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

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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 March 31, 1999, and annually thereafter, on the status of its decommissioning funding for each reactor that it owns and has already closed.

Note that Items 3, 4, and 8 are data included in PG&E's Nuclear Decommissioning Cost Triennial Proceeding (NDCTP) filed with the California Public Utilities Commission (CPUC) on March 1, 2016. PG&E does not anticipate a decision on this filing until late 2016 or early 2017.

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

   January 2016 dollars — $ 660.2

   (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 2015 dollars) — $ 192.5

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).

[1] The NRC formulas in section 10 CFR 50.75(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 nonradiological systems and structures is not included in the NRC decommissioning cost estimates. The costs of managing and storing spent fuel on site until transfers to Department of Energy are not included in the cost formulas.

Amount remaining	$ 282.0
Number of years to collect 2016-2019	4 years
2016 Annual amount to be collected	$ 96.319
2017-2019 Annual amount to be collected	$ 61.906

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 (all values below are from the 2015 NDCTP filing).

Escalation in decommissioning costs Rate of Return 2016	3.01 percent
Escalation in decommissioning costs Rate of Return 2017	2.96 percent
Escalation in decommissioning costs Rate of Return 2018	2.92 percent
Escalation in decommissioning costs Rate of Return 2019-2030	2.88 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 providing financial assurance occurring since the last submitted report. None

7. Any material changes to trust agreements. None

8. CPUC Submittal in 2016 Dollars in Millions:

Total Project (Decommission 2016)	$ 1,080.0
Scope Excluded from NRC calculations	$ 55.2
Scope of Independent Spent Fuel Storage Installation from Licensing to Decommissioning in 2030	$ 213.7
Scope Decommissioned and disbursed from Trust(s)	$ 549.4
Total NRC Decommissioning Remaining Scope	$ 261.7

Decommissioning Estimate

Composite Escalation

Development of E Component

Development of L Component

Development of B Component

Nuclear Regulatory Commission
Estimate of Decommissioning Costs for Boiling Water Reactor (BWR)
In 2016

	HBPP BWR ($ in millions)
January 1986 Estimate	$114.80
Escalated to 1999	(Table 2.1 in NUREG 1307 Rev 15 has 128.9 no value for 1999 Burial)
Escalated to 2000	$400.2 ($360.9 in 2000 Submittal)
Escalated to 2001	$354.1 ($425.3 in 2001 Submittal)
Escalated to 2002	$357.4 ($445.6 in 2002 Submittal)
Escalated to 2003	$373.8 ($430.1 in 2003 Submittal)
Escalated to 2004	$388.0 ($439.6 in 2004 Submittal)
Escalated to 2005	$416.8 ($453.2 in 2005 Submittal)
Escalated to 2006	$519.2 ($494.3 in 2006 Submittal)
Escalated to 2007	$538.3 ($548.6 in 2007 Submittal)
Escalated to 2008	$564.4 ($590.9 in 2008 Submittal)
Escalated to 2009	$574.6 ($573.8 in 2009 Submittal)
Escalated to 2010	$594.5 ($596.6 in 2010 Submittal)
Escalated to 2011	$626.5 ($619.0 in 2011 Submittal)
Escalated to 2012	$659.9 ($645.4 in 2012 Submittal)
Escalated to 2013	$663.3 ($687.2 in 2013 Submittal)
Escalated to 2014	$666.8 ($714.3 in 2014 Submittal)
Escalated to 2015	$664.2 ($712.0 in 2015 Submittal)
Escalated to 2016	$660.2

January 1986 based on 10 CFR 50.75 (c) Table of minimum amounts
BWR based on minimum 1200 MWt = ($104 + (.009xMWt)) million per unit
where BWR less than 1200 MWt use P=1200 MWt, HBPP 220 MWt

Calculating Overall Escalation Rate

BWR	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13	Dec-14	Dec-15	Weight (1)
L (Labor)	2.0600	2.1218	2.1939	2.2536	2.2784	2.3175	2.3711	2.4061	2.4638	2.5235	2.5812	0.65
E (Energy)	1.9106	1.9808	2.4513	1.8323	2.0402	2.3945	2.7719	2.8265	2.7672	2.2944	1.7402	0.13
B (Burial)	13.3331	13.8744	14.4164	15.0096	15.6028	16.5439	17.4856	17.4856	17.4856	17.4856	17.4856	0.22

(1) From NUREG 1307 Revision 15, 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.

BWR
Combined Escalation Rate for:

Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13	Dec-14	Dec-15
4.6891	4.9163	5.0052	5.1788	5.4573	5.7484	5.7782	5.8080	5.7854	5.7508

Calculation of Energy Escalation Factor - Reference NUREG-1307, Revision 15, Section 3.2
Using Regional Indices SERIES ID: WPU0573 Light Fuel Oils (as of 03/11/16) and WPU0543 Industrial Electric Power (as of 03/11/16)

	PPI for Fuels & Related Products (2000 = 100) (P) =Industrial Energy Power	PPI for Light Fuel Oils (2000=100) (F) = Light Fuel Oils	REBASED TO 1986 = 100 PPI for Fuels & Related Products (2000 = 100) (P) =Industrial Energy Power BWR wt. = 0.54	REBASED TO 1986 = 100 PPI for Light Fuel Oils (2000=100) (F) = Light Fuel Oils BWR wt. = 0.46	Energy Escalation Factor (E) for BWR (Humboldt)
Dec-99	126.5	72.9	1.0000	1.0000	1.0000
Jan-00	126.8	75.3	1.0024	1.0329	1.0164
Feb-00	126.7	87.9	1.0016	1.2058	1.0955
Mar-00	126.7	89.7	1.0016	1.2305	1.1069
Apr-00	126.8	83.1	1.0024	1.1399	1.0656
May-00	128.6	82.9	1.0166	1.1372	1.0721
Jun-00	133.6	86.2	1.0561	1.1824	1.1142
Jul-00	136.2	88.7	1.0767	1.2167	1.1411
Aug-00	137.4	91.6	1.0862	1.2565	1.1645
Sep-00	137.8	110.1	1.0893	1.5103	1.2830
Oct-00	134.1	108.6	1.0601	1.4897	1.2577
Nov-00	130.9	108.4	1.0348	1.4870	1.2428
Dec-00	132.7	100.6	1.0490	1.3800	1.2013
Jan-01	136.4	96.1	1.0783	1.3182	1.1887
Feb-01	136.4	91.6	1.0783	1.2565	1.1603
Mar-01	136.5	83.1	1.0791	1.1399	1.1070
Apr-01	135.1	86.2	1.0680	1.1824	1.1206
May-01	136.2	94.2	1.0767	1.2922	1.1758
Jun-01	148.4	90.2	1.1731	1.2373	1.2026
Jul-01	149.5	81.3	1.1818	1.1152	1.1512
Aug-01	148.9	83.2	1.1771	1.1413	1.1606
Sep-01	148.2	93	1.1715	1.2757	1.2195
Oct-01	143.8	76.8	1.1368	1.0535	1.0985
Nov-01	137.3	70.5	1.0854	0.9671	1.0310
Dec-01	136.9	56.6	1.0822	0.7764	0.9415
Jan-02	136.3	58.3	1.0775	0.7997	0.9497
Feb-02	135.4	59.6	1.0704	0.8176	0.9541
Mar-02	135.7	69.1	1.0727	0.9479	1.0153
Apr-02	135.4	76.4	1.0704	1.0480	1.0601
May-02	137.9	75	1.0901	1.0288	1.0619
Jun-02	143.6	71.4	1.1352	0.9794	1.0635
Jul-02	144.9	75.5	1.1455	1.0357	1.0950
Aug-02	145.0	77.9	1.1462	1.0686	1.1105
Sep-02	145.8	89.5	1.1526	1.2277	1.1871
Oct-02	140.0	95.1	1.1067	1.3045	1.1977
Nov-02	139.5	82.8	1.1028	1.1358	1.1180
Dec-02	139.6	84.6	1.1036	1.1605	1.1297
Jan-03	140.3	95.7	1.1091	1.3128	1.2028
Feb-03	140.6	120.4	1.1115	1.6516	1.3599

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Mar-03	143.3	128.9	1.1328	1.7682	1.4251
Apr-03	144.3	98.3	1.1407	1.3484	1.2363
May-03	145.1	85.5	1.1470	1.1728	1.1589
Jun-03	148.3	87.2	1.1723	1.1962	1.1833
Jul-03	151.6	90.1	1.1984	1.2359	1.2157
Aug-03	151.3	94.1	1.1960	1.2908	1.2396
Sep-03	152.0	88.2	1.2016	1.2099	1.2054
Oct-03	147.4	97.8	1.1652	1.3416	1.2463
Nov-03	142.7	93.0	1.1281	1.2757	1.1960
Dec-03	142.9	95.8	1.1296	1.3141	1.2145
Jan-04	143.1	106.8	1.1312	1.4650	1.2848
Feb-04	143.1	100.8	1.1312	1.3827	1.2469
Mar-04	143.1	107.8	1.1312	1.4787	1.2911
Apr-04	143.1	115.2	1.1312	1.5802	1.3378
May-04	144.2	116	1.1399	1.5912	1.3475
Jun-04	152.4	111.5	1.2047	1.5295	1.3541
Jul-04	152.2	119.3	1.2032	1.6365	1.4025
Aug-04	154.0	131.1	1.2174	1.7984	1.4846
Sep-04	154.0	136.8	1.2174	1.8765	1.5206
Oct-04	145.8	161.7	1.1526	2.2181	1.6427
Nov-04	144.9	153.6	1.1455	2.1070	1.5878
Dec-04	146.2	133.8	1.1557	1.8354	1.4684
Jan-05	148.9	138.5	1.1771	1.8999	1.5096
Feb-05	148.0	146	1.1700	2.0027	1.5530
Mar-05	148.1	169.4	1.1708	2.3237	1.7011
Apr-05	148.7	170.9	1.1755	2.3443	1.7131
May-05	151.1	165.3	1.1945	2.2675	1.6881
Jun-05	159.7	180.6	1.2625	2.4774	1.8213
Jul-05	162.1	186.2	1.2814	2.5542	1.8669
Aug-05	162.5	194.5	1.2846	2.6680	1.9210
Sep-05	162.8	209.9	1.2870	2.8793	2.0194
Oct-05	159.5	252.0	1.2609	3.4568	2.2710
Nov-05	161.1	199.1	1.2735	2.7311	1.9440
Dec-05	161.4	193.6	1.2759	2.6557	1.9106
Jan-06	167.0	191.8	1.3202	2.6310	1.9231
Feb-06	168.6	190.0	1.3328	2.6063	1.9186
Mar-06	167.4	199.2	1.3233	2.7325	1.9715
Apr-06	169.6	221.9	1.3407	3.0439	2.1242
May-06	170.8	231.4	1.3502	3.1742	2.1892
Jun-06	181.2	238.1	1.4324	3.2661	2.2759

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Jul-06	181.9	231.6	1.4379	3.1770	2.2379
Aug-06	180.2	241.4	1.4245	3.3114	2.2925
Sep-06	181.0	203.1	1.4308	2.7860	2.0542
Oct-06	171.2	198.1	1.3534	2.7174	1.9808
Nov-06	167.2	198.2	1.3217	2.7188	1.9644
Dec-06	167.8	200.4	1.3265	2.7490	1.9808
Jan-07	171.9	180.0	1.3589	2.4691	1.8696
Feb-07	175.7	191.5	1.3889	2.6269	1.9584
Mar-07	172.1	215.1	1.3605	2.9506	2.0919
Apr-07	173.1	231.8	1.3684	3.1797	2.2016
May-07	179.2	225.3	1.4166	3.0905	2.1866
Jun-07	186.7	222.4	1.4759	3.0508	2.2003
Jul-07	187.0	237.8	1.4783	3.2620	2.2988
Aug-07	187.6	225.5	1.4830	3.0933	2.2237
Sep-07	188.4	238.9	1.4893	3.2771	2.3117
Oct-07	182.7	243.3	1.4443	3.3374	2.3151
Nov-07	180.3	288.2	1.4253	3.9534	2.5882
Dec-07	180.0	266.7	1.4229	3.6584	2.4513
Jan-08	181.9	273.8	1.4379	3.7558	2.5042
Feb-08	180.0	280.2	1.4229	3.8436	2.5364
Mar-08	183.1	339.6	1.4474	4.6584	2.9245
Apr-08	185.2	352.5	1.4640	4.8354	3.0149
May-08	189.5	384.9	1.4980	5.2798	3.2377
Jun-08	191.9	410.5	1.5170	5.6310	3.4094
Jul-08	196.1	423.8	1.5502	5.8134	3.5113
Aug-08	197.1	343.9	1.5581	4.7174	3.0114
Sep-08	195.9	335.1	1.5486	4.5967	2.9507
Oct-08	193.0	279.0	1.5257	3.8272	2.5844
Nov-08	187.7	218.2	1.4838	2.9931	2.1781
Dec-08	188.3	163.0	1.4885	2.2359	1.8323
Jan-09	190.3	159.8	1.5043	2.1920	1.8207
Feb-09	190.3	145.6	1.5043	1.9973	1.7311
Mar-09	187.6	136.8	1.4830	1.8765	1.6640
Apr-09	186.9	159.9	1.4775	2.1934	1.8068
May-09	190.5	158.6	1.5059	2.1756	1.8140
Jun-09	193.3	183.7	1.5281	2.5199	1.9843
Jul-09	196.2	165.2	1.5510	2.2661	1.8799
Aug-09	194.7	196.1	1.5391	2.6900	2.0685
Sep-09	194.9	186.6	1.5407	2.5597	2.0094
Oct-09	189.9	193.3	1.5012	2.6516	2.0304

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Nov-09	186.0	207.8	1.4704	2.8505	2.1052
Dec-09	186.0	197.5	1.4704	2.7092	2.0402
Jan-10	186.3	220.7	1.4727	3.0274	2.1879
Feb-10	186.1	200.2	1.4711	2.7462	2.0577
Mar-10	189.0	217.0	1.4941	2.9767	2.1761
Apr-10	188.8	231.5	1.4925	3.1756	2.2667
May-10	192.0	226.0	1.5178	3.1001	2.2457
Jun-10	197.8	212.4	1.5636	2.9136	2.1846
Jul-10	199.8	209.3	1.5794	2.8711	2.1736
Aug-10	200.8	221.4	1.5874	3.0370	2.2542
Sep-10	200.0	220.0	1.5810	3.0178	2.2420
Oct-10	194.6	235.8	1.5383	3.2346	2.3186
Nov-10	190.9	245.3	1.5091	3.3649	2.3628
Dec-10	191.4	250.0	1.5130	3.4294	2.3945
Jan-11	193.1	260.4	1.5265	3.5720	2.4674
Feb-11	194.4	278.8	1.5368	3.8244	2.5891
Mar-11	195.0	307.5	1.5415	4.2181	2.7727
Apr-11	194.1	325.1	1.5344	4.4595	2.8800
May-11	196.9	315.1	1.5565	4.3224	2.8288
Jun-11	205.7	316.9	1.6261	4.3471	2.8777
Jul-11	215.3	311.5	1.7020	4.2730	2.8846
Aug-11	216.6	296.9	1.7123	4.0727	2.7981
Sep-11	215.8	306.5	1.7059	4.2044	2.8552
Oct-11	206.6	299.6	1.6332	4.1097	2.7724
Nov-11	204.0	322.7	1.6126	4.4266	2.9071
Dec-11	204.4	301.0	1.6158	4.1289	2.7719
Jan-12	201.1	308.8	1.5897	4.2359	2.8070
Feb-12	200.3	316.5	1.5834	4.3416	2.8522
Mar-12	199.8	330.8	1.5794	4.5377	2.9403
Apr-12	198.1	327.1	1.5660	4.4870	2.9096
May-12	201.5	315.6	1.5929	4.3292	2.8516
Jun-12	207.7	284.6	1.6419	3.9040	2.6825
Jul-12	221.5	287.9	1.7510	3.9492	2.7622
Aug-12	222.1	313.4	1.7557	4.2990	2.9257
Sep-12	222.8	330.4	1.7613	4.5322	3.0359
Oct-12	214.1	334.1	1.6925	4.5830	3.0221
Nov-12	212.3	311.6	1.6783	4.2743	2.8725
Dec-12	213.8	303.3	1.6901	4.1605	2.8265
Jan-13	199.2	303.6	1.5747	4.1646	2.7661
Feb-13	199.4	327.7	1.5763	4.4952	2.9190

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Mar-13	199.0	308.7	1.5731	4.2346	2.7974
Apr-13	198.8	303.9	1.5715	4.1687	2.7662
May-13	203.5	296.4	1.6087	4.0658	2.7390
Jun-13	211.9	294.9	1.6751	4.0453	2.7654
Jul-13	211.4	300.4	1.6711	4.1207	2.7979
Aug-13	210.4	307.4	1.6632	4.2167	2.8378
Sep-13	210.3	315.3	1.6625	4.3251	2.8873
Oct-13	201.2	306.8	1.5905	4.2085	2.7948
Nov-13	199.0	295.3	1.5731	4.0508	2.7128
Dec-13	200.5	302.9	1.5850	4.1550	2.7672
Jan-14	215.1	297.5	1.7004	4.0809	2.7954
Feb-14	214.4	309.1	1.6949	4.2401	2.8657
Mar-14	214.8	306.5	1.6980	4.2044	2.8510
Apr-14	210.8	306.7	1.6664	4.2071	2.8351
May-14	215.2	304.4	1.7012	4.1756	2.8394
Jun-14	224.0	296.5	1.7708	4.0672	2.8271
Jul-14	227.5	295.3	1.7984	4.0508	2.8345
Aug-14	227.7	293.9	1.8000	4.0316	2.8265
Sep-14	225.1	291.0	1.7794	3.9918	2.7971
Oct-14	217.0	271.4	1.7154	3.7229	2.6389
Nov-14	210.7	260.9	1.6656	3.5789	2.5457
Dec-14	213.9	218.9	1.6909	3.0027	2.2944
Jan-15	222.4	173.6	1.7581	2.3813	2.0448
Feb-15	221.1	184.3	1.7478	2.5281	2.1068
Mar-15	218.2	185.7	1.7249	2.5473	2.1032
Apr-15	213.3	178.2	1.6862	2.4444	2.0350
May-15	217.0	196.6	1.7154	2.6968	2.1669
Jun-15	237.2	193.4	1.8751	2.6529	2.2329
Jul-15	237.3	187.0	1.8759	2.5652	2.1930
Aug-15	236.8	180.4	1.8719	2.4746	2.1492
Sep-15	234.2	163.1	1.8514	2.2373	2.0289
Oct-15	218.4	166.0	1.7265	2.2771	1.9798
Nov-15	212.3	160.4	1.6783	2.2003	1.9184
Dec-15	214.9	130.4	1.6988	1.7888	1.7402

October 2015 through December 2015 are Preliminary Values from PPI Indices

Based on Base Year 2000 being the indices values Dec 1999, January 2016 base will be December 2015

Calculation of Labor Escalation Factor - Reference NUREG-1307, Revision 15, Section 3.1
Using Regional Indices SERIES ID: CIU2010000000240I (as of 03/11/16)
Note 1: The Base Labor factor was reindexed in December 2005, at which time the index was reset to 100.

	Employment Cost Indust West Region Private Industry (2005=100)	Labor Escalation Factor
Dec-05	100	2.06000
Jan-06		
Feb-06		
Mar-06	100.6	2.07236
Apr-06		
May-06		
Jun-06	101.8	2.09708
Jul-06		
Aug-06		
Sep-06	102.5	2.11150
Oct-06		
Nov-06		
Dec-06	103	2.12180
Jan-07		
Feb-07		
Mar-07	104.2	2.14652
Apr-07		
May-07		
Jun-07	104.9	2.16094
Jul-07		
Aug-07		
Sep-07	105.7	2.17742
Oct-07		
Nov-07		
Dec-07	106.5	2.19390
Jan-08		
Feb-08		
Mar-08	107.8	2.22068

Calculation of Labor Escalation Factor - Reference NUREG-1307, Revision 15, Section 3.1
Using Regional Indices SERIES ID: CIU2010000000240I (as of 03/11/16)
Note 1: The Base Labor factor was reindexed in December 2005, at which time the index was reset to 100.

	Employment Cost Indust West Region Private Industry (2005=100)	Labor Escalation Factor
Dec-05	100	2.06000
Apr-08		
May-08		
Jun-08	108.4	2.23304
Jul-08		
Aug-08		
Sep-08	109.3	2.25158
Oct-08		
Nov-08		
Dec-08	109.4	2.25364
Jan-09		
Feb-09		
Mar-09	109.9	2.26394
Apr-09		
May-09		
Jun-09	110	2.26600
Jul-09		
Aug-09		
Sep-09	110.3	2.27218
Oct-09		
Nov-09		
Dec-09	110.6	2.27836
Jan-10		
Feb-10		
Mar-10	111.3	2.29278
Apr-10		
May-10		
Jun-10	111.7	2.30102

Calculation of Labor Escalation Factor - Reference NUREG-1307, Revision 15, Section 3.1
Using Regional Indices SERIES ID: CIU2010000000240I (as of 03/11/16)
Note 1: The Base Labor factor was reindexed in December 2005, at which time the index was reset to 100.

	Employment Cost Indust West Region Private Industry (2005=100)	Labor Escalation Factor
Dec-05	100	2.06000
Jul-10		
Aug-10		
Sep-10	112.3	2.31338
Oct-10		
Nov-10		
Dec-10	112.5	2.31750
Jan-11		
Feb-11		
Mar-11	113.5	2.33810
Apr-11		
May-11		
Jun-11	114.3	2.35458
Jul-11		
Aug-11		
Sep-11	114.6	2.36076
Oct-11		
Nov-11		
Dec-11	115.1	2.37106
Jan-12		
Feb-12		
Mar-12	115.7	2.38342
Apr-12		
May-12		
Jun-12	116.3	2.39578
Jul-12		
Aug-12		
Sep-12	116.8	2.40608

Calculation of Labor Escalation Factor - Reference NUREG-1307, Revision 15, Section 3.1
Using Regional Indices SERIES ID: CIU2010000000240I (as of 03/11/16)
Note 1: The Base Labor factor was reindexed in December 2005, at which time the index was reset to 100.

	Employment Cost Indust West Region Private Industry (2005=100)	Labor Escalation Factor
Dec-05	100	2.06000
Oct-12		
Nov-12		
Dec-12	116.8	2.40608
Jan-13		
Feb-13		
Mar-13	117.6	2.42256
Apr-13		
May-13		
Jun-13	118.5	2.44110
Jul-13		
Aug-13		
Sep-13	119.2	2.45552
Oct-13		
Nov-13		
Dec-13	119.6	2.46376
Jan-14		
Feb-14		
Mar-14	120.1	2.47406
Apr-14		
May-14		
Jun-14	120.9	2.49054
Jul-14		
Aug-14		
Sep-14	121.9	2.51114
Oct-14		
Nov-14		
Dec-14	122.5	2.52350

Calculation of Labor Escalation Factor - Reference NUREG-1307, Revision 15, Section 3.1
Using Regional Indices SERIES ID: CIU2010000000240I (as of 03/11/16)
Note 1: The Base Labor factor was reindexed in December 2005, at which time the index was reset to 100.

	Employment Cost Indust West Region Private Industry (2005=100)	Labor Escalation Factor
Dec-05	100	2.06000
Jan-15		
Feb-15		
Mar-15	123.1	2.53586
Apr-15		
May-15		
Jun-15	123.8	2.55028
Jul-15		
Aug-15		
Sep-15	124.6	2.56676
Oct-15		
Nov-15		
Dec-15	125.3	2.58118

Development of Burial Escalation
Developed from NUREG-1307 Revision 15
Table 2.1 "VALUES OF B SUB-X AS A FUNCTION OF LLW BURIAL SITE, WASTE VENDOR, AND YEAR" (Summary for non-Atlantic Compact)
Revised to Bx Values for Generic LLW Disposal Site are assumed to be the same as that provided for the Atlantic Compact, for lack of a better alternative at this time
Revised to Bx Values for Generic LLW Disposal Site are assumed to be Combination of Compact-Affiliated and Non-Compact Facility for HBPP

	BWR Burial Costs	BWR Restated to 1986 = 100
1986	1.561	1.0000
1987		
1988	1.831	1.1730
1989		
1990		
1991	2.361	1.5125
1992		
1993	9.434	6.0436
1994	9.794	6.2742
1995	10.42	6.6752
1996	10.379	6.6489
1997	13.837	8.8642
1998	13.948	8.9353
1999		
2000	16.244	10.4061
2001	16.474	10.5535
2002	16.705	10.7015
2003	17.337	11.1063
2004	17.970	11.5119
2005	19.391	12.4222
2006	20.813	13.3331
2007	21.658	13.8744
2008	22.504	14.4164
2009	23.430	15.0096
2010	24.356	15.6028
2011	25.825	16.5439
2012	27.295	17.4856
2013	27.295	17.4856
2014	27.295	17.4856
2015	27.295	17.4856
2016	27.295	17.4856

Table 2.1 Note (e) Bx values for the generic site are assumed to be the same as that provided for the Atlantic Compact for lack of a better alternative at this time.
Note (f) Effective with NUREG-1307, Revision 8 (Ref.3) an alternative disposal option was introduced in which the bulk of the LLW is assumed to be dispositioned by waste vendors and/or disposed of at a non-compact disposal facility.
Note (g) Effective with NUREG1307, Revision 15, the nomenclature for the two disposal options, referred to as "Direct Disposal" and "Direct Disposal with Vendors" in previous revisions of NUREG-1307, is changed to "Compact-Affiliated Disposal Facility Only" and "Combination of Compact-Affiliated and Non-Compact Disposal Facilities" to better describe the options.

2015 The NRC has issued Regulatory Issue Summary 2014-12, "Decommissioning Fund Status Report Calculations Update to Low-Level Waste Burial Charge Information," to inform licensees that they may use low-level waste burial charge data contained in Revision 15 of NUREG-1307, Report on Waste Burial Charges: Changes in Decommissioning Waste Disposal Costs at Low-Level Waste Burial Facilities, dated January 2013, when preparing their periodic decommissioning fund status report.

Decommissioning Cash Flow

Humboldt Bay Power Plant
Decommissioning Cash Flow (Note 1)
Nominal/2016 Dollars

Year	NRC	NON - NRC	SPENT FUEL MANAGEMENT	TOTAL	Cumulative Decommission Estimate	
1996	$1,678,452			$1,678,452	$1,678,452	
1997	$8,663,216			$8,663,216	$10,341,668	
1998	$5,573,757		$344,408	$5,918,165	$16,259,833	
1999	$723,490		$2,281,454	$3,004,944	$19,264,777	
2000	$85,241		$2,736,091	$2,821,332	$22,086,109	
2001	$89,543		$398,012	$487,555	$22,573,664	
2002	$994,127		$113,704	$1,107,831	$23,681,495	
2003	$494,838		$2,539,476	$3,034,314	$26,715,809	
2004	$491,070		$1,444,628	$1,935,698	$28,651,506	
2005	$161,506		$1,671,769	$1,833,275	$30,484,781	
2006	$1,073,612		$3,546,617	$4,620,229	$35,105,010	
2007	$4,474,247		$9,240,172	$13,714,419	$48,819,429	
2008	$12,590,383		$28,485,988	$41,076,371	$89,895,800	
2009	$32,901,391		$3,179,956	$36,081,347	$125,977,147	
2010	$56,957,494		$5,734,776	$62,692,270	$188,669,417	
2011	$60,585,531		$5,495,157	$66,080,688	$254,750,105	
2012	$81,577,560		$4,509,009	$86,086,569	$340,836,673	
2013	$93,946,862		$4,668,626	$98,615,488	$439,452,161	
2014	$79,506,972		$5,085,456	$84,592,428	$524,044,589	
2015	$106,846,881		$5,853,718	$112,700,599	$636,745,188	$636,745,188 Actual
2016	$119,991,418	$6,998,468	$14,260,889	$141,250,774	$777,995,962	$829,288,518 Actual + Market Value
2017	$82,657,153	$10,197,234	$9,013,936	$101,868,323	$879,864,285	
2018	$45,650,709	$23,705,976	$8,950,930	$78,307,614	$958,171,899	
2019	$10,657,171		$9,275,427	$19,932,597	$978,104,497	
2020	$2,323,376		$9,013,936	$11,337,312	$989,441,809	
2021	$146,374		$8,498,413	$8,644,787	$998,086,596	
2022	$100,085		$7,872,884	$7,972,969	$1,006,059,565	
2023	$100,085		$7,849,919	$7,950,004	$1,014,009,568	
2024	$0		$7,872,884	$7,872,884	$1,021,882,453	
2025	$0		$7,872,884	$7,872,884	$1,029,755,337	
2026	$0		$8,550,085	$8,550,085	$1,038,305,422	
2027	$0		$7,941,780	$7,941,780	$1,046,247,202	
2028	$0		$7,940,757	$7,940,757	$1,054,187,959	
2029	$0	1,543,411	$10,021,262	$11,564,673	$1,065,752,632	
2030	$0	$12,784,436	$1,479,454	$14,263,889	$1,080,016,522	
TOTAL	$811,042,542	$55,229,524	$213,744,458	$1,080,016,523		

1) Cash Flow is based on construction of ISFSI and Fuel removed from HBPP in 2030 (Assumes DOE Used Fuel Repository opens in 2028 allowing HBPP Fuel to be shipped during 2028-2029 allowing for Final Site Restoration in 2030).

2) Market Value of Trust as of 12/2015 was $192.5 million, actual expended as of 12/2015 was $636.7 Million including $87.3 million Spent Fuel Management.

3) Totals may not balance due to rounding.

Variance of the 2015 Forecast

Estimated Costs:

Forecast of 2015 per PG&E Letter HBL-15-003, Enclosure 3, dated March 31, 2015, in 2015 dollars:

NRC Scope (Radiological)	$114,650,720
Non-NRC Scope	$ 50,000
Spent Fuel Management	$ 6,007,869

Actual Costs:

Actual 2015 Incurred Costs, provided in Enclosure 3 of this letter, reflects the actuals for 2015 in nominal dollars.

NRC Scope (Radiological)	$106,846,881
Non-NRC Scope	$ 0
Spent Fuel Management	$ 5,853,718

<u>Variance:</u>

NRC Scope (Radiological)	$ -7,803,839
Non-NRC Scope	$ -50,000
Spent Fuel Management	$ -154,151

Decommissioning costs were underspent in 2015 primarily due to waste disposal shipments to an alternate, less expensive, disposal site than planned. PG&E also saw a savings in staffing due to the consolidation of radiation protection and engineering support to the civil works contractor.

Decommissioning Project Report for the Humboldt Bay Power Plant, Unit 3 2015-2030

DECOMMISSIONING PROJECT REPORT FOR

THE HUMBOLDT BAY POWER PLANT UNIT 3

2015 - 2030

February 2016

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Table of Contents

ACRONYMS

ACM	Asbestos-containing material
ALARA	As low as reasonably achievable
ASO	Armed Security Officers
BAFO	Best and Final Offer
BMPs	Best Management Practices
CAB	Community Advisory Board
CAP	Corrective action program
CCC	California Coastal Commission
CDP	Coastal Development Permit
CFR	Code of Federal Regulations
COC	Constituent of concern
CPUC	California Public Utilities Commission
CSM	Cutter Soil Mixture
CTR	Contracts technical representative
CWC	Civil works contractor
CWCMT	Civil Works Contract Management Team
CWP	Circulating Water Piping
D&D	Demolition and disposal
DCGL	Derived concentration guidelines
DCPP	Diablo Canyon Power Plant
DOE	US Department of Energy
DOR	Designer of Record
DOT	Department of Transportation
DPR	Decommissioning Project Report
DRM	Decommissioning Project Risk Management Program
DTSC	Department of Toxic Substance Control
EDAR	Electronic Data Access and Reporting
EDOIs	Equipment Description and Operating Instructions
EDRS	Electronic Document Routing System
EORM	Enterprise and Operational Risk Management
EPC	Engineering, Procurement, and Construction
ESCP	Erosion and Sediment Control Plan
EVMS	Earned Value Management System
FIXS	Filtration and Ion Exchange System
FSAR	Final Safety Analysis Report
FSR	Final Site Restoration
FSS	Final Status Survey

GSAP	Generator Site Access Permit
GTCC	Greater Than Class C
GWTS	Groundwater treatment system
H&S	Health and safety
HB	Humboldt Bay
HBGS	Humboldt Bay Generation Station
HBPP	Humboldt Bay Power Plant
HDPE	High density polyethylene
HEPA	High efficiency particulate air
HVAC	Heating, Ventilation, and Air Conditioning
IH	Industrial Hygiene
IM/RAW	Interim Measures/Removal Action Work Plan
IP	Industrial packaging
ISFSI	Independent Spent Fuel Storage Installation
ISOCS	In Situ Object Counting Systems
IT	Information technology
LabSOCS	Laboratory Sourceless Calibration Software
LAR	License Amendment Request
LID	Low Impact Development
LLD	Lower Limit of Detection
LLRW	Low-level radioactive waste
LRW	Liquid Radwaste
LRWB	Liquid Radwaste Building
LTP	License termination plan
M&TE	Measuring and test equipment
MARSAME	"Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual"
MARSSIM	"Multi-Agency Radiation Survey and Site Investigation Manual"
MDC	Minimum Detectable Concentrations
MRS	monitored retrievable storage installation
NARM	Naturally-occurring and accelerator-produced radioactive materials
NCRWQCB	North Coast Regional Water Quality Control Board
NDCTP	Nuclear Decommissioning Cost Triennial Proceedings
NOR	Notice of Receipts
NORM	Naturally-occurring Radioactive Materials
NRC	US Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
O&M	Operations and Maintenance
OAD	Open-air demolition

ORISE	Oak Ridge Institute for Science and Education
ORO	Off-site response organizations
OTB	Over Target Baseline
PCBs	Polychlorinated biphenyls
PCC	Provider Cost Center
PEG	Propane Engine Generator
PG&E	Pacific Gas & Electric
PMO	Project Management Office
PMT	Post Maintenance Test
POD	Plan of the day
POND	Plan of the next day
PPE	Personal protective equipment
PWP	Project Waste Plan
QA/QC	Quality Assurance/Quality Control
QDP	Quantity Development Package
QSP	Qualified SWPPP Practitioner
QVP	Quality Verification Plan
RAI	Requests for Additional Information
RAP	Remedial Action Plan
RCA	radiological controlled area
RCRA	Resource Conservation and Recovery Act
RDT	Resin Disposal Tank
REDT	Reactor equipment drain tank
REMP	Radiological Environmental Monitoring Plan
RFB	Refueling Building
RMA	Radiological Materials Areas
RMS	Records Management System
ROM	Rough order of magnitude
RP	Radiological Protection
RPV	Reactor pressure vessel
RSDA	Radiologically Significant Decommissioning Activity
SAS	Security alarm station
SC	Shipping coordinator
SFP	Spent Fuel Pool
SGI	Safe guard information
SME	Subject matter expert
SMF	Soil Management Facility
SNM	Special Nuclear Material
SOE	Support of excavation

SONGS	San Onofre Nuclear Generating Station
SPCC	Spill Prevention, Control, and Countermeasures Plan
SR&M	Soil Remediation and Management
SSCs	Structures, systems, and components
SWLLRW	Southwestern Low-Level Radioactive Waste
SWPPP	Storm water Pollution Prevention Plan
TBDT	Turbine Building Drain Tank
TC	Technical coordinator
USACE	US Army Corps of Engineers
VCA	Voluntary Cleanup Agreement
VCT	Vertical Cask Transport
VSP	Visual Sample Plan
WAC	Waste Acceptance Criteria
WBS	Work Breakdown Structure
WCP	Work Control Program
WMF	Waste Management Facility
WWM	Work week manager

1 EXECUTIVE SUMMARY

Pacific Gas and Electric Company (PG&E) has prepared this site-specific Decommissioning Project Report (DPR) for decommissioning the Humboldt Bay Power Plant (HBPP) Unit 3 to identify the cost and schedule to complete decommissioning and license termination of HBPP Unit 3. This DPR covers the period from 2015 through the completion of fuel transfer to the Department of Energy (DOE) and the subsequent decommissioning and restoration of the Independent Spent Fuel Storage Installation (ISFSI). It incorporates the site-specific decommissioning tasks and detailed plans that have been identified as a result of the ongoing implementation of the decommissioning effort. The total estimated cost to decommission Humboldt Unit 3 is $1,054.8M. This represents an increase from the forecast approved in the 2012 NDCTP of $977.9M for decommissioning HBPP Unit 3.

Methodology

Previous cost estimates prior to 2012 were based on cost studies performed by experienced specialty consultants. The cost studies provided a solid basis from which PG&E could develop a better, site-specific estimate until the estimates could be further enhanced with actual data and lessons learned from on-site performance.

In the previous three year period, 2012-2015, PG&E had shifted from self performance of high risk radiological decommissioning activities to oversight of Civil Works Projects. PG&E has gathered two years of experience measuring cost performance using an Over Target Baseline (OTB) system. The OTB system has proven to be an effective tool to monitor cost performance and has provided PG&E with a high degree of confidence in the estimated costs going forward. The OTB methodology is discussed in Section 3.1.2.1. The Humboldt Bay Civil Works Project is approximately 50 percent complete after two and a half years of executing work and performing within 5 percent of planned value (excluding contingency). Major work, including radiological source term reduction, such as Caisson Drywell Piping Removal, Reactor Pressure Vessel (RPV) Segmentation, and demolition of the Liquid Radwaste (LRW) Facility, is partially complete. The site has met Open-air Demolition (OAD) criteria, and a portion of the Refueling Building (RFB) has been demolished. PG&E is now past the learning curve on the project, with three years left in remaining work execution, and there is a much higher level of confidence in performing the remainder of the work. The work is managed by a robust Earned Value Management System (EVMS) to contain cost, schedule, change, and risk. The EVMS has enabled PG&E to make key cost and schedule savings decisions to ensure adherence to the Over Target Baseline (OTB). Examples of these savings include:

- Change of a key subcontractor that reduced project overhead costs
- Transition from subcontractor to Direct craft
- Realignment of engineering, procurement, and construction (EPC) scope
- Realignment of PMO Staff Plan to align with major schedule milestones
- Consolidation of work groups

- Purchase instead of rental of major equipment

In addition, Change Management and Risk/Opportunity meetings occur on a frequent basis with subcontractors to identify any potential change to the OTB proactively prior to it finalizing. This allows PG&E to take action before the condition occurs. Since implementation of EVMS, PG&E has seen a major improvement in managerial control, equating to significant cost avoidance and schedule savings.

