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# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

VOLUME VI

APPENDIX D  
Operating Staff Requirements & Cost Estimate  
and  
Exhibits

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# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

VOLUME VI

APPENDIX D.1  
Alternative 1 Operating Staff  
Requirements and Cost Estimate

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## APPENDIX D.1 Alternative 1 Operating Staff Requirements and Cost Estimates

The direct (no escalation or contingency) annual operating cost for Alternative 1 is presented in Table D.1-1 for fiscal years 1995 through 2028. The operating cost assumes a complete compliment of personnel for each of the facilities during their years of operation. The year prior to operation of a facility, a compliment of roughly half the personnel will be required to ramp up the operating staff and provide a trained qualified staff. Operating costs include organizational overhead to arrive at labor costs, plus assessments, consumables, spare parts and G&A and SWS overheads. These are added together to arrive at the total annual operating cost.

The estimates of personnel by category are presented for each of the facilities. Personnel are broken down into the following categories: plant manager, training, operations, operations support, engineering, maintenance, radiological control, quality assurance, and safety. Personnel are also identified as either exempt, non-exempt, or bargaining unit and as either radiation workers or non-radiation workers.

The following list identifies the full compliment of operating staff required for each facility by table number:

- D.1-2            Processing
- D.1-3            RH & CH Waste & Material Storage

TABLE D.1-1. PROJECTED OPERATING STAFF REQUIREMENTS AND COSTS

Alternative: Facility:	1 Total Facility Operations																
	Fiscal Year												06				
	95	96	97	98	99	00	01	02	03	04	05	-23	24	25	26	27	28
<b>TOTALS</b>																	
Exempt											70	144	46	46	46	46	46
Non-Exempt											6	19	10	10	10	10	10
Bargaining Unit											73	183	73	73	73	73	73
											149	346	129	129	129	129	129
<b>COSTS (million \$)</b>																	
Exempt	\$65,850	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.61	9.48	3.03	3.03	3.03	3.03	3.03
Non-Exempt	\$28,870	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.55	0.29	0.29	0.29	0.29	0.29
Bargaining Unit	\$58,110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.24	10.63	4.24	4.24	4.24	4.24	4.24
Organizational Overhead	36.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.25	7.44	2.72	2.72	2.72	2.72	2.72
<b>TOTAL LABOR COSTS</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.27	28.10	10.28	10.28	10.28	10.28	10.28
<b>Assessments &amp; Misc</b>																	
Transportation	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Water	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Electrical	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Electrical maintenance	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Laundry	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Waste Disposal	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Consumables	10.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	2.81	1.03	1.03	1.03	1.03	1.03
Spare Parts	10.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	2.81	1.03	1.03	1.03	1.03	1.03
<b>TOTAL COSTS BEFORE G&amp;A/SWS</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.46	35.41	12.95	12.95	12.95	12.95	12.95
G&A/SWS	17.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.63	6.02	2.20	2.20	2.20	2.20	2.20
<b>TOTAL OPERATING COST (million \$)</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.09	41.43	15.16	15.16	15.16	15.16	15.16

0.1-2

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## TABLE D.1-2. DIRECT OPERATING STAFF PROJECTION

Alternative 1

Facility: Processing

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>PLANT MANAGER:</b>																	
Exempt-																	
Group Manager	1											1					
Deputy Manager	1											1					
Non-exempt-																	
Secretary/Clerk	1											1	2	1	0	0	3
<b>TRAINING:</b>																	
Exempt-																	
Group Manager	1											1					
Trainers	12											12					
Non-exempt-																	
Secretary/Clerk	1											1	13	1	0	0	14
<b>OPERATIONS:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	4											4					
Scheduler	5											5					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	2											2					
Bargaining Unit-																	
Operators	38											38	11	2	38	43	8
<b>OPERATIONS SUPPORT:</b>																	
Exempt-																	
Group Manager	1											1					
Planner	10											10					
Engineer	4											4					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Technician	2											2	15	1	2	0	18
<b>ENGINEERING:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	2											2					
Process Support	15											15					
Environmental	9											9					
Facility Support	9											9					
Maintenance	5											5					
Facility Projects	3											3					
Non-exempt-																	
Secretary/Clerk	3											3					
Bargaining Unit-																	
Technician	2											2	44	3	2	35	14

TABLE D.1-2. DIRECT OPERATING STAFF PROJECTION

Alternative 1

Facility: Processing

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	2											2					
Planner	7											7					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	22											22					
Instrumentation	15											15					
Electrical	9											9	10	1	46	48	9
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Health Physics Tech	35											35	2	1	35	35	3
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	5											5					
Non-exempt-																	
Secretary/Clerk	1											1	6	1	0	5	2
<b>SAFETY</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	6											6					
Non-exempt-																	
Secretary/Clerk	1											1	7	1	0	6	2
<b>TOTALS</b>																	
Exempt	110											110					
Non-Exempt	12											12					
Bargaining Unit	123											123					
<b>GRAND TOTALS</b>												<b>245</b>	<b>110</b>	<b>12</b>	<b>123</b>	<b>172</b>	<b>73</b>

TABLE D.1-3. DIRECT OPERATING STAFF PROJECTION

Alternative 1

Facility: CH & RH Waste & Material Storage

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers		
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad			
<b>PLANT MANAGER:</b>																			
Exempt-																			
Group Manager	1												1						
Deputy Manager																			
Non-exempt-																			
Secretary/Clerk	1												1	1	0		0		2
<b>TRAINING:</b>																			
Exempt-																			
Group Manager																			
Trainers	3												3						
Non-exempt-																			
Secretary/Clerk	1												1	3	1	0	0		4
<b>OPERATIONS:</b>																			
Exempt-																			
Group Manager	1												1						
Support Manager																			
Scheduler	2												2						
Engineer																			
Non-exempt-																			
Secretary/Clerk	1												1						
Bargaining Unit-																			
Operators	24												24	3	1	24	24		4
<b>OPERATIONS SUPPORT:</b>																			
Exempt-																			
Group Manager	1												1						
Planner	3												3						
Engineer																			
Non-exempt-																			
Secretary/Clerk	1												1						
Bargaining Unit-																			
Technician														4	1	0	0		5
<b>ENGINEERING:</b>																			
Exempt-																			
Group Manager	1												1						
Support Manager																			
Process Support	3												3						
Environmental	2												2						
Facility Support	4												4						
Maintenance	3												3						
Facility Projects	2												2						
Non-exempt-																			
Secretary/Clerk	1												1						
Bargaining Unit-																			
Technician	1												1	15	1	1	14		3

**TABLE D.1-3. DIRECT OPERATING STAFF PROJECTION**

Alternative 1

Facility: CH & RH Waste & Material Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager																	
Planner	2											2					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	10											10					
Instrumentation	6											6					
Electrical	4											4	3	1	20	20	4
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer																	
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Health Physics Tech	15											15	1	1	15	15	2
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager																	
Engineer	2											2					
Non-exempt-																	
Secretary/Clerk													2	0	0	2	0
<b>SAFETY</b>																	
Exempt-																	
Group Manager																	
Engineer	2											2					
Non-exempt-																	
Secretary/Clerk													2	0	0	2	0
<b>TOTALS</b>																	
Exempt	34											34					
Non-Exempt	7											7					
Bargaining Unit	60											60					
<b>GRAND TOTALS</b>												<b>101</b>	<b>34</b>	<b>7</b>	<b>60</b>	<b>77</b>	<b>24</b>

# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

VOLUME VI

APPENDIX D.2  
Alternative 2 Operating Staff  
Requirements and Cost Estimate



## APPENDIX D.2 Alternative 2 Operating Staff Requirements and Cost Estimates

The direct (no escalation or contingency) annual operating cost for Alternative 2 is presented in Table D.2-1 for fiscal years 1995 through 2028. The operating cost assumes a complete compliment of personnel for each of the facilities during their years of operation. The year prior to operation of a facility, a compliment of roughly half the personnel will be required to ramp up the operating staff and provide a trained qualified staff. Operating costs include organizational overhead to arrive at labor costs, plus assessments, consumables, spare parts and G&A and SWS overheads. These are added together to arrive at the total annual operating cost.

The estimates of personnel by category are presented for each of the facilities. Personnel are broken down into the following categories: plant manager, training, operations, operations support, engineering, maintenance, radiological control, quality assurance, and safety. Personnel are also identified as either exempt, non-exempt, or bargaining unit and as either radiation workers or non-radiation workers.

The following list identifies the full compliment of operating staff required for each facility by table number:

D.2-2	Remote Handled TRU/LLMW & Contact Handled LLMW Processing
D.2-3	Contact Handled TRU Processing
D.2-4	High Level Waste Storage
D.2-5	Remote Handled TRU Storage
D.2-6	Remote Handled LLMW Storage
D.2-7	Remote Handled Greater Than Category 3 LLW Storage
D.2-8	Cs & Sr Capsule Storage
D.2-9	Contact Handled Waste and Material (Unirradiated Uranium) Storage

TABLE D.2-1. PROJECTED OPERATING STAFF REQUIREMENTS AND COSTS

Alternative:

2

Facility:

Total Facility Operations

	Fiscal Year																	
	95	96	97	98	99	00	01	02	03	04	05	06 -23	24	25	26	27	28	
<b>TOTALS</b>																		
Exempt						20	41	64	88	88	106	211	46	46	46	46	46	
Non-Exempt						5	9	14	18	18	36	50	10	10	10	10	10	
Bargaining Unit						26	52	82	112	112	130	253	73	73	73	73	73	
						51	102	160	218	218	272	514	129	129	129	129	129	
<b>COSTS (million \$)</b>																		
Exempt	\$65,850	0.00	0.00	0.00	0.00	1.32	2.70	4.21	5.79	5.79	6.98	13.89	3.03	3.03	3.03	3.03	3.03	
Non-Exempt	\$28,870	0.00	0.00	0.00	0.00	0.14	0.26	0.40	0.52	0.52	1.04	1.44	0.29	0.29	0.29	0.29	0.29	
Bargaining Unit	\$58,110	0.00	0.00	0.00	0.00	1.51	3.02	4.77	6.51	6.51	7.55	14.70	4.24	4.24	4.24	4.24	4.24	
Organizational Overhead	36.00%	0.00	0.00	0.00	0.00	1.07	2.15	3.38	4.62	4.62	5.61	10.81	2.72	2.72	2.72	2.72	2.72	
<b>TOTAL LABOR COSTS</b>		0.00	0.00	0.00	0.00	4.04	8.13	12.76	17.44	17.44	21.18	40.85	10.28	10.28	10.28	10.28	10.28	
<b>Assessments &amp; Misc.</b>																		
Transportation	1.00%	0.00	0.00	0.00	0.00	0.04	0.08	0.13	0.17	0.17	0.21	0.41	0.10	0.10	0.10	0.10	0.10	
Water	1.00%	0.00	0.00	0.00	0.00	0.04	0.08	0.13	0.17	0.17	0.21	0.41	0.10	0.10	0.10	0.10	0.10	
Electrical	1.00%	0.00	0.00	0.00	0.00	0.04	0.08	0.13	0.17	0.17	0.21	0.41	0.10	0.10	0.10	0.10	0.10	
Electrical maintenance	1.00%	0.00	0.00	0.00	0.00	0.04	0.08	0.13	0.17	0.17	0.21	0.41	0.10	0.10	0.10	0.10	0.10	
Laundry	1.00%	0.00	0.00	0.00	0.00	0.04	0.08	0.13	0.17	0.17	0.21	0.41	0.10	0.10	0.10	0.10	0.10	
Waste Disposal	1.00%	0.00	0.00	0.00	0.00	0.04	0.08	0.13	0.17	0.17	0.21	0.41	0.10	0.10	0.10	0.10	0.10	
Consumables	10.00%	0.00	0.00	0.00	0.00	0.40	0.81	1.28	1.74	1.74	2.12	4.09	1.03	1.03	1.03	1.03	1.03	
Spare Parts	10.00%	0.00	0.00	0.00	0.00	0.40	0.81	1.28	1.74	1.74	2.12	4.09	1.03	1.03	1.03	1.03	1.03	
<b>TOTAL COSTS BEFORE G&amp;A/SWS</b>		0.00	0.00	0.00	0.00	5.09	10.25	16.08	21.97	21.97	26.69	51.48	12.95	12.95	12.95	12.95	12.95	
<b>G&amp;A/SWS</b>	17.00%	0.00	0.00	0.00	0.00	0.87	1.74	2.73	3.74	3.74	4.54	8.75	2.20	2.20	2.20	2.20	2.20	
<b>TOTAL OPERATING COST (million \$)</b>		0.00	0.00	0.00	0.00	5.96	11.99	18.81	25.71	25.71	31.22	60.23	15.16	15.16	15.16	15.16	15.16	

D.2-2

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TABLE D.2-2. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Remote Handled TRU/LLMW & Contact Handled LLMW Processing

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt-																		
Group Manager	1												1					
Deputy Manager	2												2					
Non-exempt-																		
Secretary/Clerk	2												2	3	2	0	0	0
<b>TRAINING:</b>																		
Exempt-																		
Group Manager	1												1					
Trainers	6												6					
Non-exempt-																		
Secretary/Clerk	2												2	7	2	0	0	0
<b>OPERATIONS:</b>																		
Exempt-																		
Group Manager	1												1					
Support Manager	3												3					
Scheduler	4												4					
Engineer	1												1					
Non-exempt-																		
Secretary/Clerk	2												2					
Bargaining Unit-																		
Operators	30												30	9	2	30	32	0
<b>OPERATIONS SUPPORT:</b>																		
Exempt-																		
Group Manager	1												1					
Planner	9												9					
Engineer	3												3					
Non-exempt-																		
Secretary/Clerk	2												2					
Bargaining Unit-																		
Technician	2												2	13	2	2	0	17
<b>ENGINEERING:</b>																		
Exempt-																		
Group Manager	1												1					
Support Manager																		
Process Support	9												9					
Environmental	6												6					
Facility Support	4												4					
Maintenance	2												2					
Facility Projects	2												2					
Non-exempt-																		
Secretary/Clerk	2												2					
Bargaining Unit-																		
Technician	2												2	24	2	2	19	9

TABLE D.2-2. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Remote Handled TRU/LLMW & Contact Handled LLMW Processing

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad		
<b>MAINTENANCE:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager												0						
Planner	5											5						
Non-exempt-																		
Secretary/Clerk	2											2						
Bargaining Unit-																		
Mechanical	17											17						
Instrumentation	11											11						
Electrical	7											7	6	2	35	35	8	
<b>RADIOLOGICAL CONTROL</b>																		
Exempt-																		
Group Manager	1											1						
Engineer	3											3						
Non-exempt-																		
Secretary/Clerk	2											2						
Bargaining Unit-																		
Health Physics Tech	28											28	4	2	28	28	6	
<b>QUALITY ASSURANCE</b>																		
Exempt-																		
Group Manager	1											1						
Engineer	5											5						
Non-exempt-																		
Secretary/Clerk	2											2	6	2	0	4	4	
<b>SAFETY</b>																		
Exempt-																		
Group Manager	1											1						
Engineer	5											5						
Non-exempt-																		
Secretary/Clerk	2											2	6	2	0	4	4	
<b>TOTALS</b>																		
Exempt	78											78						
Non-Exempt	18											18						
Bargaining Unit	97											97						
<b>GRAND TOTALS</b>												<b>193</b>	<b>78</b>	<b>18</b>	<b>97</b>	<b>122</b>	<b>71</b>	

## TABLE D.2-3. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Contact-Handled TRU Processing

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>PLANT MANAGER:</b>																	
Exempt-																	
Group Manager	1											1					
Deputy Manager	1											1					
Non-exempt-																	
Secretary/Clerk	1											1	2	1	0	0	3
<b>TRAINING:</b>																	
Exempt-																	
Group Manager	1											1					
Trainers	3											3					
Non-exempt-																	
Secretary/Clerk	1											1	4	1	0	0	5
<b>OPERATIONS:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	1											1					
Scheduler	2											2					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit- Operators	16											16	5	1	16	17	5
<b>OPERATIONS SUPPORT:</b>																	
Exempt-																	
Group Manager	1											1					
Planner	5											5					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit- Technician	1											1	7	1	1	0	9
<b>ENGINEERING:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager																	
Process Support	4											4					
Environmental	3											3					
Facility Support	2											2					
Maintenance	1											1					
Facility Projects	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit- Technician	1											1	12	1	1	9	5

## TABLE D.2-3. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Contact-Handled TRU Processing

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager																	
Planner	2											2					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	9											9					
Instrumentation	6											6					
Electrical	4											4	3	1	19	19	4
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Health Physics Tech	15											15	2	1	15	15	3
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	2											2					
Non-exempt-																	
Secretary/Clerk	1											1	3	1	0	2	2
<b>SAFETY</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	2											2					
Non-exempt-																	
Secretary/Clerk	1											1	3	1	0	2	2
<b>TOTALS</b>																	
Exempt	41											41					
Non-Exempt	9											9					
Bargaining Unit	52											52					
<b>GRAND TOTALS</b>												<b>102</b>	<b>41</b>	<b>9</b>	<b>52</b>	<b>64</b>	<b>38</b>

TABLE D.2-4. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: High Level Waste Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>PLANT MANAGER:</b>																	
Exempt-																	
Group Manager	1										1						
Deputy Manager																	
Non-exempt-																	
Secretary/Clerk	1										1	1	0		0	2	
<b>TRAINING:</b>																	
Exempt-																	
Group Manager																	
Trainers	1										1						
Non-exempt-																	
Secretary/Clerk												1	0	0	0	1	
<b>OPERATIONS:</b>																	
Exempt-																	
Group Manager	1										1						
Support Manager																	
Scheduler	1										1						
Engineer																	
Non-exempt-																	
Secretary/Clerk	1										1						
Bargaining Unit-																	
Operators	3										3	2	1	3	3	3	
<b>OPERATIONS SUPPORT:</b>																	
Exempt-																	
Group Manager																	
Planner																	
Engineer																	
Non-exempt-																	
Secretary/Clerk																	
Bargaining Unit-																	
Technician																	
<b>ENGINEERING:</b>																	
Exempt-																	
Group Manager	1										1						
Support Manager											0						
Process Support											0						
Environmental	1										1						
Facility Support	1										1						
Maintenance											0						
Facility Projects											0						
Non-exempt-																	
Secretary/Clerk											0						
Bargaining Unit-																	
Technician												3	0	0	2	1	

## TABLE D.2-4. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: High Level Waste Storage

Personnel Group/Type	Days	P	Q	Projected Shift Schedule								Group Total	Type Total			Radiation Workers	
				A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager																	
Planner	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	3											3					
Instrumentation	2											2					
Electrical	2											2	2	1	7	7	3
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer																	
Non-exempt-																	
Secretary/Clerk																	
Bargaining Unit-																	
Health Physics Tech	3											3	1	0	3	3	1
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager																	
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk													1	0	0	1	0
<b>SAFETY</b>																	
Exempt-																	
Group Manager																	
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk													1	0	0	1	0
<b>TOTALS</b>																	
Exempt	12											12					
Non-Exempt	3											3					
Bargaining Unit	13											13					
<b>GRAND TOTALS</b>												<b>28</b>	<b>12</b>	<b>3</b>	<b>13</b>	<b>17</b>	<b>11</b>

TABLE D.2-5. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Remote-Handled TRU Waste Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers		
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt-																		
Group Manager	1											1						
Deputy Manager																		
Non-exempt-																		
Secretary/Clerk	1											1	1	0		0	2	
<b>TRAINING:</b>																		
Exempt-																		
Group Manager																		
Trainers	1																	
Non-exempt-																		
Secretary/Clerk													1	0	0		0	1
<b>OPERATIONS:</b>																		
Exempt-																		
Group Manager	1																	
Support Manager																		
Scheduler	1																	
Engineer																		
Non-exempt-																		
Secretary/Clerk	1																	
Bargaining Unit-																		
Operators	5												2	1	5		5	3
<b>OPERATIONS SUPPORT:</b>																		
Exempt-																		
Group Manager																		
Planner	1																	
Engineer																		
Non-exempt-																		
Secretary/Clerk																		
Bargaining Unit-																		
Technician													1	0	0		0	1
<b>ENGINEERING:</b>																		
Exempt-																		
Group Manager	1																	
Support Manager																		
Process Support																		
Environmental	1																	
Facility Support	1																	
Maintenance																		
Facility Projects																		
Non-exempt-																		
Secretary/Clerk	1																	
Bargaining Unit-																		
Technician													3	1	0		2	2

TABLE D.2-5. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Remote-Handled TRU Waste Storage

Personnel Group/Type	Days	P	Q	Projected Shift Schedule								Group Total	Type Total			Radiation Workers		
				A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad		
<b>MAINTENANCE:</b>																		
<b>Exempt-</b>																		
Group Manager		1											1					
Support Manager																		
Planner		1											1					
<b>Non-exempt-</b>																		
Secretary/Clerk																		
<b>Bargaining Unit-</b>																		
Mechanical		3											3					
Instrumentation		1											1					
Electrical		1											1	2	0	5	5	2
<b>RADIOLOGICAL CONTROL</b>																		
<b>Exempt-</b>																		
Group Manager		1											1					
Engineer																		
<b>Non-exempt-</b>																		
Secretary/Clerk																		
<b>Bargaining Unit-</b>																		
Health Physics Tech		3											3	1	0	3	3	1
<b>QUALITY ASSURANCE</b>																		
<b>Exempt-</b>																		
Group Manager																		
Engineer		1											1					
<b>Non-exempt-</b>																		
Secretary/Clerk														1	0	0	1	0
<b>SAFETY</b>																		
<b>Exempt-</b>																		
Group Manager																		
Engineer		1											1					
<b>Non-exempt-</b>																		
Secretary/Clerk														1	0	0	1	0
<b>TOTALS</b>																		
Exempt		13											13					
Non-Exempt		3											3					
Bargaining Unit		13											13					
<b>GRAND TOTALS</b>													<b>29</b>	<b>13</b>	<b>3</b>	<b>13</b>	<b>17</b>	<b>12</b>

TABLE D.2-6. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Remote-Handled LLMW Waste Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers		
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt-																		
Group Manager	1											1						
Deputy Manager																		
Non-exempt-																		
Secretary/Clerk	1											1	1	0		0	2	
<b>TRAINING:</b>																		
Exempt-																		
Group Manager																		
Trainers	1											1						
Non-exempt-																		
Secretary/Clerk													1	0	0		0	1
<b>OPERATIONS:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Scheduler	1											1						
Engineer																		
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Operators	5											5	2	1	5		5	3
<b>OPERATIONS SUPPORT:</b>																		
Exempt-																		
Group Manager																		
Planner	1											1						
Engineer																		
Non-exempt-																		
Secretary/Clerk																		
Bargaining Unit-																		
Technician													1	0	0		0	1
<b>ENGINEERING:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Process Support																		
Environmental	1											1						
Facility Support	1											1						
Maintenance												0						
Facility Projects												0						
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician													3	1	0		2	2

TABLE D.2-6. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Remote-Handled LLMW Waste Storage

Personnel Group/Type	Days	P	Q	Projected Shift Schedule								Group Total	Type Total			Radiation Workers		
				A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad		
<b>MAINTENANCE:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Planner	1											1						
Non-exempt-																		
Secretary/Clerk																		
<b>Bargaining Unit-</b>																		
Mechanical	3											3						
Instrumentation	1											1						
Electrical	1											1	2	0	5		5	2
<b>RADIOLOGICAL CONTROL</b>																		
Exempt-																		
Group Manager	1											1						
Engineer																		
Non-exempt-																		
Secretary/Clerk																		
<b>Bargaining Unit-</b>																		
Health Physics Tech	3											3	1	0	3		3	1
<b>QUALITY ASSURANCE</b>																		
Exempt-																		
Group Manager																		
Engineer	1											1						
Non-exempt-																		
Secretary/Clerk													1	0	0		1	0
<b>SAFETY</b>																		
Exempt-																		
Group Manager																		
Engineer	1											1						
Non-exempt-																		
Secretary/Clerk													1	0	0		1	0
<b>TOTALS</b>																		
Exempt	13											13						
Non-Exempt	3											3						
Bargaining Unit	13											13						
<b>GRAND TOTALS</b>												<b>29</b>	<b>13</b>	<b>3</b>	<b>13</b>		<b>17</b>	<b>12</b>

TABLE D.2-7. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Remote-Handled GTC3 LLW Waste Storage

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers			
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad				
<b>PLANT MANAGER:</b>																				
Exempt-																				
Group Manager	1											1								
Deputy Manager																				
Non-exempt-																				
Secretary/Clerk	1											1	1	1	0			0		2
<b>TRAINING:</b>																				
Exempt-																				
Group Manager																				
Trainers	1											1								
Non-exempt-																				
Secretary/Clerk													1	0	0			0		1
<b>OPERATIONS:</b>																				
Exempt-																				
Group Manager	1											1								
Support Manager																				
Scheduler	1											1								
Engineer																				
Non-exempt-																				
Secretary/Clerk	1											1								
Bargaining Unit-																				
Operators	5											5	2	1	5			5		3
<b>OPERATIONS SUPPORT:</b>																				
Exempt-																				
Group Manager																				
Planner	1											1								
Engineer																				
Non-exempt-																				
Secretary/Clerk																				
Bargaining Unit-																				
Technician													1	0	0			0		1
<b>ENGINEERING:</b>																				
Exempt-																				
Group Manager	1											1								
Support Manager																				
Process Support																				
Environmental	1											1								
Facility Support	1											1								
Maintenance												0								
Facility Projects												0								
Non-exempt-																				
Secretary/Clerk	1											1								
Bargaining Unit-																				
Technician													3	1	0			2		2

TABLE D.2-7. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Remote-Handled GTC3 LLW Waste Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager																	
Planner	1											1					
Non-exempt-																	
Bargaining Unit-																	
Mechanical	3											3					
Instrumentation	1											1					
Electrical	1											1	2	0	5	5	2
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer																	
Non-exempt-																	
Bargaining Unit-																	
Health Physics Tech	3											3	1	0	3	3	1
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager																	
Engineer	1											1					
Non-exempt-																	
Bargaining Unit-																	
Secretary/Clerk													1	0	0	1	0
<b>SAFETY</b>																	
Exempt-																	
Group Manager																	
Engineer	1											1					
Non-exempt-																	
Bargaining Unit-																	
Secretary/Clerk													1	0	0	1	0
<b>TOTALS</b>																	
Exempt	13											13					
Non-Exempt	3											3					
Bargaining Unit	13											13					
<b>GRAND TOTALS</b>												<b>29</b>	<b>13</b>	<b>3</b>	<b>13</b>	<b>17</b>	<b>12</b>

TABLE D.2-8. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Cs & Sr Capsule Storage

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers		
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad			
<b>PLANT MANAGER:</b>																			
Exempt-																			
Group Manager	1											1							
Deputy Manager																			
Non-exempt-																			
Secretary/Clerk	1											1	1	0			0		2
<b>TRAINING:</b>																			
Exempt-																			
Group Manager	1											1							
Trainers	1											1							
Non-exempt-																			
Secretary/Clerk	1												2	1	0		0		3
<b>OPERATIONS:</b>																			
Exempt-																			
Group Manager	1											1							
Support Manager																			
Scheduler	1											1							
Engineer																			
Non-exempt-																			
Secretary/Clerk	1											1							
Bargaining Unit-																			
Operators	4											4	2	1	4		4		3
<b>OPERATIONS SUPPORT:</b>																			
Exempt-																			
Group Manager																			
Planner																			
Engineer																			
Non-exempt-																			
Secretary/Clerk																			
Bargaining Unit-																			
Technician																			
<b>ENGINEERING:</b>																			
Exempt-																			
Group Manager	1											1							
Support Manager												0							
Process Support	3											3							
Environmental	1											1							
Facility Support	2											2							
Maintenance	2											2							
Facility Projects	1											1							
Non-exempt-																			
Secretary/Clerk	1											1							
Bargaining Unit-																			
Technician													10	1	0		8		3

TABLE D.2-8. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Cs & Sr Capsule Storage

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers		
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad			
<b>MAINTENANCE:</b>																			
Exempt-																			
Group Manager	1												1						
Support Manager																			
Planner	1												1						
Non-exempt-																			
Secretary/Clerk	1												1						
Bargaining Unit-																			
Mechanical	4												4						
Instrumentation	3												3						
Electrical	2												2	1	9		9	3	
<b>RADIOLOGICAL CONTROL</b>																			
Exempt-																			
Group Manager	1												1						
Engineer																			
Non-exempt-																			
Secretary/Clerk																			
Bargaining Unit-																			
Health Physics Tech	5												5	1	0	5		5	1
<b>QUALITY ASSURANCE</b>																			
Exempt-																			
Group Manager																			
Engineer	1												1						
Non-exempt-																			
Secretary/Clerk														1	0	0		1	0
<b>SAFETY</b>																			
Exempt-																			
Group Manager																			
Engineer	1												1						
Non-exempt-																			
Secretary/Clerk														1	0	0		1	0
<b>TOTALS</b>																			
Exempt	20												20						
Non-Exempt	5												5						
Bargaining Unit	18												18						
<b>GRAND TOTALS</b>													<b>43</b>	<b>20</b>	<b>5</b>	<b>18</b>		<b>28</b>	<b>15</b>

TABLE D.2-9. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Contact-Handled Waste and Material (Unirradiated Uranium) Storage

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt- Group Manager	1												1					
Deputy Manager																		
Non-exempt- Secretary/Clerk	1												1	1	1	0	0	2
<b>TRAINING:</b>																		
Exempt- Group Manager																		
Trainers	1												1					
Non-exempt- Secretary/Clerk	1												1	1	1	0	0	2
<b>OPERATIONS:</b>																		
Exempt- Group Manager	1												1					
Support Manager																		
Scheduler	1												1					
Engineer																		
Non-exempt- Secretary/Clerk													0					
Bargaining Unit- Operators	11												11	2	0	11	11	2
<b>OPERATIONS SUPPORT:</b>																		
Exempt- Group Manager	1												1					
Planner	1												1					
Engineer																		
Non-exempt- Secretary/Clerk	1												1					
Bargaining Unit- Technician														2	1	0	0	3
<b>ENGINEERING:</b>																		
Exempt- Group Manager	1												1					
Support Manager																		
Process Support																		
Environmental	1												1					
Facility Support	1												1					
Maintenance													0					
Facility Projects	1												1					
Non-exempt- Secretary/Clerk	1												1					
Bargaining Unit- Technician	1												1	4	1	1	3	3

TABLE D.2-9. DIRECT OPERATING STAFF PROJECTION

Alternative 2

Facility: Contact-Handled Waste and Material (Unirradiated Uranium) Storage

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers			
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad				
<b>MAINTENANCE:</b>																				
Exempt-																				
Group Manager	1											1								
Support Manager																				
Planner	1											1								
Non-exempt-																				
Secretary/Clerk	1											1								
Bargaining Unit-																				
Mechanical	4											4								
Instrumentation	3											3								
Electrical	2											2	2	1	9			9		3
<b>RADIOLOGICAL CONTROL</b>																				
Exempt-																				
Group Manager	1											1								
Engineer																				
Non-exempt-																				
Secretary/Clerk	1											1								
Bargaining Unit-																				
Health Physics Tech	5											5	1	1	5			5		2
<b>QUALITY ASSURANCE</b>																				
Exempt-																				
Group Manager																				
Engineer	1											1								
Non-exempt-																				
Secretary/Clerk													1	0	0			1		0
<b>SAFETY</b>																				
Exempt-																				
Group Manager																				
Engineer	1											1								
Non-exempt-																				
Secretary/Clerk													1	0	0			1		0
<b>TOTALS</b>																				
Exempt	15											15								
Non-Exempt	6											6								
Bargaining Unit	26											26								
<b>GRAND TOTALS</b>												<b>47</b>	<b>15</b>	<b>6</b>	<b>26</b>			<b>30</b>		<b>17</b>

# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

VOLUME VI

APPENDIX D.3  
Alternative 3 Operating Staff  
Requirements and Cost Estimate

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## APPENDIX D.3 Alternative 3 Operating Staff Requirements and Cost Estimates

The direct (no escalation or contingency) annual operating cost for Alternative 3 is presented in Table D.3-1 for fiscal years 1995 through 2028. The operating cost assumes a complete compliment of personnel for each of the facilities during their years of operation. The year prior to operation of a facility, a compliment of roughly half the personnel will be required to ramp up the operating staff and provide a trained qualified staff. Operating costs include organizational overhead to arrive at labor costs, plus assessments, consumables, spare parts and G&A and SWS overheads. These are added together to arrive at the total annual operating cost.

