NRC Decommissioning Funding Status Report
Diablo Canyon Power Plant
Unit 1 (3411 MWe) and 2 (3411 MWe)
(Pages 1 through 3)

NRC Decommissioning Funding Status Report
Diablo Canyon Power Plant - Units 1 (3411 MWt) & 2 (3411 MWt)

As provided in 10 CFR 50.75(f)(1), each power reactor licensee is required to report to the NRC on a calendar year basis, beginning on March 31, 1999, and every 2 years thereafter, on the status of its decommissioning funding for each reactor or share of reactor it owns. This interim report is being submitted to reflect the 2002 TLG Decommissioning Cost Study for DCPP.

1. The minimum decommissioning fund estimate, pursuant to 10 CFR 50.75 (b) and (c)[1] — $ in Millions

   January 2003 dollars — $ 809.6

2. The amount accumulated at the end of the calendar year preceding the date of the report for items included in 10 CFR 50.75 (b) and (c). (Alternatively, the total amount accumulated at the end of the calendar year preceding the date of the report can be reported here if the cover letter transmitting the report provides the total estimate and indicates what portion of that estimate is for items not included in 10 CFR 50.75 (b) and (c)).

   Market Value (December 2002 dollars) — $ 1,210.4

3. A schedule of the annual amounts remaining to be collected; for items in 10 CFR 50.75 (b) and (c). Alternatively, the annual amounts remaining to be collected can include items beyond those required in 10 CFR 50.75 (b) and (c) if the cover letter transmitting the report provides a total cost estimate and indicates what portion of that estimate is for items that are not included in 10 CFR 50.75 (b) and (c). (See item 6 of this enclosure describing the collection of additional funds)

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[1] • The NRC formulas in section 10CFR50.75(c) include only those decommissioning costs incurred by licensees to remove a facility or site safely from service and reduce residual radioactivity to levels that permit: (1) release of the property for unrestricted use and termination of the license; or (2) release of the property under restricted conditions and termination of the license. The cost of dismantling or demolishing non-radiological systems and structures is not included in the NRC decommissioning cost estimates. The costs of managing and storing spent fuel on site until transfer to DOE are not included in the cost formulas.

Unit 1	
amount remaining	$ 180.3
# years to collect	19.75 years
Unit 2	
amount remaining	$ 347.7
# years to collect	23.3 years

4. The assumptions used regarding escalation in decommissioning cost, rates of earnings on decommissioning funds (anticipates that the Portfolio of each trust will be gradually converted to a more conservative, all income portfolio in 2016 for Unit 1 and 2018 for Unit 2), and rates of other factors used in funding projections;

Escalation in decommissioning costs	5.50 percent
Rate of Return on Qualified Trust Unit 1 (thought 2016)	6.34 percent
Rate of Return on Qualified Trust Unit 1 2017	6.05 percent
Rate of Return on Qualified Trust Unit 1 2018	5.76 percent
Rate of Return on Qualified Trust Unit 1 2019	5.47 percent
Rate of Return on Qualified Trust Unit 1 2020	5.18 percent
Rate of Return on Qualified Trust Unit 1 (Post 2020)	4.89 percent
Rate of Return on Qualified Trust Unit 2 (through 2018)	6.34 percent
Rate of Return on Qualified Trust Unit 2 2019	6.05 percent
Rate of Return on Qualified Trust Unit 2 2020	5.76 percent
Rate of Return on Qualified Trust Unit 2 2021	5.47 percent
Rate of Return on Qualified Trust Unit 2 2022	5.18 percent
Rate of Return on Qualified Trust Unit 2 (Post 2022)	4.89 percent

5. Any contracts upon which the licensee is relying pursuant to 10 CFR 50.75(e)(1)(v); None

6. Any modifications to a licensee's current method of providing financial assurance occurring since the last submitted report. Yes

   PG&E submitted to the CPUC on March 15, 2002 a request to seek contributions of $9.205 million per year ending on the last day of commercial operation (September 22, 2021) for Unit 1 and $14.836 million per year ending on the last day of commercial operation (April 26, 2025) for Unit 2

7. Any material changes to trust agreements. None

8. TLG Cost Study in 2003 Dollars (in Millions)

Total Project (Decommission 2021 & 2025)	$ 1,452.9
Scope Excluded from NRC calculations[2]	$ 397.3
Total NRC Decommissioning Costs	$ 1,055.6

9. CPUC Submittal in 2003 Dollars (in Millions)

Total Project (Decommission 2021 & 2025)	$ 1,722.1
Scope Excluded from NRC calculations[2]	$ 471.0
Total NRC Decommissioning Costs	$ 1,251.1

The cost differential between the TLG Study and the CPUC Submittal is that the TLG estimate does not include contingency for financial risk. Financial risk includes but is not limited to:

- Costs associated with delays in approval of the reports required for decommissioning
- Changes in the project work scope from the baseline estimate, including discovery of unexpected levels of contaminants
- Contamination in places not previously expected
- Regulatory changes
- Policy decisions at the federal and state level which could affect the Utility's ability or timeframe to process certain waste forms for disposal
- Changes in the cost of disposal of low-level radioactive waste

[2] Scope excluded from NRC calculations includes dismantling or demolishing the non-radiological systems or structures of the facility, the construction and operation of an ISFSI facility.

Enclosure 2
PG&E Letter DCL-03-035
HBL-03-002

NRC Decommissioning Funding Status Report
Humboldt Bay Power Plant - Unit 3 (220 MWt)
(Pages 1 through 3)

NRC Decommissioning Funding Status Report
Humboldt Bay Power Plant - Unit 3 (220 MWt)

As provided in 10 CFR 50.75(f)(1), each power reactor licensee is required to report to the NRC on a calendar year basis, beginning on March 31, 1999, and annually thereafter, on the status of its decommissioning funding for each reactor that it owns and has already closed.

1. The minimum decommissioning fund estimate, pursuant to 10 CFR 50.75 (b) and (c)[3] — $ in Millions

   January 2003 dollars — $ 430.1

   (HBPP is a shutdown unit with a Site Specific Cost Study; therefore, the minimum decommissioning fund estimate is based on the Site Specific Cost Study shown in item 8 of this enclosure.)

2. The amount accumulated at the end of the calendar year preceding the date of the report for items included in 10 CFR 50.75 (b) and (c). (Alternatively, the total amount accumulated at the end of the calendar year preceding the date of the report can be reported here if the cover letter transmitting the report provides the total estimate and indicates what portion of that estimate is for items not included in 10 CFR 50.75 (b) and (c)).

   Market Value (December 2002 dollars) — $ 195.1

3. A schedule of the annual amounts remaining to be collected; for items in 10 CFR 50.75 (b) and (c). Alternatively, the annual amounts remaining to be collected can include items beyond those required in 10 CFR 50.75 (b) and (c) if the cover letter transmitting the report provides a total cost estimate and indicates what portion of that estimate is for items that are not included in 10 CFR 50.75 (b) and (c). (See item 6 of this enclosure describing collection of additional funds):

   Amount remaining — $ 167.6

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[3] * The NRC formulas in section 10CFR50.75(c) include only those decommissioning costs incurred by licensees to remove a facility or site safely from service and reduce residual radioactivity to levels that permit: (1) release of the property for unrestricted use and termination of the license; or (2) release of the property under restricted conditions and termination of the license. The cost of dismantling or demolishing non-radiological systems and structures is not included in the NRC decommissioning cost estimates. The costs of managing and storing spent fuel on site until transfer to DOE are not included in the cost formulas.

Number of years to collect	13 years

4. The assumptions used regarding escalation in decommissioning cost, rates of earnings on decommissioning funds (assumes trust will be gradually converted to a more conservative, all fixed income portfolio after 2010), and rates of other factors used in funding projections;

Escalation in decommissioning costs	5.50 percent
Rate of Return on Qualified Trust (through 2010)	6.34 percent
Rate of Return on Qualified Trust 2011	6.05 percent
Rate of Return on Qualified Trust 2012	5.76 percent
Rate of Return on Qualified Trust 2013	5.47 percent
Rate of Return on Qualified Trust 2014	5.18 percent
Rate of Return on Qualified Trust (Post 2014)	4.89 percent
Rate of Return on Non-Qualified Trust (through 2010)	5.39 percent
Rate of Return on Non-Qualified Trust 2011	5.11 percent
Rate of Return on Non-Qualified Trust 2012	4.82 percent
Rate of Return on Non-Qualified Trust 2013	4.54 percent
Rate of Return on Non-Qualified Trust 2014	4.25 percent
Rate of Return on Non-Qualified Trust (Post 2015)	3.97 percent

5. Any contracts upon which the licensee is relying pursuant to 10 CFR 50.75(e)(1)(v); — None

6. Any modifications to a licensee's current method of providing financial assurance occurring since the last submitted report. — Yes

   PG&E submitted to the CPUC on March 15, 2002, a request to seek contributions of $12.892 million per year for the next 13 years to the Humboldt Unit 3 Trusts to fully fund the decommissioning liability.

7. Any material changes to trust agreements. — None

8. TLG Cost Study in 2003 Dollars (in Millions)

Total Project (Decommission 2015)	$ 362.1
Scope Excluded from NRC calculations[4]	$ 13.6
Scope Decommissioned to date	$ 17.8
Total NRC Decommissioning Costs	$ 330.7

[4] Scope excluded from NRC calculations includes dismantling or demolishing the non-radiological systems or structures of the facility.

9. CPUC Submittal in 2003 Dollars (in Millions)

Total Project (Decommission 2015)	$ 420.1
Scope Excluded from NRC calculations[5]	$ 14.5
Scope Decommissioned to date	$ 17.8
Total NRC Decommissioning Costs	$ 387.8

The cost differential between the TLG Study and the CPUC submittal is that the TLG estimate does not include contingency for financial risk. Financial risk includes but is not limited to:

- Costs associated with delays in approval of the reports required for decommissioning.
- Changes in the project work scope from the baseline estimate, including discovery of unexpected levels of contaminants.
- Contamination in places not previously expected.
- Regulatory changes.
- Policy decisions at the federal and state level which could affect the Utility's ability or timeframe to process certain waste forms for disposal.
- Changes in the cost of disposal of low-level radioactive waste.

[5] Scope excluded from NRC calculations includes dismantling or demolishing the non-radiological systems or structures of the facility.

2003 Decommissioning Estimate
(Pages 1 through 14)

Nuclear Regulatory Commission
Estimate of Decommission Costs for BWR and PWR
In 2003

	HBPP BWR (millions)		DCPP PWR (millions)	
Jan 1986 Estimate	114.8		210	
Escalated to 1999	128.9	(Table 2.1 in NUREG 1307 Rev 10 has no value for 1999 Burial)	236.5	(Table 2.1 in NUREG 1307 Rev 10 has no value for 1999 Burial)
Escalated to 2000	400.2	($360.9 in 2000 Submittal)		(No Submittal Required)
Escalated to 2001	412.4	($425.3 in 2001 Submittal)	774.4	($793.4 in 2001 Submittal)
Escalated to 2002	418.1	($445.6 in 2002 Submittal)		(No Submittal Required)
Escalated to 2003	430.1		809.6	

<u>Jan 1986</u> based on 10 CFR 50.75 (c) Table of minimum amounts
PWR Greater than or equal to 3400 MWt = $105 million per unit
BWR based on minimum 1, 200 MWt = ($104 + (.009xMWt)) million per unit

Composite Escalation

Calculating Overall Escalation Rate

BWR	Jan-86	Jan-99	Jan-00	Jan-01	Jan-02	Jan-03	Weight (1)
L (Labor)	1 0000	1 5624	1 6370	1.7183	1.7862	1 8508	0 65
E (Energy)	1 0000	0 8257	1 0220	1.1841	0.9715	1 2030	0 13
B (Burial)	1 0000	0 0000	10 4061	10.5540	10.7015	10 8491	0 22

BWR
Combined Escalation Rate for:

Jan-86	Jan-99	Jan-00	Jan-01	Jan-02	Jan-03
1 0000	1 1229	3 4862	3.5927	3 6417	3 7462

PWR	Jan-86	Jan-99	Jan-00	Jan-01	Jan-02	Jan-03	Weight (1)
L (Labor)	1 0000	1.5624	1 6370	1.7183	1 7862	1 8508	0 65
E (Energy)	1 0000	0 8499	1.0297	1.1850	0 9909	1 2048	0 13
B (Burial)	1 0000	0 0000	10 8039	10.9840	11.1633	11 3430	0 22

PWR
Combined Escalation Rate for.

Jan-86	Jan-99	Jan-00	Jan-01	Jan-02	Jan-03
1 0000	1 1260	3 5748	3 6874	3 7458	3 8551

(1) from NUREG 1307 Revision 10, Report on Waste Burial Charges, Section 2 Summary, Page 3 ... where A, B, and C are the fractions of the total 1986 dollar costs that are attributable to labor (0 65), energy (0.13), and burial (0 22), respectively, and sum to 1 0

(2) Jan-01 B (Burial) value in this table is a calculation based on averaging the values of Jan-00 and Jan-02 because NUREG 1307 Revision 10 Table 2 1 does not supply a value for 2001.

Calculation of Energy Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3 2
Using Regional Indices SERIES ID WPU0573 Light Fuel Oils (as of 03/06/03) and WPU0543 Industrial Electric Power (as of 03/06/03)

			REBASED TO 1986 = 100			
	PPI for Fuels & Related Products (1982 = 100) (P) =Industrial Energy Power	PPI for Light Fuel Oils (1982=100) (F) = Light Fuel Oils	PPI for Fuels & Related Products (1986 = 100) (P) =Industrial Energy Power BWR wt = 0 54 PWR wt = 0 58	PPI for Light Fuel Oils (1986=100) (F) = Light Fuel Oils BWR wt = 0 46 PWR wt = 0 42	Energy Escalation Factor (E) for BWR (Humboldt)	Energy Escalation Factor (E) for PWR (Diablo Canyon)
Jan-86	114 2	82 0	1 0000	1 0000	1 0000	1 0000
Feb-86	115 0	62 4	1 0070	0 7610	0 8938	0 9037
Mar-86	114 4	51 3	1 0018	0 6256	0 8287	0 8438
Apr-86	113 7	49 8	0 9956	0 6073	0 8170	0 8325
May-86	114 1	47 0	0 9991	0 5732	0 8032	0 8202
Jun-86	115 3	44 7	1 0096	0 5451	0 7960	0 8145
Jul-86	116 2	36 4	1 0175	0 4439	0 7537	0 7766
Aug-86	116 3	40 1	1 0184	0 4890	0 7749	0 7961
Sep-86	116 3	46 3	1 0184	0 5646	0 8097	0 8278
Oct-86	113 0	43 1	0 9895	0 5256	0 7761	0 7947
Nov-86	112 7	43 5	0 9869	0 5305	0 7769	0 7952
Dec-86	112 3	45 6	0 9834	0 5561	0 7868	0 8039
Jan-87	110 3	51 4	0 9658	0 6268	0 8099	0 8235
Feb-87	109 8	53 1	0 9615	0 6476	0 8171	0 8296
Mar-87	110 2	49 7	0 9650	0 6061	0 7999	0 8142
Apr-87	109 9	52 0	0 9623	0 6341	0 8114	0 8245
May-87	111 8	53 3	0 9790	0 6500	0 8277	0 8408
Jun-87	113 9	55 1	0 9974	0 6720	0 8477	0 8607
Jul-87	116 2	56 3	1 0175	0 6866	0 8653	0 8785
Aug-87	115 7	59 4	1 0131	0 7244	0 8803	0 8919
Sep-87	115 5	56 8	1 0114	0 6927	0 8648	0 8775
Oct-87	111 0	59 3	0 9720	0 7232	0 8575	0 8675
Nov-87	109 2	61 2	0 9562	0 7463	0 8597	0 8681
Dec-87	109 6	58 1	0 9597	0 7085	0 8442	0 8542
Jan-88	108 8	54 8	0 9527	0 6683	0 8219	0 8333
Feb-88	109 0	51 5	0 9545	0 6280	0 8043	0 8174
Mar-88	109 0	49 7	0 9545	0 6061	0 7942	0 8082
Apr-88	109 1	53 3	0 9553	0 6500	0 8149	0 8271
May-88	108 9	54 3	0 9536	0 6622	0 8195	0 8312
Jun-88	117 2	50 6	1 0263	0 6171	0 8380	0 8544
Jul-88	118 2	46 9	1 0350	0 5720	0 8220	0 8405
Aug-88	118 3	46 8	1 0359	0 5707	0 8219	0 8405
Sep-88	118 5	45 9	1 0377	0 5598	0 8178	0 8369
Oct-88	114 2	42 3	1 0000	0 5159	0 7773	0 7967
Nov-88	109 2	47 2	0 9562	0 5756	0 7811	0 7964
Dec-88	110 5	50 6	0 9676	0 6171	0 8064	0 8204
Jan-89	112 0	54 9	0 9807	0 6695	0 8376	0 8500
Feb-89	112 0	54 0	0 9807	0 6585	0 8325	0 8454
Mar-89	112 3	57 3	0 9834	0 6988	0 8525	0 8638
Apr-89	112 4	61 5	0 9842	0 7500	0 8765	0 8859
May-89	113 6	57 5	0 9947	0 7012	0 8597	0 8715
Jun-89	119 8	53 3	1 0490	0 6500	0 8655	0 8814
Jul-89	122 2	52 7	1 0701	0 6427	0 8735	0 8906
Aug-89	122 4	53 5	1 0718	0 6524	0 8789	0 8957

Calculation of Energy Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3 2
Using Regional Indices SERIES ID WPU0573 Light Fuel Oils (as of 03/06/03) and WPU0543 Industrial Electric Power (as of 03/06/03)

			REBASED TO 1986 = 100			
	PPI for Fuels & Related Products (1982 = 100) (P) =Industrial Energy Power	PPI for Light Fuel Oils (1982=100) (F) = Light Fuel Oils	PPI for Fuels & Related Products (1986 = 100) (P) =Industrial Energy Power BWR wt = 0 54	PPI for Light Fuel Oils (1986=100) (F) = Light Fuel Oils BWR wt = 0 46	Energy Escalation Factor (E) for BWR (Humboldt)	Energy Escalation Factor (E) for PWR (Diablo Canyon)
Sep-89	122 5	59 3	1 0727	0 7232	0 9119	0 9259
Oct-89	117 2	64 0	1 0263	0 7805	0 9132	0 9230
Nov-89	113 5	64 4	0 9939	0 7854	0 8980	0 9063
Dec-89	114 2	68 1	1 0000	0 8305	0 9220	0 9288
Jan-90	114 9	85 3	1 0061	1 0402	1 0218	1 0205
Feb-90	115 0	59 4	1 0070	0 7244	0 8770	0 8883
Mar-90	115 4	60 4	1 0105	0 7366	0 8845	0 8955
Apr-90	115 1	61 0	1 0079	0 7439	0 8865	0 8970
May-90	117 0	58 4	1 0245	0 7122	0 8808	0 8933
Jun-90	123 9	53 0	1 0849	0 6463	0 8832	0 9007
Jul-90	124 4	51 6	1 0893	0 6293	0 8777	0 8961
Aug-90	124 6	72 3	1 0911	0 8817	0 9948	1 0031
Sep-90	125 0	87 3	1 0946	1 0646	1 0808	1 0820
Oct-90	121 2	104 8	1 0613	1 2780	1 1610	1 1523
Nov-90	120 2	98 9	1 0525	1 2061	1.1232	1 1170
Dec-90	118 9	89 3	1 0412	1 0890	1 0632	1 0613
Jan-91	124 2	82 9	1 0876	1 0110	1 0523	1 0554
Feb-91	124 3	74 3	1 0884	0 9061	1 0046	1 0119
Mar-91	124 3	61 6	1 0884	0 7512	0 9333	0 9468
Apr-91	124 7	60 0	1 0919	0 7317	0 9262	0 9406
May-91	128 2	59 6	1 1226	0 7268	0 9405	0 9564
Jun-91	132 6	57 6	1 1611	0 7024	0 9501	0 9685
Jul-91	134 5	58 1	1 1778	0 7085	0 9619	0 9807
Aug-91	133 8	62 1	1 1716	0 7573	0 9810	0 9976
Sep-91	133 8	65 4	1 1716	0 7976	0 9996	1 0145
Oct-91	128 3	67 6	1 1235	0 8244	0 9859	0 9979
Nov-91	123 1	71 0	1 0779	0 8659	0 9804	0 9889
Dec-91	125 1	62 2	1 0954	0 7585	0 9405	0 9539
Jan-92	125 9	54 4	1 1025	0 6634	0 9005	0 9181
Feb-92	125 3	57 3	1 0972	0 6988	0 9139	0 9299
Mar-92	125 8	56 0	1,1016	0 6829	0 9090	0 9257
Apr-92	124 8	59 0	1 0928	0 7195	0 9211	0 9360
May-92	128 5	62 1	1 1252	0 7573	0 9560	0 9707
Jun-92	134 8	65 4	1,1804	0 7976	1 0043	1 0196
Jul-92	135 6	64 6	1 1874	0 7878	1 0036	1 0196
Aug-92	135 1	63 3	1 1830	0 7720	0 9939	1 0104
Sep-92	135 9	65 6	1 1900	0 8000	1 0106	1 0262
Oct-92	131 2	68 2	1,1489	0 8317	1 0030	1 0157
Nov-92	125 5	64 2	1 0989	0 7829	0 9536	0 9662
Dec-92	126 7	59 4	1 1095	0 7244	0 9323	0 9477
Jan-93	127 1	59 0	1 1130	0 7195	0 9320	0 9477
Feb-93	126 4	60 4	1,1068	0 7366	0 9365	0 9513
Mar-93	126 7	63 2	1 1095	0 7707	0 9536	0 9672
Apr-93	126 8	62 4	1 1103	0 7610	0 9496	0 9636
May-93	127 5	62 6	1 1165	0 7634	0 9541	0 9682
Jun-93	136 9	60 8	1 1988	0 7415	0 9884	1 0067

Calculation of Energy Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3 2
Using Regional Indices SERIES ID WPU0573 Light Fuel Oils (as of 03/06/03) and WPU0543 Industrial Electric Power (as of 03/06/03)

	PPI for Fuels & Related Products (1982 = 100) (P) =Industrial Energy Power	PPI for Light Fuel Oils (1982=100) (F) = Light Fuel Oils	REBASED TO 1986 = 100: PPI for Fuels & Related Products (1986 = 100) (P) =Industrial Energy Power BWR wt = 0 54	REBASED TO 1986 = 100: PPI for Light Fuel Oils (1986=100) (F) = Light Fuel Oils BWR wt = 0 46	Energy Escalation Factor (E) for BWR (Humboldt)	Energy Escalation Factor (E) for PWR (Diablo Canyon)
Jul-93	137.1	57 0	1 2005	0 6951	0 9680	0 9883
Aug-93	137 2	54 4	1 2014	0 6634	0 9539	0 9754
Sep-93	137 6	59 3	1 2049	0 7232	0 9833	1 0026
Oct-93	131 9	65 4	1 1550	0 7976	0 9906	1 0049
Nov-93	126 3	61 6	1 1060	0 7512	0 9428	0 9570
Dec-93	126 0	51 4	1 1033	0 6268	0 8841	0 9032
Jan-94	126 2	51 5	1.1051	0 6280	0 8856	0 9047
Feb-94	125 9	57 5	1 1025	0 7012	0 9179	0 9339
Mar-94	125 8	56 2	1 1016	0 6854	0 9101	0 9268
Apr-94	125 4	54 7	1 0981	0 6671	0 8998	0 9171
May-94	126 0	54 7	1 1033	0 6671	0 9027	0 9201
Jun-94	133 5	54 1	1 1690	0 6598	0 9347	0 9551
Jul-94	134 5	56 3	1 1778	0 6866	0 9518	0 9715
Aug-94	134 5	57 5	1 1778	0 7012	0 9586	0 9776
Sep-94	134 9	57 7	1 1813	0 7037	0 9616	0 9807
Oct-94	129 1	57 7	1 1305	0 7037	0 9341	0 9512
Nov-94	127 0	58 8	1 1121	0 7171	0 9304	0 9462
Dec-94	127 4	54 7	1 1156	0 6671	0 9093	0 9272
Jan-95	127 6	54 7	1 1173	0 6671	0 9102	0 9282
Feb-95	128 0	53 3	1 1208	0 6500	0 9043	0 9231
Mar-95	128 3	54 3	1 1235	0 6622	0 9113	0 9297
Apr-95	126 4	57 1	1 1068	0 6963	0 9180	0 9344
May-95	130 2	59 1	1 1401	0 7207	0 9472	0 9640
Jun-95	135 3	55 8	1 1848	0 6805	0 9528	0 9730
Jul-95	136 6	53 5	1 1961	0 6524	0 9460	0 9678
Aug-95	136 5	55 6	1 1953	0 6780	0 9573	0 9780
Sep-95	133 7	58 2	1 1708	0 7098	0 9587	0 9771
Oct-95	131 4	57 8	1 1506	0 7049	0 9456	0 9634
Nov-95	127 6	59 5	1 1173	0 7256	0 9371	0 9528
Dec-95	127 7	60 6	1 1182	0 7390	0 9438	0 9590
Jan-96	127 9	62 6	1 1200	0 7634	0 9560	0 9702
Feb-96	127 1	59 7	1 1130	0 7280	0 9359	0 9513
Mar-96	127 8	63 5	1 1191	0 7744	0 9605	0 9743
Apr-96	129 1	74 7	1 1305	0 9110	1 0295	1 0383
May-96	135 0	72 0	1.1821	0 8780	1 0423	1 0544
Jun-96	137 5	62 8	1 2040	0 7659	1 0025	1 0200
Jul-96	136 0	64 3	1 1909	0 7841	1 0038	1 0201
Aug-96	136 2	66 5	1.1926	0 8110	1 0171	1 0323
Sep-96	136 2	73 4	1 1926	0 8951	1 0558	1 0677
Oct-96	131 2	79 7	1 1489	0 9720	1 0675	1 0746
Nov-96	127 1	76 5	1 1130	0 9329	1 0301	1 0373
Dec-96	127 7	76 1	1 1182	0 9280	1 0307	1 0383
Jan-97	128 3	73 7	1 1235	0 8988	1 0201	1 0291
Feb-97	128 1	72 3	1 1217	0 8817	1 0113	1 0209
Mar-97	128 2	65 2	1.1226	0 7951	0 9720	0 9851
Apr-97	127 3	65 3	1 1147	0 7963	0 9683	0 9810

Calculation of Energy Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3 2
Using Regional Indices SERIES ID WPU0573 Light Fuel Oils (as of 03/06/03) and WPU0543 Industrial Electric Power (as of 03/06/03)

			REBASED TO 1986 = 100			
	PPI for Fuels & Related Products (1982 = 100) (P) =Industrial Energy Power	PPI for Light Fuel Oils (1982=100) (F) = Light Fuel Oils	PPI for Fuels & Related Products (1986 = 100) (P) =Industrial Energy Power BWR wt = 0 54	PPI for Light Fuel Oils (1986=100) (F) = Light Fuel Oils BWR wt = 0 46	Energy Escalation Factor (E) for BWR (Humboldt)	Energy Escalation Factor (E) for PWR (Diablo Canyon)
May-97	129 7	64 2	1 1357	0 7829	0 9734	0 9876
Jun-97	135 1	60 8	1 1830	0 7415	0 9799	0 9976
Jul-97	135 9	57 8	1 1900	0 7049	0 9669	0 9863
Aug-97	134 7	61 5	1 1795	0 7500	0 9819	0 9991
Sep-97	136 0	60 4	1 1909	0 7366	0 9819	1 0001
Oct-97	130 1	64 8	1 1392	0 7902	0 9787	0 9927
Nov-97	127 9	65 8	1 1200	0 8024	0 9739	0 9866
Dec-97	128 3	59 4	1 1235	0 7244	0 9399	0 9559
Jan-98	127 4	54 1	1 1156	0 6598	0 9059	0 9241
Feb-98	127 2	52 0	1 1138	0 6341	0 8932	0 9124
Mar-98	126 7	48 3	1 1095	0 5890	0 8701	0 8909
Apr-98	126 4	50 2	1 1068	0 6122	0 8793	0 8991
May-98	129 2	50 0	1 1313	0 6098	0 8914	0 9123
Jun-98	133 8	46 3	1 1716	0 5646	0 8924	0 9167
Jul-98	134 8	45 0	1 1804	0 5488	0 8898	0 9151
Aug-98	135 2	44 0	1 1839	0 5366	0 8861	0 9120
Sep-98	135 2	48 3	1 1839	0 5890	0 9103	0 9340
Oct-98	130 4	47 4	1 1419	0 5780	0 8825	0 9051
Nov-98	127 6	46 2	1.1173	0 5634	0 8625	0 8847
Dec-98	126 6	38 8	1 1086	0 4732	0 8163	0 8417
Jan-99	126 1	40 9	1 1042	0 4988	0 8257	0 8499
Feb-99	125 5	38 2	1 0989	0 4659	0 8077	0 8330
Mar-99	125 5	42 8	1 0989	0 5220	0 8335	0 8566
Apr-99	125 2	52 5	1 0963	0 6402	0 8865	0 9048
May-99	127 4	52 6	1 1156	0 6415	0 8975	0 9165
Jun-99	131 0	52 4	1 1471	0 6390	0 9134	0 9337
Jul-99	133 9	58 7	1 1725	0 7159	0 9624	0 9807
Aug-99	133 9	63	1 1725	0 7683	0 9866	1 0027
Sep-99	134 1	67 6	1 1743	0 8244	1 0133	1 0273
Oct-99	129 5	65 5	1 1340	0 7988	0 9798	0 9932
Nov-99	127 5	71 3	1 1165	0 8695	1 0029	1 0127
Dec-99	126 5	72 9	1 1077	0 8890	1 0071	1 0159
Jan-00	126 8	75 3	1 1103	0 9183	1 0220	1 0297
Feb-00	126 7	87 9	1 1095	1 0720	1 0922	1 0937
Mar-00	126 7	89 7	1 1095	1 0939	1 1023	1.1029
Apr-00	126 8	83 1	1 1103	1 0134	1 0658	1 0696
May-00	128 6	82 9	1 1261	1 0110	1 0731	1 0777
Jun-00	133 6	86 2	1 1699	1 0512	1 1153	1 1200
Jul-00	136 2	88 7	1 1926	1 0817	1 1416	1 1461
Aug-00	137 4	91 6	1 2032	1 1171	1 1636	1.1670
Sep-00	137 8	110 1	1 2067	1 3427	1 2692	1 2638
Oct-00	134 1	108 6	1 1743	1 3244	1 2433	1 2373
Nov-00	130 9	108 4	1 1462	1 3220	1 2271	1 2200
Dec-00	132 7	100 6	1 1620	1 2268	1 1918	1 1892
Jan-01	136 4	96 1	1 1944	1 1720	1 1841	1 1850
Feb-01	136 4	91 6	1 1944	1 1171	1 1588	1 1619