Project Status

Decommissioning of the PG&E HBPP Unit 3 nuclear facility achieved a significant milestone in June 2014. The Plant Systems Removal Phase, resulting in removal of radiologically significant plant systems from the buildings, was completed after more than three decades in SAFSTOR. The HBPP historical design and construction, close proximity to the bay, and associated tidal interactions pose unique challenges to an effective decommissioning effort as the Site transitioned to a major earthwork project—designated as Civil Works. PG&E still maintains its 10 CFR Part 50 license and in May 2013, PG&E submitted its License Termination Plan (LTP) to the NRC.

Several other significant milestones were met in the summer and fall of 2015 when the RPV Segmentation Project completed, the Caisson Removal project began, and the Unit 3 RFB and Main Plant Ventilation system were released for OAD. The Civil Works Contractor (CWC) was awarded the contract to complete the RPV Segmentation in December of 2014. This work scope continued to use the first-of-a-kind segmentation equipment that was designed and fabricated for the HBPP Reactor Project.

The CWC reevaluated the baseline design approach outlined in the original proposal and awarded contract. As the CWC further developed design plans, it proposed several variations for three key support elements: the perimeter cutoff wall; the dewatering well system; and the caisson support of excavation shoring system. The variation to the perimeter cutoff wall was an option to complete a smaller wall with Cutter Soil Mixing (CSM) technology rather than the originally envisioned Slurry Wall. The proposed alternatives brought many enhancements in the design and integration of the work to be executed.

CWC personnel were persistent in seeing their vision through, which resulted in a significant benefit in worker safety and schedule enhancement. Their efforts were presented to PG&E at three key rigorous Readiness Review Board meetings. PG&E listened to the innovative approach, benchmarked the change against other similar projects in the country and vetted the proposed change with the project risk profile.

This key CSM project as well as many others including spent fuel pool (SFP) liner removal, completion of RPV shell segmentation and an early start demolishing the first 40 feet of the RFB has enabled PG&E to pull in the contract finish date from May 2019 to December 2018. Execution of the work has gone well and completion is consistent with an early finish as conveyed in PG&E's

Post Shutdown Decommissioning Activities Report dated July 19, 2013, and presented at the CPUC hearings.

The HBPP Site Vision is to "complete the decommissioning of HBPP in a manner that establishes a new benchmark for the nuclear industry". The Vision is aligned with the corporate vision to yield a leading position in the decommissioning realm for HBPP and to promote the corporate position of a leading utility.

Remaining Costs

A detailed breakdown of these major cost contributors to the decommissioning cost estimate is reported in the Table 1.1 and in Section 3 of this document.

This 2015 DPR incorporates the site-specific decommissioning tasks and detailed plans that have been identified as a result of the ongoing implementation of the remaining phase of its decommissioning effort.

TABLE 1.1—DECOMMISSIONING COST CONTRIBUTORS 2012 AND 2017 NDCTP

	2012 NDCTP			2017 NDCTP					
	A Base 2012 NDCTP (2011$)	B Base 2012 NDCTP Nominal / $2014	C Reduced 2012 NDCTP Nominal / $2014	D 2012 Through 2014 Spent	E ETC 2015 To 2025 $2014	F Total EAC 2012 To 2025 Nominal / $2014	G Delta from Base (nominal / $2014) (B - F)	H Delta from Reduced (nominal / $2014) (C - F)	I 2026-2030 Estimate
General Staffing (Excludes Caisson) [1]	**97,037,084**	**113,552,612**	**102,442,205**	**73,759,966**	**44,453,015**	**118,212,981**	**(4,660,369)**	**(15,770,776)**	**-**
Overall Project	87,001,807	93,019,124	83,917,789	66,432,824	32,021,433	98,454,257	(5,435,133)	(14,536,469)	
License Termination Survey (Excludes Caisson)	13,165,630	12,606,885	11,373,381	7,327,142	7,769,468	15,096,610	(2,489,724)	(3,723,229)	
EPC Services	(962,235)	(1,175,125)	(1,060,146)			-	(1,175,125)	(1,060,146)	
ISFSI Engineering / Specialty Contracts	(2,168,117)	(2,721,767)	(2,455,459)				(2,721,767)	(2,455,459)	
Contingency	-	11,823,495	10,666,641		4,662,114	4,662,114	7,161,381	6,004,526	
Remainder of Plant Systems / PG&E Civil Works Support	**56,692,956**	**66,505,271**	**59,998,149**	**43,789,616**	**5,473,369**	**49,262,985**	**17,242,286**	**10,735,164**	**-**
Direct Labor (PG&E and Contractor)	32,813,846	34,158,613	30,816,408	32,264,615	2,509,630	34,774,245	(615,632)	(3,957,837)	-
Craft	17,748,070	18,417,271	16,615,257	16,516,296		16,516,296	1,900,975	98,961	
Radiation Protection	15,065,776	15,741,342	14,201,151	15,748,319	2,509,630	18,257,949	(2,516,607)	(4,056,798)	
Liquid Radwaste System	6,659,466	7,029,516	6,341,723	4,282,774		4,282,774	2,746,743	2,058,949	
Tools & Equipment	17,219,644	17,985,743	16,225,952	7,642,227	2,589,267	10,231,494	7,754,249	5,994,458	
Common Tools	3,770,666	3,954,883	3,567,922	2,009,526		2,009,526	1,945,357	1,558,397	
Rad Protection	12,628,468	13,182,903	11,893,039	5,046,356	2,589,267	7,635,623	5,547,280	4,257,416	
Glove Bags	820,511	847,958	764,991	586,346		586,346	261,612	178,645	
Disallowed Scope (Seismic Upgrades) [2]				(400,000)		(400,000)	400,000	400,000	
Contingency	-	7,331,398	6,614,066		374,472	374,472	6,956,925	6,239,594	
Site Infrastructure	**2,074,282**	**3,598,638**	**3,246,534**	**4,935,540**		**4,935,540**	**(1,336,902)**	**(1,689,006)**	
Specific Project Costs (Excludes Disposal / Caisson / Canal)	**104,253,745**	**122,394,383**	**110,418,864**	**37,065,813**	**103,968,390**	**141,034,202**	**(18,639,819)**	**(30,615,339)**	**-**
Reactor Vessel Removal	15,367,912	15,981,650	14,417,946	15,263,911	1,693,007	16,956,917	(975,267)	(2,538,971)	
Turbine Bldg Demolition (Contractor)	14,306,833	14,880,738	13,424,752	12,118,881		12,118,881	2,761,857	1,305,871	
Civil Works Contract	74,579,000	79,050,745	71,316,127	9,783,021	92,761,682	102,544,703	(23,493,959)	(31,228,576)	
Facilities Demolition	62,079,000	65,801,247	59,363,009	9,783,021	55,954,[illegible]	65,737,[illegible]	[illegible]	(6,374,[illegible])	
Office Trailer Demobilization	1,500,000	1,589,940	1,434,374		1,831,638	1,831,638	(41,698)	(397,263)	
Final Site Restoration	11,000,000	11,659,558	10,518,744		32,255,378	32,255,378	(20,596,820)	(21,736,634)	
Other Services/Letter of Credit					2,920,554	2,920,554	(2,920,554)	(2,920,554)	
Disallowed Scope (Seismic Upgrades) [2]				(100,000)	(190,206)	(290,206)	290,206	290,206	
Contingency	-	12,481,250	11,260,038		9,703,906	9,703,906	2,777,344	1,556,132	
Waste Disposal (Excludes Caisson / Canals)	**74,011,221**	**84,627,731**	**76,347,441**	**52,002,172**	**34,822,844**	**86,825,016**	**(2,197,285)**	**(10,477,575)**	**-**
Labor (Packaging and Handling)	18,994,489	20,509,272	18,502,569	10,874,350	2,221,071	13,095,421	7,413,851	5,407,148	
Third Party Disposal Sites	52,315,427	56,195,189	50,696,844	37,389,482	30,349,040	67,738,523	(11,543,333)	(17,041,678)	
Waste Handling Building (Contractor)	2,701,305	2,863,558	2,583,377	3,765,430		3,765,430	(901,872)	(1,182,053)	
Disallowed Scope (Seismic Upgrades) [2]				(27,090)		(27,090)	27,090	27,090	
Contingency	-	5,059,712	4,564,651		2,252,732	2,252,732	2,806,980	2,311,919	
Small Value Contracts	**35,654,016**	**39,758,493**	**35,868,375**	**21,610,723**	**16,069,098**	**37,679,821**	**2,078,673**	**(1,811,445)**	**-**
Small Dollar Vendors	10,751,075	11,239,798	10,140,055	2,715,658	1,857,790	4,573,447	6,666,351	5,566,608	
Specialty Contracts	25,291,138	26,274,027	23,703,279	18,895,065	12,569,999	31,465,064	(5,191,037)	(7,761,785)	
EPC Services	(388,197)	(477,572)	(430,844)			-	(477,572)	(430,844)	
Contingency	-	2,722,239	2,455,886		1,641,309	1,641,309	1,080,931	814,577	
Spent Fuel Management	**65,553,906**	**78,917,475**	**71,293,127**	**14,279,397**	**89,337,377**	**103,616,774**	**(24,699,299)**	**(32,323,647)**	**47,809,066**
Security (PG&E)	47,243,286	51,004,286	46,013,838	11,235,555	58,225,757	69,461,312	(18,457,026)	(23,447,474)	21,094,303
ISFSI O&M	7,925,034	8,416,526	7,593,022	1,632,172	5,530,894	7,163,067	1,253,459	429,955	2,000,000
ISFSI Staffing / Engineering / Specialty Contracts	2,945,587	3,100,203	2,877,996	1,089,192	5,674,259	6,763,451	(3,663,248)	(3,885,455)	892,000
ISFSI Infrastructure Expenses				77,231	6,713,000	6,790,231	(6,790,231)	(6,790,231)	830,000
NRC Fees	2,940,000	3,133,692	2,827,080	245,246	1,842,559	2,087,805	1,045,887	739,275	1,115,000
ISFSI Removal	2,000,000	2,132,983	1,924,284			-	2,132,983	1,924,284	11,744,264
Transfer to DOE	2,500,000	2,666,229	2,405,355			-	2,666,229	2,405,355	2,666,229
Contingency	-	8,463,556	7,651,551		11,350,908	11,350,908	(2,887,352)	(3,699,356)	7,467,269
Contingency (Excludes Caisson / Canals)	**46,505,136**								
Subtotal Base	**481,782,347**	**509,354,604**	**459,614,695**	**247,443,226**	**294,124,093**	**541,567,320**	**(32,212,716)**	**(81,952,625)**	**47,809,066**
Caisson	**188,863,707**	**202,326,010**	**202,326,010**	**9,194,034**	**132,677,602**	**141,871,637**	**60,454,374**	**60,454,374**	**-**
Field Work (Civil Works Contract)	78,000,000	83,062,664	83,062,664	9,194,034	64,212,338	73,406,372	9,656,292	9,656,292	
Packaging / Material Handling	12,931,940	14,313,245	14,313,245			-	14,313,245	14,313,245	
Project Staffing	22,126,103	24,644,002	24,644,002		15,303,886	15,303,886	9,340,116	9,340,116	
Waste Disposal	24,037,438	26,604,960	26,604,960		21,824,507	21,824,507	4,780,453	4,780,453	
License Termination Survey	6,167,964	5,807,439	5,807,439		3,354,407	3,354,407	2,453,033	2,453,033	
Tools and Supplies	2,345,608	2,465,351	2,465,351		1,145,473	1,145,473	1,319,878	1,319,878	
Other	4,237,846	4,523,839	4,523,839		7,717,907	7,717,907	(3,194,067)	(3,194,067)	
RP Discrete	395,596	426,112	426,112		1,104,794	1,104,794	(678,683)	(678,683)	
Small Dollar Vendors	3,437,250	3,665,799	3,665,799		786,949	786,949	2,878,849	2,878,849	
Specialty Contracts	405,000	431,929	431,929		5,826,163	5,826,163	(5,394,234)	(5,394,234)	
EPC Services	(1,831,033)	(1,953,558)	(1,953,558)				(1,953,558)	(1,953,558)	
ISFSI Engineering / Specialty Contracts	(931,772)	(993,727)	(993,727)				(993,727)	(993,727)	
Caisson Contingency	41,779,613	43,851,795	43,851,795		19,119,086	19,119,086	24,732,709	24,732,709	
Canal Remediation	**47,408,200**	**51,284,882**	**51,284,882**	**8,379,236**	**44,242,713**	**52,621,949**	**(1,337,067)**	**(1,337,067)**	**-**
Removal (Civil Works Contract)	21,000,000	22,396,325	22,396,325	8,379,236	28,294,233	36,673,469	(14,277,144)	(14,277,144)	
Disposal	20,224,200	22,384,417	22,384,417		11,660,406	11,660,406	10,724,010	10,724,010	
Canal Contingency	6,184,000	6,504,140	6,504,140		4,288,073	4,288,073	2,216,066	2,216,066	
Common Site Support - Caisson and Canals	**5,745,630**	**6,021,785**	**6,021,785**	**3,551,583**	**2,158,445**	**5,710,028**	**311,756**	**311,756**	**-**
Relocation of Trailer City	2,542,000	2,688,812	2,688,812	888,774	1,542,565	2,431,338	257,474	257,474	
Groundwater Treatment	2,892,636	3,020,620	3,020,620	2,391,763	292,342	2,684,104	336,516	336,516	
Groundwater Treatment System Operation	761,474	792,786	792,786	271,047	34,579	305,626	487,160	487,160	
EPC Services	(450,481)	(480,434)	(480,434)			-	(480,434)	(480,434)	
Common Site Support Contingency					288,960	288,960	(288,960)	(288,960)	
EPC Services (including Quality Training)	**3,832,663**	**4,086,688**	**3,924,982**	**199,315**	**10,270,378**	**10,469,692**	**(6,383,004)**	**(6,544,710)**	
EPC Services					9,085,128				
EPC Services Contingency					1,185,250				
Subtotal Caisson / Canal / GWTS	245,850,200	263,719,364	263,557,658	21,324,168	189,349,138	210,673,306	**53,046,058**	**52,884,353**	-
Final Site Restoration (California Coastal Commission)							20,595,820	20,595,820	
Stand Alone ISFSI and License Renewal							28,910,506	28,910,506	
DOE Four Year Delay of Spent Fuel Pickup									
Subtotal Scope Consistent with 2012 Filing							**70,339,668**	**20,438,053**	
TOTAL (with Scope Increase)	**727,632,547**	**773,073,968**	**723,172,353**	**268,767,394**	**483,473,231**	**752,240,626**	**20,833,343**	**(29,068,272)**	**47,809,066**
Spent through 2011 (Prior to 2012 NDCTP Filing)	254,750,101	254,750,101	254,750,101	254,750,101	N/A	254,750,101			
	982,382,648	**1,027,824,069**	**977,922,454**	**523,517,495**	**483,473,231**	**1,006,990,727**	**20,833,343**	**(29,068,272)**	**47,809,066**
				2026 - 2030 Estimate		**47,809,066**			
Project Total	**982,382,648**	**1,027,824,069**	**977,922,454**	**Total New Forecast 2015-2030**		**1,054,799,792**	**(26,975,723)**	**(76,877,338)**	

Note:
1. The Staffing is split differently in the 2017 forecast compared to the 2012 NDCTP methodology. The overall balance of staffing between the General Staffing section and Caisson Staffing section is favorable compared to the original estimate.
2. Reduction to reflect cost of removal of seismic upgrades which were previously disallowed.
3. Line items in blue text are new since the 2012 NDCTP filing.

1.1 OBJECTIVE

The objective of this DPR is to provide an updated, comprehensive evaluation of the remaining activities, costs and schedule to decommission the HBPP Unit 3 as well as to provide a status of the work completed to date.

1.2 PRIOR HISTORY

PG&E initially developed the site on which HBPP Unit 3 is located as a fossil-based electrical generating station around 1950[1].

HBPP Unit 3 began commercial operation in 1963 as a 65-megawatt electric, or MW(e), natural circulation boiling water reactor. It was taken off line in 1976 for refueling and seismic modifications. In 1979, prior to the completion and acceptance of the seismic modifications, the nuclear incident at Three-Mile Island occurred and, as a result, the NRC mandated a comprehensive series of further modifications that would have required substantial additional investment. The CPUC approved an early decommissioning plan for HBPP Unit 3 because the additional NRC-required investments would have made restarting the plant uneconomic.

PG&E placed the plant in an NRC-approved long-term storage and monitoring condition known as SAFSTOR. During this period, the plant was maintained to ensure the integrity of its safety systems and to safeguard the health and safety of the public, the environment, and PG&E's work force. While HHPP Unit 3 was in SAFSTOR, PG&E planned and constructed an ISFSI. Once construction and testing were completed, PG&E transferred the spent nuclear fuel from the SFP to the ISFSI, finishing in 2008.

In addition to Unit 3, two natural gas- or oil-fueled units, Units 1 and 2 (the fossil units), existed on the plant site, but were dismantled and decommissioned in August 2011. Unit 1 was rated at 52 MW(e), and Unit 2 was rated at 53 MW(e). Dismantlement and decommissioning were funded through the General Rate Case. The space previously occupied by Units 1 and 2 is being used as a laydown area for the completion of Unit 3 decommissioning. Two diesel-fueled, gas turbine Mobile Emergency Power Plants (MEPP), each rated at 15 MW(e), were also decommissioned in 2011.

Units 1 and 2 were replaced by a new generating facility called the Humboldt Bay Generating Station (HBGS), adjacent to HBPP Unit 3. PG&E constructed HBGS during 2009 and 2010, and commenced commercial operation in September 2010.

PG&E hired a specialty consultant to perform several cost studies between 1978 and 2009, including, the 2001 SAFSTOR Decommissioning Study. The decommissioning cost study and other studies by the specialty consultant provided PG&E with sufficient information to prepare the financial planning documents for decommissioning, as required by NRC. These estimates were not

[1] Attachment A, Site History of Humboldt Bay Power Plant Unit 3, provides a photographic history of the site beginning in the mid-1940s.

detailed engineering documents, but were financial analyses prepared in advance of the detailed engineering studies that would be required to carry out the decommissioning. The methodology used to develop these cost estimates applied a unit cost factor to estimate various standard decommissioning activities, adjusted for expected work difficulties unique to the Humboldt site. PG&E subsequently shifted to a more accurate, self-prepared cost estimate based on industry pricing and actual on-site experience. The cost estimates were backed by competitive bids and several years of successful decommissioning.

1.3 PLANT DESCRIPTION

HBPP Unit 3 is located approximately four miles southwest of Eureka, California. The site consists of approximately 143 acres located on the mainland shore of Humboldt Bay. Figure 1.3.1 shows the layout of the site and the surrounding area. The most recent aerial view of the site is shown in Attachment A, Site History of HBPP Unit 3.

Many unique features were used in the design and construction of HBPP Unit 3, including the construction of a pressure suppression system. Instead of an above-ground containment dome, HBPP Unit 3 was built as an airtight, underground chamber constructed out of steel and concrete. The cavity was partially filled with water to suppress the condensation of the steam that could be freed from the reactor system in case of an accident. The construction technique used for HBPP Unit 3 was also unique and innovative. The tank designated as the pressure suppression chamber was built on the surface of the ground. The bottom was equipped with "cookie cutter" edges, and water jets were placed underneath the tank. The water jets softened the soil and the cookie cutter edges then cut through the soil, causing the tank to sink into the ground under its own weight. The construction of the caisson ultimately placed the lowest floor at approximately 66 feet below sea level, the bottom of the structure about 80 feet below grade and most of the structure below the water table.

The Nuclear Steam Supply System for HBPP Unit 3 consisted of a single-cycle, natural circulation, boiling water reactor and the associated control and support systems. The generating unit had a rated core thermal power of 220 Megawatts thermal, MW(th) with a corresponding net electrical output of 65 MW(e).

The Nuclear Steam Supply System was located within the primary containment structure. The primary containment was located mostly below grade and consisted of a drywell vessel and a suppression chamber. Both the drywell and the suppression chamber area were located within a reinforced concrete caisson. The drywell vessel was centrally located in the caisson and served as the primary containment vessel. The suppression chamber was constructed of reinforced concrete and lined with carbon steel plate. Six vent pipes connected the drywell to a common ring header at the top of the suppression chamber. Downcomers dropped from the ring header and terminated below the normal water level of the suppression pool. As a system, the drywell, suppression chamber, and interconnecting piping were designed to reduce the pressure increase in the event of a local process system piping failure. Other supporting systems included the turbine-generator system that converted heat produced in the reactor to electrical energy; a closed feedwater cycle

that condensed steam and returned the condensate/feedwater to the reactor vessel; and a Circulating Water System that delivered the water required to remove the heat load from the main condenser and other auxiliary equipment and return it to the Bay through the discharge pipes and a canal.

The unique elements of the design and construction process have posed challenges in the decommissioning of HBPP Unit 3. Early operation of the plant led to unexpectedly high levels of alpha contamination. Over the SAFSTOR period, as beta and gamma emitting radionuclides decayed, alpha became a more dominant factor in dose contribution. Because alpha causes more severe biological damage when internal exposure occurs, the potential radiological dose consequences are likewise more severe. The extent of the alpha contamination has required significant additional radiological controls and reduced the efficiency of component removal activities.

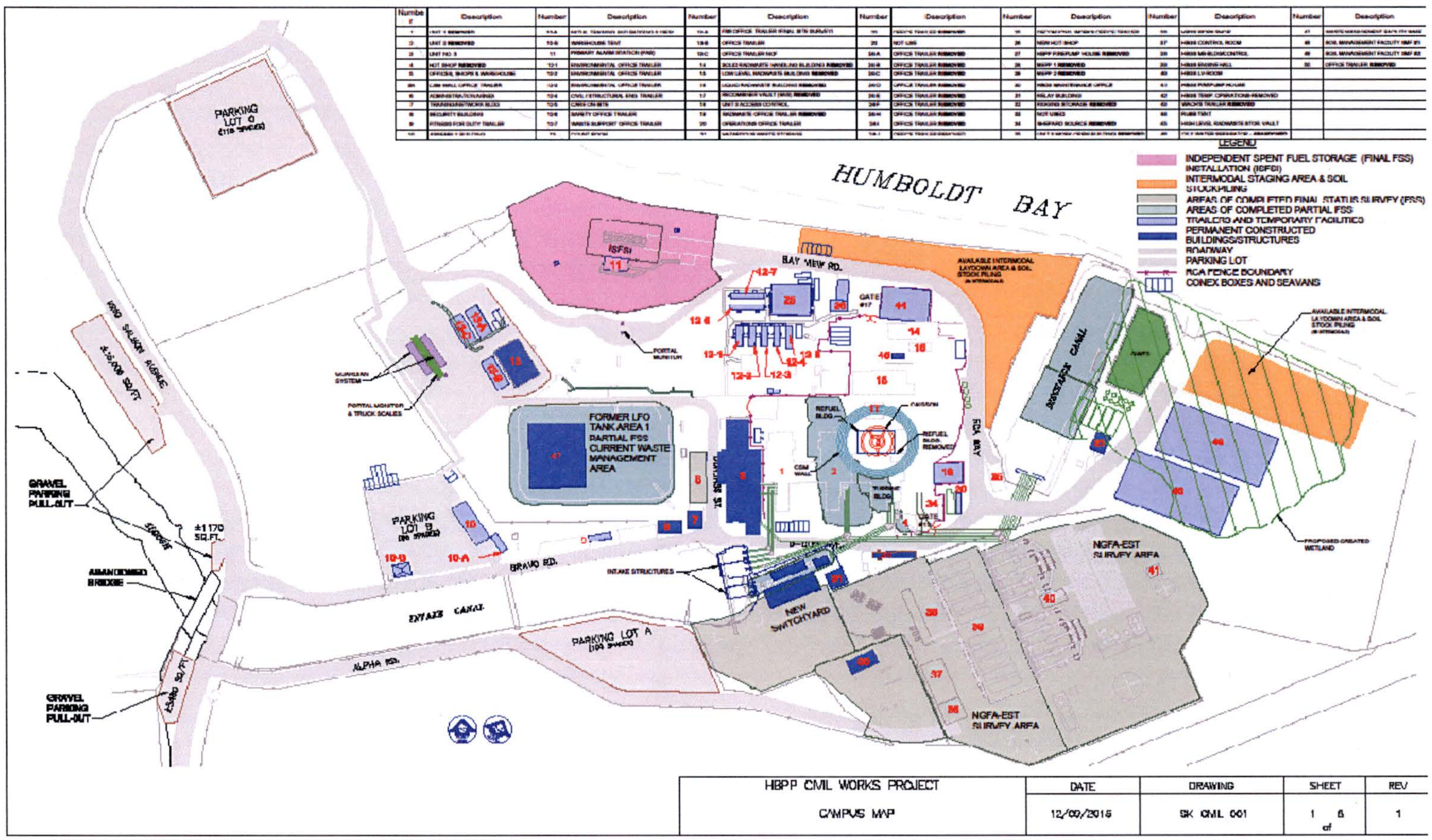
Additionally, when PG&E first obtained access to the interior of the bio-shield wall surrounding the reactor vessel, quantities of neutron activation products (carbon-14) were discovered. Because of this contamination, PG&E determined that the entire caisson should be removed. The caisson will be deconstructed from the top down and then backfilled once deconstruction has been completed.

Asbestos was commonly used during the HBPP construction, making removal time consuming and requiring trained personnel. The drywell between the reactor vessel and the caisson contains asbestos, which was completely abated.

Groundwater also poses a challenge during removal of below-ground structures. This water needs to be collected, tested, and stored until test results determine whether it must be shipped to a processor or can be discharged through the Groundwater Treatment System. Handling of increased volumes of groundwater may pose significant challenges once caisson removal has started. To combat the groundwater problem, construction of a CSM wall will be coupled with dewatering well installation. The CSM wall will allow for dewatered excavation of the caisson.

The discharge canal is undergoing remediation to remove radiological contaminants above cleanup objectives. Soil is being stored on site during the remediation. Once remediation is completed, stored soils with acceptable concentrations of non-radiological contaminants will be used to backfill the discharge canal. When the discharge canal has been backfilled, Final Site Restoration will determine the final configuration of the discharge canal.

FIGURE 1.3.1—LAYOUT OF THE NUCLEAR PLANT SITE AND SURROUNDING AREA



1.4 NRC LICENSE TERMINATION

1.4.1 License Termination Plan

HBPP Unit 3 has two NRC-issued licenses: one issued under 10 CFR §50 pertaining to operation of the plant, and the other issued under 10 CFR §72 pertaining to the storage of spent nuclear fuel and operation of the ISFSI. Once the decommissioning effort is complete, PG&E will petition the NRC to terminate the 10 CFR §50 license. A License Termination Plan (LTP) is required at least two years prior to the anticipated date of license termination. Submitted as a supplement to the Final Safety Analysis Report or its equivalent, the plan must include a site characterization, a 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 a discussion of any associated environmental concerns. The NRC will notice receipt of the plan in the *Federal Register*, make the plan available for public comment, and schedule a local hearing. LTP approval will be subject to any conditions and limitations deemed appropriate by the NRC.

Incorporated into the LTP is the Final Survey Plan, which identifies the radiological surveys to be performed once the decontamination activities are completed. The Final Survey Plan is developed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM). The MARSSIM incorporates the statistical approaches to survey design and data interpretation used by the US Environmental Protection Agency (EPA). It also identifies state-of-the-art, commercially available instrumentation and procedures for conducting radiological surveys. Surveys performed under this guidance provide 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 10 CFR §50 operating license if it determines that site remediation has been performed in accordance with the LTP and that the terminal radiation survey and associated documentation demonstrate the facility is suitable for release.

1.4.2 Radiological Criteria for License Termination

In 1997, the NRC published 10 CFR Subpart E, "Radiological Criteria for License Termination," amending 10 CFR §20. This subpart provides radiological criteria for releasing a facility for unrestricted use. The regulation states 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 in excess of 25 millrems (mrem) per year, and provided that residual radioactivity has been reduced to levels that are As Low as Reasonably Achievable (ALARA).

The NRC and the 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 mrem

per year is derived from criteria established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund). An additional limit of 4 mrem per year, as defined in 40 CFR §141.16, is applied to the drinking water exposure pathway.

On October 9, 2002, the NRC signed a Memorandum of Understanding (MOU) with the EPA on the radiological decommissioning and decontamination of NRC-licensed sites. The MOU provides that EPA will defer exercise of authority under CERCLA for the majority of facilities decommissioned under NRC authority. The MOU also includes provisions for NRC and EPA consultation for certain sites when, at the time of license termination, (1) groundwater contamination exceeds EPA-permitted levels; (2) NRC contemplates restricted release of the site; and/or (3) residual radioactive soil concentrations exceed levels defined in the MOU. The MOU does not impose any new requirements on NRC licensees and should reduce the involvement of the EPA with NRC licensees who are decommissioning. Most sites are expected to meet the NRC criteria for unrestricted use, and PG&E understands that the NRC believes that only a few sites will have groundwater or soil contamination in excess of the levels that trigger consultation with the EPA, as specified in the MOU. However, if there are other hazardous materials on the site, the EPA may be involved in the cleanup. As such, the possibility of dual regulation remains for certain licensees. The present study does not include any costs for this occurrence.

Early in the decommissioning process, PG&E conducted extensive studies on projected use of the land upon which HBPP was constructed. The purpose of the studies was, in part, to evaluate the impact of residual radioactivity on people who would work or inhabit the land after the operating license for the plant was terminated. The NRC contemplates two possible "critical groups"—an Industrial Worker Scenario and a Residential Farmer Scenario. Both scenarios require meeting the same exposure limit; the difference is the exposure duration and the number of pathways by which a dose may be delivered. The anticipated exposure to a critical group member is used to calculate the Derived Concentration Guideline Level for each radionuclide, which forms the maximum allowable residual radioactivity.

PG&E's 2009 cost estimate for remediation of soils and structures assumed control of the site for at least an additional 30 years beyond license termination. PG&E intended to remediate the site using the Industrial Worker Scenario to determine initial residual radiation levels, with natural isotope decay resulting in the site meeting the lower exposures associated with the Residential Farmer Scenario in 30 years. At the end of the 30 years, the site could then be released for unrestricted use.

Further investigation revealed that more long-lived isotopes were present than previously believed, so that the site would not meet the Residential Farmer Scenario exposure criteria within 30 years without substantially more soil removal and disposal than originally contemplated. PG&E reevaluated the comparative costs and regulatory risks and determined that it would be more prudent to remediate to the Resident Farmer Scenario immediately. In its order in Phase 1 of the 2012 NDCTP (Decision 14-02-024) the CPUC approved that decision. This cost study is based on the lower limits.

1.5 AGENCY APPROVALS

1.5.1 Interfaces with Agencies 2013 to 2015

While the NRC has the authority to terminate the 10 CFR §50 license, other agencies also have permitting authority over decommissioning activities. This section summarizes the major decommissioning and restoration projects for which permits have been obtained or will be obtained. It includes the agencies involved, the time required to obtain the permit(s), the mitigation required by the agency(s), and any permitting or compliance constraints or issues. In addition, several of the decommissioning or restoration permits have or will have ongoing long-term monitoring requirements. These monitoring requirements are also addressed below.

1.5.2 Caisson/Spent Fuel Pool Removal (CDP E-09-010-A3)

In order to remove the Unit 3 caisson and SFP, PG&E had to obtain an amendment to the original Coastal Development Permit (CDP), E-09-010 Major Decommissioning, from the California Coastal Commission (CCC). PG&E submitted the application for the CDP amendment on February 1, 2013, and it was approved on May 9, 2013.

The permit conditions imposed by the CCC include five Special Conditions previously included in the original CDP approved in December 2009). The Special Conditions require: (1) the development of a Storm Water Management Plan, (2) designation of biologists to implement the plan, (3) site restoration requirements, (4) development of an Archaeological Resources Protection Plan, and (5) requirements that visible project structures and features be painted in neutral tones and lights be directed downward and inward. Special Conditions 1-5 were already being implemented as part of CDP E-09-010. The Caisson/SFP Removal CDP required that the plans be expanded to incorporate the area within Unit 3 where the new work would occur.

In the Caisson/SFP Removal CDP, the CCC also imposed a new condition, Special Condition 6, requiring the preparation of a water cutoff wall Work Plan describing the proposed "as left" condition of the water cutoff wall, which will be built around the caisson and remain once it is removed. The Work Plan must include any planned modifications to the water cutoff wall that are meant to minimize disruption of the existing pre-project groundwater flows and velocities.

The collection of the pre-construction groundwater flow information for inclusion in the water cutoff wall Work Plan has been affected by ongoing decommissioning activities. Specifically, the dewatering of the discharge canal is influencing groundwater flows. This has complicated the development of the Work Plan, since current groundwater monitoring data are not representative. However, alternative data and the timing for collecting the post-construction groundwater monitoring data have been discussed with the CCC and determined to be acceptable.

1.5.3 Canal Remediation (CDP 9-13-0621)

The Canal Remediation Project involves the radiological and chemical remediation of the intake and discharge canals. It also involves the removal of the outfall pipelines that extend from the discharge

canal into Humboldt Bay. The numerous agencies involved in the regulatory permitting and compliance of the canal remediation project, the permits or consultations required by each of the agencies, and the dates the applications were submitted and received are listed below:

- California Coastal Commission, Coastal Development Permit, Application submitted August 7, 2013, Permit received February 12, 2014
- Humboldt Bay Harbor, Recreation, and Conservation District, Development Permit, Application submitted July 25, 2013, Permit received January 23, 2014
- California Department of Fish and Wildlife, Incidental Take Permit, Application submitted May 5, 2014, Permit received July 3, 2014
- U.S. Army Corps of Engineers, 404 Permit, Application submitted July 19, 2013, Permit received July 22, 2014
- US Fish and Wildlife Service, Biological Opinion, Biological Assessment submitted September 4, 2013, USACE initiated consultation November 25, 2013, Biological Opinion received March 7, 2014
- National Marine Fisheries Service, Biological Opinion, Biological Assessment submitted September 4, 2013, USACE consultation initiated November 25, 2013, USACE reinitiated consultation due to project changes July 7, 2014, Biological Opinion received July 17, 2014
- North Coast Regional Water Quality Control Board, 401 Water Quality Certification, Application submitted September 13, 2013, Permit received April 18, 2014

Before submitting permit applications to the regulatory agencies, PG&E formed an HBPP Canal Remediation Project Interagency Working Group consisting of representatives from each of these agencies. An initial meeting of the Interagency Working Group was held on August 14, 2013. Additional meetings were held on September 17, 2013 and November 19, 2013.

The mitigation measures for the Canal Remediation Project were developed based on feedback provided by the Interagency Working Group and consultation with agency staff. The mitigation measures include the following:

- Design and create a new wetland mitigation area by conversion of the Alpha Road Parking lot to a tidal wetland
- Install a turbidity curtain in Humboldt Bay anchored to the bay floor to exclude fish from the outfall pipe working area
- Use a vibratory hammer to set piles for removal of discharge canal outfall pipes
- Install a water control structure/bladder dam in the intake canal prior to remediation activities
- Implement a fish rescue and relocation plan within the dewatered portions of the canals
- Conduct pre-construction eelgrass surveys
- Monitor wetland creation and eelgrass mitigation areas
- Prepare construction monitoring, survey, and mitigation completeness reports

Installation of the turbidity curtain proved difficult, since it was required to be anchored to the bay floor to reduce turbidity and exclude fish.

1.5.4 Canal Remediation, Long-Term Monitoring/Maintenance Requirements

As part of the Canal Remediation Project, PG&E will remove the discharge canal outfall pipes. Removal of the pipes requires the temporary closure of the Shoreline Trail. To mitigate for the temporary closure, the CCC imposed Special Condition 3 in CDP 9-13-0621, which requires that PG&E prepare a Buhne Point Vista Improvement Plan that describes PG&E's proposed measures to enhance public access at the Buhne Point Vista and trail, located adjacent to the shoreline on the HBPP property.

The condition requires the Improvement Plan to include a discussion of amenities that will be installed (retaining wall and bench, safety barrier, and modifications to the existing trail to the Vista) and maintenance measures for those amenities. The condition also requires PG&E to identify a legal mechanism to ensure perpetual protection of the public access way. PG&E intends to record a deed restriction on the trail and Vista. The deed restriction will ensure that the Vista and trail are always available and maintained for public access.

CDP Special Condition 4 for the Canal Remediation Project requires PG&E to provide for a total of at least 1.7 acres of created and enhanced intertidal and wetland habitat at the Buhne Point Wetland Preserve and the Alpha Road parking lot mitigation area. Performance standards developed for the wetland areas will require ongoing monitoring until the standards are met. There are also ongoing maintenance obligations. The Buhne Point Wetland Preserve and Alpha Road parking lot mitigation area will be permanently protected under deed restrictions, ensuring the maintenance of the wetland areas as a continuing obligation.