The estimates of personnel by category are presented for each of the facilities. Personnel are broken down into the following categories: plant manager, training, operations, operations support, engineering, maintenance, radiological control, quality assurance, and safety. Personnel are also identified as either exempt, non-exempt, or bargaining unit and as either radiation workers or non-radiation workers.

The following list identifies the full compliment of operating staff required for each facility by table number:

D.3-2	LLMW Processing (Generic Facility)
D.3-3	TRU Processing (Generic Facility)
D.3-4	Cs & Sr Capsule Storage at FMEF
D.3-5	Contact Handled & Remote Handled Waste Storage and Contact Handled Material (Unirradiated Uranium) Storage
D.3-6	High Level Waste Storage

Tables D.3-2 and D.3-3 are for generic facilities since multiple existing facilities were examined for both LLMW processing and TRU processing. Actual operating personnel requirements may vary according to the specific facility.

**TABLE D.3-1. PROJECTED OPERATING STAFF REQUIREMENTS AND COSTS**

Alternative:  
Facility:

3  
Total Facility Operations

	Fiscal Year																	
	95	96	97	98	99	00	01	02	03	04	05	06	23	24	25	26	27	28
<b>TOTALS</b>																		
Exempt						32	64	101	138	138	172	206	46	46	46	46	46	46
Non-Exempt						5	11	16	22	22	29	37	10	10	10	10	10	10
Bargaining Unit						33	66	100	135	135	190	245	73	73	73	73	73	73
						70	141	217	295	295	391	488	129	129	129	129	129	129
<b>COSTS (million \$)</b>																		
Exempt	\$65,850	0.00	0.00	0.00	0.00	2.11	4.21	6.65	9.09	9.09	11.33	13.57	3.03	3.03	3.03	3.03	3.03	3.03
Non-Exempt	\$28,870	0.00	0.00	0.00	0.00	0.14	0.32	0.46	0.64	0.64	0.84	1.07	0.29	0.29	0.29	0.29	0.29	0.29
Bargaining Unit	\$58,110	0.00	0.00	0.00	0.00	1.92	3.84	5.81	7.84	7.84	11.04	14.24	4.24	4.24	4.24	4.24	4.24	4.24
Organizational Overhead	36.00%	0.00	0.00	0.00	0.00	1.50	3.01	4.65	6.32	6.32	8.35	10.39	2.72	2.72	2.72	2.72	2.72	2.72
<b>TOTAL LABOR COSTS</b>		0.00	0.00	0.00	0.00	5.67	11.38	17.58	23.89	23.89	31.56	39.26	10.28	10.28	10.28	10.28	10.28	10.28
<b>Assessments &amp; Misc</b>																		
Transportation	1.00%	0.00	0.00	0.00	0.00	0.06	0.11	0.18	0.24	0.24	0.32	0.39	0.10	0.10	0.10	0.10	0.10	0.10
Water	1.00%	0.00	0.00	0.00	0.00	0.06	0.11	0.18	0.24	0.24	0.32	0.39	0.10	0.10	0.10	0.10	0.10	0.10
Electrical	1.00%	0.00	0.00	0.00	0.00	0.06	0.11	0.18	0.24	0.24	0.32	0.39	0.10	0.10	0.10	0.10	0.10	0.10
Electrical maintenance	1.00%	0.00	0.00	0.00	0.00	0.06	0.11	0.18	0.24	0.24	0.32	0.39	0.10	0.10	0.10	0.10	0.10	0.10
Laundry	1.00%	0.00	0.00	0.00	0.00	0.06	0.11	0.18	0.24	0.24	0.32	0.39	0.10	0.10	0.10	0.10	0.10	0.10
Waste Disposal	1.00%	0.00	0.00	0.00	0.00	0.06	0.11	0.18	0.24	0.24	0.32	0.39	0.10	0.10	0.10	0.10	0.10	0.10
Consumables	10.00%	0.00	0.00	0.00	0.00	0.57	1.14	1.76	2.39	2.39	3.16	3.93	1.03	1.03	1.03	1.03	1.03	1.03
Spare Parts	10.00%	0.00	0.00	0.00	0.00	0.57	1.14	1.76	2.39	2.39	3.16	3.93	1.03	1.03	1.03	1.03	1.03	1.03
<b>TOTAL COSTS BEFORE G&amp;A/SWS</b>		0.00	0.00	0.00	0.00	7.14	14.34	22.15	30.10	30.10	39.76	49.47	12.95	12.95	12.95	12.95	12.95	12.95
G&A/SWS	17.00%	0.00	0.00	0.00	0.00	1.21	2.44	3.76	5.12	5.12	6.76	8.41	2.20	2.20	2.20	2.20	2.20	2.20
<b>TOTAL OPERATING COST (million \$)</b>		0.00	0.00	0.00	0.00	8.36	16.78	25.91	35.22	35.22	46.52	57.88	15.16	15.16	15.16	15.16	15.16	15.16

D.3-2

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**TABLE D.3-2. DIRECT OPERATING STAFF PROJECTION**

Alternative 3

Facility: LLMW Processing (Generic Facility)

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>PLANT MANAGER:</b>																	
Exempt-																	
Group Manager	1											1					
Deputy Manager	1											1					
Non-exempt-																	
Secretary/Clerk	1											1	2	1	0	0	3
<b>TRAINING:</b>																	
Exempt-																	
Group Manager	1											1					
Trainers	5											5					
Non-exempt-																	
Secretary/Clerk	1											1	6	1	0	0	7
<b>OPERATIONS:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	3											3					
Scheduler	3											3					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	2											2					
Bargaining Unit-																	
Operators	22											22	8	2	22	29	3
<b>OPERATIONS SUPPORT:</b>																	
Exempt-																	
Group Manager	1											1					
Planner	6											6					
Engineer	3											3					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Technician	1											1	10	1	1	0	12
<b>ENGINEERING:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	2											2					
Process Support	7											7					
Environmental	5											5					
Facility Support	4											4					
Maintenance	2											2					
Facility Projects	2											2					
Non-exempt-																	
Secretary/Clerk	2											2					
Bargaining Unit-																	
Technician	1											1	23	2	1	16	10

## TABLE D.3-2. DIRECT OPERATING STAFF PROJECTION

Alternative 3

Facility: LLMW Processing (Generic Facility)

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
<b>Exempt-</b>																	
Group Manager	1											1					
Support Manager	2											2					
Planner	4											4					
<b>Non-exempt-</b>																	
Secretary/Clerk	1											1					
<b>Bargaining Unit-</b>																	
Mechanical	11											11					
Instrumentation	7											7					
Electrical	5											5	7	1	23	23	8
<b>RADIOLOGICAL CONTROL</b>																	
<b>Exempt-</b>																	
Group Manager	1											1					
Engineer	1											1					
<b>Non-exempt-</b>																	
Secretary/Clerk	1											1					
<b>Bargaining Unit-</b>																	
Health Physics Tech	19											19	2	1	19	19	3
<b>QUALITY ASSURANCE</b>																	
<b>Exempt-</b>																	
Group Manager	1											1					
Engineer	2											2					
<b>Non-exempt-</b>																	
Secretary/Clerk	1											1	3	1	0	2	2
<b>SAFETY</b>																	
<b>Exempt-</b>																	
Group Manager	1											1					
Engineer	2											2					
<b>Non-exempt-</b>																	
Secretary/Clerk	1											1	3	1	0	2	2
<b>TOTALS</b>																	
Exempt	64											64					
Non-Exempt	11											11					
Bargaining Unit	66											66					
<b>GRAND TOTALS</b>												<b>141</b>	<b>64</b>	<b>11</b>	<b>66</b>	<b>91</b>	<b>50</b>

**TABLE D.3-3. DIRECT OPERATING STAFF PROJECTION**

Alternative 3

Facility: TRU Processing (Generic Facility)

Personnel Group/Type	Days	P	Q	Projected Shift Schedule								Group Total	Type Total			Radiation Workers	
				A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>PLANT MANAGER:</b>																	
Exempt-																	
Group Manager	1											1					
Deputy Manager	1											1					
Non-exempt-																	
Secretary/Clerk	1											1	2	1	0	0	3
<b>TRAINING:</b>																	
Exempt-																	
Group Manager	1											1					
Trainers	7											7					
Non-exempt-																	
Secretary/Clerk	1											1	8	1	0	0	9
<b>OPERATIONS:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	3											3					
Scheduler	3											3					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	2											2					
Bargaining Unit-																	
Operators	22											22	8	2	22	29	3
<b>OPERATIONS SUPPORT:</b>																	
Exempt-																	
Group Manager	1											1					
Planner	6											6					
Engineer	3											3					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Technician	1											1	10	1	1	0	12
<b>ENGINEERING:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	2											2					
Process Support	9											9					
Environmental	5											5					
Facility Support	5											5					
Maintenance	3											3					
Facility Projects	2											2					
Non-exempt-																	
Secretary/Clerk	2											2					
Bargaining Unit-																	
Technician	1											1	27	2	1	19	10

TABLE D.3-3. DIRECT OPERATING STAFF PROJECTION

Alternative 3

Facility: TRU Processing (Generic Facility)

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE.</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	2											2					
Planner	4											4					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	12											12					
Instrumentation	9											9					
Electrical	5											5	7	1	26	26	8
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Health Physics Tech	19											19	2	1	19	19	3
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	4											4					
Non-exempt-																	
Secretary/Clerk	1											1	5	1	0	4	2
<b>SAFETY</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	4											4					
Non-exempt-																	
Secretary/Clerk	1											1	5	1	0	4	2
<b>TOTALS</b>																	
Exempt	74											74					
Non-Exempt	11											11					
Bargaining Unit	69											69					
<b>GRAND TOTALS</b>												<b>154</b>	<b>74</b>	<b>11</b>	<b>69</b>	<b>101</b>	<b>52</b>

TABLE D.3-4. DIRECT OPERATING STAFF PROJECTION

Alternative 3

Facility: Cs & Sr Capsule Storage @ FMEF

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>PLANT MANAGER:</b>																	
Exempt-																	
Group Manager	1										1						
Deputy Manager																	
Non-exempt-																	
Secretary/Clerk	1										1	1	1	0	0	2	
<b>TRAINING:</b>																	
Exempt-																	
Group Manager	1										1						
Trainers	1										1						
Non-exempt-																	
Secretary/Clerk	1											2	1	0	0	3	
<b>OPERATIONS:</b>																	
Exempt-																	
Group Manager	1										1						
Support Manager																	
Scheduler	1										1						
Engineer																	
Non-exempt-																	
Secretary/Clerk	1										1						
Bargaining Unit-																	
Operators	4										4	2	1	4	4	3	
<b>OPERATIONS SUPPORT:</b>																	
Exempt-																	
Group Manager																	
Planner																	
Engineer																	
Non-exempt-																	
Secretary/Clerk																	
Bargaining Unit-																	
Technician																	
<b>ENGINEERING:</b>																	
Exempt-																	
Group Manager	1										1						
Support Manager											0						
Process Support	3										3						
Environmental	1										1						
Facility Support	2										2						
Maintenance	2										2						
Facility Projects	1										1						
Non-exempt-																	
Secretary/Clerk	1										1						
Bargaining Unit-																	
Technician												10	1	0	8	3	

TABLE D.3-4. DIRECT OPERATING STAFF PROJECTION

Alternative 3

Facility: Cs & Sr Capsule Storage @ FMEF

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager																	
Planner	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	4											4					
Instrumentation	3											3					
Electrical	2											2	2	1	9	9	3
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer																	
Non-exempt-																	
Secretary/Clerk																	
Bargaining Unit-																	
Health Physics Tech	5											5	1	0	5	5	1
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager																	
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk													1	0	0	1	0
<b>SAFETY</b>																	
Exempt-																	
Group Manager																	
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk													1	0	0	1	0
<b>TOTALS</b>																	
Exempt	20											20					
Non-Exempt	5											5					
Bargaining Unit	18											18					
<b>GRAND TOTALS</b>												<b>43</b>	<b>20</b>	<b>5</b>	<b>18</b>	<b>28</b>	<b>15</b>

**TABLE D.3-5. DIRECT OPERATING STAFF PROJECTION**

Alternative 3

Facility: CH & RH Waste Storage & CH Material (Unirradiated Uranium) Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers		
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt-																		
Group Manager	1											1						
Deputy Manager																		
Non-exempt-																		
Secretary/Clerk	1											1	1	0		0	2	
<b>TRAINING:</b>																		
Exempt-																		
Group Manager																		
Trainers	3											3						
Non-exempt-																		
Secretary/Clerk	1											1	3	1	0		0	4
<b>OPERATIONS:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Scheduler	2											2						
Engineer																		
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Operators	21											21	3	1	21		21	4
<b>OPERATIONS SUPPORT:</b>																		
Exempt-																		
Group Manager	1											1						
Planner	3											3						
Engineer																		
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician													4	1	0		0	5
<b>ENGINEERING:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Process Support																		
Environmental	2											2						
Facility Support	3											3						
Maintenance	2											2						
Facility Projects	1											1						
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician	1											1	9	1	1		8	3

## TABLE D.3-5. DIRECT OPERATING STAFF PROJECTION

Alternative 3

Facility: CH &amp; RH Waste Storage &amp; CH Material (Unirradiated Uranium) Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager																	
Planner	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	8											8					
Instrumentation	6											6					
Electrical	4											4	2	1	18	18	3
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer																	
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Health Physics Tech	13											13	1	1	13	13	2
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager																	
Engineer	2											2					
Non-exempt-																	
Secretary/Clerk													2	0	0	2	0
<b>SAFETY</b>																	
Exempt-																	
Group Manager																	
Engineer	2											2					
Non-exempt-																	
Secretary/Clerk													2	0	0	2	0
<b>TOTALS</b>																	
Exempt	27											27					
Non-Exempt	7											7					
Bargaining Unit	53											53					
<b>GRAND TOTALS</b>												<b>87</b>	<b>27</b>	<b>7</b>	<b>53</b>	<b>64</b>	<b>23</b>

**TABLE D.3-6. DIRECT OPERATING STAFF PROJECTION**

Alternative 3

Facility: High Level Waste Storage @ 3 Canyon Facilities

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt- Group Manager	1												1					
Deputy Manager																		
Non-exempt- Secretary/Clerk	1												1	1	1	0	0	2
<b>TRAINING:</b>																		
Exempt- Group Manager																		
Trainers	1												1					
Non-exempt- Secretary/Clerk														1	0	0	0	1
<b>OPERATIONS:</b>																		
Exempt- Group Manager	1												1					
Support Manager	3												3					
Scheduler	1												1					
Engineer																		
Non-exempt- Secretary/Clerk	1												1					
Bargaining Unit- Operators	9												9	5	1	9	3	12
<b>OPERATIONS SUPPORT:</b>																		
Exempt- Group Manager																		
Planner																		
Engineer																		
Non-exempt- Secretary/Clerk																		
Bargaining Unit- Technician																		
<b>ENGINEERING:</b>																		
Exempt- Group Manager	1												1					
Support Manager													0					
Process Support													0					
Environmental	3												3					
Facility Support	3												3					
Maintenance													0					
Facility Projects													0					
Non-exempt- Secretary/Clerk													0					
Bargaining Unit- Technician														7	0	0	6	1

TABLE D.3-6. DIRECT OPERATING STAFF PROJECTION

Alternative 3

Facility: High Level Waste Storage @ 3 Canyon Facilities

Personnel Group/Type	Days	P	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
			Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad		
<b>MAINTENANCE:</b>																		
Exempt-																		
Group Manager	1												1					
Support Manager																		
Planner	3												3					
Non-exempt-																		
Secretary/Clerk	1												1					
Bargaining Unit-																		
Mechanical	9												9					
Instrumentation	6												6					
Electrical	6												6	4	1	21	21	5
<b>RADIOLOGICAL CONTROL</b>																		
Exempt-																		
Group Manager	1												1					
Engineer																		
Non-exempt-																		
Secretary/Clerk																		
Bargaining Unit-																		
Health Physics Tech	9												9	1	0	9	9	1
<b>QUALITY ASSURANCE</b>																		
Exempt-																		
Group Manager																		
Engineer	1												1					
Non-exempt-																		
Secretary/Clerk														1	0	0	1	0
<b>SAFETY</b>																		
Exempt-																		
Group Manager																		
Engineer	1												1					
Non-exempt-																		
Secretary/Clerk														1	0	0	1	0
<b>TOTALS</b>																		
Exempt	21												21					
Non-Exempt	3												3					
Bargaining Unit	39												39					
<b>GRAND TOTALS</b>													<b>63</b>	<b>21</b>	<b>3</b>	<b>39</b>	<b>41</b>	<b>22</b>

# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

VOLUME VI

APPENDIX D.4  
Alternative 4 Operating Staff  
Requirements and Cost Estimate

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## APPENDIX D.4 Alternative 4 Operating Staff Requirements and Cost Estimates

The direct (no escalation or contingency) annual operating cost for Alternative 4 is presented in Table D.4-1 for fiscal years 1995 through 2028. The operating cost assumes a complete compliment of personnel for each of the facilities during their years of operation. The year prior to operation of a facility, a compliment of roughly half the personnel will be required to ramp up the operating staff and provide a trained qualified staff. Operating costs include organizational overhead to arrive at labor costs, plus assessments, consumables, spare parts and G&A and SWS overheads. These are added together to arrive at the total annual operating cost.

The estimates of personnel by category are presented for each of the facilities. Personnel are broken down into the following categories: plant manager, training, operations, operations support, engineering, maintenance, radiological control, quality assurance, and safety. Personnel are also identified as either exempt, non-exempt, or bargaining unit and as either radiation workers or non-radiation workers

The following list identifies the full compliment of operating staff required for each facility by table number

- D.4-2 Processing
- D.4-3 Contact Handled & Remote Handled Waste & Material Storage

TABLE D.4-1. PROJECTED OPERATING STAFF REQUIREMENTS AND COSTS

Alternative: Facility:	4 Total Facility Operations	Fiscal Year																
		95	96	97	98	99	00	01	02	03	04	05	06 -23	24	25	26	27	28
<b>TOTALS</b>																		
Exempt												70	144	46	46	46	46	46
Non-Exempt												6	19	10	10	10	10	10
Bargaining Unit												73	183	73	73	73	73	73
												149	346	129	129	129	129	129
<b>COSTS (million \$)</b>																		
Exempt	\$65,850	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.61	9.48	3.03	3.03	3.03	3.03	3.03
Non-Exempt	\$28,870	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.55	0.29	0.29	0.29	0.29	0.29
Bargaining Unit	\$58,110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.24	10.63	4.24	4.24	4.24	4.24	4.24
Organizational Overhead	36.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.25	7.44	2.72	2.72	2.72	2.72	2.72
<b>TOTAL LABOR COSTS</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.27	28.10	10.28	10.28	10.28	10.28	10.28
<b>Assessments &amp; Misc</b>																		
Transportation	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Water	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Electrical	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Electrical maintenance	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Laundry	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Waste Disposal	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.28	0.10	0.10	0.10	0.10	0.10
Consumables	10.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	2.81	1.03	1.03	1.03	1.03	1.03
Spare Parts	10.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	2.81	1.03	1.03	1.03	1.03	1.03
<b>TOTAL COSTS BEFORE G&amp;A/SWS</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.46	35.41	12.95	12.95	12.95	12.95	12.95
G&A/SWS	17.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.63	6.02	2.20	2.20	2.20	2.20	2.20
<b>TOTAL OPERATING COST (million \$)</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.09	41.43	15.16	15.16	15.16	15.16	15.16

D.4-2

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TABLE D.4-2. DIRECT OPERATING STAFF PROJECTION

Alternative 4  
 Facility: Processing

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt-																		
Group Manager	1											1						
Deputy Manager	1											1						
Non-exempt-																		
Secretary/Clerk	1											1	2	1	0	0	3	
<b>TRAINING:</b>																		
Exempt-																		
Group Manager	1											1						
Trainers	12											12						
Non-exempt-																		
Secretary/Clerk	1											1	13	1	0	0	14	
<b>OPERATIONS:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager	4											4						
Scheduler	5											5						
Engineer	1											1						
Non-exempt-																		
Secretary/Clerk	2											2						
Bargaining Unit-																		
Operators	38											38	11	2	38	43	8	
<b>OPERATIONS SUPPORT:</b>																		
Exempt-																		
Group Manager	1											1						
Planner	10											10						
Engineer	4											4						
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician	2											2	15	1	2	0	18	
<b>ENGINEERING:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager	2											2						
Process Support	15											15						
Environmental	9											9						
Facility Support	9											9						
Maintenance	5											5						
Facility Projects	3											3						
Non-exempt-																		
Secretary/Clerk	3											3						
Bargaining Unit-																		
Technician	2											2	44	3	2	35	14	

TABLE D.4-2. DIRECT OPERATING STAFF PROJECTION

Alternative 4  
 Facility: Processing

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	2											2					
Planner	7											7					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	22											22					
Instrumentation	15											15					
Electrical	9											9	10	1	46	48	9
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Health Physics Tech	35											35	2	1	35	35	3
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	5											5					
Non-exempt-																	
Secretary/Clerk	1											1	6	1	0	5	2
<b>SAFETY</b>																	
Exempt-																	
Group Manager	1											1					
Engineer	6											6					
Non-exempt-																	
Secretary/Clerk	1											1	7	1	0	6	2
<b>TOTALS</b>																	
Exempt	110											110					
Non-Exempt	12											12					
Bargaining Unit	123											123					
<b>GRAND TOTALS</b>												<b>245</b>	<b>110</b>	<b>12</b>	<b>123</b>	<b>172</b>	<b>73</b>

## TABLE D.4-3. DIRECT OPERATING STAFF PROJECTION

Alternative 4

Facility: CH &amp; RH Waste &amp; Material Storage

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt-																		
Group Manager	1											1						
Deputy Manager																		
Non-exempt-																		
Secretary/Clerk	1											1	1	0		0	2	
<b>TRAINING:</b>																		
Exempt-																		
Group Manager																		
Trainers	3											3						
Non-exempt-																		
Secretary/Clerk	1											1	3	1	0		0	4
<b>OPERATIONS:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Scheduler	2											2						
Engineer																		
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Operators	24											24	3	1	24		24	4
<b>OPERATIONS SUPPORT:</b>																		
Exempt-																		
Group Manager	1											1						
Planner	3											3						
Engineer																		
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician													4	1	0		0	5
<b>ENGINEERING:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Process Support	3											3						
Environmental	2											2						
Facility Support	4											4						
Maintenance	3											3						
Facility Projects	2											2						
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician	1											1	15	1	1		14	3

## TABLE D.4-3. DIRECT OPERATING STAFF PROJECTION

Alternative 4

Facility: CH &amp; RH Waste &amp; Material Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE.</b>																	
<b>Exempt-</b>																	
Group Manager	1											1					
Support Manager																	
Planner	2											2					
<b>Non-exempt-</b>																	
Secretary/Clerk	1											1					
<b>Bargaining Unit-</b>																	
Mechanical	10											10					
Instrumentation	6											6					
Electrical	4											4	3	1	20	20	4
<b>RADIOLOGICAL CONTROL</b>																	
<b>Exempt-</b>																	
Group Manager	1											1					
Engineer																	
<b>Non-exempt-</b>																	
Secretary/Clerk	1											1					
<b>Bargaining Unit-</b>																	
Health Physics Tech	15											15	1	1	15	15	2
<b>QUALITY ASSURANCE</b>																	
<b>Exempt-</b>																	
Group Manager																	
Engineer	2											2					
<b>Non-exempt-</b>																	
Secretary/Clerk													2	0	0	2	0
<b>SAFETY</b>																	
<b>Exempt-</b>																	
Group Manager																	
Engineer	2											2					
<b>Non-exempt-</b>																	
Secretary/Clerk													2	0	0	2	0
<b>TOTALS</b>																	
Exempt	34											34					
Non-Exempt	7											7					
Bargaining Unit	60											60					
<b>GRAND TOTALS</b>												<b>101</b>	<b>34</b>	<b>7</b>	<b>60</b>	<b>77</b>	<b>24</b>

# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

VOLUME VI

APPENDIX D.5  
Alternative 5 Operating Staff  
Requirements and Cost Estimate

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## APPENDIX D.5 Alternative 5 Operating Staff Requirements and Cost Estimates

The direct (no escalation or contingency) annual operating cost for Alternative 5 is presented in Table D.5-1 for fiscal years 1995 through 2028. The operating cost assumes a complete compliment of personnel for each of the facilities during their years of operation. The year prior to operation of a facility, a compliment of roughly half the personnel will be required to ramp up the operating staff and provide a trained qualified staff. Operating costs include organizational overhead to arrive at labor costs, plus assessments, consumables, spare parts and G&A and SWS overheads. These are added together to arrive at the total annual operating cost.