Calculation of Energy Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3 2
Using Regional Indices SERIES ID WPU0573 Light Fuel Oils (as of 03/06/03) and WPU0543 Industrial Electric Power (as of 03/06/03)

			REBASED TO 1986 = 100			
	PPI for Fuels & Related Products (1982 = 100) (P) =Industrial Energy Power	PPI for Light Fuel Oils (1982=100) (F) = Light Fuel Oils	PPI for Fuels & Related Products (1986 = 100) (P) =Industrial Energy Power BWR wt = 0 54	PPI for Light Fuel Oils (1986=100) (F) = Light Fuel Oils BWR wt = 0 46	Energy Escalation Factor (E) for BWR (Humboldt)	Energy Escalation Factor (E) for PWR (Diablo Canyon)
Mar-01	136 5	83 1	1 1953	1 0134	1 1116	1 1189
Apr-01	135 1	86 2	1 1830	1 0512	1.1224	1 1277
May-01	136 2	94 2	1 1926	1 1488	1 1725	1.1742
Jun-01	148 4	90 2	1 2995	1 1000	1 2077	1 2157

Calculation of Labor Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3.1
Using Regional Indices SERIES ID: EDU 13402i (as of 03/06/03)
Jan '86 adjusted to reflect NUREG 1307 Rev 10 Scaling Factor for West Labor (Pg 7)

	Employment Cost Indust West Region Private Industry (1989=100)	Labor Escalation Factor
Jan-86	89.8	1.00000
Feb-86		
Mar-86		
Apr-86	90.8	1.01114
May-86		
Jun-86		
Jul-86	91.2	1.01559
Aug-86		
Sep-86		
Oct-86	91.6	1.02004
Nov-86		
Dec-86		
Jan-87	92.5	1.03007
Feb-87		
Mar-87		
Apr-87	92.6	1.03118
May-87		
Jun-87		
Jul-87	93.7	1.04343
Aug-87		
Sep-87		
Oct-87	94.1	1.04788
Nov-87		
Dec-87		
Jan-88	95.4	1.06236
Feb-88		
Mar-88		
Apr-88	96.3	1.07238
May-88		
Jun-88		
Jul-88	97	1.08018
Aug-88		
Sep-88		
Oct-88	97.7	1.08797
Nov-88		
Dec-88		
Jan-89	98.8	1.10022
Feb-89		
Mar-89		
Apr-89	100	1.11359
May-89		
Jun-89		

Calculation of Labor Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3.1
Using Regional Indices SERIES ID: EDU 13402i (as of 03/06/03)
Jan '86 adjusted to reflect NUREG 1307 Rev 10 Scaling Factor for West Labor (Pg 7)

	Employment Cost Indust West Region Private Industry (1989=100)	Labor Escalation Factor
Jul-89	101	1.12472
Aug-89		
Sep-89		
Oct-89	101.8	1.13363
Nov-89		
Dec-89		
Jan-90	103.3	1.15033
Feb-90		
Mar-90		
Apr-90	104.5	1.16370
May-90		
Jun-90		
Jul-90	105.6	1.17595
Aug-90		
Sep-90		
Oct-90	106.3	1.18374
Nov-90		
Dec-90		
Jan-91	107.5	1.19710
Feb-91		
Mar-91		
Apr-91	108.9	1.21269
May-91		
Jun-91		
Jul-91	110	1.22494
Aug-91		
Sep-91		
Oct-91	110.9	1.23497
Nov-91		
Dec-91		
Jan-92	111.9	1.24610
Feb-92		
Mar-92		
Apr-92	112.9	1.25724
May-92		
Jun-92		
Jul-92	114.1	1.27060
Aug-92		
Sep-92		
Oct-92	114.9	1.27951
Nov-92		
Dec-92		

Calculation of Labor Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3.1
Using Regional Indices SERIES ID: EDU 13402i (as of 03/06/03)
Jan '86 adjusted to reflect NUREG 1307 Rev 10 Scaling Factor for West Labor (Pg 7)

	Employment Cost Indust West Region Private Industry (1989=100)	Labor Escalation Factor
Jan-93	116.2	1.29399
Feb-93		
Mar-93		
Apr-93	116.4	1.29621
May-93		
Jun-93		
Jul-93	117.8	1.31180
Aug-93		
Sep-93		
Oct-93	118.1	1.31514
Nov-93		
Dec-93		
Jan-94	119.4	1.32962
Feb-94		
Mar-94		
Apr-94	120.5	1.34187
May-94		
Jun-94		
Jul-94	121.3	1.35078
Aug-94		
Sep-94		
Oct-94	121.7	1.35523
Nov-94		
Dec-94		
Jan-95	122.6	1.36526
Feb-95		
Mar-95		
Apr-95	123.4	1.37416
May-95		
Jun-95		
Jul-95	123.9	1.37973
Aug-95		
Sep-95		
Oct-95	125	1.39198
Nov-95		
Dec-95		
Jan-96	125.9	1.40200
Feb-96		
Mar-96		
Apr-96	127.3	1.41759
May-96		
Jun-96		

Calculation of Labor Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3.1
Using Regional Indices SERIES ID: EDU 13402i (as of 03/06/03)
Jan '86 adjusted to reflect NUREG 1307 Rev 10 Scaling Factor for West Labor (Pg 7)

	Employment Cost Indust West Region Private Industry (1989=100)	Labor Escalation Factor
Jul-96	128.3	1.42873
Aug-96		
Sep-96		
Oct-96	128.9	1.43541
Nov-96		
Dec-96		
Jan-97	130.3	1.45100
Feb-97		
Mar-97		
Apr-97	131.4	1.46325
May-97		
Jun-97		
Jul-97	132.5	1.47550
Aug-97		
Sep-97		
Oct-97	133.4	1.48552
Nov-97		
Dec-97		
Jan-98	135.2	1.50557
Feb-98		
Mar-98		
Apr-98	136.6	1.52116
May-98		
Jun-98		
Jul-98	138.5	1.54232
Aug-98		
Sep-98		
Oct-98	140	1.55902
Nov-98		
Dec-98		
Jan-99	140.3	1.56236
Feb-99		
Mar-99		
Apr-99	142.1	1.58241
May-99		
Jun-99		
Jul-99	143.3	1.59577
Aug-99		
Sep-99		
Oct-99	144.7	1.61136
Nov-99		
Dec-99		

Calculation of Labor Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3.1
Using Regional Indices SERIES ID: EDU 13402i (as of 03/06/03)
Jan '86 adjusted to reflect NUREG 1307 Rev 10 Scaling Factor for West Labor (Pg 7)

	Employment Cost Indust West Region Private Industry (1989=100)	Labor Escalation Factor
Jan-00	147	1.63697
Feb-00		
Mar-00		
Apr-00	148.8	1.65702
May-00		
Jun-00		
Jul-00	150.8	1.67929
Aug-00		
Sep-00		
Oct-00	151.8	1.69042
Nov-00		
Dec-00		
Jan-01	154.3	1.71826
Feb-01		
Mar-01		
Apr-01	156	1.73719
May-01		
Jun-01		
Jul-01	157.6	1.75501
Aug-01		
Sep-01		
Oct-01	159.4	1.77506
Nov-01		
Dec-01		
Jan-02	160.4	1.78619
Feb-02		
Feb-02		
Mar-02		
Apr-02	162.9	1.81403
May-02		
Jun-02		
Jul-02	163.8	1.82405
Aug-02		
Sep-02		
Oct-02	165	1.83742
Nov-02		
Dec-02		
Jan-03	166.2	1.85078

Calculation of Labor Escalation Factor - REFERENCE NUREG-1307, REVISION 10, SECTION 3.1
Using Regional Indices SERIES ID: EDU 13402i (as of 03/06/03)
Jan '86 adjusted to reflect NUREG 1307 Rev 10 Scaling Factor for West Labor (Pg 7)

Employment Cost Indust West Region Private Industry (1989=100)	Labor Escalation Factor

Jan-03 is an estimate based on the difference between Jul-02 and Oct-02

Development of Burial Escalation
Developed from NUREG-1307 Revision 9
Table 2.1 "VALUES OF B SUB-X AS A FUNCTION OF LLW BURIAL SITE, WASTE VENDOR, AND YEAR" (Summary for non-Atlantic Compact)

	BWR Burial Costs (South Carolina)	**BWR Restated to 1986 = 100**	PWR Burial Costs (South Carolina)	**PWR Restated to 1986 = 100**
1986	1.561	1.0000	1.678	1.0000
1987				
1988	1.831	1.1730	2.007	1.1961
1989				
1990				
1991	2.361	1.5125	2.494	1.4863
1992				
1993	9.434	6.0436	11.408	6.7986
1994	9.794	6.2742	11.873	7.0757
1995	11.42	7.3158	12.824	7.6424
1996	10.379	6.6489	12.771	7.6108
1997	13.837	8.8642	15.852	9.4470
1998	13.948	8.9353	15.886	9.4672
1999		0.0000		0.0000
2000	16.244	10.4061	18.129	10.8039
2001		0.0000		0.0000
2002	16.705	10.7015	18.732	11.1633
2003	16.936	10.8491	19.034	11.3430

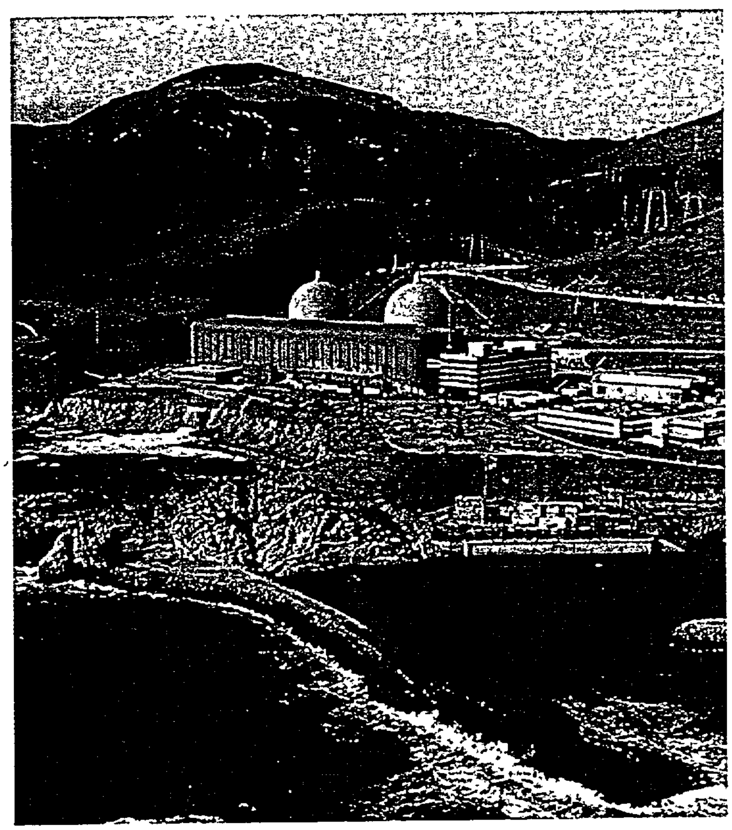
2003 has no information in NUREG-1307 Rev 10. 2003 is an estimate that is calculated by applying the average % change between 2000 and 2002 to the 2002 base.

Enclosure 4
PG&E Letter DCL-03-035
HBL-03-002

Decommissioning Cost Study for the Diablo Canyon Power Plant Units 1 and 2

Document No. P01-1421-003, Rev. 0

DECOMMISSIONING COST STUDY
for the
DIABLO CANYON POWER PLANT
UNITS 1 AND 2



prepared for

Pacific Gas & Electric Company

prepared by

TLG Services, Inc.
Bridgewater, Connecticut

February 2002

APPROVALS

Project Engineer	Benjamin J. Stochmal	2/12/02 Date
Project Manager	Geoffrey M. Griffiths	2/12/02 Date
Technical Manager	William A. Cloutier	2/12/02 Date
Quality Assurance Manager	Carolyn A. Palmer	2/12/2002 Date

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

SECTION PAGE

TABLES

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

FIGURES

APPENDICES

REVISION LOG

No.	CRA No.	Date	Item Revised	Reason for Revision
0		02/12/02		Original Issue

EXECUTIVE SUMMARY

This study, prepared for Pacific Gas & Electric Company (PG&E) by TLG Services, Inc., evaluates two different decommissioning alternatives for the Diablo Canyon Power Plant (DCPP) following the final cessation of plant operations. The projected costs to decommission the station are estimated at approximately $1,377.2 million and $1,363.0 million for the DECON and SAFSTOR alternatives, respectively. For each of these alternatives, the major cost contributors to the overall decommissioning cost are labor, spent fuel management, radioactive waste disposal, and other removal related activities (e.g. engineering, support equipment). The costs are based on several key assumptions, including regulatory requirements, estimating methodology, contingency requirements, low-level radioactive waste disposal availability, high-level radioactive waste disposal options, and site restoration requirements. A complete discussion of the assumptions used in this estimate is presented in Section 3.

A detailed breakdown of the major cost contributors to the decommissioning cost estimate is reported in Section 6. Cost and schedule summaries are reported at the end of this summary. Schedules of annual expenditures are provided in Section 3, with the detailed activity costs, waste volumes, and removal man-hours provided in the Appendices. Costs are reported in 2002 dollars. Both cost estimates include the continued operation of the Fuel Handling Building's fuel storage pools as an interim wet fuel storage facility until the year 2033 and 2037 (approximately twelve years after each unit's license expiration.) In addition, the estimates include the costs to expand the site Independent Spent Fuel Storage Installation (ISFSI) to accommodate the inventory of spent fuel located on site. This ISFSI is expected to operate until the year 2040.

Alternatives and Regulations

The Nuclear Regulatory Commission (NRC) provided general decommissioning guidance in the rule adopted on June 27, 1988.[1] In this rule the NRC set forth technical and financial criteria for decommissioning licensed nuclear facilities. The regulations addressed planning needs, timing, funding methods, and environmental review requirements for decommissioning. The rule also defined three decommissioning alternatives as being acceptable to the NRC - DECON, SAFSTOR, and ENTOMB.

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1 U.S. Code of Federal Regulations, Title 10, Parts 30, 40, 50, 51, 70 and 72 "General Requirements for Decommissioning Nuclear Facilities," Nuclear Regulatory Commission, Federal Register Volume 53, Number 123 (p 24018 et seq.), June 27, 1988.

DECON was defined as "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations." [2]

SAFSTOR was defined as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." [3] Decommissioning is required to be completed within 60 years, although longer time periods will be considered when necessary to protect public health and safety. The safe-storage period evaluated in this document defers decommissioning 30 years.

ENTOMB was defined as "the alternative in which radioactive contaminants are encased in a structurally long-lived material, such as concrete; the entombed structure is appropriately maintained and continued surveillance is carried out until the radioactive material decays to a level permitting unrestricted release of the property." [4] As with the SAFSTOR alternative, decommissioning is currently required to be completed within 60 years, although longer time periods will also be considered when necessary to protect public health and safety.

The 60-year restriction has limited the practicality of the ENTOMB alternative at commercial reactors that generate significant amounts of long-lived radioactive material. However, the NRC is currently re-evaluating this option and the technical requirements and regulatory actions that would be necessary for entombment to become a viable option.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The amendments allow for greater public participation and better definition of the transition process from operations to decommissioning. Regulatory Guide 1.184, issued in July 2000, further describes the methods and procedures that are acceptable to the NRC staff for implementing the requirements

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2 Ibid. Page FR24022, Column 3.

3 Ibid.

4 Ibid. Page FR24023, Column 2.

of the 1996 revised rule that relate to the initial activities and the major phases of the decommissioning process. The costs and schedules presented in this estimate follow the general guidance and sequence in the amended regulations.

Methodology

The methodology used to develop the decommissioning cost estimates for DCPP follows the basic approach originally presented in the cost estimating guidelines [5] developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference describes a unit cost factor method for estimating decommissioning activity costs. The unit cost factors used in this study reflect site-specific costs and the latest available information about worker productivity in decommissioning. The information obtained from the Shippingport Station Decommissioning Project, completed in 1989, as well as from TLG's involvement in the decommissioning planning and engineering for the Shoreham, Yankee Rowe, Trojan, Rancho Seco, Pathfinder, Big Rock Point, Maine Yankee, and Cintichem reactor facilities, is reflected within this estimate.

An activity duration critical path is used to determine the total decommissioning program schedule required for calculating the carrying costs. These costs include program management, administration, field engineering, equipment rental, quality assurance, and security. Such a systematic approach for assembling decommissioning estimates has ensured a high degree of confidence in the reliability of the resulting costs.

Contingency

Consistent with industry practice, contingencies are applied to the decontamination and dismantling costs developed as, "specific provision for unforeseeable elements of cost within the defined project scope, particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur."[6] The cost elements in this estimate are based on ideal conditions; therefore, the types of unforeseeable events that are almost certain to occur in decommissioning, based on industry experience, are addressed through a percentage contingency applied on a line-item basis. This contingency factor is a nearly universal element in all large-scale construction and demolition projects. It should be noted that contingency, as used in this estimate, does not

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5 T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

6 Project and Cost Engineers' Handbook, Second Edition, American Association of Cost Engineers, Marcel Dekker, Inc., New York, New York, p. 239.

account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the units.

The use and role of contingency within decommissioning estimates is not a safety factor issue. Safety factors provide additional security and address situations that may never occur. Contingency funds, by contrast, are expected to be fully expended throughout the program. Inclusion of contingency is necessary to provide assurance that sufficient funding will be available to accomplish the intended tasks.

Low-Level Radioactive Waste Disposal

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is classified as low-level radioactive waste, although not all of the material is suitable for "shallow-land" disposal. With the passage of the "Low-Level Radioactive Waste Disposal Act" in 1980, and its Amendments of 1985 [7], the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. Consequently, low-level radioactive waste generated in the decontamination and dismantling of PG&E's nuclear generating units is destined for the Southwest Compact's future disposal site.

For purposes of constructing the decommissioning cost estimates, an assumed unit burial rate of $5.05 per pound was used to calculate the cost for disposal of low-level radioactive waste generated in the decontamination and dismantling of DCPP. This rate is derived from the disposal rates charged at the Barnwell low-level waste disposal facility for non-Atlantic compact generators.

High-Level Waste

Congress passed the "Nuclear Waste Policy Act" [8] in 1982, assigning the responsibility for disposal of spent nuclear fuel created by the commercial nuclear generating plants to the DOE. This legislation also created a Nuclear Waste Fund to cover the cost of the program, which is funded by the sale of electricity from nuclear reactors, and an estimated equivalent value of assemblies irradiated prior to April 1983. The Nuclear Waste Policy Act, along with the individual disposal contracts with utilities, specified that the DOE was to begin accepting spent fuel by January 31, 1998.

After several delays, DOE estimates that the geologic repository will not be operational until sometime between the years 2010 and 2015. For the basis of this

[7] "Low-Level Radioactive Waste Policy Amendments Act of 1985," Public Law 99-240, 1/15/86.

[8] "Nuclear Waste Policy Act of 1982 and Amendments," U.S. Department of Energy's Office of Civilian Radioactive Management, 1982.

cost study, PG&E has assumed that the high-level waste repository or some interim storage facility will accept spent fuel from DCPP starting in the year 2018. The backlog of spent fuel in the national inventory, and slow progress in the development of a waste transportation system, make it necessary to include spent fuel storage in the cost and schedule of commercial reactor decommissioning.

Although the cost to dispose of spent fuel assemblies generated during plant operations currently is not considered a decommissioning expense, the presence of those assemblies on site does have a bearing on the cost to decommission. For estimating purposes, a spent fuel storage scenario was developed for DCPP. This scenario assumes that PG&E will have constructed an ISFSI at the plant site to support continued plant operations. It also assumes that the Fuel Handling Buildings at DCPP will be operational for at least 12 years after the cessation of each unit's operations, regardless of the decommissioning mode selected (so as to allow for sufficient cooling for passive storage). For both decommissioning alternatives, the spent fuel assemblies in the storage pools at the cessation of plant operations will be relocated to the ISFSI for storage until such time that a transfer to a DOE or interim storage facility can be completed. Costs are included within the estimates to expand the ISFSI to accommodate the pool inventories at shutdown. By relocating the fuel to the ISFSI, PG&E can secure the wet storage pools and proceed with decommissioning the DCPP. The current PG&E spent fuel storage plan projects that spent fuel will be at Diablo Canyon until the year 2040 for both the DECON and SAFSTOR alternatives.

<u>Site Restoration</u>

The efficient removal of the contaminated materials at the site will result in substantial damage to many of the site structures. Blasting, coring, drilling and the other decontamination activities will substantially damage power block structures, potentially weakening the footings and structural supports. Prompt demolition after license termination is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a work force already mobilized on site is more efficient and less costly than if the process is deferred. Experience at shutdown generating stations has shown that plant facilities quickly degrade without continual maintenance, adding additional expense and creating potential hazards to the public, as well as to the demolition work force. Consequently, this study assumes that site structures will be removed to a nominal depth of three feet below the local grade level. The site will then be graded and stabilized.

DIABLO CANYON UNITS 1 AND 2

COST AND SCHEDULE ESTIMATE SUMMARY

	Cost 02$ (thousand)	Schedule (years)
DECON (Prompt Removal/Dismantling)		
Unit 1	575,843.6	19.2
Unit 2 & Common	801,321.5	16.1
STATION TOTAL	**1,377,165.1** (1)	**19.8** (2)
SAFSTOR (Mothball with Delayed Dismantling)		
Unit 1		
Preparations	56,564.8	1.5
31.62 year Maintenance	188,024.0	31.6
Delayed Dismantling	338,862.0	7.8
Subtotal	**583,450.8**	**40.9**
Unit 2 & Common		
Preparations	58,643.8	1.5
29.3 year Maintenance	162,632.4	29.3
Delayed Dismantling	558,266.6	6.5
Subtotal	**779,542.8**	**37.3**
STATION TOTAL	**1,362,993.6**	**40.9** (3)

(1) Columns may not add due to rounding.
(2) Time elapsed from the cessation of operations at Unit 1 to the completion of the off-site transfer of spent fuel and decommissioning of the ISFSI.
(3) Time elapsed from the cessation of operations at Unit 1 to the completion of site restoration at Unit 2.

1. INTRODUCTION

This analysis is designed to provide Pacific Gas & Electric (PG&E) with sufficient information to prepare financial planning documents required by the Nuclear Regulatory Commission (NRC). It is not a detailed engineering document, but a cost estimate prepared in advance of the detailed engineering preparations required to carry out the decommissioning of Units 1 and 2 of the Diablo Canyon Power Plant (DCPP).

1.1 OBJECTIVE OF STUDY

The objective of this study is to prepare an estimate of the cost, schedule, occupational exposure, and waste volume generated to decommission the DCPP, including all common and supporting facilities. The study considers the integration of two-unit dismantling, as discussed below.

Unit 1 began commercial operation in May 1985, with Unit 2 following in March of 1986. For the purposes of this study, the shutdown dates were taken as 36 years after the date commercial operation, or September 2021 for Unit 1, and 39 years after the date commercial operation for Unit 2, or April 2025. This time frame was used as input for scheduling the decommissioning.

1.2 SITE DESCRIPTION

DCPP is located on the central California coast in San Luis Obispo County, approximately 12 miles west southwest of the City of San Luis Obispo. The plant, comprised of two nuclear units, is located on a 750-acre site adjacent to the Pacific Ocean, roughly equidistant from San Francisco and Los Angeles.

The Nuclear Steam Supply System (NSSS) consists of a pressurized water reactor and a four-loop Reactor Coolant System. The systems were supplied by the Westinghouse Electric Corporation. Units 1 and 2 each have a current license rating of 3411 Mwt, with corresponding net dependable capability electrical ratings of 1087 megawatts (electric), with the reactors at rated power.

The Reactor Coolant System is comprised of the reactor vessel and four heat transfer loops, each containing a vertical U-tube type steam generator, and a single-stage centrifugal reactor coolant pump. In addition, the system includes an electrically heated pressurizer, a pressurizer relief tank, and

interconnected piping. The system is housed within a "containment structure," a seismic Category I reinforced-concrete dry structure. It consists of an upright cylinder topped with a hemispherical dome, supported on a reinforced concrete foundation mat, which is keyed into the bedrock. A welded steel liner plate anchored to the inside face of the containment serves as a leak-tight membrane. The liner on top of the foundation mat is protected by a two-foot thick concrete fill mat, which supports the containment internals and forms the floor of the containment. The lower portion of the containment cylindrical wall has additional embedded wide flange steel beams between elevations 88 ft. 2 in. and 108 ft. 2 in. (mean sea level).

Heat produced in the reactor is converted to electrical energy by the Steam and Power Conversion Systems. A turbine-generator system converts the thermal energy of steam produced in the steam generators into mechanical shaft power and then into electrical energy. The plant's turbine-generators are each tandem compound, four element units. They consist of one high-pressure double-flow and three low-pressure double-flow elements driving a direct-coupled generator at 1800 rpm. The turbines are operated in a closed feedwater cycle these condenses the steam; the heated feedwater is returned to the steam generators. Heat rejected in the main condensers is removed by the Circulating Water System (CWS).

The circulating water system provides the heat sink required for removal of waste heat in the power plant's thermal cycle. The system has the principal function of removing heat by absorbing this energy in the main condenser. Condenser circulating water is water from the Pacific Ocean. Each unit is served by two circulating water pumps at the intake structure. From this structure seawater is pumped through two circulating water conduits to the condenser inlet water boxes. The water is returned to the ocean at Diablo Cove through an outfall at the water's edge.

1.3 REGULATORY GUIDANCE

The NRC provided decommissioning guidance in the rule "General Requirements for Decommissioning Nuclear Facilities," (Ref. 1) published and adopted on June 27, 1988. This rule amended NRC regulations to set forth technical and financial criteria for decommissioning licensed nuclear facilities. The regulation addressed decommissioning planning needs, timing, funding methods, and environmental review requirements. The intent of the rule was to ensure that decommissioning would be accomplished in a safe and timely

manner and that adequate licensee funds would be available for this purpose. Subsequent to the rule, the NRC issued Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," (Ref. 2) which provided guidance to the licensees of nuclear facilities on methods acceptable to the NRC staff for complying with the requirements of the rule. The regulatory guide addressed the funding requirements and provided guidance on the content and form of the financial assurance mechanisms indicated in the rule amendments.

The rule defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR and ENTOMB. It also placed limits on the time allowed to complete the decommissioning process. For SAFSTOR, the process is restricted in overall duration to 60 years unless it can be shown that a longer duration is necessary to protect public health and safety. The guidelines for ENTOMB are similar, providing the NRC with both sufficient leverage and flexibility to ensure that these deferred options are only used in situations where it is reasonable and consistent with the definition of decommissioning. Consequently, with the new restrictions, the SAFSTOR and ENTOMB options are no longer decommissioning alternatives in themselves, as neither terminates the license for the site. At the conclusion of a 60-year dormancy period (or longer for ENTOMB if the NRC approves such a case), the site would still require significant remediation to meet the definition of unrestricted release and license termination.

In 1996 the NRC published revisions to the general requirements for decommissioning nuclear power plants (Ref. 3). When the decommissioning regulations were adopted in 1988, it was assumed that the majority of licensees would decommission at the end of the operating license life. Since that time, several licensees have permanently and prematurely ceased operations without having submitted a decommissioning plan. In addition, these licensees requested exemptions from certain operating requirements as being unnecessary once the reactor is defueled. Each case has been handled individually without clearly defined generic requirements. The NRC amended the decommissioning regulations in 1996 to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The new amendments allow for greater public participation and better definition of the transition process from operations to decommissioning.

Under the revised regulations, licensees would submit written certification to the NRC within 30 days after the decision to cease operations. Certification

would also be required once the fuel were permanently removed from the reactor vessel. Submittal of these notices would entitle the licensee to a fee reduction and eliminate the obligation to follow certain requirements needed only during operation of the reactor. Within two years of submitting notice of permanent cessation of operations, the licensee would be required to submit a Post-Shutdown Decommissioning Activities Report (PSDAR) to the NRC. The PSDAR describes the planned decommissioning activities, the associated sequence and schedule, and an estimate of expected costs. Prior to completing decommissioning, the licensee would be required to submit an application to the NRC to terminate the license, along with a license termination plan.

1.3.1 Nuclear Waste Policy Act

Congress passed the Nuclear Waste Policy Act in 1982 (Ref. 4), assigning the responsibility for disposal of spent nuclear fuel from the commercial generating plants to the Department of Energy (DOE). Two permanent disposal facilities were envisioned, as well as an interim facility. To recover the cost of permanent spent fuel disposal, this legislation created a Nuclear Waste Fund through which money was to be collected from the consumers of the electricity generated by commercial nuclear power plants. The date targeted for startup of the federal Waste Management System was 1998.

After pursuing a national site selection process, the Act was amended in 1987 to designate Yucca Mountain, Nevada, as the only site to be evaluated for geologic disposal of high-level waste. Also in 1987, DOE announced a five-year delay in the opening date for the repository, from 1998 to 2003. Two years later, in 1989, an additional 7-year delay was announced, primarily due to problems in obtaining the required permits from the state of Nevada to perform the required characterization of the site. DOE has projected additional delays as a result of proposed Congressional reductions in appropriations for the program.