Other areas within the Buhne Point Wetland Preserve that serve as mitigation for wetland impacts from the HBGS and several decommissioning projects approved in 2007-2009 also have performance standards and ongoing maintenance requirements similar to the Canal Remediation Project mitigation wetlands.

1.5.5 HBPP Final Site Restoration (CDP 9-15-0531)

Nearly every HBPP decommissioning CDP has a requirement that either a CDP or CDP amendment be submitted to the CCC to address site restoration once decommissioning is complete. PG&E commenced work on its FSR plan the second quarter of 2014. This work has been coordinated with the two PG&E departments that will remain on site once decommissioning is complete—the ISFSI and the HBGS. The CDP/CDP amendment application was submitted in April 2015.

In preparing the application, PG&E had several pre-filing meetings and calls with the CCC. In addition, the CCC reviewed and commented on the HBPP FSR Plan before it was formally submitted. CCC pre-filing comments on the plan pertained primarily to the need for additional restoration and wetland creation compared to PG&E's initial proposal. PG&E believed it had provided a balanced plan that accounted for site restoration, yet addressed the needs of the ISFSI

and HBGS. However, as requested by the CCC, PG&E modified its plan to include more restoration acreage.

By letter dated June 1, 2015, the CCC provided PG&E with a Notice of Incompleteness (NOI) for CDP/Amendment Application 9-15-0531. On July 9, 2015, PG&E submitted responses to the NOI. On August 7, 2015, the CCC provided PG&E with a second NOI for CDP/Amendment application. PG&E staff has met with CCC staff to discuss the application and CCC completeness comments on July 28, October 2, and November 13, 2015. PG&E continues to work with the CCC on the FSR. An FSR Plan amendment and responses to the CCC's second NOI were provided in December 2015. It is anticipated that the CDP/Amendment application will be deemed complete as a result of these documents.

As part of FSR, wetlands will be created and developed areas restored and vegetated. Although the amount of wetland creation and site restoration is still being determined, there will be monitoring and maintenance requirements for these areas. The specifics of these requirements will be determined during the permitting process. However, it is expected to be similar to the requirements for the Buhne Point Wetland Preserve and Alpha Road parking lot wetland mitigation area.

In addition to the CDP Amendment from the CCC, there are several other permits required for FSR. Table 1.5.1 provides a summary of the permits required and the status of each.

TABLE 1.5.1—SUMMARY OF THE FINAL SITE RESTORATION PLAN APPROVALS AND PERMITS

Agency	Permit/Approval	Notes
California Coastal Commission	Coastal Development Permit	The CDP serves as the primary state development permit. The application was submitted on April 30, 2015. The design drawings and hydrology report were submitted on May 29, 2015. The first application incompleteness response was filed on July 9, 2015. The Final Site Restoration Plan amendment and second application incompleteness response was filed in December 2015.
Humboldt Bay Harbor, Recreation and Conservation District	Harbor permit	A Harbor permit is required for any project involving the area below the Humboldt Bay high tide line (culvert replacements). The District is the lead agency for California Environmental Quality Act compliance. The Mitigated Negative Declaration (MND) was adopted and the harbor permit issued on August 27, 2015.
US Army Corps of Engineers (USACE)	Clean Water Act Section 404 permit and Nationwide Permit 27	A 404 permit is required for activities in jurisdictional waters of the United States, including wetland restoration and storm water drain culvert replacements associated with FSR. The 404 application was submitted on July 6, 2015. A revised 404 application was submitted in January 2016.
US Fish and Wildlife Service	Endangered Species Act	As part of the 404 permitting process, the USACE will consult with this agency regarding potential impacts to federally threatened and endangered species.
National Marine Fisheries Service	Magnuson-Stephens Fishery Conservation and Management Act/Endangered Species Act	As part of the 404 permitting process, the USACE may consult with this agency regarding whether the project would adversely affect critical habitat for listed anadromous fish species and essential fish habitat.
California Office of Historic Preservation	National Historic Preservation Act	As part of the 404 permitting process, the USACE will consult with this agency to determine whether the project would adversely affect historic properties.

Agency	Permit/Approval	Notes
California Department of Toxic Substances Control (DTSC)	Statement of basis to select final remedial actions; state hazardous waste management regulations; California Environmental Quality Act compliance	The DTSC is the lead state oversight agency for remedial activities. Note that remediation activities are included in Final Site Restoration permitting. However, they are also permitted separately by the DTSC.
North Coastal Regional Water Quality Control Board (NCRWQCB)	Waste discharge requirements, National Pollution Discharge Elimination System (NPDES) permit, construction storm water permit and Section 401 water quality certification	An NPDES permit is required for wastewater discharges to surface water or land. The 401 application was submitted on July 7, 2015. A revised 401 application was submitted in January 2016. The NCRWQCB also required submittal of a storm water management plan for the HBPP site post-decommissioning. The Drainage and Hydrology Report was submitted to the NCRWQCB in compliance with this requirement in May 2015 and approved in July 2015.
Humboldt County Building Department	Grading permit	A grading permit is required if 50 cubic yards or more of soil are disturbed.

1.5.6 Soil Remediation

In conjunction with the CCC approval of CDP E-09-010, the DTSC approved the Interim Measures Removal Action Work Plan (IMRAW) to govern the management of soil generated by the decommissioning project. The IMRAW ensures consistency for managing soils excavated from ongoing decommissioning and demolition activities at the HBPP where chemical contamination may be present. To date, some of the soil that has been excavated during implementation of the HBPP decommissioning and demolition projects contained constituents of concern. Excavated soil with chemical concentrations exceeding the soil reuse screening levels established in the IMRAW has been disposed off site, and cleanup of localized chemical contamination has been documented through confirmation soil sampling to verify that affected soil has been adequately remediated.

1.5.7 Remedial Action Plan

PG&E submitted a combined draft Feasibility Study and Remedial Action Plan (FS/RAP) to the DTSC on October 10, 2014, in conjunction with three additional reports: (1) *Revised Additional Site Chemical Characterization Report*; (2) *Human Health Risk Assessment*; and (3) *Predictive Ecological Risk Assessment*. Comparing the results of these reports to the proposed Site-Specific screening levels established for the protection of human health and the environment and the potential risk to groundwater quality, the draft FS/RAP identified nine Potential Soil Remediation Areas and one sediment location (the Discharge Canal) as having concentrations of constituents of concern that exceeded the proposed final soil cleanup goals. The draft FS/RAP recommends pre-excavation soil characterization and limited soil excavation activities for these areas. The remediation of the Discharge Canal is already underway and is being conducted pursuant to the IMRAW.

The DTSC completed review of the *Revised Additional Site Chemical Characterization*, the *Human Health Risk Assessment*, and the *Predictive Ecological Risk Assessment Reports* in October 2015 but indicated that it would defer consideration of a final RAP until after the decommissioning activities are completed. The primary reason for deferring consideration of the RAP was that, with the high level of decommissioning activities and associated soil excavations, the data summaries (such as the overall site characterization in the draft FS/RAP) quickly become out-of-date. In addition, areas of localized chemical impacts that were previously unidentified could be discovered during ongoing excavations, as subsurface structures are removed.

Following further discussions, the DTSC agreed that PG&E should continue to operate under the existing IMRAW through the end of decommissioning. The DTSC intends to reconsider this issue at the end of 2016. At the end of decommissioning, updated overall site characterization and risk assessments will be prepared based on data that is representative of the current site conditions. Because all of the Potential Soil Remediation Areas proposed in the draft FS/RAP are located in areas that will be excavated and regraded as part of decommissioning or FSR activities, removal of these areas of soil contamination will occur pursuant to the IMRAW requirements. In addition, any

localized contamination that is discovered during decommissioning can be effectively remediated in conjunction with decommissioning excavations, pursuant to the IMRAW.

To ensure that remediation conducted under the IMRAW will be consistent with the final cleanup goals approved in the final RAP, the DTSC will work with PG&E to administratively update the soil reuse screening levels for upland areas currently established in the IMRAW, and to develop soil screening levels for soil reuse in the lowland, wetland, and habitat areas that would be applicable during the FSR activities. In addition, PG&E will revise and resubmit the *Predictive Ecological Risk Assessment* to the DTSC in late 2016 to complete the evaluation of whether chemical impacts in any of the habitat areas pose any unacceptable risk to ecological resources.

Constituents of concern on site may also include radiological constituents such as Cesium-137. However, the cleanup of radiological contamination is being performed under the regulatory oversight of the NRC as part of its license termination process.

1.5.8 ISFSI Site Restoration

Although the ISFSI CDP does not include a permit condition addressing site restoration, the CCC staff report for the ISFSI CDP states: "The current proposed project does not address decommissioning [of the ISFSI] due in part to the uncertainty about when or if it would occur and how it would be regulated at that time. Decommissioning would require either a new coastal development permit or an amendment to this permit." (*California Coastal Commission, CDP E-05-001 Staff Report [2005], 12)*

PG&E will be required to submit a CDP or CDP amendment application to the CCC to address decommissioning of the ISFSI and restoration of the site. Decommissioning will also likely include removal of ISFSI roads, offices, and support facilities. The specific regulatory requirements for ISFSI decommissioning are not known at this time.

1.5.9 ISFSI Long Term Monitoring/Maintenance Requirements (CDP E-05-001)

As part of the CDP permits that have been obtained for the ISFSI and decommissioning, there are ongoing monitoring requirements. Given the ISFSI's location adjacent to the shoreline and on the bluff top of the HBPP site, the CCC imposed two Special Conditions pertaining to erosion of the shoreline and bluff. The CCC also imposed a condition to develop and maintain a coastal access trail along the shoreline of the HBPP property. These conditions are summarized below:

- Special Condition 1—Monitoring Bluff Slopes: This condition requires that PG&E annually monitor the bluff slopes adjacent to the ISFSI structure for sliding, ground movement, or other motion. If the monitoring results for any of the annual reports indicate that slope movement may require additional measures to protect the ISFSI, PG&E must submit a CDP or CDP amendment application to the ISFSI permit to address the measures to be implemented.
- Special Condition 2—Monitoring Shoreline Erosion: This condition requires that PG&E conduct surveys of the shoreline adjacent to the ISFSI site no less than annually for the life of the project. If the monitoring results for any of the annual surveys indicate that the ISFSI

may be threatened by coastal erosion in fewer than five years, PG&E must submit a CDP application or CDP amendment application to the ISFSI permit to relocate the ISFSI or other project components, as needed.

- Special Condition 5—Shoreline Trail Access Plan: This condition requires that PG&E submit a trail access plan for improvements to the shoreline trail, required as a result of the ISFSI project. The condition requires PG&E to identify "measures that will be taken to maintain the access way in a safe and usable condition to ensure safe pedestrian use (e.g., providing a level walking surface..."

PG&E's access plan provides that the trail improvements will consist of "a generally level meandering gravel path varying between 3 and 6 feet in width immediately landward and reinforced slope protection at the water's edge, extending the entire length of the PG&E shoreline. To ensure that the trail provides safe public access, PG&E will perform periodic inspections of access way conditions."

PG&E will record a deed restriction for the trail. Special Condition 5 states in part: "in the event of an extinguishment or termination of the deed restriction for any reason, the terms and conditions of this [ISFSI CDP] permit shall continue to restrict the use and enjoyment of the subject property so long as either this permit or the development it authorizes, or any part, modification, or amendment thereof, remains in existence on or with respect to the subject property." Therefore, the requirement that PG&E continue to inspect and maintain the trail extends at least until the ISFSI is decommissioned.

1.6 ISFSI OPERATIONS AND DEMOLITION

The ISFSI will continue to operate under a separate and independent license (10 CFR §72) following the termination of the 10 CFR §50 operating license. The ISFSI will continue to operate until all spent fuel and Greater Than Class C (GTCC) material has been transferred to the DOE. This study assumes that the DOE will commence transferring all spent fuel from HBPP Unit 3 in the year 2028, with transfer operations complete in 2029.

At the conclusion of the transfer process, the ISFSI will be decommissioned. PG&E assumes that the storage modules will not be activated from the storage of fuel, due to the age of the fuel when it was placed in the modules and the relatively short residence time. Consequently, this estimate does not include the cost of any significant decontamination of the ISFSI facility. Confirmation of the radiological status will be obtained through surveys and sampling of the modules.

The NRC will terminate the ISFSI 10 CFR §72 license when 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 structure is suitable for release.

2 DECOMMISSIONING PLANNING AND ACTIVITIES

2.1 PLANNING

PG&E entered active decommissioning in 2009. Work performed initially was in a Self-Perform venue. The work selected for self performance was comprised of high-risk activities for which PG&E wanted to exercise very tight controls. PG&E completed this work in 2015. In 2011, based on the contracting experience gained during the decommissioning of Units 1 and 2, PG&E began planning for a shift from self-performance of high risk activities to performance of the balance of work by contracted entites. The lower risk activities were identified and bid specifications for this work (known as the Civil Works Project) were developed in 2011 and 2012 (see Section 2.5, Bid Specifications, for more details.)

Once the contracts for the Civil Works Project were awarded and Self-Perform work was completed, PG&E was able to shift its on-site efforts to administering and monitoring the Civil Works Contracts and identifying and evaluating any emergent work or issues. With the contracts in place, PG&E was able to re-evaluate their own staffing needs.

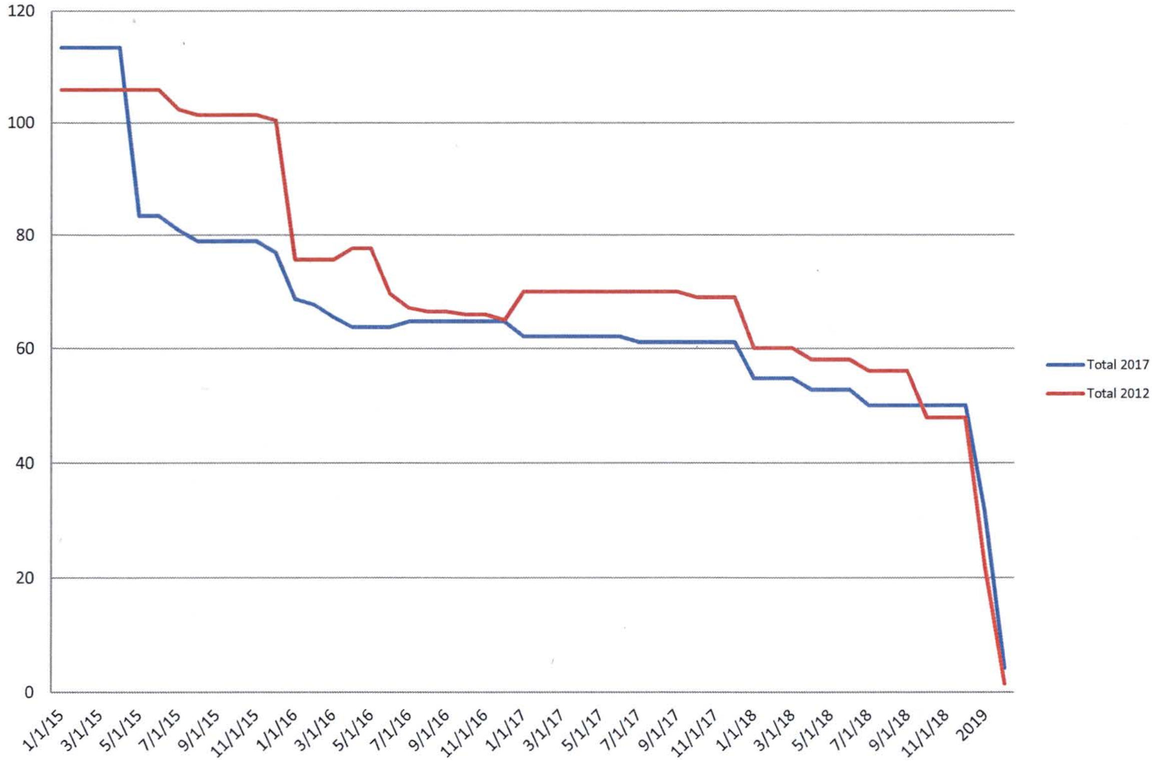
2012 Staffing Basis Changes were predicated on:

- The self-performed work conducted from 2009 through 2012 was performed well.
- During this same period, PG&E separately decommissioned Units 1 and 2, using a competitively bid contract. The scope of the Unit 1 and 2 decommissioning was well defined with little uncertainty. The total costs for that decommissioning were under budget and the work was completed ahead of schedule. Based on this experience, PG&E decided to identify those remaining scopes of work for HBPP Unit 3 that could be defined easily and well with little or no uncertainty.
- Shifting major pieces of work scope to a contract had the effect of reducing the PG&E staff that was required. The residual PG&E staff was and still is considered overhead and consists mainly of management, engineering, oversight, safety, and RP. The duration that the overhead is required will be extended based upon adding the reactor caisson removal as a new scope of work. That scope will extend the duration of the decommissioning and the need to retain the overhead staffing about two and one half years.

2017 Staffing Basis Changes were further refined based on performance and experience to date. Successful management of the cost of the decommissioning is contingent on control of labor costs. To that end, the first priority is to manage the head count for the entire duration of the decommissioning. PG&E developed a staffing plan specific to the head count for each period that runs to the end of 2019. The Plant Director and the Department Managers responsible for the various aspects of the decommissioning met off-site to develop this staffing plan. The staffing plan includes ramp-up, ramp-down, durations, funding sources, and number of staff needed to complete each function associated with the decommissioning.

PG&E used aggressive management of both work assignments and total head count to reduce the expected staffing needs for the balance of the decommissioning and restoration. As a result of their efforts, the total staffing to complete the work has been reduced as shown in the Figure 2.1.1.

FIGURE 2.1.1—NDCTP STAFFING COMPARISON, 2012 TO 2017



With the staffing portion of planning completed, focus moved to the final planning phase, which identified three additional cost drivers:

- The permits necessary to complete Final Site Restoration were identified as more complex, time consuming to implement, are required more stakeholder input.
- Changes to the overall site decommissioning sequence necessitated an early transition to a stand-alone ISFSI. That in conjunction with the delays by DOE to take possession of the fuel led to changes in staffing numbers and durations, a major procedure upgrade project, and changes to the ISFSI infrastructure.

2.2 GENERAL STATUS OF DECOMMISSIONING WORK

2.2.1 Completed Projects for Reasonableness Review

Removal of the remaining plant systems followed a prescribed sequence and methodology to remove structures, systems, and components (SSCs) of contaminated systems from the refueling and liquid radwaste buildings, utilizing a Self-Perform Organization. This sequence focused on a comprehensive, safe, and cost-effective approach to decommissioning the facility. Some of this work was performed in parallel with turbine building systems removal, which was the primary focus early in decommissioning from 2009 to 2011, with site infrastructure improvements. However, the majority of this work and cost occurred during the period from 2012 to 2014 when PG&E transitioned to a replacement self-perform general contractor for craft services. During this period,

the RPV internals segmentation was well underway, and RPV shell segmentation started in Feb 2013. By June 2014 most plant systems removal campaigns were completed successfully, utilizing strict Safety and RP processes for very complex undertaking by the craft.

PG&E has now fully transitioned to the Civil Works Projects (CWP) phase of its decommissioning and that work is being safely executed. This phase is currently in progress, and several key areas have been completed, including:

- Turbine Building and most of its below-grade structures have been removed
- Hot Machine Shop (HMS) and its below-grade structures have been removed
- Security Alarm Station (SAS) Building and its below-grade structures have been removed
- Low Level Radwaste Storage (LLRW) Building has been demolished
- Solid Radwaste Building has been demolished
- Majority of the pre-trenching has been completed
- North, South, and West Yard Substructures have been removed
- Liquid Radwaste Building (LRWB) interior has been prepared for demolition
- Phase II, exterior LRWB steel structure has been demolished
- SFP liner has been removed and the pool decontaminated, coated, and drained
- Most of the discharge canal has been remediated
- Spams / Main Exhaust Fan and its below grade structures have been removed
- Refuel Building (RFB) east wall paint and roof ACM abatement have been completed
- RFB, east 40' of structure has been demolished
- Filtration and Ion Exchange System (FIXS) has been removed
- Turbine Building Drain Tank (TBDT) has been removed

Table 2.2.1 contains a list of the more significant accomplishments during self perform. The following is a brief summary of some of the projects.

Access Shaft

The access shaft provided personnel, equipment, and tooling access from the El. -14 level to the El. -66 level of the caisson. Piping and equipment were removed at all levels of the access shaft and placed in special debris bags that were designed to fit in the access shaft. For more information, see Section E.4.2.2.1.

Control Rod Drive Mechanism Removal and Disposal

The CRDMs were mounted to the bottom head of the RPV and consisted of 32 control rods. The CRDMs had trapped internal contamination and very high radiation dose rates. To address the alpha contamination risk, special tools were made in order to remove the CRDMs. These tools were extrapolated from historical drawings and manuals of equipment designed for the reactor. Team members had constant observation of their personnel dosimetry devices to monitor their exposures. The CRDMs were removed with no personnel injury or unexpected radiation doses. For more information, see Section E.4.2.2.2.

Suppression Chamber

The suppression chamber had 17 out of 46 downcomers removed entirely. The lower halves of the remaining 29 were removed. The remainders of the downcomer piping and the ring header were cleared for open-air demolition. The removal of the suppression chamber systems was completed safely, without incident, and on schedule. These feats were achieved due to the attentiveness and alertness of team personnel. For more information, see Section E.4.2.2.3.

Emergency Condenser

The Emergency Condenser provided an emergency heat sink for the reactor. Removal was completed safely, without personnel injury or unexpected radiation exposures. The removal included the 8,800-gallon tank of water and two tube bundles connected to the reactor, along with support bracing that was added as a retrofit in 1975. After all support systems were removed, the Emergency Condenser was lifted with the SFP bridge crane and lowered onto a transport lowboy trailer. The Emergency Condenser was sealed in a specialty designed bag and secured to the trailer for transport. For more information, see Section E.4.2.2.4.

Off Gas Tunnel

The pipes within the off gas tunnel were cut, bagged, and hoisted to the B-25 shipping box placed over the existing plug opening to the tunnel. After all piping was removed, sealing grout was injected into the tunnel cracks and the whole tunnel was sprayed with a specialized tunnel coating. This method of removal proved effective and was later used for the pipe gallery. For more information, see Section E.4.2.2.5.

Stack Components

The stack ventilation system was redesigned and modified to improve airflow within the stack base structure to the plant ventilation system. Some equipment downsizing was required in order to be able to fit through the existing El. +12 doors. For more information, see Section E.4.2.2.6.

Spent Fuel Pool Piping, Cooler and Demin Vessel

Resin was removed from the SFP resin vessel located in the condensate demin room and transferred into a catch vessel for shipment and disposal. SFP piping coolers and pumps were cut and bagged then packaged in B-25 boxes. For more information, see Sections E.4.2.2.8 and E.4.2.2.9.

Refueling Building

The RFB enclosed the above-grade space above the reactor containment area. Remaining building commodities tied to the RFB include the Turbine Building Drain Tank (TBDT), which is prepared for removal, and the Dry Well Cavity. Final cleanout of the drywell was finished by civil contract workers in June 2015. For more information, see Section E.4.2.2.10.

Air Ejector, Anion-Cation, Condensate Demineralizers

Engineered rigging anchor points were installed and used to remove the piping, instrument panels, wire and conduit, pumps, and filter skids for the Anion/Cation/Resin Storage tanks. Many components associated with and including the Air Ejector and gland seal system were also removed. The remaining condensate system was removed using a mobile crane. The demineralizers were the last systems removed. For more information, see Section E.4.2.2.11.

Pipe Gallery

The valve gallery was not designed to facilitate system dismantlement. This made the use of mechanized rolling equipment impossible and made dismantlement both time and labor intensive. Glove bags with high efficiency particulate air (HEPA) filters were needed to cut pipe, and samples of the pipes had to be sent to the laboratory for testing before removal from the gallery. This process could take three or more days for a single cut. Piping was dismantled, removed, and packaged for off-site disposal. For more information, see Section E.4.2.2.12 Pipe Gallery.

Reactor Vessel Removal

The RPV and all of its associated internals have been completely removed. The RPV internals were moved to SFP to be directly loaded underwater into shipping cask liners. For more information, see Section E.4.4.1.1.

Turbine Building

Turbine building demolition was performed by a demolition specialty contractor. Demolition was conducted under plastic enclosures with HEPA filtration. For more information, see Section E.4.4.1.2.

TABLE 2.2.1—SIGNIFICANT SELF-PERFORM PROJECTS COMPLETED

Project Performed by Self-Perform Origination	Year Completed	Testimony Section
Access Shaft, El. -2 and -14, -24, -34, -44, -54 and -66	2014	E.4.2.2.1
Control Rod Drive Mechanisms (CRDM) and Nuclear Instruments Removal	2013	E.4.2.2.2
Suppression Pool Chambers North and South	2014	E.4.2.2.3
Emergency Condenser (EC) and Asbestos Removal	2013	E.4.2.2.4
Gaseous Off Gas Holdup Tunnel	2013	E.4.2.2.5
Stack Systems Removal	2014	E.4.2.2.6
Liquid Radwaste System	2014	E.4.2.2.7
SFP Piping, SFP Cleanup/Legacy Waste	2014	E.4.2.2.8, 9
Refueling Building Systems Removal	2014	E.4.2.2.10
Condensate Demineralizers	2014	E.4.2.2.11
Pipe Gallery	2013	E.4.2.2.12
Hot Shop and Equipment	2013	E.4.2.2.15
Yard and Plant Drains	2014	E.4.2.2.16
RPV Internals	2013	E.4.4.1.1
Turbine Building Demolition by specialty contractor	2013	E.4.4.1.2

2.2.2 Completed Projects Not for Reasonableness Review

From 2009 to 2014, PG&E self-performed SSC removal of plant equipment. As PG&E planned the transition from self-perform to civil works, it continued to look for opportunities to adopt safer practices and a more practical approach to the remaining decommission work. PG&E recognized that SSCs removal could be accomplished with more appropriate means and methods and more safely if it was performed by the CWC, particularly if the work scope could be integrated with caisson excavation, such as removal of the suppression chamber ring header and remaining downcomers.

During the bid evaluation process, PG&E discussed potential opportunities to better integrate some of the remaining self-perform work with the CWC. As the CWC neared contract execution, PG&E recognized that the CWC would need access to the buildings as required, which could create potential conflicts with work interface that would affect execution of work activities originally tasked to the Self-Perform Origination.

PG&E fully transitioned to the Civil Works Project (CWP) phase of decommissioning at the beginning of 2015. This work is being safely executed and is currently in progress.

The CWC completed several big accomplishments in the field once it transitioned from a major planning effort to start of field work, as shown in Table 2.2.2. Several above-grade buildings were abated and demolished including the HMS and the former SAS building, previously a hydrogen re-combiner concrete structure. These demolitions required carefully placed debris curtains and for the SAS building a closure plate to isolate the SAS building from the main plant ventilation system.

Known Challenges

For the scopes of work discussed in the following subsections, the CWC worked through typical known challenges. Pre-demolition building requirements included hazardous waste assessments, radiological surveys, characterization reports, and project waste plans. State and local regulatory permitting requirements included notification to the North Coast Unified Air Quality Management District (NDAQMD) of demolition or renovation pursuant to the National Emissions Standards for Hazardous Air Pollutants (NESHAP), coordination with PG&E's RP Group, and submittal of a building survey report authorizing OAD. Additionally, project work packages required detailed instructions, work or schedule coordination, design implementation, permits, and other elements, as required by the contract specifications.

Site Coordination and Congestion: The site footprint is extremely small and constricted. Coordination among all parties performing work on site was critical for success. Very little space was available on site for laydown areas, soil stockpiling, demolition debris, and equipment operation, including demolition machines and truck traffic. Significant delays or inefficiencies were unavoidable due to interference and coordination with other site activities. The constricted space limited the pace of demolition and excavation.

Hazardous Waste Remediation: Assessments characterized hazardous building materials requiring extensive remediation including mercury, lead, and polychlorinated biphenyls (PCBs). Federal and

state regulations for abatement for hazardous or toxic materials are prescriptive and labor and time intensive. Each waste stream was handled and managed differently. This required additional staffing to develop, train, manage, monitor, and report on programs to assure compliance with the regulations. Abatement activities included the removal of mercury vapor lighting, ballasts, and lead seals.

Demolition: Pressure washers were deployed for wetting concrete surfaces to control fugitive dust emissions. There was a zero-emission requirement for fugitive, contaminated dust. Multiple operations conducted by separate entities (PG&E, various contractors) were occurring simultaneously throughout the course of the demolition, requiring close coordination, communication, and interface between the parties. Safety barriers were installed near active plant systems and work areas to protect them from possible flying debris generated during concrete demolition.

Groundwater: Excavations deeper than El. +8 require water control. Groundwater encountered during below grade SAS removal was pumped into holding tanks then sampled and analyzed for chemical and radionuclide constituents prior to transfer to the Groundwater Treatment System. Excavation dewatering management can causes significant delays and inefficiencies.

Environmental Health and Safety: Decommissioning activities are performed in strict compliance with all federal, state, and local regulations. These highly regulated work activities require extensive atmospheric monitoring and personnel anti-contamination garments and respiratory protection. Additionally, PG&E has placed a heightened emphasis on worker safety regarding radiological dose rates and ambient temperature work activity durations. Activities performed under these extreme conditions cause significant inefficiencies and increase project cost.

Key Completions

Several key infrastructures were completed as well including removal of trailer city and construction of two large RUBB tents to manage soils. The GARDIAN system was completed which allows ease of soil screening for use.

Divers were mobilized to isolate the discharge canal discharge piping from the power block using bladders. Once completed, they transitioned to their primary project, a radiologically significant activity, to cut the SFP liner underwater.

Discharge canal remediation accomplishments included: completion of coffer dam installation; Groundwater Treatment System (GWTS) tightness test completion; and completion of Discharge Canal seining.

Pre-trenching for the caisson water cutoff wall and removal of underground substructures beneath and nearby were well underway during this period. To support this excavation effort, numerous storm water and firewater design changes and field modifications had to be performed.

TABLE 2.2.2—CIVIL WORKS PROJECTS COMPLETION DATES

Projects Performed by Civil Origination	Year Completed
RPV Shell segmentation	2015
Activities Not Part of Reasonableness Review	
Cask Shipping, Laydown, Wash Area	2015
Reactor Vessel Cavity (Drywell Systems Removal)	2015
Characterize/Grout, RFB Embedded Pipe and Penetrations	2015
Decon/Remove New Fuel Storage	2015
Oily Water Sumps, Condensate Pump Casing Removal	2015
Yard Equipment and Soils Removal (Underground Utilities)	In Progress
Discharge Canal Remediation allowing for CSM wall installation soils storage for reuse	In Progress
Liquid Radwaste System, Outer Building (complete), Building Foundation and Retaining Wall Removal, LRWB	In Progress
Refuel Building Removal	In Progress
Plant Ventilation Stack Base	Future
Access Shaft embedded piping	With Caisson
Suppression Chambers (Ring Headers/Downcomers)	With Caisson
Office Facility Demobilization	Future
Site Restoration	Future

2.2.2.1 SFP Liner

The HBPP Unit 3 SFP had contained severely damaged fuel in addition to significant amounts of dispersed activated metals from performing segmentation of reactor vessel internals in the spent fuel pool. The highly contaminated nature of the SFP was a significant radiation protection concern during cleanup of the pool considering the internal hazards from the distribution of alpha contamination on the surfaces of the pool liner. Compounding the hazard, sealant coating

(carboline)— applied to the underlying concrete surface and suspected to contain asbestos requiring remediation—would also create an industrial hygiene hazard.

In order to mitigate the above concerns, the use of divers working in the SFP to remove and package the liner underwater, remediate the concrete coating containing asbestos under the liner, and coat the remediated surface with a sealant to prevent water in leakage after drain down was decided. This eliminated both the radiological and asbestos airborne concerns associated with plans to remediate the SFP in a dry condition. Additionally, this approach removed the work from the critical path.

The SFP liner was mechanically cut from the walls and floor in large sheets to limit heat impacts to mastic applied to the underlying concrete surface. The larger sheets were then segmented for packaging using arc gouging. A floating hood ducted to the plant ventilation system was used over the pool surface to capture potential airborne from arc gouging operation. Once the liner was removed, the mastic and concrete surfaces were remediated and an underwater sealant to prevent leakage applied to allow for early pool draining.

The underwater remediation and sealing of the SFP reduced the estimated person-rem exposure to personnel by 8 person-rem. Additionally, even though the divers were in wetsuits, this precluded an entire crew from performing the work dry which would have required the use of Power Air Purifying Respirators. Overall, the wet approach resulted in a safer working environment for the work crews.

The SFP liner removal task that had a significant effect on project duration was the time it took to ship the existing in-pool SFP water—and any additional groundwater intruding once the pool is drained—off site for disposal including. Waiting for completion of the CSM cutoff wall would have prevented additional groundwater intrusion from entering the SFP post draining. This would have created scheduling issues and significant time delays that would have prevented beginning demolition of the refueling building and thus extended project duration.

The applied methods allowed two activities, reactor vessel segmentation and SFP, to occur concurrently with minimal schedule consequence.

2.2.2.2 Hot Machine Shop

The 1,250 square foot HMS has been demolished. Both of the above- and below-ground HMS superstructures have been demolished. This process involved surveying, decontaminating, and releasing the HMS for OAD. The subsurface removal of foundations, drain pipes, and water lines was accomplished with shallow excavations. Deeper excavation was needed for the Unit 3 Discharge Pipe and the two adjacent discharge pipes for Unit 1 and Unit 2.

2.2.2.3 Security Alarm Station/Recombiner/Instrument Building

The SAS was an approximately 930 square foot reinforced concrete building, with walls up to 3 feet thick and a 2 foot thick floor slab. The building was located in close proximity to active work faces and nearby active plant systems. The structure consisted of an entry at El. +12 opening into a stairwell down to the main floor of the structure at El. +3.5. The east wall at El. +3.5 provided access into a pipe tunnel, which was adjacent, but not connected, to the Off Gas Tunnel. The SAS

Building previously stored miscellaneous radiological monitoring equipment. The structure was constructed in 1976 to 1977 as the Recombiner Vault but was never put into service.

Work Scope

The scope of work for the SAS Building included removal of the superstructure to ground level at El. +12, interior walls to slab at El. +3.5, and any remaining components. The contractor sealed the entry to the Pipe Tunnel and protected that feature during the work. When the work of this specification was completed, the contractor used flowable grout to El. +12 to protect the subgrade.

Large demolition equipment included loaders and excavators with hydraulic hammer, processor, or bucket attachments. Initial demolition occurred with the removal of the above-grade concrete structure, allowing the debris to remain within the building basement. The building basement void space was then filled with a concrete slurry mix providing a stable foundation for ongoing decommissioning activities.

Phase (II) SAS demolition consisted of below-grade concrete removal, disposal, backfill, and compaction of the building footprint. Heavy demolition equipment included loaders and excavators with hydraulic hammer, processor, or bucket attachments.

Initial demolition began on the west end of the foundation, progressing east, removing the on-grade slab and exposing below-grade walls and footings. As demolition progressed, concrete slabs, walls, and footers were removed. Fill material was then placed and compacted, providing a stable foundation for ongoing decommissioning activities. Concrete debris was loaded into intermodals in accordance with the project waste plan.

2.2.2.4 Solid Radwaste Building (Building 14)

The Solid Radwaste Building (SRWB) was an approximately 2,700 square foot structure used for waste packaging and waste container decontamination and release surveys. The structure was constructed of sheet metal atop a six-inch, reinforced concrete, mat-slab foundation. It contained two bay doors to the outside and one bay door between the structure's two main rooms.

Work Scope

The scope of work for the SRWB included removal of the superstructure and any remaining components down to the top of the slab. The building contained two floor drains that PG&E cleaned clean and grouted before Notice to Proceed to the CWC for demolition. The contractor plugged these drains before structural demolition commenced to protect the drain lines until they were removed during subgrade demolition.

The SRWB was demolished using conventional demolition methods. Mobilization of specialty large heavy demolition equipment consisted of excavators with metal cutting shears and bucket/thumb attachments. Initial demolition began on the west end, demolishing the structure methodically bay by bay. Multiple excavators were employed throughout the demolition process ensuring positive control of building components. Building components were processed and loaded into intermodals in accordance with the project waste plan.

2.2.2.5 Low Level Radwaste Building (Building 15)

The LLRWB was an approximately 640 square foot structure that housed contaminated equipment and newly generated radiological waste. It was also used to place packaged waste into waste containers. The building had an open floor plan with a movable wall partition. It was constructed of Concrete Masonry Unit walls atop a six-inch reinforced concrete slab and shallow footings. Additionally, the LLRWB was located within close proximity to the High Level Vault and the SRWB, which impeded equipment access.

Work Scope

The scope of work for the LLRWB included removal of the superstructure and any remaining components to the slab at El. +29.5. The building contained two floor drains that PG&E cleaned and grouted before Notice to Proceed. These drains were plugged before structural demolition commenced. The LLRWB was located adjacent to the High Level Vault. The contractor protected the High Level Vault while undertaking demolition of the LLWRB.

Abatement activities included the removal of an unknown fibrous material sandwiched between approximately 100 square feet of transite fire wall panels. Removal of this newly discovered material required construction of air-tight negative pressure enclosures with HEPA filter units attached to controlled employee change rooms for donning and doffing street and protective clothing and functional shower facilities for workers. Construction of these types of enclosures is a unique craft and is usually performed by specialty contractors. Compounding this challenge was the additional requirement for radiological safety, made more significant by the presence of alpha contamination. Furthermore, removal of the sandwiched material involved site-specific training and integration with existing site work activities, increasing time and cost of building demolition.