The estimates of personnel by category are presented for each of the facilities. Personnel are broken down into the following categories: plant manager, training, operations, operations support, engineering, maintenance, radiological control, quality assurance, and safety. Personnel are also identified as either exempt, non-exempt, or bargaining unit and as either radiation workers or non-radiation workers.

The following list identifies the full compliment of operating staff required for each facility by table number:

D.5-2	Processing Facility (WRAP 2B)
D.5-3	Contact Handled & Remote Handled Waste Storage
D.5-4	Cs & Sr Capsule Storage
D.5-5	Unirradiated Uranium Storage

TABLE D.5-1. PROJECTED OPERATING STAFF REQUIREMENTS AND COSTS

Alternative: Facility:	5 Total Facility Operations																
	Fiscal Year												06				
	95	96	97	98	99	00	01	02	03	04	05	-23	24	25	26	27	28
<b>TOTALS</b>																	
Exempt											85	169	46	46	46	46	46
Non-Exempt											13	27	10	10	10	10	10
Bargaining Unit											103	207	73	73	73	73	73
											201	403	129	129	129	129	129
<b>COSTS (million \$)</b>																	
Exempt	\$65,850	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60	11.13	3.03	3.03	3.03	3.03	3.03
Non-Exempt	\$28,870	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.78	0.29	0.29	0.29	0.29	0.29
Bargaining Unit	\$58,110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.99	12.03	4.24	4.24	4.24	4.24	4.24
Organizational Overhead	36.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	8.62	2.72	2.72	2.72	2.72	2.72
<b>TOTAL LABOR COSTS</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.26	32.55	10.28	10.28	10.28	10.28	10.28
<b>Assessments &amp; Misc</b>																	
Transportation	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.33	0.10	0.10	0.10	0.10	0.10
Water	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.33	0.10	0.10	0.10	0.10	0.10
Electrical	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.33	0.10	0.10	0.10	0.10	0.10
Electrical maintenance	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.33	0.10	0.10	0.10	0.10	0.10
Laundry	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.33	0.10	0.10	0.10	0.10	0.10
Waste Disposal	1.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.33	0.10	0.10	0.10	0.10	0.10
Consumables	10.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.63	3.26	1.03	1.03	1.03	1.03	1.03
Spare Parts	10.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.63	3.26	1.03	1.03	1.03	1.03	1.03
<b>TOTAL COSTS BEFORE G&amp;A/SWS</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.49	41.02	12.95	12.95	12.95	12.95	12.95
<b>G&amp;A/SWS</b>	17.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	6.97	2.20	2.20	2.20	2.20	2.20
<b>TOTAL OPERATING COST (million \$)</b>		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.97	47.99	15.16	15.16	15.16	15.16	15.16

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## TABLE D.5-2. DIRECT OPERATING STAFF PROJECTION

Alternative 5

Facility: Processing Facility (WRAP 2B)

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>PLANT MANAGER:</b>																	
Exempt-																	
Group Manager	1											1					
Deputy Manager	1											1					
Non-exempt-																	
Secretary/Clerk	1											1	2	1	0	0	3
<b>TRAINING:</b>																	
Exempt-																	
Group Manager	1											1					
Trainers	12											12					
Non-exempt-																	
Secretary/Clerk	1											1	13	1	0	0	14
<b>OPERATIONS:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	4											4					
Scheduler	5											5					
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk	2											2					
Bargaining Unit-																	
Operators	38											38	11	2	38	43	3
<b>OPERATIONS SUPPORT:</b>																	
Exempt-																	
Group Manager	1											1					
Planner	10											10					
Engineer	4											4					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Technician	2											2	15	1	2	0	18
<b>ENGINEERING:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager	2											2					
Process Support	15											15					
Environmental	9											9					
Facility Support	9											9					
Maintenance	5											5					
Facility Projects	3											3					
Non-exempt-																	
Secretary/Clerk	3											3					
Bargaining Unit-																	
Technician	2											2	44	3	2	35	14

TABLE D.5-2. DIRECT OPERATING STAFF PROJECTION

Alternative 5

Facility: Processing Facility (WRAP 2B)

Personnel Group/Type	Days	Projected Shift Schedule											Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex	NE		BU	Rad	Non Rad		
<b>MAINTENANCE:</b>																		
Exempt-																		
Group Manager	1												1					
Support Manager	2												2					
Planner	7												7					
Non-exempt-																		
Secretary/Clerk	1												1					
Bargaining Unit-																		
Mechanical	22												22					
Instrumentation	15												15					
Electrical	9												9	10	1	46	48	9
<b>RADIOLOGICAL CONTROL</b>																		
Exempt-																		
Group Manager	1												1					
Engineer	1												1					
Non-exempt-																		
Secretary/Clerk	1												1					
Bargaining Unit-																		
Health Physics Tech	35												35	2	1	35	35	3
<b>QUALITY ASSURANCE</b>																		
Exempt-																		
Group Manager	1												1					
Engineer	5												5					
Non-exempt-																		
Secretary/Clerk	1												1	6	1	0	5	2
<b>SAFETY</b>																		
Exempt-																		
Group Manager	1												1					
Engineer	6												6					
Non-exempt-																		
Secretary/Clerk	1												1	7	1	0	6	2
<b>TOTALS</b>																		
Exempt	110												110					
Non-Exempt	12												12					
Bargaining Unit	123												123					
<b>GRAND TOTALS</b>													<b>245</b>	<b>110</b>	<b>12</b>	<b>123</b>	<b>172</b>	<b>73</b>

TABLE D.5-3. DIRECT OPERATING STAFF PROJECTION

Alternative 5

Facility: CH & RH Waste Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers		
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt-																		
Group Manager	1											1						
Deputy Manager																		
Non-exempt-																		
Secretary/Clerk	1											1	1	0		0	2	
<b>TRAINING:</b>																		
Exempt-																		
Group Manager																		
Trainers	3											3						
Non-exempt-																		
Secretary/Clerk	1											1	3	1	0		0	4
<b>OPERATIONS:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Scheduler	2											2						
Engineer																		
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Operators	24											24	3	1	24		24	4
<b>OPERATIONS SUPPORT:</b>																		
Exempt-																		
Group Manager	1											1						
Planner	3											3						
Engineer																		
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician													4	1	0		0	5
<b>ENGINEERING:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Process Support	3											3						
Environmental	2											2						
Facility Support	4											4						
Maintenance	3											3						
Facility Projects	2											2						
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician	1											1	15	1	1		14	3

TABLE D.5-3. DIRECT OPERATING STAFF PROJECTION

Alternative 5

Facility: CH & RH Waste Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager	1											1					
Support Manager																	
Planner	2											2					
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Mechanical	10											10					
Instrumentation	6											6					
Electrical	4											4	3	1	20	20	4
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager	1											1					
Engineer																	
Non-exempt-																	
Secretary/Clerk	1											1					
Bargaining Unit-																	
Health Physics Tech	15											15	1	1	15	15	2
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager																	
Engineer	2											2					
Non-exempt-																	
Secretary/Clerk													2	0	0	2	0
<b>SAFETY</b>																	
Exempt-																	
Group Manager																	
Engineer	2											2					
Non-exempt-																	
Secretary/Clerk													2	0	0	2	0
<b>TOTALS</b>																	
Exempt	34											34					
Non-Exempt	7											7					
Bargaining Unit	60											60					
<b>GRAND TOTALS</b>												<b>101</b>	<b>34</b>	<b>7</b>	<b>60</b>	<b>77</b>	<b>24</b>

## TABLE D.5-4. DIRECT OPERATING STAFF PROJECTION

Alternative 5

Facility: Cs &amp; Sr Capsule Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers		
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad		
<b>PLANT MANAGER:</b>																		
Exempt-																		
Group Manager	1											1						
Deputy Manager																		
Non-exempt-																		
Secretary/Clerk	1											1	1	0		0	2	
<b>TRAINING:</b>																		
Exempt-																		
Group Manager	1											1						
Trainers	1											1						
Non-exempt-																		
Secretary/Clerk	1												2	1	0		0	3
<b>OPERATIONS:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager																		
Scheduler	1											1						
Engineer																		
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Operators	4											4	2	1	4		4	3
<b>OPERATIONS SUPPORT:</b>																		
Exempt-																		
Group Manager																		
Planner																		
Engineer																		
Non-exempt-																		
Secretary/Clerk																		
Bargaining Unit-																		
Technician																		
<b>ENGINEERING:</b>																		
Exempt-																		
Group Manager	1											1						
Support Manager												0						
Process Support	3											3						
Environmental	1											1						
Facility Support	2											2						
Maintenance	2											2						
Facility Projects	1											1						
Non-exempt-																		
Secretary/Clerk	1											1						
Bargaining Unit-																		
Technician													10	1	0		8	3

## TABLE D.5-4. DIRECT OPERATING STAFF PROJECTION

Alternative 5

Facility: Cs &amp; Sr Capsule Storage

Personnel Group/Type	Days	P	Q	Projected Shift Schedule								Group Total	Type Total			Radiation Workers	
				A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
<b>Exempt-</b>																	
Group Manager	1											1					
Support Manager																	
Planner	1											1					
<b>Non-exempt-</b>																	
Secretary/Clerk	1											1					
<b>Bargaining Unit-</b>																	
Mechanical	4											4					
Instrumentation	3											3					
Electrical	2											2	2	1	9	9	3
<b>RADIOLOGICAL CONTROL</b>																	
<b>Exempt-</b>																	
Group Manager	1											1					
Engineer																	
<b>Non-exempt-</b>																	
Secretary/Clerk																	
<b>Bargaining Unit-</b>																	
Health Physics Tech	5											5	1	0	5	5	1
<b>QUALITY ASSURANCE</b>																	
<b>Exempt-</b>																	
Group Manager																	
Engineer	1											1					
<b>Non-exempt-</b>																	
Secretary/Clerk													1	0	0	1	0
<b>SAFETY</b>																	
<b>Exempt-</b>																	
Group Manager																	
Engineer	1											1					
<b>Non-exempt-</b>																	
Secretary/Clerk													1	0	0	1	0
<b>TOTALS</b>																	
Exempt	20											20					
Non-Exempt	5											5					
Bargaining Unit	18											18					
<b>GRAND TOTALS</b>												<b>43</b>	<b>20</b>	<b>5</b>	<b>18</b>	<b>28</b>	<b>15</b>

TABLE D.5-5. DIRECT OPERATING STAFF PROJECTION

Alternative 5

Facility: Unirradiated Uranium Storage

Personnel Group/Type	Days	P	Projected Shift Schedule								Group Total	Type Total			Radiation Workers	
			Q	A	B	C	D	X	Y	Z		Ex	NE	BU	Rad	Non Rad
<b>PLANT MANAGER:</b>																
Exempt-																
Group Manager	1										1					
Deputy Manager																
Non-exempt-																
Secretary/Clerk	1										1	1	1	0	0	2
<b>TRAINING:</b>																
Exempt-																
Group Manager																
Trainers	1										1					
Non-exempt-																
Secretary/Clerk												1	0	0	0	1
<b>OPERATIONS:</b>																
Exempt-																
Group Manager																
Support Manager																
Scheduler	1										1					
Engineer																
Non-exempt-																
Secretary/Clerk																
Bargaining Unit-																
Operators	2										2	1	0	2	2	1
<b>OPERATIONS SUPPORT:</b>																
Exempt-																
Group Manager																
Planner	1															
Engineer																
Non-exempt-																
Secretary/Clerk																
Bargaining Unit-																
Technician												1	0	0	0	1
<b>ENGINEERING:</b>																
Exempt-																
Group Manager																
Support Manager																
Process Support	1										1					
Environmental																
Facility Support																
Maintenance																
Facility Projects																
Non-exempt-																
Secretary/Clerk																
Bargaining Unit-																
Technician												1	0	0	1	0

TABLE D.5-5. DIRECT OPERATING STAFF PROJECTION

Alternative 5

Facility: Unirradiated Uranium Storage

Personnel Group/Type	Days	Projected Shift Schedule										Group Total	Type Total			Radiation Workers	
		P	Q	A	B	C	D	X	Y	Z	Ex		NE	BU	Rad	Non Rad	
<b>MAINTENANCE:</b>																	
Exempt-																	
Group Manager																	
Support Manager																	
Planner																	
Non-exempt-																	
Secretary/Clerk																	
Bargaining Unit-																	
Mechanical	1											1					
Instrumentation																	
Electrical	1											1	0	0	2	2	0
<b>RADIOLOGICAL CONTROL</b>																	
Exempt-																	
Group Manager																	
Engineer																	
Non-exempt-																	
Secretary/Clerk																	
Bargaining Unit-																	
Health Physics Tech	2											2	0	0	2	2	0
<b>QUALITY ASSURANCE</b>																	
Exempt-																	
Group Manager																	
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk													1	0	0	1	0
<b>SAFETY</b>																	
Exempt-																	
Group Manager																	
Engineer	1											1					
Non-exempt-																	
Secretary/Clerk													1	0	0	1	0
<b>TOTALS</b>																	
Exempt	7											7					
Non-Exempt	1											1					
Bargaining Unit	6											6					
<b>GRAND TOTALS</b>												<b>14</b>	<b>7</b>	<b>1</b>	<b>6</b>	<b>9</b>	<b>5</b>

# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

## VOLUME VI

### APPENDIX D.6

Alternative 1 Exhibits

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ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I. PROCESSING FACILITY

MODULE TYPE : TREATMENT, RECEIVING, PREPERATION, AND SHIPPING (BB) [FROM GTC3]  
 (FROM DOCUMENT) TRU OPEN, DUMP, AND SORT (OSORT) [FROM TRU]

PFD FUNCTIONS : RECEIVE FOR PROCESSING  
 COVERED CH-TRU WASTE ASSAY AREA

APPLICABLE WASTE: RH-TRU AND CH-TRU  
 STREAM(S)

ADDITIONAL ASSUMED: ALL  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

D.6-1

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/11R)	WASTE MASS FLOW RATE (KG/11R)	WASTE MASS FLOW RATE (LBS/11R)	WASTE FLOW RATE (FT3/11R)	REF MASS FLOW RATE (KG/11R)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
BB	189261	17	8	1034	2274	281	3833	3721	1004
OSORT	189261	17	8	1034	2274	281	875	2997	3539

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT)  
(FROM DOCUMENT)

PFD FUNCTIONS : TRU SIZE REDUCTION AND PACKAGING  
COVERED

APPLICABLE WASTE: CH--TRU  
STREAM(S)

ADDITIONAL ASSUMED: NONE  
WASTE STREAMS

YRS TILL : 11  
CONSTRUCTED

WEIGHTED : 0.14  
DENSITY, KG/L

D.6-2

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	27974	17	1	165	362	42	633	842	219

09/09/2014  
 WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I. PROCESSING FACILITY

MODULE TYPE : NEUTRALIZATION (NEUTR)  
 (FROM DOCUMENT) GROUT STABILIZATION (GROUT)

PFD FUNCTIONS : TRU WASTE GLOVE BOX PROCESSING AREA  
 COVERED

APPLICABLE WASTE: CH-TRU  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.40  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
NEUTR	2358	17	0.1	40	87	3	383	887	92
GROUT	2358	17	0.1	40	87	3	600	747	49

D.6-3

2000000000  
 WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT) (FROM LL MW)  
 (FROM DOCUMENT)

PFD FUNCTIONS : LLW SIZE REDUCTION AND PACKAGING  
 COVERED

APPLICABLE WASTE: UNIRRADIATED URANIUM  
 STREAM(S) LLW CONTAINERS

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.06  
 DENSITY, KG/L

D.6-4

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/11R)	WASTE MASS FLOW RATE (KG/11R)	WASTE MASS FLOW RATE (LBS/11R)	WASTE FLOW RATE (FT3/11R)	REF MASS FLOW RATE (KG/11R)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	74111	17	3	187	411	110	1850	936	95

05/12/2011 11:16

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I. PROCESSING FACILITY

MODULE TYPE : CERTIFICATION AND SHIPPING (CSHIP) [TRU]  
 (FROM DOCUMENT)

PFD FUNCTIONS : PACKAGE EXAMINATION/VERIFICATION  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: Cs/Sr, MISC, LLMW  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.59  
 DENSITY, KG/L

D.6-5

MODULE NAME	PFD WASTE INPLTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CSHIP	46419	17	2	1151	2532	69	2750	615	257

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I PROCESSING FACILITY

MODULE TYPE : CERTIFICATION AND SHIPPING (CSHIP) [TRU]  
 (FROM DOCUMENT)

PFD FUNCTIONS : SHIP TO STORAGE OR DISPOSAL  
 COVERED

APPLICABLE WASTE: NUMEROUS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.24  
 DENSITY, KG/L

D.6-6

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CSHIP	194892	17	8	1965	4324	289	5500	1861	665

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I. PROCESSING FACILITY

MODULE TYPE : PACKAGING (PACKG)  
(FROM DOCUMENT)

PFD FUNCTIONS : TRU PROCESSING  
COVERED

APPLICABLE WASTE: TRU  
STREAM(S)

ADDITIONAL ASSUMED: NONE  
WASTE STREAMS

YRS TILL : 11  
CONSTRUCTED

WEIGHTED : 0.40  
DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
PACKG	10612	17	0.4	178	392	16	1200	559	83

D.6-7

9514392.119  
WMC-SD-WM-ES-341, Rev 0

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I. PROCESSING FACILITY

MODULE TYPE : PACKAGING (PACKG) (FROM TRU)  
 (FROM DOCUMENT)

PFD FUNCTIONS COVERED : LLMW PROCESSING

APPLICABLE WASTE STREAM(S) : LLMW

ADDITIONAL ASSUMED WASTE STREAMS : NONE

YRS TILL CONSTRUCTED : 11

WEIGHTED DENSITY, KG/L : 0.40

D.6-8

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/11R)	WASTE MASS FLOW RATE (KG/11R)	WASTE MASS FLOW RATE (LBS/11R)	WASTE FLOW RATE (FT3/11R)	REF MASS FLOW RATE (KG/11R)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
PACKG	18788	17	1	316	695	28	1200	559	147

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I. PROCESSING FACILITY

MODULE TYPE : TREATMENT FRONT-END SUPPORT (TADMN)  
 (FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD. A REQ'D SUPPORT MODULE  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: ALL  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
TADMN	189261	17	8	1034	2274	281	5750	2464	443

0.6.9

05/10/2011  
 WHC-SD-WM-ES-341. Rev 0

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

I. PROCESSING FACILITY

MODULE TYPE : MAINTENANCE (MAINT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD: A REQ'D SUPPORT MODULE  
 COVERED

APPLICABLE WASTE : TRU  
 STREAM(S)

ADDITIONAL ASSUMED : ALL  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

D.6-10

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (F13/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
MAINT	189261	17	8	1034	2274	281	5500	701	132

WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

II. NEW RH STORAGE AREA

MODULE TYPE : ENCLOSED VAULT STORAGE FACILITY (Z): REFERENCE FOR TYPICAL RH FACILITY  
 (FROM DOCUMENT)

PFD FUNCTIONS : RH-LLMW, RH-TRU, Cs/Sr CAPSULES,  
 COVERED MISC SOURCES, STORAGE PRIOR TO PROCESSING

APPLICABLE WASTE: ALL NOTED PFD FUNCTIONS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR 2017

WEIGHTED : N/A: PER WHC DIRECTION THE FACTOR 5FT<sup>2</sup>/M<sup>3</sup> WAS USED  
 DENSITY, KG/L THIS FACTOR IS USED BY PARSONS (ALTERNATIVE 3)

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT <sup>3</sup> )	PARSONS FACTOR (FT <sup>2</sup> /M <sup>3</sup> )	NEW SCALED FACILITY SIZE (M <sup>2</sup> )
Z	60542	1	N/A	N/A	2137738	5	28133

D.6-11

WHC-SD-WM-ES-341, Rev 0

01 08 2017

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

II. NEW RH STORAGE AREA

MODULE TYPE : ENCLOSED VAULT STORAGE FACILITY (Z): REFERENCE FOR TYPICAL RH FACILITY  
 (FROM DOCUMENT)

PFD FUNCTIONS : HLW CANISTERS, RH-TRU, Cs/Sr CAPSULES,  
 COVERED AND MISC SOURCES STORAGE PRIOR TO DISPOSAL

APPLICABLE WASTE: HLW CANISTERS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR 2028

WEIGHTED : N/A: PER WHC DIRECTION: ASSUMES ALL WASTE PRIOR TO DISPOSAL CAN BE  
 DENSITY, KG/L ADEQUATELY STORED IN THE CANISTER STORAGE FACILITY DEPICTED IN WHC-EP-0616, APP. 1

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT3)	NEW ASSUMED FACILITY SIZE (M2)
Z	8588	1	N/A	N/A	303242	15836

0.6-12

0616001.024  
 WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 1. FACILITY SCALING DATA SHEET

III. NEW CH STORAGE AREA

MODULE TYPE : CONTACT-HANDLED STORAGE (STORE) [FROM TRU]: REFERENCE AS A TYPICAL CH FACILITY  
 (FROM DOCUMENT) STORAGE FRONT-END SUPPORT (SADMN) [FROM TRU]  
 STORAGE RECEIVING AND SHIPPING (SRCHS) [FROM TRU]

PFD FUNCTIONS : LARGE/SPECIAL CH- TRU, UNIRRADIATED URANIUM,  
 COVERED GTC3 LLW, STORAGE PRIOR TO PROCESSING

APPLICABLE WASTE: ALL NOTED PFD FUNCTIONS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR 2017

WEIGHTED : N/A FOR STORE MODULE. PER WIC DIRECTION THE FACTOR 6FT<sup>2</sup>/M<sup>3</sup> WAS USED.  
 DENSITY, KG/L THIS FACTOR IS BASED ON DATA FROM THE W-112 PROJECT. FOR SADMN AND SRCHS, EG+G BASIS USED WITH .4 KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT <sup>3</sup> )	PARSONS FACTOR (FT <sup>2</sup> /M <sup>3</sup> )	NEW SCALED FACILITY SIZE (M <sup>2</sup> )
STORE	2893	1	N/A	N/A	102152	6	1613

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M <sup>3</sup> /HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT <sup>3</sup> /HR)	REF FLOW RATE (M <sup>3</sup> /HR)	REF FACILITY SIZE (M <sup>2</sup> )	NEW SCALED FACILITY SIZE (M <sup>2</sup> )
SADMN	2893	17	0.1	49	107	4	3	722	35
SRCHS	2893	17	0.1	49	107	4	3	288	14

D.6-13

MHC-SD-WM-ES-341, Rev 0

01/06/2015

ALTERNATIVE 1: FACILITY SCALING DATA SHEET

III NEW CH STORAGE AREA

MODULE TYPE : CONTACT-HANDLED STORAGE (STORE) (FROM TRU): REFERENCE AS A TYPICAL RH FACILITY  
 (FROM DOCUMENT) STORAGE FRONT-END SUPPORT (SADMN) (FROM TRU)  
 STORAGE RECEIVING AND SHIPPING (SRCHS) (FROM TRU)

PFD FUNCTIONS : CH-TRU AND UNIRRADIATED URANIUM  
 COVERED STORAGE PRIOR TO DISPOSAL

APPLICABLE WASTE: ALL NOTED PFD FUNCTIONS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR 2023

WEIGHTED : N/A FOR STORE MODULE: PER WHC DIRECTION THE FACTOR 6FT2/M3 WAS USED.  
 DENSITY, KG/L THIS FACTOR IS BASED ON DATA FROM THE W-112 PROJECT. FOR SADMN AND SRCHS, EG+G BASIS USED WITH 4 KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT3)	PARSONS FACTOR (FT2/M3)	NEW SCALED FACILITY SIZE (M2)
STORE	46848	1	N/A	N/A	1654203	6	26123

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/11R)	WASTE MASS FLOW RATE (KG/11R)	WASTE MASS FLOW RATE (LBS/11R)	WASTE FLOW RATE (FT3/11R)	REF FLOW RATE (M3/11R)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
SADMN	46848	17	2.0	787	1732	70	3	722	568
SRCHS	46848	17	2.0	787	1732	70	3	288	227

D.6-14

MHC-SD-WM-ES-341, Rev 0

94-13361-1217

WHC-SD-WM-ES-341, Rev 0

# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

VOLUME VI

APPENDIX D.7

Alternative 2 Exhibits

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ALTERNATIVE 2. FACILITY SCALING DATA SHEETS

I REMOTE HANDLED PROCESSING FACILITY

MODULE TYPE : TREATMENT, RECEIVING, PREPERATION, AND SHIPPING (BB) [FROM GTC3]  
 (FROM DOCUMENT) TRU OPEN, DUMP, AND SORT (OSORT) [FROM TRU]

PFD FUNCTIONS : RECEIVE FOR PROCESSING  
 COVERED

APPLICABLE WASTE : RH-TRU AND CH-TRU  
 STREAM(S)

ADDITIONAL ASSUMED : ALL  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
BB	42474	17	2	232	510	63	875	2997	794
OSORT	42474	17	2	232	510	63	1916	930	113

0.7-1

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

I. REMOTE HANDLED PROCESSING FACILITY

MODULE TYPE : CERTIFICATION AND SHIPPING (CSHIP) [TRU]  
 (FROM DOCUMENT)

PFD FUNCTIONS : PACKAGE EXAMINATION/VERIFICATION  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: LLMW  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.42  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (F13/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CSHIP	10795	17	0	191	419	16	2750	615	43

0.7-2

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

I REMOTE HANDLED PROCESSING FACILITY

MODULE TYPE : CERTIFICATION AND SHIPPING (CSHIP) [TRU]  
 (FROM DOCUMENT)

PFD FUNCTIONS : SHIP TO STORAGE OR DISPOSAL  
 COVERED

APPLICABLE WASTE: NUMEROUS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.41  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CSHIP	37446	17	2	645	1419	56	2750	615	144

D.7-3

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

I REMOTE HANDLED PROCESSING FACILITY

MODULE TYPE : PACKAGING (PACKG)  
(FROM DOCUMENT)

PFD FUNCTIONS : TRU PROCESSING  
COVERED

APPLICABLE WASTE: TRU  
STREAM(S)

ADDITIONAL ASSUMED: NONE  
WASTE STREAMS

YRS TILL : 11  
CONSTRUCTED

WEIGHTED : 0.40  
DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
PACKG	10612	17	0	178	392	16	1200	559	83

0.7-4

2013.08.14.12.42  
 WMC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

I REMOTE HANDLED PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT) [FROM TRU]  
 (FROM DOCUMENT)

PFD FUNCTIONS : CH LOW LEVEL WASTE SIZE REDUCTION AND PACKAGING  
 COVERED

APPLICABLE WASTE: CH-TRU  
 STREAM(S)

ADDITIONAL ASSUMED: LLW  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.05  
 DENSITY, KG/L

0.7-5

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	31944	17	1	67	148	47	1266	842	45

ALTERNATIVE 2. FACILITY SCALING DATA SHEETS

I REMOTE HANDLED PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : CH LOW LEVEL MIXED WASTE PACKAGING  
 COVERED

APPLICABLE WASTE: LLMW  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.05  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	0	17	0	0	0	0	633	842	0

D.7-6

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

I. REMOTE HANDLED PROCESSING FACILITY

MODULE TYPE : TREATMENT FRONT-END SUPPORT (TADMN)  
 (FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD: A REQ'D SUPPORT MODULE  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: ALL  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
TADMN	42474	17	2	232	510	63	1917	860	104

D.7-7

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

I. REMOTE HANDLED PROCESSING FACILITY

MODULE TYPE : MAINTENANCE (MAINT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD: A REQ'D SUPPORT MODULE  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: ALL  
 WASTE STREAMS

YRS TILL : 11  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/11R)	WASTE MASS FLOW RATE (LBS/11R)	WASTE FLOW RATE (FT3/11R)	REF MASS FLOW RATE (KG/11R)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
MAINT	42474	17	2	232	510	63	2750	241	20