Utilities have responded to this impasse by initiating legal action and constructing supplemental storage as a means of maintaining necessary operating margins. On November 14, 1997, the U.S. Court of Appeals for the District of Columbia Circuit issued a decision in Northern States Power Company, et al., v. U.S. Department of Energy. In the decision, the Court reaffirmed its ruling in Indiana Michigan Power Company, et al v. U.S. Department of Energy that the DOE has an unconditional obligation to begin disposal of the utilities' spent nuclear

fuel by January 31, 1998. Since the agency was not in default at the time the Northern States Power decision was issued, the court declined to prescribe "remedies" in the likely event the DOE failed to uphold its obligation. More recently, the U.S. Court of Federal Claims has ruled in favor of Yankee Atomic Power Company in its damage claim. However, even with the ruling, the DOE's position has remained unchanged. The agency continues to maintain that its delayed performance is unavoidable because it does not have an operational repository and does not have authority to provide storage in the interim. Consequently, the DOE has no plans to accept any spent fuel from commercial U.S. reactors before the year 2010.

For purposes of constructing the decommissioning cost estimate, DOE is assumed to begin receiving spent fuel from the DCPP site in the year 2018. It is estimated that the DCPP spent fuel would be completely transferred to DOE by the end of year 2040. These schedules and dates are based upon information provided by PG&E and DOE's capacity and turnover schedule (Ref. 5).

1.3.2 Low-Level Radioactive Waste Policy and Amendments

Congress passed the "Low-Level Radioactive Disposal Act" in 1980, declaring the states as being ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. The federal law encouraged the formation of regional groups or compacts to implement this objective safely, efficiently and economically, and set a target date of 1986. With little progress, the "Amendments Act" of 1985 (Ref. 6) extended the target, with specific milestones and stiff sanctions for non-compliance.

The low-level radioactive waste generated in the decontamination and dismantling of DCPP is destined for the Southwest Compact's future disposal facility. For purposes of constructing the decommissioning cost estimates, an assumed unit burial rate of $5.05 per pound was used to calculate the cost for disposal of low-level radioactive waste generated in the decontamination and dismantling of DCPP. This rate is derived from the disposal rates charged at the Barnwell low-level waste disposal facility for non-Atlantic compact generators.

1.3.3 Radiological Criteria for License Termination

In 1997, 10 CFR 20, Subpart E, "Radiological Criteria for License Termination," (Ref. 7) was published. This subpart provided radiological criteria for releasing a facility for unrestricted use. The regulation provides that the site can be released for unrestricted use if radioactivity levels are such that the average member of a critical group would not receive a Total Effective Dose Equivalent (TEDE) in excess of 25 millirem per year, and provided residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA).

It should be noted that the NRC and the Environmental Protection Agency (EPA) differ on the amount of residual radioactivity considered acceptable in site remediation. The EPA has two limits that apply to radioactive materials. An EPA limit of 15 millirem per year is derived from criteria established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). An additional limit of 4 millirem per year, as defined in 40 CFR Part 141.16, is applied to drinking water.

The Congress has prohibited the EPA from spending funds to enforce cleanup requirements at sites under the jurisdiction of the NRC. However, the mandate is not legally binding and the possibility exists that a site, once released from its NRC license, could be subject to EPA regulation.

2. DECOMMISSIONING ALTERNATIVES

Cost studies were developed to decommission DCPP under two of the NRC-approved decommissioning alternatives: DECON and SAFSTOR. The duration of dormancy (30 years) selected for the SAFSTOR alternative is within the maximum allowable interval (60 years) between cessation of operations and termination of the site license(s). Although the alternatives differ with respect to technique, process, cost, and schedule, the two alternatives attain the same result: removal of all regulated radioactive material from the site and ultimate release of the site for unrestricted and/or alternative use.

The following sections describe the basic activities associated with each alternative. Although detailed procedures for each activity identified are not provided, and the actual sequence of work may vary, these activity descriptions provide a basis not only for estimating, but also for the expected scope of work, i.e., engineering and planning at the time of decommissioning.

2.1 DECON

The DECON alternative, as defined by the NRC, is "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations." This study does not address the cost to dispose of the spent fuel residing at the site; such costs are funded through a surcharge on electrical generation. However, the study does estimate the costs incurred with the interim on-site storage of the fuel pending shipment by the DOE to a disposal facility.

The conceptual approach that the NRC has chosen in its amended regulations is to divide decommissioning into three phases. The initial phase commences with the effective date of permanent cessation of operations and involves the transition of both plant and licensee from reactor operations, i.e., power production, to facility de-activation and closure. During the first phase, notification is to be provided to the NRC certifying the permanent cessation of operations and the removal of fuel from the reactor vessel. The licensee would then be prohibited from reactor operation.

The second phase encompasses activities during the storage period or during major decommissioning activities, or a combination of the two. The third phase pertains to the activities involved in license termination. TLG's methodology

divides the decommissioning project into periods, based upon major milestones in the project. The NRC's initial phase corresponds to TLG's Period 1, with phases two and three as subsets of Period 2. TLG's Period 3, Site Restoration, and Post-Period 3, ISFSI Operations and Decommissioning, have no corresponding NRC phases. However, the NRC does require licensees to have a funding and high-level waste management plan under 10 CFR §50.54(bb).

2.1.1 Period 1 - Preparations

In anticipation of the cessation of plant operations, detailed preparations are undertaken to provide a smooth transition from plant operations to site decommissioning. The organization required to manage the intended decommissioning activities is assembled from available plant staff and outside resources, as required. Preparations include the planning for permanent defueling of the reactor, revision of technical specifications appurtenant to the operating conditions and requirements, a characterization of the facility and major components, and the development of the PSDAR.

Engineering and Planning

The PSDAR, required before or within two years of the notice to cease operations, provides a description and timetable of the licensee's planned decommissioning activities and the associated financial requirements of the intended decommissioning program. Upon receipt of the PSDAR, the NRC will make the document available to the public for comment in a local hearing to be held in the vicinity of the reactor site. Ninety days following submittal and NRC receipt of the PSDAR, the licensee may begin to perform major decommissioning activities under a modified 10 CFR §50.59 procedure, i.e., without specific NRC approval. Major activities are defined as any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components (for shipment) containing Greater-than-Class C waste (GTCC), as defined by 10 CFR §61. Major components are further defined as comprising the reactor vessel and internals, large bore reactor coolant system piping, and other large components that are radioactive. The NRC includes the following additional criteria for use of the §50.59 process in decommissioning. The proposed activity must not:

- foreclose release of the site for possible unrestricted use,

- significantly increase decommissioning costs,
- cause any significant environmental impact, or
- violate the terms of the licensee's existing license.

Consequently, in conjunction with the development of the PSDAR, activity specifications, cost-benefit and safety analyses, work packages, and procedures must be assembled in support of the proposed decontamination and dismantling activities.

The decommissioning program outlined in the PSDAR will be designed to accomplish the required tasks within the ALARA guidelines (as defined in 10 CFR §20) for protection of personnel from exposure to radiation hazards. It will also address the continued protection of the health and safety of the public and the environment during the dismantling activity.

The NRC recognizes that the existing operational technical specifications will require review and modifications to reflect plant conditions and the safety concerns associated with permanent cessation of operations. The environmental impact associated with the planned decommissioning activities must also be considered. A licensee will not be allowed to proceed if the consequences of a particular decommissioning activity are greater than bounded by previously issued environmental assessments or impact statements. In this instance, the licensee would have to submit a license amendment for the specific activity and update the environmental report.

Much of the work in preparing the PSDAR is also relevant to the development of the detailed engineering plans and procedures. This work includes, but is not limited to:

- Site preparation plans for the proposed decommissioning activities;
- Detailed procedures and removal sequences for plant systems and components;
- Evaluation of the disposition alternatives for the reactor vessel and its internals;
- Plans for decontamination of structures and systems;

- Design/procurement and testing of tooling and equipment;
- Identification/selection of specialty contractors;
- Procedures for removing and disposing of radioactive materials; and
- Sequential planning of activities to minimize conflicts with simultaneous tasks.

Site Preparations

Following final plant shutdown and in preparation for actual decommissioning activities, the following activities are initiated.

- Prepare site support and storage facilities, as required.
- Perform site characterization study to determine extent of site contamination.
- Isolate spent fuel storage services and fuel handling systems located in the Fuel Handling Buildings from the power block such that decommissioning operations can commence on the balance of the plant. This activity may be carried out by existing plant personnel in accordance with existing operating technical specifications. Decommissioning operations are assumed to be scheduled around the Fuel Handling Buildings to the greatest extent possible such that the overall project schedule is optimized. Current dry storage cask designs are licensed for spent fuel with a core discharge decay time averaging approximately five years or longer. Considering the longer fuel cycles and higher fuel burnup, the fuel at DCPP may require up to twelve years of active cooling before being relocated to dry storage. Therefore, decommissioning operations for the Fuel Handling Buildings cannot be expected to begin prior to twelve years after the cessation of plant operations. As spent fuel decays to the point that it meets the heat load criteria of the dry storage casks, it will be transferred either to the on-site ISFSI or to the DOE high-level waste repository. It is assumed that all fuel is transferred from the Fuel Handling Buildings within approximately 12 years after cessation of operations at each unit.
- Clean all plant areas of loose contamination and process all liquid and solid wastes.

- Conduct radiation surveys of work areas, major components (including the reactor vessel and its internals), sampling of internal piping contamination levels, and primary shield cores.

- Correlate survey data and normalize for development of packaging and transportation procedures.

- Determine transport and disposal container requirements for activated materials and/or hazardous materials, including shielding and stabilization. Fabricate or procure such containers.

- Develop procedures for occupational exposure control, control and release of liquid and gaseous effluent, processing of radwaste including Dry Active Waste (DAW), resins, filter media, metallic and non-metallic components generated in decommissioning, site security and emergency programs, and industrial safety.

Following submittal of the PSDAR and certification of permanent fuel removal from the reactor vessel, the licensee may commence major decommissioning activities. Full access to the decommissioning fund will require the preparation of a detailed site-specific cost estimate for submittal to the NRC. In addition, a license termination plan must be prepared at least two years prior to the license termination date.

2.1.2 Period 2 - Decommissioning Operations & License Termination

For the DECON alternative, significant decommissioning activities involve the following steps:

- Construct temporary facilities and modify existing storage facilities to support the dismantling activities. These may include additional changing rooms and contaminated laundry facilities for increased work force, establishment of laydown areas to facilitate equipment removal and preparation for off-site transfer, upgrading roads to facilitate hauling and transportation, and modifications to the Reactor Building to facilitate access of large/heavy equipment.

- Design and fabricate shielding and contamination control envelopes in support of removal and transportation activities; specify/procure specialty tooling and remotely operated equipment. Modify the refueling canal to support segmentation activities and prepare

rigging for segmentation and extraction of heavy components, including the reactor vessel and its internals.

- Procure required shipping canisters, cask liners, and Industrial Packages (IPs) from suppliers.

- Conduct decontamination of components and piping systems as required to control (minimize) worker exposure. Remove, package, and dispose of all piping and components that are no longer essential to support decommissioning operations.

- Remove control rod drive housings and the head service structure from reactor vessel head and package for controlled disposal.

- Segment reactor vessel closure head and vessel flange for shipment in cask liners. Load overpack liners into shielded casks or place in shielded vans for transport.

- Segment upper internals assembly, including upper support assembly, deep beam weldment, support columns, and upper core plates; package segments in shielded casks. These operations are performed remotely by cutting equipment located underwater in the refueling canal. Package and dispose of items that meet §61 Class C criteria or less.

- Disassemble/segment remaining reactor internals in shielded casks. These internals include core barrel, core baffle/former assembly, thermal shields, lower core plate, and lower core support assembly. The operations are also conducted under water using remotely operated tooling and contamination controls. Package and dispose of items that meet §61 Class C criteria or less.

- Package §61 GTCC components into fuel bundle containers for handling and storage along with the spent fuel assemblies. Transfer fuel bundle containers to the Fuel Handling Buildings or suitable storage location.

- Segment/section the reactor vessel, placing segments into shielded containers. The operation is performed remotely in air using a contamination control envelope. Sections are placed in containers stored under water (for example in an isolated area of the refueling

canal) using a remote or shielded crane. Transport the containers using shielded truck casks.

- Remove the reactor coolant piping and pumps after the vessel water level drops below the elevation of the inlet and outlet nozzles during vessel segmentation. Package the piping in IPs; the reactor coolant pumps are sealed with steel plate so as to serve as their own containers. Ship piping and pumps for controlled disposal.

- Remove systems and associated components as they become non-essential to the vessel removal operation, related decommissioning activities or worker health and safety (e.g., waste collection and processing systems, electrical and ventilation systems, etc.).

- Remove activated concrete biological shield and accessible contaminated concrete (excluding steam generator and pressurizer cubicles). If dictated by the steam generator and pressurizer removal scenarios, remove those portions of the associated cubicles necessary for access and component extraction.

- Remove steam generators and pressurizer for shipment and controlled disposal. Remove steam domes from generators as the diameter exceeds the clearance requirements dictated by rail transport. Weld an end-cap over the exposed tube bundle on the lower shell units. Decontaminate exterior surfaces, as required, and seal-weld openings (nozzles, inspection hatches, and other penetrations). These components can serve as their own burial containers provided that all penetrations are properly sealed and the internal contaminants are stabilized. Add steel shields to those external areas of the steam generator lower shell units to meet transportation limits and regulations. Segment steam generator steam domes to meet individual package restrictions and transport dome segments off site for recycle.

A License Termination Plan is required to be prepared at least two years prior to the anticipated date of license termination. Submitted as a supplement to the FSAR or equivalent, the plan must include: a site characterization, description of the remaining dismantling activities, plans for site remediation, procedures for the final radiation survey, designation of the end use of the site, an updated cost estimate to complete the decommissioning, and any associated environmental concerns. The NRC will notice the receipt of the plan, make the plan

available for public comment, and schedule a local hearing. Plan approval will be subject to any conditions and limitations as deemed appropriate by the NRC. The licensee may then commence with the final remediation of site facilities and services, including:

- Remove steel liners from the refueling canal and containment, including any contaminated canal concrete, and route for controlled disposition.

- Remove contaminated equipment and material from the Auxiliary Building. Remediate until radiation surveys indicate that the structure can be released for unrestricted access.

- Remove contaminated equipment and material from the Fuel Handling Buildings following the transfer of all residual spent fuel to either an onsite storage facility or a federal facility off site. Remediate Fuel Handling Building areas until radiation surveys indicate that the structure can be released for unrestricted access.

- Decontaminate remaining site buildings and facilities with residual contaminants. Remove all remaining low-level radioactive waste along with any remaining hazardous and toxic materials. Material removed in the decontamination and dismantling of the nuclear units will be routed to an on-site central processing area. Material certified to be free of contamination will be released for unrestricted disposition, e.g., as scrap or for recycle or general disposal. Contaminated material will be characterized and segregated for additional on-site decontamination, off-site processing (disassembly, chemical cleaning, volume reduction, waste treatment, etc.) and/or packaged for controlled disposal at the regional low-level radioactive waste disposal facility.

- Remove remaining components, equipment, and plant services in support of the area release survey(s).

- Conduct final radiation survey to ensure that all radioactive materials in excess of permissible residual levels have been remediated. This survey may coincide with final NRC site inspection.

Incorporated into the License Termination Plan, the Final Survey Plan details the radiological surveys to be performed once the decontamination activities are completed. The Final Survey Plan is developed using the guidance provided in NUREG/CR-5849, "Manual

for Conducting Radiological Surveys in Support of License Termination." This document delineates the statistical approaches to survey design and data interpretation used by the EPA. It also identifies state-of-the-art, commercially available instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that survey design and implementation are conducted in a manner that provides a high degree of confidence that applicable NRC criteria are satisfied. Once the survey is complete, the results are provided to the NRC in a format that can be verified.

The NRC then reviews and evaluates the information, performs an independent confirmation of radiological site conditions, and makes a determination on final termination of the license. The NRC will terminate the license if it determines that site remediation has been performed in accordance with the License Termination Plan and that the final radiation survey and associated documentation demonstrate that the facility is suitable for release.

NRC Acceptance Criteria for Decommissioning

NRC's requirements for decommissioning and license termination are contained in §20, Subpart E (Radiological Criteria for License Termination). The NRC's current position on residual contamination criteria, site characterization, and other related decommissioning issues is outlined in an NRC document entitled "Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites," that was published in the Federal Register on April 6, 1993 (57 FR 13389). Through rulemaking, the NRC has established the decommissioning acceptance criteria to be an annual dose of not more than 25 mRem above natural background to an average member of the critical group from all exposure pathways (i.e. direct radiation, inhalation and ingestion). The critical group is defined in §20.1003 as "the group of individuals reasonably expected to receive the greatest exposure to residual reactivity for any applicable set of circumstances."

Other Regulations and Standards Applicable to Decommissioning

- §190, "Environmental Radiation Protection Standards for Nuclear Power Operation" - limits radiation doses to members of the public from radioactive materials introduced into the general environment as the result of operations that are part of the nuclear fuel cycle.

- §20 "Standards for Protection Against Radiation" - regulates the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual does not exceed the radiation protection standards. According to §20.1001, the total dose to an individual includes doses from licensed and unlicensed radioactive material and from radiation sources other than background radiation. In addition, the requirements of §20.1302 apply to NRC-licensed facilities during decommissioning and when the facility is operational. This regulation prohibits licensees from releasing radioactive materials to an unrestricted area in concentrations that exceed the limits specified in §20 or that exceed limits otherwise authorized in an NRC license.

- §50 Appendix I - provides numerical guidance for keeping radioactive materials in liquid and gaseous effluents released to unrestricted areas "as low as reasonably achievable" during normal operations of a nuclear power reactor.

NRC Decommissioning Process and Survey Procedures

NRC licensees are required to conduct radiation surveys of the premises where the licensed activities were conducted and submit a report describing the survey results. The survey process follows requirements contained in §50.82 that pertain to the decommissioning of a site and termination of a license. This process is designed to result in the unrestricted release of a site.

The current decommissioning regulatory process associated with license termination is comprised of the following basic steps:

- Site radiological characterization;

- Development, submission, and NRC review of PSDAR;

- Performance of decommissioning actions described in the PSDAR and leading to the removal of radioactivity from the site;

- Performance of termination surveys and submittal of the final termination survey report;

- Performance of NRC confirmatory survey; and

- NRC termination of the §50 license.

2.1.3 Period 3 - Site Restoration

Following completion of decommissioning operations, site restoration activities may begin. Efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits will result in substantial damage to many of the structures. Blasting, coring, drilling, scarification (surface removal), and the other decontamination activities will substantially damage power block structures including the Reactor, Auxiliary, Fuel Handling and Turbine Buildings. Verifying that subsurface radionuclide concentrations meet NRC site release requirements may require removal of grade slabs and lower floors, potentially weakening footings and structural supports. This removal activity will be necessary for those facilities and plant areas where historical records, when available, indicate the potential for radionuclides having been present in the soil, where system failures have been recorded, or where it is required to confirm that subsurface process and drain lines were not breached over the operating life of the station.

Prompt dismantling of site structures is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures, with a work force already mobilized on site, is more efficient and less costly than if the process were deferred. Site facilities quickly degrade without continual maintenance, adding additional expense and creating potential hazards to the public and future workers. Abandonment creates a breeding ground for vermin infestation as well as other biological hazards.

This cost study presumes that non-essential structures and site facilities will be dismantled as a continuation of the decommissioning activity. Foundations and exterior walls are assumed to be removed to a nominal depth of three feet below grade. This depth of removal allows for clearance of the exposed rebar mats, embedded conduit and piping, and structural steel produced in demolition. The three-foot depth also allows for the placement of both gravel for drainage and topsoil for vegetation to be established as erosion control. Site areas affected by the dismantling activities are cleaned and the plant area graded as required to prevent

ponding and inhibit the refloating of subsurface materials. Activities include:

- Demolition of the remaining portions of the containment structure and interior portions of the Reactor Building. Internal floors and walls are removed from the lower levels upward, using controlled blasting techniques. Concrete rubble and clean fill produced by demolition activities are used on site to backfill voids. Suitable materials can be used on site for fill; other wise the rubble is trucked off site for disposal as construction debris.

- Removal of remaining buildings using conventional demolition techniques for above ground structures, including the Turbine Building, Auxiliary Building, Fuel Handling Buildings, and other site structures, including the Breakwater.

- Preparation of the final dismantling program report.

2.1.4 Post-Period 3 - ISFSI Operations and Demolition

Following the transfer of the spent fuel inventory from the Fuel Handling Buildings, the ISFSI will continue to operate under a separate and independent license (§72). Transfer of spent fuel to a DOE or interim facility will be exclusively from the ISFSI once the fuel pool structures have been emptied and the released for decommissioning. Assuming initiation of the federal Waste Management System in 2010, transfer of spent fuel is assumed to begin in 2018 and continue for a period of approximately 22 years, with the final spent fuel shipment presumed to occur in the year 2040.

At the conclusion of the spent fuel transfer process, the ISFSI will be decommissioned. Long-term exposure from the spent fuel assemblies will have produced low-level neutron activation of the interior surfaces of the dry storage modules to levels exceeding current release limits. Consequently, portions of the modules will be disposed of as low-level radioactive waste.

The NRC will terminate the §72 license if it determines that site remediation has been performed in accordance with a license termination plan and the terminal radiation survey and associated documentation demonstrate that the facility is suitable for release. Once

the requirements are satisfied, the NRC can terminate the license for the ISFSI.

The reinforced concrete dry storage modules are then demolished and disposed of as clean fill, the concrete loading ramps are removed, and the area graded and landscaped to conform with the surrounding environment.

2.2 SAFSTOR

The NRC defines SAFSTOR as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." The facility is left intact, (during the SAFSTOR period) with structures maintained in a sound condition. Systems not required to operate in support of the spent fuel pool or site surveillance and security are drained, de-energized, and secured. Minimal cleaning/removal of loose contamination and/or fixation and sealing of remaining contamination is performed. Access to contaminated areas is secured to provide controlled access for inspection and maintenance.

The engineering and planning requirements are similar to those for the DECON alternative, although a shorter time period is expected for these activities due to the more limited work scope. Site preparations are also similar to those for the DECON alternative. However, with the exception of the required radiation surveys and site characterizations, the mobilization and preparation of site facilities is less extensive.

2.2.1 Period 1 - Operations

In anticipation of the cessation of plant operations, detailed preparations are undertaken to provide a smooth transition from plant operations to site decommissioning. While implementing the staffing transition plan, the organization required to manage the intended decommissioning program is assembled from available plant staff and outside resources. Preparations include the planning for permanent defueling of the reactor, revision of technical specifications appropriate to the operating conditions and requirements, characterization of the facility and major components, and development of the PSDAR.

The program outlined in the PSDAR will be designed to accomplish the required tasks within the ALARA guidelines for protection of personnel

from exposure to radiation hazards. It also addresses the continued protection of the health and safety of the public and the environment.

The NRC recognizes that the existing operational technical specifications will require review and modifications to reflect plant conditions and the safety concerns associated with permanent cessation of operations. The environmental impact associated with the planned decommissioning activities must be considered; an environmental report on those concerns not already assessed must be submitted to the NRC for consideration and possible preparation of an environmental impact statement.

The process of placing the plant into SAFSTOR includes, but is not limited to, the following activities:

- Isolate spent fuel storage services and fuel handling systems located in the Fuel Handling Buildings from the power block so that safe-storage operations may commence on the balance of the plant. This activity may be carried out by plant personnel in accordance with existing operating technical specifications. Activities are assumed to be scheduled around the fuel handling systems to the greatest extent possible. The spent fuel contained within dry storage casks at the time of shutdown will remain in dry storage until shipment to DOE can be completed. All remaining spent fuel on site will continue to be stored in the existing spent fuel pools awaiting pickup by DOE. The existing spent fuel storage facilities will continue to operate until all spent fuel is removed from the site, is currently projected to occur in 2040.

- Drain/de-energize/secure all non-contaminated systems not required to support dormancy operations.

- Dispose of contaminated filter elements and resin beds not required for processing wastes from decontamination activities.

- Drain reactor vessel; internals remain in place.

- Drain/de-energize/secure all contaminated systems. Decontaminate systems as required for future maintenance and inspection.

- Prepare lighting and alarm systems if continued use is required. De-energize and/or secure portions of fire protection, electric power, and HVAC systems if continued use is not required.

- Clean loose surface contamination from building access pathways.
- Perform an interim radiation survey of plant; post warning signs as appropriate.
- Erect physical barriers and/or secure all access to radioactive or contaminated areas, except as required for controlled access, i.e., inspection and maintenance.
- Ship spent fuel to a DOE or intermediate facility - continuously throughout Period 1 and into the dormancy period.
- Install security and surveillance monitoring equipment and relocate security fence around secured structures, as required.

This study assumes that demolition would be delayed for those structures located outside the secured area until after the termination of the license.

2.2.2 Period 2 - Dormancy

The second phase identified by the NRC in its rule addresses licensed activities during a storage period and is applicable to the dormancy phases of the SAFSTOR alternative. After an optional period of storage (such that license termination is accomplished within 60 years of final shutdown), it is required that the licensee submit an application to terminate the license, along with a License Termination plan (described in Section 2.1.2), thereby initiating the third phase.

Activities required during the planned dormancy period include a 24-hour guard force, preventive and corrective maintenance on security systems, area lighting, general building maintenance, heating and ventilation of buildings, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program. The length of the dormancy period selected for each unit is approximately 30 years.

Spent fuel transfers, from the ISFSI to a federal repository, will continue until the year 2040.

Equipment maintenance, inspection activities, and routine service are performed by resident maintenance personnel. This work force will

maintain the structures in a safe condition, provide adequate lighting, heating, and ventilation, and perform periodic preventive maintenance on essential site services.

An environmental surveillance program is carried out during the dormancy period to ensure that potential releases of radioactive material to the environment are detected and controlled. Appropriate emergency procedures are established and initiated for potential releases that exceed prescribed limits. The environmental surveillance program constitutes an abbreviated version of the program in effect during normal plant operations.

Security during the dormancy period is conducted primarily to prevent unauthorized entry and to protect the public from the consequences of its own actions. Security will be provided by the security fence, sensors, alarms, surveillance equipment, etc., which must be maintained in good condition for the duration of this period. Fire and radiation alarms are also to be monitored and maintained. While remote surveillance is an option, it does not offer the immediate response time of a physical presence.

Variations in the length of the dormancy period are expected to have little effect upon the quantities of radioactive wastes generated from system and structure removal operations. While there will be a decrease in the contamination levels present on all surfaces due to radioactive decay over an increased dormancy duration, it is not expected that any material that is non-releasable at the time of shutdown will decay to a releasable state over the permissible time frame (i.e. 60 years maximum). Without detailed contamination characterization-information, it is not possible to make any further assumptions concerning contamination levels.

Given the levels of radioactivity and spectrum of radionuclides expected from 40 years of plant operation, no plant process system identified as being contaminated upon final shutdown will become releasable due to the decay period alone, i.e., there is no significant reduction in waste volume by delaying decommissioning. In fact, SAFSTOR estimates can show a slight increase in the total projected waste volume, due primarily to initial preparation activities for placing the units in safe-storage, as well as from follow-up housekeeping tasks over the caretaking period for the station. Since SAFSTOR does not require system flushes for decontamination purposes, the waste volumes associated with liquid

waste processing have been eliminated. In this case, the cost estimate showed a small decrease in the total low-level waste volume in the SAFSTOR mode relative to DECON.

The delay in decommissioning yields lower working area radiation levels. As such, the difference between the prompt and delayed scenarios is moderated by reduced ALARA controls for the SAFSTOR's lower occupational exposure potential. Because this alternative provides a period of decay for the residual radioactive material, lower radiation fields are encountered than with the DECON alternative. Some of the dismantling activities may employ manual techniques rather than remote procedures. Thus, dismantling operations may be simplified for some tasks. However, this study does not attempt to quantify this effect because it would have an immaterial impact on overall costs.

2.2.3 Periods 3 - 4 Deferred Decommissioning

A License Termination Plan must be prepared at least two years prior to the anticipated date of license termination. Submitted as a supplement to the FSAR or equivalent, the plan must include a site characterization, description of the remaining dismantling activities, plans for site remediation, detailed plans for the final radiation survey, designation of the end-use of the site, an updated cost estimate to complete the decommissioning, and any associated environmental concerns. The NRC will notice the receipt of the plan and make the plan available for public comment. A local hearing will also be scheduled. Plan approval will be subject to any conditions and limitations deemed appropriate by the NRC. The licensee may then commence with the final remediation of site facilities and plant services.

Although the initial radiation levels due to ^{60}Co will decrease significantly during the dormancy period, the internal components of the reactor vessel will still exhibit sufficiently high radiation dose rates to require remote sectioning under water due to the presence of long-lived radionuclides such as ^{94}Nb and ^{59}Ni. Therefore, the dismantling procedures described for the DECON alternative would still be employed during SAFSTOR. Portions of the biological shield will still be radioactive due to the presence of activated trace elements with long half-lives (^{152}Eu and ^{154}Eu). Decontamination will require controlled removal and disposal. It is assumed that radioactive corrosion products on inner surfaces of piping and components will not have decayed to levels that will permit unrestricted use or allow conventional removal.

These systems and components are surveyed as they are removed and disposed of in accordance with the existing radioactive release criteria.

Prior to the commencement of decommissioning operations, preparations are undertaken to reactivate site services and prepare for decommissioning. Preparations include engineering and planning, a detailed site characterization, and the assembly of a decommissioning management organization. Final planning for activities and writing of activity specifications and detailed procedures are also initiated at this time.

Much of the work in developing a License Termination Plan is relevant to the development of the detailed engineering plans and procedures. The activities associated with this phase, as well as the follow-on decontamination and dismantling processes, are detailed in Sections 2.1.1 and 2.1.2. The primary difference between the sequences anticipated for the DECON and SAFSTOR scenarios is the absence, in the latter, of any constraint on the availability of the Fuel Handling Buildings for decommissioning. The timing for the SAFSTOR scenario is such that the spent fuel inventory has been removed from the site prior to the initiation of decontamination and dismantling activities, eliminating a significant scheduling hindrance. Any GTCC material generated in the segmentation of the reactor vessel internals is assumed to be directly routed to DOE's geological facility, without the need to provide for interim storage on site.

2.2.4 Period 5 - Site Restoration

For the SAFSTOR alternative, the site restoration activities are the same as those for DECON Period 3, without restriction on the availability of the ISFSI for dismantling and demolition.

3. COST ESTIMATE

The DCPP cost estimate accounts for the unique features of the site, including the primary coolant system, electric power generation systems, site buildings, and structures. The basis of the estimate and its sources of information, methodology, site-specific considerations, assumptions and total costs are described in this section.