The LLRWB was demolished using conventional demolition methods. Building demolition required large excavators with metal cutting shears and bucket/thumb attachments. Initial demolition began on the west end, demolishing the structure methodically bay by bay. Multiple excavators were employed throughout the demolition process, ensuring positive control of building components. Building components were processed and loaded into intermodals in accordance with the project waste plan.

2.2.2.6 Liquid Radwaste Building Steel Structure and Concrete Vaults

The LRWB was an approximately 3,500 square foot structure built into the excavated hillside north of the RFB. The structure was a heavily reinforced concrete structure surrounded by a pre-engineered steel building that was constructed around the concrete structure years after plant startup.

The concrete walls were up to three feet thick, and the slab was 3.5 feet thick (nominal), with thicker sections beneath interior walls and the former Radwaste tanks. The foundation was also supported by concrete piers, installed as part of a structural upgrade. The structure contained a Radwaste sump, trench, and access to the Off Gas Tunnel that connected many of the Radiologically

Controlled Area (RCA) structures. PG&E cleaned and grouted the sump, cleaned the trench, and cleared access to the tunnel before Notice to Proceed.

The LRWB was maintained under negative pressure to minimize the spread of contaminants to the environment during work activities that had the potential to cause airborne contamination. PG&E authorized demolition of the LRWB upon contractor completion of all required decontamination work and isolation of the ventilation system to the structure. The building and ventilation systems have recently been removed.

Work Scope

The scope of work for the LRWB included removal of the steel superstructure and any remaining components to the slab at El. +12. (PG&E removed the tanks and equipment during self-perform). The concrete building's structural features included external buttress walls on the east and west elevations and a retaining wall on the north elevation, all of which remain in place until planned removal as part of subgrade demolition. Similarly, the internal vault walls, which were an integral part of the ground support system provided by the north wall, will remain in place until subgrade demolition. The contractor protected and covered the sump, trench, and access to the Off Gas Tunnel during the work.

Radiological Remediation: The LRWB was maintained under localized negative pressure ventilation to minimize the spread of contaminants to the environment during work activities that had the potential to cause airborne contamination. Compounding this challenge was the additional requirement for radiological safety, made more significant by the presence of alpha contamination. The negative pressure work involves site-specific training and integration with existing site work activities, adding time and cost for building demolition.

All piping, equipment, furnishings, and components that interfered with access to structural surfaces of floors, walls, and ceilings were removed to allow decontamination and demolition. Extensive surface decontamination included wet wipe method and mechanical shaving of the concrete surfaces to a specified depth. Additionally, fixative agents were applied within the building interior, encapsulating remediated surfaces.

Dust Control: Demolition of the LRWB required extensive decontamination of the interior concrete walls and floor surfaces. The LRWB connection to the main plant exhaust system was removed, and local HEPA filtration units were used to capture dust. Water sprays were used to knock down the concrete silica-laden dust. Although effective, application of this control process was labor intensive. Too little water created an unacceptable airborne dust hazard with the significant potential for migration out of the building. Too much water clogged the HEPA filters and was difficult to maintain within building confines, continuously interrupting the progress of work. Water misters and garden sprayers delivered the appropriate volume of water but required the user to work too close to the operating demolition equipment. Pressure washers were used and the water was collected in floor trenches and sumps, pumped to water totes, decanted, and reused to manage the volume. This was a significant impediment to a sustained pace of demolition work and could not have been accurately predicted.

Interior Concrete Demolition: Equipment operation within a negative pressure enclosure required extensive planning and equipment modifications to eliminate the existence of carbon monoxide fumes within the LRWB. Appropriate size machines capable of maneuvering within a confined work space were selected and specialty exhaust manifolds with flexible ducting routed to the building exterior had to be engineered and installed. Additionally, the requirement for radiological safety was made more significant by the presence of alpha contamination. These risks combined to add to the importance of site-specific training and integration with existing site work activities, increasing the time and cost for building demolition.

The LRWB interior concrete remediation was accomplished using conventional demolition methods. Concrete removal required large excavators with metal cutting shears, concrete breaker, and bucket/thumb attachments. Interior concrete demolition was conducted methodically from top to bottom, bay by bay, beginning with the Radwaste Demin Room, followed by the Radwaste Concentrator Room and Pump Room. Access into the Concentrated Waste Tank and Resin Disposal Tank room required breaching through three feet five inch thick walls, enabling the removal of contaminated concrete tank pads. Contaminated sumps and embedded drain pipes were also removed throughout the building footprint.

Processing of demolition debris was consistently challenging, due to the building's configuration and radiological controls, which required conducting multiple handling and stockpiling activities within a constricted work space. Concrete debris was loaded into large nylon bags, lifted via an overhead crane, and staged on the upper floor. Upon radiological release, waste bags were loaded onto carts and transferred out of the building. Ultimately, the nylon waste bags were loaded into intermodals for disposal in accordance with the project waste plan. This project required extensive coordination, communication, and support from multiple groups, significantly increasing time and cost to perform the work.

Exterior Steel Structure Demolition: Building demolition was a prerequisite of CSM wall installation and clearing of areas for material storage. There were several obstructions within close proximity to the LRWB, including active electrical distribution panels, dewatering sumps, and equipment exclusion zones protecting the hillside retaining wall. Installation of protective measures and equipment operation within this limited space significantly increased time and cost to perform the work.

Structural steel demolition was accomplished using conventional demolition methods. Steel removal required large excavators equipped with metal cutting shears and bucket/thumb attachments. Initial demolition began on the west end, demolishing the structure methodically bay by bay. Multiple excavators were employed throughout the demolition process, ensuring positive control of building components. Components were processed and loaded into intermodals in accordance with the project waste plan.

2.2.3 Ongoing Projects

Refueling Building Phase 1 (Decom Crane El. + 12 Demo)

This project involved demolition of the east 40 feet of the RFB and removal and disassembly of the 75-Ton (75T) crane, which was completed in 2015. This was necessitated by the overlap of the CSM wall with the east forty foot section of the RFB. Prerequisite activities included removal of asbestos containing materials (ACM) on the east side exterior paint coatings and roofing materials. Additionally, forty feet of the El. +12 slab was demolished exposing the Off-Gas Tunnel and providing backfill material for the SFP & NFSV.

Asbestos, lead paint, and other hazardous material were removed from the Interior RFB Structure. Remediation will took place in the RFB TBDT and the Valve Gallery, as well as the Upper Shelf in the SFP at El. -14. The RFB Drywell, Pipe Chases, SFP and caisson sump were also remediated. The Filtration and Ion Exchange System (FIXS) was removed during Phase 1 as well. These activities were completed in 2015 with exception of remaining Thermal Systems Insulation (TSI) within the West Pipe Chase El. -2 to El. -58 elevation, and the remaining exterior ACM paint coatings located on the north and west exterior RFB walls.

The Propane Engine Generator (PEG) room underwent asbestos and transite abatement; after abatement, the asbestos was transferred to waste management. The PEG room was demolished, and the RFB was tested for open-air demolition and approved. The scaffold and containment structures were removed. PEG room above and below grade demolition was completed in 2015 as a prerequisite of CSM wall installation.

Turbine Building Slab

The Turbine Building Slab demolition will remove the concrete slab where the turbine building once stood. Two of three of the slab demolition work scopes were completed and the pilings that anchored the slab were removed. After these steps had been accomplished, the turbine building footprint was ready for License Termination Survey (LTS), following which the area was backfilled.

CSM Wall Installation

The CSM wall is being installed around the caisson. The deep shoring and cutoff wall is composed of five concentric CSM rings to be installed at various depths that will allow excavation to a depth of 96 feet. The outermost ring of the CSM wall will penetrate one foot into the Unit F clay layer, which is approximately 174 feet in depth. This outer ring is used to prevent groundwater from penetrating the work site so that caisson removal can take place in a dewatered area. The four inner rings will provide shoring to suppor the excavation. The innermost ring will have a diameter of 110 feet, centered near the Unit 3 foundation support Caisson, and will extend to a depth of 106 feet. The following three rings will increase in depth by four feet per ring. Each CSM ring will be made of individual panels that are three feet thick and nine feet long. The panels will overlap a minimum of 12 inches; the overlapping techniques will ensure that overlap extends to the full depth of the wall. Total thickness of all rings will be approximately 13 feet.

Two material batch plants will be constructed to supply a continuous flow of slurry to the drill rig. The batch plant will make a high shear colloidal mix of bentonite or cement and water and be equipped with a controlled weighing system to assure proper proportions of dry and wet constituents.

Once constructed, the CSM wall will need time to cure before caisson removal can commence. After the CSM wall has cured, the area will be ready for dewatering and caisson removal. CSM wall construction has required the development and manufacturing of a one-off Bauer Equipment BG-50. This rig drills and mixes the panels comprising the CSM wall. The BG-50 was needed in order for the CSM wall out panels to reach the deep clay layers to control water effectively.

Refueling Building Phase 2 (+12 Slab/Backfill Caisson)

This project will be the removal of the RFB El. +12 slab at Crane Bay. The removal of the condensate demineralizer room took place during RFB Phase 1. The off gas tunnel beneath the RFB rail bay was removed. Six H-Piles below the rail bay were also removed. Once completed, the RFB area will undergo LTS; once LTS is passed the RFB area, including the SFP, will be backfilled with approved material. After backfilling, the site will be part of a gravel parking and laydown area. The 75T crane, Demineralizer room and east forty feet of the RFB were demolished during 2015 Phase 1 activities. Phase 2 activities include abatement of remaining ACM paint coatings located on the north and west RFB exterior walls and demolition of the remaining sixty feet of RFB structure.

Off Gas Tunnel

The off gas Tunnel beneath the RFB Rail Bay area was removed. The off gas tunnel was used to tie the turbine building, RFB, stack, access shaft, and liquid radwaste areas together. The actual piping in the tunnel routed gaseous discharges, plant waste streams and drains, emergency backup and makeup systems, cooling water inlet and outlets, and auxiliary steam throughout the plant. When the plant was placed in SAFSTOR, much of the piping in the off gas tunnel was abandoned or had minimal use. After the off gas tunnel was removed, the area was tested for LTS and then backfilled.

Dewatering: Dewatering will take place within the caisson area to allow for dry deconstruction of the caisson, which is necessary to ensure worker safety during caisson removal. Dewatering will be performed after the CSM wall has been completed. Four dewatering wells will be located inside the CSM wall and will extend to a depth of 126 feet to allow for dry excavation of deep structures. The dewatering deep wells will be installed in 36-inch diameter boreholes and will extend to 108 feet below sea level, which is approximately 120 feet below the existing ground surface. The dewatering system discharge rates will be adjusted to meet the maximum treatment rate of the groundwater treatment system.

Caisson Removal Phase 1 (El. -22): The caisson removal project will take place in alternating phases of excavation then demolition of concrete. This sequence will take place from the El. +12 elevation to El. +6, then in four foot increments down to the El. -22 level. This process is necessary to ensure safe deconstruction and to address any concerns or issues that may come up during deconstruction.

Activated Drywell Region: Wall penetration in the Drywell and activated portions of concrete in the Drywell Region will be removed. Removal will be performed from scaffolding or a suspended man basket. Removal by mechanical means only (i.e. excavator with shear, breaker, bucket/thumb)

Caisson Removal Phase 2 (El. -22 to El. -66): The caisson removal for Phase 2 from El. -22 to El. -66 will proceed much like the sequence in Phase 1, with excavation and concrete demolition every four feet. There will also be the removal of the caisson floor, which will include six inches of floor, six inches of gravel, and six inches Tremie.

Tremie Removal and Caisson LTS: During caisson removal Phase 2, there will be a removal of the Tremie Layer to El. -74. The Tremie is concrete that was deposited through a pipe below water level during construction so that the concrete would displace water upwards without washing out the cement (aggregate) content. This Tremie is essentially a "plug" at the bottom of the Caisson. PG&E will perform the Caisson LTS after all material has been removed and deemed ready to be backfilled.

Caisson Backfill: After the LTS has been passed, the caisson site location will be backfilled with approved soil materials, and restored as part of final site restoration.

Site Restoration: Final site restoration activities will mark the end of the HBPP decommissioning project. Much of the site will be converted to wetlands, with some new paving for better access to the ISFSI and a proposed gravel parking and laydown area where the power units were located. The scheduled completion of site restoration is December 22, 2018.

2.3 TRANSITION TO CIVIL WORKS CONTRACTOR

Since the last NDCTP filing, PG&E has completed all plant systems removal activities, essentially completing Self-Perform work at HBPP. In 2012, PG&E initiated the Turbine Building Decommissioning and Demolition (D&D) contract, which was the company's second foray into a Construction type contract at the HBPP Site, and which laid the groundwork for development of a larger Civil Works contract to perform the balance of D&D and Site Restoration work. The Civil Works Contract was executed in 2013, and the Contractor has been on site since that time, initially planning the work, and now executing broad scopes of work toward the overall D&D strategy.

In 2014, HBPP management revised the site Oversight Plan to provide for better focus in a dynamic environment. This plan describes the framework for oversight of all work activities associated with the HBPP Decommissioning and applies to personnel performing oversight activities of nuclear decommissioning, decontamination, and demolition. Oversight is intended to support the safe, compliant, and effective decommissioning through all stages of the project, including contracting, work planning, field work and any necessary Owner support, management and ultimate final disposition of waste materials, demobilization from the site, and establishing the end state configuration through a site restoration program.

This plan allows HBPP management to institute administrative controls to effectively manage and communicate those identified potential impacts in such a way that the HBPP Management Team can execute pre-emptive and mitigative corrective action strategies to achieve success in meeting HBPP's Decommissioning Goals and Objectives.

The plan was designed to examine each aspect of the HBPP Decommissioning Project systematically. This includes planning through execution and site closure, to identify the specific

times, places, conditions, and coordination points where adverse impacts to safety, compliance, quality, schedule, or cost performance might occur.

Key areas for Oversight Team attention include:

- The HBPP site safety and teamwork culture
- Unique project radiological and environmental issues
- Complex and unique regulatory requirements
- Current best industry practices specific to nuclear facility decommissioning

This Oversight Plan provides functional guidelines to assist PG&E Leadership in assuring the Contractor's compliance with contractual requirements, and facilitates full support of and adherence to over-arching HBPP Values. This document, with existing Site Procedures, ensures an appropriate level of PG&E review, approval, and inspection of all work scope executed at the site. As the Site continues its transition into the Civil Works phase of its Decommissioning, Department-level Desk Guides for oversight may be developed on an as-needed basis to support each of the defined Project Functional Areas.

An effective PG&E oversight program is critical to ensuring the success of the project. A key factor in ensuring this success is ensuring that all work continues to be performed and overseen by qualified and experienced personnel, consistent with regulatory and contract requirements. A key element to the success of the HBPP Decommissioning effort is the use of Subject Matter Experts (SMEs) within and external to the PG&E organization to take advantage of the best possible knowledge base available in the industry.

At HBPP, Oversight is executed horizontally across functional areas (i.e., the HBPP Organizational Chart) and implemented at three vertically-integrated focus levels, which are also key risk management areas:

- Enterprise: the over-arching elements that are consistently applied to all decommissioning projects, and which address potential risk to PG&E's corporate image, goals, and mission.
- Project: Specific Definable Features of Work (DFWs) which, if not executed as expected, could potentially pose risk to other projects, thus increasing the potential for becoming an Enterprise issue (e.g., Caisson Removal).
- Task: Individual activities within a Project that are managed to assure overall project success by isolating and mitigating risk at the lowest level possible (e.g., within Canal Restoration, hydraulic isolation, intake structure removal and sediment dredging).

It is important to note that oversight function is not constrained by who executes Task-level work, but rather by HBPP cross-organizational responsibilities and Contract boundaries.

Effective oversight understands the role of the Contractor to implement work scope effectively and efficiently. Effective oversight means guarding against potential failure by engaging appropriately to balance the subject matter expertise of the Oversight Team with that of the Contractor. Effective oversight understands that Contractor Means, Methods, and Equipment may differ from past HBPP experience, but that the Contractor has been selected for its unique approach and expertise.

Through their respective knowledge bases, effective oversight provides a Contractor with the benefit of Owner site understanding, and the Owner benefits with Contractor experience on tasks not previously undertaken at HBPP.

The function of Civil Works Project Oversight is to execute real time observation of Contractor performance of work planning; work-in-progress; conduct of operations; and implementation of plans, policies, procedures, guides, and practices.

Oversight personnel review Contractor performance in terms of managing, planning, and executing day-to-day Civil Works Project requirements, as well as longer-term goals and strategies. Performance requirements and standards are defined by the Civil Works Contract and Specifications; the HBPP Decommissioning program; various regulatory agencies; and the Contractor's internal policies, plans, procedures, and guidelines.

Oversight Personnel are assigned to continuously monitor Contractor project work processes and work products for immediate detection of potentially adverse impacts on worker safety, public safety, or the environment.

To be effective, the Oversight process at HBPP must be defined across the organizational structure by the Subject Matter Experts that make up Functional Areas. It is critical to recognize that while an individual or group of individuals may have unique expertise outside his/her functional area(s), the process must channel that expertise through the defined organization structure so that decisions are made within context, appropriate to current regulatory and contracted requirements, and consistent with current practice.

To that end, implementing decommissioning oversight at HBPP relies upon a continuous improvement process already in use at HBPP for work operations. At its root, oversight is work scope to be executed by some party, so it should undergo planning and execution just like any other work scope. The basic management approach of Plan, Do, Check, and Adjust is germane here.

The oversight process is structured based on the following guidelines, which should be evaluated by each Functional Area for relevance and appropriateness, and then implemented:

- Plan: Develop methods to ensure that the Functional Area objectives are being met and to identify and prevent negative impacts. Bear in mind that written scope defines the expectations for the Work, and Contracts were written with the input of each functional area (i.e., do not invent requirements). Gain an understanding, in advance, of how success of the Work will be measured. Check for error traps or "known unknowns" that could hamper performance of the Work or of the Oversight.
- Do: Execute the plan, engaging with the Work in a learning mode, carefully observing the Work as it is executed, proactively guarding against failure as defined in the plan, and keeping an open mind to changing conditions.
- Check: As the project matures, continually evaluate whether expectations are being met, the Contractor is executing as planned, and oversight is meeting the defined expectations encompassed by the Plan (i.e., nothing "doesn't feel right").

- Adjust: Recognize that, as the project matures, the assumptions applied may not fit the matured project, either because the assumptions and goals were not realistic or are no longer applicable, or unexpected conditions have arisen. As a result of checking, identifying, and implementing modifications to the planned methods for oversight, new methods may be required to compensate for the lack of meeting expectations.

In developing methods, functional area leaders define oversight to include the following points:

- Periodically review the Work Scope execution as the project matures to determine changes to oversight methods—including those times, places, and circumstances predetermined to be risk triggers—that would improve Project performance and avoid, share, mitigate, and/or accept the level of Enterprise, DFW, or task risk being assumed by the Project.
- Assign qualified oversight staff to plan for, observe at the appropriate time and place, and document the observations associated with the planned activity. Coach staff on the difference between "success" and "perfection".
- Plan and implement external or independent review or surveillance of the work scope, as required, to achieve pre-defined objectives (i.e., "no surprises").

Whether related to safety, regulatory compliance (i.e. environmental), contract compliance or Work Instruction compliance, potential problems should be identified and corrected at the lowest level possible using effective on-the-spot three-way communication. The manner in which this communication is conveyed should be planned for and discussed in the Functional Area's plan for oversight.

The Civil Works transition has been successful. As the CWC onboarded onto the HBPP site, PG&E was able to terminate several Self-Perform activities, adding the scopes to the CWC scopes and ultimately reducing cost to the Project, eliminating coordination issues brought about by having multiple contractors working in close proximity to each other, and giving command and control of site logistics to one entity. The benefits of this transition have been seen at multiple work faces, perhaps most notably the Nuclear Facilities Demolition and Excavation scope.

The Civil Works contracts were divided into five separate activities conducted by two Contractors. The Turbine Building D&D contract, now complete, was executed well ahead of plan and under budget. The balance of the Civil Works tasks were awarded in mid-2013 to the CWC, who is charged with Nuclear Facilities Demolition and Excavation, Intake and Discharge Canal Remediation, Office Facility Demobilization, and Final Site Restoration. Each work scope was the subject of detailed and high-quality bid specifications, with clear and concise descriptions of work. As the CWC identifies opportunities for improved operations or other changes in approach, PG&E vets the change through technical review meetings before approving the approach at Readiness Review Board meetings and in revisions to the contract specifications.

During specification development, PG&E formed a broad-based, interdisciplinary team of subject matter experts to develop the contract. Much of that team has been retained to manage the contract, and additional subject matter experts have been engaged to assist PG&E with activities

not typically conducted by the company (for example, deep earth excavation, ground control, and groundwater control).

2.4 MAJOR CIVIL WORKS PROJECTS

The following major civil work projects will span the next three years at HBPP Unit 3:

2.4.1 Intake and Discharge Canal Remediation

This scope of work includes mechanical removal of radiologically and chemically contaminated sediment from the Intake and Discharge Canals, demolition of the discharge outfall and levee to Humboldt Bay, demolition of the intake and discharge structures, restoration of levee and coastal trail along the Bay, management and dewatering of contaminated sediments, and treatment of water to meet discharge permit requirements.

2.4.2 Nuclear Facilities Demolition and Excavations

This scope of work includes decommissioning and demolition of all remaining permanent plant structures and facilities identified for demolition and subgrade excavations.

2.4.3 Caisson Removal

This scope of work includes installation of a CSM shoring and cutoff wall that will encompass the Reactor Building Caisson and other deep structures in the Unit 3 area, extending down to the Unit F clay layer to provide groundwater control and isolation. The CSM wall provides for safe work access and egress for demolition personnel and equipment by preventing earth and groundwater outside the CSM wall from entering the caisson excavation. This scope of work will include removal of the Reactor Caisson.

2.4.4 Office Facility Demobilization

This scope of work includes removal or demolition of office facilities, including buildings and structures owned and leased by PG&E. Most of buildings and structures to be removed are modular or trailer type construction. Leased trailers and structures will be isolated, disconnected, removed from HBPP Unit 3, and returned to the owner. Buildings and structures owned by PG&E will be isolated, disconnected, demolished, and disposed as waste, unless released for salvage or recycle. This scope of work includes an estimated 32 building units comprising approximately 40,000 square feet.

2.4.5 Final Site Restoration

This scope of work includes development of site grading and drainage; placement of ground cover, including vegetation and other surfacing; road construction and repairs; installation of fencing and site lighting; and other final site development work to achieve the required end-state condition for PG&E's future industrial use. It includes demolition of remaining miscellaneous structures to support final site restoration plans. The parcel containing the restoration area is approximately 102

acres. Main features of this scope of work include removal of buried asbestos containing materials; demolition of the reinforced concrete settling basins, truck ramp, and associated piping; soil excavation, backfilling, and compaction; wetlands construction; finish grading; storm drain and storm water treatment using natural processes system installation; topsoil placement; vegetation establishment; installation of erosion control features; ground cover installation; final surfacing; and removal of portal monitors and truck scales.

2.5 BID SPECIFICATIONS

In 2011 and 2012, as the self-performed portions of the decommissioning were well underway, PG&E identified scopes of work that were well understood with minimal risk. PG&E decided that competitively bid contracts for the work would be the most cost-effective, efficient, and safest way to complete the work. In order to assure itself and its stakeholders that the contractors would meet all expectations, PG&E developed a set of bid specifications. The specifications contained the requirements that successful bidders would need to meet and PG&E's commitments to those bidders. A partial list of the topics contained in the specifications included:

- Health and Safety Requirements
- Project Coordination and Meeting Requirements
- Quality Programs
- Temporary Facilities and Utilities
- Environmental Protection
- Waste Management
- Decontamination Processes
- Final Site Restoration

PG&E commissioned publication of a Decommissioning Capstone Document that summarized the expectations, goals, processes, and projects that would be performed under contracts with one or more demolition contractors. The Decommissioning Capstone Document helped all parties, including HBPP Unit 3 staff, bidders, and stakeholders, understand the approach and final outcomes of this phase of the decommissioning.

PG&E developed several bid specifications to identify and control important aspects of the bidding, award, and implementation of contracts. Both clear direction to the bidders and clear commitments for support and oversight by PG&E will result in consistent and reliable bids for the work and work that meets PG&E's expectation after implementation. A partial list of the bid specifications included:

2.5.1 Health and Safety Requirements (01-11-01)

PG&E fosters a safety culture and the expectation of exemplary safety performance. Protection of personnel and the environment are the number one priorities at PG&E. The purpose of this specification is to outline the health and safety requirements for the performance of all work identified in the Specifications for decontamination, demolition and remediation activities at the former HBPP Unit 3. This specification includes requirements for training, radiation protection, monitoring and control, and site security, as well as PG&E's expectations and codes of conduct.

2.5.2 Project Coordination (01-31-13)

PG&E will continue to self-perform some minor activities after awarding the Civil Works contract(s). Those activities include operations, maintenance, and some decommissioning. The purpose of this specification is to outline the coordination requirements for the performance of all work identified in the Specifications for decontamination, demolition, and remediation activities at HBPP Unit 3. Defined in this specification are operations performed by PG&E, procedure identification and compliance, work sequencing and constraints, work planning, environmental quality, radiation protection and LTS requirements, and expected responses to emergencies.

2.5.3 Submittal Procedures (01-33-00)

PG&E considers development of accurate and timely submittals during project planning and demolition to be extremely important. Proper, complete, and appropriate documentation is necessary to record project decisions, the basis for planned activities, execution of the Work, and conformity with project plans and specifications. PG&E also recognizes that submittal and review is a two-way street. The purpose of this specification is to clearly define the expectations and processes for submittal and review of all project documentation including drawings, calculations, design data, test and inspection reports, procedures, and plans. Included in this specification are the requirements to be followed by both the contractor and PG&E.

2.5.4 Contractor Quality Control (01-45-16)

Contractor Quality Control (CQC) is the means by which a contractor ensures that the work, including that performed by subcontractors and suppliers, complies with the requirements of the Contract. This specification defines the requirement for a contractor to have, maintain, and implement a CQC Plan. It further defines the content requirements for the CQC Program and for the CQC organization. To assure PG&E of proper and compliant implementation of this specification, the specification also includes requirements and methods that PG&E will implement to verify Quality.

2.5.5 Temporary Facilities and Controls (01-50-00)

The purpose of this specification is to provide the contractors with information about regulatory and PG&E requirements for permits and approvals for facilities, structures, and engineered solutions necessary to support the Decommissioning effort. Because of the dynamic nature of the work, a variety of temporary systems will be necessary, including utilities, laydown areas and structures, and protective systems and barriers. In addition, the CWCs must develop plans addressing a variety of temporary and changing situations, particularly with respect to noise and dust control, traffic and pedestrian routing, and other field logistics, as work among the various Civil Works contracts progresses around the site. This specification provides the expectations and direction to assist with successful completion of work, while accounting for the requirements for temporary facilities and controls.

2.5.6 Storm Water Pollution Prevention Plan Implementation (01-57-13)

All storm water collected and discharged from the HBPP Unit 3 is subject to regulation under an NPDES permit. PG&E and its contractors are responsible for maintaining storm water collection and discharge systems, and preventing storm water pollution from entering Humboldt Bay, including through the Intake and Discharge Canals. PG&E accomplishes this through a system of drain inlets, underground piping, and best management practices that control erosion, minimize sediment loss, and prevent or limit exposure of potential contaminants to precipitation during routine plant operations. This specification defines the requirements for both PG&E and contractors to comply with the requirements of the NPDES permit and the SWPPP including control of materials, required staffing, inspections, maintenance of control and monitoring systems, and responses to hazardous waste releases.

2.5.7 Supplemental Environmental Protection Requirements (01-57-19)

In addition to PG&E's commitment to the health and safety of personnel and the environment as noted in Specification 01-11-01, PG&E is committed to demonstrating environmental leadership through its actions. This specification defines the general environmental requirements and expectations that PG&E imposes on contractors performing work at HBPP Unit 3. Included in the specification are quality requirements, accountabilities, and training. Specific requirements are defined for hazardous materials, biological resource preservation, cultural resource preservation, air quality, noise and vibration, water quality, vehicular traffic, and aesthetics and visual resource preservation.

2.5.8 Waste Management (01-74-01)

The HBPP Unit 3 Decommissioning and Demolition CWP will involve several discrete processes generating waste that must be managed for off-site disposal on-site reuse, or in limited cases, off-site reuse. This specification requires the contractor to develop a plan and to manage wastes in accordance with PG&E's established waste management and radiological protection programs. PG&E currently conducts its own waste management operations in accordance with a sitewide Waste Management Plan that addresses contaminated soil, demolition debris, and radiological waste. The plan is robust and addresses regulatory background and requirements; provides information on site-specific waste management practice, policy, and procedure; and serves to meet a requirement of the CCC for compliance with permitting, documents, and agreements. This specification provides direction on scheduling, waste acceptance criteria, waste accumulation, packaging, loading, shipping, and decontamination.

2.5.9 Building Decontamination (02-51-00)

This specification covers decontamination of the interior concrete surfaces to contamination levels that are low enough to allow open-air demolition. This specification includes allowable decontamination methods, sequencing and schedules, plan development, plan evaluation, personnel and environmental safety requirements, debris and material controls, and final acceptance criteria.

2.5.10 Above-Ground Demolition—RCA Structures (02-41-16.02)

This Specification Section describes PG&E's expectations of contractors in demolishing the above-ground portions of the buildings located inside the HBPP Unit 3 RCA Structures. In developing these Specifications, PG&E separated the Work of this Section from the Work of Specification Section 02 61 00, "Removal of Subgrade Structures and Contaminated Soil" because several of the deeper subgrade features must be protected until they are ready for removal. Specifically, the RFB at El. +12 feet is located atop the Reactor Caisson and Caisson Access Shaft that extend down to El. -66 feet, the SFP at El. -14 feet, and the Cask Pit inside the SFP at El. -24 feet. The RCA structures included in this specification include:

- Solid Radwaste Building (Building 14)
- Low Level Radwaste Building (Building 15)
- Liquid Radwaste Building (Building 16)
- Hot Machine Shop (Building 4)
- Security Alarm System Building/Recombiner/Instrument Building (Building 17)
- Plant Ventilation Stack Base
- Refueling Building (Building 3)
- Various miscellaneous RCA structures

2.5.11 Non-RCA Ancillary Buildings Demolition (02-41-16.09)

This Specification Section describes PG&E's expectations of contractors in demolishing buildings and structures located outside the HBPP Unit 3 RCA. These structures will be removed after or in conjunction with demolition of the RCA structures and include a mix of permanent and temporary facilities. The end state of the Non-RCA Ancillary Buildings Demolition is that all identified Buildings and Structures have been demolished or removed from the HBPP site and the site is stabilized and turned over for Final Site Restoration.

2.5.12 Removal of Subgrade Structures, Contaminated Soil (02-61-00.01)

This specification describes the work involved in removal of hazardous, nonhazardous, and radiologically contaminated materials, which include paving, concrete slabs, subgrade structures, embedded pipe, soils, and debris. The contractor's work plans shall include a description of how the contractor will keep doses ALARA and minimize the generation of wastes. In addition to licensed nuclear material, other environmental contaminants that may be encountered include total petroleum hydrocarbons, polycyclic aromatic hydrocarbons, PCBs, and metals, including chromium, lead, copper, and molybdenum.

Removal of subgrade structures and contaminated soils includes the following:

- Condensate Pump Pit and four Casings
- Unit 3 Turbine Building slabs, embedded piping, subgrade structure, the Condensate Pump Pit, and two Pit Casings
- Liquid Radwaste Handling Building slabs and subgrade structures
- Sump and trenches

- Hot Machine Shop slab and subgrade structures and the pit casing
- Recombiner Security Alarm Station Building and sump
- High Level Storage Vault
- North and South Yard Drainage Storm water drain system
- Underground Radwaste and utility piping
- Off Gas Tunnel
- Circulation cooling water intake and discharge water piping up to the canals
- Firewater protection pipe on the north and east side of Unit 3
- All buried and embedded piping within the RCA boundary

2.5.13 Removal of Subgrade Structures and Contaminated Soil—Spent Fuel Pool (02-61-00.01)

This specification is for the demolition of the SFP subgrade structure to the El. -29 elevation to remove: three SFP concrete walls (one must be retained to support the Suppression Pool); contaminated soil around the pool cell after the walls have been removed; and the tremie concrete below the SFP floor. The SFP was a poured-in-place concrete vault approximately 26 feet long by 20 feet high, with a deeper cask pit that extends from El. -14- to El. -24 elevation and is 10 feet by 12.5 feet. The SFP stainless steel liner was installed on the inside of the structural walls.

2.5.14 Intake and Discharge Canal (02-60-00)

This specification describes the requirements for setup and mechanical removal of contaminated sediment from the Intake and Discharge Canals; demolition of the discharge outfall structure that is within existing levee; removal of the intake and discharge structures and isolation and severing of the circulation water piping; restoration of the levee; and management and dewatering of sediments. Remediation, removal, or isolation of the Intake and discharge circulation cooling water piping is coordinated with canal remediation. This specification further stipulates sequencing and scheduling requirements; planning and evaluation requirements; safety requirements; excavation methods and surveys; demolition controls and debris management; water management; and other safety and environmental requirements.

2.5.15 Final Site Restoration (32-71-00.00)

This specification is for completing the final restoration Work to fulfill the requirements of the various permits covering HBPP Unit 3 and to assist with obtaining the NRC's release of the Part 50 license. Included in this Work are demolition of the Assembly building (Building 10); removal of asbestos-containing materials; demolition of reinforced concrete settling basins, the truck ramp and associated piping; soil excavation, backfilling, and compaction; wetlands construction; finish grading; storm drain system installation; topsoil placement; vegetation establishment; installation of erosion control features; ground cover installation; final surfacing; removal of portal monitors and truck scales; fencing and gate installation; lighting installation; and construction of new roads or repairs to existing roads.

2.6 BID PROCESS AND RESULTS

When PG&E initially prepared the technical Specifications for the CWP in 2011 and 2012, it was unclear whether removal of the submerged reactor caisson would be required. PG&E invited eight firms to submit proposals for one or more of the four major scope areas (Office Facility Demobilization, Nuclear D&D, Canal Remediation, and Site Restoration). In September 2012, PG&E received four proposals (two of the eight firms teamed with others on the list, and two declined to bid). Three of those submittals included all four scope areas, and one included the Canal Remediation scope only. To minimize potential conflict between Contractors executing the work within the limited area of the site, PG&E invited the three bidders to HBPP to present their approaches to the HBPP Management Team.

By the time PG&E filed the 2012 NDCTP it had become became clear that the site's subsurface structures needed to be completely removed. The Phase 1 decision in the 2012 NDCTP approved that plan. At that time, PG&E issued a "Best and Final Offer" (BAFO) Request for Proposal that included Caisson Removal scope and allowed the bidders to modify their approaches based upon discussions with PG&E during the initial proposal discussions. All three Bidders submitted BAFO Proposals. Ultimately, PG&E selected the Initial Highest Ranked Bidder to execute the work as the CWC.

2.7 2012 COST STUDY AND NDCTP DECISION

In February 2014, the CPUC issued the Proposed Decision on Phase 1 of the 2012 Triennial Review of Nuclear Decommissioning Costs and activities for PG&E as related to the HBPP Unit 3. This decision found reasonable a 2011 cost estimate of $680.4M (approximately $400M higher than the 2009 estimate) to complete the decommissioning. The $680.4M estimate represents a reduction of approximately $47.2M to PG&E's request of $727.6M. Decommissioning is well underway, and PG&E has established that most of its revised estimate of necessary decommissioning costs is reasonable based on new information about the extent of contamination, actual contract costs, experience, and other factors.

2.8 COST CONTAINMENT PROCEDURES

2.8.1 Contract Strategy

In setting up the contracting strategy for the Civil Works Contract, PG&E assessed the lessons learned from the Turbine Building demolition strategy. The constraints and scope of the demolition work are generally well known. Decontamination was less well described and was contracted on a time and materials basis. PG&E also looked at the self-perform effort that was done on a time and materials basis to provide insight into the types of work where this approach was successful.

For Civil Works, PG&E identified two of the four major WBS elements as FFP: (1) Office Demobilization and (2) Site Restoration. The basis for the determinations was the general understanding of scope and anticipated low risk for change. For example, the removal of office

trailers and other non-industrial facilities is a relatively straightforward operation for which costs can easily be estimated, and for which standard construction procedures and means and methods exist.

For the other major WBS elements—Nuclear Demolition and Canals Remediation—PG&E acknowledged the contracting risk that site conditions were likely to be different than expected. This acknowledgement was based in large part on the Turbine Building Demolition experience, where building structures often did not match design drawings, and on self-perform work conducted around the plant, where nearly all subsurface work undertaken by PG&E resulted in the discovery of previously unknown conditions such as soil contamination or the presence of unexpected subgrade utilities. The Contractor was given the opportunity to account for up to a year of delay in the overall schedule with no penalty. These work elements were released under a CPFF model, whereby Contractor costs are paid, but profit is limited to a "fixed fee" that is held constant regardless of whether the Contractor works fewer or more hours than proposed. The CPFF model incentivizes the Contractor to perform more efficiently, providing flexibility to cover the actual cost of work performed, but limiting profit dollars (and by corollary, increasing profit rate to reward efficient work).

2.8.2 Schedule Management

Specification Section 01 32 00, "Progress Documentation," called for Level 3 Earned Value scheduling, which would allow for project-level (WBS Level 1) assessment of schedule and cost performance against an established baseline. When the D&D project went to bid, PG&E decided to implement an Earned Value Management System (EVMS) to allow for near real-time tracking of schedule and cost for the CWC scope of work.

EVMS includes establishment of a performance management baseline schedule tied to control accounts, with schedule performance metrics integrated with cost performance metrics. Budgeted Cost of Work Performed is derived from the schedule for each definable feature of work (activity), and Actual Cost of Work Performed is generated from the Accounting system. Budgeted Cost of Work Performed and Actual Cost of Work Performed filter into a cost processor to review the cost performance index, and to derive an estimate at completion, which allows for variances to be tracked and reported to HBPP Management.

