon	32	14	330	a	
Sm-153	Samarium	153	62	46.7	h	
Sn-113	Tin	113	50	115.1	d	
Sn-117m	Tin	117	50	13.6	d	
Sr-85	Strontium	85	38	64.84	d	
Sr-89	Strontium	89	38	50.55	d	
Sr-90	Strontium	90	38	28.6	a	
Ta-182	Tantalum	182	73	114.74	d	
Tc-99	Technetium	99	43	2.13E+08	a	
Tc-99m	Technetium	99	43	6.02	h	
Te-123m	Tellurium	123	52	119.7	d	
Te-127m	Tellurium	127	52	109	d	
Th-228	Thorium	228	90	1.913	a	
Th-230	Thorium	230	90	7.70E+04	a	
Th-232	Thorium	232	90	1.41E+10	a	
Th-234	Thorium	234	90	24.1	d	
Th-Nitrate	Thorium	***	90	***		Th-229, Th-230 & Th-232 in abundances as found in nature

Low-Level Radioactive Waste Tracking – Annual Report for 2010

Radioisotope General Information						
Isotope Symbol	Element Name	Mass Number	Atomic Number	Atomic Half Life	Time factor	Comments
TI-201	Thallium	201	81	73.06 h	h	
TI-204	Thallium	204	81	3.779	a	
TI-208	Thallium	208	81	3.053	m	
U-232	Uranium	232	92	72	a	
U-233	Uranium	233	92	1.59E+05	a	
U-234	Uranium	234	92	2.45E+05	a	
U-235	Uranium	235	92	7.038 E+08 a	a	
U-236	Uranium	236	92	2.34E+07	a	
U-238	Uranium	238	92	4.468 E+09 a	a	
U-acetate	Uranium	***	92	***		U-234, U-235, U-238 in abundances as found in nature
U-Nitrate	Uranium	***	92	***		U-234, U-235, U-238 in abundances as found in nature
W-181	Tungsten	181	74	120.95	d	
W-185	Tungsten	185	74	75.1	d	
Xe-133	Xenon	133	54	5.245	d	
Y-88	Yttrium	88	39	106.6	d	
Y-90	Yttrium	90	39	64.1	h	
Yb-169	Ytterbium	169	70	31.97	d	
Zn-65	Zinc	65	30	244.4	d	
Zr-95	Zirconium	95	40	64.02	d	

Appendix C: Health and Safety Code Section 115000.1

The following is an excerpt from the California Health and Safety Code relating to the gathering of information on LLRW generated in the State.

115000.1.

(a) For the purposes of this section, the following terms have the following meanings:

(1) "Generate" means to produce or cause the production of, or to engage in an activity which otherwise results in the creation or increase in the volume of, low-level radioactive waste.

(2) (A) "Generator" means any person who, by his or her actions, or by the actions of his or her agent, employee, or independent contractor, generates low-level radioactive waste in the state.

(B) For purposes of this section, a person who provides for or arranges for the collection, transportation, treatment, storage, or disposal of low-level radioactive waste generated by others is a generator only to the extent that his or her actions, or the actions of his or her agent, employee, or independent contractor, generate low-level radioactive waste.

(3) "Person" means an individual, partnership, corporation, or other legal entity, including any state, interstate, federal, or municipal governmental entity.

(4) "Waste" means material that is not in use and is no longer useful.

(5) "Generator category" includes, but is not limited to, any of the following:

(A) Nuclear power plants.

(B) Reactor vendors or designers.

(C) Government.

(D) Medicine.

(E) Academia.

(F) Aerospace.

(G) Military.

(H) Research.

(I) Industrial gauges.

(J) Manufacturing.

(6) "Low-level radioactive waste" or "LLRW" has the same meaning as defined in Article 2 of the Southwestern Low-Level Radioactive Waste Disposal Compact, as set forth in Section 115255.