0.7-8

9613582-2736  
 WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

II. CH TRU PROCESSING FACILITY

MODULE TYPE : TREATMENT, RECEIVING, PREPERATION, AND SHIPPING (BB) [FROM GTC3]  
 (FROM DOCUMENT) TRU OPEN, DUMP, AND SORT (OSORT) [FROM TRU]

PFD FUNCTIONS : RECEIVE FOR PROCESSING  
 COVERED CH-TRU WASTE ASSAY AREA

APPLICABLE WASTE: TRU, GTC3  
 STREAM(S)

ADDITIONAL ASSUMED: CH-TRU  
 WASTE STREAMS

YRS TILL : 8  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
BB	47096	20	2	219	481	59	875	2997	749
OSORT	47096	20	2	219	481	59	1916	930	106

0.7-9

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

II. CH TRU PROCESSING FACILITY

MODULE TYPE : CERTIFICATION AND SHIPPING (CSHIP) (TRU)  
 (FROM DOCUMENT)

PFD FUNCTIONS : SHIP TO STORAGE OR DISPOSAL  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 8  
 CONSTRUCTED

WEIGHTED : 0.28  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CSHIP	38969	20	1	390	857	49	2750	615	87

D.7-10

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ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

II. CH TRU PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : TRU WASTE SIZE REDUCTION AND PACKAGING  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 8  
 CONSTRUCTED

WEIGHTED : 0.40  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	16784	20	1	240	527	21	633	842	319

D.7-11

99-0701-009  
 WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

II. CH TRU PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT) (FROM TRU)  
 (FROM DOCUMENT)

PFD FUNCTIONS : LOW LEVEL WASTE SIZE REDUCTION AND PACKAGING  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: LLW  
 WASTE STREAMS

YRS TILL : 8  
 CONSTRUCTED

WEIGHTED : 0.05  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	30280	20	1	54	119	38	633	842	72

D.7-12

WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

II. CH TRU PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : LLMW PACKAGING  
 COVERED

APPLICABLE WASTE: CH-LLMW  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 8  
 CONSTRUCTED

WEIGHTED : 0.40  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	3506	20	0	50	110	4	617	558	45

0.7-13

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

II. CH TRU PROCESSING FACILITY

MODULE TYPE : NEUTRALIZATION (NEUTR)  
 (FROM DOCUMENT) GROUT STABILIZATION (GROUT)

PFD FUNCTIONS : TRU WASTE GLOVE BOX PROCESSING AREA  
 COVERED

APPLICABLE WASTE: CH-TRU  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 8  
 CONSTRUCTED

WEIGHTED : 0.40  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
NEUTR	1436	20	0	21	45	2	383	887	48
GROUT	1436	20	0	21	45	2	600	747	26

0.7-14

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ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

II. CH TRU PROCESSING FACILITY

MODULE TYPE : TREATMENT FRONT-END SUPPORT (TADMN)  
 (FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD: A REQ'D SUPPORT MODULE  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: TRU  
 WASTE STREAMS

YRS TILL : 8  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
TADMN	47096	20	2	219	481	59	1917	860	98

D.7-15

9913682.2793  
 WMC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

II. CH TRU PROCESSING FACILITY

MODULE TYPE : MAINTENANCE (MAINT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD: A REQ'D SUPPORT MODULE  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: ALL  
 WASTE STREAMS

YRS TILL : 8  
 CONSTRUCTED

WEIGHTED : 0.13  
 DENSITY, KG/L

0.7-16

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
MAINT	47096	20	2	219	481	59	2750	241	19

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

III. RH AND CH LLMW PROCESSING FACILITY

MODULE TYPE : TREATMENT, RECEIVING, PREPERATION, AND SHIPPING (BB) [FROM GTC3]  
 (FROM DOCUMENT) TRU OPEN, DUMP, AND SORT (OSORT) [FROM LLMW]

PFD FUNCTIONS : RECEIVE FOR PROCESSING  
 COVERED

APPLICABLE WASTE: GTC3 LLW AND LLMW  
 STREAM(S)

ADDITIONAL ASSUMED: LLW  
 WASTE STREAMS

YRS TILL : 6  
 CONSTRUCTED

WEIGHTED : 0.16  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (F13/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
BB	103053	22	3	535	1178	118	875	2997	1833
OSORT	103053	22	3	535	1178	118	1916	744	208

D.7-17

MHC-SD-WM-ES-341, Rev 0

20130219

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

III. RH AND CH LLMW PROCESSING FACILITY

MODULE TYPE : CERTIFICATION AND SHIPPING (CSHIP) [LLMW]  
 (FROM DOCUMENT)

PFD FUNCTIONS : SHIP TO STORAGE OR DISPOSAL  
 COVERED

APPLICABLE WASTE: LLMW  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 6  
 CONSTRUCTED

WEIGHTED : 0.21  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/11R)	WASTE MASS FLOW RATE (KG/11R)	WASTE MASS FLOW RATE (1 BS/11R)	WASTE FLOW RATE (FT3/11R)	REF MASS FLOW RATE (KG/11R)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CSHIP	128082	22	4	873	1921	147	2767	595	188

0.7-18

WHC-SD-MM-ES-341, Rev 0

99 1000 1216

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

III. RH AND CH LLMW PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : LLMW SIZE REDUCTION AND PACKAGING  
 COVERED

APPLICABLE WASTE: CH-LLMW  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

YRS TILL : 6  
 CONSTRUCTED

WEIGHTED : 0.40  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	18788	22	1	244	537	22	1233	558	110

D.7-19

WMC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

III RH AND CH LLMW PROCESSING FACILITY

MODULE TYPE : SHREDDING AND COMPACTION (CMPCT) [FROM LLMW]  
 (FROM DOCUMENT)

PFD FUNCTIONS : LLW SIZE REDUCTION AND PACKAGING  
 COVERED

APPLICABLE WASTE: LLMW  
 STREAM(S)

ADDITIONAL ASSUMED: LLW  
 WASTE STREAMS

YRS TILL : 6  
 CONSTRUCTED

WEIGHTED : 0.05  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
CMPCT	11809	22	0	19	42	14	1233	558	9

0.7-20

MHC-SD-WM-ES-341. Rev 0

05/20/2016

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

III. RH AND CH LLMW PROCESSING FACILITY

MODULE TYPE : TREATMENT FRONT-END SUPPORT (TADMN)  
(FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD: A REQ'D SUPPORT MODULE  
COVERED

APPLICABLE WASTE: LLMW  
STREAM(S)

ADDITIONAL ASSUMED: LLW  
WASTE STREAMS

YRS TILL : 6  
CONSTRUCTED

WEIGHTED : 0.16  
DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
TADMN	103053	22	3	535	1178	118	2000	2464	660

0.7-21

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ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

III RH AND CH LLMW PROCESSING FACILITY

MODULE TYPE : MAINTENANCE (MAINT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD: A REQ'D SUPPORT MODULE  
 COVERED

APPLICABLE WASTE: LLMW  
 STREAM(S)

ADDITIONAL ASSUMED: LLW  
 WASTE STREAMS

YRS TILL : 6  
 CONSTRUCTED

WEIGHTED : 0.16  
 DENSITY, KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
MAINT	103053	22	3	535	1178	118	2750	241	47

0.7-22

AHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

IV. NEW CH WASTE STORAGE FACILITY

MODULE TYPE : CONTACT-HANDLED STORAGE (STORE) [FROM TRU]; REFERENCE AS A TYPICAL CH FACILITY  
 (FROM DOCUMENT) STORAGE FRONT-END SUPPORT (SADMN) [FROM TRU]  
 STORAGE RECEIVING AND SHIPPING (SRCHS) [FROM TRU]

PFD FUNCTIONS : TRU, LLMW, GTC3 LLW,  
 COVERED STORAGE PRIOR TO PROCESSING

APPLICABLE WASTE: ALL NOTED PFD FUNCTIONS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR 2022

WEIGHTED : N/A FOR STORE MODULE: PER WHC DIRECTION THE FACTOR 6FT<sup>2</sup>/M<sup>3</sup> WAS USED  
 DENSITY, KG/L THIS FACTOR IS BASED ON DATA FROM THE W-112 PROJECT FOR SADMN AND SRCHS, EG+G BASIS USED WITH 4 KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT <sup>3</sup> )	PARSONS FACTOR (FT <sup>2</sup> /M <sup>3</sup> )	NEW SCALED FACILITY SIZE (M <sup>2</sup> )
STORE	48650	1	N/A	N/A	1717832	6	27128

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT <sup>3</sup> /HR)	REF FLOW RATE (M3/HR)	REF FACILITY SIZE (M <sup>2</sup> )	NEW SCALED FACILITY SIZE (M <sup>2</sup> )
SADMN	48650	22	2	632	1390	56	3	722	456
SRCHS	48650	22	2	632	1390	56	3	288	182

D.7-23

WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

IV. NEW CH WASTE STORAGE FACILITY

MODULE TYPE : CONTACT-HANDLED STORAGE (STORE) [FROM TRU]: REFERENCE AS A TYPICAL CH FACILITY  
 (FROM DOCUMENT) STORAGE FRONT-END SUPPORT (SADMN) [FROM TRU]  
 STORAGE RECEIVING AND SHIPPING (SRCHS) [FROM TRU]

PFD FUNCTIONS : TRU WASTE PRIOR TO DISPOSAL  
 COVERED

APPLICABLE WASTE : ALL NOTED PFD FUNCTIONS  
 STREAM(S)

ADDITIONAL ASSUMED : NONE  
 WASTE STREAMS

PEAK YEAR 2022

WEIGHTED : N/A FOR STORE MODULE: PER WHC DIRECTION THE FACTOR 6FT2/M3 WAS USED.  
 DENSITY, KG/L THIS FACTOR IS BASED ON DATA FROM THE W-112 PROJECT FOR SADMN AND SRCHS, EG 1 G BASIS USED WITH .4 KG/L

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT3)	PARSONS FACTOR (FT2/M3)	NEW SCALED FACILITY SIZE (M2)
STORE	71	1	N/A	N/A	2507	6	40

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR) (VALUE <1)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF FLOW RATE (M3/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
SADMN	71	22	0	1	2	0	3	722	1
SRCHS	71	22	0	1	2	0	3	288	0.3

D. 7-24

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ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

IV. NEW CH WASTE STORAGE FACILITY

MODULE TYPE : MAINTENANCE (MAINT)  
 (FROM DOCUMENT)

PFD FUNCTIONS : NOT IN PFD: A REQ'D SUPPORT MODULE  
 COVERED

APPLICABLE WASTE: TRU  
 STREAM(S)

ADDITIONAL ASSUMED: CH-TRU, CH-LLMW, CH-GTC3 LLW  
 WASTE STREAMS

YRS TILL : 6  
 CONSTRUCTED

WEIGHTED : 0.40  
 DENSITY, KG/L

0.7-25

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE FLOW RATE (M3/HR)	WASTE MASS FLOW RATE (KG/HR)	WASTE MASS FLOW RATE (LBS/HR)	WASTE FLOW RATE (FT3/HR)	REF MASS FLOW RATE (KG/HR)	REF FACILITY SIZE (M2)	NEW SCALED FACILITY SIZE (M2)
MAINT	116723	22	4	1516	3335	134	5500	701	193

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 08/12/2011

ALTERNATIVE 2. FACILITY SCALING DATA SHEETS

V STAND ALONE STORAGE FACILITIES

MODULE TYPE : CONTACT-HANDLED STORAGE (STORE) [FROM TRU]: REFERENCE FOR TYPICAL CH FACILITY  
 (FROM DOCUMENT)

PFD FUNCTIONS : UNIRRADIATED URANIUM  
 COVERED

APPLICABLE WASTE: UNIRRADIATED URANIUM  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR 2005

WEIGHTED : N/A. PER WHC DIRECTION, THE UNIRRADIATED URANIUM FACILITY IS ASSUMED TO BE  
 DENSITY, KG/L IDENTICAL TO THAT USED BY BAYTHEON (ALTERNATIVE 4), 24,000#/12

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL. (FT3)	NEW ASSUMED FACILITY SIZE (M2)
STORE	145	1	N/A	N/A	5120	2230

D.7-26

WHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

V. STAND ALONE STORAGE FACILITIES

MODULE TYPE : ENCLOSED VAULT STORAGE FACILITY (Z); REFERENCE FOR TYPICAL RH FACILITY  
 (FROM DOCUMENT)

PFD FUNCTIONS : HLW CANISTER STORAGE  
 COVERED

APPLICABLE WASTE: HLW CANISTER STORAGE  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR 2028

WEIGHTED : N/A. PER WHC DIRECTION: ASSUMES CANISTER STORAGE FACILITY DESCRIBED IN  
 DENSITY, KG/L WHIC-EP-0616, APP. I, BEST DEPICTS THE STORAGE REQUIREMENTS FOR THE HLW CANISTERS.

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT3)	NEW ASSUMED FACILITY SIZE (M2)
Z	8569	1	N/A	N/A	302571	15836

0.7-27

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

V. STAND ALONE STORAGE FACILITIES

MODULE TYPE : ENCLOSED VAULT STORAGE FACILITY (Z): REFERENCE FOR TYPICAL RH FACILITY  
 (FROM DOCUMENT)

PFD FUNCTIONS : Cs/Sr CAPSULE AND OVERPACK STORAGE  
 COVERED

APPLICABLE WASTE: Cs/Sr CAPSULES AND OVERPACKS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR CONSTANT

WEIGHTED : N/A: PER WHC DIRECTION, THE Cs/Sr AND OVERPACK FACILITY IS ASSUMED TO BE  
 DENSITY, KG/L IDENTICAL TO THAT USED BY RAYTHEON (ALTERNATIVE 4), 1,128 FT<sup>2</sup>.

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT <sup>3</sup> )	NEW ASSUMED FACILITY SIZE (M <sup>2</sup> )
Z	4	1	N/A	N/A	141	105

D. 7-28

MHC-SD-WM-ES-341, Rev 0

ALTERNATIVE 2: FACILITY SCALING DATA SHEETS

V. STAND ALONE STORAGE FACILITIES

MODULE TYPE : ENCLOSED VAULT STORAGE FACILITY (Z). REFERENCE FOR TYPICAL RH FACILITY  
 (FROM DOCUMENT)

PFD FUNCTIONS : REMOTE-HANDLED TRU, LLMW, GTC3 LLW,  
 COVERED AND MISCELLANEOUS STORAGE

APPLICABLE WASTE: ALL NOTED PFD FUNCTIONS  
 STREAM(S)

ADDITIONAL ASSUMED: NONE  
 WASTE STREAMS

PEAK YEAR 2005

WEIGHTED : N/A FOR STORE MODULE: PER WHC DIRECTION THE FACTOR 5FT<sup>2</sup>/M<sup>3</sup> WAS USED.  
 DENSITY, KG/L THIS FACTOR IS USED BY PARSONS (ALTERNATIVE 3).

MODULE NAME	PFD WASTE INPUTS, (M3)	OPERATIONAL DURATION, YRS	WASTE MASS (KG)	WASTE MASS (LBS)	WASTE VOL (FT <sup>3</sup> )	PARSONS FACTOR (FT <sup>3</sup> /M <sup>3</sup> )	NEW SCALED FACILITY SIZE (M <sup>2</sup> )
Z	84956	1	N/A	N/A	2999796	5	39478

0.7-29

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WHC-SD-WM-ES-341, Rev 0

# SOLID WASTE AND MATERIALS SYSTEMS ALTERNATIVES STUDY

VOLUME VI

APPENDIX D.8,  
Alternative 3 Exhibits

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**EXHIBIT 6.6.1-1**

**TPA MILESTONE M-33 ALTERNATIVE 3  
REGULATORY ISSUES/UNCERTAINTIES**

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**EXHIBIT 6.6.1-1****TPA MILESTONE M-33 ALTERNATIVE 3: REGULATORY ISSUES / UNCERTAINTIES****1. General Background on Regulatory Issues**

One area of uncertainty for alternative 3 is the permitting of existing Hanford facilities to accommodate their new roles, as suggested by the conclusion of this report. The specific details of the waste streams, that these modified facilities would be designed to handle, must be provided as an early input into the permitting decision making process. The intangible details of the waste stream further complicate the permitting issue because, in the permitting process, detailed plant process logic, equipment layout and operation are described to aid government agencies to make judgements as to how the proposed facilities will affect the health and safety of the public and environment. Permitting is an uncertainty not because of the technical adequacy of the proposed facilities, but rather because permitting involves decisions based on unforeseeable public comments and concerns.

For Hanford modifications of the magnitude required to treat the waste stream identified by TPA milestone M-33, a wide variety of permitting actions needs to be considered. The WHC *Permitting Assessment* group is responsible for identifying the required permitting actions for proposed projects. This organization was consulted to help address the scope of permitting actions needed. The permitting actions which need to be considered are: 1) the Treatment, Storage and Disposal of Dangerous and Extremely Hazardous Waste (RCRA, 40 CFR 240-271; and WAC-173-303), 2) Receipt, Acquisition, Ownership, Possession, Use, Transfer or Dispose of any source of Radiation (10 CFR 150; WAC 246-232, 233, 235, 250), 3) Air Emissions of Hazardous Substance (WAC 173-401 which is consistent with the requirements of Title V of the Federal Clean Air Act, 42 U.S.C. 7401), 4) Air Emissions of Radionuclides (WAC 173-480), 5) Project Environmental Impact (National Environmental Protection Act, 40 CFR 1500.1; the State Environmental Protection Act, WAC 197-11), and 6) transportation of waste over public roads between major Hanford areas, such as a shipment between the 200 areas and the 300 area (49 CFR 173). All of the above mentioned permitting requirements are developed further in the following sections.

**2.0 RCRA Permitting**

To understand the RCRA permitting system at Hanford, a brief description of the current permit status must be given. Currently more than 60 Treatment, Storage and/or Disposal (TSD) units operate at the Hanford Site under independent "interim status" permits, meaning that RCRA Part A permits have been issued by the Washington Department of Ecology (Ecology) and the U. S. Environmental Protection Agency (EPA). Each permit has two parts. The first part is the *Dangerous Waste Portion of the Resource Conservation and Recovery Act Interim Status Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, and is issued by Ecology. The second part is the *Hazardous and Solid Waste Amendments Portion of the Resource*

*Conservation and Recovery Act, Interim Status permit for the Treatment, Storage, and Disposal of Hazardous Waste*, and is issued by the EPA. Types of units operating under an interim status include tank systems, surface impoundments, container storage areas, waste piles, landfills, and miscellaneous units.

The U.S. Department of Energy (DOE) obtained a "final status" permit last year for the Treatment, Storage and Disposal of Dangerous and Hazardous / Solid Waste at Hanford. The final status permit is also divided into two sections. The first section was issued by Ecology for the treatment, storage, and disposal of dangerous waste, and the second section was issued by the EPA for the Hazardous and Solid Waste Amendment Portion of RCRA. Both permits are contained in one document maintained by Ecology indexed by permit number WA7890008967. This document has been in effect and enforceable since September 28, 1994 and will remain in effect through September 27, 2004. This final status permit has chapters which authorize the operation or closure of five Hanford units. The two facilities authorized for operation are the *616 Nonradioactive Dangerous Waste Storage Facility* and the *305-B Mixed Waste Storage Facility*. The *183-H Solar Evaporation Basins*, *2727-S Nonradioactive Dangerous Waste Storage Facility*, and the *300 Area Solvent Evaporator* are all permitted for the final closure process. There is a schedule to permit all other interim status Hanford units under this final status permit. The schedule is outlined in the M-20 series of milestones of the Tri-Party-Agreement (TPA).

## 2.1 RCRA Permit Modifications

Interim status permit modifications are governed by WAC 173-303-805(7), while final status permit changes are governed by WAC 173-303-830. A notice of intent (NOI) is required to be submitted to Ecology no less than one hundred fifty days prior to filing an application for a permit or permit revision, WAC 173-303-281.3.b. Permit revisions will be required for any expansion of a facility, to include an enlargement of the land surface area of an existing facility, the addition of a new dangerous waste management process, or an increase in the overall design capacity of existing dangerous waste management processes at a facility. An interim status permit change application may be approved by default as early as sixty days after Ecology receives the application, WAC 173-303-805.7.a.i, or it may go through an undetermined period of clarification, public comment and arbitration.

A final status permit modification requested by the permittee will fall into one of four classes, WAC 173-830.4. Class one modifications may be implemented no more than seven calendar days prior to notifying Ecology. Class one modifications do not substantially alter the permit conditions or reduce the capacity of the facility to protect human health or the environment. Examples of class one modifications include: administrative and informational changes, equipment replacement or upgrading with functionally equivalent components, an increase in the frequency of procedures for monitoring, reporting, sampling, or maintenance activities by the permittee, etc.

A class 2 modification involves a sixty day public comment period and a public hearing. No later than ninety days after receipt of the class two modification request, Ecology must either: 1) approve the modification request, with or without changes or 2) deny the request or 3) determine the request must follow the class 3 modification procedure or 4) temporarily approve the modification or 5) delay their decision for up to thirty days. Class two modifications apply to changes that are necessary to enable a permittee to respond, in a timely manner to common variations in the types and quantities of the wastes managed under the facility permit, technological advancements, and changes necessary to comply with new regulations, where these changes can be implemented without substantially changing design specifications or management practices in the permit. Typical class two modifications include changing the type of training given, a change in sample analysis procedure, or removal of equipment from the emergency equipment list.

Class three modifications require the same public notification and comment period as class two modifications, however they are reviewed with a greater degree of scrutiny. Class three modifications substantially alter the facility or its operation. Some class three modifications include an extension of final compliance date, a change in ground water monitoring parameters and action levels or the addition of a compliance monitoring program.

In the case of other modifications not explicitly listed in WAC 173-303-830 Appendix I, the permittee proposes and justifies a modification class. Ecology determines if the proposed modification class is appropriate, and then follows the procedures outlined above for the modification class selected.

## **2.2 M-33 RCRA Permitting**

All facilities considered for modification by alternative 3 of M-33 are either permitted in an interim status under RCRA or are not permitted at all. The permit status of these facilities is as follows: T Plant (interim status treatment and storage of mixed waste), the Maintenance and Storage Facility (interim status to treat and store sodium contaminated equipment, currently a petition is being prepared to cancel MASF's part A as no RCRA operations have occurred at MASF to date), Fuel and Materials Examination Facility (not permitted under RCRA), the Grout Facilities in 200E (currently under interim status, however extensive effort has been expended preparing a part B permit, DOE/RL-88-27), and the proposed Modular Dry Vault Storage Facilities (not permitted). The WHC RCRA permitting organization estimated it would take on the order of months of effort and a cost of approximately \$300,000 to obtain a change to an interim status permit, compared to years of effort with a cost running into the millions to change a final status permit. Therefore all M-33 related modifications should be done under interim status. This will require immediate action in some cases to redirect efforts toward modification of the interim status permits before the "final status" permitting proceeds much further. For example, efforts to cancel the existing MASF part A permit should be discontinued if MASF is to be used to support one of Hanford's treatment or storage missions.

### **3. Permitting for Possession, Use and Disposal of Any Source of Radiation**

The authority to possess, use and dispose of radionuclides is derived directly from the Atomic Energy Act for DOE facilities. State authorities do not have jurisdiction over the DOE's operations with radionuclides, unless the radionuclides are mixed with a dangerous waste. The state regulations listed in the general background pertaining to possession, use and disposal of any source of radiation are therefore not applicable to the Hanford operation, or any of the system upgrades proposed by this M-33 study.

#### **4.0 Air Emissions**

##### **4.1 Radionuclide Air Emissions**

The Hanford Site Wide Air Emissions License number FF-01, issued by the Washington Department of Health, covers radionuclide air emissions. At this time it is expected that the system upgrades proposed by M-33 will require only minor permitting efforts for radionuclide air emissions such as submitting Notices Of Construction (NOCs) to the Washington Department of Health and selection of the best available radionuclide control technologies per WAC 246-247-070. This is due to the relatively low level of potential air emissions associated with the repackaging of various waste streams covered by M-33 when compared to the potential air emissions of operating a plant such as PUREX, which is currently covered by the Hanford Site Wide Air Emissions License. This permit change process would likely take six months, cost on the order of \$100,000 and could cover all proposed M-33 changes.

##### **4.2 Hazardous Substances Air Emissions**

The Hanford Site is applying for a site wide Air Operating Permit, to be issued by the Washington Department of Ecology in accordance with their new requirements listed in WAC 173-401. Permitting activities required for a change in this license will involve submitting a NOC, and a public review period as outlined in WAC 173-401-720 & 725. This permit change process would also likely take six months, cost on the order of \$100,000 and could cover all proposed M-33 changes.

### **5. National Environmental Protection Act (NEPA) / State Environmental Protection Act (SEPA)**

Based on the programmatic extent of the system upgrades proposed by M-33, it is recommended that an Environmental Impact Statement (EIS) be prepared without expending the resources to conduct an Environmental Assessment (EA) and taking the risk an EIS may eventually be required.

A threshold determination is required for any action which is not categorically exempt under the SEPA rules. Although a SEPA environmental checklist is not required to be filled out by an

applicant (WAC 197-11-315.1 b), it is routine to submit a completed checklist with all SEPA applications to assist the lead agency in making their threshold determination. During the threshold determination process, the responsible official reviews the proposed project, environmental checklist, and any other available information, and determines whether the project will have any probable significant adverse environmental impacts. Specific items which must be considered when making this threshold determination are listed in WAC 197-11-330.

If significant adverse environmental impacts are probable, an Environmental Impact Statement is required and a Determination of Significance (DS) is issued (WAC 197-11-360). If there will be no significant impacts, or the impacts can be mitigated, a Determination of Nonsignificance (DNS) is issued (WAC 197-11-340).

During the threshold determination process the lead agency may consider mitigative measures that the agency or the applicant will implement which would reduce or eliminate the significant environmental impacts of a project. If all significant environmental impacts are eliminated, a mitigated DNS can be issued (WAC 197-11-350).

The WHC NEPA permitting organization estimated that preparing an EIS would take 9-12 months and cost on the order of \$100,000. The EIS would then be used by the Department of Ecology to determine whether the M-33 project will have any probable significant adverse environmental impacts. If an E.A were conducted first, and the lead agency determined that the project was likely to have significant adverse environmental impacts, a decision of significance would be issued and an EIS would be required.

## **6. Solid Waste Transportation**

There are packaging, labeling and size limitations for shipments of waste between major Hanford areas over public roads or the rail system. Shipments north of the Wye barricade are not required by law to be done per Department of Transportation (DOT) requirements because the public does not have access to these roadways, however current company policy requires these shipments to either comply with all DOT requirements or use controls which have been shown to provide equivalent safety margins. If a shipment south of the Wye barricade can not comply with all DOT requirements, for either economic or technical feasibility limitations, then a road closure is required and a Safety Analysis Report for Packaging (SARP) may be required. WHC-CM-2-14. The major limitation to solid waste shipments over public roadways is the container's maximum external dose. If the external dose is above a specified level, the shipment will be scheduled for a low traffic volume time of the day and the road will be closed to public access during the shipment. Similar road closures are currently being used to transport liquid waste between the 300 and 200E areas and cost approximately \$3,000 for the added security.

If either MASF or FMEF are selected to process a major portion of the M-33 waste stream and route 4 where used to transport this waste back and forth, either major maintenance needs to be done immediately or significant road reconstruction would be required after a few years of heavy

truck traffic. If, on the other hand, the rail system were used to transport this waste, only routine rail maintenance would be required. Currently the rail system between the 200, 300 and 400 areas is fully maintained and significantly under utilized, currently *Kaiser Traffic Management* projects that only 480 rail cars will be transported over the rail system this year. Only one train crew is required to serve such a low volume, and they are working at minimal capacity. The waste would still be required to comply with DOT requirements. However, in the event that it was not economically or technically feasible to fully comply, only short road closures would be required at the crossings between the railway and roadways. These closures could be done any time, except during rush hours, and would not incur significant security related costs.

The *Traffic Management* group has DOT certified equipment, a DOT certified training program, and procedures in place to rapidly respond to all transportation requirements which may be required by this alternative. They recommend that the rail system be used for programmatic shipments to avoid major road work and to minimize the impact on roadway traffic due to road closures incidental to high dose shipments or shipments of waste which can not feasibly comply with all DOT requirements.

## 7. Summary

The longest lead times and potentially highest permitting costs for the system modifications proposed by this study are associated with RCRA permits. If existing facilities are to be used to perform all or some of the M-33 treatment, storage, or disposal functions, then the interim status permits for these facilities should be modified on an as soon as possible basis. A significant amount of future effort and expense can be averted by submitting the NOIs to modify the interim status permits before actions to obtain final status permits proceed much further.