3.1 BASIS OF ESTIMATE

A site-specific cost estimate was developed using drawings and plant documents provided by PG&E. Components were inventoried from the mechanical and electrical Piping & Instrument Diagrams (P&ID). Structural drawings and design documents were used to analyze the general arrangement of the facility and to determine estimates of building concrete volumes, steel quantities, numbers and sizes of major components, and areas of the plant to be addressed in remediation of the site.

Representative labor rates for each designated craft and salaried worker were provided by PG&E for use in construction of the unit removal factors, as well as for estimating the carrying costs for site management, worker supervision, and essential support services, e.g., health physics and security.

For purposes of constructing the decommissioning cost estimate, an assumed unit burial rate of $5.05 per pound was used to calculate the cost for disposal of low-level radioactive waste generated in the decontamination and dismantling of DCPP. This rate is derived from the disposal rates charged at the Barnwell low-level waste disposal facility for non-Atlantic compact generators.

3.2 METHODOLOGY

The methodology used to develop this cost estimate follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," (Ref. 8) and the US DOE "Decommissioning Handbook" (Ref. 9). These references utilize a unit cost factor method for estimating decommissioning activity costs, which simplifies the estimating calculations. Unit cost factors for concrete removal ($/cubic yard), steel removal ($/ton), and cutting costs ($/inch) were developed from the labor cost information provided by PG&E. The

activity-dependent costs are estimated with the item quantities (cubic yards, tons, inches, etc.) developed from plant drawings and inventory documents.

The unit cost factors used in this study reflect the latest available information about worker productivity in decommissioning, including the Shippingport Station Decommissioning Project completed in 1989, as well as from TLG's involvement in the decommissioning planning and engineering for the Shoreham, Yankee Rowe, Big Rock Point, Maine Yankee, Oyster Creek, Trojan, Rancho Seco, Pathfinder, and Cintichem reactor facilities.

An activity duration critical path was used to determine the total decommissioning program schedule. The program schedule is used to determine the period-dependent costs for program management, administration, field engineering, equipment rental, quality assurance, and security. The study used typical salary and hourly rates for personnel associated with period-dependent costs for the region in which the station is located. Some of the costs for removal of radioactive components/structures were based on information obtained from the "Building Construction Cost Data," published by R. S. Means (Ref. 10). Examples of unit cost factor development are presented in the AIF/NESP-036 study. Appendix A presents the detailed development of a typical site-specific unit cost factors. Appendix B provides the values contained within one set of factors developed for the DCPP analyses.

The unit cost factor method provides a demonstrable basis for establishing reliable cost estimates. The detail of activities provided in the unit cost factors for activity time, labor costs (by craft), and equipment and consumable costs provide assurance that cost elements have not been omitted. These detailed unit cost factors, coupled with the plant-specific inventory of piping, component, and structures, provide a high degree of confidence in the reliability of the cost estimates.

3.3 FINANCIAL COMPONENTS OF THE COST MODEL

TLG's proprietary decommissioning cost model, DECCER, is composed of a number of distinct cost line items. These direct expenditures, however, do not compose the total cost to accomplish the project goal, i.e., license termination and site restoration.

Inherent in any cost estimate that does not rely on historical data is the inability to specify the precise source of costs imposed by factors such as tool

breakage, accidents, illnesses, weather delays, and labor stoppages. In the DECCER cost model, contingency fulfills this role. Contingency is added to each line item to account for costs that are difficult or impossible to develop analytically. Such costs are historically inevitable over the duration of a job of this magnitude; therefore, this cost analysis includes monies to cover these types of expenses. The allotment of these monies is discussed further herein.

In addition to the routine uncertainties that contingency addresses, another cost element that is sometimes necessary to consider when bounding decommissioning costs relates to uncertainty, or risk. Examples can include changes in work scope, pricing, job performance, and other variations that could conceivably, but not necessarily, occur. Consideration of these uncertainties is sometimes necessary to generate a level of confidence in the estimate, within a range of probabilities. TLG considers these types of costs under the broad term "financial risk." This cost study, does not add any additional costs to the estimate for financial risk since there is insufficient historical data from which to project future liabilities. Consequently, the areas of uncertainty or risk should be revisited periodically and addressed through repeated revisions or updates of the base estimate.

3.3.1 Contingency

The activity- and period-dependent costs are combined to develop the total decommissioning costs. A contingency is then applied on a line-item basis, using one or more of the contingency types listed in the AIF/NESP-036 study. "Contingencies" are defined in the American Association of Cost Engineers "Project and Cost Engineers' Handbook" (Ref. 11) as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this estimate are based upon ideal conditions and maximum efficiency; therefore, consistent with industry practice, a contingency factor has been applied. In the AIF/NESP-036 study, the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for percentage contingency in each category. It should be noted that contingency, as used in this estimate, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the units.

The use and role of contingency within decommissioning estimates is not a "safety factor issue." Safety factors provide additional security and address situations that may never occur. Contingency funds are expected to be fully expended throughout the program. They also provide assurance that sufficient funding is available to accomplish the intended tasks. Some of the rationale for (and need to incorporate) contingency within any estimate is offered in the following discussion. An estimate without contingency, or from which contingency has been removed, can disrupt the orderly progression of events and jeopardize a successful conclusion to the decommissioning process.

The most technologically challenging task in decommissioning a commercial nuclear station will be the disposition of the reactor vessel and internal components, which have become highly radioactive after a lifetime of exposure to radiation produced in the core. The disposition of these highly radioactive components forms the basis for the critical path (schedule) for decommissioning operations. Cost and schedule are interdependent; any deviation in schedule has a significant impact on the cost for performing a specific activity.

Disposition of the reactor vessel internals involves the underwater cutting of complex components that are highly radioactive. Costs are based upon optimum segmentation, handling, and packaging scenarios. The schedule is primarily dependent upon the turnaround time for the heavily shielded shipping casks, including preparation, loading, and decontamination of the containers for transport. The number of casks required is a function of the pieces generated in the segmentation activity, a value calculated on optimum performance of the tooling employed in cutting the various subassemblies. The risk (uncertainty) associated with this task is that the expected optimization may not be achieved, resulting in delays and additional program costs. For this reason, contingency must be included to mitigate the consequences of the expected inefficiencies inherent in this complex activity, along with related concerns associated with specialty tooling modifications and repairs, field changes, discontinuities in the coordination of plant services, system failure, water clarity, lighting, computer-controlled cutting software corrections, etc. Experience in decommissioning other plants in the past has shown that many of these problem areas have occurred during, and in support of, the segmentation process. Contingency dollars are an integral part of the total cost to complete this task.

Exclusion of this component puts at risk a successful completion of the intended tasks and, potentially, follow-on related activities.

The following list is a composite of some of the activities, assembled from past decommissioning programs, in which contingency dollars were needed to respond to, compensate for, and/or provide adequate funding of decontamination and dismantling tasks:

Incomplete or Changed Conditions:

- Unavailable/incomplete operational history, which led to a recontamination of a work area because a sealed cubicle (incorrectly identified as being non-contaminated) was breached without controls.

- Surface coatings covering contamination, which, due to an incomplete characterization, required additional cost and time to remediate.

- Additional decontamination, controlled removal, and disposition of previously undetected (although at some sites, suspected) contamination due to access gained to formerly inaccessible areas and components.

Adverse Working Conditions:

- Lower than expected productivity due to high temperature environments, resulting in a change in the working hours (shifting to cooler periods of the day) and additional manpower.

- Confined space, low-oxygen environments where supplied air was necessary and additional safety precautions prolonged the time required to perform required tasks.

Maintenance, Repairs and Modifications

- Facility refurbishment required to support site operations, including those needed to provide new site services or to maintain the integrity of existing structures.

- Damage control, repair, and maintenance from birds' nesting and fouling of equipment and controls.

- Building modification, i.e., re-supporting of floors to enhance loading capacity for heavily shielded casks.

- Roadway upgrades on site to handle heavier and wider loads; roadway rerouting, excavation, and reconstruction.

- Requests for additional safety margins by a vendor.

- Requests to analyze accident scenarios beyond those defined by the removal scenario (requested by the NRC to comply with "total scope of regulation").

- Additional collection of site run-off and processing of such due to disturbance of natural site contours and drainage.

- Concrete coring for removal of embedments and internal conduit, piping, and other potentially contaminated material not originally identified as being contaminated.

- Modifications required to respond to higher than expected worker exposure, water clarity, water disassociation, and hydrogen generation from high temperature cutting operations.

- Additional waste containers needed to accommodate cutting particulates (fines), inefficient waste geometries, and excess material.

Labor

- Turnover of personnel, e.g., craft and health physics. Replacement of labor is costly, involving additional training, badging, medical exams, and associated processing procedures. Recruitment costs are incurred for more experienced personnel and can include relocation and living expense compensation.

- Additional personnel required to comply with NRC mandates and requests.

- Replacement of personnel due to non-qualification and/or incomplete certification (e.g., welders).

Schedule

- Schedule slippage due to a conflict in required resources, i.e., the licensee was forced into a delay until prior (non-licensee) commitments of outside resources were resolved.

- Rejection of material by NRC inspectors, requiring refabrication and causing program delays in activities required to be completed prior to decommissioning operations.

Weather

- Weather-related delays in the construction of facilities required to support site operations (with compensation for delayed mobilization made to vendor).

The cost model incorporates considerations for items such as those described above, generating contingency dollars (at varying percentages of total line-item cost) with every activity. The purpose of the contingency is to allow for the costs of high probability program problems occurring in the field where the occurrence, duration, and severity cannot be accurately predicted, and so their associated costs have not been included in the basic estimate. Past decommissioning experience has shown that unforeseeable cost elements are almost certain to occur in the field and may have a cumulative impact. In this study TLG examined the major activity-related problems (decontamination, segmentation, equipment handling, packaging, transport, and waste disposal) that necessitate a contingency. Individual activity contingencies ranged from 10% to 75%, depending on the degree of difficulty judged to be appropriate from TLG's actual decommissioning experience. The contingency values used in this study are as follows.

Decontamination	50%
Contaminated Component Removal	25%
Contaminated Component Packaging	10%
Contaminated Component Transport	15%
Low-Level Radioactive Waste Disposal	25%
Waste Recycling/Recovery	15%
Reactor Segmentation	75%
NSSS Component Removal	25%
Reactor Waste Packaging	25%
Reactor Waste Transport	25%
Reactor Vessel Component Disposal	50%
GTCC Disposal	15%
Non-Radioactive Component Removal	15%
Heavy Equipment and Tooling	15%
Supplies	25%
Engineering	15%
Energy	15%
License Termination Survey	30%
Construction	15%
Taxes and Fees	10%
Insurance	10%
Staffing	15%

3.3.2 Financial Risk

Financial risk refers to the possibility and associated probabilities of certain events occurring that could increase or decrease costs for decommissioning.

Included within the category of financial risk are:

- Delays in approval of the decommissioning plan due to intervention, public participation in local community meetings, legal challenges, or state and local hearings.

- Changes in the project work scope from the baseline estimate, involving the discovery of unexpected levels of contaminants, contamination in places not previously

expected, contaminated soil previously undiscovered (either radioactive or hazardous material contamination), or variations in plant inventory/configuration not indicated by the as-built drawings.

- Regulatory changes, e.g., affecting worker health and safety, site release criteria, waste transportation, or disposal.

- Policy decisions altering federal and state commitments, e.g., the ability to accommodate certain waste forms for disposition, or the adjustment of the timetable for such.

- Pricing changes for basic inputs, such as labor, energy, materials, and burial. Some of these inputs may vary slightly, e.g. -10% to +20%; burial could vary from -50% to +200% or more.

It has been TLG's experience that the results of a risk analysis, when compared with the base case estimate for decommissioning, indicate that the chances of the base decommissioning estimate's being too high is a low probability, and the chances that the estimate is too low is a much higher probability. This is primarily due to the pricing uncertainty for low-level radioactive waste burial, and to a lesser extent due to schedule increases from changes in plant conditions and pricing variations in the cost of labor (both craft and staff). TLG did not perform a risk analysis for the DCPP and therefore the cost estimate does not include any increase in decommissioning costs as a result of risk analysis.

3.4 SITE-SPECIFIC CONSIDERATIONS

There are a number of site-specific considerations that affect the method for dismantling and removal of equipment from the site and the degree of restoration required. The cost impact of these considerations, identified below, are included in this cost study.

3.4.1 Spent Fuel Disposition

For purposes of this cost study, PG&E provided a spent fuel scenario management plan that addressed the storage scenario for both DCPP nuclear units. The PG&E spent fuel disposition scenario assumes that

DOE will begin receipt of spent fuel from DCPP in 2018. It also assumes construction of an ISFSI prior to final plant shutdown in order to support continued plant operations. For both scenarios, the fuel will remain in wet storage in the existing fuel pool(s) for 12 years following shutdown of each unit. During this time, the existing ISFSI will be expanded to accept the inventory of fuel from the pools. All fuel will be transferred to the ISFSI within 12 years of final unit shutdown. The last spent fuel shipment is expected to occur in 2040.

3.4.2 Reactor Vessel and Internal Components

The reactor pressure vessel and internal components are segmented for disposal in shielded transportation casks. Segmentation and packaging of the internals' packages are performed in the refueling canal, where a turntable and remote cutter will be installed. The vessel is segmented in place, using a mast-mounted cutter supported off the lower head and directed from a shielded work platform installed overhead in the reactor cavity. Transportation cask specifications and Department of Transportation (DOT) regulations dictate segmentation and packaging methodology. All packages must meet the current physical and radiological limitations and regulations. Cask shipments will be made in DOT-approved, currently available, truck casks.

The dismantling of reactor internals at DCPP will generate radioactive waste generally unsuitable for shallow land disposal (GTCC). Although the material is not classified as high-level waste, DOE has indicated it will accept title to this waste for disposal at the future high-level waste repository. However, an acceptance criteria or a disposition schedule for this material has not been established, and numerous questions remain as to the ultimate disposal cost and waste form requirements. As such, for purposes of this study, the GTCC waste has been packaged and disposed of as high-level waste, at a cost equivalent to that envisioned for the spent fuel.

Reactor coolant piping is cut from the reactor vessel once the water level in the vessel (used for personnel shielding during dismantling and cutting operations in and around the vessel) is dropped below the nozzle zone. The piping is boxed and shipped by shielded van. The reactor coolant pumps and motors are lifted out intact, packaged, and transported for disposal together with the steam generators.

3.4.3 Steam Generators and Other Primary Coolant System Components

The steam generators' size and weight, as well as their configuration in the Reactor Building and limited access in the Reactor Building itself, place constraints on their intact removal. Modifications to the Reactor Building are necessary for component extraction, due to the fact that the only large access to the building is the existing equipment hatch, located above grade level. To remove the generators through this hatch requires that the units be positioned horizontally, typically impossible due to physical impediments within the structure.

Determination of the removal strategy requires several different considerations. Considerations for the extraction process include modifications to the Reactor Building for removal of the generators, rigging needed to maneuver and extract the generators from the structure, and component preparations needed to transport the generators to a disposal site.

A potential method for removal (and the one used as the basis in this estimate) is the extraction of the generators through a hatch created in the side of the Reactor Building. Sections of concrete are removed to create an opening large enough to extract the steam generators. Prior to sectioning and removal of the steam generator cubicle walls, adjoining floor slabs, and floor grating must be accomplished before the generators can be maneuvered to the opening.

The hatch is re-created using a diamond wire saw to section the containment wall into removable blocks. Once the building is opened, grating within the work area is decontaminated and removed. Next, a trolley crane is set up for removal of the generators. By setting the trolley crane first, it can be used to lower portions of the steam generator cubicle walls that will have to be removed as part of the building modification effort. It also can be used to help remove portions of the floor slab. A 15-foot section of the cubicle wall will be dismantled to allow the maneuvering of the generators within the building. Large cubicle wall sections are lowered out of the Reactor Building using the trolley crane, where they can be decontaminated and transported to the material handling area.

The upper steam generator domes will be disconnected from the surrounding piping and supports. The steam dome will then be rigged

for removal. The steam domes will be cut from the lower shell units and transferred to a laydown area for further segmentation. A prefabricated end-cap will mate with the exposed cut end on the lower shell unit. This end-cap will cover the exposed lower shell tube bundle, recreating a leaktight container. The lower shell units will then be disconnected from all piping and supports, rigged for removal and maneuvered into the open area where they will be lowered onto a dolly. The dolly will allow the lower end of the steam generator to rotate through the opening as it is being lowered. Nozzles and other openings will be welded closed. When this stage has been completed, the generator lower shell unit will be lifted onto a multi-wheeled transporter and moved to an on-site storage area to await transport to the disposal facility. The three remaining steam generators will be removed using the same technique. Once the components have been removed, a portion of the opening will be closed using concrete blocks. A smaller opening will be covered with a temporary barrier to allow for future access.

Once at the storage area, each generator lower shell unit will have a two-inch thick carbon steel membrane welded to its outside surface for shielding during transport. The units will then be loaded onto a multi-wheeled transporter and moved to an on-site rail head where they will be shipped to the Ward Valley waste disposal facility. Depending upon the proximity of the rail head to the disposal location, the units may be off-loaded from the train and onto multi-wheeled transporters to be moved for the remaining distance to the disposal site.

The size and weight of the generator packages was a concern in evaluating transportation alternatives. As such, discussions were held with both the railroad and Lampson, Inc. (rigging), on the moving of the generators. Both companies have had experience with moving large nuclear components, and were able to supply costs based on specific generator dimensions and weight. TLG was also able to apply its experience gained in the planning of the disposition of the steam generators at the Trojan site, where Lampson was a subcontractor.

3.4.4 Transportation Methods

For the purposes of the cost estimate, it was assumed that the low-level radioactive waste produced in the decontamination and dismantling of the nuclear units will be moved overland by truck, shielded van, rail,

and/or multi-wheeled transporter to the regional burial facility. Transport costs were derived assuming a final destination of no greater than 1,000 miles from the plant using published tariffs from Tri-State Motor Transit (Ref. 12).

3.4.5 Low-Level Radioactive Waste Disposal

For purposes of constructing the decommissioning cost estimates, an assumed unit burial rate of $5.05 per pound was used to calculate the cost for disposal of low-level radioactive waste generated in the decontamination and dismantling of DCPP. This rate is derived from the disposal rates charged at the Barnwell low-level waste disposal facility for non-Atlantic compact generators.

To the greatest extent practical, non-compactable low-level radioactive waste is treated to reduce the total volume of radioactive material requiring controlled disposal. The treated material meeting the regulatory and/or site release criteria is released as clean scrap, requiring no further cost consideration. Material not meeting release criteria will be processed for volume reduction and packaged for controlled disposal as radioactive waste. Material/waste recovery and recycling are assumed to be performed by an off site, licensed processing center.

Compactable DAW, such as booties, glove liners, respirator filter cartridges, shipping containers, radiological controls survey materials, etc. will be assumed to be drummed and compacted to 10% of their original volume. This is the minimum practical volume to which low-level waste can be compacted to reduce costs.

3.4.6 Site Conditions Following Decommissioning

A final radiation survey will be conducted to ensure that all radioactive materials in excess of permissible residual levels have been remediated in accordance with 10 CFR §20 Subpart E "Radiological Criteria for License Termination." This survey may coincide with final NRC site inspection.

The NRC will terminate the 10 CFR §50 license if it determines that site remediation has been performed in accordance with the license termination plan, and that the terminal radiation survey and associated

documentation demonstrate that the facility is suitable for release. The NRC's involvement in the decommissioning process will end at this point. Local building codes and state environmental regulations will dictate the next step in the decommissioning process.

3.5 ASSUMPTIONS

The following are the major assumptions made in the development of the cost estimates for decommissioning DCPP.

3.5.1 Estimating Basis

1. Costs are calculated in 2002 dollars. TLG has not included factors for present-value economic analysis, escalation, or general inflation.

2. Both units are assumed to be essentially identical except for common structures and systems. Common systems and structures are assigned to and incorporated within the estimate for Unit 2 since they are required to support decommissioning operations.

3. Plant drawings, equipment, structural specifications, and construction details were provided by PG&E.

3.5.2 Labor Costs

1. The craft labor required to decontaminate and dismantle the DCPP units will be acquired through standard site contracting practices. The current cost of labor at the site is used as an estimating basis.

2. Costs for site administration, operations, construction, and maintenance personnel are based upon current, average salary information provided by PG&E.

3. PG&E, as the licensee, will oversee the decommissioning operations, as well as provide site security, radiological controls, and overall site administration during decommissioning and dismantling. PG&E will hire a Decommissioning Operations Contractor (DOC), providing contract management of the decommissioning labor force and subcontractors. The DOC provides engineering services for such items as writing activity specifications, procedures, activation analyses, or structural modifications.

4. The costs associated for the transition of an operating to a decommissioning organization, (e.g., separation packages, retraining, severance, or incentives) are not included in this estimate.

3.5.3 Design Conditions

1. Any fuel cladding failure that has occurred or may occur during the lifetime of the plant is assumed:

   - to have released fission products at sufficiently low levels that the buildup of quantities of long-lived isotopes (e.g. cesium-137, strontium-90, or transuranics) has been prevented from reaching levels exceeding those which permit the major primary coolant system components to be shipped as Low Specific Waste (LSA) or Surface Contaminated Object (SCO) waste and to be buried within the requirements of 10 CFR 61 or the regional burial ground; or

   - to have necessitated systematic decontamination during the operating life of the plant so that the radionuclide levels will be acceptable for transport as LSA or SCO waste and the burial will be within the requirements of 10 CFR 61.

2. The estimated curie content of the vessel and internals at final shutdown was derived from those listed in NUREG/CR-3474 (Ref. 13). Actual estimates will be derived from the Ci/gram values in NUREG/CR-3474 and adjusted for the different mass of components and projected operating life, as well as for different periods of decay. Additional short-lived isotopes were derived from NUREG/CR-0130 (Ref. 14) and NUREG/CR-0672 (Ref. 15), and benchmarked to the long-lived values from NUREG/CR-3474.

3.5.4 General

1. PG&E provides for any necessary electrical power to be brought on site required to decommission the plant. Energy costs are included in the estimate.

2. Material and heavy equipment rental and operating costs are taken from R.S. Means Building Construction Cost Data.

3. Selected secondary side systems are assumed to be contaminated, and will require radiological controls during dismantling, and off-site waste processing. Systems assumed to be affected include:

    - Auxiliary Steam
    - Condensate
    - Extraction Steam and Heater Drip
    - Lube Oil Distribution and Purification
    - Turbine Steam Supply
    - Turbine and Generator
    - Main Condensers
    - Main Turbine/Generator

4. Contaminated concrete surfaces in the Reactor Buildings, Fuel Handling Buildings, Containment Penetration Areas, Radwaste Storage Building and Auxiliary Building will require decontamination by scabbling (removal of concrete surfaces to a depth of one-half inch), or a drill and spall technique (removal of concrete surfaces to a depth of two inches).

5. Radioactively contaminated piping, components, and structures other than the reactor vessel and internals are assumed to meet DOT limits for LSA or SCO material. For transportation calculations, the distance from the plant site to the (burial site) is not greater than 1,000 miles. Rates for shipping radioactive wastes were provided by Tri-State Motor Transit in published tariffs for this cargo.

6. The reactor vessel and internals disposal costs were based on remote in-place segmentation, packaging in shielded casks, and shipping by truck to the burial ground. A maximum normal road weight limit of 80,000 pounds is assumed for all truck shipments, with the exception of anticipated overweight cask shipments. Cask shipments may exceed 95,000 pounds, including vessel segment(s), supplementary shielding, cask tie-downs and tractor-trailer. The maximum curies per shipment assumed permissible is based upon the license limits of available shielded shipping casks. The number and curie content of vessel segments were selected to meet these limits.

7. The number of cask shipments out of the Reactor Building is expected to average three, every two weeks. In the DECON alternative, the reactor vessel and coolant system will be chemically

decontaminated using one chemical flush and two water rinses prior to segmentation. Typically, a decontamination factor of 10 is expected from this operation.

8. This study estimates that there will be some radioactive waste generated which is greater than 10 CFR 61 Class C quantities (GTCC), resulting from disposal of the highly activated sections of the reactor vessel internals. This waste will most likely be disposed of as high-level waste in the DOE's repository unless an alternative solution is approved by the NRC. The cost of disposal, unlike that for the spent fuel, is not addressed by DOE's 1 mill/kWhr surcharge, and has been estimated from equivalent disposal costs for spent nuclear fuel.

9. Control elements will be removed and disposed of along with the spent fuel assemblies.

10. GTCC waste generated through segmentation of the reactor vessel internals will be transferred to the on-site ISFSI or to the DOE high-level repository within the approximate 12-year decay period following plant shutdown. If the DOE were to default on its obligations to accept spent fuel and GTCC material, decommissioning costs would almost certainly increase.

11. This study does not address the cost for the removal and disposal of spent fuel from the site. Ultimate disposition of the spent fuel is the province of DOE's Waste Management System, as defined by the Nuclear Waste Policy Act and funded through the 1 mill/kWhr electrical generation surcharge. If the DOE were to delay its obligations to accept spent fuel later than a time consistent with its initial pickup of spent fuel from DCPP in 2018, then decommissioning costs would increase.

12. Spent fuel is assumed to remain in the spent fuel pools for a 12-year decay period to satisfy the dry cask storage system design criteria.

13. The final reactor core discharge will be transferred to the spent fuel pool, located in the Fuel Handling Buildings, where it will remain for at least twelve years. Additional storage of fuel on site will be necessary prior to its transfer to the DOE for final disposal.

14. Scrap generated during decommissioning is not included as a salvage credit line item in this study for two reasons: (1) the scrap

value merely offsets the associated site removal and scrap processing costs, and (2) a relatively low value of scrap exists in the market. Scrap processing and site removal costs are not included in the estimate.

15. PG&E will make economically reasonable efforts to salvage equipment during decommissioning. Nonetheless, because placing a salvage value on this machinery and equipment would be speculative, and the value would be small in comparison to overall decommissioning expenses, this estimate does not attempt to quantify the value that PG&E might realize based upon those efforts. For purposes of this study, decommissioning is assumed to begin in 2021; it may occur earlier or later, depending on a variety of economic and regulatory factors. Additionally, because of PG&E's life cycle management of equipment (a program designed to optimize equipment performance through preventive maintenance), it is difficult to predict the remaining life of on site equipment when decommissioning begins. Finally, it is difficult to predict whether the market for used equipment will be stronger or weaker than it is at the time of this estimate. For these reasons, it is not possible to provide an estimate of the salvage value of the equipment at DCPP. Moreover, any salvage value would be small when compared to total decommissioning expenses.

16. The PG&E staffing requirements during decommissioning vary with the level of effort associated with the various phases of the project. Once the decommissioning program commences, only those staff positions necessary to support the decommissioning program are included. Costs are not included in this study for staff transition from plant operations to decommissioning.

17. Engineering services for such items as writing activity specifications, detailed procedures, detailed activation analyses, and structural modifications, etc. are assumed to be provided by outside contractors.

18. PG&E will remove items of personal property owned by PG&E that can be removed without the use of special equipment.

19. PG&E has sufficient scaffolding to support the decommissioning project. No costs associated with the purchase or rental of scaffolding are included in the estimate.

20. Existing warehouses will remain for use by PG&E and its subcontractors. Those warehouses scheduled for removal will be dismantled as they are no longer needed to support the decommissioning program; others may remain for alternate use.

21. PG&E will perform the following activities as a staff function, shortly after cessation of operations at Unit 2:

    - Fuel oil tanks will be emptied. Tanks will be cleaned by flushing or steam cleaning as required prior to disposal.

    - Acid and caustic tanks will be emptied through normal usage; any excess acid or caustic removed to support disposal of the storage container(s) are returned to the vendor.

    - Lubricating and transformer oils will be drained and removed from the site by a waste disposal vendor.

22. The decommissioning activities will be performed in accordance with the current regulations, which are assumed to still be in place at the time of decommissioning. Changes in current regulations may have a cost impact on decommissioning.

23. This study follows the principles of ALARA through the use of work duration adjustment factors that incorporate such items as radiological protection instruction, mock-up training, the use of respiratory protection, and personnel protective clothing. These items lengthen a task's duration, which increase the costs and lengthens the schedule. ALARA planning is considered in the costs for engineering and planning, and in the development of activity specifications and detailed procedures. Changes to §20 worker exposure limits may impact the decommissioning cost and project schedule.

24. Nuclear liability insurance provides coverage for offsite damage or injuries due to radiation exposure from equipment and material. Nuclear property insurance provides protection against direct physical damage to onsite property by a broad range of causes including, radioactive contamination, fires, floods, etc. This estimate includes the premium cost for both liability and property insurance. PG&E provided current nuclear liability and property insurance premiums. These premiums are adjusted to reflect the relative changes in risk during the various phases of

decommissioning. Insurance is required until both the Part 50 and Part 72 are terminated

25. Only existing site structures and those presently planned will be considered in the decommissioning cost.

26. The perimeter fence and in-plant security barriers will be moved as appropriate to conform with the Site Security Plan in force at the various stages in the project.

27. The existing electrical switchyard will remain after decommissioning in support of the utility's electrical transmission and distribution system.

28. Underground metal and concrete piping will either be surveyed in place and released, or excavated and removed for survey. Any piping that exceeds the site release criteria will be removed.

29. Property tax payments for DCPP are not included in this estimate.

3.6 COST ESTIMATE SUMMARY

Summaries of the radiological decommissioning costs and annual expenditures are provided in Tables 3.1 and 3.2. The costs were extracted from the detailed cost tables in Appendices C & D, and divided into five categories, PG&E Labor, Equipment and Materials, Contractor Labor, Burial, and Other. The following should be considered when reviewing Appendices C and D:

- "Decon" as used in the headings of these tables, refers to decontamination activities (as opposed to the NRC term DECON), which refer to the prompt removal decommissioning scenario.

- "Total" as used in the headings of these tables, is the sum of Decon, Remove, Pack, Ship, Bury, and Contingency, as well as other miscellaneous items not listed (such as engineering and preparations).

- The subtotal reported for the major cost categories does not include contingency, which is reported in a separate column.

- "Other" includes different types of costs that are not easily categorized. For instance, in systems removal and structures decontamination, the "Other" cost consists of the off-site recycling costs for low-level radioactive

waste. In most of the engineering preparatory activities the "Other" cost is strictly engineering labor; however, "Other" also includes taxes, insurance, plant energy budgets, and regulatory fees.