A benefit to EVMS is a documented Change Management Program that integrates proposed changes to project approach, means and methods, suppliers, or any other cost variable into the Schedule, which automatically shows up as a change that is to be evaluated against the baseline. Variance analyses can be performed to assess the impacts from one or more changes in a particular schedule element, and can be performed on any permutation of small-scale changes required to implement a planned change.

Another benefit of the EVMS approach is that progress can be measured (and managed) in varying levels of granularity. For example, the Baseline Schedule was developed at a Level 3 (Project-level) level-of-detail. However, as the CWC has developed innovative alternatives to the specifications, PG&E saw value in measuring (and managing) at the task level (Level 4). This means that the task-level components of a project can be evaluated against the baseline (for example, modifications to

the water cutoff and earth support method are evaluated against the baseline slurry wall approach) to assess cost, schedule, safety, and other benefits.

To ensure that the Contactor understood PG&E's requirements and to increase visibility and managerial control over project costs, PG&E vetted the Baseline Schedule against the Technical Specifications and Contractor Proposal with a third-party consultant, allowed the transfer of critical Project Controls assets to the contractor after Self-Perform work was complete, and continues to maintain regular planning and scheduling meetings to monitor progress against project requirements.

Since Baseline Schedule acceptance, the Contractor has provided regular schedule updates—with cost performance index and Schedule Performance Index (SPI) updates—subject to PG&E management review. These updates are evaluated to verify that cost and schedule expectations are met, or to identify potential areas for improvement where cost performance index or SPI metrics indicate that expectations may not be met.

2.8.3 Contract Management and Administration

PG&E monitors its contractors closely to ensure that contract requirements are being met in a safe, timely, and efficient manner. Three monitoring methods currently in use are an Executive Oversight Board, tabletop planning, and Plan of the Day (POD).

2.8.3.1 Executive Oversight Board Meetings

Decommissioning of HBPP is a complex project requiring a high degree of planning and coordination between on-site work groups, corporate resources, and government agencies. The Executive Oversight Board (EOB) was established to facilitate success of the HBPP Nuclear Decommissioning Project by:

- Removing barriers for the project team
- Assuring appropriate resources are provided for project success
- Clarifying or prioritizing objectives
- Assuring issues are resolved expeditiously to support project schedules
- Providing leadership for the project team, holding the project team accountable for and empowering them to work effectively as a team
- Providing a clear path for escalation of issues that are not being resolved at the project level
- Performing a periodic review of project scope, schedule and budget

Executive oversight is accomplished through regular interface between senior PG&E personnel with applicable project experience, and HBPP project leadership. This interface occurs primarily in approximately quarterly meetings attendeed by HBPP Site Leadership, PG&E Contracting, HBPP Contracting, and Contractor Leadership (collectively, the EOB Team).

The PG&E Decommissioning Manager is responsible for setting meeting dates, arranging meeting locations, providing meeting accommodations, planning ancillary activities, organizing presentations, taking meeting minutes, and providing information packages to Board members prior

to meetings. The Decommissioning Manager also communicates with the Board on issues that require attention between meetings.

The Contractor's project team presents current plans, status, significant risks, and areas of concern. The Board occassionally tours the HBPP site; observes activities in progress; requests additional information; and interviews individuals working on the project to assess project relationships, progress, and areas of risk. The EOB provides feedback and direction to the project team, as required. The EOB may also establish sub-committees to investigate and recommend actions for specific issues.

The Decommissioning Manager is responsible for documenting action items directed by the EOB and ensuring that resolution is achieved. Each action item resolution is discussed at the following meeting, unless the level of urgency requires a more rapid response, as determined by the Decommissioning Manager.

2.8.3.2 Tabletop Planning

In late 2013, as the CWC began its work planning in earnest, it elected to begin holding "Tabletop Planning" sessions with various PG&E Subject Matter Experts. The purpose of these meetings is for the Contractor to gather as much information as possible prior to Work Package (or other formal submittal) delivery for PG&E review and approval. Similarly, the meetings provide an opportunity for the CWC to provide PG&E Subject Matter Experts with the benefit of its own unique expertise, capabilities, and experience.

The benefits to CWC work planning is gained by (1) verifying that stakeholder needs are considered; (2) identifying project risks and mitigation strategies; (3) increasing the likelihood for fully responsive and Contract-compliant submittals; and (4) educating PG&E stakeholders on the proposed project, including means, methods, sequencing, and other distinct project features that may differ from HBPP experience.

2.8.3.3 Plan of the Day Meetings

All Project Execution Teams at HBPP are responsible for engaging with the PG&E management and operations teams during daily planning meetings that provide the level of coordination required to conduct Work at HBPP. Each Functional Area (i.e., management discipline) provides its input at POD meetings at its discretion, as outlined in the Functional Area Oversight Desk Guides.

The POD meeting is a plant-wide activity that occurs each workday at approximately 6:30 a.m. and lasts about 30 minutes. Task-level project representatives, including Job Supervisor(s), attend the meetings and provide details regarding the Work planned for the day, with highlights of significant or unusual interface with PG&E or other Contractors. No work may be performed at HBPP if it is not discussed at the POD meeting, unless the Deputy Site Manager has provided written approval for the unplanned work.

2.8.4 Oversight Plan

PG&E used an oversight "shake-down" strategy during the Turbine Building D&D project, leading a top-down conversion of staff from Project Supervision to Project Oversight. Essentially, the people doing the work began learning how to oversee the work, allowing the Contractor to pursue the work outcome using its own means and methods, and recognizing that in the realm of Civil Works and D&D, the Contractor directs its own work.

As the Civil Works Contract was awarded, PG&E went to work documenting lessons learned from the Turbine Building D&D. Each HBPP department participated in internal and cross-departmental discussions to identify key outcomes of the Contractor's work on day-to-day, weekly, monthly, and project basis; departmental expectations of the Contractor's performance and coordination with PG&E; and methods by which the Oversight process could be streamlined for consistent, effective oversight.

As the Contractor developed Work Packages for execution of the work, HBPP trained its Oversight staff through regular internal oversight meetings and Management Observation to streamline the oversight effort by focusing on the result rather than the means and methods the Contractor was taking to execute the work. As improvements to a work execution strategy are identified by the Contractor, PG&E reviews potential changes for cost and schedule impact as well as technical and risk management impacts, but recognizes that the Contractor is in a much better position to manage these costs.

In early 2014, upon recognizing that schedule performance metrics flagged potential schedule delivery issues, PG&E initiated a "Start-Work Initiative," developing an approach to technical and contract review of Contractor deliverables. Without sacrificing safety, quality, or work performance, HBPP streamlined the review process, set up regular planning meetings between PG&E and the Contractor to plan work packages, and created an HBPP-wide initiative to get the Contractor to work. This initiative was exceptionally successful, with the Contractor noting that several bottlenecks had become unplugged, the mood at the site was more conducive to accomplishing the work, and work was starting up on several work faces that appeared to have been delayed prior to the initiative.

2.8.5 Over Target Baseline

After two and a half years of executing work, the Humboldt Bay CWP is approximately 50 percent complete and is performing within five percent of planned value, excluding contingency. Major radiological source term removal work is complete, including Caisson Drywell Piping Removal, RPV Segmentation, and Liquid Radwaste Facility demolition. The site has met OAD criteria and the CWC has demolished a portion of the RFB.

PG&E has now passed the learning curve on the project, with three years left in remaining work execution. There is a much higher level of confidence in performing the remainder of the work, which is managed by a robust EVMS to contain cost, schedule, change, and risk. The EVMS has enabled the project to make key cost and schedule savings decisions to ensure adherence to the OTB. Examples of these savings include:

- Change of a key subcontractor that reduced project overhead costs
- Transition from subcontractor to direct craft labor
- Realignment of Engineering, Procurement, and Construction (EPC) scope
- Realignment of PMO Staff Plan to align with major schedule milestones
- Consolidation of work groups
- Purchase of major equipment rather than long-term rental, which can be more costly over the life of a long project

In addition, Change Management and Risk/Opportunity meetings occur on a periodic basis between the CWC and its subcontractors to identify potential changes to the planned approach, proactively considering impacts prior to definitizing the plans for work execution. This allows PG&E (and the CWC) to take action before these anticipated conditions occur. Since implementation of EVMS, the project has seen a major improvement in managerial control, resulting in significant cost avoidance and schedule savings. OTB is discussed in greater detail in Sections 3.1.2.1 and 3.1.2.4.

2.9 DECISION LOG

NDCTP decision D.14-02-024 specifies that PG&E maintain an ongoing Decision Log to track the company's decision-making activities relative to nuclear decommissioning activities. Items requiring documentation in that log include decisions having the potential to affect any Cost Category by more than 10 percent, positively or negatively.

To best manage this task, PG&E engaged a "Prudency Reviewer" who is familiar with the decommissioning effort, but not engaged in day-to-day operations at HBPP. The Prudency Reviewer conducts monthly review of the work conducted at HBPP the prior month, attends planning meetings and Readiness Review Boards (as appropriate), and regularly interfaces with Site Management and the CWC to identify ongoing Decommissioning activities anticipated to have potential impacts on cost, scope, or schedule, each of which has to potential to affect overall cost.

The output of this effort is the Decision Log required by the Commission. In tabular format, the log shows major decisions identified by PG&E and the potentially affected Cost Category. As impacts of each decision are realized, those impacts are documented in individual Issue Logs that describe the issue in some detail, outline the key aspects of the decision-making process, discuss potential project impacts at the time the decision was made, and assess the actual impacts to the project through direct cost, schedule, and scope impacts.

Cost impacts from decisions relating to Self-Perform work—much of which was undertaken before the Decision Log was required—are documented in Section E Reasonableness Review. For decisions on the Civil Works aspects of the Decommissioning effort, most impacts can only be qualitatively ascertained at this time, simply because much of the Civil Works efforts have yet to be completed.

Table 2.9.1 identifies key decisions made by PG&E since D.14-02-024.

TABLE 2.9.1—PG&E KEY DECISIONS AFTER D.14-02-024

Decision Log	**Through-Date:** December 31, 2015
Issues Tracked for Decision Log	**CPUC Category**
Late NDCTP Decision	Common Site Support Caisson And Canals
SFP Liner	Project:Nuclear Facilities Demolition and Excavation
Civil Works Optimization	
RPV Segmentation - Execution (2nd Shift)	Project:Reactor Vessel Removal
Drywell Insulation Removal	Project:Nuclear Facilities Demolition and Excavation
Drywell Piping System Removal	Project:Nuclear Facilities Demolition and Excavation
Caisson Bottom Hinge Hatch Removal	Project:Nuclear Facilities Demolition and Excavation
RPV Lead and Asbestos Abatement	Project:Nuclear Facilities Demolition and Excavation
Drywell Liner Rescoping	Project:Nuclear Facilities Demolition and Excavation
Activated Concrete Removal Rescoping	Project:Nuclear Facilities Demolition and Excavation
Chimney	Project:Nuclear Facilities Demolition and Excavation
RPV Segmentation - Tools	Project:Reactor Vessel Removal
Liquid RadWaste Phase II	Project:Nuclear Facilities Demolition and Excavation
Energy*Solutions* Intermodals	Waste Disposal (Excludes Caisson/Canal)
Offgas Tunnels	Project:Nuclear Facilities Demolition and Excavation
FIXS / NPDES / USEI	Remainder of Plant Systems
Slurry Wall and CSM Wall Modifications	Caisson Removal
Separation of Intake and Discharge Canal Work	Canal Remediation
Termination of Key Subcontractor (Parsons)	Canal Remediation
Use of Discharge Canal for Soil Storage	Canal Remediation
RFB Demolition by Year-End (2015)	Project:Nuclear Facilities Demolition and Excavation
Engineering, Procurement, and Construction Realignment	Site Infrastructure
Spent Fuel Storage Extension and ISFSI Relicensing	Spent Fuel Management
Transition to Standalone ISFSI	Spent Fuel Management

3 COST ESTIMATE

Initial site-specific cost estimates were prepared for PG&E prior to commencing decommissioning. The estimates were based on the unique features of the facility and previous studies and accounted for lessons learned at other facilities that had undergone similar decommissionings. As decommissioning proceeded from 2009-2012, PG&E identified efficiencies and discovered issues that affected work processes, and therefore costs. In addition, changes to implementation methodologies were researched, planned, and reviewed by management. With system dismantling work underway, the 2012 NDCTP cost estimate reflected forecasts which were newly developed from engineering studies and/or actual contractor bids. The cost estimate also incorporated numerous additional site-specific and special tasks identified as a result of the ongoing decommissioning planning. The 2012 NDCTP Phase 1 decision approved the changes in scope and the majority of the estimated costs to complete decommissioning of HBPP Unit 3.

The basis of the 2017 NDCTP estimate and the sources of information, methodology, site-specific considerations, assumptions and total costs are described in this section. Unless otherwise noted, all 2012 NDCTP cost estimates referenced in this document have been escalated and presented in $2014. Similarly, all estimates to complete are presented in $2014 for consistency and ease of comparison.

Table 1.1 and the detailed cost tables presented in this document include PG&E's 2012 NDCTP filing estimates, as well as the stipulated reduction of $47.2M ($2012) imposed by the Commission. Unless otherwise noted, all comparisons between 2012 NDCTP estimates and 2017 NDCTP estimates reflect PG&E's original 2012 estimates and current 2017 estimates, without consideration of the imposed reduction.

Primarily, this estimate incorporates an Over Target Baseline (OTB) that was developed after more than two years of executing civil works. PG&E currently estimates that the cost to complete remaining decommissioning work at HBPP Unit 3 is $531.3M, including contingency. The total estimated cost to decommission Humboldt Unit 3 is $1,054.8M. This represents an increase from the forecast approved in the 2012 NDCTP of $977.9M for decommissioning HBPP Unit 3.

PG&E has fully transitioned to civil works from self-perform and the CWC has been on site for over two years, positioning the project well past the learning curve. Using the experience gained, a high-level OTB for cost was executed to further refine processes, schedules, and expectations.

The principal reasons for the increase in costs from the 2012 NDCTP are:

- ISFSI Relicensing Study - The current HBPP ISFSI license for Special Nuclear Material (SNM) expires in 2025. Since as many as ten years can be required to perform all activities required to obtain a license extension, HBPP is initiating this work. The scope of work is estimated at $6.4M. $3.2M is included in the ISFSI Infrastructure Section 3.3.1.8.4.1 of this filing, and another $3.2M is captured under Security Staffing Section 3.3.1.8.1.
- Costs for FSR have increased significantly ($20.6M) since the 2012 NDCTP due to changes resulting from agreements reached with the permitting agencies regarding FSR. The areas impacted include: storm water runoff-collection and treatment, increased wetland area, replacement and new additions to site fencing and more extensive Intake Canal modifications to support aquatic vegetation. Details for FSR are in Section 3.3.1.5.3.3.
- Early shift to a stand-alone ISFSI ($15M, excluding contingency), making it an independent ISFSI organization, separate from the remaining decommissioning activities, reporting to Diablo Canyon ISFSI management organization. This independent organization is responsible for its own training, engineering, and radiological emergency response activities.
- Costs for spent fuel management have increased because PG&E assumes that Four additional years will be required to store high-level radioactive waste (spent nuclear fuel) on site until a federal repository or suitable facility is established by the DOE. This change in scope increases decommissioning cost estimates by roughly $25.9M excluding contingency. These costs are comprised primarily of staffing, O&M, Engineering, Infrastructure improvements and NRC fees. The details of the cost for spent fuel management are in Section 3.3.1.8
- A new, $14.7M (Including contingency) scope of work to fully restore the site upon complete removal of spent fuel from the site.

3.1 2017 NUCLEAR DECOMMISSIONING COST TRIENNIAL PROCEEDINGS

This NDCTP covers the period from 2015 through 2030. At a high level, the work necessary to decommission HBPP and restore the site can be divided into two sections. The first includes the current owner of the facility, PG&E. PG&E holds all the pertinent licenses and permits to operate and decommission the facility. They also hold the legal and financial obligation to safely complete the decommissioning and restoration within the requirements of the regulations and permits, within a reasonable schedule, and at a reasonable cost. The second section is the Civil Works scope of work. This scope is held by contracted entities for specific field work that will result in a site that has been restored to requirements defined in the contracts.

3.1.1 PG&E Work Scope

The remaining work that PG&E has undertaken to complete the decommissioning consists of oversight of the CWC's activities, cost control and accounting, disposal of wastes, and management of spent nuclear fuel and GTCC waste.

The management of spent nuclear fuel and GTCC waste includes operation and maintenance of the ISFSI, protection of the spent nuclear fuel and the facility, environmental and radiological surveillance at and around the facility, and continued compliance with regulatory and permit requirements. The details of this scope of work are discussed in detail in Section 3.3.1.8.

Disposal of wastes includes the labor, equipment, and supervision to deliver, unload, move, manipulate, and reload intermodals on site and at marshalling yards. It also includes the costs of disposal at the selected sites and facilities. The details of this scope of work are discussed in Section 3.3.1.6 and Section 3.7.

Cost control and accounting includes tracking and validating expenses against budgets, contractual requirements, and regulatory requirements. The details of this scope of work are discussed in Section 3.3.1.1.3.2 through 3.3.1.1.3.5 and Section 4.

Oversight of CWC activities includes oversight of the day-to-day execution of field work and the contractual and work-related documentation needed to support that work. Included in the oversight of field work is radiological and safety oversight.

3.1.2 Civil Works Contractor Work Scope

The Humboldt Bay Civil Works Project is approximately 50 percent complete after two and a half years of executing work and performing within 5 percent of planned value (excluding contingency). Major work, including radiological source term, such as Caisson Drywell Piping Removal, RPV Segmentation, and demolition of the LRW Facility, is complete. The site has met OAD criteria, and a portion of the RFB has been demolished. As described in Section 2.8.5, EVMS produced schedule and cost savings.

3.1.2.1 Over Target Baseline Methodology and Development

Prior to the completion of calendar year 2014, one and a half years into execution, PG&E was implementing a number of major execution changes. An OTB should be utilized if the Project Management Team concludes that the baseline is no longer adequate to provide valid performance measurement information relative to the remaining work using the principles of earned value management. An OTB should therefore be considered where improved control of the project would result.

PG&E concluded the following major changes would require an OTB:

- Decision to utilize CSM Technology in lieu of a Slurry Wall for caisson removal
- Decision for the prime contractor to complete the remaining Intake and Discharge Canal Scope
- Addition of RPV Scope and to bring project to completion

Due to these major changes, it was concluded the remaining work scope needed to be reestimated. A series of off-site meetings were held for a three-week period to develop the new estimates. PG&E made a copy of the current forecast schedule and integrated all major scope changes. Once complete, each Control Account Manager (CAM) filled out a Quantity Development Package (QDP) for each level 4 work breakdown structure (WBS) element within the schedule. The QDPs contain a to-go schedule activity-based estimate. An activity-based estimate is the most definitive estimating technique. For such estimates, a detailed assessment of subtasks is conducted so that labor hours, material costs, equipment costs, and subcontract costs are itemized and quantified to the highest level of detail possible ("bottoms-up estimate"). Activity-based detail or unit-cost estimating techniques are Class 1 estimates and provide the most accuracy. Once the QDPs were complete, the estimates were compiled and integrated with the schedule.

The following are lessons learned and enhancements from the original baseline that were implemented during the March 2015 OTB development:

- Development of QDP: The QDP provided detailed, activity-based estimate information which aligned activity-based costs to the schedule.
- Activity-based vs. WBS Resource loading: Use of activity-based resource loading corrected the issues highlighted below:
  - Cost resources within the original baseline were loaded at the level 4 WBS, which is a level higher than the activity. Resource loading on the WBS caused an inability to measure progress against individual activities within the WBS.
  - WBS resource loading reduced time-phased cost accuracy, as it was spread linearly and spread resource dollars during times where work was not being performed.
  - Since all cost was loaded at the WBS level, PG&E could not accurately measure the earned value of all activities within the WBS.
- Labor Resource Loading: The original baseline only contained a cost resource element and did not utilize labor resources. The March 2015 OTB loaded labor resources estimated in the QDPs. Having labor resources in the schedule allows PG&E to analyze, evaluate, and measure projected project staffing.

Implementation of the above lessons learned provided an increased confidence level in the March 2015 OTB.

September 2015 OTB Methodology and Development

After 6 months, there was a project-wide decision to refine the March 2015 OTB and implement all known changes into the baseline. A copy of the latest forecast schedule was created and update with all outstanding known changes. CAMs were provided the latest QDPs and worked with project controls to implement updates.

The following were major changes and schedule updates made to the QDP:

- Rescheduled all work plan preparation to complete on or before March 31, 2016
- Updated schedule durations to reflect current production rates
- Accounted for CSM Labor and Equipment support impacts
- Accounted for Discharge Canal Support to CSM impacts
- Accounted for PMO saving impact
- Accounted for Project Controls Staff saving impacts
- Accounted for Coastal Trail/Coffer Dam execution schedule and cost impacts
- Accounted for EPC cost saving and scope reallocation
- Accounted for transition from Direct Hire to Subcontract Engineering cost impacts
- Accounted for transition from Subcontract to Direct Hire saving impacts

The resulting refinement of the previous estimate and schedule has further provided an increased confidence in PG&E's ability to achieve goals set in the September 2015 OTB.

3.1.2.2 Project Management Strategy

In order to achieve successful decommissioning of HBPP, PG&E elected to utilize an EVMS for the civil works scope of work. This system provides the project team with a structured planning process leading to data and information required within the project cycle to make quantitative decisions regarding cost and schedule. EVMS is composed of two key concepts: 1) measurable work progress; and 2) a focus on planning to establish the performance measurement baseline against which performance will be tracked and evaluated. This has been accomplished at HBPP through establishing a solid baseline founded on a valid schedule, clear-cut cost and budget estimates, and objective ways to measure the progress of work.

EVMS played a key role in the development of the previous two OTBs. The system first provided accurate historical cost and schedule status, delineated into the major pieces of scope as documented in the project WBS. By having accurate cumulative status and project scope organized into an intelligent structure, the team was able to systematically estimate the remaining work. This work was then documented in multiple QDPs. QDPs consist of all project resources grouped by WBS and include such information as hours,

labor, materials, and equipment. Once approved, the data in the QDPs were compiled and uploaded in the schedule and provided an accurate OTB to begin measuring progress. With the QDPs developed and the accurate historical information available, the process was easily duplicated for the second OTB, only requiring the project team to revise the existing QDPs. These adjustments were a combination of negative and positive impacts that were documented in the updated QDPs.

3.1.2.3 EPC Reconciliation

Shortly after the March 2015 OTB submittal, PG&E and the CWC met through a series of focused meetings concerning Contract Line Item Number (CLIN) 3.8 EPC. The recently submitted OTB showed a substantial increase in the estimated cost, highlighting a disconnect between PG&E's and the CWC's scope definition of the CLIN 3.8 EPC as outlined in the EPC contract. The first meeting outlined the processes in which CLIN 3.8 would be reconciled. The scope of the CLIN was delineated by major segments such as the SWPPP, Site Maintenance Team (SMT), Safety Program, Warehouse Operations, Small Value Contractors, and similar segments. The team would pick a segment and reconcile its scope definition. Based on the segments' definitions of scope, PG&E and the CWC would perform independent estimates. The following meeting would discuss the basis and value of each independent estimate. A final value would then be agreed upon by the team and would then be implemented into the project Estimate at Completion by the CWC. This process was duplicated until all CLIN 3.8 EPC scoping segments were reconciled. The new estimate takes in account the evolving site conditions and has complete project team understanding and buy in.

3.1.2.4 Over Target Baseline Process

As shown in Table 3.1.1, the baseline is composed of all reference plans in which cost, schedule, and scope are documented. Performance can therefore be measured and deviations documented. The baseline provides the appropriate level of managerial control over the project scope execution. HBPP utilizes the Primavera Scheduling tool to integrate the project estimate into time-phased activities to measure progress.

TABLE 3.1.1—CIVIL WORKS COST ESTIMATES OVER TIME, BASE SCOPE

Civil Works Cost Estimates Over Time - Base Scope	NDCTP $2011 Table 4-1 Composite Bids	NDCTP $Nominal Table 4-1 Composite Bids	Baseline Sept 2014 PMO Reallocation	CB&I Forecast March 2015 Over Target Baseline	CB&I Forecast Sept 2015 OTB Over Target Baseline
Other Civil Works	**74,579,000**	**80,835,521**	**64,605,944**	**82,145,883**	**81,981,449**
Facilities Demo / Excavation	62,079,000		51,188,123	68,728,062	68,754,666
Office Facility Demob	1,500,000		1,910,377	1,910,377	1,719,339
Final Site Restoration	11,000,000		11,507,444	11,507,444	11,507,444
Caisson Removal	**78,000,000**	**85,547,507**	**57,711,680**	**71,186,220**	**75,370,498**
Caisson	41,450,000		29,439,969	44,804,141	47,531,227
Pre-Trench/Slurry Wall Installation	17,800,000		25,140,281	23,623,787	25,493,583
Dew atering			3,131,430	2,758,292	2,345,687
Administration	18,750,000				
Intake / Discharge Canal	**21,000,000**	**27,102,568**	**30,117,257**	**34,899,715**	**36,677,295**
Units 1 & OWS			**2,150,046**	**2,895,935**	**2,367,156**
	173,579,000	**193,485,596**	**154,584,927**	**191,127,753**	**196,396,397**
EPC Operations			6,955,581	19,141,992	9,426,025
Non-Nuclear Contract Scope			(2,150,046)	(2,895,935)	(2,367,156)
	173,579,000	193,485,596	159,390,462	207,373,810	203,455,266

3.1.3 Civil Works Other Direct Services

During the performance of Civil Works activities, there are several general support services that are provided by PG&E to ensure that the CWC is able to effectively and efficiently perform their assigned tasks. Those services include leasing and moving of trailers as needed and general scaffolding support. Table 3.1.2 captures the cost of the other direct services provided.

Table 3.1.2 OTHER DIRECT SERVICES COSTS

Other Direct Services	2015 1,022,717	2016 781,951	2017 150,989	2018 822,818	2019 142,079	Total 2,920,554
Waste Handling, Letter of Credit, Misc Support	1,022,717					1,022,717
Lease of HBPP Trailer		23,913				23,913
Other Services Trailer Brkdwn / Trans Prep		57,391				57,391
PG&E Trailer Demob				676,289		676,289
Scaffolding Support		9,565				9,565
RFB Roof Asbestos Abatement		439,997				439,997
Qualified Stormwater Practitioner		251,085	150,989	146,529	142,079	690,682

3.2 REMAINING DECOMMISSIONING COST DRIVERS

The major increased cost drivers for completing decommissioning of HBPP Unit 3 have been identified and analyzed, and implementation strategies developed. They include increased costs associated primarily with ISFSI and Final Site Restoration.

The HBPP Unit 3 nuclear decommissioning project has unique challenges due to its specific design features: highly congested facilities, significantly contaminated underground systems and utilities, limited site access, a high water table and frequent adverse weather conditions. Further, multiple discrete work activities occurring simultaneously throughout the course of the decommissioning, requiring close coordination, communication and interface among the parties. Known challenges that significantly increase the cost to perform work at HBPP Unit 3 include the items discussed in the subsections immediately below. The costs associated with the remaining known challenges are incorporated in to-go forecast costs provided in Section 3.3, and selected highlights of remaining known challenges, including those noted in this paragraph, are provided in the following subsections.

3.2.1 Proximity to the Surrounding Community

Unlike most nuclear power plants in the United States, which are typically situated away from population centers, HBPP is embedded in the King Salmon residential community and across State Highway 101 from an elementary school. PG&E is sensitive to the quality of life for King Salmon residents, and minimizes abnormal workday activities to restrict intrusion from noise and lights to the extent practical. PG&E has always attempted to accommodate requests from the community to redirect portable lighting away from local residents and to curtail noisy activities near the property boundary. This results in extra efforts by planners, engineers, construction personnel, and managers to maintain a low profile and sustain good community relations.

The driveway to Charlie Gate, one of two primary plant entries, and employee Charlie Parking Lot are located on a residential street with several homes and a small restaurant. This plant entry will be subjected to a significant increase in truck traffic due to intermittent closures of the other plant entry road and cross-plant access roads. It is imperative that PG&E maintain good community relations by minimizing neighborhood impact while conducting material delivery and waste shipments.

3.2.2 Proximity to Humboldt Bay Generating Station

Humboldt Bay Generating Station (HBGS), an active power plant owned and operated by PG&E, is responsible for and committed to providing reliable power to the surrounding community and to the city of Eureka. A portion of the HBPP intake canal headwall structure, which is slated for demolition and removal, is situated within the HBGS fence line, adjacent to the power plant's switchyard. The switchyard equipment is sensitive to vibration, which poses a significant challenge to the CWC. Industry standard demolition practice would be installation of a sheet pile cofferdam to isolate the tidally influenced canal from the headwall structure. However, this methodology could trip the

switchyard equipment supporting HBGS, resulting in potential power outages and associated disruptions to the surrounding community.

The hilltop at the north end of the HBPP footprint is the highest local geographical elevation west of State Highway 101 and has been designated a safe assembly location for a tsunami event. Workers at both HBGS and HBPP are trained and drilled to evacuate to the top of the hill for a major earthquake or tsunami warning. The route for HBGS workers to the hilltop is through the HBPP site, and an egress path must be maintained on site to ensure safe passage. Maintaining safe egress requires careful planning and separation of work zones along the fence line between HBGS and HBPP and necessitates non-contiguous excavations, which can lead to rework of excavations, remediation surveys, and backfilling along overlapping, adjacent work face edges.

3.2.3 Coastal Access Trail

PG&E is required by its CDP to maintain public access to the coastal trail that for the full length of the HBPP site running alongside Humboldt Bay, inside the riprap seawall. Remediation of the discharge canal entails removal of the four discharge pipes under the seawall. PG&E's installation of a sheet pile cofferdam in the bay to allow dewatering of the discharge canal interrupted public access to the coastal trail. The trail is temporarily reopened to the public, but work on each side of the trail requires careful planning and coordination with the Coastal Commission and the community. Permit request approvals from local regulatory agencies are not always provided in time to support planned work schedules. Four discharge pipes under the seawall remain to be removed.

On September 15, 2005, the CCC approved CDP No. E-05-001 for the development and operation of an ISFSI located at HBPP and within the coastal zone. Special Condition 5 of the CDP requires PG&E to formally establish a public access way through the use of a deed restriction that preserves public access to the shoreline. The ISFSI is located about 150 feet from the Humboldt Bay shoreline and near this existing public trail.

Special Condition 5 of the CDP includes an access plan for the Coastal Access Trail. This access plan includes several basic improvements to the existing public use trail to allow for safe pedestrian use. The plan requires PG&E to maintain a minimum 20-foot-wide access way, as measured landward from the mean high water mark and extending from the shoreline, from the western end of the PG&E property near King Salmon to the rail line on the northern end of HBPP.

The trail improvements include a generally level, meandering gravel path varying between 3 and 6 feet in width immediately landward of the reinforced slope protection at

the water's edge. This extends the entire length of the PG&E shoreline, a total of approximately 2,700 lineal feet. Signage is maintained at both ends of the access trail describing the access available, and the conditions related to the adjacent ISFSI that may affect access. The signage includes a description of the trail and a tsunami area warning.

Additional special condition requirements include five-year surveys by a licensed Civil Engineer of the bluff, shoreline, and toe of the bluff to monitor potential horizontal or vertical movement of the slope that may affect coastal access. If substantial movement is noted by the report, the Coastal Development Department may require annual surveying and reporting.

Measures must be taken to maintain the Coastal Access Trail in a safe and usable condition to ensure safe pedestrian use. Several recent storms have caused significant damage to the Coastal Access Trail, requiring substantial modifications and improvements. These storms have affected the entire trail along the HBPP shoreline, with the most significant damage from King Salmon to the Discharge Canal. This section will require major civil work to repair and reestablish a generally level, six foot wide walking path. The section to the north of the Discharge Canal was also damaged by recent strong storms.

To continue to meet the requirements in Special Condition 5 of the CDP, PG&E's Civil Engineering Representative performed a walkdown in December 2015. The walkdown resulted in recommended Coastal Access Trail repairs for safe pedestrian access. These recommendations include:

- Remove the cyclone fence near King Salmon at the South end of HBPP
- Install 12-inch import fill along the existing riprap to fill gaps in large existing barrier (1,300 lineal feet)
- Utilize existing materials along the trail to fill smaller gaps
- Import fill 3-inch minus and build the trail level
- Import fill ¾-inch minus Class 2 aggregate base and reestablish the 6-foot walking trail with a generally level walking surface
- Compact and smooth the trail, utilizing a smooth drum roller
- Replace the fence and install a larger gate for future equipment maintenance on the trail

When the required repairs are completed, minor work will be required to maintain safe access. This will include an inspection after each storm event and some minor grading as necessary depending on storm severity.

3.2.4 Site Coordination and Congestion

The site footprint is extremely small and constrained and coordination among all parties performing work on site is critical. Very little space is available on site for laydown areas, soil stockpiling, demolition debris, and equipment operation, including demolition machines and truck traffic. Significant delays or inefficiencies may be unavoidable due to interference and coordination with other site activities. The constricted space can limit the pace of demolition and excavation.

The CWC developed and sequenced the OTB in a manner that minimizes or eliminates significant delays or major inefficiencies due to coordination with other site activities or constricted space. Traffic flow models for on-site equipment movement, truck traffic, and waste transport off site have been completed and incorporated. Models are updated to match current forecasted schedules as circumstances change.

3.2.5 Soil Management

All soil excavated as part of the HBPP decommissioning must be managed in compliance with various environmental requirements. Due to historical chemical use and past releases of environmental contaminants, such as petroleum hydrocarbons, PCBs, metals, and polycyclic aromatic hydrocarbons, the DTSC established specific soil management requirements for the HBPP decommissioning in the IMRAW approved in 2009.

The IMRAW requires all excavated soil to be sampled and analyzed for chemicals of potential concern and results of the analyses to be compared to soil reuse screening levels that have been established for determining whether excavated soil can be reused as backfill at HBPP. This determination requires additional planning, either to conduct pre-excavation characterization of soil samples collected through soil borings, or to collect soil samples from the excavation or stockpiles. Specific requirements have also been established for sampling frequency based on the volume of soil generated by individual excavations.

Soil samples must be screened for radiological contamination before any samples are shipped off site, and if site-related radioactivity is detected, arrangements must be made to ship the samples to specially licensed laboratories that handle licensed radioactive materials. Laboratory analysis generally takes up to 14 days (unless a premium is paid for faster turnaround by the laboratory).

To prevent potential cross-contamination, soil must be managed in separate stockpiles until sample results are obtained. The limited availability of on-site space for soil stockpiling is a challenge when multiple excavations are underway, and often requires

multiple handling as soil stockpiles must be moved and combined, where possible, after sample results are reviewed in order to create additional space for the next loads of excavated soil.

Soil stockpiles must always be managed in accordance with SWPPP requirements, with use of best management practices (BMP) to minimize dust and prevent excessive sediment runoff. Stockpile BMPs include covering all stockpiles with plastic at the end of the workday, and use of weights and tie-downs to keep stockpile covers in place during high winds or storm events.

Soil stockpiles or containers must be tracked with respect to the area where they were excavated, their chemical and radiological testing results, PG&E's review of sampling results, the determination of whether the soil may be reused or must be disposed, and its ultimate disposition, including shipment to a licensed disposal facility or the location where the soil was used as backfill on site. Detailed records of all soil management activities must be compiled and maintained to document PG&E's compliance with IMRAW requirements, and quarterly reports must be prepared and submitted to DTSC summarizing soil management activities.

If the results of sampling determine that soil from an excavation must be disposed off site, additional requirements may apply. Saturated soil from excavations below the water table may need to be dried or conditioned with additives in order to prepare it for shipment. Waste shipments must be appropriately profiled for the planned disposal facility to obtain final approval for shipment. In certain instances, sampling results have indicated excavated soil is classified as hazardous waste. This status invokes additional environmental compliance requirements related to labeling, storage requirements, and inspections that must be conducted until the waste is shipped, which must occur within 90 days of generation.

When excavations are conducted in areas of known environmental contamination, DTSC requires PG&E to perform soil confirmation sampling of the floor and sidewalls of the excavation to verify that the area has been adequately remediated or to document environmental conditions that may need to be addressed later. Based on the results, additional soil excavation may be required. This requires close coordination between excavation crews and the HBPP environmental team to minimize delays in completing excavations while waiting for soil sampling results.

In some instances, previously unidentified areas of environmental contamination are encountered during excavations. When this occurs, additional sampling of both the excavated soil and excavation floor and sidewalls may be required, and potentially contaminated soil must be segregated and managed separately from other excavated

soil until sample results can be obtained and reviewed. This often requires additional activities and coordination that were not expected during the planning of the excavation.

PG&E is required to construct wetlands in several areas of the site to meet various permit requirements. DTSC will require soil used as backfill for wetlands restoration to meet chemical screening requirements that are more stringent than the IMRAW screening levels in order to protect ecological resources. Demonstrating that soil meets these screening levels will require additional documentation and potentially additional chemical testing during the final restoration activities.

In addition to meeting DTSC environmental compliance requirements, soil management records must be developed to demonstrate compliance with NRC license termination plan (LTP) requirements. HBPP must compile and maintain records of radiological screening of soil and tracking soil from its excavation to its disposition, including documentation of how all soil that is reused meets LTP requirements for the area where it is placed.