The next significant permitting effort will involve satisfying NEPA / SEPA requirements. To minimize the time delay associated with getting project approved under these acts, an Environmental Impact Statement and an Environmental Checklist should be prepared promptly and submitted to the Washington Department of Ecology for the proposed waste processing facilities. It is important to get an early start on this process as it can take several years to complete according to the SEPA handbook published by the Washington Department of Ecology.

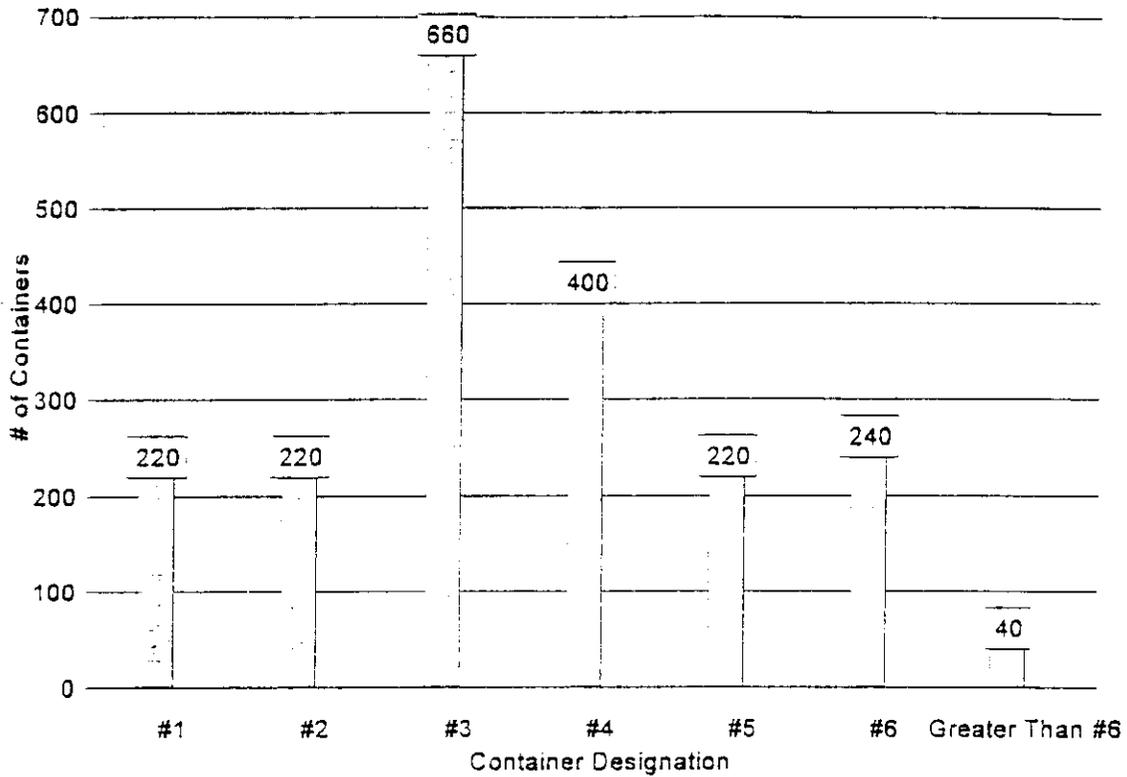
Air emission permitting will involve submitting NOCs to the Departments of Ecology and Health, answering public comments, and reviewing currently available technologies to select the best economically feasible technologies for the control of hazardous and radionuclide emissions. In comparison to RCRA and NEPA / SEPA permitting efforts the air permitting should not be a major obstacle.

Hanford has an existing transportation system which includes DOT certified equipment, training programs and established compliant procedures for the transportation of oversized, hazardous and radioactive payloads over public roads and the Hanford railways. However the major roads are currently in marginal condition and are already under a heavy daily commuter traffic load. To

avoid significant road improvement costs and commuter traffic delays, the Traffic Management group recommends using the rail system as the primary conduit for waste related traffic between the major Hanford Site areas.

**EXHIBIT 6.6.1-2**  
**LLCE EVALUATION**

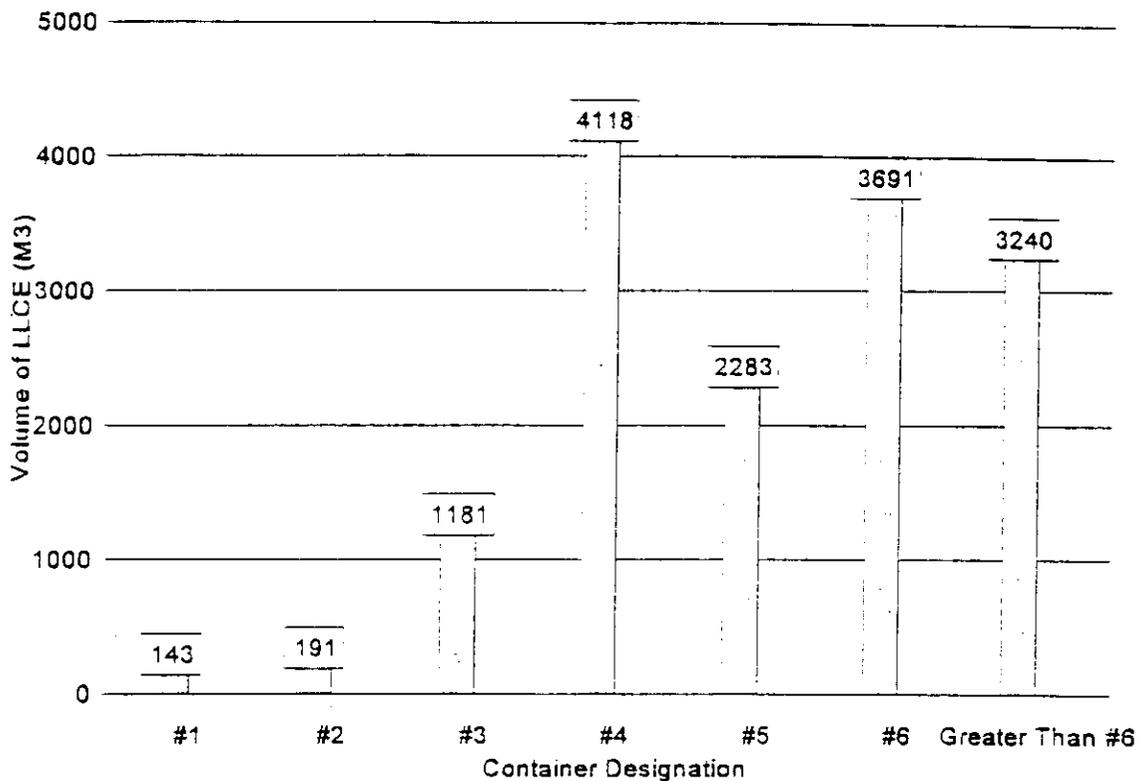
# Distribution of LLCE Containers



Designation Number	Container Outside dimension (BxWxH)	Maximum Equipment Size (OD x Length)	Estimated Weight Empty Unshielded (lb)	Est. Weight Loaded Fully Shielded (lb)
LLCE-1	48" x 50" x 36'4"	30.5" x 28'	11,000	44,200
LLCE-2	48" x 50" x 52'4"	30.5" x 42'	15,000	68,000
LLCE-3	48" x 50" x 70'4"	30.5" x 62'	20,500	89,000
LLCE-4	66" x 66" x 70'4"	44.6" x 62'	30,000	117,000
LLCE-5	86" x 82" x 62'6"	60.85" x 42'	40,200	116,500
LLCE-6	86" x 82" x 70'6"	60.85" x 62'	51,300	148,300

Note: It is estimated that there is 3% of the total LLCE > Container LLCE-6

# Distribution of LLCE Volume



## LLCE CONTAINERS

	Estimated # of Containers Assuming 1300 LLCE items	Assuming 2000 LLCE Items	Container Volume (M <sup>3</sup> )	Max Equip. Envelope(M <sup>3</sup> )	Avg Equip. Envelope (M <sup>3</sup> )	Total Container Volume for 2000 LLCE Items (M <sup>3</sup> )	Equip. Envelope for Disposal Vol. 2000 LLCE items
LLCE-1	143	220	17	4	0.65	3,768	143
LLCE-2	143	220	25	6	0.87	5,500	191
LLCE-3	429	660	33	9	1.79	21,780	1,181
LLCE-4	260	400	60	19	10.29	24,000	4,118
LLCE-5	143	220	87	24	10.38	19,140	2,283
LLCE-6	156	240	97	26	19.38	23,280	4,651
> LLCE-6	26	40	120		81.00	4,800	3,240
<b>Totals</b>	<b>1,300</b>	<b>2,000</b>				<b>102,268</b>	<b>14,847</b>

D.8-12

**LONG LENGTH CONTAMINATED EQUIPMENT (LLCE) CONTAINER EVALUATION**

**Container #1**

		Volume M <sup>3</sup>	
outside (inches)	48x50x435	17	
inside		14	
max. equip. size	30.5x336	4	
Envelope Volume:	diameter	length	M <sup>3</sup>
average	15	252	1
maximum	22.5	329	2
ID #	max diam.	max length	
8	7.5	327.75	
18	9	192.38	
19	9	225.75	
20	9	266	
21	9	332	
37	11	175	
38	11	175	
39	11	173	
40	11	184	
41	11	265	
239	14.25	263	
68	17	294	
69	17.25	165	
70	17.25	168	
71	17.25	211	
72	17.25	319	
233	18.06	228	
73	19	257	
74	23	329	
98	21.75	318	
700	22	246	
102	22.13	311	
104	22.5	310	
103	22.5	310	

**Container #2**

		Volume M <sup>3</sup>	
outside (inches)	48x50x627	25	
inside		20	
max. equip. size	30.5x504	6	
Envelope Volume:	diameter	length	M <sup>3</sup>
average	12.24	451	1
maximum	19	502	2
ID #	max diam.	max length	
9	8	349	
10	8	399	
11	8	432	
12	8	463	
13	8	468	
14	9	492	
257	9	357	
22	9	386	
23	9	436	
24	9	464	
25	9	470	
26	9	490	
27	9	491	
42	11	472	
43	11	477	
44	11	481	
45	11	502	
67	17	460	
75	19	399	
76	19	426	
77	19	431	
78	19	473	
79	19	487	
80	19	495	
93	19	466	

Container #3

		Volume M <sup>3</sup>	
outside (inches)	48x50x843	33	
inside		27	
max. equip. size	30.5x744	9	
Envelope Volume:			
	diameter	length	M <sup>3</sup>
average	15	618	2
maximum	27	639	6
ID #	max diam.	max length	
1	2	57	
2	3	650	
3	3	718	
5	4	668	
6	5	681	
7	6	660	
15	7	625	
16	7	634	
17	3	658	
28	9	675	
39	9	600	
30	9	611	
31	9	648	
32	9	661	
33	9	665	
34	9	677	
35	9	715	
36	9	667	
253	11	495	
46	11	517	
47	11	565	
48	11	568	
49	11	572	
50	11	610	
51	11	559	
52	11	666	
53	11	671	
54	11	674	
55	11	685	
58	11	697	
56	11	697	
57	11	697	
59	11	621	
60	12	592	
52	13	607	
61	13	607	
53	14	705	
64	14	607	
66	16	682	
81	19	533	
82	19	535	
83	19	549	
84	19	555	
85	19	564	
86	19	566	
87	19	646	
88	19	653	
89	19	666	
90	19	661	

Container #4

		Volume M <sup>3</sup>	
outside (inches)	66x66x843	60	
inside		48	
max. equip. size	44x744	19	
Envelope Volume:			
	diameter	length	M <sup>3</sup>
average	40	500	10
maximum	42	740	17
ID #	max diam.	max length	
101	36	27	
120	32	155	
237	35	166	
254	36	267	
252	36	384	
256	41	242	
156	43	264	
152	43	299	
227	43	295	
207	41	304	
126	36	321	
130	36	323	
129	36	390	
127	36	440	
128	36	452	
141	40	469	
135	40	480	
145	42	487	
121	33	491	
123	34	562	
124	34	598	
125	34	665	
132	38	587	
133	39	623	
134	39	540	
136	40	517	
137	40	599	
138	40	665	
139	40	314	
140	40	496	
142	41	559	
143	41	652	
144	41	567	
146	42	545	
147	42	644	
148	42	740	
149	42	592	
150	42	662	
151	42	683	
153	43	584	
154	43	598	
155	43	665	
157	43	633	
158	43	636	
159	44	596	
160	44	668	

91	19	561
92	19	577
94	19	576
241	19	576
96	20	576
251	23	500
243	24	564
105	24	566
106	24	712
109	25	549
110	25	564
111	27	566
250	27	598
112	27	579
113	27	539
115	28	507
244	27	556
117	30	597
118	30	584
234	22	595
238	19	562
119	30	515
249	11	553

**Container #5**

		Volume M <sup>3</sup>
outside (inches)	86x82x750	87
inside		69
max. equip. size	60.85x504	24
Envelope Volume:		
	diameter	length
average	51	310
maximum	60	482
ID #		
	max diam.	max length
236	44	223
161	46	336
209	47	269
162	47	378
245	48	159
212	47	311
231	49	276
166	49	187
167	50	226
168	50	266
175	51	276
176	51	338
95	51	283
184	52	344
185	53	224
232	53	265
230	53	298
187	54	493
195	57	293
196	57	301
199	50	321
200	50	482
248	39	580
247	46	302

**Container #6**

		Volume M <sup>3</sup>
outside (inches)	86x82x846	98
inside		78
max. equip. size	60.85x744	35
Envelope Volume:		
	diameter	length
average	51	579
maximum	54	703
ID #		
	max diam.	max length
163	48	505
164	49	509
188	54	512
159	50	513
189	54	513
174	50	516
201	50	523
177	51	549
229	56	553
190	54	571
216	55	582
165	49	587
173	51	588
170	50	592
198	59	597
192	55	603
197	57	616
182	52	630
193	55	630
171	50	634
180	51	660
172	50	682
173	50	682
191	54	703
181	51	711
240	48	745
186	53	714

<b>Greater than LLCE-6 Detail</b>					
					estimated
					container size
equip #	dimension (inches)	in <sup>3</sup>	ft <sup>3</sup>	envelope M <sup>3</sup>	75% > envelope
179	97.92*582.56	6,544.608	3.787	107	188
242	65.5*624.81	2,680.591	1,551	44	77
255	91.62*464.81	3,901,719	2,258	64	112
203	74.75*312.5	1,746.113	1,010	29	50
204	79.29*644.25	4,050.338	2,344	66	116
205	172.5*383.5	11,411.522	6,604	187	327
246	71.56*868	4,444.884	2,572	73	127
<b>total</b>		<b>34,779,775</b>	<b>20,127</b>	<b>570</b>	<b>997</b>
<b>average</b>		<b>4,968,539</b>	<b>2,875</b>	<b>81</b>	
Assumed Container Volume M <sup>3</sup> :				<b>120</b>	

**EXHIBIT 6.6.1-3**  
**WASTE ISOLATION PILOT PROJECT WASTE**  
**ACCEPTANCE CRITERIA**

**Exhibit 6.6.1-3****1. Waste Acceptance Criteria for the Waste Isolation Pilot Plant, Remote Handled TRU**

In 1978 and 1979, a U.S. Department of Energy (DOE) Steering Committee developed the Waste Acceptance Criteria (WAC) for the Waste Isolation Pilot Plant (WIPP). Revision 4.0 of the WAC document consolidates and clarifies the existing criteria and requirements for the safe handling, preparation for transportation, and emplacement of TRU waste in the WIPP. The Remote Handled (RH) cask requirements have not yet been finalized, but are included only as guidance for generator and/or storage sites. Final requirements will be included in the WAC after the NRC approves the RH Cask Safety Analysis Report for Packaging (SARP).

Waste generator and/or storage sites need to certify their waste to the following four subsets, as discussed under each criterion/requirement in section 3.0 of the WAC and outlined in Table B-1:

- WIPP Operations and Safety Criteria
- Transportation: Waste Package Requirements
- RCRA Requirements
- Performance Assessment (PA) Criteria

The WIPP Operations and Safety Criteria were developed to ensure safe handling of wastes at the WIPP. Site certification plans and procedures incorporate process and administrative controls, and may include tests on individual waste packages to accomplish certification. WIPP authorities will review and approve certification and QA plans.

The Transportation: Waste Package Requirements are from the Certificate of Compliance (CC) issued by the NRC, which references the Transuranic Package Transporter-II (TRUPACT-II) SARP. WIPP authorities will not complete waste package requirements for RH-TRU wastes until the NRC approves the RH Cask SARP and issues a CC. The preliminary requirements derived from meetings with the NRC and the RH cask SARP are summarized below.

The RCRA regulations, as they apply to the WIPP, include Standards for the Owners/Operators of Treatment, Storage, or Disposal (TSD) facilities that are codified in 40 CFR Parts 264 and 265. These require the owner/operator to obtain a chemical and physical characterization of the waste, and ensure that the waste shipped to the facility is the waste specified on the shipping manifest. The generator must satisfy these RCRA requirements before making a shipment of waste to the WIPP.

The Performance Assessment Criteria are for the characterization of waste used in the WIPP experimental waste program. The RH TRU system has not been subjected to testing or any operational readiness review scrutiny to date. Therefore it is likely that the first shipments of RH-TRU to the WIPP will meet these criteria while latter shipments will not have to meet them.

Section 4.0 of the WAC define the TRU waste certification Quality Assurance Program (QAP). WIPP authorities modeled the QA requirements after American Society of Mechanical Engineers (ASME) Quality Assurance Program Requirements for Nuclear Facilities (ASME NQA-1), DOE

Order 5700.6C, and EPA's guidance document QAMS-005/80. Hanford shall assure that their QA plan will allow only certified waste to be shipped to the WIPP. The QA requirements pertaining to transportation shall be addressed in a site-specific Transuranic Package Transporter-II (TRUPACT-II) Authorized Methods for Payload Control (TRAMPAC) plan. The site-specific Quality Assurance Project Plan (QAPjP) shall address QA requirements pertaining to the RCRA and PA.

The DOE regulators of WIPP have the authority to grant or suspend the TRU waste generator and/or storage sites' authority to certify waste to the WAC. The steps required for a site to obtain waste certification capability include:

- The internally approved site certification and QA plans are submitted to the DOE/WPIO for approval.
- The Waste Acceptance Criteria Certification Committee (WACCC) reviews and evaluates the adequacy of the plans.
- After resolution of any comments or concerns the DOE/WPIO and the WACCC grant conditional approval.
- WIPP authorities conduct an initial certification audit.
- The results of all these actions are considered before granting formal approval of these plans and granting certification authority.
- WIPP authorities conduct periodic audits and surveillance to ensure continuing compliance with the certification QA plans.

The DOE Order 5820.2A, "Radioactive Waste Management," requires that waste generator and/or storage sites must comply with these criteria and requirements before shipping waste to the WIPP. The consolidated WIPP criteria and requirements are presented in Section 3.0 and summarized in section 3.1 of the WIPP WAC and the following table 3-1.

TABLE 3-1 SUMMARY OF WASTE ACCEPTANCE CRITERIA AND REQUIREMENTS, RH-TRU <sup>1</sup>				
WASTE CONTAINER REQUIREMENTS / CRITERIA				
WAC Criterion/ Requirement & Section	WIPP Operations and Safety Criteria	Transportation: Waste Package Requirements TRAMPAC/RH-Cask <sup>2</sup>	RCRA Requirements	Performance Assessment Criteria
Waste Containers 3.2.1	<i>Type A, Noncombustible</i>	<i>RH Canister</i>	No Additional Requirements	None
Waste Package Size 3.2.2	<i>RH Canister</i>	RH Canister	None	None

TABLE 3-1 (Cont.)  
SUMMARY OF WASTE ACCEPTANCE CRITERIA AND REQUIREMENTS, RH-TRU<sup>1</sup>

WASTE FORM REQUIREMENTS / CRITERIA (CONT.)				
WAC Criterion/ Requirement & Section	WIPP Operations and Safety Criteria	Transportation: Waste Package Requirements TRAMPAC/RH-Cask <sup>2</sup>	RCRA Requirements	Performance Assessment Criteria
Waste Package Handling 3.2.3	<i>Axial Pintle</i>	Axial Pintle	None	None
Immobilization 3.3.1	$\leq 1\%$ Below 10 Microns $\leq 15\%$ Below 200 Microns	None	No Additional Requirements	Same as WIPP Operations
Liquids 3.3.2	<i>Only Residual Liquids (see definitions in section 3.3.2.1)</i>	< 1 Volume Percent	No Additional Requirements	< 1 Volume Percent
Pyrophoric Materials 3.3.3	$\leq 1\%$ Radionuclides, No Non-Radionuclide Pyrophorics	<i>&lt; 1% Radionuclides, No Non-Radionuclide Pyrophorics</i>	<i>See Section 3.3.5.3</i>	Same as Transportation
Explosives and Compressed Gasses 3.3.4	Not Permitted. 49 CFR 173 Subpart C and G	<i>Explosives and Compressed Gases are not permitted</i>	<i>See Section 3.3.5.3</i>	No Additional Requirements
TRU Mixed Wastes 3.3.5	<i>Hazardous Waste must be reported</i>	<i>Corrosives are not permitted</i>	<i>WIPP RCRA Parts A &amp; B Permit Applications, WAP, NMD</i>	No Additional Requirements
Specific Activity of Waste 3.3.6	$> 100$ nCi/g TRU $\leq 23$ Ci/liter total	Same as WIPP Operations	None	Same as WIPP Operations
WASTE PACKAGE REQUIREMENTS / CRITERIA				
Waste Package Weight 3.4.1	$< 8,000$ lbs	RH-Cask TBD	None	None
Nuclear Criticality (Pu-239 FGE) 3.4.2	$\leq 600$ g	$< 325$ g/cask	None	Same as Transportation
Pu-239 Equivalent Activity 3.4.3	$\leq 1000$ PE-Ci/package	None	None	None
Surface Dose Rate 3.4.4	$95\% \leq 100$ rem/hr $5\% \leq 1000$ rem/hr	RH-Cask TBD and DOT Package Limits	None	None
Removable Surface Contamination 3.4.5	$\leq 50$ pCi/100 cm <sup>2</sup> alpha $\leq 450$ pCi/100 cm <sup>2</sup> beta- gamma	None	None	Same as WIPP Operations
Thermal Power 3.4.6	$\leq 300$ Watts/canister	RH-Cask TBD	None	None

TABLE 3-1(Cont.) SUMMARY OF WASTE ACCEPTANCE CRITERIA AND REQUIREMENTS, RH-TRU <sup>1</sup>				
WASTE PACKAGE REQUIREMENTS / CRITERIA (CONT.)				
WAC Criterion/ Requirement & Section	WIPP Operations and Safety Criteria	Transportation: Waste Package Requirements TRAMPAC/RH-Cask <sup>2</sup>	RCRA Requirements	Performance Assessment Criteria
Gas Generation 3.4.7	Vented	RH-Cask TBD	None	<i>SNL Test Plan</i>
Labeling 3.4.8	<i>ID Number, DOT</i>	RH-Cask TBD	TBD	None
DATA PACKAGE REQUIREMENTS / CRITERIA				
Data Package Certification 3.5.1	<i>Certification, WWIS Information, Data Format</i>	RH-Cask TBD	TBD	None

- 1 - Limiting parameters are shown in *bold italics*.  
2 - RH Cask limits have not been finalized.

## 2. RH-TRU Canister and Transportation Cask

All RH-TRU will be sent to WIPP in a RH-TRU canister overpacked in a transportation cask. The RH-TRU canister is a right cylinder with a maximum outside-diameter of 26 inches, maximum length of 121 inches and has a pintle for axial lifting. RH-TRU waste containers shall be noncombustible and meet, as a minimum, the structural requirements and design conditions for Type A packaging as contained in 49 CFR 173.412. In addition, all RH-TRU waste containers shall be certified to the WIPP approved specifications and shall be used, handled and stored in a manner that is expected to maintain their Type A packaging specification from the time of certification to emplacement in the WIPP.

Rockwell drawing H-2-91273A RH-T shows a RH-TRU canister design currently under development, see Figures 3-5,6 & 7. It can be either packed directly or used as an overpack. When used as an overpack it can hold three 55 gallon drums. The maximum loaded weight is 8,000 lbs and the approximate internal volume is 25 ft<sup>3</sup> (0.7 m<sup>3</sup>).

The overpack used for contaminated RH TRU waste canister shall have an outside diameter of 28 inches, a maximum length of 133 inches, a maximum design weight of 10,000 pounds, and shall be provided with a pintle for axial lifting.

### 3. RH-TRU PROCESSING AT THE WIPP

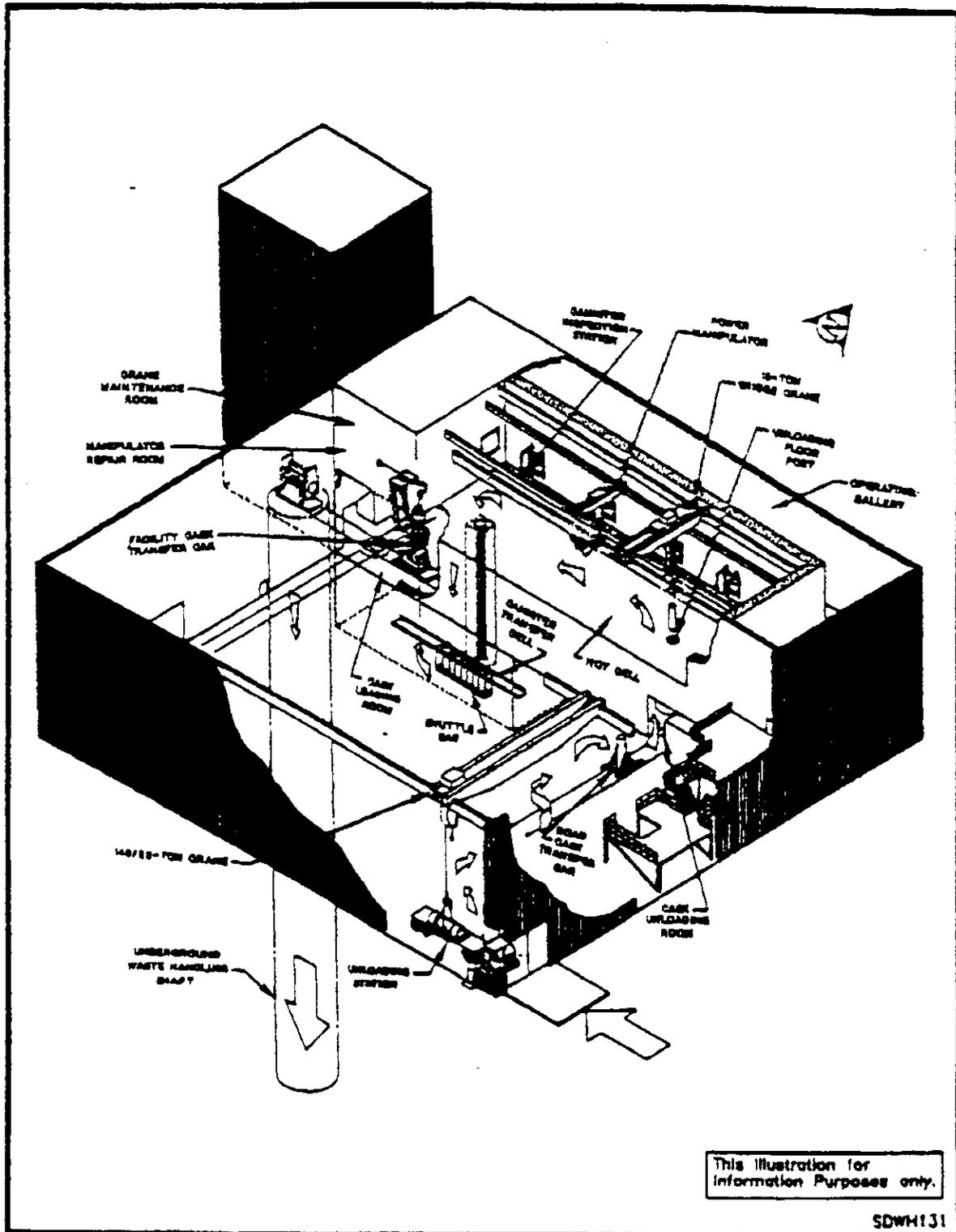
Canisters will be received by the RH-TRU processing side of the WIPP. They will be loaded onto a road cask transfer car, processed through the hot cell and inspected. Next they will be loaded into a facility cask, onto a facility cask car and sent to the underground waste handling shaft. For all of the above ground operations see Figure 3-1.