TABLE 3.1a
SCHEDULE OF ANNUAL EXPENDITURES
DECON UNIT 1
(2002 Dollars)

Year	PG&E Labor	Equipment & Materials	Contractor Labor	Burial	Other	Yearly Totals
2021	5,547,377	2,381,238	2,487,881	1,131,341	2,939,654	14,487,491
2022	20,047,451	8,605,465	14,647,881	4,088,511	10,623,502	58,012,810
2023	21,258,915	14,884,293	22,246,880	22,367,201	3,369,110	84,126,398
2024	21,194,678	15,606,509	23,693,952	27,573,020	1,149,009	89,217,168
2025	18,747,094	14,471,071	21,986,005	25,562,136	1,118,713	81,885,019
2026	15,558,491	11,149,372	17,038,566	19,679,343	1,024,117	64,449,890
2027	4,891,853	37,500	488,207	0	707,670	6,125,230
2028	4,904,604	37,500	489,545	0	708,993	6,140,642
2029	4,891,853	37,500	488,207	0	707,670	6,125,230
2030	4,891,853	3,677,500	488,207	0	707,670	9,765,230
2031	5,431,853	7,517,500	1,028,207	0	752,670	14,730,230
2032	5,444,604	6,002,500	1,029,545	0	753,993	13,230,642
2033	4,794,164	2,327,500	737,442	0	752,664	8,611,770
2034	1,444,189	3,677,500	206,226	0	752,614	6,080,530
2035	1,894,189	7,517,500	656,226	0	752,614	10,820,530
2036	1,897,248	6,002,500	656,545	0	753,936	9,310,230
2037	7,666,470	6,951,638	7,411,803	8,189,439	869,921	31,089,271
2038	6,099,036	1,869,967	5,835,776	2,284,422	675,345	16,764,546
2039	1,581,432	5,239,500	7,688,837	0	359,846	14,869,614
2040	1,568,134	5,225,248	7,658,566	0	15,549,170	30,001,118
	159,755,488	123,219,300	136,964,505	110,875,414	45,028,881	575,843,588

TABLE 3.1b
SCHEDULE OF ANNUAL EXPENDITURES
DECON UNIT 2
(2002 Dollars)

Year	PG&E Labor	Equipment & Materials	Contractor Labor	Burial	Other	Yearly Totals
2023	402,500	842,500	165,000	0	270,000	1,680,000
2024	237,500	37,500	0	0	225,000	500,000
2025	13,968,627	5,795,926	6,687,035	2,660,585	6,094,731	35,206,905
2026	20,476,977	9,905,468	15,303,036	8,230,499	7,391,659	61,307,639
2027	21,331,089	16,402,159	24,727,894	27,560,667	1,150,789	91,172,598
2028	20,124,408	18,297,783	25,923,039	30,753,197	1,198,414	96,296,842
2029	17,321,980	17,913,970	24,124,073	30,106,795	1,182,627	90,649,444
2030	6,015,823	3,677,500	1,185,629	0	707,663	11,586,615
2031	6,555,823	7,517,500	1,725,629	0	752,663	16,551,615
2032	6,571,654	6,002,500	1,728,877	0	753,985	15,057,017
2033	6,305,823	2,327,500	1,475,629	0	752,663	10,861,615
2034	6,105,823	3,677,500	1,275,629	0	752,663	11,811,615
2035	6,555,823	7,517,500	1,725,629	0	752,663	16,551,615
2036	6,571,654	6,002,500	1,728,877	0	753,985	15,057,017
2037	12,979,138	7,149,637	10,440,868	8,121,239	869,945	39,560,827
2038	10,765,830	10,293,129	11,815,732	2,265,398	687,150	35,827,240
2039	5,456,464	85,467,891	26,503,564	0	473,028	117,900,948
2040	5,261,853	81,020,856	25,144,870	21,795	15,662,779	127,112,153
2041	1,144,370	3,096	2,765,673	2,670,917	45,782	6,629,838
	174,153,160	289,852,415	184,446,683	112,391,093	40,478,190	801,321,541

TABLE 3.2a
SCHEDULE OF ANNUAL EXPENDITURES
SAFSTOR UNIT 1
(2002 Dollars)

Year	PG&E Labor	Equipment & Materials	Contractor Labor	Burial	Other	Yearly Totals
2021	4,850,631	846,248	1,857,546	0	2,284,698	10,321,311
2022	17,529,510	3,058,223	6,712,913	0	8,256,582	37,299,786
2023	8,823,891	1,775,062	2,053,322	433,490	2,388,083	15,473,848
2024	6,031,467	354,042	489,522	53,734	562,561	7,491,326
2025	6,015,637	353,177	488,184	53,588	561,638	7,472,224
2026	6,015,637	353,177	488,184	53,588	561,638	7,472,224
2027	6,015,637	353,177	488,184	53,588	561,638	7,472,224
2028	6,031,467	354,042	489,522	53,734	562,561	7,491,326
2029	6,015,637	353,177	488,184	53,588	561,638	7,472,224
2030	6,015,637	3,993,177	488,184	53,588	561,638	11,112,224
2031	6,555,637	7,833,177	1,028,184	53,588	606,638	16,077,224
2032	6,571,467	6,319,042	1,029,522	53,734	607,561	14,581,326
2033	5,953,236	2,643,177	737,427	53,588	601,759	9,989,187
2034	2,889,978	3,993,177	206,277	53,588	562,118	7,705,137
2035	3,339,978	7,833,177	656,277	53,588	562,118	12,445,137
2036	3,346,999	6,319,042	656,595	53,734	562,918	10,939,288
2037	3,139,978	2,643,177	606,277	53,588	562,118	7,005,137
2038	2,939,978	353,177	406,277	53,588	562,118	4,315,137
2039	2,939,978	353,177	406,277	53,588	562,118	4,315,137
2040	2,927,675	353,177	396,277	53,588	556,966	4,287,681
2041	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2042	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2043	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2044	1,726,375	316,542	116,554	53,734	237,149	2,450,354
2045	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2046	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2047	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2048	1,726,375	316,542	116,554	53,734	237,149	2,450,354
2049	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2050	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2051	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2052	1,726,375	316,542	116,554	53,734	237,149	2,450,354
2053	1,721,658	315,677	116,236	53,588	236,501	2,443,659
2054	4,040,322	594,075	3,033,213	228,896	321,736	8,218,242
2055	16,569,245	2,098,401	18,795,122	1,176,180	1,279,348	39,918,296
2056	16,944,801	9,839,187	22,281,443	19,515,241	4,275,457	72,856,128
2057	13,553,369	13,855,245	22,385,072	29,045,677	5,691,175	84,530,538
2058	7,351,707	13,855,245	18,977,249	29,045,677	5,675,946	74,905,824
2059	483,863	6,488,430	8,322,722	13,602,130	2,651,906	31,549,051
2060	416,307	2,161,308	3,262,031	0	22,375	5,862,020
2061	1,033,195	5,363,958	7,576,629	0	22,314	13,996,095
2062	670,869	3,482,899	4,919,619	0	14,487	9,087,874
	197,409,433	112,282,138	131,238,258	96,880,690	45,640,304	583,450,824

TABLE 3.2b
SCHEDULE OF ANNUAL EXPENDITURES
SAFSTOR UNIT 2
(2002 Dollars)

Year	PG&E Labor	Equipment & Materials	Contractor Labor	Burial	Other	Yearly Totals
2023	402,500	842,500	165,000	0	270,000	1,680,000
2024	237,500	37,500	0	0	225,000	500,000
2025	12,249,273	2,653,289	5,235,246	1,234,596	4,477,493	25,849,897
2026	15,404,947	3,220,843	6,506,889	1,480,804	5,353,516	31,966,999
2027	4,891,819	400,584	1,464,610	53,588	561,651	7,372,252
2028	4,904,571	401,578	1,468,622	53,735	562,574	7,391,080
2029	4,891,819	400,584	1,464,610	53,588	561,651	7,372,252
2030	4,891,819	4,040,584	1,464,610	53,588	561,651	11,012,252
2031	5,431,819	7,880,584	2,004,610	53,588	606,651	15,977,252
2032	5,444,571	6,366,578	2,008,622	53,735	607,574	14,481,080
2033	5,181,819	2,690,584	1,754,610	53,588	606,651	10,287,252
2034	4,981,819	4,040,584	1,554,610	53,588	606,651	11,237,252
2035	5,431,819	7,880,584	2,004,610	53,588	606,651	15,977,252
2036	5,444,571	6,366,578	2,008,622	53,735	607,574	14,481,080
2037	3,390,826	2,690,584	1,700,868	53,588	583,537	8,419,402
2038	1,495,173	400,584	1,267,158	53,588	562,247	3,778,751
2039	1,495,173	400,584	1,267,158	53,588	562,247	3,778,751
2040	1,483,682	400,584	1,255,818	53,588	557,094	3,750,766
2041	573,217	363,084	488,177	53,588	236,494	1,714,560
2042	573,217	363,084	488,177	53,588	236,494	1,714,560
2043	573,217	363,084	488,177	53,588	236,494	1,714,560
2044	574,788	364,078	489,514	53,735	237,142	1,719,258
2045	573,217	363,084	488,177	53,588	236,494	1,714,560
2046	573,217	363,084	488,177	53,588	236,494	1,714,560
2047	573,217	363,084	488,177	53,588	236,494	1,714,560
2048	574,788	364,078	489,514	53,735	237,142	1,719,258
2049	573,217	363,084	488,177	53,588	236,494	1,714,560
2050	573,217	363,084	488,177	53,588	236,494	1,714,560
2051	573,217	363,084	488,177	53,588	236,494	1,714,560
2052	574,788	364,078	489,514	53,735	237,142	1,719,258
2053	573,217	363,084	488,177	53,588	236,494	1,714,560
2054	573,217	363,084	488,177	53,588	236,494	1,714,560
2055	573,217	363,084	488,177	53,588	236,494	1,714,560
2056	8,230,983	2,101,376	13,723,416	1,051,068	1,151,599	26,258,441
2057	12,237,128	7,768,680	19,821,806	12,252,551	3,021,843	55,102,007
2058	17,031,454	16,977,602	26,764,735	31,079,522	5,972,715	97,826,028
2059	15,725,639	16,977,602	25,637,752	31,079,522	5,964,506	95,385,022
2060	4,932,336	43,981,067	24,877,476	18,641,753	3,571,905	96,004,536
2061	3,728,096	83,879,669	26,277,215	0	53,674	113,938,655
2062	2,420,709	54,464,333	17,062,192	0	34,854	73,982,088
	160,564,838	282,714,853	196,087,530	98,374,759	41,800,865	779,542,846

4. SCHEDULE ESTIMATE

The schedule for the decommissioning scenarios considered in this DCPP study followed the sequence presented in the AIF/NESP-036 study, with minor changes to reflect recent experience and site-specific constraints. In addition, the scheduling has been revised to reflect the spent fuel management plan outlined for the DCPP inventory.

Figure 4.1 presents a schedule for the prompt decommissioning alternative; the assumptions supporting this schedule are listed in Section 4.1. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the Appendix C cost tables, but reflect dividing some activities for clarity and combining others for convenience. The schedule was prepared using the "Microsoft Project 98" computer software (Ref. 16).

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule estimates reflect the results of a precedence network developed for the site decommissioning activities, i.e., a PERT (Program Evaluation and Review Technique) Software Package. The durations used in the precedence networks reflect the actual man-hour estimates from the cost tables in Appendix C, adjusted by stretching certain activities over their slack range and shifting the start and end dates of others. The following assumptions were made in the development of the decommissioning schedules.

- All work (except vessel and internals removal activities) is performed during an 8-hour workday, 5 days per week, with no overtime. There are 11 paid holidays per year.

- The fuel handling facilities located in the Fuel Handling Buildings will be isolated and serve as interim wet fuel storage facilities until such time that all spent fuel has been discharged from the spent fuel pools, i.e., within approximately 12 years from shutdown of each unit. The pools are assumed to accommodate the final core discharge from each unit, allowing decontamination and dismantling to commence on each unit's power block structures without constraint. Decontamination and dismantling of the Fuel Handling Buildings are initiated once the transfer of spent fuel to the on-site ISFSI is complete.

- Reactor vessel and internals removal activities are performed by using separate crews for different activities working on different shifts, with a corresponding backshift charge for the second shift.

- Multiple crews work parallel activities to the maximum extent possible, consistent with: optimum efficiency; adequate access for cutting, removal and laydown space; and stringent safety measures necessary during demolition of heavy components and structures.

- For plant systems removal, the systems with the longest removal durations in areas on the critical path are considered to determine the duration of the activity.

4.2 PROJECT SCHEDULE

The period-dependent costs presented in the cost tables in Appendices C and D are based upon the durations developed in the schedule for each decommissioning alternative. Durations are established between several milestones in each project period; these durations are used to establish a critical path for the entire project. In turn, the critical path duration for each period is used as the basis for determining the total costs for these period-dependent items.

Project timelines for the two decommissioning alternatives are included in this section as Figure 4.2a and 4.2b. Milestone dates are based on a 36 and 39-year plant operating life from the start of commercial operations, for Units 1 and 2, respectively, a minimum of 12 years wet storage for the last core discharge of fuel, and a deferral of thirty years for license termination (SAFSTOR) and final site release.

FIGURE 4.1

DECON ACTIVITY SCHEDULE

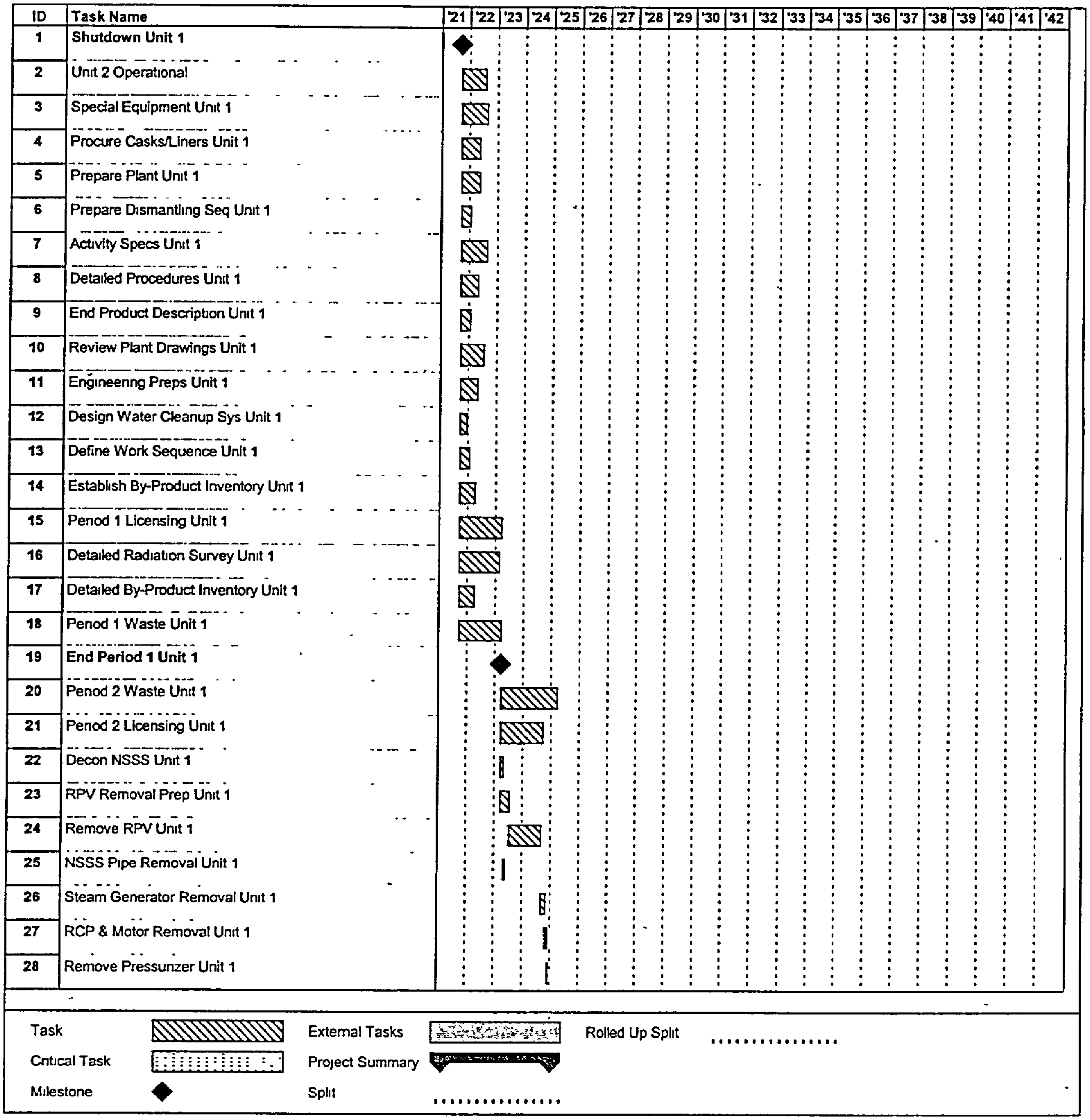


FIGURE 4.1
(Continued)

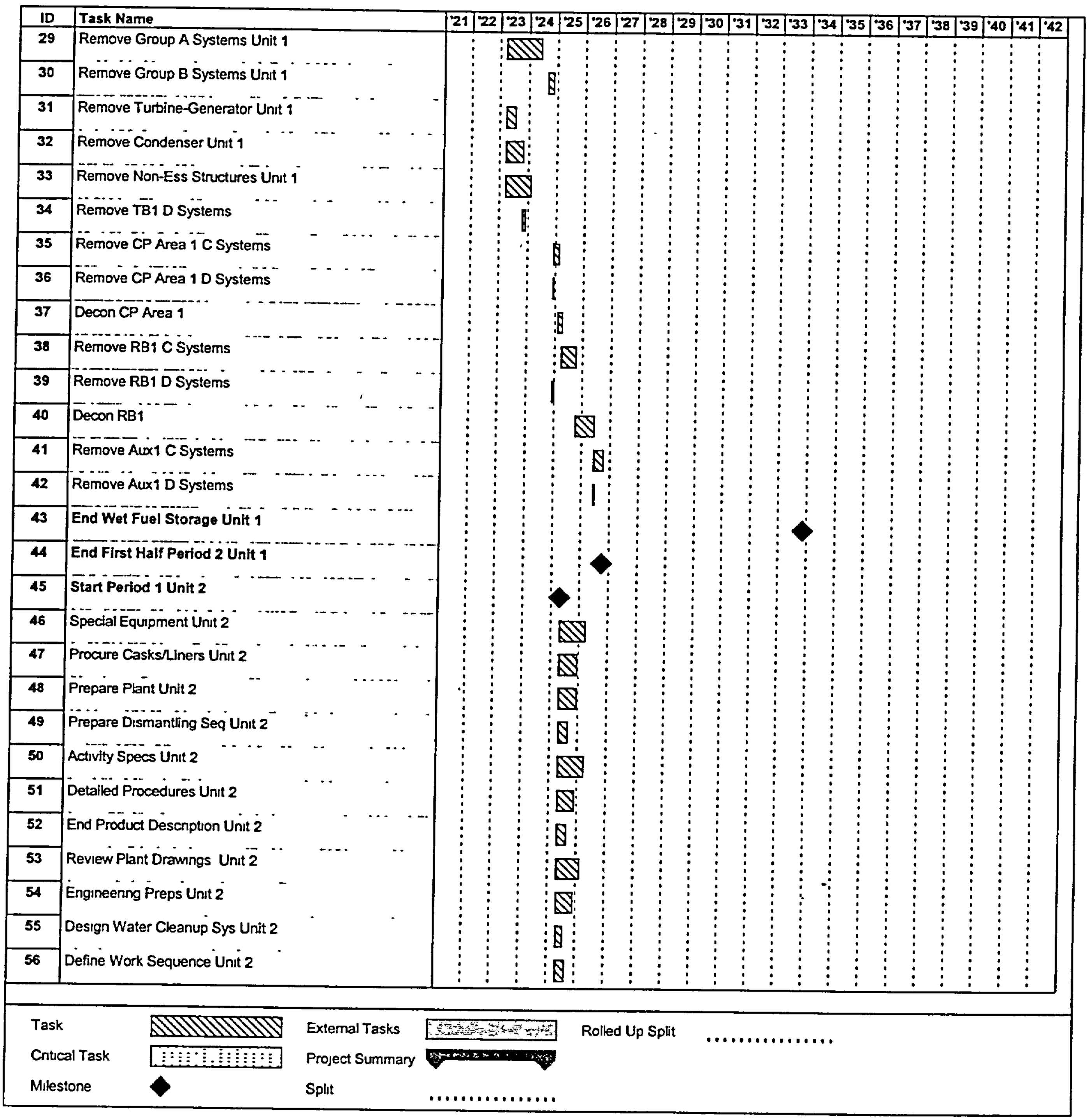
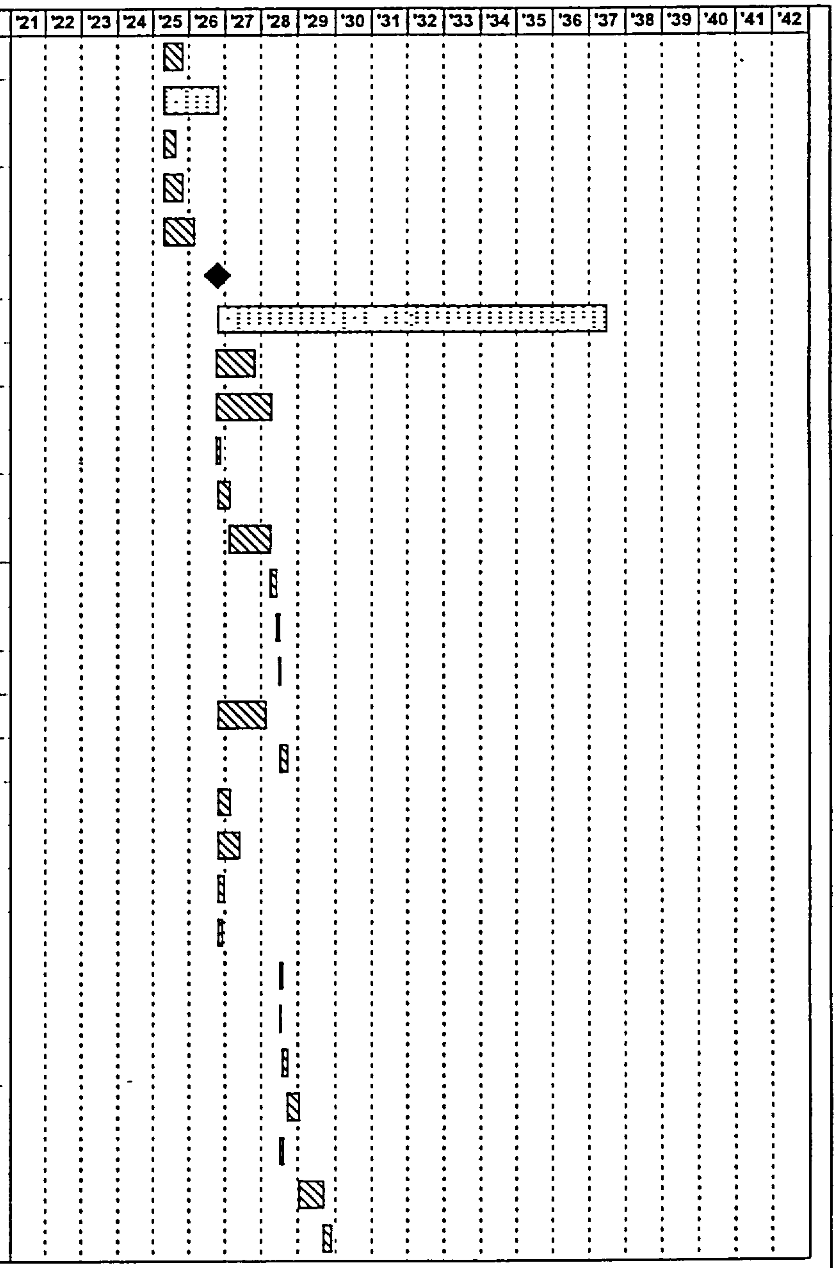


FIGURE 4.1
(Continued)

ID	Task Name
57	Establish By-Product Inventory Unit 2
58	**Period 1 Licensing Unit 2**
59	Detailed Radiation Survey Unit 2
60	Detailed By-Product Inventory Unit 2
61	Period 1 Waste Unit 2
62	**End Period 1 Unit 2**
63	**Unit 2 Wet Layup**
64	Period 2 Waste Unit 2
65	Licensing Period 2 Unit 2
66	Decon NSSS Unit 2
67	RPV Prep Unit 2
68	Rmv RPV Unit 2
69	Rmv Steam Gens Unit 2
70	Rmv RC Pumps Unit 2
71	Rmv Pressurizer Unit 2
72	Remove Group A Systems Unit 2
73	Remove Group B Systems Unit 2
74	Remove Turbine-Generator Unit 2
75	Remove Condenser Unit 2
76	Remove Non-Ess Structures Unit 2
77	Remove TB2 D Systems
78	Remove CP Area 2 C Systems
79	Remove CP Area 2 D Systems
80	Decon CP Area 2
81	Remove RB2 C Systems
82	Remove RB 2 D Systems
83	Decon RB2
84	Remove Aux2 C Systems



Task | Critical Task | Milestone | External Tasks | Project Summary | Split | Rolled Up Split

FIGURE 4.1
(Continued)

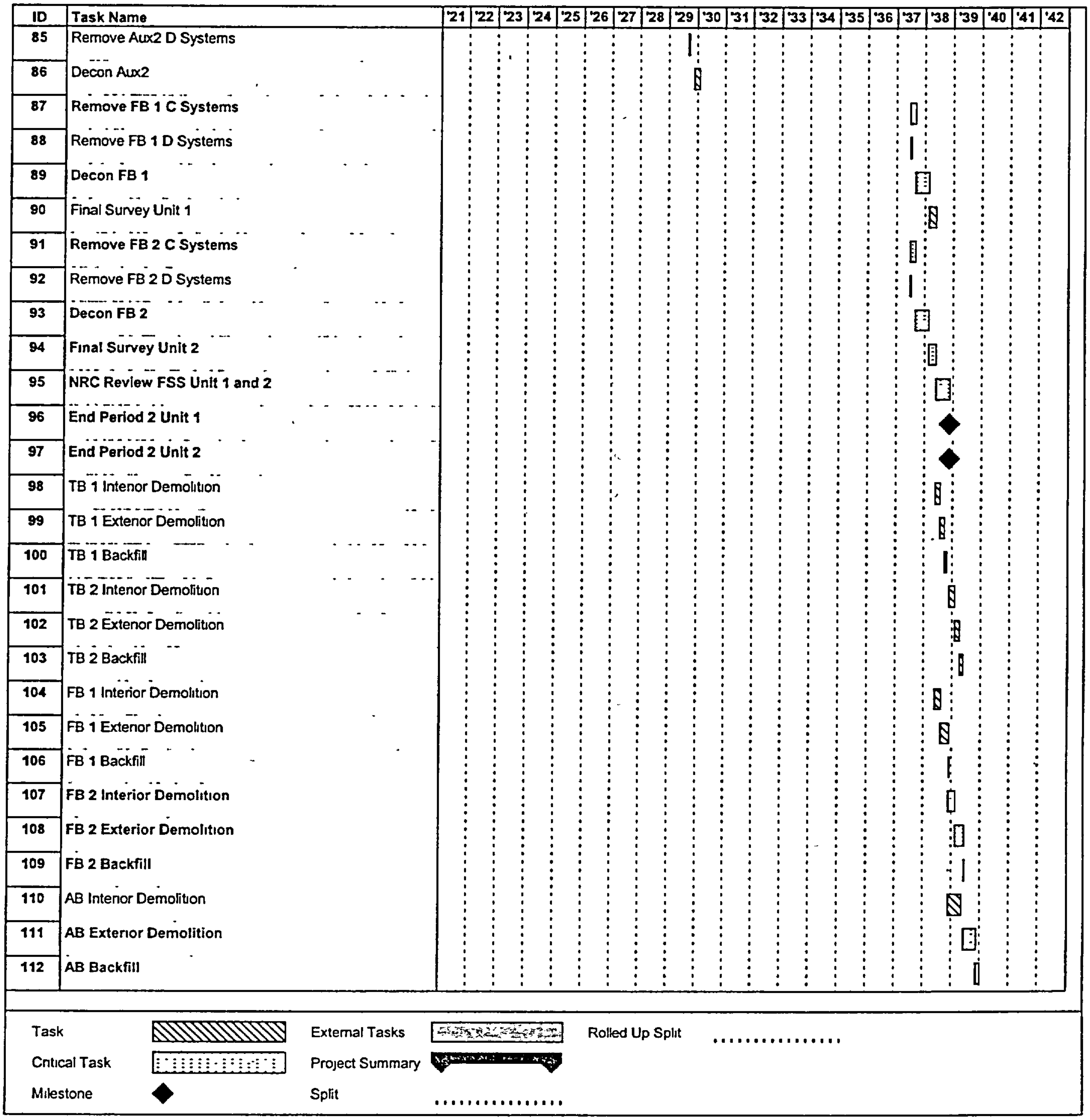
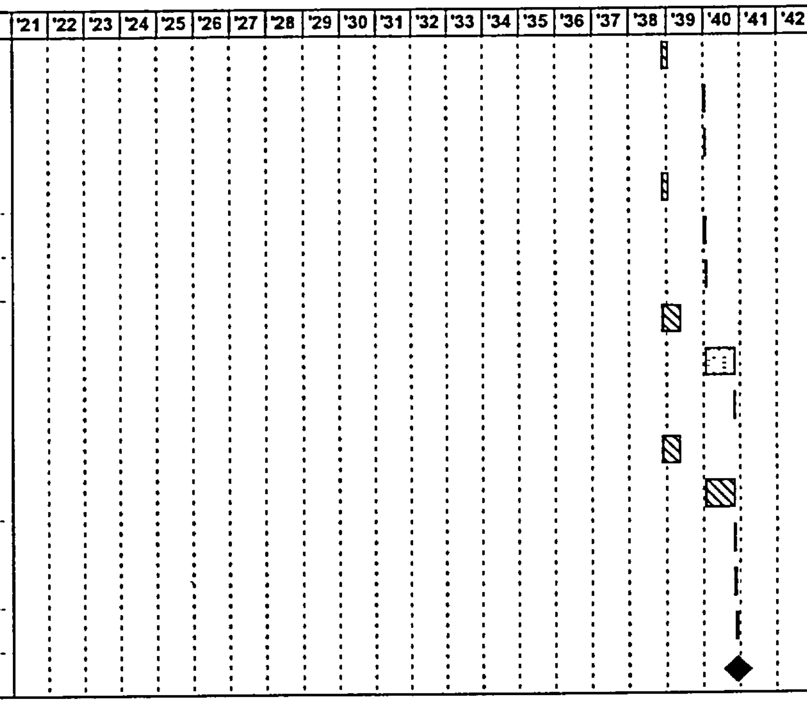