3.2.6 Traffic Control

Remediation of the Intake Canal is planned in the peak demolition period in 2016. Excavation activities and equipment will likely require extended closure of HBPP's main access road at Bravo Gate. Long-reach excavators, pile-driving equipment, heavy-haul dump trucks, and large articulated loaders employed to remove riprap, sediment, and the concrete intake structure will require a substantial footprint to maneuver and work. This effort will disrupt all other concurrent waste export and material import truck traffic for the project, forcing site ingress and egress through Charlie Gate. For further information discussing the proximity to the local community, see Section 3.2.1.

3.2.7 Asbestos, Lead, and PCBs

Industry-standard building materials available during the era of HBPP construction were vastly different from those used in present-day construction. The long-term health hazards of working with those materials were unknown or not well understood at the time of construction. Asbestos, mercury, chromate, lead, silica, and PCBs are a few of the chemicals in building materials commonly used in the late 1950s and early 1960s. Asbestos, lead, and PCB-containing compounds were popular paint additives and most of HBPP's painted surfaces contain some or all of these constituents. Federal and state regulations for abatement of hazardous or toxic materials are prescriptive as well as labor and time intensive. Each constituent waste stream is handled and managed differently. This requires additional staffing to develop, train, manage, monitor, and report on programs to ensure compliance with the regulations.

For example, abatement of asbestos-containing paint or insulation materials requires a comprehensive training program and demonstrated competency by trained workers. Large-scale abatement tasks require that the abatement work be performed in airtight, negative-ventilation enclosures with High Efficiency Particulate Air (HEPA) filter units, attached clean and dirty change rooms for doffing and donning street and protective clothing, and functional shower facilities for workers. Construction of these enclosures is a unique craft and usually is performed by specialty contractors. This site-specific training and integration with the existing site work activities adds time and cost for many of the building demolitions.

Where documented in current site drawings, the CWC has factored remediation of environmental contaminants in OTB. In anticipation of the need for remediation activities, specialty subcontractors are in place and currently working as scheduled.

3.2.8 Inadvertent Release of Radioactive Material Off Site

PG&E's RP Department is systematically preparing the site for license termination. As radiological source term materials are removed from the site, the necessity for stringent control of the remaining materials diminishes. Procedures for entry and exit of the radiologically controlled area (RCA) were relaxed in late 2015. Personnel dosimetry is no longer required, the Access Control Facility was demolished, and the boundary fence will be removed. The former Unit 3 area is designated a radioactive materials area (RMA). This is a planned and normal progression toward license termination, but the changes will bring a new set of challenges to the work force.

The transition from an RCA to a RMA could result in less positive control over the movement of radioactive material. The remaining radioactive material is of low concentration and activity and, therefore, difficult to measure with field instruments. To allow the civil works portion of decommissioning to be performed efficiently and economically, the easy and rapid movement of heavy equipment must be allowed, but PG&E must ensure that a piece of equipment that has been used in the movement of contaminated soils or in the removal of Unit 3 concrete structures does not leave the site without the proper radiological survey.

The controls to prevent a release of equipment with contaminated soil or concrete employ a multi-layered approach. The work force is trained to understand that mud, soil, and concrete or concrete dust must be removed from equipment before it is surveyed by RP. RP has transitioned to area or zone coverage by the technicians, allowing them to periodically survey the equipment during use and finally upon removal from the site. Security personnel have been trained to ensure that construction equipment does not leave the site without a release form from the RP Department.

3.2.9 Below-grade Obstructions

Underground utilities and other underground commodities have been frequently encountered during installation of a support of excavation (SOE) system or during open-cut excavation.

During underground utility removal excavation in the north yard, construction-era sheet piling and timber piles were unearthed in the path of the CSM wall. This construction material did not appear on original plant design drawings and, therefore, removal was not identified as part of the scope in the forecast schedule. Removal of these obstructions added approximately six days to the completion schedule.

Previously unidentified areas of radiological or non-radiological contamination associated with unidentified underground commodities also have been encountered during excavations. Removal in these areas may require additional measures, including unexpected soil sampling and segregation of soil stockpiles, to manage potentially contaminated soil appropriately.

Excavation activities in the OTB are forecasted based on production history, incorporating lessons learned. If an undocumented commodity is encountered during field work execution, the CWC has a process to update the forecast schedule and trend any cost impacts for incorporation into the Estimate at Completion (EAC).

3.2.10 Deep Excavations

Excavations deeper than El. +8 (about 4 feet below grade) require water control. Numerous excavations will be deeper than 4 feet, and the CWC will need to collect and pump the water into holding tanks. Due to the depth of these excavations, shoring may be required for water intrusion and trench stabilization. Excavation spoils need to be sampled for hazardous constituents before reuse or off-site disposal. Spoils must be stockpiled until sample results are received, generally a 14-day turnaround. Soil piles must be maintained and managed to prevent water runoff and potential cross-contamination. Due to the small footprint of the Site, there is limited space for stockpiling soils and soil stockpiles may accumulate faster than PG&E can package and ship the soil off site.

The CWC has a process to account for the OTB activities and resources associated with deep excavation soil stockpiling. BMPs have been budgeted in the OTB and environmental aspects will be managed through the SWPPP.

3.2.11 Weather

Eureka receives about 75 percent of its average annual rainfall during the rainy season, generally October through April, with greatest monthly totals in December and January. Eureka's average annual rainfall over the past 30 years is 49.15 inches. The area available for staging empty and filled intermodals and PG&E's ability to ship intermodals during the rainy season affect the rate at which the structures can be demolished.

The SWPPP permit is a complex document that specifies actions, restrictions, limits, and other controls to ensure site pollutants are not carried by water runoff into the surrounding wetlands, waterways, environmentally sensitive areas, and the bay. The SWPPP provides for an independent Qualified SWPPP Practitioner (QSP) with the necessary authority to impose specific actions and to monitor site activities for compliance with the SWPPP permit. The QSP has summarized the following list of actions to be implemented in advance of a predicted rain event. PG&E has environmental oversight personnel assigned to coordinate with the QSP for a proactive approach to compliance. At a minimum, every work zone job supervisor is responsible to ensure his or her work zone is prepared for a rain event by performing these actions:

- Close or cover containers and bins during the rain event and at the end of the day
- Use the lockdown bar on all trash and recycle bins at the end of day to prevent the wind from re-opening
- Sweep and collect any loose soil or debris in the work area or near drain inlets
- Clean and dispose of any trash or debris in the work area
- Store construction materials properly (i.e., on pallets and covered)
- Ensure all stockpiled material is contained and securely protected (from both wind and rain)
- Ensure all trenches and excavations are protected from runon and runoff
- Secure inside or appropriately cover any tools, equipment, or other items not designed to be in the rain
- Sweep all direct work areas and haul routes used for transporting loose materials at the end of the day
- Replace any drain inlet protection or other BMPs (e.g., fiber rolls, gravel bags) that have been moved, during rain events and at end of day
- Clean any incidental spills or drips in work areas immediately
- Ensure all perimeter controls (e.g., silt fencing, fiber rolls) around disturbed work areas are in place and functional during rain events and at end of day
- Check drip pans on equipment in work area and remove any accumulated materials

Depending on the season and the daily work activities, SWPPP compliance can be a labor- and time-intensive requirement that is disruptive to ongoing decommissioning work. PG&E must take additional measures for a four-day weekend to secure plastic sheeting and container covers for contingency of high winds. The site has a dedicated team that continually checks and maintains several of these elements, repairing and replacing materials as necessary, to assist the job supervisors with the magnitude of the tasks. As required, this team works weekends as well to ensure continued compliance during forecasted weather events. This justifiable added cost can prevent a noncompliance event that could stop work for an extended duration and erode the confidence PG&E has developed with regulatory agencies.

3.2.12 Regulatory Permit Integration

HBPP decommissioning is a high-profile, high-risk project that has high visibility with several local, regional, state, and federal regulatory agencies. PG&E is decommissioning an old, contaminated nuclear power plant located on the bay in northern California within sight of the ocean, surrounded by environmentally sensitive wetlands with protected native wildlife species, amongst ranches, farms, fishing communities, redwood forests, and a moderately large population center. In addition to the NRC, there are several environmentally driven public agencies whose approval is required to conduct decommissioning and remediation work at HBPP. The agencies include: the US Army Corps of Engineers, National Marine Fisheries Service, US Fish and Wildlife Service, California Coastal Commission, California DTSC, California Department of Fish and Wildlife, North Coast Regional Water Quality Control Board (NCRWQCB), North Coast Unified Air Quality Management District, and Humboldt County Building Department. Approval to work is by formal permit, participation agreement, and local, state, and federal law. Each major definable feature of work may have activity-specific supplements and addendums for conduct of work.

For a given work activity, the stipulations in one permit may conflict with the stipulations in another. Further, the permits are periodically revised by the issuing agencies, typically increasing the control measures or monitoring requirements. For example, the SWPPP has been revised to raise the risk level from 2 to 3 for HBPP, invoking more frequent compliance monitoring by the QSP. HBPP environmental coordinators have different areas of expertise and often must confer and concur to determine an acceptable approach to compliance with all appropriate requirements. Notifications to agencies may be required for some activities. These coordination efforts can cause delays in the field but are necessary to avoid notices of violation and financial penalties.

The evolving requirements to control and monitor the discharge of suspended solids and dissolved metals into local water sources that feed into the vast ecological water

systems and environment of the county, state, and country, is a national initiative. Adherence to and compliance with local and state permit requirements have affected HBPP work activities to an extent that would have been difficult to predict or anticipate by work planners, engineers, and construction specialists. Work plans and schedules are developed and influenced by these requirements.

3.2.13 Storm Water

The existing storm water conveyance system, consisting of a network of catch basins and drainage piping to collect runoff from the hard surfaces for discharge into the intake canal, is antiquated, and several portions are undersized. As decommissioning has progressed, portions of the system have been modified or enlarged. However, the overall system capacity is limited by a few undersized components directly upstream of the discharge locations. These undersized components hinder the efficacy of any upstream modifications.

The CWC ultimately recognized that complying with the specifications to prevent flooding at the site necessitated implementation of additional measures during demolition and excavations to manage the excess water. Straw wattles, plastic sheeting, sand bags, interim grading, temporary retention sumps and pumps, and leased water storage tanks were used to divert and retain storm water for monitoring, settlement, and eventual discharge to the bay. These measures represent an ongoing source of expense and delay. They must be constantly relocated, repaired, and maintained to accommodate ongoing demolition work, as construction equipment continually moves around the site. These necessary water management activities frequently slow the pace of demolition and commodity removal. All the measures add cost and schedule impacts that were not initially identified by the CWC.

The majority of the intensely developed industrial site is at a mean elevation of about 11 to 12 feet above mean sea level. Throughout this document, depth will be clearly presented in one of two nomenclatures:

- Feet relative to mean sea level (e.g., El.+12 references the elevation of the majority of Unit 3)
- Feet above or below ground surface (e.g., 10 feet below ground surface, which corresponds to El.+2 throughout the majority of Unit 3)

All storm water runoff needs to be treated prior to leaving the site to ensure no pollutants are discharged; methods implemented in FSR achieve this through the use of several large bio-detention basins. These basins must provide adequate catchment volume to capture 150 percent of the 85th percentile, 24-hour storm event, and this volume must be detained above the groundwater table, which varies seasonally

between about 4 to 6 feet below ground surface (El.+8 to El.+6). This constraint necessitates shallow large basins with inlet elevations no lower than El.+10 to ensure adequate volumes are achieved. This limits the available vertical elevation change to about 1 to 2 feet from the existing surface grades to the required inlet elevations at the treatment basins.

The minimal elevation change prohibits the use of subterranean pipes to convey storm water runoff. Often the upper reaches of drainage areas can be 1,000 feet from the inlet location of the treatment basin. This combination of long distances and minimal elevation change results in a network of shallow-sloped (0.25 percent) surface swales. Very shallow swales such as these are difficult to build and represent the very minimum slopes achievable by contractors. The overall carrying capacity is also very low for low-sloped features such as these, requiring very large swales to carry even the minimal 10-year design storm.

These large, precise drainage features are expensive in terms of labor and materials when compared to a more conventional conveyance system using catch basins, pipes and steeper slopes. Even after execution of the FSR upgrades, temporary and isolated flooding is predicted for more intense 25-, 50-, and 100-year design storms. Often, a solution to this design problem is simply to raise the mean elevation of the site to provide more vertical change from the upper reaches of a watershed down to the inlet of a basin. This option is infeasible, however, due to the requirement to retain several buildings with finished floor elevations at El.+11. In addition, site grades after FSR need to match adjacent grades of HBGS at about El.+12.

The compounding effects of these unique site dynamics could not have been predicted or accounted for prior to the detailed planning that accompanied the latest submission to the relevant stakeholders.

3.2.14 Groundwater

The groundwater table on the HBPP property is about 8 feet below the existing nominal grade elevation, which is aapproximately El. +12. The relationship between tidal bay water and groundwater is not well understood, but every deep excavation for underground structure and commodity removal has groundwater presence, and the groundwater has a specific, permit-controlled, sampling and treatment process, with limited, metered discharge to Humboldt Bay.

Collection and management of groundwater was anticipated with estimated volumes, but inflow sources (underground springs, fissures, and seams) and concurrent work activities overwhelmed the planning estimates and exceeded the GWTS design and operating flow and discharge capacities. Additionally, the site has a network of cooling

water intake and discharge pipes, and storm drainage and utility piping. The pipes are bedded in a sand and gravel layer that acts as a conduit for groundwater. When designated site areas are excavated for utility removal, groundwater flows into the excavations along the pipe bedding material.

There is no conclusive method to determine where the groundwater sources originate for positive isolation. The only viable method for control is to manage the water as it flows into the excavations. Numerous frac tanks (mobile, 20,000-gallon-capacity storage tanks) were leased and located on the HBPP site to collect, buffer, and sample groundwater from several concurrently working excavation zones around the RFB, prior to transfer to the GWTS.

Groundwater management and control has become a continually challenging project, frequently requiring work crews to pump their excavations and transfer water from storage tanks to the GWTS, stalling the ongoing excavation and commodity removal work. Upgrades to the GWTS have been completed to increase the throughput capacity and provide redundancy to ensure continuous operation. Training of additional personnel to operate the system was completed in October to allow 24-hour-per-day, 7-day-per-week operation as needed, based on rain events.

3.2.15 Process Water

Process water is loosely defined as any legacy operations residual process-piping water, including water propelled through pumps for dust control, fixed and mobile equipment rinse water, cutting tool coolant and lubricant water, building floor and roof drain water, and radiation shield/contamination control water (e.g., SFP water).

Process water, if radiologically clean and meeting other acceptance criteria, may be disposed in the county sewer system. The water must be collected in tanks and sampled and analyzed for chemical constituents and meet volumetric inflow restrictions set by the county. The discharge permit to the Humboldt Community Service District was renewed in 2015 for a period of five years. Water management processes and sampling and analysis requirements remain in place and are ongoing.

Large, tracked construction equipment operating in excavations within the RCA must be thoroughly cleaned before release from the RCA. This usually involves chipping dried mud from the tracks and drive components before RP is able to survey the equipment with instruments to confirm that no contamination exists. Pressure washers are occasionally used to assist the cleaning process, and water generated by this action must be captured and transferred to collection tanks for sampling. This requires constructing temporary collection basins, driving the heavy equipment into them and carefully controlling the runoff to prevent potential cross-contamination of the

unprotected surrounding ground surface. Pumps and hoses have to be routed to transfer the water to designated storage tanks. The time and labor to perform these tasks is often greater than the time and labor required to excavate the ground.

3.2.16 Radioactive Water Management

With the return of a rainy winter season, water management remains a challenge to successful completion of demolition work and increases the difficulty of completing work during November through March. PG&E retains contracts with waste processors and disposal sites to process and dispose of radioactive and hazardous water if needed. PG&E can ship contaminated water to processors in Washington or Tennessee or to disposal in Idaho, Utah, or Texas. Heels (accumulated residue) in two tanks will require processing. However, PG&E's current cost estimate assumes that off-site bulk shipment of contaminated water will not be needed in the future. Accumulated water in demolition areas from groundwater and rain runoff is sampled, verified to meet acceptance criteria and processed through the GWTS. Radioactivity in the water is generally at or near background levels for Cesium-Cs-1 (Cs-137). Process water requiring off-site treatment and disposal is not expected after 2016.

Water accumulates in excavated areas, in sumps and drain inlets, and in the RFB Caisson during demolition activities. Since the RFB was declared OAD-ready and the east side of the building has been removed or exposed, water has migrated into the caisson through the partially demolished Off Gas Tunnels, cracks through the RFB wall, and the exposed east side of the building. The pH and radioactivity levels of the accumulated water meet GWTS system criteria for processing. In addition, water from the east yard excavation is collected in portable tanks and processed through the GWTS.

Water from washing equipment or from demolition activities can be managed in totes. Water in totes is sampled, surveyed, and analyzed to determine how the water should be managed. Process water verified to be clean can be stored in portable tanks and periodically discharged through the lift station to the municipal sewer system. Radiologically or chemically contaminated process water is collected in portable tanks and sent off site for processing. As noted above, process water requiring off-site treatment and disposal is not expected after 2016. In some cases, groundwater and rain runoff may be collected in totes and transferred to portable tanks for processing through the GWTS. The use of totes has decreased and will be phased out over time as demolition activities are completed. Generally, due to the larger volumes, groundwater and rain runoff is pumped from the excavated areas to the portable tanks. The GWTS processes water via filter for particulates, carbon bed for volatile organic compounds, ion exchange media for metals removal, and pH adjustment with sodium hydroxide and

sulfuric acid. The caisson removal is planned to be completed in 2017 and the Circulating Water system along Decom Ave will be removed so that water management via totes, portable tanks, and the GWTS is not expected after April 2018.

3.2.17 pH Control of Concrete Cutting Lubrication Water

Water is used to lubricate and cool concrete-cutting tooling. This usage of domestic or potable water reclassifies it as process water. Contact with the cement in concrete causes a chemical reaction called hydration that can raise the pH of the cooling water. If the pH exceeds 12.5 when the lubricating process is complete, the water meets EPA classification as “hazardous waste” and requires special handling, control, and disposal. Hazardous waste cannot be treated without a facility treatment permit, which is not a viable option for the decommissioning project. If hazardous water is contaminated with radionuclides, it may be classified as mixed waste, which is prohibitively expensive to dispose.

To avoid generation of a hazardous or mixed waste from lubricating or cooling water, PG&E recycles process water to the extent practical. In addition, PG&E Temporary Procedure TP 2010-01 provides guidance on how to monitor water pH and blend citric acid into process water while lubricating operations are ongoing to maintain a pH less than 12.5. Although this process adds another layer of labor, water collection and management materials, and complexity to set-up for the job, the cost is justified by the cost savings and potential risk mitigation for regulatory noncompliance associated with management of hazardous or mixed wastes.

3.2.18 Dust Control

A significant challenge to the project is the requirement for dust control, especially for concrete scabbling or shaving of radiologically contaminated surfaces. For example, demolition of the LRWB required extensive decontamination of the interior concrete wall and floor surfaces. There was a zero-emission requirement for fugitive contaminated dust. The LRWB connection to the main plant exhaust system was removed, and local HEPA filtration units were used to capture dust. Water sprays were used to knock down the concrete, silica-laden dust, but effectively applying and adjusting this control process was labor intensive. This example is discussed in more detail in Section 2.2.2.6. This was a significant impediment to a sustained pace of demolition work and could not have been accurately predicted.

3.2.19 License Termination Survey

In order to release the Nuclear Regulatory HBPP license, the entire area of the PG&E property must be systematically surveyed and records generated for submittal to the

NRC. The degree of effort in the surveys varies from low in outlying areas to very high in the affected areas of Unit 3 and adjacent areas. All below-grade excavations must likewise have the below-grade surface surveyed prior to being backfilled. Any soils from excavations also must be surveyed to the same standard as the area from which they came prior to being allowed for on-site reuse. All the records of the surveys and analytical results from thousands of samples must be compiled into data packages, with reports for NRC approval.

Extensive surface and subgrade preparation was required to clear underground commodities and near-surface contamination for installation of the CSM panels. Subgrade excavations have been wide and deep, and the preference is to perform the final status survey (FSS) before backfilling, to avoid having to re-excavate, conduct the FSS, and backfill the same areas later. The FSS process has not been seamless because of challenges such as building demolition activities, debris and excavation spoils logistics, emergent issues (like groundwater management), concurrent work at non-contiguous work zones, and the disjointed sequence of work (dictated by the type and location of work) for pre-trenching, CSM installation, and building demolition. It is difficult to declare any one area FSS-clean when an adjacent area is still being worked. The intent is to avoid re-excavation after all the buildings are demolished and the caisson removed to resurvey the site.

Additionally, the NRC and the DOE Oak Ridge Associated Universities (ORAU) have to visually confirm that FSS activities and results meet all requirements established for termination of the site's license. Ample notice has to be provided to these agencies to coordinate travel to HBPP for inspections and oversight. For example, the Discharge Canal work was on hold awaiting the NRC and ORAU oversight of the north end of the canal. The FSS process and coordination with regulatory agencies has become a monumental effort and compliance with all requirements frequently disrupts the pace of work and often causes rework of specific areas and work zones.

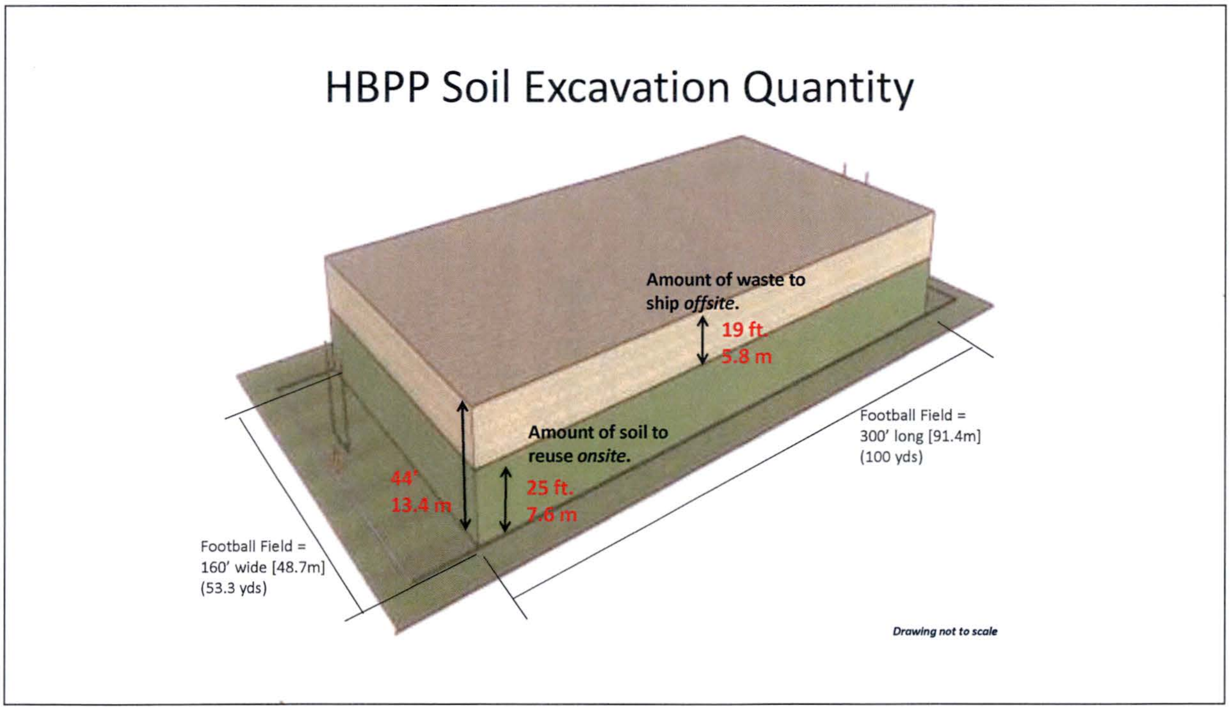
Once all surveys and site restoration are essentially complete, PG&E must generate a summary report on the overall FSS results, comparing the data not only to the guidelines established in the HBPP LTP, but also to the generic guidelines in the EPA memorandum of understanding with the NRC. Along with this report will be a request for termination of the license issued by the NRC pursuant to Title 10 of the Code of Federal Regulations 10 CFR Part 50 license for the HBPP Unit 3, using the data in the report to substantiate that the site is within the license termination criteria established by the NRC.

3.2.20 License Amendment Requests

Throughout the decommissioning process, various changes as a result of decommissioning activities require many changes to the licensing basis documents. Many of the changes are under the control of PG&E and are modified internally to maintain configuration control. However, some changes require prior NRC approval in order to be implemented. Such changes most often occur with changes to the emergency plans, quality assurance plan, or the license or technical specifications themselves. More complicated amendment requests can result in significant time and consultation, including face-to-face meetings with the NRC to respond to requests for additional information. Adequate time must be built into schedules where the lack of the amendment request approval may affect schedules of planned work. For example, PG&E needed approval of a change request to eliminate HBPP Unit 3 radiological events from the emergency plan to facilitate RFB demolition to support CSM wall installation and caisson removal.

Significant effort has been expended in working toward an approval of the LTP. Without the approval of the LTP, FSS work is conducted at risk.

FIGURE 3.2.1—ESTIMATED VOLUME OF EXCAVATED SOIL FOR DECOMMISSIONING



3.3 COST CATEGORIES

PG&E estimates and then tracks costs against various categories. Cost categories included:

- General Staffing (that excludes caisson and common site support) includes the overhead staffing costs for the project, License Termination Survey and the contingency associated with each
- Programs includes the costs associated with implementing and maintaining the Corrective Actions, Enterprise Risk, Work Control, and Procedure Manual Programs. Costs for this category are covered in General Staffing
- Remainder of Plant Systems/PG&E Civil Works Support includes the direct labor costs (both craft and RP), Liquid Radwaste System, tools and equipment to support all, and the associated contingency
- Site Infrastructure includes maintenance, support, and modifications to those systems, structures, and components (such as trailers and communications equipment) necessary for the daily functioning at the site
- Specific Project Costs (that excludes caisson, canals, and common site support) includes the total costs associated with the RPV removal, Turbine Building demolition, and a general Civil Works contract (primarily for site restoration)
- Waste Disposal (that excludes caisson, canals, and common site support) includes the labor for packaging, handling, and shipping waste; the cost of disposal at third-party disposal site; construction, maintenance, and work in the Waste Handling Building (performed by a contractor), and a factor for contingency associated with each
- Small Value Contracts include the cost for retaining small-dollar vendors, specialty contracts and the associated contingency for each
- Spent Fuel Management includes the cost of ISFSI staffing, operations and maintenance, ISFSI Engineering and Specialty Contracts, ISFSI infrastructure expenses, NRC fees, DOE transfer costs that will be incurred when the spent nuclear fuel and GTCC wastes are taken by the DOE, ISFSI removal after DOE transfer, and the contingency associated with each
- Contingency is a summation of the contingency lines in each of the other cost categories
- Caisson includes the costs of field work (CWC), packaging and material handling, project staffing, waste disposal, license termination survey (for the excavation, does not include the site at large), tools and supplies and a factor for contingency
- Canal Remediation includes the cost of removal (as a part of the Civil Works contract), waste disposal, and a factor for contingency
- Common Site Support for caisson and canal removal includes relocation of trailers, construction, operation and maintenance of the GWTS
- EPC Services (see Section 3.4)

For this 2017 NDCTP, PG&E estimates cost to complete as shown in Table 3.3.1.

TABLE 3.3.1—2017 NDCTP COST CATEGORIES AND FISCAL ALLOCATION

Cost Category	Percentage (%)	Amount ($M)
General Staffing (Excludes Caisson)	14.8	118.2
Remainder of Plant Systems	6.2	49.3
Site Infrastructure	0.6	4.9
Specific Project Costs (Excludes Disposal/Caisson/ Canal)	17.6	141.0
Waste Disposal (Excludes Caisson/Canals)	10.9	86.8
Small Value Contracts	4.7	37.7
Spent Fuel Management	18.9	151.4
Caisson (including Disposal and Contingency)	17.7	141.9
Canal Remediation (including Disposal and Contingency)	6.6	52.6
Common Site Support—Caisson and Canals	0.7	5.7
EPC Services (including Quality Training)	1.3	10.5
TOTAL	**100**	800.0

3.3.1 Costs Excluding Caisson and Canals

The cost categories are aligned in two distinct groups—Base work and work associated with caisson, canals, and common site support. The base work costs are articulated in the balance of this section and include:

- General Staffing (Section 3.3.1.1)
- Programs (Section 3.3.1.2)
- Remainder of Plant Systems/PG&E Civil Works Support (Section 3.3.1.3)
- Site Infrastructure (Section 3.3.1.4)
- Specific Project Costs (Section 3.3.1.5)
- Waste Disposal (Section 3.3.1.6)
- Small Value Contract (Section 3.3.1.7)
- Spent Fuel Management (Section 3.3.1.8)
- Contingency (Section 3.3.1.9)
- EPC Services (Section 3.3.2.1.15)

As discussed, during the 2012 filing, a $47.2M reduction was applied to the base work. PG&E has been tracking the costs associated with the base work against values of both the original filing in 2009 and the reduced values from 2012.

The $47.2M reduction was not applied to caisson removal, canal remediation, and common site support.

3.3.1.1 General Staffing

The cost of staffing (labor) is a significant portion of the remaining overall costs of the HBPP Unit 3 decommissioning project. Both the cost of direct labor to perform the work and the cost of overhead labor to support the direct labor force contribute to the total labor costs. Through proactive planning, PG&E has done an excellent job of managing the total work force and is projecting that the total head count will remain less than originally projected throughout most of the balance of the decommissioning. Staffing comparisons are depicted in Figure 2.2.1.

The budget analysis for General Staffing is provided in Table 3.3.2.

To ensure that the decommissioning is completed safely and in a cost-effective and efficient manner, selecting the right people for the tasks at hand and ensuring that they are aligned with management expectation is crucial for success. PG&E's entire team recognizes the importance of effective communications, both horizontally and vertically, in an organization to ensure that expectations are well understood. This is especially true in a highly variable environment, such as during a plant decommissioning.

PG&E has established corporate Vision, Goals, and Strategies to be the leading utility in the United States, and HBPP has developed compatible site-level objectives to support them. Further, the HBPP Decommissioning Organization has developed Execution Goals and Planning Principles that are aligned with the HBPP Vision, Goals, and Strategies

PG&E's Goals are Public and Employee Safety, Delighted Customers, Engaged Employees, Rewarded Shareholders, and Environmental Leadership. The Strategies to achieve these Goals include employees maintaining a Customer Focus and striving for Operational Excellence.

The HBPP Site Vision is to "complete the decommissioning of HBPP in a manner that establishes a new benchmark for the nuclear industry". This Vision is aligned with the corporate vision of maintaining a leading position in the decommissioning realm for HBPP, supporting the corporate position of being a leading utility.

PG&E views the HBPP Decommissioning Project as a long-term opportunity to develop a cohesive team that will accomplish many things. As one of the county's prominent employers, maintaining the company's standing in the local community is critical. In developing a close Partnering relationship that accomplishes HBPP's Decommissioning goals, PG&E and the Contractor teams represent both parties' business interests,

relationships, and most importantly, reputations. As the HBPP decommissioning progresses, PG&E, the CWC, and all other Contractors and Subcontractors will develop and share mutual values that address the corporate Vision, Goals, and Strategies.

To align with the PG&E corporate Vision, Goals, and Strategies, HBPP developed and implemented the following goals and objectives:

- Safety—We will make Safety the core of our culture at Humboldt Bay.
- Decommissioning Excellence—We will be the benchmark for decommissioning projects. We will complete the Humboldt Bay Decommissioning safely and efficiently, while minimizing effects on the public and the environment, and controlling worker hazard exposure.

TABLE 3.3.2—GENERAL STAFFING (EXCLUDES CAISSON) BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014	ETC 2015 To 2020	Total EAC 2012 To 2020 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
General Staffing (Excludes Caisson)	**107,761,959**	**113,552,612**	**102,442,205**	**73,759,966**	**44,453,015**	**118,212,981**	**(4,660,369)**	**(15,770,776)**
Overall Project	87,001,807	93,019,124	83,917,789	66,432,824	32,021,433	98,454,257	(5,435,133)	(14,536,469)
License Termination Survey (Excl	13,165,630	12,606,885	11,373,381	7,327,142	7,769,468	15,096,610	(2,489,724)	(3,723,229)
EPC Services	(962,235)	(1,175,125)	(1,060,146)			-	(1,175,125)	(1,060,146)
ISFSI Engineering / Specialty Con	(2,168,117)	(2,721,767)	(2,455,459)				(2,721,767)	(2,455,459)
Contingency	10,724,875	11,823,495	10,666,641		4,662,114	4,662,114	7,161,381	6,004,526
Caisson	**31,584,971**	**33,878,491**	**33,878,491**	**-**	**21,832,534**	**21,832,534**	**12,045,957**	**12,045,957**
Project Staffing	22,126,103	24,644,002	24,644,002		15,303,886	15,303,886	9,340,116	9,340,116
License Termination Survey	6,167,964	5,807,439	5,807,439		3,354,407	3,354,407	2,453,033	2,453,033
EPC Services	(1,102,622)	(1,177,936)	(1,177,936)				(1,177,936)	(1,177,936)
ISFSI Engineering / Specialty Con	(931,772)	(993,727)	(993,727)				(993,727)	(993,727)
Caisson Contingency	5,325,299	5,598,712	5,598,712		3,174,242	3,174,242	2,424,471	2,424,471
TOTAL	**139,346,930**	**147,431,103**	**136,320,695**	**73,759,966**	**66,285,549**	**140,045,515**	**7,385,588**	**(3,724,820)**
Prorated Reduction [2]			11,110,408 or 7.5%					
Level 2 Subtotals								
Overall Project Staffing	116,602,651	125,437,061	115,751,725	66,432,824	52,914,704	119,347,528	6,089,533	(3,595,803)
License Termination Survey	22,744,279	21,994,043	20,568,970	7,327,142	13,370,845	20,697,987	1,296,056	(129,017)

Note:

1. The Staffing is split differently in the forecast compared to the 2012 NDCTP methodology. The overall balance of staffing between the General Staffing section and Caisson Staffing section is favorable compared to the original estimate.
2. The staffing prorated reduction represented $11M of the $47M. Staffing was expected to be reduced by 7.5% but was reduced by 5%

- Teamwork—We will work together as a team, act with integrity, and communicate openly and honestly.

The work force was also involved in the process and demonstrated commitment by developing a Key Initiative. The primary initiative at HBPP is to promote a culture of safety. Rather than set any long-term "Fewer Accidents" or "No Accident" goal, the work force decided to adopt a "Plus 1" approach to safety, based on the idea of focusing on creating a safe working environment today, each day and then repeating the same focus tomorrow. That "Plus 1" way of thinking does not aim at an "end goal"; instead it puts the focus on today, plus one more day. Safety is the core of the culture at Humboldt Bay. Every employee is empowered and expected to contribute to a safe work environment.

Management first ensured that the vision of the project team and PG&E management was understood. The initial employee training sessions were used to present what management valued and expected of all new employees. The current employees attended a series of off-site meetings during which the values and expectations were discussed. Initially, this message was reinforced in monthly off-site training sessions. As the work force matured and demonstrated excellence, it was articulated less frequently. Visual aids were placed on walls of meeting rooms, at Access Control, and on office walls to keep the focus on successes and goals. HBPP offered personnel voluntary lunch-time training sessions, with Project Management Institute materials, for Project Management Professional certification and continuation education credits. RP provided training to staff every two weeks and a formal course on certification. Senior management attended the schedule meetings, Plan-of-the-day (POD) meetings, and Plan-of-the-next-day (POND) meetings, and mentored substandard performance with positive reinforcement and training if needed.

This communication was key to ensuring that all personnel were aligned with HBPP's vision. Major project changes or evolutions, such as transitioning to the CWC or downgrading RCA were introduced ahead of time and briefed to all stakeholders. Visual aids, such as the "Capstone Project" visual aids were used in these briefings. Management's ability to take schedules and relate them physically to the field to firmly establish ownership and buy-in contributed to the success of the project. Buy-in was particularly important with a work force composed of local hires, operators, utility folks, and organizations with varied exposure to good project control tools. The production increase over time, with commensurate safety improvements and environmental stewardship, proved the value of the time and effort invested. The pride and accountability instilled in personnel, coupled with the feeling of being part of the team, often led to new and innovative solutions to field problems being advanced by the work force itself.

3.3.1.1.1 Overall Project

Scheduled work drives the need for personnel. As the work load increases, the staffing to successfully complete pre-project planning as well as the implementation of the plans increases. As the work is completed, the need for staffing begins to decrease as well. The prediction of staffing needs, staffing increases, and staff lay-offs is referred to as staffing ramp-up/ramp-down or simply as the "Staffing Plan."

Successful management of the cost of the decommissioning is contingent on control of Labor costs. To that end, the first priority is to manage the head count for the entire duration of the decommissioning. PG&E developed a staffing plan specific to the head count for each period that runs to the end of 2019. The Plant Director and the Department Managers responsible for the various aspects of the decommissioning met off-site several times to develop a staffing plan. The staffing plan includes ramp-up, ramp-down, durations, funding sources, and number of staff needed to complete each function associated with the decommissioning.

All aspects of decommissioning require detailed planning and scheduling to ensure regulatory compliance and to ensure the safety of workers and the public. As with any project, performing more work—and work that differs from what has been done in the past—involves changes to the organization, including adding people with different skills and increasing the numbers of people. To manage these transitions in a safe and effective manner, this plan identifies the changes that will occur and the strategies for dealing with them.