Once the canister/facility cask reaches the underground repository room, it will be transported by a forklift to a waste transfer machine, see Figure 3-2 and Figure 3-3. The waste transfer machine has an emplacement mechanism which pushes the RH-TRU canister out of the facility cask and into the horizontal, sleeved bore hole in a sidewall of the underground repository room, see figure 3-3. The waste transfer machine then follows the canister with a shield plug. To hold everything in place a stop bar is installed. The stop bar is held in place by two long rock bolts with nuts, see Figure 3-4.

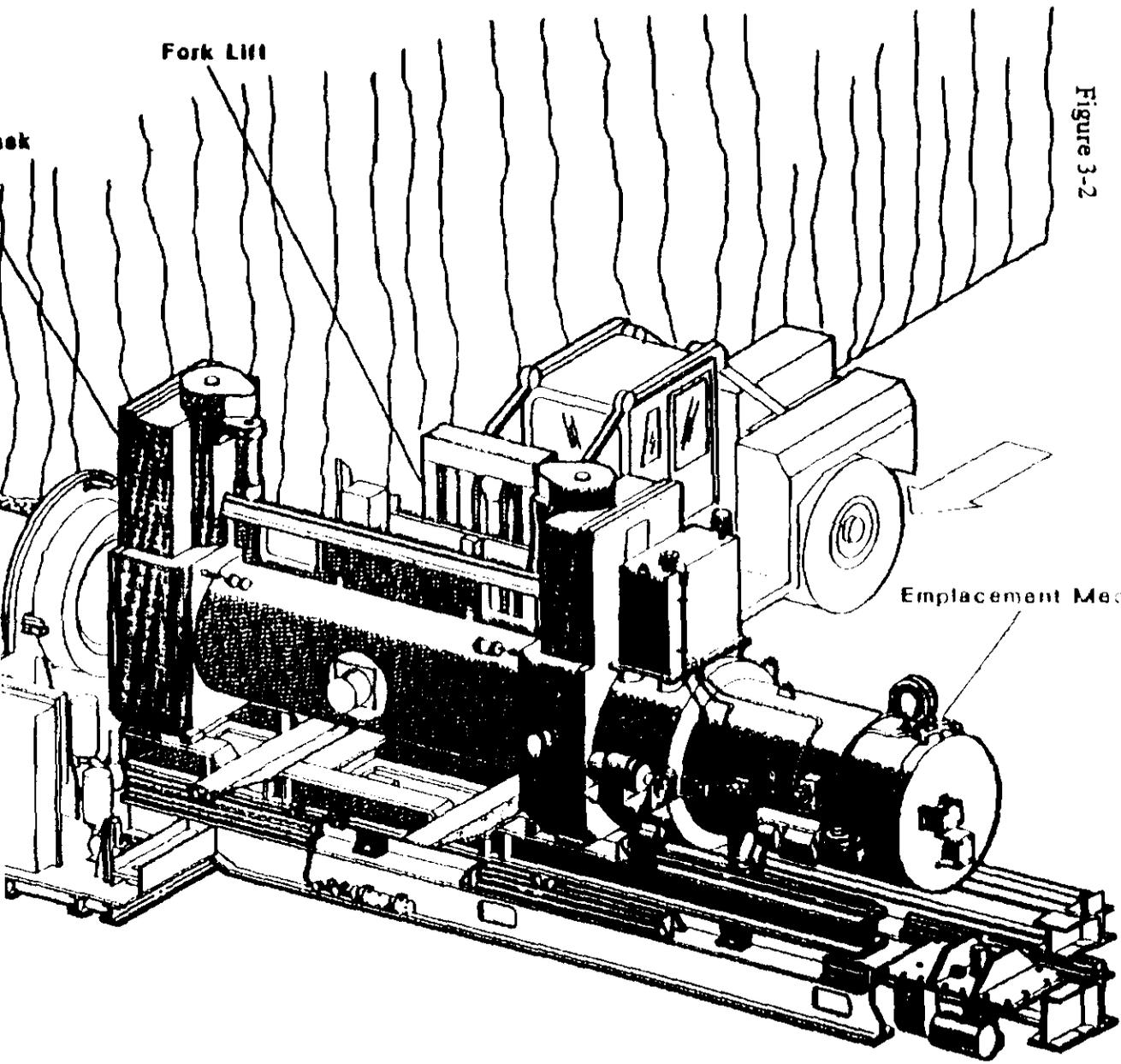
Figure 3-1

SDD WHCO REV. 2

SEPTEMBER 1994



RH TRU Waste Handling Process



Fork Lift

Figure 3-2

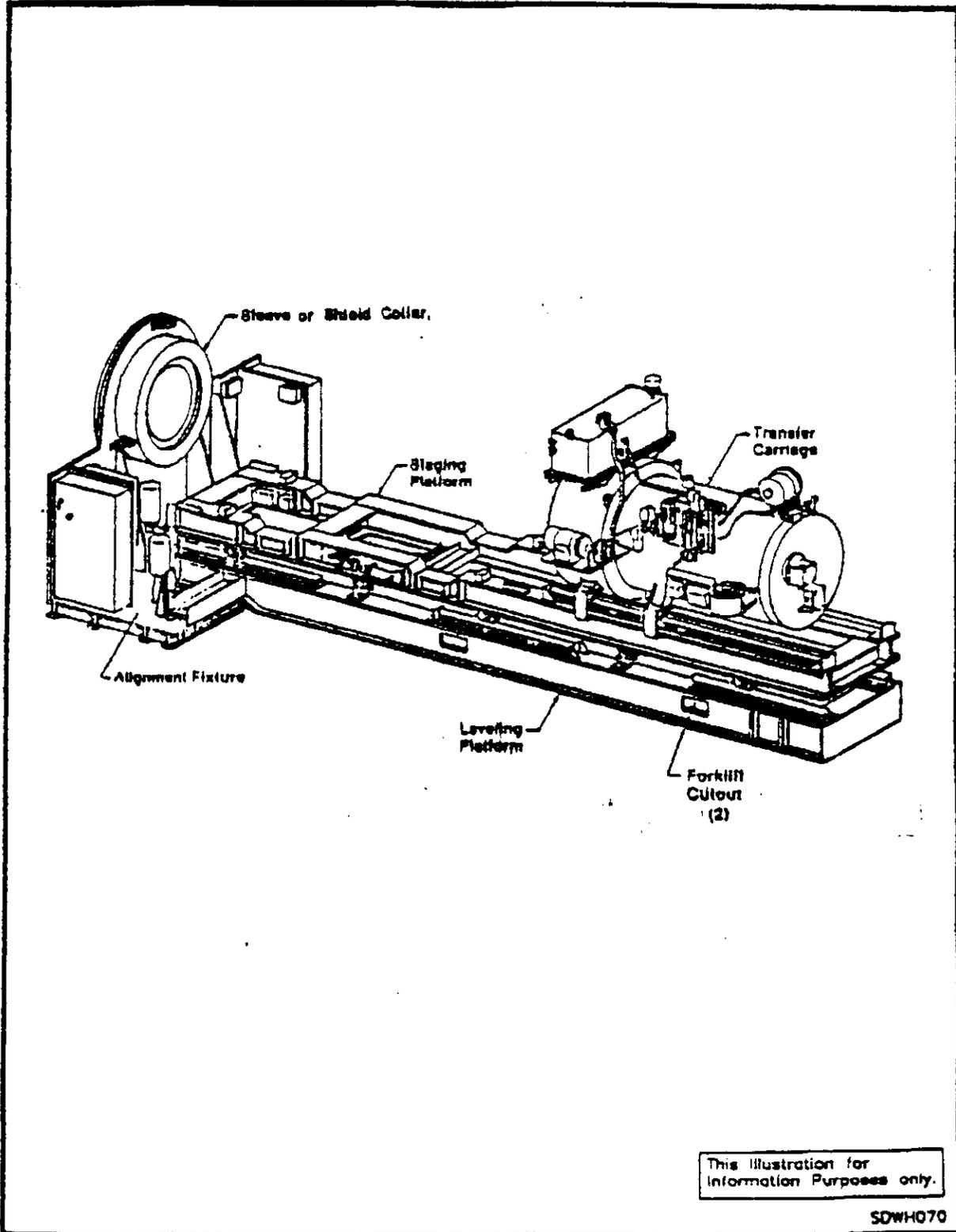
Emplacement Mechanism

987 5002 11B6  
AHC-SD-AM-19-0-0-11, REV. 3

Figure 3-3

SDD WHOO REV. 2

SEPTEMBER 1994



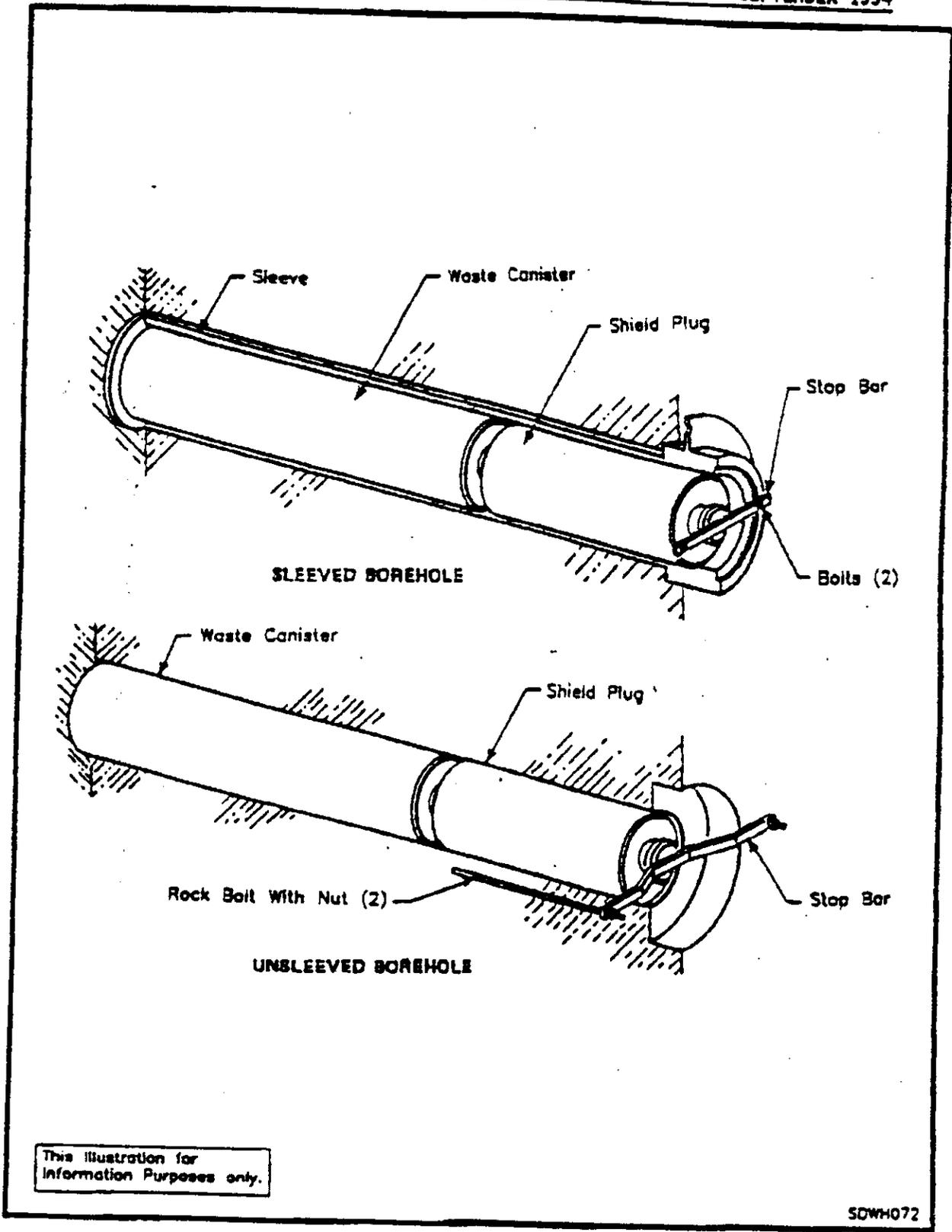
Waste Transfer Machine

15-000000

Figure 3-4

SDD WH00 REV. 2

SEPTEMBER 1994



This illustration for information purposes only.

SOWH072

Sleeve, Waste Canister and Shield Plug Installation

**EXHIBIT 6.6.1-4**  
**STORAGE REQUIREMENTS FOR RH AND CH TRU**  
**LLMW AND GTC 3 AND HLW CONTAINERS**

CATEGORY	A		E	
	M3	PERCENT	M3	PERCENT
<b>HIGH LEVEL WASTE</b>				
CANISTERS	8,569	2.94%	8,569	3.18%
<b>TRU WASTE</b>				
FORECAST REMOTE HANDLED	40,662	51%	41,316	56%
EXISTING REMOTE HANDLED	8,072	10%	380	1%
REMOTE HANDLED TRU				
REMOTE HANDLED TRUM				
REMOTE HANDLED TRU SUSPECT				
FORECAST CH -LARGE CONTAINERS	21,832	27%	21,832	30%
EXISTING CH -LARGE CONTAINERS	7,299	9%	7,299	10%
CONTACT HANDLED TRU				
CONTACT HANDLED TRUM				
CONTACT HANDLED TRU SUSPECT				
PRE-70 BURIED DELETED 109,000 M3	-	0%	-	0%
CONTAMINATED SOIL DELETED 32,000 M3		0%		0%
EXISTING CH -SPECIAL CASE	491	1%	491	1%
FORECAST CH -SPECIAL CASE	1,892	2%	1,893	3%
OVERPACKS (2 TIMES RH TRU/TRUM WASTE)				
SUB TOTAL	80,248	27.58%	73,211	27.14%
<b>LOW LEVEL MIXED</b>				
FORECAST REMOTE HANDLED RH	96,302	87%	96,480	98%
EXISTING REMOTE HANDLED RH	8,227	7%	277	0%
FORECAST CH -LARGE CONTAINERS	838	1%	980	1%
EXISTING CH -LARGE CONTAINERS	5,825	5%	650	1%
SUB TOTAL	111,192	38.21%	98,387	36.47%
<b>GT CATEGORY 3 LLMW</b>				
FORECAST REMOTE HANDLED RH - LLW	41,035	46%	41,035	46%
FORECAST REMOTE HANDLED RH - LLMW	1,554	2%	1,554	2%
FORECAST CH - LLW	42,327	47%	42,327	47%
FORECAST CH - LLMW	4,376	5%	4,376	5%
SUB TOTAL	89,292	30.68%	89,292	33.10%
<b>MISC. MATERIALS</b>				
CONTAMINATED METALLIC SODIUM	1,159	85%	177	53%
UNIRRADIATED URANIUM	144	11%	144	43%
MISC. SOURCES	60	4%	15	1%
SUB TOTAL	1,363	0.47%	336	0.12%
<b>Cs/Sr CAPSULES</b>				
CESIUM CAPSULES	2.4	69%	2.4	69%
STRONTIUM CAPSULES	1.1	31%	1.1	31%
SUB TOTAL	3.5	0.00%	3.5	0.00%
<b>TOTAL</b>	<b>291,006</b>	<b>100%</b>	<b>269,799</b>	<b>100%</b>

SOURCE

A = M-33 TPA MILESTONE FEBRUARY 23, 1995

E = M-33 TPA MILESTONE APRIL 21, 1995

PROCESS LOGIC RH AND CH LLMW AND TRU

THIS SECTION PROVIDES THE LOGIC FOR WASTE VOLUME REDUCTION FOR BOTH CH AND RH LLMW AND TRU

WASTE VOLUME PROJECTIONS TRU WASTE

RH	41.696	CUBIC METERS	
CH	29,131	CUBIC METERS	
SPECIAL CASE CH	2,383	CUBIC METERS	NOTE 1
	<u>73,210</u>	CUBIC METERS	

NUMBER OF TRU CONTAINERS	2.587	
WITH AN AVERAGE PACKAGE SIZE OF	<u>28.3</u>	CUBIC METERS

PACKAGE VOLUME	5.7	CUBIC METERS	EXTERIOR MINUS INTERIOR VOLUME
EQUIP ENVELOPE	8.5	CUBIC METERS	NOTE 2
HARD EQUIPMENT	4.3	CUBIC METERS	
VOID VOLUME	14.2	CUBIC METERS	

PACKAGE VOLUME IS SIZE REDUCED TO FIT IN TO STANDARD PLYWOOD BOXES  
NO NET VOLUME REDUCTION IS CONSIDERED WITH THE REPACKAGED CONTAINER WASTE  
RH WASTE IS SIZE REDUCED AND PACKAGED IN 200 L DRUMS OR A WIPP CANISTER

CH WASTE IS SIZE REDUCED AND REPACKAGED IN 200 L DRUMS FOR SHIPMENT TO WRAP 1  
SEGMENTS PLACED IN DRUMS IS MORE EFFICIENT THAN WHEN PLACED IN A WIPP CANISTER

ESTIMATED VOLUME OF SIZE REDUCED RH THU	14,594	CUBIC METERS	NOTE 3
ESTIMATED VOLUME OF RH IN CANISTERS	17,169	CUBIC METERS	
AT PERCENT FULL	85%		

ESTIMATED VOLUME OF RH CANISTERS	0.48	30,640	CUBIC METERS
BASED ON NET RATIO OF INT VOL TO EXT VOL			

ESTIMATED VOLUME OF SIZE REDUCED CH THU	9,454	CUBIC METERS
ESTIMATED VOLUME OF CH IN 200 L DRUMS	11,123	CUBIC METERS
AT PERCENT FULL	85%	

ESTIMATED VOLUME OF CH 200 L DRUMS	0.56	16,860	CUBIC METERS
BASED ON NET RATIO OF INT VOL TO EXT VOL			

NOTES TRU WASTE

1. SPECIAL CASE CH TRU INCLUDED WITH CH TRU VOLUME
2. EQUIPMENT ENVELOPE VOLUME IS 50% VOID SPACE
3. VALUES ARE CONSISTENT EXCEPT FOR ROUNDING

WASTE VOLUME PROJECTIONS LLMW

RH	96.760	CUBIC METERS
CH	1,630	CUBIC METERS
TOTAL	<u>98,390</u>	CUBIC METERS



**MATERIAL BALANCE BASED ON REVISED INVENTORY**

**REMOTE HANDLE TRU SMALL AND LARGE CONTAINERS**                      DWG NO      950020

		1,940 M3 ANNUAL VOLUME	
STREAM	NUMBER		
FEED	1	1,940	ALL VALUES IN M3
AFTER ND ASSAY	15	1,940	
CONTAINER	17	1,940	
WASTE	16	1,164	
CONT. VOL. REDUCTION	12	388	
CONT. REPACK	13	456	
WASTE AFTER ND	18	1,164	
SORT WASTE			
RESTRICTED	19	58	5% OF STREAM (18)
SORTED REJECT	20	1,106	
SIZE REDUCTION			
	21	524	55% VOLUME REDUCTION
STABILIZED WASTE	22	728	IN WIPP CONTAINER      15,341

**CONTACT HANDLE TRU IN LARGE CONTAINERS**                      DWG NO      950018

		1,466 M3 ANNUAL VOLUME	
STREAM	NUMBER		
FEED	1	1,466	ALL VALUES IN M3
AFTER ND ASSAY	8	1,466	
CONTAINER	9	1,466	
WASTE	12	880	
CONT. VOL. REDUCTION	10	293	
CONT. REPACK	11	345	
SORT WASTE			
RESTRICTED	14	40	5% OF STREAM (12)
SORTED REJECT	13	800	MINOR LOSS OF VOLUME
SIZE REDUCTION			
	15	400	50% VOLUME REDUCTION
WASTE TO DRUMS	16	440	
DRUMMED WASTE	22	517	IN 200 L DRUMS      11,124

**CONTACT HANDLE LLMW IN LARGE CONTAINERS**                      DWG NO      950017

		76 M3 ANNUAL VOLUME	
STREAM	NUMBER		
FEED	1	76	ALL VALUES IN M3
FEED	3	76	
CONTAINER	4	76	

REVMATBL

**MATERIAL BALANCE BASED ON REVISED INVENTORY**

WASTE	9	53	
CONT. VOL. REDUCTION	6	15	
CONT. REPACK	7	18	
SIZE REDUCTION			
	10	21	
SORT			
DEBRIS	14	11 50% OF STREAM (10)	
PARTICULATE	11	11 50% OF STREAM (10)	
WASTE TO DRUMS	(11 & 14)	21	
DRUMMED WASTE	15	25 IN 200 L DRUMS	538

**REMOTE HANDLE LLMW AND LLCE**

DWG NO 950019

4.500 M3 ANNUAL VOLUME

STREAM	NUMBER		
FEED	1	4.500	ALL VALUES IN M3
FEED	2	4.500	
CONTAINER	4	4.500	
WASTE	10	2.700	
CONT. VOL. REDUCTION	8	900	
CONT. REPACK	9	1.059	
SORT			
REDUCTION BYPASS	11	54	2.% OF WASTE (10)
TO SIZE REDUCT	12	2,117	80% OF WASTE LESS (11)
SIZE REDUCTION			
SIZE REDUCED	13	1,058	50% REDUCTION
COMBINED WASTE			
TO STABILIZATION	14	1,112	
PACKAGED WASTE	17	1,309	IN HIC's 28,137

Storage Requirements, RH TRU			FEED	PRODUCT			
YEAR	RH TRU	RH SUSPECT	RH TRUM	STORAGE REQMTS	PROCESS RATE	STORAGE WIPP	NET STORAGE
1994	1,464.2		753.8	2,218			2,218
1995	103.4		90.5	2,412			2,412
1996	38.5		90.5	2,541			2,541
1997	1.7		133.8	2,676			2,676
1998	26.9		115.7	2,819			2,819
1999	24.8		124.7	2,969			2,969
2000	24.8		133.8	3,127		-	3,127
2001	1.7		144.8	2,789	485	355	3,145
2002	1.7		167.4	1,988	970	1,069	3,057
2003	1.7		171.9	707	1,455	2,138	2,845
2004	1.7		4,067.4	2,837	1,939	3,563	6,400
2005	1.7		7,736.5	8,636	1,939	4,988	13,624
2006	1.7		7,704.9	14,403	1,939	6,413	20,816
2007	1.7		366.6	12,832	1,939	7,838	20,670
2008	1.7		324.7	11,219	1,939	9,263	20,482
2009	1.7		346.2	9,628	1,939	10,688	20,316
2010	48.6		444.2	8,181	1,939	12,113	20,294
2011	51.2		527.6	6,820	1,939	13,539	20,359
2012	51.0		634.2	5,566	1,939	14,964	20,530
2013	518.6		1,004.5	5,150	1,939	16,389	21,539
2014	520.8		1,064.5	4,796	1,939	17,814	22,610
2015	640.7		1,259.2	4,756	1,939	19,239	23,996
2016	643.3		1,281.6	4,742	1,939	20,664	25,406
2017	640.7		1,304.4	4,748	1,939	22,089	26,837
2018	791.4		673.1	4,273	1,939	23,514	27,787
2019	833.8		643.6	3,811	1,939	24,940	28,750
2020	586.4		605.3	3,063	1,939	26,365	29,428
2021	520.8		641.5	2,286	1,939	27,790	30,076
2022	518.4		675.3	1,540	1,939	29,215	30,755
2023	51.0		347.9		1,939	30,640	30,640
	8,116	-	33,580				
			41,696				

AFTER YEAR 2001 IT INDICATES YEARLY GENERATION RATE

ANNUAL AVERAGE PROCESSING RATE

1,939 M3

REPACKAGED WASTE IS IN WIPP CANISTERS

30,640 M3

RH SIZE REDUCTION FACTOR

26.5%

73.5%

9513352.1296

Storage Requirements, CH TRU

YEAR	Large Cont. CH TRU	Large Cont. CH TRUM	Special CH TRU	Special CH TRUM	STORAGE	PROCESS RATE	PRODUCT STORAGE	NET STORAGE
1994	7,476	-	493	1	7,970			7,970
1995	71	-	68	0	8,109			8,109
1996	63	-	48	1	8,220			8,220
1997	-	-	13	0	8,233			8,233
1998	-	-	13	0	8,246			8,246
1999	-	-	37	0	8,283			8,283
2000	-	-	216	4	8,503			8,503
2001	-	-	7	0	8,144	366	196	8,340
2002	-	-	44	0	7,455	733	588	8,043
2003	-	-	56	0	6,412	1,099	1,176	7,588
2004	-	-	38	1	4,985	1,466	1,960	6,946
2005	-	-	36	2	3,558	1,466	2,745	6,302
2006	-	-	36	9	2,137	1,466	3,529	5,666
2007	-	-	36	9	716	1,466	4,313	5,029
2008	-	-	42	9	29	738	4,708	4,737
2009	-	-	42	9	32	48	4,733	4,765
2010	-	-	34	2	31	37	4,753	4,784
2011	-	-	34	2	29	38	4,773	4,803
2012	-	-	28	2	28	31	4,790	4,818
2013	864	1,277	113	2	233	2,051	5,387	6,120
2014	864	1,277	110	0	433	2,051	6,984	7,417
2015	876	1,277	110	0	645	2,051	8,081	8,726
2016	876	1,277	104	0	851	2,051	9,178	10,029
2017	878	1,277	104	0	1,059	2,051	10,275	11,335
2018	876	1,277	98	0	1,259	2,051	11,373	12,631
2019	876	1,277	98	0	1,458	2,051	12,470	13,928
2020	876	1,277	91	0	1,652	2,051	13,567	15,219
2021	876	1,277	91	0	1,846	2,051	14,664	16,510
2022	876	1,277	91	0	2,039	2,051	15,761	17,800
2023	14	-	0	0	(0)	2,054	16,860	16,860
	16,359	12,772	2,328	55		31,514		
					SIZE REDUCED VOLUME		16,860	
					31,514	1,466	1,466	53.5%

RH and CH TRUSTORAGE REQUIREMENTS

Storage Requirements, RH TRU and CH TRU

YEAR	RH TRU	RH SUSPECT	RH TRUM	RH STORAGE	Large Cont CH TRU	Large Cont. CH TRUM	Special CH TRU	Special CH TRUM	CH STORAGE	TOTAL STORAGE	TREATMENT PROCESSE RATE	STORAGE	NET STORAGE
1994	1,048		448	1,496	7,476	-	493	1	7,970	9,466			9,466
1995	103		124	227	71	-	68	0	139	9,832			9,832
1996	39		124	163	63	-	48	1	111	10,106			10,106
1997	2		168	170	-	-	13	0	13	10,289			10,289
1998	27		150	177	-	-	13	0	13	10,479			10,479
1999	25		159	184	-	-	37	0	37	10,700			10,700
2000	25	538	168	731	-	-	216	4	220	11,651			11,651
2001	2	538	179	719	-	-	7	0	7	11,526	851	552	12,078
2002	2	538	201	741	-	-	44	0	44	10,608	1,703	1,657	12,265
2003	2	538	206	746	-	-	56	0	56	8,857	2,554	3,314	12,171
2004	2	538	4,067	4,607	-	-	38	1	39	10,098	3,405	5,523	15,621
2005	2	538	7,738	8,278	-	-	36	2	38	15,009	3,405	7,733	22,742
2006	2	538	7,705	8,245	-	-	36	9	45	19,894	3,405	9,942	29,836
2007	2	538	367	907	-	-	36	9	45	17,440	3,405	12,151	29,592
2008	2	538	325	865	-	-	42	9	51	14,951	3,405	14,360	29,312
2009	2	538	346	886	-	-	42	9	51	12,483	3,405	16,570	29,053
2010	2	538	444	984	-	-	34	2	36	10,098	3,405	18,779	28,877
2011	49	538	528	1,115	-	-	34	2	36	7,844	3,405	20,988	28,832
2012	51	538	634	1,223	-	-	28	2	30	5,691	3,405	23,198	28,889
2013	51	538	1,005	1,594	864	1,277	113	2	2,256	6,136	3,405	25,407	31,543
2014	519	538	1,064	2,121	864	1,277	110	0	2,251	7,103	3,405	27,616	34,719
2015	521		1,259	1,780	876	1,277	110	0	2,263	7,740	3,405	29,826	37,566
2016	641		1,282	1,923	876	1,277	104	0	2,257	8,514	3,405	32,035	40,549
2017	641		1,173	1,814	878	1,277	104	0	2,259	9,182	3,405	34,244	43,426
2018	-		-	-	876	1,277	98	0	2,250	8,028	3,405	36,453	44,481
2019	-		-	-	876	1,277	98	0	2,250	6,873	3,405	38,663	45,536
2020	-		-	-	876	1,277	91	0	2,244	5,712	3,405	40,872	46,584
2021	-		-	-	876	1,277	91	0	2,244	4,551	3,405	43,081	47,633
2022	-		-	-	876	1,277	91	0	2,244	3,390	3,405	45,291	48,681
2023	-		-	-	14	-	0	0	15	0	3,405	47,500	47,500
	3,762	8,070	29,864		16,359	12,772	2,328	55			73,210		
			41,696					31,514			3,405		
								73,210	3,405				
								RH TRU REDUCTION		26.5% WEIGHTED SR FACTOR			64.9%
								CH TRU REDUCTION		46.5%			