(7) "Class" means the class of low-level radioactive waste. "Class A", "class B", and "class C" waste are those classes defined in Section 61.55 of Title 10 of the Code of Federal Regulations.

(8) "Licensed LLRW disposal facility" means any of the three disposal facilities located at Barnwell, South Carolina; Clive, Utah; or Richland, Washington, that exist on January 1, 2003.

(b) The department shall, for the protection of public health and safety maintain a file of each manifest from each generator of LLRW that is sent to a disposal facility or to a facility subject to the Southwestern Low-level Radioactive Waste Disposal Compact, as set forth in Article 17 (commencing with Section 115250).

(c) The department shall, for the protection of public health and safety, maintain a file of all LLRW transferred for disposal to a licensed LLRW disposal facility during the reporting period, either directly or through a broker or agent, that shall meet all of the following conditions:

(1) Specify the category of generator, class, quantity by activity, and volume of LLRW, including an estimate of the peak and average quantities in storage, along with the identity of the generator, and the chemical and physical characteristics of that waste, including its half-life, properties, or constituents, and radionuclides present at, or above, the minimum labeling requirements, with their respective concentrations and amounts of radioactivity.

(2) Be updated annually, at minimum, to ensure an accurate and timely depiction of radioactive waste in the state.

(3) Include all of the following information in the file:

(A) The total volume, volume by class, and activity by radionuclide and class.

(B) The types and specifications of individual containers used and the number of each type transferred for disposal.

(C) The maximum surface radiation exposure level on any single container of LLRW transferred, the number of disposal containers that exceed 200 mR/hour, and the volume, class, and activity by radionuclide.

(D) The identification of each licensed LLRW disposal facility to which LLRW was transferred, either directly or through a broker or agent, and the volume and activity by class of LLRW transferred by each broker to each licensed LLRW disposal facility.

(E) The identification of all brokers or agents to which LLRW was transferred and the volume and activity by class of the generator's LLRW transferred by each broker or agent to each licensed LLRW disposal facility.

(F) The weight of source material by its type. For purposes of this paragraph, "type" includes, but is not limited to, natural uranium, depleted uranium, or thorium.

(G) The total number of grams of special nuclear material by radionuclide, and the maximum number of grams of special nuclear material in any single shipment by radionuclide.

(H) As complete a description as practicable of the principal chemical and physical form of the LLRW by volume and radionuclide, including the identification of any known hazardous properties, other than its radioactive property.

(I) For solidified or sorbed liquids, the nature of the liquid, the solidifying or sorbing agent used, and the final volume.

(J) For LLRW containing more than 0.1 percent by weight chelating agents, the identification of the chelating agent, the volume and weight of the LLRW and the weight percentage of chelating agent.

(K) For LLRW that was treated, either by the generator or its agent or independent contractor, in preparation for transfer to a licensed LLRW disposal facility described in paragraph (8) of subdivision (a) for the purpose of reducing its volume or activity by any method including reduction by storage for decay, or for the purpose of changing its physical or chemical characteristics in a manner other than by solidification or sorption of liquids, the file shall include a description of the treatment process.

(L) The volume, volume by class, and activity by radionuclide and class of that LLRW, if any, that the generator is holding at the end of the annual reporting period because the

generator knows or has reason to believe that LLRW will not be accepted for disposal at any of the licensed LLRW disposal facilities. The file shall include a description of this LLRW.

(d) The department shall maintain a file on each generator's LLRW stored, including specific radionuclides, total volume, and volume by class, total activity, and activity by radionuclide and class of LLRW stored for decay and stored for later transfer, including the periods of time for both types of storage.

(e) (1) The department shall prepare an annual report, including a set of tables summarizing data collected from the activities and maintenance of files specified in subdivisions (c) and (d) to the department. These annual data tables shall contain information that summarizes and categorizes, by category, and if applicable, subcategory, of generator and location by county and identity of generator, the nature, characteristics and the total volume, volume by class, total activity and activity by radionuclide and class of LLRW generated, disposed of, treated, transferred, stored for later transfer, and stored for decay during each calendar year.