Details of the plan for staffing throughout the duration of the project are included in later sections of this plan. Having the appropriate number of people possessing proper skills is extremely important to the successful completion of this project. The HBPP Unit 3 staffing plan is connected to the working schedule to ensure that the necessary staff will be available to complete the decommissioning in a safe, cost-effective, and timely manner. Figure 5.5.1 in Section 5.6.2.5 shows the remaining work with a relative staffing curve superimposed over the work. The curve starts in 2016 at approximately 113[2] employees and drops over time to approximately four by the end of 2019.

PG&E established the work sequence and duration based upon ongoing planning efforts. The schedule is relied upon in calculating the carrying costs, which include program management, administration, field engineering, equipment rental, support services such as quality control and security, and the staffing ramp-up/ramp-down. This systematic approach for assembling decommissioning estimates ensures a high degree of confidence in the reliability of the resulting cost estimate.

[2] Note that these staffing numbers do not include the ISFSI staff, which remains relatively stable.

The staffing plan also captures the expected changes to organizational staffing; the decommissioning phases; and the impact of each phase on departmental staffing during the demolition and decommissioning of Unit 3. PG&E and contractor staffing levels were revised based upon an in-depth PG&E review of its staffing needs during the project.

After managing head count, the next priority is managing the billing rates. The staffing plan specifies the head count for each period and runs to the end of 2020. The management team is managing billing rates in the procurement process.

At a summary level, HBPP is about $7.4M below the 2012 NDCTP request ($3.7M over the reduced budget). The prorated reduction in staffing costs represented $11M of the $47.2M. Staffing was expected to be reduced by 7.5 percent, but was reduced by 5 percent. The savings from the base 2012 request was accomplished through an optimization of staffing to better align the organization to the work to be completed. One convenient way to measure the change from the 2012 filing for staffing to the 2017 filing is to compare the projected FTE-Years in the two filings. Some examples by department include:

- Engineering staffing was predicted to consume about 83.1 FTE-Years in the 2012 filing and is now predicted at 41.0 FTE-Years.
- Environmental staffing was predicted to consume about 31.5 FTE-Years in the 2012 filing and is now predicted at 19.5 FTE-Years.

The details for each department are discussed later in this section.

PG&E remains attentive to the dynamic needs for staffing by routinely reviewing those needs and tracking actual expenditures against the expected expenditures. By developing the staffing plan early based on the planned execution of decommissioning and by frequently reviewing needs against actuals, PG&E has been able optimize the staffing levels. This rigorous process has successfully reduced the predicted staffing needs from 338 FTE-Years in the 2012 to 300 FTE-Years in the 2017 filing, for a total staffing savings of about $7.4M. In addition to the thorough effort that PG&E has applied in reducing staffing costs where prudent, the result also indicates that the methods used to forecast the staffing needs were very accurate as evidenced by the variance from 2012 to 2017 forecasts being roughly 5 percent of the $147M 2012 forecast.

Throughout decommissioning, PG&E frequently evaluates and tracks the results of its staffing plan to best fit the needs of the project based on project risk. This was effectively done through periodic review of staffing head counts and expenditures, off-site meetings, and a close scrutiny of the scope of work and work packages. As a result, the actual staffing expenditures remain well within acceptable margins of the predicted values. For example, for the first three years (2009 to 2011), the staffing costs were

within $0.4M of the $64.3M forecast. The actual performance varied from the forecast by approximately 0.5 percent.

From the data, it is easy to conclude the PG&E has done a reliable job of forecasting staffing needs, managing staffing head count and billing rates to the forecasted values, and seeking opportunities to further optimize the staffing. Therefore, PG&E believes that the methodology that it developed in the 2012 NDCTP filing is sound, and that methodology was retained for the 2017 NDCTP. Through further efficiency in use of staffing and better alignment, a $7.4M reduction in staffing is favorable going into the 2017 NDCTP filing and demonstrates affordability, which is one of PG&E's Business Priorities. It demonstrates HBPP's alignment with PG&E's Extended Leadership Team commitment to bring value to its rate payers.

The $7.4M savings was accomplished through an aggressive optimization of staffing to better align the organization to the work to be completed. Some examples by department include:

Director Department

- With the reduction in the radiological source term and elimination of the safety systems required during operation, HBPP was able to reduce quality assurance requirements for Unit 3 and to split off the ISFSI from Unit 3.
- Unit 3 was able to downgrade procedures to a more appropriate level and reclassify and simplify most of the remaining work as non-quality (with the exception of LTP and RP).
- As the workload was simplified, the need for a large management organization was also reduced. HBPP was able to reduce the management ranks through severances in key PG&E managers including RP, Engineering and Project Superintendent.

Engineering

- With the shift in work from self-perform to Civil Works Contracts, the need for a full engineering department was eliminated. HBPP reduced engineering staff significantly in 2015 by moving the engineering contractor under the CWC. HBPP retained the appropriate subject matter experts to facilitate review of engineering and work plans. The shift of personnel resulted in a staff reduction from 30 to approximately 12 personnel in 2015. The significant difference in staffing is evident in Figure 3.3.2.
- As the site changed over from Self Perform to Civil Works, PG&E reviewed and refined its work planning strategy by proceduralizing the civil works planning and approval process. This issue is discussed further in Section 3.3.1.2.3.
- The majority of the responsibility for safety oversight of field operations was shifted to the CWC, thus facilitating a reduction in staffing to one person. PG&E decided to retain one individual to provide independent oversight of safety functions.

Environmental and Strategic Waste

- The environmental and strategic waste functions were able to be combined after the high level radioactive waste (Class B&C) were removed from the site. This resulted in a notable reduction and streamlining in operations. The significant difference in staffing is shown in Figure 3.3.3.

PG&E assessed the staffing needs based on the work and project plans, complexity of the work, hazards associated with the work (alpha contamination in particular), potential conflicts with other projects on site, and the schedule to complete the work.

PG&E sought the help of highly experienced staff and consultants to assist in developing detailed plans and schedules. Four major companies supplied personnel with previous experience in decommissioning at 24 sites throughout the United States, who were able to draw upon many years of personal experience when drafting their work plans and technical work papers. PG&E was thus able to benefit from the collective lessons learned at other commercial nuclear and DOE and Department of Defense facilities that have undergone decommissioning.

The staffing plan includes ramp-up, ramp-down, durations, funding sources, and number of staff needed to complete each function associated with the decommissioning. The staffing plan starts in 2015 and continues through the caisson removal project, restoration, and planned administrative close-out in 2019.

PG&E has scheduled the remainder of the decommissioning of the HBPP site over a period that extends until the end of 2019. Schedule duration is sufficient for the decommissioning activities, including the caisson removal project that spans two and a half years. The ISFSI will continue in operation until the DOE takes custody of the fuel and GTCC waste, which expected to commence in 2029. The ISFSI costs are discussed in a separate work break down structure—Spent Fuel Management, and they are not included in the staffing plan.

The staffing plan for this cost estimate update starts in January 2015 and ends in 2019. The staffing plan ramps down during the caisson removal project starting 2016 and into the latter part of 2018 during FSR. During close-out of the project in 2019, the staffing plan is at a minimum head count as PG&E submits its HBPP license termination request, completes its invoicing, and closes out its records.

In order to better track and quantify costs for staffing, a work breakdown structure was developed. The "Staffing Plan" work breakdown structure consists of the following departments:

- Site Management (Director)

- Decommissioning (including Finance, Sourcing, and contract oversight)
- Environmental
- Engineering
- RP
- Environmental/Strategic Waste
- Site Closure (including FSS, License Termination Survey, and Count Room)
- Site Services

The staffing plan includes fixed overhead, which are those costs incurred for maintaining staff that is assigned to management, safety, facility maintenance, licensing support, and procurement and finance. Fixed overhead are job functions that are needed regardless of the status and progress of the decommissioning. It also includes direct and discrete labor, which are staffing costs for personnel who directly support schedule progress such as engineered plans, development of work packages, and permits.

These overhead costs are classified as PMO costs. The costs are captured in total so that the final costs of decommissioning can be estimated. In order to accurately ascertain the total cost of a particular project (such as the caisson removal), the PMO costs are apportioned to active projects based upon the level of effort needed by the PMO to support the specific project.

The staffing apportionment methodology between the base scope and Reactor Caisson support is determined based on the amount of work being performed at a given time. During the 2012 NDCTP CPUC filing, the Caisson scope of work was scheduled during a two and a half year time frame from the beginning of 2016 through mid-2018. Staffing support during the two and a half year timeframe was applied almost exclusively to support Reactor Caisson Removal. Staffing support for the base scopes of work, including Civil Works and Canals, was estimated up to the end of 2015 and from the second half of 2018 through the end of the project. This was determined based on the forecast schedule at the time of the 2012 NDCTP CPUC filing.

Following contract award for Civil Works, Caisson, and Canals scopes of work, a schedule was developed to better integrate the Caisson removal and improve efficiency of the remaining activities to be performed. The apportionment of level of effort support, such as staffing, is being updated in this NDCTP filing to reflect the amount of work being performed each quarter based on the current schedule of activities. Rather than a two-and-a-half-year application, the levels of staffing to support ongoing activities are divided quarterly between the two staffing WBS elements using the ratios in Table 3.3.3.

TABLE 3.3.3—OVERHEAD STAFFING DIVISION BETWEEN BASE SCOPE AND NEW SCOPE

Over-head Split	2015				2016				2017				2018			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Base %	100	100	65	65	50	50	50	50	50	50	50	50	50	50	50	50
Caisson%	0	0	35	35	50	50	50	50	50	50	50	50	50	50	50	50

During the development of the schedule after the Civil Works Contract award, it was evident that PMO costs would need to be redistributed among the various contracts awarded to the CWC for different work scopes. The ratios of the PMO costs within each contract were redistributed based on the field work activities. A contract change order was processed to reconcile the new apportionment assumptions of PMO-related costs.

3.3.1.1.2 Site Management

To ensure project success, PG&E recruited a highly experienced and specialized group of managers with solid management skills, strong technical skills, industry-specific knowledge, and the desire to see the project succeed through the critical phases. The low attrition rate, strong participation in professional and industry forums, and proven ability to solve unexpected problems has validated the selections. The combination of PG&E and contractor personnel with specialized skill sets has proven to be very cost effective. Industry evaluations, audits, NRC inspections, H&S records, and project accomplishments attest to the team's ability to manage the project within the project parameters. This strategy was used throughout the decommissioning process. Key elements of the effort are depicted in Figure 3.3.4.

FIGURE 3.3.4—PROJECT MANAGEMENT STRATEGY

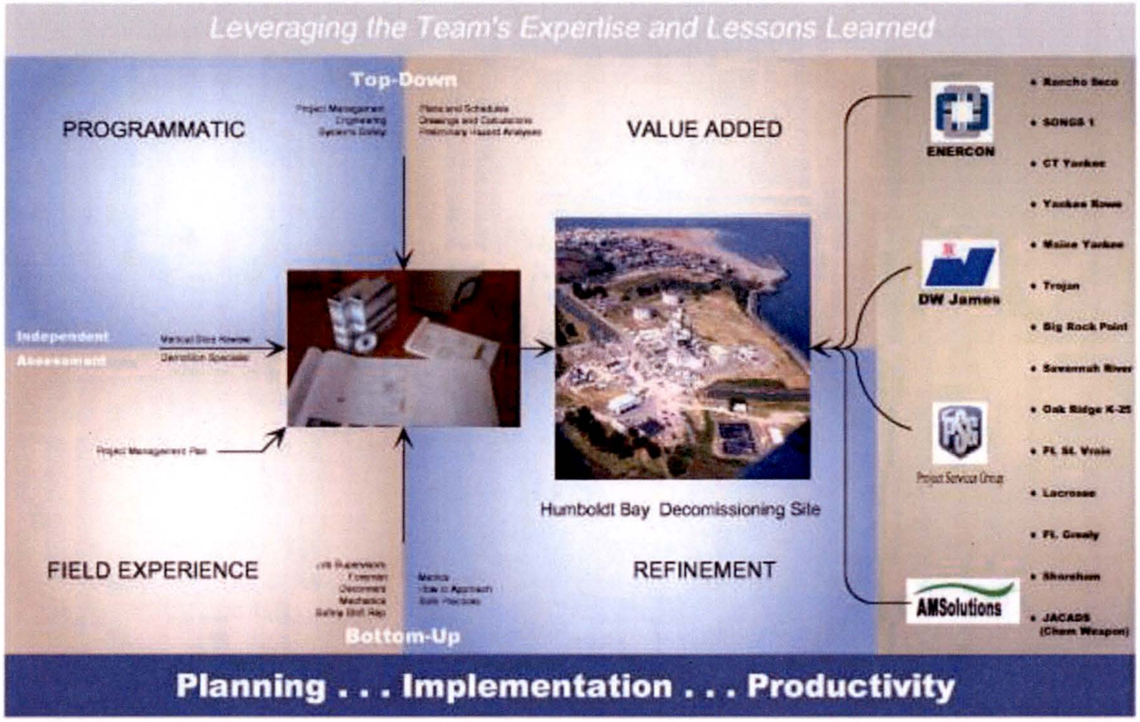
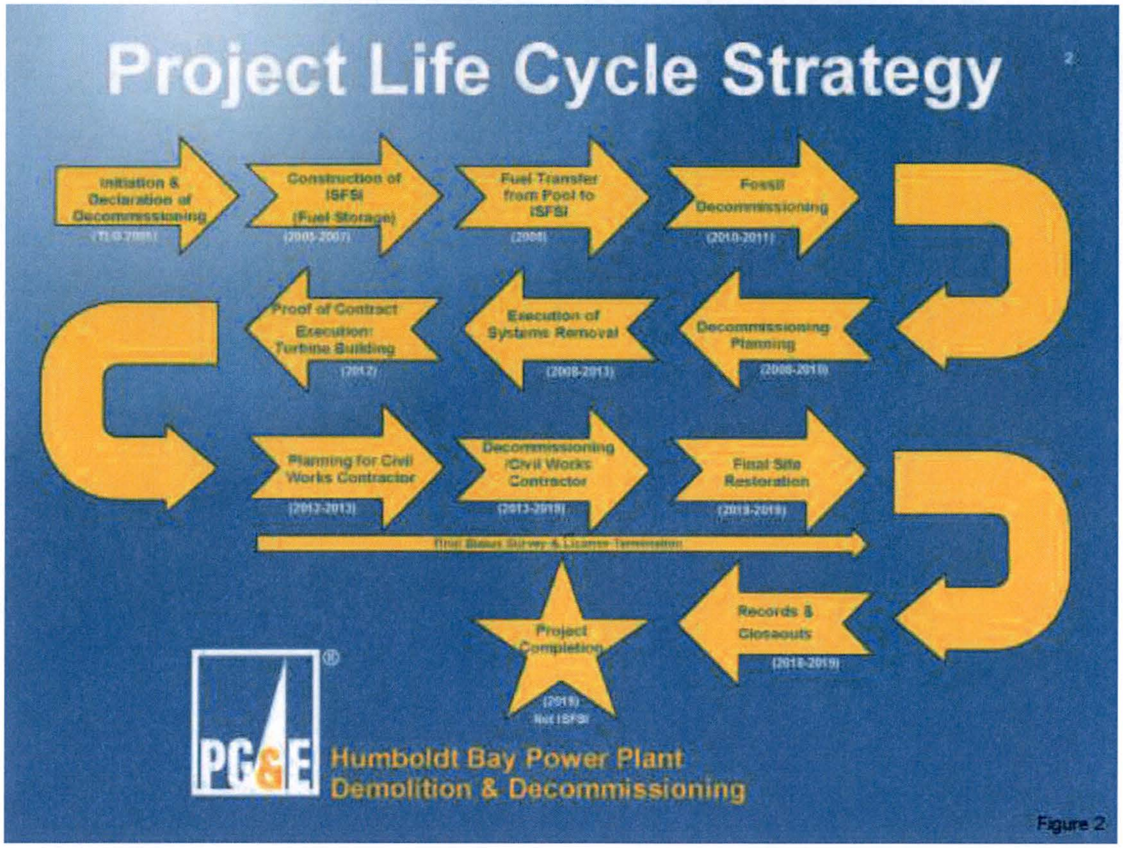


Figure 1

By virtue of the project life cycle, the management team should and did change. Known phases of the project are depicted in Figure 3.3.5 and reflect the underlying basis for the staffing changes of the director's team over time.

FIGURE 3.3.5—PROJECT LIFE CYCLE STRATEGY



Overarching criteria of technical excellence; team compatibility; safety culture background; project management, demolition, and risk mitigation experience; ability to interface with the public and community; and nuclear awareness, combined with specific individual skills and experience, were considered in selecting management team candidates for the respective work phases. PG&E determined that the best choice of staffing mix consisted of utility personnel, who could provide direct line-of-business influence, and contractor personnel, who could provide expertise not inherent in utility staff. This mix changed over time. The transition of the organization from 2009 to present has in fact reflected this evolution. Early staffing during the planning stages and into self-perform systems removal required stronger resources for planning, work control, and RP. As work was completed, a shift towards FSS and Environmental took place, with specific resources as needed for Strategic Waste. Progress into civil works required more civil/structural- and contracts-type skills.

In addition to the overarching criteria, considerations in hiring the management team varied based on the position. The budget was somewhat dictated by necessity, and in some cases, by regulatory requirements. In filling management positions in Engineering, RP, FSS, Environmental, and Strategic Waste (packaging and transportation) the primary selection criteria were specific technical skills, qualifications, and experience to avoid violations or noncompliance. Adjustments in senior management positions and on-site personnel reductions will occur as the work evolves from high-risk and self-performed to less hazardous and contracted work under the CWC.

The current management organization is well suited to manage and oversee the remaining civil works projects and site restoration. The Director's organization is depicted in Attachment D. Below, several of the staff positions under the director are described. The strategy going forward is to align with the project needs as the CWC executes the projects, and PG&E is able to focus its oversight.

Director/Plant Manager

The Director/Plant Manager has the responsibility for oversight of the entire decommissioning and site restoration, including safety of employees, implementation of work processes, disposal of wastes, and control of the budgets to accomplish the entire project. The Director works collaboratively with a wide variety of other groups to safely and efficiently execute the mission. These groups include a mix of internal stakeholders, such as RP, Safety, Security, and Quality Verification groups, and external stakeholders, such as interested Federal and State regulators, other utilities who are preparing to decommission facilities, and local community groups such as the Citizen's Advisory Board (CAB).

Decommissioning Manager

The Decommissioning Manager is assigned to management and supervision of the day-to-day activities of the finance, litigation, and project controls groups; oversight of remaining self-perform work field activities; and oversight of the contractors and contracts for the civil works projects. This position is primarily responsible for the Cost and Schedule baselines and managing the line-of-business interests for PG&E.

Based on the status to date and the schedule going forward, the PG&E plans to reduce direct reports as their specific specialties warrant. The Engineering Manager was released in 2015. It is anticipated that by the end of 2016, the RP Manager and Deputy

Director will be released. Any residual responsibilities will be managed by one of the remaining Managers—Decommissioning, Site Closure, or Environmental.

Site Closure Manager

The Site Closure Manager is anticipated to supervise the Count Room, CAP, Records Management, Training, FSS, and the remaining RP staff. Specific activities will include managing and supervising the day-to-day activities of the FSS and Count Room employees; coordinating activities with NRC as required for the HBPP LTP; developing and implementing "Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual" (MARSAME) and "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM) FSS packages for dispositions of waste; providing radiological analysis support to RP, Environmental, Radwaste, and the FSS and LTP; coordinating Quality Assurance/Quality Control (QA/QC) with outside laboratories; coordinating the Radiological Environmental Monitoring Plan (REMP) sampling for HBPP; and other duties as requested by HBPP's Director for Decommissioning.

Site Closure Manager

The Environmental Manager will continue to supervise the Environmental, Remediation, and Waste organizations and maintain some responsibilities for remnants of the Engineering organization, including Fire Protection and Safety day-to-day supervision. Again, this approach puts focus on the key project priorities as the site transitions.

Staff ramp-down in accordance with the staffing plan will ensure line-of-business focus on project cost and schedule through CWC oversight while releasing resources that were brought in for specific phases of work.

3.3.1.1.3 Decommissioning

The Decommissioning organization is responsible for performing cost and budget control, procurement, and warehouse functions. The Decommissioning organization is also tasked with oversight, identification, and control of the execution of project transition and work. The Decommissioning organization structure is depicted in Attachment E.

The Decommissioning organization interfaces directly with the CWC and the associated field activities. The relationships between the Decommissioning organization and the CWC and field activities are depicted in Attachment I.

The Decommissioning Organization is the central group responsible for planning, executing, and tracking progress and funding for the decommissioning of HBPP Unit 3. The Decommissioning Organization, led by a strong and well-seasoned project

manager, began its activities when PG&E decided to transition from a SAFSTOR mode into full decommissioning. In order to effectively execute its assigned missions, the Decommissioning Organization started by assembling a team of very experienced professionals to plan the decommissioning from start to finish. The makeup of the Decommissioning Organization has changed over time with the changes to the workload and to the remaining work to oversee. The current organization is composed of several functional teams including:

- field work and oversight
- business, financial, and project analysis
- Civil Works Projects oversight

3.3.1.1.3.1 Field Work and Oversight

The field work and oversight functional group is responsible for the day-to-day execution of the decommissioning project tasks (as directed by the Decommissioning Manager) and operation of plant systems. The group is responsible for executing work including:

- Project Management of work to support all decommissioning activities
- Implementation of work orders
- Control and direction of craft personnel
- Coordination of clearance orders
- Revision of Unit 3 Operations procedures and programs
- Provision of feedback to work control and engineering on implementation of work orders (lessons learned)

This group is currently composed of four employees. Staffing ramp-down will begin in mid-2016 with the completion of the RFB demolition and will continue through CSM wall installation. One employee will be retained through the site restoration period and will be terminated in late 2019.

3.3.1.1.3.2 Financial

The business, financial, and project analysis group is responsible for tracking and validating expenses against budgets, contractual requirements, and regulatory requirements. The Sarbanes–Oxley Act of 2002 (Pub.L. 107–204, 116 Stat. 745, enacted July 30, 2002), more commonly called Sarbanes–Oxley, Sarbox, or SOX, is a federal law that sets new or expanded requirements for United States public company boards, management, and public accounting firms. The bill covers responsibilities of a public corporation's board of directors, adds criminal penalties for certain misconduct, and requires the Securities and Exchange Commission to create regulations to define how public corporations are to comply with the law.

As a result of SOX, top management must certify that they are "responsible for establishing and maintaining internal controls" and "have designed such internal controls to ensure that material information relating to the company and its consolidated subsidiaries is made known to such officers by others within those entities, particularly during the period in which the periodic reports are being prepared."

SOX Testing is required every quarter by the PG&E FSS Business Process Group, beginning in the 2nd Quarter 2014. The testing is a review of transactions that are paid after the monthly close of business.

To ensure the continued accuracy and completeness of the Company's financial statements and US Securities and Exchange Commission filings, PG&E is required to update the Asset Retirement Obligations on a quarterly basis.

Request for HBPP Decommissioning Trust disbursements are prepared each month for costs that were paid to PG&E employees, contractors, and vendors during the period of the request. Because disbursements are requested for costs when actually paid, a significant review of transactions in the PG&E accounting system (SAP) is completed each month to remove transactions that have been posted but not paid. The completed report, with the requested amount of reimbursement, is submitted to the Asset Accounting Department for review and approval. The Asset Accounting Department prepares a Withdrawal Certificate to the Nuclear Decommissioning Trust Trustee requesting reimbursement of the funds from the Qualified Trust to PG&E

3.3.1.1.3.3 Department of Energy Litigation Specialist

Congress enacted the Nuclear Waste Policy Act of 1982 (NWPA), requiring the DOE to establish repositories for the disposal of radioactive waste. The NWPA initially provided for the selection of two permanent repository sites, with the initial site being limited to a capacity of 70,000 metric tons.

Under the NWPA, utilities that own nuclear plants are assessed a user fee on every kilowatt-hour the plant generates, in exchange for the government's contractual commitment to accept commercial spent fuel for disposal. The government was slated to begin accepting spent fuel on January 31, 1998. The DOE failed to meet this date and has yet to receive any spent fuel. The DOE and the utilities have been engaged in litigation since the DOE's failure to perform its obligations.

When work was suspended at the Yucca Mountain Depository, the DOE breached its contractual agreement with PG&E. In 2008 and 2010, PG&E litigated to recover costs incurred for the continued storage of spent nuclear fuel on site.

In 2012, PG&E reached a settlement agreement with the DOE for reimbursement, requiring preparation and submittal of yearly DOE Claims for Diablo Canyon Power Plant (DCPP) and HBPP. HBPP finance staff is responsible for the preparation and submittal of the yearly DOE Claims, in excess of $5M annually, for HBPP. They analyze expenses for appropriateness to the claim, and collect, justify, and prepare backup documentation of expenses for submittal to DOE, remove any charges disallowed from previous claims, and provide assurance that transactions during the claim have been paid within the claim period by PG&E. Backup documentation includes detailed analytical spreadsheets for HBPP, fulfilling DOE settlement agreement guidelines.

To prepare the DOE claim, HBPP Finance is required to work closely with other HBPP departments, DCPP, and PG&E Corporate. The submittal requires HBPP and DCPP Security Departments and Nuclear Project Management Departments to review transactions made during the claim period and provide detailed explanations of charges to assist HBPP Finance in ensuring that the charges are due to the DOE breach of contract. HBPP and DCPP Procurement Departments provide copies of Master Service Agreements, Contract Work Authorizations, or Purchase Order Scope of Work documents for contractors used by HBPP that incur transactions exceeding $5K, per the settlement agreement.

Upon submittal and prior to DOE final acceptance, the DOE review process allows for Requests for Additional Information as needed, to assure settlement agreement guidelines are in compliance. The HBPP Finance team prepares responses to Requests for Additional Information and submits them in compliance with the agreement. The Request for Additional Information process can take up to 90 days before the DOE and HBPP concur that the claim is fair to all parties involved.

Under the Settlement agreement with the DOE, PG&E has submitted four yearly HBPP claims to date, with the most recent submitted in October 2015. The first claim included costs for January 2011 through May 2012 in the amount of $8.3M and was awarded $8.2M, a 98.8 percent success rate. The second claim submitted included costs for 2012 through May 2013 for the amount of $5.0M and was awarded $4.7M, a success rate of 94.0 percent. The third claim included costs for June 2013 through May 2014 for the amount of $5.0M and was awarded $4.9M, a 98.0 percent success rate. Finally, the fourth claim included costs for June 2014 through May 2015 for the amount of $5.7M and is currently pending DOE review.

Proceeds of the HBPP litigation and claim submittals, currently totaling $152.2M, are returned to customers in accordance with the procedures adopted in the general rate case.

The DOE Litigation Specialist is the only position within the Decommissioning Organization that will remain in place through the ISFSI Operations phase, final transfer of spent nuclear fuel and GTCC wastes to the DOE, and final ISFSI decommissioning and site restoration.

3.3.1.1.3.4 Project Controls and Business Analyst

Project controls functions are assigned to business analysts, project controls analysts, and invoice coordinators who are responsible for developing project controls to report metrics for monitoring and controlling the decommissioning project performance. Various Tiger Teams[3] were initiated with the support of the business analyst, to develop the appropriate reporting tools necessary to track, monitor, and control project costs. First, a WBS was established using the approved 2009 NDCTP TLG cost study and broken down into eight cost categories to measure cost performance as the project evolved. A change-control process was established to trade baseline budgeted costs between WBS categories in order to balance the budget and manage the work scope appropriately.

Following approval of the 2012 NDCTP filing, all reporting templates were updated to reflect the reporting structure with eleven discrete WBS elements. These various reporting tools included: monthly accounting to budget performance metrics, comparing total project actual expenditures to the established budget; cost-account-manager-specific project reporting tools for measuring individual project performance with regards to cost and schedule; staffing head count and man-hour reports with actual work hours performed compared to budgeted hours planned; and burn rate reports including large vendor monthly burn rate analysis and quarterly, annual, and cumulative project-required financial performance reports. The reporting tools developed by the tiger teams were maintained, updated, and revised periodically throughout the project by the PMO led by the business analyst. The scheduling group was later integrated into the PMO to incorporate schedule reporting metrics with established cost reports and processes. This move helped consolidate and standardize the reporting tools for a more efficient and consistent project management process.

In addition to maintaining ongoing periodic performance reports, the PMO and business analyst are responsible for supporting government- and trust fund- related filings, including annual advice letters to the CPUC, NDCTP filings, and NRC assurance of funding reports. The PMO is involved in supporting all cost and schedule aspects of project management, such as purchase requisitions, vendor invoice review, contract performance tracking, risk and opportunity analysis, and contract closure.

[3] A Tiger Team is a team of specialists brought together to work on specific tasks.

In support of Project Controls, the business analyst is responsible for assisting in the development of government- and trust-fund-related filings, overall project and department-level reporting, data analysis, invoice review and tracking, and waste tracking.

Monthly financial reporting is prepared and analyzed at both the overall project and individual department levels. In crafting these reports and analyzing them with the appropriate project oversight, the business analyst performs a robust cost evaluation to maintain project goals and finances. In reviewing and tracking various vendor invoices, it is imperative to maintain consistent accounting of the charges as they are related to the CPUC filing and budgets. The roles of the business analyst are regularly updated to provide accurate information on the project specifics in support of annual Advice Letters, NDTCP, and various other CPUC-related reporting requirements.

As the direct central contact for tracking staffing plan changes, the budget analyst is an integral part of staffing analysis and forecasting. The business analyst maintains current staffing data. Each department manager notifies the business analyst of any unexpected change in staffing or long-term leave of absence that will affect cost. Monthly meetings are held between the business analyst and each Manager to review the current staffing tables and future staffing plans in regard to the project schedule. The information formulated in these meetings and regular communications establish costs that are compared to the original plans and budgets and provide a strong basis for maintaining an optimal staffing plan.

Financial reporting is provided to the entire management team each month for review and evaluation of the overall project finances. This reporting is also used for department-level evaluation and review with each Manager. The reports outline the cost by month as they pertain to the monthly CPUC budget. The costs are compared to the budgets by both month and year, providing trends that can be analyzed to forecast how future costs will affect the project. These forecasts are regularly assessed to determine the reasonableness of planned expenditures and where appropriate adjustments may be implemented to comply with the original plan or to provide justification to support current and future plans.

Vendor invoices are received daily, reviewed for appropriateness of charge, and assigned relevant accounting allocation. Accounting allocation is assigned to each invoice based on how the charges pertain to the planned costs outlined in the 2012 NDCTP filing under Table 4.1. Invoices pertaining to large contracts are tracked in separate database structures to permit quick spending trend, contract and performance comparisons, and other beneficial valuations.

The Invoice Coordinators keep invoices moving through the process so that validated invoices are paid in accordance with contract terms. The Invoice Coordinator confirms that invoices and associated documents have been uploaded to EDRS and is responsible for assigning appropriate reviewers and approvers. In addition, the Invoice Coordinator is responsible for ensuring that invoicing issues are resolved and documenting resolution of those issues. The Invoice Coordinator reviews identified issues and action items as they are raised, to ensure the issue or item has not been previously identified and resolved; to determine if the issue or item requires formal resolution; and ensure that the desired resolution or concern is clearly worded.

The need for continued tracking, invoice review, and budgetary oversight will continue through the beginning of Site Restoration. There are currently approximately four people assigned to fulfil these functions. The staffing will start to ramp down in mid-2018 with a complete ramp-down by the end of 2019.

3.3.1.1.3.5 Contract Administrator and Contract Technical Representatives

PG&E has used contracted support extensively during the HBPP demolition process. Most of the contracted support has worked directly for PG&E in a staff-augmentation role for the self-perform portion of the demolition project. Several major definable features of work have warranted contracts dedicated to completion of these grouped demolition tasks. These include the fossil fueled generation plant (Units 1 and 2) demolition, the Turbine Building demolition, and the civil works portion of Unit 3 demolition.

To manage these larger scopes of work, PG&E set up contract management teams to execute the technical contract administration. Lessons learned from the demolition of Units 1 and 2 were incorporated, and staff with prior HBPP site experience provided the contract administrative team with the insight to implement work package review by HBPP departments including RP, FSS, Strategic Waste Management, Environmental, Engineering, and Procurement (Contract Management) prior to issuance. This step helped ensure compliance with HBPP procedures and coordination with other interfacing decommissioning activities.

A significant lesson learned in the Turbine Building demolition process was a need for the contractor to have a more extensive and thorough understanding of HBPP procedures prior to starting the work effort to ensure procedure compliance and attain performance consistent with the safety culture already established by HBPP. This and other lessons were incorporated into contract development for the last major contract for the HBPP site, the Civil Works Contract.

For the existing staff of HBPP, the Civil Works Contract began a significant transformation from execution to oversight. Along with his management team, the plant Director developed an oversight plan to provide direction for the HBPP staff in this transition. The primary driver in this oversight plan was identification of the role change—from performing the execution function to assessing the risk that work methods described by the CWC would impose on PG&E—and working with the contractor to minimize those risks. From the high-level oversight plan, the Civil Works Contract Management Team (CWCMT) produced a desk guide providing detailed direction on a department-by-department basis for HBPP's expectations regarding oversight implementation.

As with many large-scale projects, the early efforts by the CWC to meet contractual requirements and develop work packages compliant with established HBPP protocols were not as successful as hoped. The field and administrative CTRs orchestrated a major effort, called the "Field Initiative", to push past this initial challenge. The purpose was to utilize the site-specific knowledge of HBPP subject matter experts to provide intensive support to the CWC staff so work packages could be developed and completed in a manner that not only provided compliance with the HBPP safety culture, but also satisfied the requirements of the CWC's culture. The effort was marked as successful in achieving the targeted work start date.

The Civil Works Contract administration staff was selected based on expertise in nuclear-related activities, experience with existing HBPP decommissioning activities and anticipated support requirements. The initial staffing level was anticipated to be higher in order to facilitate the initial surge of submittals from the contractor to satisfy contractual requirements to establish working procedures and the foundation for future work. The CWCMT has undergone a ramp-down and currently consists of a one CTR, a supporting Administrative CTR, and a Document Control Specialist. The responsibilities for the various positions include the following:

- The CTR is the PG&E administrative and field representative who oversees the work package implementation. The CTR is familiar with the Civil Works Contract and is capable of making on-the-spot determinations as to in-scope and out-of-scope work elements. The CTR does not have the authority to make decisions that may affect schedule and budget. However, the CTR is PG&E's eyes and ears in the field. They also receive required Contractor Design Outputs, associated Engineering Support Documents, other associated work package components, and other submittals. The CTR then assigns engineering and other subject matter experts and technical staff to review, comment upon, resolve issues with, and approve work package components. In addition, the CTR assigns PG&E resources capable of and qualified to review Contractor submittals

(including Work Plans and job safety analyses), responds to RFIs, and review Contractor Design Output. When necessary, the Administrative CTR confirms that Contractor designs meet desired and reasonable design requirements, comply with applicable codes and standards, and may be issued and used for their intended purpose.

- The Document Control Specialist assists the Contract Administration. The Document Control Specialist maintains project records and coordinates retention of digital, paper, and archival records for the Civil Works Project. This position is also tasked with sending, tracking, and receiving submittals, contractual responses, correspondences, and RFIs for the CWCM, Decommissioning Manager, and Civil Works Project.

The CTR staff will be required through the end of site restoration at the end of 2018. The staff will ramp down to between one and two full-time equivalent staff for a short period in 2019 to close open work packages and contracts and then file all documentation for archival.

3.3.1.1.4 Engineering

The Engineering function for decommissioning is embedded in the Plant Director's organization as depicted in Attachment C.

During the self-perform phase of decommissioning, the engineering functional area was responsible for developing, reviewing, and approving drawings, calculations, work packages, and other documents; evaluating non-conformances of licensed components for engineering implications; assisting with development of work flow plans; revising Engineering procedures and programs; field engineering; and developing rigging and heavy lift plans.

Also during the self-perform phase, the work control group prepared work packages as well as cost and time estimates, drafted clearance orders, and revised procedures during the planning phase.

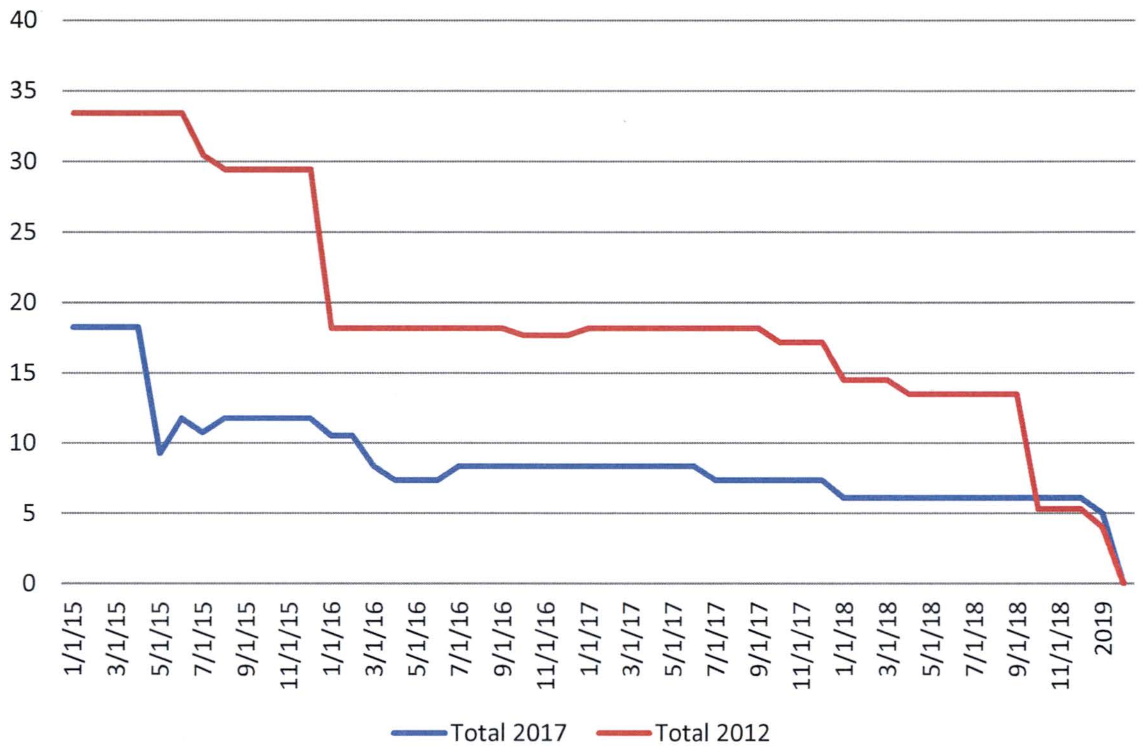
Administration included procedures, document control and records management functions, and payroll. Many changes to plant procedures and license bases documents were required to support decommissioning activities.