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Storage Requirements, RH LLMW

YEAR	RH LLMW STORAGE		TREATMENT PROCESSED		NET
			RATE	STORAGE	STORAGE
1994	5,108.2	5,108			5,108
1995	917.1	6,025			6,025
1996	904.6	6,930			6,930
1997	1,382.6	8,313			8,313
1998	1,056.6	9,369			9,369
1999	1,119.3	10,488			10,488
2000	1,144.0	11,632			11,632
2001	1,363.5	11,871	1,125	450	12,321
2002	1,567.0	11,188	2,250	1,350	12,537
2003	1,607.7	9,420	3,375	2,699	12,119
2004	2,797.0	7,716	4,500	4,499	12,215
2005	2,631.0	5,847	4,500	6,298	12,145
2006	2,459.2	3,806	4,500	8,098	11,903
2007	2,703.4	2,009	4,500	9,897	11,906
2008	2,637.2	145	4,500	11,697	11,342
2009	3,029.1	(1,326)	4,500	13,496	12,170
2010	3,555.0	(2,271)	4,500	15,296	13,024
2011	4,268.2	(2,504)	4,500	17,095	14,592
2012	5,232.2	(1,772)	4,500	18,895	17,123
2013	5,707.2	(565)	4,500	20,694	20,129
2014	6,559.7	1,494	4,500	22,494	23,988
2015	7,167.2	4,161	4,500	24,293	28,454
2016	7,430.3	7,091	4,500	26,093	33,183
2017	7,574.3	10,165	4,500	27,892	38,057
2018	2,979.9	8,644	4,500	29,692	38,336
2019	2,904.6	7,048	4,500	31,491	38,539
2020	2,419.1	4,967	4,500	33,291	38,257
2021	2,688.9	3,155	4,500	35,090	38,245
2022	3,018.2	1,673	4,500	36,890	38,553
2023	2,827.4	0	4,500	38,689	38,689
	96,760		96,760		
			4,500	M3 PER ANNUM	
VOLUME REDUCTION FACTOR			40.0%		60.0%

Storage Requirements, CH LLMW

YEAR	CH LLMW	TREATMENT PROCESSED		NET STORAGE
		STORAGE	RATE	
1994	725	725		725
1995	22	747		747
1996	22	769		769
1997	22	791		791
1998	22	813		813
1999	22	835		835
2000	22	857		857
2001	22	860	19	370
2002	22	844	38	374
2003	22	809	57	869
2004	22	755	76	356
2005	22	701	76	842
2006	48	672	76	855
2007	22	619	76	841
2008	22	565	76	828
2009	22	511	76	814
2010	48	482	76	826
2011	22	428	76	813
2012	22	374	76	799
2013	22	321	76	786
2014	48	292	76	798
2015	22	238	76	785
2016	22	184	76	771
2017	22	130	76	758
2018	119	173	76	841
2019	93	190	76	898
2020	22	136	76	885
2021	22	82	76	871
2022	48	54	76	883
2023	22		76	870
1,630		-	1,630	
		1,630	76	M3 PER ANNUM
VOLUME REDUCTION FACTOR			46.6%	53.4%

Storage Requirements, GTC III

YEAR	CH LLMW Generation Rate	RH LLMW Generation Rate	CH LLMW Generation Rate	RH LLMW Generation Rate	CH LLMW NET STORAGE	RH LLMW NET STORAGE	CH LLMW NET STORAGE	RH LLMW NET STORAGE
1994	50	14	-	24	50	14	-	24
1995	2	-	-	0	52	14	-	25
1996	2	-	-	0	55	14	-	25
1997	33	-	-	0	88	14	-	25
1998	33	-	-	0	120	14	-	26
1999	94	-	-	0	215	14	-	26
2000	48	-	-	0	263	14	-	26
2001	46	28	283	284	309	43	283	310
2002	138	28	850	850	446	71	1,133	1,160
2003	168	28	1,416	1,417	615	99	2,550	2,577
2004	179	85	2,550	2,550	794	184	5,099	5,127
2005	149	85	3,399	3,400	942	269	8,499	8,526
2006	205	142	5,382	5,383	1,147	411	13,881	13,909
2007	205	142	7,365	7,366	1,352	552	21,246	21,275
2008	220	142	7,082	7,083	1,573	694	28,329	28,357
2009	220	142	6,516	6,516	1,793	836	34,844	34,873
2010	136	57	2,266	2,267	1,929	892	37,111	37,140
2011	107	28	1,416	1,417	2,036	921	38,527	38,556
2012	78	14	708	709	2,114	935	39,235	39,265
2013	252	65	947	814	2,365	999	40,182	40,079
2014	249	62	238	106	2,614	1,061	40,420	40,185
2015	249	62	238	106	2,862	1,123	40,659	40,292
2016	233	62	238	106	3,096	1,184	40,897	40,398
2017	233	62	238	106	3,329	1,246	41,135	40,504
2018	218	62	238	106	3,547	1,308	41,374	40,610
2019	218	62	238	106	3,765	1,369	41,612	40,716
2020	203	62	238	106	3,968	1,431	41,851	40,823
2021	203	62	238	106	4,171	1,493	42,089	40,929
2022	203	62	238	106	4,374	1,555	42,327	41,035
2023	2	-	-	0	4,376	1,555	42,327	41,035
	4,376	1,555	42,327	41,035	4,500	1,600	43,000	41,500

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**WIPP CANISTER**

REMOTE HANDLED TRU WASTE IN WIPP CANISTERS

<b>WIPP CANISTER</b>	<b>ESTIMATED</b>	<b>200 LITER DRUM</b>	
INSIDE DIAMETER	24 INCHES	INSIDE DIAMETER	22 INCHES
INSIDE HEIGHT	102 INCHES	INSIDE LENGTH	34 INCHES
VOLUME	26.70 CUBIC FEET 0.756 CUBIC METERS	VOLUME	7.48 CUBIC FEET 0.212 CUBIC METERS
		THREE DRUMS	
VOLUME OF CANISTER			22.44 CUBIC FEET
OUTSIDE DIAMETER	26 INCHES		0.635 CUBIC METERS
OUTSIDE HEIGHT	121 INCHES		
VOLUME	37.18 CUBIC FEET 1.053 CUBIC METERS		

ASSUME STORAGE VOLUME IS 26 INCHES BY 26 INCHES BY 122 INCHES

STORAGE VOLUME	1.35 CUBIC METERS
STORAGE AREA	0.437 SQUARE METERS
PACKING EFFICIENCY	

	85%	85%
NET VOLUME	0.643 CUBIC METERS	0.540 CUBIC METERS

INCREASE IN VOLUME USING WIPP CANISTERS 19%

OVERALL HEIGHT INCLUDES THE PINTLE

ANNUAL VOLUME OF RH TRU WASTE	679 CUBIC METERS
AT 85% PACKING EFFICIENCY	1.056 CONTAINERS PER ANNUM

ANNUAL VOLUME OF CANISTER BASED ON OPTIMUM STORAGE REQUIREMENTS

ANNUAL NUMBER OF CANISTERS	1,056
MINIMUM STORAGE VOLUME PER CANISTERS	1.35 CUBIC METERS
TOTAL ANNUAL STORAGE VOLUME	1,428 CUBIC METERS
OPERATING YEARS	21.5
TOTAL STORAGE VOLUME	30,696 CUBIC METERS
ANNUAL STORAGE AREA	461.2 SQUARE METERS
TOTAL STORAGE AREA	9,915 SQUARE METERS

WEIGHT LIMIT OF A SINGLE DRUM MAY BE AS HIGH AS 380 KG	838 POUNDS
WEIGHT LIMIT OF A WIPP CANISTER MAY BE AS HIGH AS 3,600 KG	7,934 POUNDS

WIPP CANISTER WEIGHT IS ASSUMED TO BE GROSS WEIGHT  
ESTIMATED WEIGHT OF CANISTER HAS NOT BEEN ASSUMED

**RH LLMW CONTAINERS**

**HIGH INTEGRITY CONTAINER (HIC)**

LENGTH	9 FEET
WIDTH	5 FEET
HEIGHT	5 FEET
VOLUME	225.00 CUBIC FEET
	6.372 CUBIC METERS

VOLUME OF CONTAINER

OUTSIDE LENGTH	9.69 FEET
OUTSIDE WIDTH	5.67 FEET
OUTSIDE HEIGHT	5.57 FEET
VOLUME	305.71 CUBIC FEET
	8.658 CUBIC METERS

INTERIOR/EXTERIOR RATIO 0.74

MINIMUM FLOOR SPACE PER HIC  
2.93 SQUARE METERS

PACKING EFFICIENCY	85%
NET VOLUME	5.42 CUBIC METERS

ANNUAL VOLUME

RH LLMW SIZE - REDUCED	1,125 CUBIC METERS
NUMBER OF CONTAINERS	208
TOTAL CONTAINERIZED VOLUME	208 CUBIC METERS

DRUM VOLUME INCLUDES PACKING EFFICIENCY  
DRUMS CONTENTS TO BE REPACKAGED IN A HIC AT NO CHANGE IN VOLUME

REQUIRED HIC'S	208 CONTAINERS PER ANNUM
EXTERIOR VOLUME OF A HIC	8.66 CUBIC METERS
ANNUAL VOLUME REQUIRED	1,798 CUBIC METERS

TOTAL VOLUME OF CONTAINER BASED ON OPTIMUM STORAGE REQUIREMENTS

ANNUAL NUMBER OF CONTAINERS	208
MINIMUM STORAGE VOLUME PER CONTAINER	8.66 CUBIC METERS
TOTAL ANNUAL STORAGE VOLUME	1,798 CUBIC METERS
OPERATING YEARS	21.5
TOTAL NUMBER OF CONTAINERS	4,466
TOTAL STORAGE VOLUME	38.664 CUBIC METERS

CH TRU IN DRUMS

CH TRU WASTE IN LARGE CONTAINERS WILL BE SIZE REDUCED AND REPACKAGED IN DRUMS

**DRUM SIZE (STANDARD)**

DIAMETER	1.83 FEET
HEIGHT	2.83 FEET
VOLUME	7.48 CUBIC FEET
	0.212 CUBIC METERS

ASSUME SQUARE FLOOR AREA AT 2 FEET BY 2 FEET

OUTSIDE LENGTH	2.00 FEET
OUTSIDE WIDTH	2.00 FEET
OUTSIDE HEIGHT	2.83 FEET
STORAGE VOLUME	11.32 CUBIC FEET
	0.321 CUBIC METERS

INTERIOR/EXTERIOR RATIO 0.56

PACKING EFFICIENCY	85%
NET VOLUME	0.18 CUBIC METERS

ANNUAL VOLUME

CH TRU SIZE - REDUCED	440 CUBIC METERS	IN DRUMS
NUMBER OF DRUMS	2,444	
TOTAL STORAGE VOLUME	783 CUBIC METERS	
FLOOR SPACE REQUIRED	909 SQUARE METERS	
DOES NOT CONSIDER STACKING		

TOTAL VOLUME OF CONTAINER BASED ON OPTIMUM STORAGE REQUIREMENTS

ANNUAL NUMBER OF DRUMS	2,444
MINIMUM STORAGE VOLUME PER DRUM	0.32 CUBIC METERS
TOTAL ANNUAL STORAGE VOLUME	783 CUBIC METERS
OPERATING YEARS	21.5
TOTAL NUMBER OF DRUMS	52,541
TOTAL STORAGE VOLUME	16,844 CUBIC METERS
TOTAL STORAGE AREA	19,545 SQUARE METERS

CH LLMW IN DRUMS

CH LLMW IN LARGE CONTAINERS WILL BE SIZE REDUCED AND REPACKAGED IN DRUMS

DRUM SIZE (STANDARD)

DIAMETER	1.83 FEET
HEIGHT	2.83 FEET
VOLUME	<u>7.48 CUBIC FEET</u>
	0.212 CUBIC METERS

ASSUME SQUARE FLOOR AREA AT 2 FEET BY 2 FEET

OUTSIDE LENGTH	2.00 FEET
OUTSIDE WIDTH	2.00 FEET
OUTSIDE HEIGHT	2.83 FEET
VOLUME	<u>11.33 CUBIC FEET</u>
	0.321 CUBIC METERS

INTERIOR/EXTERIOR RATIO 0.66

PACKING EFFICIENCY	85%
NET VOLUME	0.18 CUBIC METERS

ANNUAL VOLUME		
CH LLMW SIZE - REDUCED	23 CUBIC METERS	IN DRUMS
NUMBER OF DRUMS	126	
TOTAL STORAGE VOLUME	40 CUBIC METERS	
FLOOR SPACE REQUIRED	47 SQUARE METERS	
DOES NOT CONSIDER STACKING		

TOTAL VOLUME OF CONTAINER BASED ON OPTIMUM STORAGE REQUIREMENTS

ANNUAL NUMBER OF DRUMS	126
MINIMUM STORAGE VOLUME PER DRUM	0.32 CUBIC METERS
TOTAL ANNUAL STORAGE VOLUME	40 CUBIC METERS
OPERATING YEARS	21.5
TOTAL NUMBER OF DRUMS	2,711
TOTAL STORAGE VOLUME	870 CUBIC METERS
TOTAL STORAGE AREA	1,008 SQUARE METERS

**HLW CONTAINER STORAGE**

HLW CANISTERS WILL BE RECEIVED AND STORED ONLY  
 EACH CANISTER CONTAINS 1.26 CUBIC METERS OF WASTE  
 EACH CANISTER CONTAINS APPROXIMATELY 3.34 TONNES OF VITRIFIED WASTE  
 HEAT DISSIPATION RATE BASED ON YEAR 2005

**HIGH LEVEL WASTE CANISTERS (EXTERNAL)**

DIAMETER	2.25 FEET
HEIGHT (OVERALL)	15 FEET
VOLUME	59.64 CUBIC FEET
	1.689 CUBIC METERS

CONTAINERS WILL BE STORED IN RACKS OF THE FOLLOWING APPROXIMATE DIMENSIONS

NUMBER OF CONTAINERS PER RACK	9	
RACK SIZE	WIDTH	9 FEET
	LENGTH	9 FEET
	HEIGHT	18 FEET
	AREA	81 SQUARE FEET
		2.29 SQUARE METERS
ACCESS WAY AT 3 FEET WIDE		45 SQUARE FEET
		1.27 SQUARE METERS
TOTAL AREA PER RACK		3.57 SQUARE METERS

NOTE 1

TOTAL VOLUME PER RACK	16.32 CUBIC METERS	
ADD 25 PERCENT FOR HANDLING	4.08 CUBIC METERS	NOTE 2
GROSS VOLUME	20.40 CUBIC METERS	

ANNUAL HLW CONTAINERS	359 CONTAINERS
ANNUAL HLW RACKS	40 RACKS
ANNUAL FLOOR AREA	142 CUBIC METERS
ANNUAL VOLUME	814 CUBIC METERS

OPERATING YEARS	19
TOTAL NUMBER OF RACKS	758
TOTAL STORAGE VOLUME	15,460 CUBIC METERS

NOTES

1. INCLUDES 3 FOOT PLENUM BELOW CANISTERS
2. INCLUDES OVERHEAD SPACE FOR CRANE ACCESS

**EXHIBIT 6.6.1-5**  
**CESIUM AND STRONTIUM CAPSULE STORAGE**  
**HEAT TRANSFER CALCULATIONS**

## EXHIBIT 6.6.1-5

**CESIUM AND STRONTIUM CAPSULE STORAGE  
HEAT TRANSFER CALCULATIONS**

The objective is to store cesium and strontium capsules in a secondary containment device while providing adequate heat removal to maintain interior capsule temperatures at acceptable levels.

Studies on capsule temperature distributions (PNL 7196) show that a 200-watt single capsule being cooled by convection in air has an internal temperature distribution similar to that shown in Figure 5.3 of PNL 7196. For the typical centerline temperature of 300°C to 350°C, the out surface temperature would not exceed 150°C, and the salt - metal interface temperature would be about 200°C.

The only identified constraint on internal capsule temperature is that the salt - metal interface of a Cs capsule should be no more than 400°C (WHC-SD-HWV-ES-044). The actual estimated interface temperature for convective cooling (22°C; see PNL 7196, Figure 5.3) is well under this limit. Individual capsules vary considerably in heat generation rates, and to be conservative the following calculations assume a  $T_s$  of 150°C, corresponding to the salt - metal interface temperature of about 200 °C, though this is much less than the maximum permissible interface temperature of 400°C. This is necessary as capsules with higher than average heat generation rates will be hotter overall, with higher than average  $T_s$  and an interface temperature higher than 200°C. Adding a secondary containment barrier, such as pipe casings around the capsules in the FAA storage array at FMEF would add an additional barrier to heat transfer. This means that the permissible outer surface temperature of the secondary containment barrier would be slightly less than the capsule  $T_s$  of 150°C; assume a value of 140°C (see the calculations for more detailed discussion of this point).

The capsule temperature profile assumes a heat generation rate of 200 watts. In 2006, average heat generation rates of the capsules will be as follows:

Sr Capsule 195 Watts  
Cs Capsule 145 Watts

Accordingly, the PNL data for a 200 Watt Cs capsule are adequately conservative for the overall future capsule heat generation rates for both Cs and Sr capsules. Actually, these values decrease steadily over time due to radioactive decay. See the attached figure showing capsule heat generation rate decreases over a 30 year span.

1,577 Cs and 640 Sr capsules are to be stored in a tube bank array.

The cumulative heat generation rate  $Q$  from all capsules is  $Q = 335,000$  watts (year 2006 basis). The heat removal rate is set equal to  $Q$  and the outer capsule temperature is constrained to 150°C (corresponding to the secondary containment outer surface temperature of 140°C). Using an iterative process, the overall heat transfer coefficient and the air velocity can then be determined.

Convective heat transfer calculations based on empirical correlations for cylinders in transverse airflow indicate that the required airflow is 33,000 cfm. The calculations also result in determination of the following parameters:

- Heat transfer coefficient (overall) 13 W/m<sup>2</sup>K
- Nominal Air velocity in capsule storage area: 170 ft/min
- Resultant outlet air temperature: 65°C

The results assume:

1. Uniform  $T_s$  for all tubes. Actually, it known that  $T_s$  will not be uniform; however, hotter capsules can be place din the tube bank near the air entrance, and cooler (lower heat generation) capsules can be place din the tubes downstream, to more closely attain even  $T_s$  distribution in the bank.

2. Uniform air cross flow over the tube bank. Forced convection may be required to provide necessary air movement in all regions of the capsule storage space.

Further calculations will be required to more accurately assess whether this system would function adequately as a passive cooling system. It is likely that air ducting around the individual capsule - containing tubes and appropriate arrangements of plenums and a stack would provide adequate draft for a passive system.

From PNL-7196 UC-721

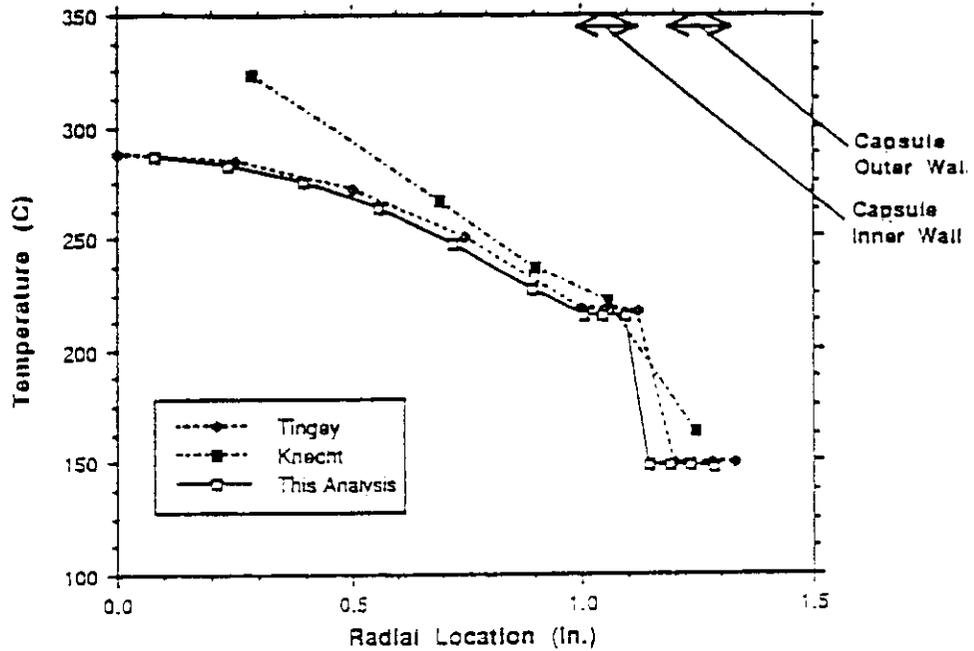


FIGURE 5.3. 200-Watt Single Capsule Radial Temperature Distribution

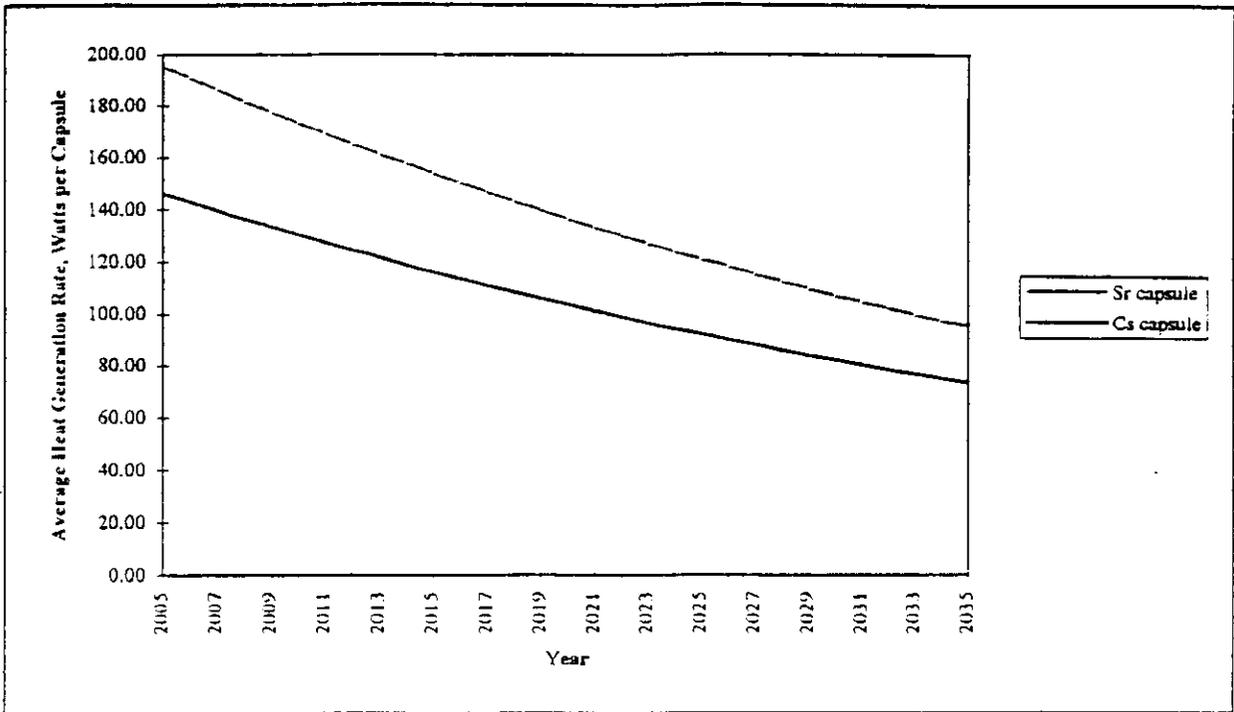
Adding capsules to the inside of a snug-fitting metallic pipe of O.D. 3", I.D. 2.625", thickness of .1875" will not cause the exterior surface temperature of the pipe to be much lower than the surface temperature of the capsule outer wall. Take  $T_s \approx 149^\circ\text{C}$  for the calculations.

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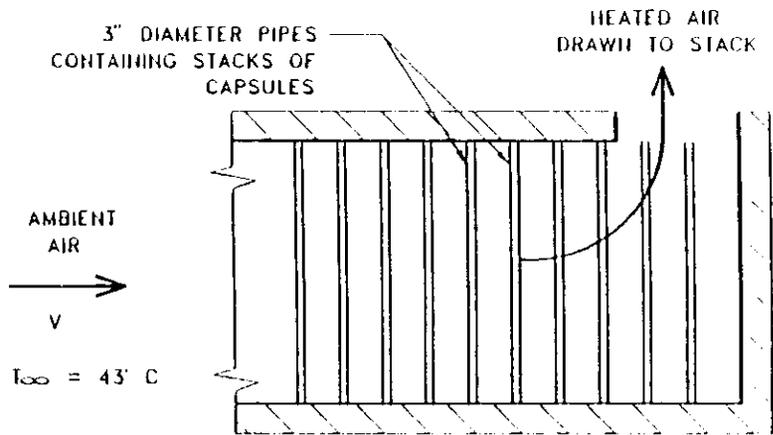
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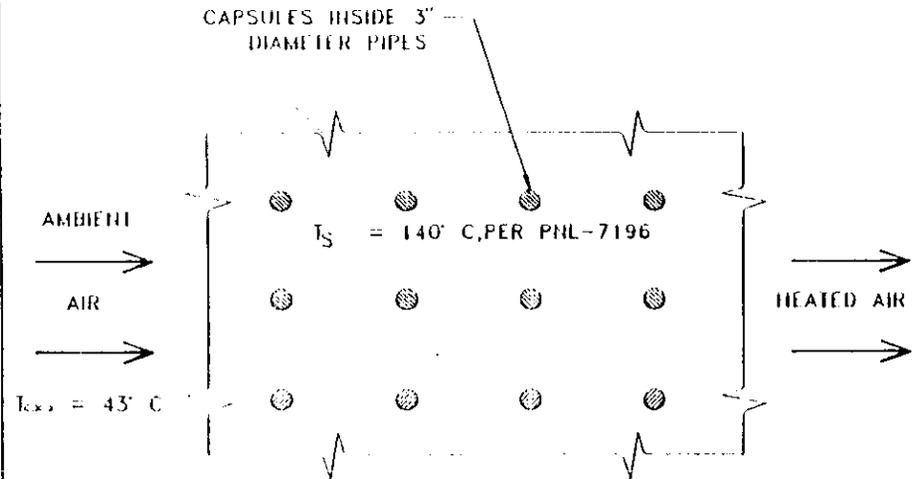
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VIEWS OF CAPSULE STORAGE AREA (NOT TO SCALE)

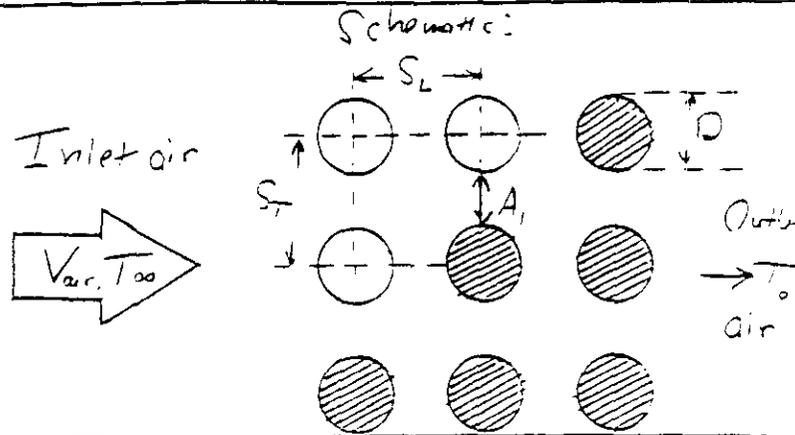
SIDE VIEW



OVERHEAD VIEW



$N_L = 32$  (rows)  
 $N_T = 9.41$  (columns some column irregular)  
 $T_\infty = 43.3^\circ\text{C}$  (worst case summer)  
 $D = 0.0762\text{ m}$   
 $S_L = S_T = 0.4065\text{ m}$   
 $T_s = 140^\circ\text{C}$



$N = 301$        $\dot{q} = 355,500\text{ W}$  known  
 Find: Convection coefficient and  $T_o, V$   
 Known: Geometry, heat rate, parameters as listed

- Assumptions:
1. Steady-state conditions
  2. Negligible radiation effects
  3. Uniform  $T_s$  for all tubes
  4. Uniform air cross-flow over tube bank

Properties:

air ( $T_\infty = 43^\circ\text{C}$ ):

- $\rho = 1.108\text{ kg/m}^3$
- $c_p = 1002\text{ J/kg}\cdot\text{K}$
- $\nu = 17.50 \times 10^{-6}\text{ m}^2/\text{s}$
- $k = 27.5 \times 10^{-3}\text{ W/m}\cdot\text{K}$

air ( $T_s = 140^\circ\text{C}$ ):  $Pr = 0.628$   
 $[V, V_{max}] = \text{m/s}$

Analysis:  
Nusselt number is

Equations (1) through (7) in the analysis are from pp. 335, 343-344. Fundamentals of Heat and Mass Transfer 2nd Edition, Frank P. Incropera and David P. Dewitt, John Wiley & Sons, 1985.

$$(1) \quad \overline{Nu}_D = C Re_{D, max}^m Pr^n \left( \frac{Pr_\infty}{Pr_s} \right)^{1/4} \left[ \begin{array}{l} 0.7 < Pr < 50 \\ 1 < Re_{D, max} < 10 \end{array} \right]$$

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for tube banks under bracketed conditions. Maximum air velocity in bank is given by

$$(2) \quad V_{\max} = \frac{S_T}{S_T - D} V$$

The overall velocity  $V$  is to be determined, but must be known to evaluate  $Re_{D, \max}$ ,  $\overline{Nu}_D$ , etc. Therefore, take approach where  $V$  is estimated and  $q$  (known value) is calculated. When estimate of  $V$  results in the correct, known value of  $q$ , that value of  $V$  is the solution.