(2) The department shall note, in the set of tables prepared pursuant to paragraph (1), any generator for which data are lacking.

(f) The department shall make the information described in subdivisions (c) and (d) available to the public in a format that aggregates the information by county. The department shall not make public the identity and location of any site where LLRW is stored or used. The department may combine information from multiple counties if necessary to protect public security. Notwithstanding any other provision of law the department shall not make the report prepared pursuant to subdivision (e) available to the public, and the report is not subject to the California Public Records Act (Chapter 3.5 (commencing with Section 6250) of Division 6 of Title 1 of the Government Code).

(g) The department may make the information described in subdivisions (c) and (d) available upon request to any Member of the Legislature. No Member of the Legislature may disclose the identity or location of any site where LLRW is stored or used to any member of the general public.

(h) To meet the requirements of this section, each generator shall submit to the department the information included in Forms 540, 541, and 542, and any successor forms, of the Nuclear Regulatory Commission, for each LLRW shipment. In addition, for purposes of subparagraph (L) of paragraph (4) of subdivision (c) and subdivision (d), each generator shall annually complete and submit to the department the information included on Forms 540, 541, and 542, and any successor forms, of the Nuclear Regulatory Commission that describe the LLRW stored and shipped by the generator.

Appendix D: LLRW Waste Classification

The following excerpt from the U.S. Code of Federal Regulation Title 10 part 61 section 55 (10 CFR 61.55) defines the classification of waste for near surface disposal at licensed LLRW disposal facilities.

(a) Classification of waste for near surface disposal. (1) *Considerations*. Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.

(2) *Classes of waste*. (i) Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in § 61.56(a). If Class A waste also meets the stability requirements set forth in § 61.56(b), it is not necessary to segregate the waste for disposal.

(ii) Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in § 61.56.

(iii) Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in § 61.56.

(iv) Waste that is not generally acceptable for near-surface disposal is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in part 60 or 63 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission.

(3) Classification determined by long-lived radionuclides. If radioactive waste contains only radionuclides listed in Table 1, classification shall be determined as follows:

(i) If the concentration does not exceed 0.1 times the value in Table 1, the waste is Class A.

(ii) If the concentration exceeds 0.1 times the value in Table 1 but does not exceed the value in Table 1, the waste is Class C.

(iii) If the concentration exceeds the value in Table 1, the waste is not generally acceptable for near-surface disposal.

(iv) For wastes containing mixtures of radionuclides listed in Table 1, the total concentration shall be determined by the sum of fractions rule described in paragraph (a)(7) of this section.

Table 1

Radionuclide	Concentration, curies per cubic meter
C-14	8
C-14 in activated metal	80
Ni-59 in activated metal	220
Nb-94 in activated metal	0.2
Tc-99	3
I-129	0.08
Alpha emitting transuranic nuclides with half-life greater than 5 years	¹ 100
Pu-241	¹ 3,500
Cm-242	¹ 20,000

¹Units are nanocuries per gram.

(4) Classification determined by short-lived radionuclides. If radioactive waste does not contain any of the radionuclides listed in Table 1, classification shall be determined based on the concentrations shown in Table 2. However, as specified in paragraph (a) (6) of this section, if radioactive waste does not contain any nuclides listed in either Table 1 or 2, it is Class A.

(i) If the concentration does not exceed the value in Column 1, the waste is Class A.

(ii) If the concentration exceeds the value in Column 1, but does not exceed the value in Column 2, the waste is Class B.

(iii) If the concentration exceeds the value in Column 2, but does not exceed the value in Column 3, the waste is Class C.

(iv) If the concentration exceeds the value in Column 3, the waste is not generally acceptable for near-surface disposal.