FIGURE 4.1
(Continued)

ID	Task Name
113	CP Area 1 Interior Demolition
114	CP Area 1 Exterior Demolition
115	CP Area 1 Backfill
116	CP Area 2 Interior Demolition
117	CP Area 2 Exterior Demolition
118	CP Area 2 Backfill
119	RB 1 Interior Demolition
120	RB 1 Exterior Demolition
121	RB 1 Backfill
122	RB 2 Interior Demolition
123	RB 2 Exterior Demolition
124	RB 2 Backfill
125	Administration Building Demolition
126	Landscaping
127	End

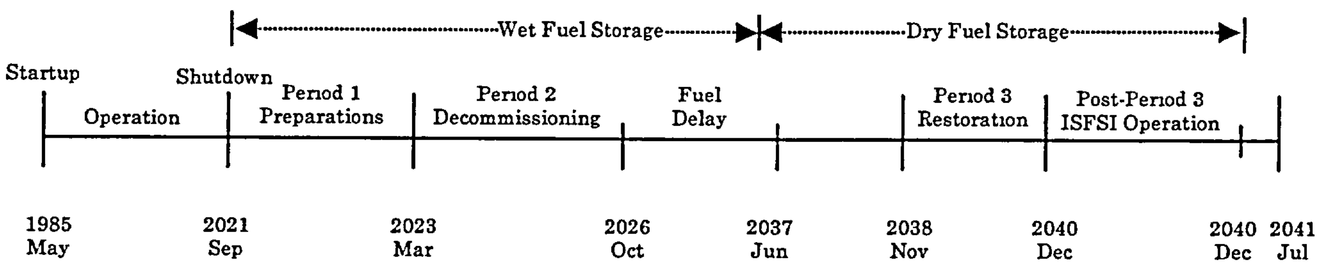


Task | External Tasks | Rolled Up Split
Critical Task | Project Summary
Milestone | Split

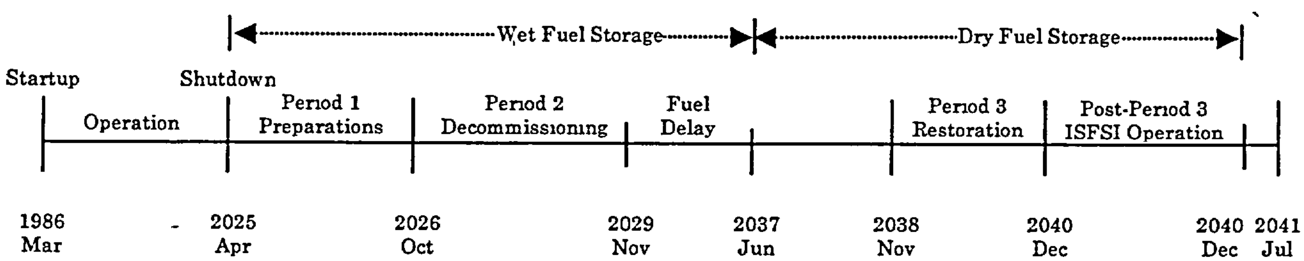
FIGURE 4.2a

DECON DECOMMISSIONING TIMELINES

DCPP UNIT 1



DCPP UNIT 2

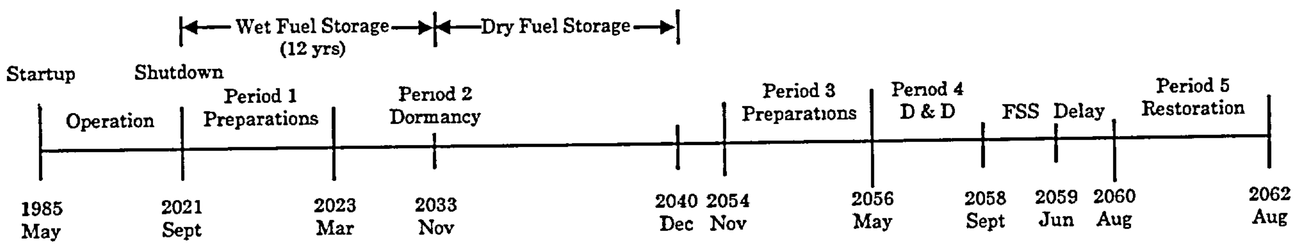


NOT TO SCALE

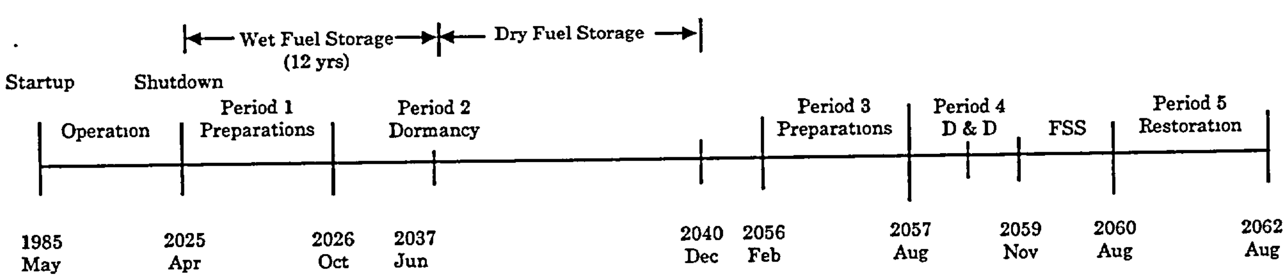
FIGURE 4.2b

SAFSTOR DECOMMISSIONING TIMELINES

DCPP UNIT 1



DCPP UNIT 2



NOT TO SCALE

5. RADIOACTIVE WASTES

The goal of the decommissioning program is the removal of all radioactive material from the site that would restrict its future use, and termination of the NRC license for the site. This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act, (Ref. 17) the NRC is responsible for protecting the public from sources of ionizing radiation. Title 10 of the Code of Federal Regulations delineates the production, utilization, and disposal of radioactive materials and processes. In particular, 10 CFR §71 defines radioactive material and 10 CFR §61 specifies its disposition.

Most of the materials being transported for controlled burial are categorized as Low Specific Activity (LSA) or Surface Contaminated Object (SCO) materials containing Type A quantities, as defined in 49 CFR §173-178. Shipping containers are required to be Industrial Packages (IP-1, IP-2 or IP-3). For this study, commercially available steel containers are presumed to be used for the disposal of piping, small components, and concrete. Larger components can serve as their own containers, with proper closure of all openings, access ways, and penetrations.

The volumes of radioactive waste generated during the various decommissioning activities at the site are shown on a line-item basis in Appendices C and D and summarized in Table 5.1. The quantified waste volume summaries shown in Table 5.1 are consistent with 10 CFR §61 classifications. The volumes are calculated based on the exterior dimensions for containerized material. The volumes are calculated on the displaced volume of components serving as their own waste containers.

The reactor vessel and internals are categorized as large quantity shipments and, accordingly, will be shipped in reusable, shielded truck casks with disposable liners. In calculating disposal costs, the burial fees are applied against the liner volume, as well as the special handling requirements of the payload. Packaging efficiencies are lower for the highly activated materials (greater than Type A quantity waste), where high concentrations of gamma-emitting radionuclides limit the capacity of the shipping canisters.

The waste volume generated in the decontamination and dismantling of the nuclear unit is primarily generated during Period 2 of DECON and Period 4 of SAFSTOR. Contaminated and activated material is characterized on site, with a significant volume shipped to off-site waste processors. Material that is considered potentially contaminated when removed from a Radiological Controlled Area (RCA), is sent to processing facilities for conditioning and disposal. Off-site processing of waste was

estimated on a $2.00 per pound basis, based on average rates from existing licensed waste processors.

For purposes of constructing the decommissioning cost estimates, an assumed unit burial rate of $5.05 per pound was used to calculate the cost for disposal of low-level radioactive waste generated in the decontamination and dismantling of DCPP. This rate is derived from the disposal rates charged at the Barnwell low-level waste disposal facility for non-Atlantic compact generators.

The burial volumes reported in Table 5.1 reflect the savings from recycling and waste conditioning. The cost of processing this material appears as an "other" cost for the systems and plant structures identified in Appendices C and D.

TABLE 5.1

DECOMMISSIONING RADIOACTIVE WASTE BURIAL VOLUMES

	Waste Class[1]	Volume (Cubic feet)
DECON		
Unit 1	A	98,652
	B	16,255
	C	574
	>C	604
Subtotal		**116,085**
Unit 2 & Common	A	107,868
	B	15,272
	C	574
	>C	604
Subtotal		**124,318**
TOTAL		**240,403**
SAFSTOR		
Unit 1	A	93,981
	B	7,051
	C	584
	>C	604
Subtotal		**102,220**
Unit 2 & Common	A	101,957
	B	7,314
	C	584
	>C	604
Subtotal		**110,459**
TOTAL		**212,679**

1 Waste is classified according to the requirements delineated in Title 10 of the Code of Federal Regulations, Part 61.55

6. RESULTS

The projected costs to decommission the Diablo Canyon Power Plant for the DECON alternative are estimated to be $575.8 and $801.3 million in 2002 dollars for Unit 1 and Unit 2, respectively. The projected decommissioning costs for the SAFSTOR alternative are estimated at $583.5 and $779.5 million in 2002 dollars for Unit 1 and Unit 2, respectively. The costs reflect the site-specific features of DCPP, the local cost of labor, interim storage of spent fuel in an on-site ISFSI, and disposal of low-level radioactive waste at the Southwest Compact's future disposal site. An analysis of the major activities contributing to the total cost for the DECON and SAFSTOR decommissioning alternatives are provided in Tables 6.1 and 6.2, respectively. Appendix C contains a detailed list of costs by "activity description" for each unit for the DECON alternative. Appendix D contains a similar list of costs for the SAFSTOR alternative.

The principal cost drivers in decommissioning the plant include labor-related costs, waste management costs, spent fuel management costs, and other costs necessary to complete the project. Staffing represents the largest single contributor to the overall cost. The magnitude of the expense is a function of both the size of the organization required to manage the decommissioning as well as the duration of the program, including the time associated with the onsite caretaking of the spent fuel while DOE completes the transfer.

The cost to process and dispose of the low-level radioactive waste generated in the decontamination and dismantling of the nuclear units represents the next largest cost component. The cost includes the conditioning and treatment of a significant portion of the metallic waste at off-site processing centers to reduce the volume of material requiring controlled disposal as well as the cost to dispose of the remaining material at a regional disposal facility. The disposal cost is indicative of the expense incurred in siting, developing, and licensing new disposal facilities.

Removal costs reflect the labor-intensive nature of the decommissioning process, as well as the management controls required to ensure a safe and successful program. Decontamination and packaging costs also have a large labor component which is based upon prevailing union wages.

Spent fuel management includes capital expenditures for the loading of the spent fuel assemblies into dry storage/transport containers, transfer of the containers to the onsite storage facility, as well as the eventual unloading of the storage cask and transfer of the inner containers to the DOE. Operational and maintenance costs are included in the value reported, as well as associated equipments costs and licensing fees.

Transport costs (shipping) are reported for only that portion of the radioactive waste stream requiring controlled disposal at the regional site. Transport costs for the material designed for off-site treatment are inclusive within the processing fees charged by the vendors and are included within the Burial or Recycling cost component. The reported cost for transport includes the tariffs and surcharges associated with moving large components and/or overweight shielded casks overland as well as the general expense of transporting, e.g., labor and fuel, material over a distance of 1,000 miles. Finally, "Other" costs include engineering costs, energy, necessary insurance, and fees.

This study provides estimates for decommissioning under current requirements, based on present-day costs and available technology. Decommissioning requirements and assumptions may change. Individual costs associated with decommissioning have, historically, increased at rates greater than that of general inflation. The US DOE spent fuel acceptance schedule is subject to change, which may impact the decommissioning schedule. The availability and cost of low-level waste disposal sites is subject to change, which would also impact the decommissioning costs. It is therefore appropriate that this cost study be reviewed periodically and revised as needed.

TABLE 6.1

SUMMARY OF DECON DECOMMISSIONING COST CONTRIBUTORS

Work Category	Costs 02$ (thousands)[1]	Percent of Total Costs[1]
Unit 1		
Decontamination	15,820	2.7
Removal	87,382	15.2
Packaging	12,939	2.2
Shipping	4,847	0.8
Burial or Recycling (Off Site)	125,518	21.8
Decommissioning Staffs	216,926	37.7
Spent Fuel Management	56,555	9.8
Other[2]	55,857	9.7
Subtotal	**575,844**	**100.0**
Unit 2 & Common		
Decontamination	17,738	2.2
Removal	118,997	14.9
Packaging	12,890	1.6
Shipping	4,814	0.6
Burial or Recycling (Off Site)	125,670	15.7
Decommissioning Staffs	242,727	30.3
Breakwater Removal	165,533	20.7
Spent Fuel Management	56,555	7.1
Other[2]	56,397	7.0
Subtotal	**801,321**	**100.0**
Station Total (with contingency)	**1,377,165**	

1. Columns may not add due to rounding.
2. Other includes engineering & preparations, undistributed costs, NRC Fees, EP Fees and Maintenance Costs, etc.

TABLE 6.2

SUMMARY OF SAFSTOR DECOMMISSIONING COST CONTRIBUTORS

Work Category	Costs 02$ (thousands)[1]	Percent of Total Costs[1]
Unit 1		
Decontamination	10,500	1.8
Removal	81,960	14.0
Packaging	11,322	1.9
Shipping	3,112	0.5
Burial or Recycling (Off Site)	111,620	19.1
Decommissioning Staffs	242,806	41.6
Spent Fuel Management	56,555	9.7
Other[2]	65,575	11.2
Subtotal	**583,451**	**100.0**
Unit 2 & Common		
Decontamination	15,026	1.9
Removal	114,523	14.7
Packaging	11,440	1.5
Shipping	3,180	0.4
Burial or Recycling (Off Site)	114,897	14.7
Decommissioning Staffs	231,998	29.8
Breakwater Removal	165,533	21.2
Spent Fuel Management	56,555	7.3
Other[2]	66,392	8.5
Subtotal	**779,543**	**100.0**
Station Total (with contingency)	**1,362,994**	

1. Columns may not add due to rounding.
2. Other includes engineering & preparations, undistributed costs, NRC Fees, EP Fees and Maintenance Costs, etc.

7. REFERENCES

1. U.S. Code of Federal Regulations, Title 10, Parts 30, 40, 50, 51, 70 and 72, "General Requirements for Decommissioning Nuclear Facilities," Nuclear Regulatory Commission, Federal Register Volume 53, Number 123 (p 24018+), June 27, 1988.

2. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," August, 1990.

3. U.S. Code of Federal Regulations, Title 10, Parts 2, 50 and 51, "Decommissioning of Nuclear Power Reactors," Nuclear Regulatory Commission, Federal Register Volume 61 (p39278+), July 29, 1996.

4. "Nuclear Waste Policy Act of 1982 and Amendments," U.S. Department of Energy's Office of Civilian Radioactive Management, 1982.

5. DOE/RW-0457, "Acceptance Priority Ranking and Annual Capacity Report," U.S. Department of Energy's Office of Civilian Radioactive Waste Management, March, 1995.

6. "Low-Level Radioactive Waste Policy Amendments Act of 1985," Public Law 99-240, January 15, 1986.

7. U.S. Code of Federal Regulations, Title 10, Part 20, Subpart E, "Radiological Criteria for License Termination," Federal Register, Volume 62, Number 139 (p 39058 et seq.), July 21, 1997.

8. T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May, 1986.

9. W.J. Manion and T.S. LaGuardia, "Decommissioning Handbook," U.S. Department of Energy, DOE/EV/10128-1, November, 1980.

10. "Building Construction Cost Data 2002," Robert Snow Means Company, Inc., Kingston, Massachusetts.

11. Project and Cost Engineers' Handbook, Second Edition, p. 239, American Association of Cost Engineers, Marcel Dekker, Inc., New York, New York.

7. REFERENCES
(continued)

12. Tri-State Motor Transit Company, published tariffs, Interstate Commerce Commission (ICC), Docket No. MC-109397 and Supplements, 1996.

13. J.C. Evans et al., "Long-Lived Activation Products in Reactor Materials," NUREG/CR-3474, Pacific Northwest Laboratory for the Nuclear Regulatory Commission, August, 1984.

14. R.I. Smith, G.J. Konzek, W.E. Kennedy, Jr., "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station," NUREG/CR-0130 and addenda, Pacific Northwest Laboratory for the Nuclear Regulatory Commission, June, 1978.

15. H.D. Oak, et al., "Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station," NUREG/CR-0672 and addenda, Pacific Northwest Laboratory for the Nuclear Regulatory Commission, June, 1980.

16. "Microsoft Project 98," Microsoft Corporation, Redmond, WA, 1997.

17. "Atomic Energy Act of 1954," (68 Stat. 919).

APPENDIX A

UNIT COST FACTOR DEVELOPMENT

APPENDIX A
UNIT COST FACTOR DEVELOPMENT

Example: Unit Factor for Removal of Contaminated Heat Exchanger < 3,000 lbs.

1. SCOPE

Heat exchangers weighing < 3,000 lbs. will be removed in one piece using a crane or small hoist. They will be disconnected from the inlet and outlet piping. The heat exchanger will be sent to the packing area.

2. CALCULATIONS

Activity Description	Critical Duration (minutes)
Install contamination controls, remove insulation, and mount pipe cutters	60
Disconnect inlet and outlet lines, cap openings	60
Rig for removal	30
Unbolt from mounts	30
Remove contamination controls	15
Remove heat exchanger, wrap in plastic, and send to packing area	60
Critical Duration	255

<u>Work Adjustments</u> (Work Difficulty Factors)

+ Respiratory Protection (50% of Critical Duration)	128
+ Radiation/ALARA (37% of Critical Duration)	95
Adjusted Work Duration	478
+ Protective Clothing (30% of Adjusted Work Duration)	143
Productive Work Duration	621
+ Work break adjustment (8.33 % of Productive Work Duration)	52
Total Work Duration	673

***** Total Work Duration = 673 minutes or 11.217 hours *****

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hours)	Rate ($/hr)	Cost
Laborers	3.00	11.217	$36.88	$1,241.05
Craftsmen	2.00	11.217	$48.00	$1,076.83
Foreman	1.00	11.217	$51.24	$574.76
General Foreman	0.25	11.217	$54.26	$152.16
Fire Watch	0.05	11.217	$36.88	$20.68
Health Physics Technician	1.00	11.217	$34.14	$382.95
Total labor cost				$3,448.43

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
-Gas torch consumables 1 @ $4.61/hr x 1 hr {1}	$4.61
-Blotting paper 50 @ $0.48 sq ft {2}	$24.00
-Plastic sheets/bags 50 @ $0.12/sq ft {3}	$6.00
Subtotal cost of equipment and materials	$34.61
Overhead & sales tax on equipment and materials @ 15.00%	$5.88
Total costs, equipment & material	$40.49
TOTAL COST: Removal of contaminated heat exchanger <3000 pounds:	**$3,488.92**
Total labor cost:	$3,488.92
Total equipment/material costs:	$40.49
Total adjusted exposure man-hours incurred:	46.247
Total craft labor man-hours required per unit:	81.884

APPENDIX A
(continued)

5. NOTES AND REFERENCES

- Work difficulty factors were developed in conjunction with the AIF (now NEI) program to standardize nuclear decommissioning cost estimates and are delineated in Volume 1, Chapter 5 of the "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

- References for equipment & consumables costs:

  1. R.S. Means (2002) Division 016 Section 420-6360 pg 23
  2. McMaster-Carr Ed. 105
  3. R.S. Means (2002) Division 015 Section 602-0200 pg 17

- Material and consumable costs were adjusted using the regional indices for San Luis Obispo, California.

APPENDIX B

UNIT COST FACTOR LISTING
(DECON: Power Block Structures Only)

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean instrument and sampling tubing, $/linear foot	$0.41
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	$4.30
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	$6.15
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	$12.00
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	$23.19
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	$30.03
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	$44.21
Removal of clean pipe >36 inches diameter, $/linear foot	$52.59
Removal of clean valves >2 to 4 inches	$79.88
Removal of clean valves >4 to 8 inches	$120.01
Removal of clean valves >8 to 14 inches	$231.90
Removal of clean valves >14 to 20 inches	$300.32
Removal of clean valves >20 to 36 inches	$442.15
Removal of clean valves >36 inches	$525.88
Removal of clean pipe hangers for small bore piping	$25.14
Removal of clean pipe hangers for large bore piping	$92.94
Removal of clean pumps, <300 pound	$199.91
Removal of clean pumps, 300-1000 pound	$557.88
Removal of clean pumps, 1000-10,000 pound	$2,219.95
Removal of clean pumps, >10,000 pound	$4,284.48
Removal of clean pump motors, 300-1000 pound	$235.93
Removal of clean pump motors, 1000-10,000 pound	$926.44
Removal of clean pump motors, >10,000 pound	$2,084.50
Removal of clean turbine-driven pumps < 10,000 pound	$2,560.20
Removal of clean turbine-driven pumps > 10,000 pounds	$5,742.59

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of clean PWR turbine-generator	$136,365.50
Removal of clean heat exchanger <3000 pound	$1,189.55
Removal of clean heat exchanger >3000 pound	$2,982.11
Removal of clean feedwater heater/deaerator	$8,424.31
Removal of clean moisture separator/reheater	$17,343.63
Removal of clean PWR main condenser	$377,985.88
Removal of clean tanks, <300 gallons	$257.46
Removal of clean tanks, 300-3000 gallon	$816.62
Removal of clean tanks, >3000 gallons, $/square foot surface area	$6.81
Removal of clean electrical equipment, <300 pound	$110.54
Removal of clean electrical equipment, 300-1000 pound	$384.11
Removal of clean electrical equipment, 1000-10,000 pound	$768.22
Removal of clean electrical equipment, >10,000 pound	$1,829.61
Removal of clean electrical transformers < 30 tons	$1,270.64
Removal of clean electrical transformers > 30 tons	$3,659.21
Removal of clean standby diesel-generator, <100 kW	$1,297.85
Removal of clean standby diesel-generator, 100 kW to 1 MW	$2,896.88
Removal of clean standby diesel-generator, >1 MW	$5,997.12
Removal of clean electrical cable tray, $/linear foot	$10.23
Removal of clean electrical conduit, $/linear foot	$4.46
Removal of clean mechanical equipment, <300 pound	$110.54
Removal of clean mechanical equipment, 300-1000 pound	$384.11
Removal of clean mechanical equipment, 1000-10,000 pound	$768.22
Removal of clean mechanical equipment, >10,000 pound	$1,829.61
Removal of clean HVAC equipment, <300 pound	$110.54

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of clean HVAC equipment, 300-1000 pound	$384.11
Removal of clean HVAC equipment, 1000-10,000 pound	$768.22
Removal of clean HVAC equipment, >10,000 pound	$1,829.61
Removal of clean HVAC ductwork, $/pound	$0.43
Removal of contaminated instrument and sampling tubing, $/linear foot	$1.20
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	$29.67
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	$54.42
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	$86.95
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	$173.61
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	$210.12
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	$294.21
Removal of contaminated pipe >36 inches diameter, $/linear foot	$349.42
Removal of contaminated valves >2 to 4 inches	$349.46
Removal of contaminated valves >4 to 8 inches	$420.45
Removal of contaminated valves >8 to 14 inches	$868.05
Removal of contaminated valves >14 to 20 inches	$1,103.48
Removal of contaminated valves >20 to 36 inches	$1,471.03
Removal of contaminated valves >36 inches	$1,747.09
Removal of contaminated pipe hangers for small bore piping	$82.79
Removal of contaminated pipe hangers for large bore piping	$278.04
Removal of contaminated pumps, <300 pound	$747.16
Removal of contaminated pumps, 300-1000 pound	$1,744.86
Removal of contaminated pumps, 1000-10,000 pound	$5,790.35
Removal of contaminated pumps, >10,000 pound	$14,101.10
Removal of contaminated pump motors, 300-1000 pound	$739.64

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated pump motors, 1000-10,000 pound	$2,354.42
Removal of contaminated pump motors, >10,000 pound	$5,285.92
Removal of contaminated turbine-driven pumps < 10,000 pounds	$7,137.15
Removal of contaminated turbine-driven pumps > 10,000 pounds	$16,293.15
Removal of contaminated heat exchanger <3000 pound	$3,488.92
Removal of contaminated heat exchanger >3000 pound	$10,090.49
Removal of contaminated tanks, <300 gallons	$1,242.29
Removal of contaminated tanks, >300 gallons, $/square foot	$24.53
Removal of contaminated electrical equipment, <300 pound	$581.04
Removal of contaminated electrical equipment, 300-1000 pound	$1,416.02
Removal of contaminated electrical equipment, 1000-10,000 pound	$2,725.95
Removal of contaminated electrical equipment, >10,000 pound	$5,354.82
Removal of contaminated electrical cable tray, $/linear foot	$27.92
Removal of contaminated electrical conduit, $/linear foot	$24.86
Removal of contaminated mechanical equipment, <300 pound	$646.95
Removal of contaminated mechanical equipment, 300-1000 pound	$1,565.84
Removal of contaminated mechanical equipment, 1000-10,000 pound	$3,009.50
Removal of contaminated mechanical equipment, >10,000 pound	$5,354.82
Removal of contaminated HVAC equipment, <300 pound	$646.95
Removal of contaminated HVAC equipment, 300-1000 pound	$1,565.85
Removal of contaminated HVAC equipment, 1000-10,000 pound	$3,009.50
Removal of contaminated HVAC equipment, >10,000 pound	$5,354.82
Removal of contaminated HVAC ductwork, $/pound	$2.64
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	$3.14
Additional decontamination of surface by washing, $/square foot	$6.44

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Additional decontamination of surfaces by hydrolasing, $/square foot	$28.35
Decontamination rig hook-up and flush	$5,495.23
Chemical flush of components/systems, $/gallon	$11.64
Removal of clean standard reinforced concrete, $/cubic yard	$65.02
Removal of grade slab concrete, $/cubic yard	$188.98
Removal of clean concrete floors, $/cubic yard	$290.00
Removal of sections of clean concrete floors, $/cubic yard	$854.92
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	$196.39
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	$1,677.08
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	$248.37
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	$2,220.36
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cu yd	$372.62
Removal of below-grade suspended floors, $/square foot	$290.00
Removal of clean monolithic concrete structures, $/cubic yard	$718.84
Removal of contaminated monolithic concrete structures, $/cu yd	$1,676.99
Removal of clean foundation concrete, $/cubic yard	$562.48
Removal of contaminated foundation concrete, $/cubic yard	$1,561.85
Explosive demolition of bulk concrete, $/cubic yard	$25.52
Removal of clean hollow masonry block wall, $/cubic yard	$71.07
Removal of contaminated hollow masonry block wall, $/cubic yard	$224.02
Removal of clean solid masonry block wall, $/cubic yard	$71.07
Removal of contaminated solid masonry block wall, $/cubic yard	$224.02
Backfill of below-grade voids, $/cubic yard	$17.11
Removal of subterranean tunnels/voids, $/linear foot	$127.27
Placement of concrete for below-grade voids, $/cubic yard	$99.68

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Excavation of clean material, $/cubic yard	$2.94
Excavation of contaminated material, $/cubic yard	$33.84
Excavation of submerged concrete rubble, $/cubic yard	$11.76
Removal of clean concrete rubble, $/cubic yard	$80.13
Removal of contaminated concrete rubble, $/cubic yard	$27.05
Removal of building by volume, $/cubic foot	$0.24
Removal of clean building metal siding, $/square foot	$1.21
Removal of contaminated building metal siding, $/square foot	$3.76
Removal of standard asphalt roofing, $/square foot	$1.91
Removal of transite panels, $/square foot	$2.02
Scarifying contaminated concrete surfaces (drill & spall)	$11.44
Scabbling contaminated concrete floors, $/square foot	$6.70
Scabbling contaminated concrete walls, $/square foot	$7.37
Scabbling contaminated ceilings, $/square foot	$66.29
Scabbling structural steel, $/square foot	$5.53
Removal of clean overhead cranes/monorails < 10 ton capacity	$537.17
Removal of contaminated overhead cranes/monorails < 10 ton capacity	$1,455.78
Removal of clean overhead cranes/monorails >10-50 ton capacity	$1,289.20
Removal of contaminated overhead cranes/monorails >10-50 ton capacity	$3,493.29
Removal of polar cranes > 50 ton capacity, each	$5,396.79
Removal of gantry cranes > 50 ton capacity, each	$22,870.09
Removal of structural steel, $/pound	$0.32
Removal of clean steel floor grating, $/square foot	$2.81
Removal of contaminated steel floor grating, $/square foot	$8.27
Removal of clean free-standing steel liner, $/square foot	$10.21

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated free-standing steel liner, $/square foot	$28.70
Removal of clean concrete-anchored steel liner, $/square foot	$5.10
Removal of contaminated concrete-anchored steel liner, $/square foot	$33.42
Placement of scaffolding in clean areas, $/square foot	$13.52
Placement of scaffolding in contaminated areas, $/square foot	$20.61
Landscaping w/o topsoil, $/acre	$1,091.62
Cost of CPC B-88 LSA box & preparation for use	$1,538.13
Cost of CPC B-25 LSA box & preparation for use	$1,403.24
Cost of CPC B-12V 12 gauge LSA box & preparation for use	$1,248.32
Cost of CPC B-144 LSA box & preparation for use	$5,723.96
Cost of LSA drum & preparation for use	$123.45
Cost of cask liner for CNSI 14-195 cask	$9,438.75
Cost of cask liner for CNSI 8-120A cask (resins)	$6,466.95
Cost of cask liner for CNSI 8-120A cask (filters)	$6,466.95
Decontamination of surfaces with vacuuming, $/square foot	$0.60