Estimate  $V = 2.00 \text{ m/s}$

$$V_{\max, \text{estimate}} = \frac{0.4065 \text{ m}}{(0.4065 \text{ m} - 0.0762 \text{ m})} 2.0 \text{ m/s} = 2.46 \text{ m/s}$$

With

$$(3) \quad Re_{D, \max} = \frac{V_{\max} D}{\nu} = \frac{2.46 \text{ m/s} \times 0.0762 \text{ m}}{17.50 \times 10^{-6} \text{ m}^2/\text{s}} = 10,700$$

constants for (i) are given as

$$C = 0.26 \quad m = 0.6 \quad n = 0.37$$

Substituting,

$$\overline{Nu}_D = 0.26 (10,700)^{0.6} (0.705)^{0.37} \left( \frac{0.705}{0.688} \right)^{0.25} = 60.2$$

and

$$(4) \quad \overline{h} = \overline{Nu}_D \frac{k}{D} = 60.2 \times \frac{27.5 \times 10^{-3} \text{ W/m}\cdot\text{K}}{0.0762 \text{ m}} = 21.7 \text{ W/m}^2\cdot\text{K}$$

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Outlet temperature can be estimated from

$$(5) \frac{T_s - T_0}{T_s - T_\infty} = \exp\left(-\frac{\pi D N \bar{h}}{\rho V N_T S_T C_p}\right) \Rightarrow$$

$$T_s - T_0 = (T_s - T_\infty) \exp\left(-\frac{\pi D N \bar{h}}{\rho V N_T S_T C_p}\right)$$

$$= (140^\circ\text{C} - 43.3^\circ\text{C}) \exp\left(-\frac{\pi (0.0762\text{m})(301)(21.7\text{W/m}^2\cdot\text{K})}{(1.198\text{kg/m}^3)(2.00\text{m}^3)(9.41)(9.4065\text{m})(1008\text{J/kg}\cdot\text{K})}\right)$$

$$T_s - T_0 = 80.5^\circ\text{C}$$

$$(6) \Delta T_{\ell_m} = \frac{(T_s - T_\infty) - (T_s - T_0)}{\ln\left(\frac{T_s - T_\infty}{T_s - T_0}\right)} = \frac{96.7^\circ\text{C} - 80.5^\circ\text{C}}{\ln\left(\frac{96.7}{80.5}\right)} = 88.5^\circ\text{C}$$

$$(7) \dot{q}' = N(\bar{h} \pi D \Delta T_{\ell_m}) = 301 \pi \times 0.0762\text{m} \times 21.7\text{W/m}^2\cdot\text{K} = 88.3^\circ\text{C}$$

$$\dot{q}'_{\text{estimate}} = 138,000\text{W/m}$$

Tube length is 4.42m, so

$$\dot{q}_{\text{estimate}} = 611,000\text{W}$$

Since  $\dot{q}_{\text{estimate}} \neq \dot{q}_{\text{known}} = 355,000\text{W}$ , the original estimate of  $V$  was too high. Decrease and repeat calculations. Results are as follows:

	2 <sup>nd</sup> Trial	3 <sup>rd</sup> Trial	4 <sup>th</sup> Trial	5 <sup>th</sup> Trial
estimate of $V$ , (m/s)	1.00	0.90	0.85	0.86
Re <sub>D, max</sub>	5,360	4,824	4,556	4,609
$N_{\text{D}}$	39.7	37.3	36.0	36.3
$\bar{h}$ (W/m <sup>2</sup> ·K)	14.3	13.5	13.0	13.1
$T_s - T_0$ (°C)	75.9	75.1	74.7	74.8
$\Delta T_{\ell_m}$ (°C)	85.9	85.4	85.2	85.2
$\dot{q}$ , (W)	392,000	366,000	353,000	355,000

Accordingly  $V_{actual} = 0.86 \text{ m/s}$ .

$$Q_{air} = V_{actual} A_{duct} \\ = (0.86 \text{ m/s}) \left( 14.5' \frac{1 \text{ m}}{3.28 \text{ ft}} \right) \left( 13.33' \frac{1 \text{ m}}{3.28 \text{ ft}} \right) = 15.5 \text{ m}^3/\text{s}$$

This is equal to 32,700 cfm.

$$T_o = T_s - 74.8^\circ\text{C} \\ = 65.2^\circ\text{C}$$

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Cs & Sr Capsule Heat Transfer

<b>Parameters:</b>			
NL=	32		
NT=	9.41		
Tinf=	43.3	degrees C	
D=	0.0762	m	
SL=ST=	0.407	m	
Ts=	140	degrees C	
N=	301		
air (Tinf = 43 degrees C):	density=	1.108	kg/m <sup>3</sup>
	cp=	1008	J/kg.K
	kin visc=	1.75E-05	m <sup>2</sup> /s
	k=	2.75E-02	W/m.K
	Pr=	0.705	
air (Ts = 140 degrees C):	Pr=	0.688	
<b>Heat Transfer Calculations:</b>			
V=	0.8598	m/s (manually adjusted parameter)	Equivalent to: 169.20 ft/min
Vmax=	1.0582	m/s	
ReD,max=	4609		<b>Average heat generation per casule:</b>
			December 31, 1994 values
Since the spacing of the	C =	0.26	Sr 260.07 W
tubes is relatively wide, use	m =	0.6	Cs 192.59 W
equation constants for:	n =	0.37	t1/2= 29 years for Sr
isolated tubes.			30.17 years for Cs
NuD=	36.31		Values 12 years later:
h=	13.1	W/m <sup>2</sup> .K	Sr 195.23 W
Ts-To=	74.8	degrees C	Cs 146.19 W
delta Tlm=	85.2	degrees C	<b>Cumulative heat generation:</b>
q'=	30415	W/m	Number of Sr capsules: 640
tube length=	4.42	m	Number of Cs capsules: 1577
q (W)=	355495	(should be equal to 355495 W)	Sr capsules: 124949 W
			Cs capsules: 230546 W
			Total: 355495 W
			<b>Heat generation per capsule unit length:</b>
			Sr capsules: 382.31 W/m
			Cs capsules: 281.72 W/m

**EXHIBIT 6.6.1-6**  
**HIGH-LEVEL WASTE CANISTERS CANYON FACILITY**  
**STORAGE HEAT TRANSFER CALCULATIONS**

**EXHIBIT 6.6.1-6****HIGH-LEVEL WASTE CANISTERS CANYON FACILITY  
STORAGE HEAT TRANSFER CALCULATIONS****1.0 CANISTER HEAT GENERATION RATES/TEMPERATURE PROFILES**

Verifiable data on high-level waste (HLW) canister heat generation rates and internal temperature profiles are limited. Engineering Study ER0665ES, Hanford Waste Vitrification Plant Project, Interim Storage Facility for Hanford Waste Vitrification Plant Canisters, Evaluation of Alternatives, ICF Kaiser Hanford Company, 1990, gives a value for heat generation of a typical HLW canister of 1,000 W for a 10 ft. long, 2 ft. diameter canister. This information is of minimal value because a design basis was not provided. The heat generation rate of vitrified HLW is time dependent, but a time reference was not provided.

Information is provided in a Westinghouse Hanford Company document WHC-SD-WM-EV-104, Revision B (Draft), Figure 9-1, which gives average radionuclide inventory in the final waste glass forms. For high-level waste, the chief (>99%) contributors to heat generation are <sup>137</sup>Cs and <sup>90</sup>Sr. The values in this table are based on a total glass volume of 9,400 m<sup>3</sup> which is about 10% higher than the volume of glass used as a study basis. Accordingly, these values were adjusted to the study basis of 8,570 m<sup>3</sup>. With these values, calculations indicated a verifiable average heat generation rate of 77 watts per canister (see attached calculations). This is in excess of an order of magnitude lower than the heat dissipation rate indicated in the ICF Kaiser Hanford Company Study ER0665ES. Decay of the heat generating isotopes in the high-level waste glass will reduce the heat generation rate of the waste over the years; the attached figure indicates these decrease over a 30 year period.

The ICF Kaiser Hanford Company Study ER0665ES states that the acceptable centerline temperature of a canister is 738°F, corresponding to an outside surface temperature of between 300°F and 600°F. These values are suspect; however, the conservative lower end value of the outside surface temperature (300°F) will be adopted with application of an additional 50% safety factor (i.e., it is assumed that as long as the outside surface temperature of the canister does not exceed 200°F, the centerline temperature upper limit will not be exceeded).

**2.0 CONVECTION HEAT TRANSFER FROM CANISTERS**

For the calculations, the heat transfer area (cylindrical surface area of the HLW canisters) can be approximated by extended vertical flat plates (the ratio of canister length to diameter is low enough to permit this approximation) surrounded by ambient air which would begin gentle upward parallel flow (air supply to the canyon will be through a plenum under the canister storage platform, and air will be exhausted through ducts near the ceiling of the canyon, causing an overall upward movement of air). Both free convective and forced convective effects are considered. Radiation heat transfer effects are expected to be negligible due to: (1) the limited temperature gradients; (2) expected moderate surface temperatures of the canisters; and (3) the geometry of the canisters in storage where most canisters mostly see only other canisters at similar temperatures.

Computations revealed that the chief mechanism of heat transfer would be free convection. Assuming worst case summer conditions of an ambient air temperature of 100°F in the canyon, the average surface temperature of the canisters would be only a few degrees above this at 117°F. With air exhausted from the canyon at a rate of 200,000 cfm, the exhaust air temperature would be about 113°F. There is considerable flexibility in the air exhaust rate that could be successfully used in this scenario. For example, canyon air exhaust rates as low as a few thousand cfm would be adequate to keep the temperature of the canisters and canyon air within acceptable parameters.

These calculations are based on the upper limit of canister storage capacity of a canyon, with 240 racks in storage. However, only 40 racks per year will be produced starting about 2005, so it would be six years before the first canyon would become full and the

maximum air exhaust rate would be required. Also, the canisters would become progressively cooler over the years as the heat-generating cesium and strontium decay, so air exhaust requirements would lessen over the years.

Average Radionuclide Inventory in Final Glass Forms (Ci/m <sup>3</sup> )			
Primary Heat Generating Radionuclides	Low-Level Waste Glass	High-Level Waste Glass, WHC-SD-WM-EV-104 Basis	High-Level Waste Glass, Current Study Basis
<sup>137</sup> Cs	1.2	3,700	4,060
<sup>90</sup> Sr	4.3	5,600	6,140
Total Volume of Glass	220,000 m <sup>3</sup>	9,400 m <sup>3</sup>	8,570 m <sup>3*</sup>

Adapted from Table 9-1, WHC-SD-WM-EV-104 Rev. B

\*This value is derived from a table of HLW glass volumes for TPA Milestone M-51, included in the data package, "M-33 Waste and Materials Inventory Preliminary Information," transmitted by C.L. Bergeson to S.D. Ellington and B.E. Bielicki, February 1, 1995.

Specific Activity and Decay Heat Generation Rates for Selected Radionuclides					
Radionuclide	Half-life	Specific Activity		Decay Heat Generation Rate	
		(dpm/g)	(Ci/g)	(W/Ci)	(Btu/Ci-h)
<sup>137</sup> Cs	30.17 years	1.92E+14	8.66E+01	1.01E-03	3.45E-03
<sup>137</sup> Ba	2.522 minutes	1.19E+21	5.38E+08	3.92E-03	1.34E-02
<sup>137</sup> Cs/ <sup>137</sup> Ba	30.17 years	3.74E+14	1.69E+02	4.72E-03	1.61E-02
<sup>90</sup> Sr	28.6 years	3.08E+14	1.39E+02	1.16E-03	3.95E-03
<sup>90</sup> Y	64.1 hours	1.21E+18	5.43E+05	5.53E-03	1.89E-02
<sup>90</sup> Sr/ <sup>90</sup> Y	28.6 years	6.17E+14	2.78E+02	6.69E-03	2.23E-02

Adapted from Table 3-1, SD-RE-TI-131, "Basis and Values for Specific Activity and Decay Heat Generation Rates for Selected Radionuclides"

1. Canister heat generation rate

Values of radionuclide inventory in final HLW glass are given in WHC-SD-WM-EV-104, Rev. B (draft). Table 9-1 gives values based on a cumulative 9,400 m<sup>3</sup> amount of HLW glass; adjust these to a 8570 m<sup>3</sup> basis. Get

$$\left. \begin{array}{l} 4,060 \text{ Ci } ^{137}\text{Cs} \\ 6,140 \text{ Ci } ^{90}\text{Sr} \end{array} \right\} \text{ per m}^3 \text{ of HLW glass, year 2005 basis}$$

Decay heat generation rates as a function of Ci amounts are given as follows:

$$\begin{array}{l} \underline{^{90}\text{Sr}} \\ 1.16 \times 10^{-3} \text{ W/Ci } ^{90}\text{Sr} \xrightarrow{\text{decay}} 5.53 \times 10^{-3} \text{ W/Ci } ^{90}\text{Y} \\ \text{for a total of } 6.69 \times 10^{-3} \text{ W/Ci } ^{90}\text{Sr} \end{array}$$

$$\begin{array}{l} \underline{^{137}\text{Cs}} \\ 1.01 \times 10^{-3} \text{ W/Ci } ^{137}\text{Cs} \xrightarrow{\text{decay}} 3.92 \times 10^{-3} \text{ W/Ci } ^{137}\text{Ba} \\ \text{for a total of } 4.92 \times 10^{-3} \text{ W/Ci } ^{137}\text{Cs } ^{137}\text{Ba} \end{array}$$

<sup>90</sup>Sr (and decay product <sup>90</sup>Y) and <sup>137</sup>Cs (and decay product <sup>137</sup>Ba) represent in excess of 99% of the heat source in HLW glass

Heat generation per canister is given as follows:

1.26 m <sup>3</sup> glass canister	4060 Ci <sup>137</sup> Cs <sup>137</sup> Ba / m <sup>3</sup>	4.92 × 10 <sup>-3</sup> W Ci <sup>137</sup> Cs <sup>137</sup> Ba	= 25.2 W/canister
1.26 m <sup>3</sup> glass canister	6140 Ci <sup>90</sup> Sr <sup>90</sup> Y / m <sup>3</sup>	6.69 × 10 <sup>-3</sup> W Ci <sup>90</sup> Sr <sup>90</sup> Y	= 51.8 W/canister

Total heat generation per canister is 77W

*Clifton J. Miller*

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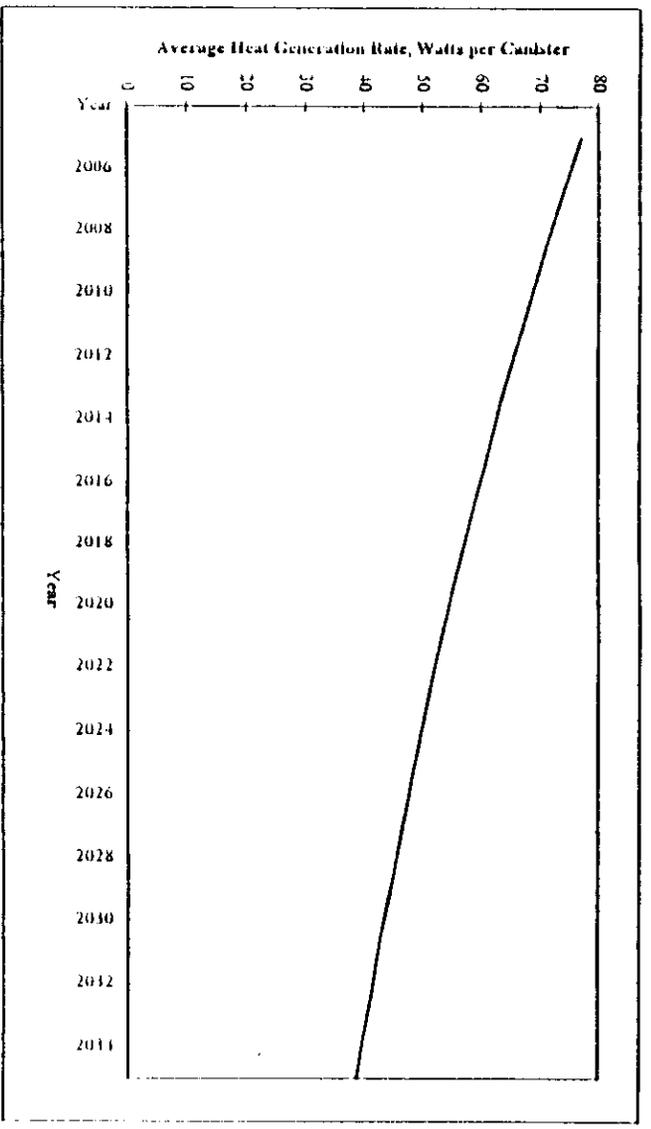
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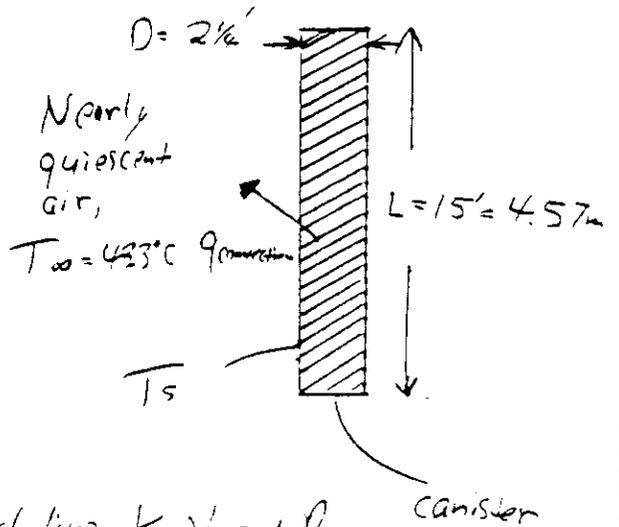


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2. Convection heat transfer from canisters

$q' = 36 \text{ W/m}$  width of canister surface area

Determine  $T_s$  corresponding to heat transfer by convection, equalling the known heat generation rate of canister.



air,  $T_f = \frac{T_s + T_{\infty}}{2}$   $\beta = \frac{1}{T_f}$

all properties evaluated @  $T_f$ , including  $k, \nu$ , and  $Pr$

Equations:

(1)  $Ra_L = Gr_L Pr = \frac{g \beta (T_s - T_{\infty}) L^3}{\nu^2} Pr$

(2)  $\overline{Nu}_L = \left\{ 0.825 + \frac{0.387 Ra_L^{1/4}}{[1 + (0.492/Pr)^{1/4}]^{4/7}} \right\}^2$  for any value of  $Pr$

(3)  $\overline{h} = \frac{\overline{Nu}_L k}{L}$

(4)  $q = \overline{h} A_s (T_s - T_{\infty})$

(1)-(4) from Incropera & Dewitt

Employ iterative method where  $T_s$  is estimated, and equations are solved to evaluate  $q$ . When  $q$  (calculated) value equals the known value of  $q$ , correct value of  $T_s$  is identified. See attached spreadsheet for final result.

Results:

$T_s = 47.3^\circ\text{C}$

An exhaust rate of 200 cfm allows air @  $45^\circ\text{C}$  to be exhausted from canyon.

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HLW Canister Heat Transfer

<b>Parameters:</b>		<b>Average heat generation per canister:</b>	
Tinf=	43.3 degrees C	December 31, 2004 value:	
L=	4.57 m	77 W	
Ts, avg=	47.3 degrees C (manually adjusted parameter)	t1/2=	30 years average
air:	kin visc=	1.77E-05 m2/s	Value
Tf=	318 K	k=	2.77E-02 W/m.K
To=	45.0 degrees C	Pr=	7.04E-01
		q'(W/m width)=	36
<b>Heat Transfer Calculations:</b>			
<b>Forced convection effects (negligible):</b>			
uinf=	0.063 m/s (manually adjusted parameter)	Equivalent to:	13 ft/min
ReL	16.754		
Since the critical Reynolds	C =	0.664	
number is 500,000	m=	0.5	
the flow is laminar along	n=	0.333	
the entire canister length.			
NuDf=	76		
<b>Free convection effects:</b>			
RaL=	2.62E-10	GrL=	3.71E-10
NuLa=	327	GrL ReL^2=	132
		Both free and forced convection	
		are of importance when this parameter is ~ 1.	
<b>Combined effects:</b>			
NuL=	328		
h=	2.0 W/m2.K		
q'=	36 W/m (should equal	36 W/m)	
Total heat transfer width within a 9 canister rack:	19.40 m	q'(rack)=	699  W
Floor area associated with a 9 canister rack:	5.95 m2		
Volumetric flow rate of air required per rack:	0.387 m3/s	or	819 cfm
Total volumetric flow rate, with	240 racks in canyon:		196485 cfm
Exhaust air temperature:	45.0 degrees C	(should equal 45 degrees C)	

*C. G. P. H.*

**EXHIBIT 6.6.1-7**  
**STORAGE REQUIREMENTS FOR**  
**UNIRRADIATED URANIUM**  
**AND MISCELLANEOUS MATERIALS**

**Floorspace Required For Storage**

	UU Not for Sale	UU For Sale
<b>Fuel Assemblies: (finished and unfinished)</b>		
weight (tons)	1,053	
area required (sf)	14,500	
psf (total is avg)	145	

<b>Billets:</b>		
weight (tons)		1,034
area required (sf)		6,000
psf (total is avg)		345

<b>Low Enriched Uranium Trioxide Powder:</b>		
weight (tons)		744
area required (sf)		6,000
psf (total is avg)		805

<b>Misc. UU:</b>		
weight (tons)	3.74	
area required (sf)	1,000	
psf (total is avg)	7	

<b>Depleted Uranium Trioxide Powder:</b>		
weight (tons)	146.2	
area required (sf)	600	
psf (total is avg)	487	

<b>DU Metal Slabs:</b>		
weight (tons)	23.38	
area required (sf)	100	
psf (total is avg)	468	

**TOTALS**

UU not for Sale area required(sf)	16,200	
UU for Sale area required (sf)		12,000
Total UU Storage Currently on Site	28,200	

**PROPOSED UNIRRADIATED URANIUM STORAGE LOCATIONS**

FME#	Room #	Dimension(ft)	Usable ft <sup>2</sup>	Usable M <sup>2</sup>	Floor Load Max (psf)
	226A	36*18*15	324	30	230
	226	62*36*15	1116	104	230
	404	22*49*15	539	50	250
	406	37*14*15	259	24	250
	413	28*91*15	1134	105	250
	401	30*23*15	345	32	250
	511	41*72*10	1440	134	250
	507	60*40*24	1200	112	250
	517	34*25*10	425	39	250
	523	74*22*10	814	76	250
	524	25*22*10	275	26	250
	526	43*22*10	473	44	250
	605	61*145*20	4350	404	225
	607	22*129*20	1419	132	225
	604	22*100*20	1100	102	225
	108	12*24*15	144	13	no limit
	119	7*12*15	42	4	no limit
	118	8*12*15	48	4	no limit
	162	6*17*15	51	5	no limit
	116	14*12*15	84	8	no limit
	131	10*100*15	500	46	no limit
	<b>totals</b>		<b>16,082</b>	<b>1,495</b>	

All liveloads can be considerably exceeded for point loading. See applicable reference drawings.  
Usable areas are 50% of total floor space in each room.

**Dioxide Pellets, Powder, Fuel Pins, Fuel Assemblies & Uranium Metal**

<b>Trioxide Powder: Current Storage Configuration</b>		
	<u>total</u>	<u>2 pallets high</u>
55-gallon drums	172	43
wt (lb)	292,400	73,100
lbs/drum	1,700	1,700
number of stacks		22
<b>area required (sf)</b>	<b>600</b>	<b>600</b>
area per stack (sf)		28
<b>psf</b>		<b>487</b>

<b>Misc. UU: Current Storage Configuration</b>	
	<u>total</u>
storage 55-gallon drums	
wt (lb)	7,480
<b>area required (sf) assumed with overpack</b>	<b>1,000</b>

<b>Metal Slabs: Current Storage Configuration</b>	
	<u>total</u>
boxes	11
wt (lb)	46,772
wt/box (lb)	4,252
<b>area required (sf)</b>	<b>100</b>
<b>psf</b>	<b>468</b>

<b>Finished Fuel: Current Storage Configuration</b>			
	<u>total</u>	<u>2 high</u>	<u>3 high</u>
boxes	1144	988	156
wt (lb)	1,806,000	1,559,727	246,273
lbs/box	1,579	1,579	1,579
number of stacks	546	494	52

<b>Unfinished Fuel: Current Storage Configuration</b>			
	<u>total</u>	<u>2 high</u>	<u>1 high</u>
boxes	339	205	134
wt (lb)	300,000	181,416	118,584
lbs/box	885	885	885
number of stacks	237	103	134
<b>finished/unfinished fuel assembly area (sf)</b>	<b>14,500</b>		

<b>TOTAL URANIUM NOT FOR SALE</b>	<b>16,200</b>
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**Metal Billets and Trioxide Powder for sale:**

<b>Billets: Current Storage Configuration</b>			
940 boxes stacked 5 high, 318 boxes stacked 3 high			
	<u>total</u>	<u>3 high</u>	<u>5 high</u>
wt (lb)	2,068,000	522,754	1,545,246
boxes (each)	1,258	318	940
wt/box (lb)	1,644	1,644	1,644
number of stacks	294	106	188
area required (sf)	6,000	2,163	3,837
area per stack (sf)	20	20	20
psf		242	403

<b>Low Enriched Trioxide Powder: Current Storage Configuration</b>	
Trioxide (lb)	1,488,000
T-Hoppers (each)	146
T-hopper empty (lb)	20,000
uranium/hopper (lb)	10,192
area required (sf)	6,000
area per hopper (sf)	13
psf	735

	<u>tons</u>	<u>Storage Area Required</u>
<b>TOTAL URANIUM FOR SALE</b>	<b>1,778</b>	<b>12,000</b>

Assumption: Current storage configurations will be used in new storage facility.

Figure 3-5