(v) For wastes containing mixtures of the nuclides listed in Table 2, the total concentration shall be determined by the sum of fractions rule

Table 2

Radionuclide	Concentration, curies per cubic meter		
	Col. 1	Col. 2	Col. 3
Total of all nuclides with less than 5 year half-life	700	(¹)	(¹)
H-3	40	(¹)	(¹)
Co-60	700	(¹)	(¹)
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7000
Sr-90	0.04	150	7000
Cs-137	1	44	4600

¹ There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other nuclides in Table 2 determine the waste to the Class C independent of these nuclides.

(5) Classification determined by both long- and short-lived radionuclides. If radioactive waste contains a mixture of radionuclides, some of which are listed in Table 1, and some of which are listed in Table 2, classification shall be determined as follows:

(i) If the concentration of a nuclide listed in Table 1 does not exceed 0.1 times the value listed in Table 1, the class shall be that determined by the concentration of nuclides listed in Table 2.

(ii) If the concentration of a nuclide listed in Table 1 exceeds 0.1 times the value listed in Table 1 but does not exceed the value in Table 1, the waste shall be Class C, provided the concentration of nuclides listed in Table 2 does not exceed the value shown in Column 3 of Table 2.

(6) Classification of wastes with radionuclides other than those listed in Tables 1 and 2. If radioactive waste does not contain any nuclides listed in either Table 1 or 2, it is Class A.

(7) The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each nuclide's concentration by the

appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0 if the waste class is to be determined by that column. Example: A waste contains Sr-90 in a concentration of 50 Ci/m³ and Cs-137 in a concentration of 22 Ci/m³. Since the concentrations both exceed the values in Column 1, Table 2, they must be compared to Column 2 values. For Sr-90 fraction $50/150=0.33$; for Cs-137 fraction, $22/44=0.5$; the sum of the fractions= 0.83 . Since the sum is less than 1.0, the waste is Class B.

(8) *Determination of concentrations in wastes.* The concentration of a radionuclide may be determined by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements. The concentration of a radionuclide may be averaged over the volume of the waste or weight of the waste if the units are expressed as nanocuries per gram.

[47 FR 57463, Dec. 27, 1982, as amended at 54 FR 22583, May 25, 1989; 66 FR 55792, Nov. 2, 2001]

Appendix E: Unit Conversions

The metric system is the standardized set of measurement units used in science and technology today. Metric or SI (Système International d’Unités) system units have been incorporated into the U.S. Nuclear Regulatory Commission’s Uniform Waste Manifest documents.

Volume is presented in cubic meters (m³) and radioactivity is presented in mega Becquerel (MBq). These units have been adopted for this report to be consistent with the uniform national LLRW manifest requirements. Some conversions for SI units to the previously used units of cubic feet and curies are provided in the following tables

UNIT CONVERSIONS				
Measurement	SI Unit	Previously used unit	Values of Conventional Unit in SI units	Conversional Factors
Radioactivity	Gigabecquerel (GBq) Megabecquerel (MBq)	Curie (Ci) milliCurie (mCi)	1 Ci = 37 GBq 1 Ci = 37,000MBq	Ci x 37 = 1 GBq Ci x 37,000 = 1 MBq GBq / 37 = Ci MBq / 37,000 = Ci
Volume	Cubic meters (m ³)	Cubic feet (ft ³)	1 ft ³ = 0.028 m ³	ft ³ x 0.028 = m ³ m ³ x 35.31 = ft ³

Radioactivity Conversions		
mCi	MBq	GBq
500	18,500	18.500
200	7,400	7.400
100	3,700	3.700
50	1,850	1.850
20	740	0.740
10	370	0.370
5	185	0.185
2	74	0.074
1	37	0.037

Volume conversions	
ft ³	m ³
11.9 (89 gal. drum)	0.33
11.1 (83 gal. drum)	0.31
7.5 (55 gal. drum)	0.21
4.01 (30 gal. drum)	0.11
0.67 (5 gal. drum)	0.019