APPENDIX C

DETAILED COST ANALYSES - DECON

TABLE C-1
DIABLO CANYON POWER PLANT UNIT 1
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site A CF	Burial site B CF	Burial site C CF	10 CFR 61 GTCC CF	Craft Labor Hours
PERIOD 1																
1	Prepare preliminary decommissioning cost	-	-	-	-	-	104	16	120	120	-	-	-	-	-	-
2	Notification of Cessation of Operations	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
3	Remove fuel & source material	-	-	-	-	-	-	-	Note 2	-	-	-	-	-	-	-
4	Notification of Permanent Defueling	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
5	Deactivate plant systems & process waste	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
6	Prepare and submit PSDAR	-	-	-	-	-	160	24	184	184	-	-	-	-	-	-
7	Review plant dwgs & specs	-	-	-	-	-	368	55	423	423	-	-	-	-	-	-
8	Perform detailed rad survey	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
9	Estimate by-product inventory	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
10	End product description	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
11	Detailed by-product inventory	-	-	-	-	-	104	16	120	120	-	-	-	-	-	-
12	Define major work sequence	-	-	-	-	-	600	90	690	690	-	-	-	-	-	-
13	Perform SER and EA	-	-	-	-	-	248	37	285	285	-	-	-	-	-	-
14	Perform Site-Specific Cost Study	-	-	-	-	-	400	60	460	460	-	-	-	-	-	-
15	Prepare/submit License Termination Plan	-	-	-	-	-	328	49	377	377	-	-	-	-	-	-
16	Receive NRC approval of termination plan	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
Activity Specifications																
17 1	Plant & temporary facilities	-	-	-	-	-	394	59	453	407	45	-	-	-	-	-
17 2	Plant systems	-	-	-	-	-	333	50	383	345	38	-	-	-	-	-
17 3	NSSS Decontamination Flush	-	-	-	-	-	40	6	46	46	-	-	-	-	-	-
17 4	Reactor internals	-	-	-	-	-	568	85	653	653	-	-	-	-	-	-
17 5	Reactor vessel	-	-	-	-	-	520	78	598	598	-	-	-	-	-	-
17 6	Biological shield	-	-	-	-	-	40	6	46	46	-	-	-	-	-	-
17 7	Steam generators	-	-	-	-	-	250	37	287	287	-	-	-	-	-	-
17 8	Reinforced concrete	-	-	-	-	-	128	19	147	74	74	-	-	-	-	-
17 9	Turbine & condenser	-	-	-	-	-	64	10	74	-	74	-	-	-	-	-
17 10	Plant structures & buildings	-	-	-	-	-	250	37	287	143	143	-	-	-	-	-
17 11	Waste management	-	-	-	-	-	368	55	423	423	-	-	-	-	-	-
17 12	Facility & site closeout	-	-	-	-	-	72	11	83	41	41	-	-	-	-	-
17	Total	-	-	-	-	-	3 025	454	3 479	3 064	416	-	-	-	-	-
Planning & Site Preparations																
18	Prepare dismantling sequence	-	-	-	-	-	192	29	221	221	-	-	-	-	-	-
19	Plant prep & temp svces	-	-	-	-	-	2,304	346	2,650	2 650	-	-	-	-	-	-
20	Design water clean-up system	-	-	-	-	-	112	17	129	129	-	-	-	-	-	-
21	Rigging/CCEs/tooling/etc	-	-	-	-	-	1 950	293	2 243	2 243	-	-	-	-	-	-
22	Procure casks/liners & containers	-	-	-	-	-	98	15	113	113	-	-	-	-	-	-
Detailed Work Procedures																
23 1	Plant systems	-	-	-	-	-	379	57	435	392	44	-	-	-	-	-
23 2	NSSS Decontamination Flush	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
23 3	Vessel head	-	-	-	-	-	200	30	230	230	-	-	-	-	-	-
23 4	Reactor internals	-	-	-	-	-	200	30	230	230	-	-	-	-	-	-
23 5	Remaining buildings	-	-	-	-	-	108	16	124	31	93	-	-	-	-	-
23 6	CRD cooling assembly	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
23 7	CRD housings & ICI tubes	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
23 8	Incore instrumentation	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
23 9	Reactor vessel	-	-	-	-	-	290	44	334	334	-	-	-	-	-	-
23 10	Facility closeout	-	-	-	-	-	96	14	110	55	55	-	-	-	-	-
23 11	Missile shields	-	-	-	-	-	36	5	41	41	-	-	-	-	-	-
23 12	Biological shield	-	-	-	-	-	96	14	110	110	-	-	-	-	-	-
23 13	Steam generators	-	-	-	-	-	368	55	423	423	-	-	-	-	-	-
23 14	Reinforced concrete	-	-	-	-	-	80	12	92	46	46	-	-	-	-	-
23 15	Turbine & condensers	-	-	-	-	-	250	37	287	-	287	-	-	-	-	-
23 16	Auxiliary building	-	-	-	-	-	218	33	251	226	25	-	-	-	-	-
23 17	Reactor building	-	-	-	-	-	218	33	251	226	25	-	-	-	-	-
23	Total	-	-	-	-	-	2 859	429	3 288	2 713	575	-	-	-	-	-
24	Decon primary loop	1 610	-	-	-	-	-	805	2 416	2 416	-	-	-	-	-	800

TABLE C-1
DIABLO CANYON POWER PLANT UNIT 1
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site A CF	Burial site B CF	Burial site C CF	10 CFR 61 GTCC CF	Craft Labor Hours
	Period 1 Additional Costs															
25	Hazardous Waste Management	-	-	-	-	-	557	84	641	641	-	-	-	-	-	-
26	Mixed Waste Management	-	-	-	-	-	557	84	641	641	-	-	-	-	-	-
27	Spent Fuel Pad, Cask, Canister, Equipment	-	-	-	-	-	158	24	182	182	-	-	-	-	-	-
28	Spent Fuel Loading Campaigns	-	-	-	-	-	29	4	34	34	-	-	-	-	-	-
29	Spent Fuel Ops & Maintenance	-	-	-	-	-	25	4	28	28	-	-	-	-	-	-
30	Spent Fuel Fixed Costs	-	-	-	-	-	49	7	56	56	-	-	-	-	-	-
31	Transfer of Spent Fuel Canisters to DOE	-	-	-	-	-	196	29	225	225	-	-	-	-	-	-
32	Spent Fuel Pool Isolation	-	-	-	-	-	7 577	1,137	8 714	8 714	-	-	-	-	-	-
33	Site Characterization	-	-	-	-	-	1 011	303	1,314	1,314	-	-	-	-	-	12 588
	Subtotal Period 1 Activity Costs	1 610	-	-	-	-	23,171	4 432	29 214	28 223	991	-	-	-	-	13 388
	Period 1 Undistributed Costs															
1	Decon equipment	687	-	-	-	-	-	103	790	790	-	-	-	-	-	-
2	Decon supplies	41	-	-	-	-	-	10	52	52	-	-	-	-	-	-
3	DOC staff relocation expenses	-	1,306	-	-	-	-	196	1 502	1,502	-	-	-	-	-	-
4	Process liquid waste	105	-	742	862	3 497	-	1 130	6,336	6 336	-	-	8 656	-	-	333
5	Insurance	-	-	-	-	-	3,564	356	3 920	3,920	-	-	-	-	-	-
6	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Health physics supplies	-	302	-	-	-	-	76	378	378	-	-	-	-	-	-
8	Heavy equipment rental	-	261	-	-	-	-	39	300	300	-	-	-	-	-	-
9	Small tool allowance	-	12	-	-	-	-	2	14	14	-	-	-	-	-	-
10	Disposal of DAW generated	-	-	590	14	1,412	-	414	2,430	2,430	-	3 496	-	-	-	9 509
11	Plant energy budget	-	-	-	-	-	876	131	1 008	1,008	-	-	-	-	-	-
12	NRC ISFSI Fees	-	-	-	-	-	26	3	28	28	-	-	-	-	-	-
13	NRC Fees	-	-	-	-	-	404	40	445	445	-	-	-	-	-	-
14	Emergency Planning Fees	-	-	-	-	-	76	8	83	83	-	-	-	-	-	-
15	Site Security Cost	-	-	-	-	-	2,215	332	2,547	2,547	-	-	-	-	-	-
	Subtotal Undistributed Costs Period 1	834	1,882	1 332	875	4,909	7,161	2,841	19 834	19,834	-	3 496	8 656	-	-	9 842
	Staff Costs															
	DOC Staff Cost	-	-	-	-	-	6 340	951	7,291	7 291	-	-	-	-	-	-
	Utility Staff Cost	-	-	-	-	-	26 166	3,925	30 091	30,091	-	-	-	-	-	-
	TOTAL PERIOD 1 COST	2,445	1,882	1,332	875	4,909	62,838	12,150	86,430	85,440	991	3,496	8,656	-	-	23,230
	PERIOD 2															
	Nuclear Steam Supply System Removal															
34.1	Reactor Coolant Piping	100	198	8	8	193	-	150	657	657	-	477	-	-	-	6 817
34.2	Pressurizer Relief Tank	25	22	9	8	251	-	83	399	399	-	621	-	-	-	1 080
34.3	Reactor Coolant Pumps & Motors	94	78	39	13	1 836	114	548	2 722	2 722	-	4,546	-	-	-	3 853
34.4	Pressurizer	38	48	362	313	905	-	340	2,006	2 006	-	2 318	-	-	-	1 867
34.5	Steam Generators	326	2 839	1 895	793	11 894	2 485	4,527	24 760	24 760	-	22 200	-	-	-	24 566
34.6	CRDMs/ICIs/Service Structure Removal	71	56	90	22	1 061	-	327	1,628	1 628	-	2 627	-	-	-	2 832
34.7	Reactor Vessel Internals	113	1,148	3 892	677	5 588	-	4 854	16 272	16 272	-	1 502	1 096	574	-	13 118
34.8	Reactor Vessel	81	3 124	677	553	8 069	-	6 726	19 230	19 230	-	6,416	2 379	-	-	33 180
34	Totals	849	7 513	6 973	2 387	29 797	2 599	17 556	67,674	67 674	-	40 707	3,474	574	-	87 312
35	Remove spent fuel racks	357	36	17	2	1,034	337	499	2 283	2 283	-	2 560	-	-	-	9 340
	Removal of Major Equipment															
36	Main Turbine/Generator	-	404	-	-	-	712	208	1 323	1 323	-	-	-	-	-	9 206
37	Main Condensers	-	1,191	-	-	-	827	422	2,440	2 440	-	-	-	-	-	27 028

TABLE C-1
DIABLO CANYON POWER PLANT UNIT 1
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site ACF	Burial site BCF	Burial site CCF	10 CFR 61 GTCC CF	Craft Labor Hours
Disposal of Plant Systems																
38 1	Auxiliary Steam	-	240	-	-	-	361	114	716	716	-	-	-	-	-	5 424
38 2	Auxiliary Steam (RCA)	-	238	-	-	-	189	88	515	515	-	-	-	-	-	5 529
38 3	Capital Additions 85-2002 (clean)	-	120	-	-	-	-	18	137	-	137	-	-	-	-	2 830
38 4	Capital Additions 85-2002 (contaminated)	-	393	3	1	75	154	140	765	765	-	185	-	-	-	9 348
38 5	Chemical & Volume Control	950	895	29	13	821	374	965	4 048	4 048	-	2 033	-	-	-	41,387
38 6	Chemical & Volume Control (Insulated)	473	386	8	4	227	31	396	1,524	1 524	-	562	-	-	-	20 357
38 7	Component Cooling Water	-	128	-	-	-	-	19	147	-	147	-	-	-	-	3 078
38 8	Component Cooling Water (RCA)	-	539	-	-	-	690	238	1,467	1,467	-	-	-	-	-	12,581
38 9	Compressed Air	-	114	-	-	-	-	17	131	-	131	-	-	-	-	2 744
38 10	Compressed Air (Insulated)	-	4	-	-	-	-	1	5	-	5	-	-	-	-	98
38 11	Compressed Air (RCA Insulated)	-	22	-	-	-	8	7	37	37	-	-	-	-	-	517
38 12	Compressed Air (RCA)	-	397	-	-	-	157	123	676	676	-	-	-	-	-	9 314
38 13	Condensate System	-	1,107	-	-	-	3 824	850	5,780	5,780	-	-	-	-	-	25 117
38 14	Condensate System (Insulated)	-	358	-	-	-	1,179	266	1,803	1 803	-	-	-	-	-	8,131
38 15	Containment Spray	-	198	-	-	-	561	134	893	893	-	-	-	-	-	4 622
38 16	Diesel Engine-Generator	-	118	-	-	-	-	18	136	-	136	-	-	-	-	2 760
38 17	Diesel Engine-Generator (Insulated)	-	7	-	-	-	-	1	8	-	8	-	-	-	-	178
38 18	Electrical (Clean)	-	1 407	-	-	-	-	211	1,618	-	1,618	-	-	-	-	32 770
38 19	Electrical (Contaminated)	-	643	2	1	100	398	246	1,390	1,390	-	247	-	-	-	15 307
38 20	Electrical (Contaminated) - FHB	-	193	0	0	9	61	60	323	323	-	22	-	-	-	4 608
38 21	Electrical (Decontaminated)	-	3 895	-	-	-	3 955	1,567	9,417	9,417	-	-	-	-	-	91 243
38 22	Electrical (Decontaminated) - FHB	-	1,171	-	-	-	585	380	2,136	2,136	-	-	-	-	-	27,474
38 23	Extraction Steam & Heater Drip	-	475	-	-	-	926	258	1,658	1 658	-	-	-	-	-	10 874
38 24	Feedwater System	-	53	-	-	-	311	60	424	424	-	-	-	-	-	1 212
38.25	Feedwater System (Insulated)	-	284	-	-	-	649	168	1,102	1,102	-	-	-	-	-	6 532
38 26	Feedwater System (RCA Insulated)	-	111	-	-	-	156	51	319	319	-	-	-	-	-	2 624
38 27	Feedwater System (RCA)	-	5	-	-	-	8	3	16	16	-	-	-	-	-	123
38 28	Fire Protection	-	260	-	-	-	599	155	1,013	1 013	-	-	-	-	-	5 914
38 29	Fire Protection (RCA)	-	195	-	-	-	128	68	390	390	-	-	-	-	-	4 482
38 30	Gaseous Radwaste	-	78	1	1	39	11	31	161	161	-	97	-	-	-	1,821
38 31	HVAC (Clean Insulated)	-	19	-	-	-	-	3	21	-	21	-	-	-	-	475
38 32	HVAC (Clean)	-	235	-	-	-	-	35	270	-	270	-	-	-	-	5 804
38 33	HVAC (Contaminated Insulated)	-	293	2	1	43	222	117	677	677	-	108	-	-	-	6 142
38 34	HVAC (Contaminated)	-	1,253	9	4	265	1 088	544	3,163	3,163	-	655	-	-	-	26 507
38 35	HVAC (Contaminated) - FHB	-	301	2	1	52	252	126	734	734	-	129	-	-	-	6 346
38 36	Liquid Radwaste	665	587	23	10	627	135	660	2,707	2,707	-	1 552	-	-	-	29 056
38 37	Liquid Radwaste (Insulated)	91	72	2	1	49	4	77	296	296	-	122	-	-	-	3 870
38 38	Lube Oil Distribution & Purification	-	173	-	-	-	161	67	401	401	-	-	-	-	-	3 879
38 39	Make-up Water	-	236	-	-	-	-	35	271	-	271	-	-	-	-	5 614
38 40	Make-up Water (Insulated)	-	21	-	-	-	-	3	24	-	24	-	-	-	-	521
38 41	Make-up Water (RCA Insulated)	-	36	-	-	-	22	12	70	70	-	-	-	-	-	833
38 42	Make-up Water (RCA)	-	186	-	-	-	124	65	375	375	-	-	-	-	-	4 307
38 43	Miscellaneous Reactor Coolant	13	74	1	1	43	23	39	194	194	-	106	-	-	-	1 927
38 44	Nitrogen & Hydrogen	-	13	-	-	-	-	2	15	-	15	-	-	-	-	315
38 45	Nitrogen & Hydrogen (Insulated)	-	1	-	-	-	-	0	1	-	1	-	-	-	-	17
38 46	Nitrogen & Hydrogen (RCA Insulated)	-	5	-	-	-	2	1	7	7	-	-	-	-	-	106
38 47	Nitrogen & Hydrogen (RCA)	-	86	-	-	-	30	26	142	142	-	-	-	-	-	2 009
38 48	Nuclear Steam Supply Sampling	-	115	2	1	50	24	45	237	237	-	124	-	-	-	2 866
38 49	Nuclear Steam Supply Sampling (Insulated	-	35	0	0	12	1	12	60	60	-	29	-	-	-	895
38 50	Oily Water Separator & TB Sump	-	30	-	-	-	49	15	95	95	-	-	-	-	-	672
38 51	Residual Heat Removal	254	274	30	14	849	244	449	2,113	2 113	-	2,101	-	-	-	9 116
38 52	Safety Injection	-	94	2	1	44	60	44	244	244	-	110	-	-	-	2 207
38 53	Safety Injection (Insulated)	-	6	0	0	3	2	2	13	13	-	7	-	-	-	136
38 54	Safety Injection (RCA Insulated)	-	37	1	0	24	18	18	99	99	-	60	-	-	-	873
38 55	Safety Injection (RCA)	-	309	8	4	218	162	158	858	858	-	541	-	-	-	7 165
38 56	Saltwater System	-	127	-	-	-	-	19	146	-	146	-	-	-	-	2 026
38 57	Service Cooling Water	-	77	-	-	-	-	12	88	-	88	-	-	-	-	1 856
38 58	Service Cooling Water (RCA)	-	24	-	-	-	21	9	54	54	-	-	-	-		560
38 59	Spent Fuel Pit Cooling	-	64	11	5	318	92	111	601	601	-	786		-	-	1 537
38 60	Spent Fuel Pit Cooling - FHB	-	90	12	6	341	98	124	670	670	-	843	-	-	-	2,115
38 61	Turbine Steam Supply	-	1 127	-	-	-	4 522	960	6 609	6 609	-	-	-	-		25 947

TABLE C-1
DIABLO CANYON POWER PLANT UNIT 1
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site A CF	Burial site B CF	Burial site C CF	10 CFR 61 GTCC CF	Craft Labor Hours
	Disposal of Plant Systems (cont)															
38 62	Turbine Steam Supply (RCA)	-	778	-	-	-	1,178	371	2,328	2,328	-	-	-	-	-	18 372
38 63	Turbine and Generator	-	101	-	-	-	236	61	398	398	-	-	-	-	-	2 272
38 64	Turbine and Generator (Insulated)	-	51	-	-	-	49	20	121	121	-	-	-	-	-	1 150
38	Totals	2 446	20 960	147	67	4,209	24 130	10 897	62 857	59 838	3 019	10 419	-	-	-	537 425
39	Erect scaffolding for systems removal	-	4 239	2	1	50	132	1 092	5 516	5 516	-	124	-	-	-	39 804
	Decontamination of Site Buildings															
40 1	Reactor	1 253	1,115	372	180	10,197	427	3 583	17,126	17,126	-	25 241	-	-	-	51 629
40 2	Capital Additions 85-2002	20	14	4	2	113	-	42	195	195	-	280	-	-	-	803
40 3	Containment Penetration Area	273	41	24	11	651	95	328	1,422	1,422	-	1 611	-	-	-	6 852
40 4	Fuel Handling	613	383	31	15	841	260	657	2 799	2,799	-	2 081	-	-	-	22 200
40	Totals	2,158	1,553	431	208	11,802	781	4 609	21 542	21,542	-	29 213	-	-	-	81 483
41	License Termination Survey	-	-	-	-	-	5 592	1 678	7 270	7,270	-	-	-	-	-	129 465
42	ORISE confirmatory survey	-	-	-	-	-	105	32	137	137	-	-	-	-	-	-
43	Terminate license	-	-	-	-	-	-	-	note 2	-	-	-	-	-	-	-
	Period 2 Additional Costs															
44	Spent Fuel Pad, Cask, Canister, Equipment	-	-	-	-	-	34,237	5 136	39 373	39 373	-	-	-	-	-	-
45	Spent Fuel Loading Campaigns	-	-	-	-	-	3 927	589	4,516	4 516	-	-	-	-	-	-
46	Spent Fuel Ops & Maintenance	-	-	-	-	-	1 636	245	1 881	1 881	-	-	-	-	-	-
47	Spent Fuel Fixed Costs	-	-	-	-	-	3 271	491	3,762	3,762	-	-	-	-	-	-
48	Spent Fuel Security	-	-	-	-	-	277	42	319	319	-	-	-	-	-	-
49	Transfer of Spent Fuel Canisters to DOE	-	-	-	-	-	1 423	213	1,637	1,637	-	-	-	-	-	-
	Period 2 Additional Costs	5 811	35,895	7,571	2 665	46 892	79 988	43 708	222,530	219 512	3 019	83,022	3 474	574	-	921,063
1	Decon equipment	687	-	-	-	-	-	103	790	790	-	-	-	-	-	-
2	Decon supplies	773	-	-	-	-	-	193	966	966	-	-	-	-	-	-
3	DOC staff relocation expenses	-	1 306	-	-	-	-	196	1,502	1,502	-	-	-	-	-	-
4	Process liquid waste	380	-	277	519	1 666	-	712	3 554	3 554	-	-	4,125	-	-	545
5	Insurance	-	-	-	-	-	2 705	270	2,975	2,975	-	-	-	-	-	-
6	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Health physics supplies	-	3 902	-	-	-	-	975	4,877	4 877	-	-	-	-	-	-
8	Heavy equipment rental	-	8 874	-	-	-	-	1,331	10,205	9,184	1,020	-	-	-	-	-
9	Small tool allowance	-	604	-	-	-	-	91	694	625	69	-	-	-	-	-
10	Pipe cutting equipment	-	911	-	-	-	-	137	1,048	1,048	-	-	-	-	-	-
11	Decon rig	1 184	-	-	-	-	-	178	1 362	1 362	-	-	-	-	-	-
12	Disposal of DAW generated	-	-	1,952	45	4 671	-	1,370	8 037	8 037	-	11,562	-	-	-	31 448
13	Decommissioning Equipment Disposition	-	-	8	4	231	480	131	855	855	-	572	-	-	-	778
14	Plant energy budget	-	-	-	-	-	5 493	824	6,317	5 685	632	-	-	-	-	-
15	NRC ISFSI Fees	-	-	-	-	-	1 710	171	1 881	1,881	-	-	-	-	-	-
16	NRC Fees	-	-	-	-	-	3 466	347	3 813	3 813	-	-	-	-	-	-
17	Emergency Planning Fees	-	-	-	-	-	791	79	871	871	-	-	-	-	-	-
18	Site Security Cost	-	-	-	-	-	13 918	2 088	16 005	16 005	-	-	-	-	-	-
19	LLRW Processing Equipment	-	-	-	-	-	1 516	227	1,743	1,743	-	-	-	-	-	-
	Subtotal Undistributed Costs Period 2	3 024	15 596	2 237	568	6 568	30 078	9 422	67 494	65 773	1 722	12,134	4,125	-	-	32 770
	Staff Costs															
	DOC Staff Cost	-	-	-	-	-	28 658	4 299	32 957	32 957	-	-	-	-	-	
	Utility Staff Cost	-	-	-	-	-	103 830	15 574	119 404	119 404	-	-	-	-	-	
	TOTAL PERIOD 2	8 835	51,491	9 808	3 233	53,461	242,555	73,004	442,386	437,645	4 740	95 156	7,599	574	-	953 833

TABLE C 1
DIABLO CANYON POWER PLANT UNIT 1
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site A CF	Burial site B CF	Burial site C CF	10 CFR 61 GTCC CF	Craft Labor Hours
PERIOD 3																
	Demolition of Remaining Site Buildings															
50 1	Reactor	-	6 871	-	-	-	-	1,031	7,902	1,185	6 717	-	-	-	-	102 078
50 2	Capital Additions 85-2002	-	105	-	-	-	-	16	121	-	121	-	-	-	-	1 766
50 3	Containment Penetration Area	-	421	-	-	-	-	63	485	48	436	-	-	-	-	6 074
50 4	Fuel Handling	-	1 313	-	-	-	-	197	1 510	151	1 359	-	-	-	-	17,063
50 5	Miscellaneous	-	20	-	-	-	-	3	23	-	23	-	-	-	-	249
50 6	Turbine	-	2,510	-	-	-	-	377	2,887	-	2 887	-	-	-	-	42 836
50 7	Turbine Pedestal	-	935	-	-	-	-	140	1 075	-	1 075	-	-	-	-	11 300
50	Totals	-	12,176	-	-	-	-	1 826	14 002	1,385	12 617	-	-	-	-	181 367
	Site Closeout Activities															
51	Grade & landscape site	-	1,386	-	-	-	-	208	1,594	-	1 594	-	-	-	-	4 587
52	Final report to NRC	-	-	-	-	-	125	19	143	143	-	-	-	-	-	-
	Period 3 Additional Cost															
53	Vessel & Internals GTCC Disposal	-	-	-	-	13 213	-	1,982	15,195	15,195	-	-	-	-	604	-
54	Spent Fuel Ops & Maintenance	-	-	-	-	-	296	44	341	341	-	-	-	-	-	-
55	Spent Fuel Fixed Costs	-	-	-	-	-	593	89	681	681	-	-	-	-	-	-
56	Spent Fuel Security	-	-	-	-	-	593	89	681	681	-	-	-	-	-	-
57	Transfer of Spent Fuel Canisters to DOE	-	-	-	-	-	512	77	588	588	-	-	-	-	-	-
Subtotal Period 3 Activity Costs		-	13 562	-	-	13 213	2,118	4,334	33 227	19 015	14 212	-	-	-	604	185 953
1	Insurance	-	-	-	-	-	172	17	189	189	-	-	-	-	-	-
2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Heavy equipment rental	-	3,779	-	-	-	-	567	4 346	-	4 346	-	-	-	-	-
4	Small tool allowance	-	154	-	-	-	-	23	177	-	177	-	-	-	-	-
5	Plant energy budget	-	-	-	-	-	103	15	119	-	119	-	-	-	-	-
6	NRC ISFSI Fees	-	-	-	-	-	310	31	341	341	-	-	-	-	-	-
7	Site Security Cost	-	-	-	-	-	622	93	716	-	716	-	-	-	-	-
Subtotal Undistributed Costs Period 3		-	3 933	-	-	-	1 207	747	5 887	530	5 357	-	-	-	-	-
Staff Costs																
	DOC Staff Cost	-	-	-	-	-	4 682	702	5,384	-	5 384	-	-	-	-	-
	Utility Staff Cost	-	-	-	-	-	2,200	330	2 530	2,277	253	-	-	-	-	-
TOTAL PERIOD 3		-	17,495	-	-	13,213	10,207	6,113	47,028	21,822	25,206	-	-	-	604	185 953
TOTAL COST TO DECOMMISSION		11,279	70 868	11,140	4,108	71,583	315,599	91,266	575,844	544,907	30,937	98 652	16 255	574	604	1,163 017

Total cost to decommission with	18 83%	contingency	$575 843,588	
Total NRC license termination cost is	94 63%	or	$544 906,510	
Non nuclear demolition cost is	5 37%	or	$30 937,078	
Total burial site radwaste volume buried			115,481	cubic feet
Total 10CFR61 greater than class C waste buried			604	cubic feet
Total scrap metal released from site			12 215	tons
Total craft labor requirements			1 163 017	person hours

NOTES

"0" indicates costs less than $500

1) This activity is performed by the decommissioning staff following plant shutdown, the costs for this are included in this period's staff cost

2) This activity while performed after final plant shutdown is considered part of operations and therefore no decommissioning costs are included for this activity

TABLE C-2
DIABLO CANYON POWER PLANT UNIT 2
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site A CF	Burial site B CF	Burial site C CF	10 CFR 61 GTCC CF	Craft Labor Hours
PERIOD 1																
1	Prepare preliminary decommissioning cost	-	-	-	-	-	104	16	120	120	-	-	-	-	-	-
2	Notification of Cessation of Operations	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
3	Remove fuel & source material	-	-	-	-	-	-	-	Note 2	-	-	-	-	-	-	-
4	Notification of Permanent Defueling	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
5	Deactivate plant systems & process waste	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
6	Prepare and submit PSDAR	-	-	-	-	-	160	24	184	184	-	-	-	-	-	-
7	Review plant dwgs & specs	-	-	-	-	-	368	55	423	423	-	-	-	-	-	-
8	Perform detailed rad survey	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
9	Estimate by-product inventory	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
10	End product description	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
11	Detailed by-product inventory	-	-	-	-	-	104	16	120	120	-	-	-	-	-	-
12	Define major work sequence	-	-	-	-	-	600	90	690	690	-	-	-	-	-	-
13	Perform SER and EA	-	-	-	-	-	248	37	285	285	-	-	-	-	-	-
14	Perform Site-Specific Cost Study	-	-	-	-	-	400	60	460	460	-	-	-	-	-	-
15	Prepare/submit License Termination Plan	-	-	-	-	-	328	49	377	377	-	-	-	-	-	-
16	Receive NRC approval of termination plan	-	-	-	-	-	-	-	Note 1	-	-	-	-	-	-	-
Activity Specifications																
17 1	Plant & temporary facilities	-	-	-	-	-	394	59	453	407	45	-	-	-	-	-
17 2	Plant systems	-	-	-	-	-	333	50	383	345	38	-	-	-	-	-
17 3	NSSS Decontamination Flush	-	-	-	-	-	40	6	46	46	-	-	-	-	-	-
17 4	Reactor internals	-	-	-	-	-	568	85	653	653	-	-	-	-	-	-
17 5	Reactor vessel	-	-	-	-	-	520	78	598	598	-	-	-	-	-	-
17 6	Biological shield	-	-	-	-	-	40	6	46	46	-	-	-	-	-	-
17 7	Steam generators	-	-	-	-	-	250	37	287	287	-	-	-	-	-	-
17 8	Reinforced concrete	-	-	-	-	-	128	19	147	74	74	-	-	-	-	-
17 9	Turbine & condenser	-	-	-	-	-	64	10	74	-	74	-	-	-	-	-
17 10	Plant structures & buildings	-	-	-	-	-	250	37	287	143	143	-	-	-	-	-
17 11	Waste management	-	-	-	-	-	368	55	423	423	-	-	-	-	-	-
17 12	Facility & site closeout	-	-	-	-	-	72	11	83	41	41	-	-	-	-	-
17	Total	-	-	-	-	-	3 025	454	3 479	3 064	416	-	-	-	-	-
Planning & Site Preparations																
18	Prepare dismantling sequence	-	-	-	-	-	192	29	221	221	-	-	-	-	-	-
19	Plant prep & temp svces	-	-	-	-	-	2 304	346	2 650	2 650	-	-	-	-	-	-
20	Design water clean-up system	-	-	-	-	-	112	17	129	129	-	-	-	-	-	-
21	Rigging/CCEs/tooling/etc	-	-	-	-	-	1 950	293	2,243	2 243	-	-	-	-	-	-
22	Procure casks/liners & containers	-	-	-	-	-	98	15	113	113	-	-	-	-	-	-
Detailed Work Procedures																
23 1	Plant systems	-	-	-	-	-	379	57	435	392	44	-	-	-	-	-
23 2	NSSS Decontamination Flush	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
23 3	Vessel head	-	-	-	-	-	200	30	230	230	-	-	-	-	-	-
23 4	Reactor internals	-	-	-	-	-	200	30	230	230	-	-	-	-	-	-
23 5	Remaining buildings	-	-	-	-	-	108	16	124	31	93	-	-	-	-	-
23 6	CRD cooling assembly	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
23 7	CRD housings & ICI tubes	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
23 8	Incore instrumentation	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-
23 9	Reactor vessel	-	-	-	-	-	290	44	334	334	-	-	-	-	-	
23 10	Facility closeout	-	-	-	-	-	96	14	110	55	55	-	-	-	-	-
23 11	Missile shields	-	-	-	-	-	36	5	41	41	-	-	-	-	-	
23 12	Biological shield	-	-	-	-	-	96	14	110	110	-	-	-	-	-	
23 13	Steam generators	-	-	-	-	-	368	55	423	423	-	-	-	-	-	
23 14	Reinforced concrete	-	-	-	-	-	80	12	92	46	46	-	-	-		
23 15	Turbine & condensers	-	-		-	-	250	37	287	-	287	-	-	-	-	

TABLE C-2
DIABLO CANYON POWER PLANT UNIT 2
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site A CF	Burial site B CF	Burial site C CF	10 CFR 61 GTCC CF	Craft Labor Hours
	Detailed Work Procedures (cont.)															
23.16	Auxiliary building	-	-	-	-	-	218	33	251	226	25	-	-	-	-	-
23.17	Reactor building	-	-	-	-	-	218	33	251	226	25	-	-	-	-	-
23	Total	-	-	-	-	-	2,859	429	3 288	2,713	575	-	-	-	-	-
24	Decon primary loop	1,492	-	-	-	-	-	746	2,238	2,238	-	-	-	-	-	800
	Period 1 Additional Costs															
25	Hazardous Waste Management	-	-	-	-	-	557	84	641	641	-	-	-	-	-	-
26	Mixed Waste Management	-	-	-	-	-	557	84	641	641	-	-	-	-	-	-
27	Spent Fuel Pad, Cask, Canister, Equipment	-	-	-	-	-	700	105	805	805	-	-	-	-	-	-
28	Spent Fuel Loading Campaigns	-	-	-	-	-	130	20	150	150	-	-	-	-	-	-
29	Spent Fuel Ops & Maintenance	-	-	-	-	-	415	62	478	478	-	-	-	-	-	-
30	Spent Fuel Fixed Costs	-	-	-	-	-	831	125	956	956	-	-	-	-	-	-
31	Transfer of Spent Fuel Canisters to DOE	-	-	-	-	-	196	29	225	225	-	-	-	-	-	-
32	Spent Fuel Pool Isolation	-	-	-	-	-	5 051	758	5 809	5 809	-	-	-	-	-	-
33	Site Characterization	-	-	-	-	-	1 011	303	1,314	1,314	-	-	-	-	-	12,588
	Subtotal Period 1 Activity Costs	1 492	-	-	-	-	22,461	4,267	28,219	27 229	991	-	-	-	-	13 388
	Period 1 Undistributed Costs															
1	Decon equipment	687	-	-	-	-	-	103	790	790	-	-	-	-	-	-
2	Decon supplies	41	-	-	-	-	-	10	52	52	-	-	-	-	-	-
3	DOC staff relocation expenses	-	1,306	-	-	-	-	196	1,502	1 502	-	-	-	-	-	-
4	Process liquid waste	103	-	688	800	3 225	-	1 046	5 861	5 861	-	-	7 982	-	-	314
5	Insurance	-	-	-	-	-	3,564	356	3 920	3 920	-	-	-	-	-	-
6	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Health physics supplies	-	302	-	-	-	-	76	378	378	-	-	-	-	-	-
8	Heavy equipment rental	-	261	-	-	-	-	39	300	300	-	-	-	-	-	-
9	Small tool allowance	-	12	-	-	-	-	2	14	14	-	-	-	-	-	-
10	Disposal of DAW generated	-	-	606	14	1,441	-	423	2 484	2 484	-	3 567	-	-	-	9 702
11	Plant energy budget	-	-	-	-	-	876	131	1,008	1 008	-	-	-	-	-	-
12	NRC ISFSI Fees	-	-	-	-	-	434	43	478	478	-	-	-	-	-	-
13	NRC Fees	-	-	-	-	-	245	25	270	270	-	-	-	-	-	-
14	Emergency Planning Fees	-	-	-	-	-	76	8	83	83	-	-	-	-	-	-
15	Site Security Cost	-	-	-	-	-	1,578	237	1 815	1 815	-	-	-	-	-	
	Subtotal Undistributed Costs Period 1	831	1 882	1,294	814	4 666	6 774	2,695	18,956	18 956	-	3,567	7,982	-	-	10 016
	Staff Costs															
	DOC Staff Cost	-	-	-	-	-	4 077	611	4 688	4 688	-	-	-	-	-	-
	Utility Staff Cost	-	-	-	-	-	26 173	3 926	30 099	30 099	-	-	-	-	-	-
	TOTAL PERIOD 1 COST	2,323	1,882	1,294	814	4 666	59,484	11,499	81,962	80,971	991	3,567	7,982	-	-	23,404
	PERIOD 2															
	Nuclear Steam Supply System Removal															
34.1	Reactor Coolant Piping	100	198	8	8	193	-	150	657	657	-	477	-	-	-	6 817
34.2	Pressurizer Relief Tank	25	22	9	8	251	-	83	399	399	-	621	-	-	-	1 080
34.3	Reactor Coolant Pumps & Motors	94	78	39	13	1 836	114	548	2 722	2 722	-	4 546	-	-	-	3 853
34.4	Pressurizer	38	48	362	313	905	-	340	2 006	2,006	-	2 318	-	-	-	1 867
34.5	Steam Generators	326	2 839	1 895	793	11 894	2 485	4 527	24 760	24 760	-	22 200	-	-	-	24 566
34.6	CRDMs/ICIs/Service Structure Removal	71	56	91	22	1 061	-	327	1 629	1 629	-	2 627	-	-	-	2 832
34.7	Reactor Vessel Internals	106	1 123	3 867	644	5 487	-	4 766	15 992	15 992	-	1 502	845	574	-	12 286
34.8	Reactor Vessel	79	3 118	674	553	8 069	-	6 720	19 213	19 213	-	6 416	2 379	-		31 020
34	Totals	839	7 482	6 946	2 354	29 696	2 599	17,462	67,378	67 378	-	40,707	3 224	574		86 320
35	Remove spent fuel racks	357	36	18	2	1 034	337	498	2 282	2 282	-	2 558		-	-	9 333

TABLE C-2
DIABLO CANYON POWER PLANT UNIT 2
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site			10 CFR 61	Craft Labor
												A CF	B CF	C CF	GTCC CF	Hours
	Removal of Major Equipment															
36	Main Turbine/Generator	-	410	-	-	-	723	211	1 344	1,344	-	-	-	-	-	9 347
37	Main Condensers	-	1,191	-	-	-	827	422	2 440	2,440	-	-	-	-	-	27 028
	Disposal of Plant Systems															
38 1	Auxiliary Steam	-	122	-	-	-	198	60	380	380	-	-	-	-	-	2,751
38 2	Auxiliary Steam (RCA)	-	117	-	-	-	93	43	253	253	-	-	-	-	-	2 707
38 3	Building Services (Non-Power Block)	-	5	-	-	-	-	1	5	-	5	-	-	-	-	106
38 4	Capital Additions 85-2002 (Clean)	-	638	-	-	-	-	96	733	-	733	-	-	-	-	14 662
38 5	Capital Additions 85-2002 (contaminated)	-	448	3	1	85	226	168	931	931	-	210	-	-	-	10 337
38 6	Chemical & Volume Control	877	777	26	12	712	317	863	3 584	3 584	-	1,763	-	-	-	37,131
38 7	Chemical & Volume Control (Insulated)	427	354	7	3	207	30	360	1 388	1,388	-	512	-	-	-	18 505
38 8	Component Cooling Water	-	124	-	-	-	-	19	143	-	143	-	-	-	-	2 984
38 9	Component Cooling Water (RCA)	-	528	-	-	-	691	236	1,455	1,455	-	-	-	-	-	12 322
38 10	Compressed Air	-	77	-	-	-	-	11	88	-	88	-	-	-	-	1 881
38 11	Compressed Air (Insulated)	-	4	-	-	-	-	1	5	-	5	-	-	-	-	99
38 12	Compressed Air (RCA Insulated)	-	22	-	-	-	9	7	37	37	-	-	-	-	-	513
38 13	Compressed Air (RCA)	-	387	-	-	-	167	122	676	676	-	-	-	-	-	9 116
38 14	Condensate System	-	1 011	-	-	-	3 525	781	5,317	5,317	-	-	-	-	-	22 930
38 15	Condensate System (Insulated)	-	345	-	-	-	1,166	261	1,772	1,772	-	-	-	-	-	7 832
38 16	Containment Spray	-	187	-	-	-	541	128	856	856	-	-	-	-	-	4 348
38 17	Diesel Engine-Generator	-	74	-	-	-	-	11	85	-	85	-	-	-	-	1,719
38 18	Diesel Engine Generator (Insulated)	-	2	-	-	-	-	0	2	-	2	-	-	-	-	48
38 19	Electrical (Clean)	-	2 058	-	-	-	-	309	2 366	-	2 366	-	-	-	-	47 918
38 20	Electrical (Contaminated)	-	371	1	1	45	191	133	741	741	-	111	-	-	-	8 826
38 21	Electrical (Contaminated) - FHB	-	115	0	0	5	36	35	192	192	-	13	-	-	-	2,741
38 22	Electrical (RCA)	-	2,222	-	-	-	1,656	804	4 682	4,682	-	-	-	-	-	52 102
38 23	Electrical (RCA)-FHB	-	691	-	-	-	342	224	1 257	1 257	-	-	-	-	-	16 220
38 24	Extraction Steam & Heater Drip	-	402	-	-	-	887	234	1,522	1,522	-	-	-	-	-	9 195
38 25	Feedwater System	-	75	-	-	-	723	127	925	925	-	-	-	-	-	1,711
38 26	Feedwater System (Insulated)	-	106	-	-	-	-	16	122	-	122	-	-	-	-	2 547
38 27	Feedwater System (RCA Insulated)	-	107	-	-	-	155	50	311	311	-	-	-	-	-	2 521
38 28	Feedwater System (RCA)	-	5	-	-	-	8	2	16	16	-	-	-	-	-	118
38.29	Fire Protection	-	245	-	-	-	590	150	986	986	-	-	-	-	-	5 590
38 30	Fire Protection (RCA)	-	203	-	-	-	175	77	454	454	-	-	-	-	-	4 666
38 31	Gaseous Radwaste	-	106	2	1	49	48	46	252	252	-	121	-	-	-	2 505
38 32	HVAC (Clean Insulated)	-	26	-	-	-	-	4	30	-	30	-	-	-	-	662
38 33	HVAC (Clean)	-	274	-	-	-	-	41	315	-	315	-	-	-	-	6 878
38.34	HVAC (Contaminated Insulated)	-	220	1	0	25	155	84	485	485	-	61	-	-	-	4 609
38.35	HVAC (Contaminated)	-	942	7	3	181	763	396	2 292	2 292	-	448	-	-	-	19 921
38 36	HVAC (Contaminated) - FHB	-	213	1	0	25	167	85	491	491	-	62	-	-	-	4 495
38 37	Liquid Radwaste	355	317	15	6	392	112	374	1 570	1 570	-	970	-	-	-	15 541
38 38	Liquid Radwaste (Insulated)	40	35	1	0	25	2	35	138	138	-	61	-	-	-	1 771
38 39	Lube Oil Distribution & Purification	-	188	-	-	-	269	87	545	545	-	-	-	-	-	4 239
38 40	Make-up Water	-	161	-	-	-	-	24	185	-	185	-	-	-	-	3 794
38 41	Make-up Water (Insulated)	-	15	-	-	-	-	2	18	-	18	-	-	-	-	376
38 42	Make-up Water (RCA Insulated)	-	25	-	-	-	19	9	54	54	-	-	-	-	-	586
38 43	Make-up Water (RCA)	-	125	-	-	-	109	48	282	282	-	-	-	-	-	2 884
38 44	Mechanical Department Equipment	-	1	-	-	-	-	0	1	-	1	-	-	-	-	19
38 45	Miscellaneous Reactor Coolant	13	76	1	1	43	23	40	197	197	-	106	-	-	-	1 978
38 46	NSSS Sampling	-	95	2	1	62	7	41	208	208	-	154	-	-	-	2 395
38 47	NSSS Sampling (Insulated)	-	27	0	0	8	-	9	44	44	-	19	-	-	-	711
38 48	Nitrogen & Hydrogen	-	13	-	-	-	-	2	14	-	14	-	-	-	-	309
38 49	Nitrogen & Hydrogen (Insulated)	-	1	-	-	-	-	0	1	-	1	-	-	-	-	16
38 50	Nitrogen & Hydrogen (RCA Insulated)	-	4	-	-	-	1	1	7	7	-	-	-	-	-	98

TABLE C-2
DIABLO CANYON POWER PLANT UNIT 2
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site A CF	Burial site B CF	Burial site C CF	10 CFR 61 GTCC CF	Craft Labor Hours
Disposal of Plant Systems (cont)																
38 51	Nitrogen & Hydrogen (RCA)	-	79	-	-	-	27	24	129	129	-	-	-	-	-	1 853
38 52	Nuclear Steam Supply Sampling	-	19	0	0	10	2	7	38	38	-	24	-	-	-	441
38 53	Nuclear Steam Supply Sampling (Insulated	-	8	0	0	4	1	3	16	16	-	10	-	-	-	189
38 54	Oily Water Separator & TB Sump	-	20	-	-	-	33	10	62	62	-	-	-	-	-	441
38 55	Residual Heat Removal	248	256	30	14	841	240	439	2 067	2,067	-	2 081	-	-	-	8 554
38 56	Safety Injection	-	92	2	1	44	60	43	241	241	-	109	-	-	-	2,157
38 57	Safety Injection (Insulated)	-	5	0	0	3	2	2	12	12	-	7	-	-	-	118
38 58	Safety Injection (RCA Insulated)	-	36	1	0	24	18	18	97	97	-	60	-	-	-	833
38 59	Safety Injection (RCA)	-	294	8	4	217	160	153	835	835	-	537	-	-	-	6 789
38 60	Saltwater System	-	120	-	-	-	-	18	138	-	138	-	-	-	-	2,779
38 61	Service Cooling Water	-	90	-	-	-	-	14	104	-	104	-	-	-	-	2 186
38 62	Service Cooling Water (RCA)	-	30	-	-	-	28	12	70	70	-	-	-	-	-	698
38 63	Sewer System Expansion	-	31	-	-	-	-	5	36	-	36	-	-	-	-	746
38 64	Spent Fuel Pit Cooling	-	65	11	5	319	94	112	606	606	-	790	-	-	-	1 555
38 65	Spent Fuel Pit Cooling - FHB	-	90	12	6	342	101	125	677	677	-	848	-	-	-	2,157
38 66	Turbine Steam Supply	-	1,157	-	-	-	4,610	981	6,748	6,748	-	-	-	-	-	26,620
38 67	Turbine Steam Supply (RCA)	-	803	-	-	-	1 234	386	2,422	2,422	-	-	-	-	-	18 952
38 68	Turbine and Generator	-	102	-	-	-	250	63	416	416	-	-	-	-	-	2 299
38 69	Turbine and Generator (Insulated)	-	46	-	-	-	46	18	111	111	-	-	-	-	-	1 037
38	Totals	1 960	18 026	130	59	3 666	20,308	9 089	53,239	48 847	4,391	9 074	-	-	-	458 334
39	Erect scaffolding for systems removal	-	7,950	4	1	111	292	2 060	10 419	10,419	-	276	-	-	-	79 553
Decontamination of Site Buildings																
40 1	Reactor	1 253	1,116	375	180	10,197	427	3 583	17,131	17,131	-	25 241	-	-	-	51 630
40 2	Auxiliary	1 111	103	96	46	2 630	183	1,283	5,451	5,451	-	6,510	-	-	-	26 226
40 3	Capital Additions 85-2002	326	14	24	11	672	-	339	1,385	1 385	-	1 662	-	-	-	7 457
40 4	Containment Penetration Area	273	41	24	11	651	95	328	1,422	1 422	-	1 611	-	-	-	6 852
40 5	Fuel Handling	613	383	31	15	841	260	657	2 800	2,800	-	2 081	-	-	-	22 200
40 6	Radwaste Storage	38	6	10	5	286	6	94	445	445	-	707	-	-	-	766
40	Totals	3,614	1,663	561	268	15,276	970	6,283	28 635	28 635	-	37,812	-	-	-	115,131
41	License Termination Survey	-	-	-	-	-	9 074	2 722	11,796	11 796	-	-	-	-	-	217,991
42	ORISE confirmatory survey	-	-	-	-	-	105	32	137	137	-	-	-	-	-	-
43	Terminate license	-	-	-	-	-	-	-	note 2	-	-	-	-	-	-	-
Period 2 Additional Costs																
44	Spent Fuel Pad Cask Canister Equipment	-	-	-	-	-	33 696	5 054	38 750	38 750	-	-	-	-	-	-
45	Spent Fuel Loading Campaigns	-	-	-	-	-	3 826	574	4 400	4 400	-	-	-	-	-	-
46	Spent Fuel Ops & Maintenance	-	-	-	-	-	1 333	200	1 533	1,533	-	-	-	-	-	-
47	Spent Fuel Fixed Costs	-	-	-	-	-	2 666	400	3 066	3 066	-	-	-	-	-	-
48	Spent Fuel Security	-	-	-	-	-	454	68	522	522	-	-	-	-	-	-
49	Transfer of Spent Fuel Canisters to DOE	-	-	-	-	-	1 582	237	1 819	1 819	-	-	-	-	-	-
Subtotal Period 2 Activity Costs		6 770	36 757	7 659	2 684	49 783	78 793	45 313	227,759	223,367	4 391	90,427	3 224	574	-	1 003 038
Period 2 Undistributed Costs																
1	Decon equipment	687	-	-	-	-	-	103	790	790	-	-	-	-	-	-
2	Decon supplies	1,247	-	-	-	-	-	312	1 559	1 559	-	-	-	-	-	-
3	DOC staff relocation expenses	-	1 306	-	-	-	-	196	1 502	1 502	-	-	-	-	-	-
4	Process liquid waste	399	-	269	522	1 643	-	715	3 548	3 548	-	-	4 067	-	-	566
5	Insurance	-	-	-	-	-	2 084	208	2 293	2 293	-	-	-	-	-	-
6	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Health physics supplies	-	4 092	-	-	-	-	1 023	5 114	5,114	-	-	-	-	-	
8	Heavy equipment rental	-	8 027	-	-	-	-	1,204	9 231	8 308	923	-	-	-	-	-
9	Small tool allowance	-	594	-	-	-	-	89	683	615	68	-	-	-	-	-
10	Pipe cutting equipment	-	911	-	-	-	-	137	1 048	1 048	-	-	-	-	-	-

TABLE C-2
DIABLO CANYON POWER PLANT UNIT 2
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2002 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC Lic Term	Site Restore	Burial site ACF	Burial site BCF	Burial site CCF	10 CFR 61 GTCC CF	Craft Labor Hours
	Period 2 Undistributed Costs (cont)															
11	Decon rig	1 184	-	-	-	-	-	178	1 362	1 362	-	-	-	-	-	
12	Disposal of DAW generated	-	-	1 814	42	4 311	-	1,265	7,432	7 432	-	10 671	-	-	-	29 025
13	Decommissioning Equipment Disposition	-	-	8	4	231	480	131	855	855	-	572	-	-	-	778
14	Plant energy budget	-	-	-	-	-	4 969	745	5 714	5,143	571	-	-	-	-	-
15	NRC ISFSI Fees	-	-	-	-	-	1 394	139	1 533	1 533	-	-	-	-	-	-
16	NRC Fees	-	-	-	-	-	2,672	267	2,939	2 939	-	-	-	-	-	
17	Emergency Planning Fees	-	-	-	-	-	610	61	671	671	-	-	-	-	-	-
18	Site Security Cost	-	-	-	-	-	19 050	2 858	21,908	21 908	-	-	-	-	-	-
19	LLRW Processing Equipment	-	-	-	-	-	1 346	202	1 547	1 547	-	-	-	-	-	-
	Subtotal Undistributed Costs Period 2	3 517	14 929	2,092	568	6,185	32,604	9,833	69 728	68 165	1 563	11 243	4 067	-	-	30 368
	Staff Costs															
	DOC Staff Cost	-	-	-	-	-	29 080	4,362	33,442	33 442	-	-	-	-	-	-
	Utility Staff Cost	-	-	-	-	-	108,415	16 262	124 677	124 677	-	-	-	-	-	-
	TOTAL PERIOD 2	**10,287**	**51,686**	**9,750**	**3,252**	**55,968**	**248,892**	**75,771**	**455,606**	**449,652**	**5,954**	**101,669**	**7,291**	**574**	**-**	**1,033,407**
	PERIOD 3															
	Demolition of Remaining Site Buildings															
50 1	Reactor	-	6 887	-	-	-	-	1 033	7,921	1,188	6 732	-	-	-	-	102 078
50 2	Administration	-	793	-	-	-	-	119	912	-	912	-	-	-	-	10 358
50 3	Auxiliary	-	5 449	-	-	-	-	817	6 266	627	5 639	-	-	-	-	82 811
50 4	Breakwater	-	35,437	-	-	-	-	5,316	40 752	-	40 752	-	-	-	-	118,381
50 5	Capital Additions 85-2002	-	3,410	-	-	-	-	512	3,922	-	3,922	-	-	-	-	51,043
50 6	Chemical Storage	-	3	-	-	-	-	1	4	-	4	-	-	-	-	46
50 7	Chlorination	-	7	-	-	-	-	1	8	-	8	-	-	-	-	97
50 8	Circulating Water Tunnels	-	1,035	-	-	-	-	155	1,190	-	1,190	-	-	-	-	20 361
50 9	Cold Machine Shop	-	290	-	-	-	-	43	333	-	333	-	-	-	-	3 779
50 10	Communication	-	3	-	-	-	-	0	4	-	4	-	-	-	-	44
50 11	Condensate Polishing/Technical Support	-	386	-	-	-	-	58	444	-	444	-	-	-	-	6 959
50 12	Containment Penetration Area	-	423	-	-	-	-	63	486	49	438	-	-	-	-	6 077
50 13	Discharge Structure	-	756	-	-	-	-	113	869	-	869	-	-	-	-	8 052
50 14	Fabrication Shop	-	92	-	-	-	-	14	106	-	106	-	-	-	-	1 223
50 15	Fire Pump House	-	4	-	-	-	-	1	5	-	5	-	-	-	-	55
50 16	Fuel Handling	-	1 276	-	-	-	-	191	1 468	147	1 321	-	-	-	-	18 457
50 17	Hazardous Waste Storage Facility	-	1 360	-	-	-	-	204	1 564	-	1 564	-	-	-	-	417
50 18	Intake Structure	-	4 296	-	-	-	-	644	4 940	-	4 940	-	-	-	-	16 312
50 19	Maintenance Shop	-	266	-	-	-	-	40	306	-	306	-		-	-	3 444
50 20	Miscellaneous Structures	-	51	-	-	-	-	8	58	-	58	-	-	-	-	703
50 21	NPO Permanent Warehouse	-	1 057	-	-	-	-	159	1 216	-	1 216	-	-	-	-	14 092
50 22	Ponds	-	1	-	-	-	-	0	1	-	1	-	-	-	-	18
50 23	Portable Fire Pump & Fuel Cart	-	1	-	-	-	-	0	1	-	1	-	-	-	-	14
50 24	Pretreatment	-	8	-	-	-	-	1	9	-	9	-	-	-	-	108
50 25	Radwaste Storage	-	1,403	-	-	-	-	210	1 613	81	1 533	-	-	-	-	18 120
50 26	Rotor Warhouse	-	717	-	-	-	-	107	824	-	824	-	-	-	-	9 938
50 27	Security	-	286	-	-	-	-	43	329	-	329	-	-	-	-	3 942
50 28	Simulator	-	316	-	-	-	-	47	364	-	364	-	-	-	-	1 191
50 29	Telephone Terminal	-	2	-	-	-	-	0	2	-	2	-	-	-	-	28
50 30	Turbine	-	3 466	-	-	-	-	520	3 986	-	3 986	-	-	-	-	58 341
50 31	Turbine Pedestal	-	938	-	-	-	-	141	1 079	-	1 079	-	-	-	-	11 300
50 32	Vehicle Maintenance	-	27	-	-	-	-	4	31	-	31	-	-	-		366
50 33	Waste Water Holding & Treatment Facility	-	18	-	-	-	-	3	20	-	20	-		-	-	238
50	Totals	-	70 464	-	-	-	-	10 570	81 034	2 091	78 943	-	-	-	-	601 721

TABLE C-2
DIABLO CANYON POWER PLANT UNIT 2
DECON DECOMMISSIONING COST ESTIMATE
(Thousands of 2003 Dollars)

ID Number	Activity Description	Decon	Remove	Pack	Ship	Burial	Other	Contingency	Total	NRC LicTerm	Site Restore	Burial site ACF	Burial site BCF	Burial site CCF	10 CFR 61 GTCC CF	Craft Labor Hours
	Site Closeout Activities															
51	Remove Rubble	-	108 505	-	-	-	-	16 276	124,781	-	124,781	-	-	-	-	184 226
52	Grade & landscape site	-	1,395	-	-	-	-	209	1 605	-	1 605	-	-	-	-	4 587
53	Final report to NRC		-	-	-	-	125	19	143	143	-	-	-	-	-	-
	Period 3 Additional Cost															
54	Vessel & Internals GTCC Disposal	-	-	-	-	13 213	-	1 982	15 195	15 195	-	-	-	-	604	-
55	ISFSI License Termination	26	2,179	54	17	1 063	1,152	1,004	5,496	5,496	-	2 632	-	-	-	40 148
56	ISFSI Demolition	-	1,557	-	-	-	34	239	1 830	-	1 830	-	-	-	-	15 396
57	Spent Fuel Ops & Maintenance	-	-	-	-	-	208	31	239	239	-	-	-	-	-	-
58	Spent Fuel Fixed Cost	-	-	-	-	-	416	62	478	478	-	-	-	-	-	-
59	Spent Fuel Security	-	-	-	-	-	416	62	478	478	-	-	-	-	-	-
50	Transfer Spent Fuel Canisters to DOE	-	-	-	-	-	353	53	406	406	-	-	-	-	-	-
	Subtotal Period 3 Activity Costs	26	184 100	54	17	14 276	2 703	30,507	231,684	24,526	207,158	2 632	-	-	604	846 078
	Period 3 Undistributed Costs															
1	Insurance	-	-	-	-	-	218	22	240	240	-	-	-	-	-	-
2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Heavy equipment rental	-	3 779	-	-	-	-	567	4 346	-	4 346	-	-	-	-	-
4	Small tool allowance	-	691	-	-	-	-	104	795	-	795	-	-	-	-	-
5	Plant energy budget	-	-	-	-	-	103	15	119	-	119	-	-	-	-	-
6	NRC ISFSI Fees	-	-	-	-	-	217	22	239	239	-	-	-	-	-	-
7	Emergency Planning Fees	-	-	-	-	-	212	21	234	234	-	-	-	-	-	-
8	Site Security Cost	-	-	-	-	-	2,572	386	2 958	-	2 958	-	-	-	-	-
	Subtotal Undistributed Costs Period 3	-	4 471	-	-	-	3 323	1,137	8 930	712	8 218	-	-	-	-	-
	Staff Costs															
	DOC Staff Cost	-	-	-	-	-	9 994	1,499	11,493	-	11,493	-	-	-	-	-
	Utility Staff Cost	-	-	-	-	-	10,128	1,519	11,647	10 483	1,165	-	-	-	-	-
	TOTAL PERIOD 3	26	188,571	54	17	14,276	26,148	34 662	263,754	35,721	228,033	2,632	-	-	604	846,078
	TOTAL COST TO DECOMMISSION	12 637	242,138	11,099	4 082	74,910	334,524	121,932	801,322	566,343	234 978	107,868	15 272	574	604	1,902 888

Total cost to decommission with	17 95%	contingency	$801,321,541	
Total NRC license termination cost is	70 68%	or	$566 343 448	
Non-nuclear demolition cost is	29 32%	or	$234,978,098	
Total burial site radwaste volume buried			123 715	cubic feet
Total 10CFR61 greater than class C waste buried			604	cubic feet
Total scrap metal released from site			22 080	tons
Total craft labor requirements			1 902 888	person hours

NOTES

"0" indicates costs less than $500
1) This activity is performed by the decommissioning staff following plant shutdown the costs for this are included in this period's staff cost
2) This activity while performed after final plant shutdown is considered part of operations and therefore no decommissioning costs are included for this activity