Within plant operations were functions requiring clearance, which is the need to identify, mark, and clear energized and active systems to assure that work can proceed safely prior to the start of decommissioning field activities. This effort incorporated a number of methods to assure that these systems were not affected during decommissioning

activities, including established clearance and tagging processes, physical marking of systems, and walkdowns with field supervision.

With the shift in work from self-perform to Civil Works Contracts, the need for a full engineering department was eliminated. HBPP reduced engineering staff significantly in 2015 by moving the engineering contractor under the CWC. HBPP retained the appropriate subject matter experts to facilitate review of engineering and work plans. The shift of personnel resulted in a staff reduction from 30 to approximately 12 in 2015.

FIGURE 3.3.2— NDCTP ENGINEERING STAFFING COMPARISON (2012 TO 2017)



As the site transitioned from self-performed work to a civil works project, the work control process also had to transition. A new procedure, HBAP C-17, Work Control Process for Civil Works Projects, was developed for use by the primary CWC. The new procedure was focused on ensuring that the civil works project work to be completed was clearly defined, thoroughly reviewed, totally transparent, and within all the safety, contractual, and regulatory requirements. HBAP C-17 also provides the interfaces between PG&E and the CWC to ensure work planning meets contract requirements through PG&E review and approval of contractor submittals.

3.3.1.1.5 Radiation Protection

The RP organization primarily implements the requirements of 10 CFR §20 (Standards for Protection Against Radiation). The organization also contributes significantly to implementation of the Radiological Effluents Monitoring Program and compliance with 40 CFR §190 (Environmental Radiation Protection Standards for Nuclear Power Operations), Unit 3 Technical Specifications, 10 CFR §19 (Notices, Instructions and Reports to Workers: Inspection and Investigations), and the REMP. For decommissioning sites, the RP Program is perhaps the major focus area of NRC oversight, particularly once nuclear spent fuel has been transferred to dry cask storage.

As a result of the past fuel failures and the resultant alpha contamination at HBPP Unit 3, an RP Consultant, who had previous experience as an RP Manager and Senior Reactor Operator on boiling water reactors and extensive decommissioning experience and knowledge of HBPP, was contracted to assist with setting up the alpha control program for the station before the start of decommissioning. In addition, the consultant had experience at DOE facilities dealing with alpha-emitting isotopes. As an RP Manager, the consultant had worked at both Rocky Flats and Hanford, facilities where significant alpha contamination occurred as a result of the DOE weapons program. During his time working for the DOE, the RP Manager received a US patent on the remote encapsulation of alpha-emitting radioisotopes. The implementation of the patent was used successfully to reduce the airborne concentrations in the Infinity rooms at Rocky Flats and the Plutonium Finishing Plant at the Hanford Reservation. The consultant's recommendations resulted in implementing protection and monitoring controls used successfully at DOE facilities. These included use of lapel samplers to monitor for personnel internal contamination, use of alpha continuous air monitors to warn workers if engineering controls had begun to fail, development of an empirical self-absorption factor for smear surveys to more accurately record actual alpha contamination levels, and training for the RP staff on the hazards and controls for alpha contamination work.

At the start of active decommissioning, the same RP Consultant was contracted to work with the work planners to incorporate RP controls into the work plans.

The RP organization specifically recruited a core group of both professional and technician level staff with prior alpha experience, mostly gained at DOE facilities. The three principal leaders of the RP department—the RP manager, the site closure manager, and the senior RP consulting engineer—have years of experience at DOE facilities or facilities that handle uranium and plutonium. Ten RP technicians, who were specifically hired for their DOE and alpha experience, were used as lead technicians or as foremen to help the remaining staff understand the complexities of protecting

workers from alpha-emitting isotopes. As a result of the decommissioning experience of the RP staff and the use of the specialty equipment at HBPP, the self-perform phase was completed with lower than estimated radiation dose, no internal uptakes of radioactive materials, and no violations of NRC regulations. The results of numerous NRC inspection reports are available as public documents.

In addition to the experienced staff of technicians recruited for the project, local personnel were hired, primarily as support labor to RP. They were given the opportunity to attend one of three after-hours RP training courses on their own time. Approximately 10 to 12 candidates completed each course after which they were task-qualified to work with the experienced RP technicians. As the project has progressed and radiological hazards decreased, these local-hired technicians have advanced to assume roles in RP, Count Room, and FSS organizations. Hiring local personnel has reduced HBPP's per diem budget while providing a stable work force and injecting money into local economy.

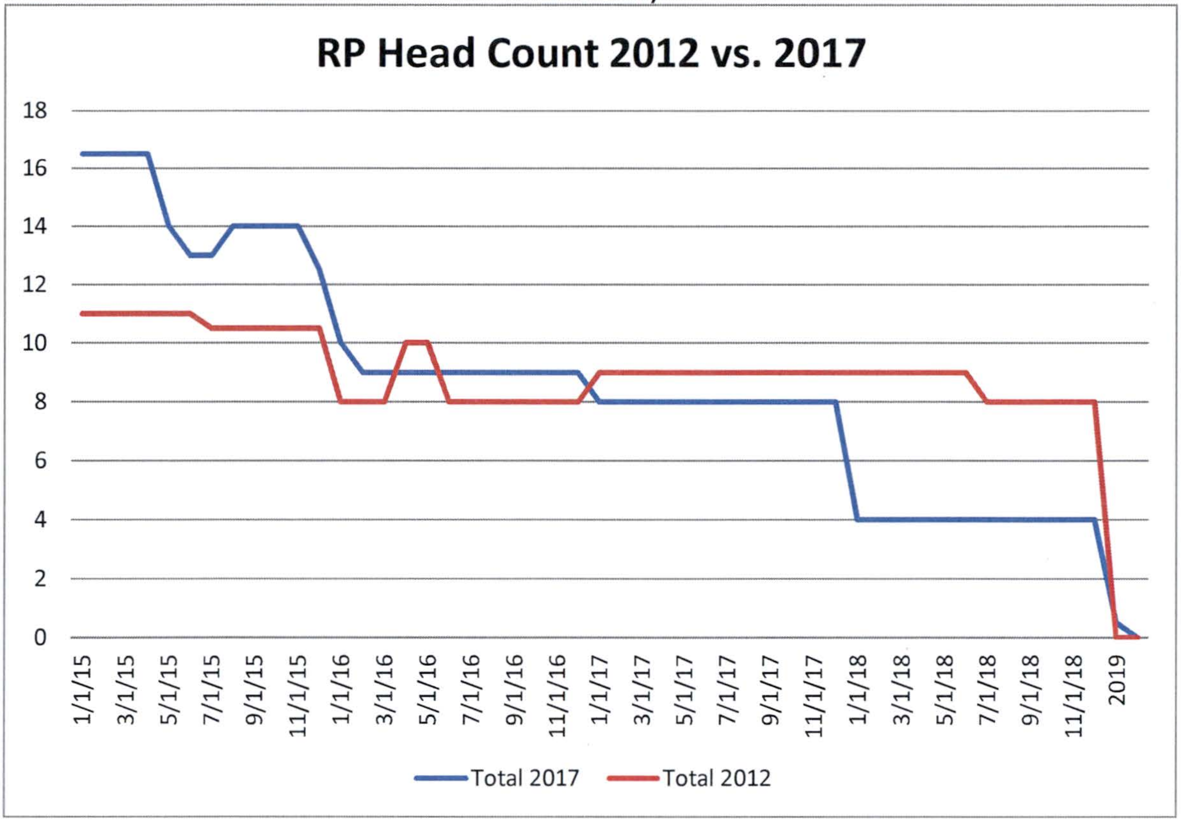
The RP organization began the triennium with approximately 17 positions performing assigned duties in the following functional areas:

- Dosimetry and RP Records Management Team
- RP Instrumentation Maintenance and Calibration Team
- RP Engineering Team
- Radioactive Material Control Team
- RP Operations Team
- RP Radiologically Restricted Area Access Control
- SAFSTOR radiological monitoring Team

As the radioactive materials (source term) have been removed and sent for disposal, the associated radiological hazard and risk have been steadily reduced. With the reduction in source term and risk, the staffing needed to monitor and control has also been reduced. The staffing levels are expected to slowly ramp down over the balance of the decommissioning.

Note that the current projection for RP staffing is higher than originally expected in the 2012 filing. The RPV and internals project, which was a radiologically significant project, required the retention of approximately four additional positions. The project finished in September 2015, with a corresponding ramp-down seen in the graph. In addition, the SFP cleanup and removal was accelerated in the schedule from 2017 to 2014/2015.

FIGURE 3.3.6— NDCTP RADIOLOGICAL PROTECTION STAFFING COMPARISON (2012 TO 2017)



The RP organization currently is divided into the following functional areas: As Low as Reasonably Achievable (ALARA)/Job Coverage; Instrumentation and Respiratory Protection; and Dosimetry. The RP organization structure is depicted in Attachment G.

The ALARA/Job Coverage functional area is responsible for writing Routine and Special Work Permits for work in radiological areas; providing Radiological Job Coverage; assessing and ensuring ALARA work practices; performing radiological surveys of work areas; prescribing and monitoring HEPA ventilation systems, HEPA vacuums, and associated alpha contamination controls; and revising procedures and programs. Also included are the RP General and Foreman and Access Control personnel.

The Instrumentation and Respiratory Protection functional area is responsible for Radiological Instrumentation, fixed and portable; revising procedures and programs; preparing, issuing, maintaining, decontaminating, and testing respiratory protection devices; fit testing; calibrating, issuing, and maintaining radiological measuring equipment (including meters, air samplers, and breathing zone air samplers).

The Dosimetry functional area is responsible for Dosimetry issue, retrieval, and processing; whole body counting; revising procedures and programs; generating reports to the NRC and State of California regulators; and generating dose reports for monitored employees.

The SAFSTOR team maintains the routine surveys required above and beyond the radiological monitoring for decommissioning work, including routine environmental thermoluminescent dosimeter (TLD placement and removal, routine radiological surveys of areas outside of the RCA, and monitoring fence line dose rates to verify that no measureable dose rates to members of the public are observed.

Operations Foreman

The overall responsibility of the Operations Foreman is to provide guidance to Radiological Control Technicians and Radiological Decontamination Technicians. The Operations Foreman provides radiological safety input for planning activities at the site and confers with cross-departmental supervision and management to ensure dose and safety goals are accomplished.

Radiological Control Technician

The Radiological Control Technicians' primary responsibility is to ensure the successful completion of the project while maintaining safety as the first priority. Personnel assigned to this position perform radiological surveys and use those data to ensure that personnel in the field are informed of the hazards and know the appropriate protective equipment and procedures to use while completing assigned tasks.

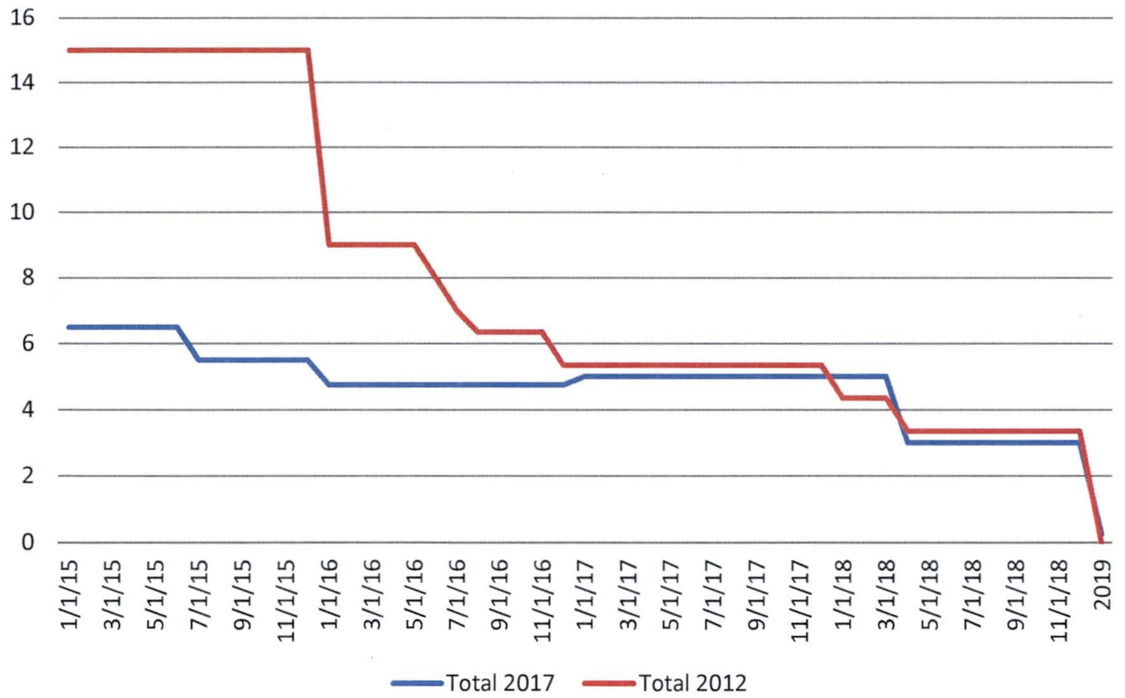
Radiological Decontamination Technician

The Radiological Decontamination Technician performs housekeeping and decontamination activities in all RCAs, excluding offices and restrooms. The Radiological Decontamination Technician operates various test equipment and machines, such as high-pressure washers, laundry machines, and RP meters, as needed. Due to the broad diversity of work activities in this classification, most individuals are required to certify to all Decontamination-specific tasks as directed by the PG&E RP department.

3.3.1.1.6 Environmental/Strategic Waste

At the beginning of this triennium, the Environmental and Strategic Wastes groups were merged into a single organization. This was done, in part, to reduce the overhead associated with multiple managers managing similar organizations. The organization began the period with approximately seven people on staff.

FIGURE 3.3.3— NDCTP ENVIRONMENTAL/STRATEGIC WASTE STAFFING COMPARISON (2012 TO 2017)



The Environmental organization is responsible for developing an environmental plan for the entire decommissioning project; testing for (non-radiological) chemical and physical hazards in the work areas; characterizing materials for recycling prior to shipping; characterizing materials for disposal or processing prior to shipping; identifying residual chemical and physical parameters around the site that prevent free release to public access; revising Environmental and safety procedures and programs; evaluating the need for and obtaining permits, and interfacing with stakeholders who have concerns about areas of Cultural, Paleontological, and Biological significance at the site and surrounding areas; developing surveillance and monitoring plans for areas of Cultural, Paleontological, and Biological significance; environmental sampling and remediation; sampling to support discharge permits (monitoring of National Pollutant Discharge Elimination System, or NPDES, and license-required parameters); generating and obtaining approval of revisions to the NPDES Permit as needed; environmental

sampling to characterize the site and waste streams; and developing remediation and site closure reports.

The Environmental Manager and Environmental Coordinator implement the Environmental functional area requirements. A Remediation Manager (reporting to the Environmental Manager) ensures proper execution of the Voluntary Cleanup Agreement (VCA) between PG&E and the California DTSC.

The Environmental Coordinator acts as a liaison between the PG&E Environmental organization, RP personnel, Emergency Response personnel, Biological Support contractors, Cultural Resources contractors, and the CWC environmental staff. His role extends to the PG&E Team, the CWC, and local offices of government agencies. He ensures that work teams are supported when environmental concerns arise during field work, and ensures HBPP meets compliance requirements specified within CDPs, US Army Corps of Engineers Wetlands Permits, the facility SWPPP, the Spill Prevention Control and Countermeasure Plan, and the Sewer Discharge Permit. Specifically, the Environmental Coordinator's duties include:

- Monitoring, reviewing, and tracking contractor work activities to ensure compliance with the various site environmental permits
- Coordinating biological, botanical, archaeological, and SWPPP consultants to maintain compliance with permits
- Providing guidance on meeting GWTS regulatory requirements
- Reviewing invoices related to the SWPPP
- Reviewing excavation permits and provide guidance on environmental compliance
- Reviewing reports and other submittals provided by consultants to ensure compliance with regulatory requirements
- Creating or revising procedures related to environmental compliance
- Coordinating with CWC environmental team
- Facilitating communication between project team members to help ensure efficient planning with regards to environmental compliance

The Environmental Coordinator will continue to support decommissioning activities through the conclusion of field work and major site restoration activities. Following field work and restoration, the Environmental Coordinator will ensure that permit requirements are complete, permits are properly closed, and appropriate records are archived. The Environmental Coordinator is forecast to depart the project at the end of 2018.

The Remediation Manager reports to the Environmental Manager and is responsible for implementing the requirements of the VCA between PG&E and DTSC. He monitors daily decommissioning activities at HBPP, and interfaces with managers, supervision, and craft to ensure VCA requirements are met during excavation and backfilling activities. He also ensures that workers are knowledgeable of contaminants in their work areas, and that any suspected contamination is properly evaluated and managed.

The Remediation Engineer supports the Remediation Manager. He was added to the site staff in February 2015 when excavation activities increased. His presence ensures that PG&E complies with the requirements of the VCA. Specific duties for the Remediation Engineer are:

- Tracking, inspecting, and soliciting informational updates regarding current excavations and soil stockpiles
- Investigating and preparing soil tracking information and analytical data for submission to the PG&E Records Management System
- Coordinating confirmation and investigative sampling activities with subcontractors and work face Job Supervisors
- Evaluating soil analytical data for reuse determination and providing recommendations to the Remediation Manager
- Performing excavation observation and oversight; tracking excavation progress for coordination with confirmation sampling activities
- Reviewing engineering drawings to locate and map underground utilities in planned excavation areas for use in development of Sampling Plans

The Remediation Manager will have an active role in the HBPP facility beyond the completion of decommissioning, as the requirements of the VCA will not be complete. However, the Remediation Engineer responsibilities will be significantly reduced when major excavation activities are complete, and he is forecast to depart the project in the third quarter of 2017.

Future work activities for Environmental personnel will be focused on the activities in the following subsections.

3.3.1.1.6.1 Storm Water Pollution Prevention

HBPP operates under the NPDES Construction General Permit. As such, HBPP is required to develop and implement an SWPPP to manage storm water that falls within the construction (decommissioning) areas.

The Environmental team monitors contractor compliance with SWPPP. This includes reviewing proposed site activities with subcontractors, the QSP, the Qualified Storm

Water Developer, and the Legally Responsible Person. The Environmental Coordinator will review work packages and Erosion and Sediment Control Plans (ESCPs) for compliance with permit and regulatory requirements.

In addition, the Environmental Coordinator will conduct daily ESCP checks to ensure that the site remains in compliance, assist with identification of problematic trends, and work with the project team to identify effective corrective actions. The Environmental Coordinator will be responsible for overseeing SWPPP recordkeeping and will also assist with coaching HBPP staff and contractors on SWPPP compliance.

The Environmental Coordinator will also act as a spill response coordinator for HBPP and will ensure that the site complies with the Spill Prevention, Control, and Countermeasures Plan (SPCC).

The Environmental team will interface with PG&E Environmental personnel at HBGS and at PG&E headquarters to migrate SWPPP program activities from the HBPP Construction NPDES Permit to the HBGS Industrial NPDES Permit as decommissioning activities conclude.

3.3.1.1.6.2 Coastal Development Permits

HBPP acquired nine CDPs for support of decommissioning activities. In some cases, compliance requires the acquisition of additional permits, such as California Department of Fish and Wildlife Incidental Take Permits, US Army Corps of Engineer Permits, and NCRWQB permits.

The Environmental Coordinator will review proposed site activities with subcontractors, the SWPPP team, and coastal-commission-approved biologists, botanists, and archaeologists. The Environmental Coordinator will also review work packages, and will attend strategic discussions, Transfer of Knowledge meetings, tailboards, and team meetings to assist with identification and resolution of potential CDP problems.

The Environmental Coordinator will coordinate biological, botanical, or archaeological assessments in support of CDP activities, as well as routine site maintenance activities, such as landscaping or maintenance of laydown areas. The Environmental Coordinator will be responsible for isolating sensitive resource areas to prevent adverse impacts from project activities.

The Environmental Coordinator will be trained by the coastal-commission-approved biologist to relocate frogs, snakes, and other animals encountered on site. When birds or larger mammals are encountered by HBPP personnel, the Environmental Coordinator will coordinate with the biologist to determine how to retain or relocate the animal, if needed.

The Environmental Coordinator will identify activities that will be occurring near sensitive resource areas and will instruct work crews regarding fueling practices, access paths, and response actions for wildlife encounters.

3.3.1.1.6.3 Voluntary Cleanup Agreement

In October 2009, PG&E and the California DTSC entered into a VCA. Eighteen tasks are identified in the agreement, as follows:

- Submittal of Existing Data and Scoping Meeting
- Additional Site Characterization
- Risk Evaluation and Cleanup Level Determination
- FS
- Remedy Selection
- California Environmental Quality Act
- Remedial Design and Implementation Plan
- Implementation of Final Removal Action Work plan
- Implementation of Final Remedial Action Plan (RAP)
- Implementation Report
- Changes during Implementation of the Final RAP/RAW
- Public Participation
- Land Use Covenant
- O&M
- Financial Assurance
- Discontinuation of Remedial Technology
- QA/QC Plan
- Health and Safety Plan

The Remediation Manager and Remediation Engineer are responsible for implementing the requirements of the VCA.

PG&E completed site characterization studies, but was not able to complete a FS and Remedy Selection prior to start of decommissioning activities. As a result, the DTSC approved an Interim Measures Remedial Action Work Plan (IMRAW) proposed by PG&E to govern the management of soil generated by the decommissioning project (ARCADIS, 2009). The IMRAW ensures consistency for managing soils excavated as a result of ongoing decommissioning and demolition activities in areas where chemical contamination may exist at the HBPP. To date, some of the soil that has been excavated during implementation of the HBPP decommissioning and demolition projects contained constituents of concern (COCs). Excavated soil with chemical concentrations exceeding the soil reuse screening levels established in the IMRAW has

been disposed off site, and cleanup of localized chemical contamination has been documented through confirmation soil sampling to verify that affected soil has been adequately remediated.

3.3.1.1.6.4Remedial Action Plan

PG&E submitted a draft FS and RAP (combined FS/RAP) to the DTSC on October 10, 2014, in conjunction with three additional reports: 1) Revised Additional Site Chemical Characterization Report; 2) Human Health Risk Assessment; and 3) Predictive Ecological Risk Assessment. During summer 2015, DTSC indicated it would complete its review of the Revised Additional Site Chemical Characterization, the Human Health Risk Assessment, and the Predictive Ecological Risk Assessment reports (these reviews were completed in October 2015), but that it wished to defer consideration of a final RAP until after decommissioning activities were completed. The primary reason for deferring consideration of the RAP was that, due to the high level of decommissioning activity and associated soil excavations, data summaries (such as the overall site characterization as summarized in the draft FS/RAP) quickly become out-of-date. Also, additional areas of localized chemical impacts previously unidentified can be discovered during ongoing excavations as subsurface structures are completely removed. DTSC has indicated that localized contamination can be effectively remediated in conjunction with decommissioning excavations as has occurred during excavations conducted to date pursuant to the IMRAW.

Following further discussions with DTSC, it was agreed that PG&E should continue to operate under the existing IMRAW as the decommissioning continues. DTSC intends to reconsider this issue at the end of 2016, but the general approach is to continue operating under the IMRAW through the end of decommissioning. At that time, updated overall site characterization and risk assessments will be prepared based on data that represent the current condition of the site after decommissioning activities and excavations are complete. Since all of the Potential Soil Remediation Areas proposed in the draft FS/RAP are located in areas that will be excavated or regraded as part of decommissioning or FSR activities, removal of these areas of soil contamination will occur pursuant to IMRAW requirements.

To ensure that remediation conducted under the IMRAW is consistent with final cleanup goals approved in the final RAP prepared after the decommissioning is complete, DTSC will work with PG&E to administratively update soil reuse screening levels for upland areas currently established in the IMRAW, as well as to develop applicable screening levels for soil reuse in lowland, wetland, or habitat areas during FSR activities. In addition, PG&E will revise and resubmit the Predictive Ecological Risk Assessment to

DTSC in late 2016 in order to complete the evaluation of whether chemical impacts in any of the habitat areas poses any significant risk to ecological resources.

COCs on site may also include radiological constituents such as Cs-137. However, the cleanup of radiological contamination is being performed under the regulatory oversight of the NRC as part of its license termination process.

3.3.1.1.6.5 Site Restoration

At the conclusion of all Civil Works activities, PG&E must reconfigure the property for future use, in support of ISFSI and HBGS operations. Reconfiguration of the PG&E property will occur in a phased manner at various locations as decommissioning activities are concluded. Property not dedicated to operational activities will be redeveloped in accordance with the FSR Plan, and will be developed to meet the following objectives:

- Implement mitigation prescribed in previously obtained permits
- Restore portions of property to natural conditions
- Reroute or repair drainage and grade site as needed to maximize implementation of Low Impact Development (LID) measures
- Reroute, repair, or remove communications and other infrastructure on property
- Enhance existing natural areas on the property to improve wildlife habitat and connectivity and restore native vegetation

The Environmental Manager and Environmental Coordinator will interface with contractors and regulatory agencies to ensure success (via monitoring and adaptive management) of the objectives of the FSR and to ensure that all permit requirements are met. At the conclusion of FSR activities, they will ensure that all permit completion activities are properly documented, and appropriate correspondence is completed.

3.3.1.1.6.6 Strategic Waste

The Strategic Waste group maintains a staff of three Waste Management Professionals. Within this group, one individual is specialized in Radioactive Waste, one in Hazardous Waste, and one is experienced in both areas. The team provides a robust source of talent for oversight of waste management practices at HBPP, the packaging of waste materials for disposal, and preparation of required shipping papers and notifications when waste material is shipped from HBPP. These responsibilities span the requirements of the Federal and State Hazardous Waste Management regulations, the Federal Toxic Substances Control Act, the NRC waste management regulations, and the Federal and State highway transportation regulations.

Additionally, this team interfaces with transportation and disposal vendors to ensure that the HBPP service needs are met, and that the vendors continue to meet HBPP performance expectations. Each year, this team obtains export permits from the Southwest Low-Level Radioactive Waste Compact, for radioactive waste leaving California.

The Strategic Waste Management organization is responsible for coordinating waste transportation, treatment, and disposal with vendors, reviewing and approving shipping papers for waste shipments, evaluating securement practices for waste shipments, completing waste disposal permits and reports for regional waste disposal compacts and hazardous waste management reporting, and maintaining updates to the California Hazardous materials Business Plan.

As waste material is generated during decommissioning, waste management personnel interface with work crews and waste handling personnel to ensure waste materials are efficiently packaged for disposal. This includes planning and oversight to ensure container weights and volumes are optimized in order to minimize the total number of waste shipments, and ensuring that waste packaging is aligned with disposal facility acceptance criteria to avoid non-conforming shipments and additional fees. Additionally, they ensure the continued movement of waste materials off the HBPP site, as an excessive backlog of waste material on site could force a suspension of decommissioning activities.

The staffing plan anticipates that the three Waste Management Professionals will be required to oversee waste activities until completion of major excavation activities, which is expected to coincide with completion of caisson removal. At that time, a reduction in waste volumes being produced and shipped will allow a staffing reduction. Given this understanding, HBPP staffing plans assume that two of the three Waste Management Professionals will depart the project during the third quarter of 2017. The remaining Waste Management Professional is expected to remain on the project until completion of major site restoration activities at the end of 2018.

3.3.1.1.6.7 Waste Shipments

In 2015, the HBPP decommissioning project completed nearly 1000 waste shipments.

Table 3.3.4 – DECOMMISSIONING WASTE SHIPMENTS

	Actual Shipments						Forecast Shipments			2012-2018	2009-2018
	'09-'10	2011	2012	2013	2014	2015	2016	2017	2018		
Number of Shipments	126	312	175	288	446	998	1,004	1,099	511	**4,521**	**4,959**

Waste management professionals will be actively engaged in coordinating the shipping activity with the CWC, the transportation companies, and the disposal facilities. Additionally, staff will ensure that shipping documents are properly prepared, that proper permits are in-place, and that import/export licenses are acquired in support of the shipping activities.

During 2016, major waste generating activities will be the RFB demolition, initial caisson excavation, and intake canal excavation. Caisson excavation will continue into 2017. Once caisson excavation is complete, the potential for radioactive waste generation will be reduced to a level where oversight expertise should no longer be required, and the project anticipates a Strategic Waste staffing reduction at that time.

3.3.1.1.6.8 NRC Exemptions

PG&E obtained three exemptions from NRC for waste material disposal at the Grand View, Idaho, facility. Within those exemptions, NRC established performance requirements that HBPP must meet, including total volumes of waste material, total amount of activity disposed, and total shipments of liquid waste. The Strategic Waste staff will ensure HBPP compliance with the exemption requirements.

3.3.1.1.6.9 Asset Recovery

The Waste Management staff will interface with PG&E asset recovery personnel to identify materials that are no longer usable at HBPP, but that still have value. These items will be evaluated for asset recovery opportunities.

3.3.1.1.6.10 Waste Management Compliance

While waste materials are accumulated and packaged on site, the Strategic Waste staff will perform compliance reviews of accumulated waste material, to ensure compliance with waste management regulations. This includes regulation of radioactive waste by the NRC, Hazardous Waste by the US EPA, and California Hazardous Waste by the California EPA.

3.3.1.1.7 Site Closure (License Termination Survey)

The Site Closure organization is responsible for ensuring site characterization and Historical Site Assessment and LTP consideration during decommissioning; maintaining and submitting updates to the LTP; ensuring performance of turnover surveys when decommissioning or remediation of an area is complete to confirm compliance with building, soils, and groundwater Derived Concentration Guidelines (DCGL) for future

FSS; performing and documenting the surveys; revising procedures and programs; coordinating with NRC oversight; and generating reports to the NRC and State of California regulators. Site Closure has also assumed responsibility for the Count Room as discussed later in this section. The Site Closure/FSS organization is depicted in Attachment H.

This organization is managed by the Site Closure Manager. Within this functional area, a project lead developed the LTP to radiologically release the site for unrestricted use. The LTP is an application that is submitted to the NRC for an amendment to Facility Operating License No. DPR-7 for HBPP, Unit 3. Submittal of the LTP to the NRC for approval is required at least two years prior to license termination. It provides detailed site characterization, descriptions of remaining dismantlement activities, plans for site remediation, technical data for development of site-specific DCGLs, methods for FSS of excavated soils for reuse, detailed plans for the final radiological survey, description of the end state of the site, updated site-specific estimations of the remaining decommissioning costs, and an update to the site environmental report. Based on experience gained from other decommissioned sites, submittal of this plan as early as practical has facilitated early end-state decisions and provided for stakeholder involvement.

The LTP was submitted to the NRC in May 2013. NRC requests for additional information on the LTP submittal were addressed with the NRC through early 2014. PG&E has continued to assist the NRC with its environmental assessment for its approval of the LTP. The License Amendment Request (LAR) proposes to add License Condition 2.C.5, which approves the LTP.

Releasing the site from its Part 50 License follows a rigorous survey process that requires specialized skill sets and substantial and accurate documentation under a quality-related program. The MARSSIM approach to final status uses a graded approach to determine if a survey unit meets the release criteria. In other words, the greater the potential for contaminants to be present in concentrations at, or above, the DCGLs, the more demanding the survey. The more demanding survey translates into more complicated and time-consuming preparation and development, survey performance, and evaluation activities. MARSSIM uses three classifications to dictate the level of effort of survey, Class 1 being the most rigorous and Class 3 being the least rigorous. Survey unit release can be divided into four phases:

- Phase 1 Remediation—In this phase, the soils or building surfaces are remediated until there is a high degree of certainty that the survey will pass the FSS. No remediation may be required for Class 3 units, while Class 1 units may require a substantial amount of effort. Class 1 units can take four weeks or longer

to remediate. Remediated soils are sampled to determine if the levels are below the DCGL and to determine the appropriate disposition (e.g., reuse for backfill or shipment for burial). Historically, Class 2 and Class 3 units should require little to no radiological remediation. Once the survey unit has been successfully remediated, it is turned over to the FSS group who will initiate isolation and controls.

o

- Phase 2 Planning—The planning phase typically is performed in concert with the remediation phase, provided the original configuration and classification of the survey unit remains unchanged. During the planning phase, the following sequence is followed to develop the FSS package:
  - The survey unit is delineated by GPS and a .dwg file is created in AutoCAD. The time to complete the survey is dependent on the complexity of unit, but three days is the minimum.
  - The Data Quality Objective process is started for the package.
  - Appropriate characterization data for the unit is determined and entered into the package.
  - Based on the characterization data, the number of samples is determined in accordance with RCP FSS-7.
  - The locations of the samples are determined by importing the .dwg file into the Visual Sample Plan (VSP)[4] software.
  - Survey instrument Minimum Detectable Concentrations (MDC) and Lower Limit of Detection (LLD) are calculated and entered into the package.
  - Investigation levels are determined for the survey.
  - General and specific instructions for the performance of the survey are developed.
  - A prospective power curve is developed to ensure that sufficient power exists in the survey to pass the unit.
  - Once the package is complete, it is sent for a review by another FSS Engineer. Package development time is about one week for a simple survey unit such as a small Class 3 excavation. More complex units, such as a Class 1, may take two weeks or more to complete. The peer review typically takes a minimum of one week to complete. During this review, all data and calculations are verified as well as assumptions, instructions, and other items. Once all comments and questions are reconciled for the peer review, the package is sent to the Site Closure Manager for review and approval. As in

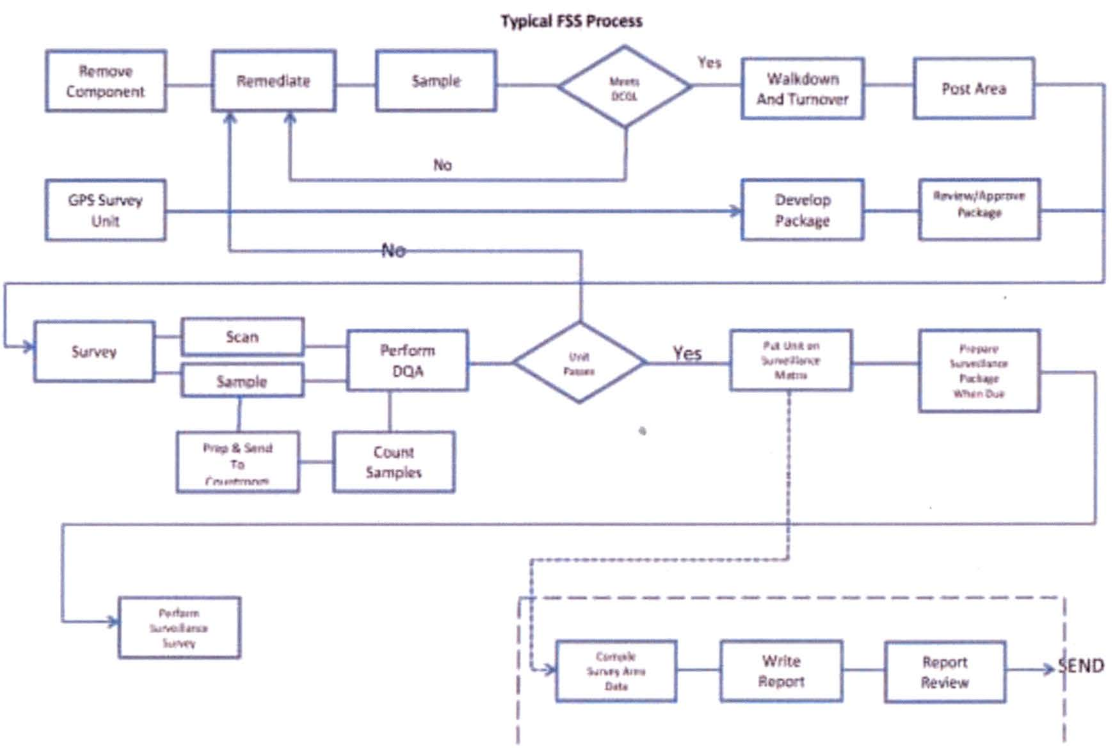
[4] VSP is a software tool that supports the development of defensible sampling plans based on statistical sampling theory and the statistical analysis of sample results to support confident decision making. It was created by the Pacific Northwest National Laboratory, a division of Battelle.

the peer review, all comments and questions are reconciled. This review and approval time varies as well, typically with a one-week minimum. To ensure quality in the data being reported, this work is performed under the FSS Quality Assurance program.

- Phase 3 Survey—The time required to perform the FSS is dependent on the complexity of the survey unit. Following are factors affecting the survey time:
  - *Configuration of the survey unit.* Simple survey units such as a small excavation like the Circulating Water Piping or a Class 3 building typically will take a week to complete. Heavily remediated Class 1 areas may take several weeks to complete. Piping surveys typically take in excess of a month to perform, due to the complexity and instrumentation used.
  - *Survey instrumentation used.* Hand-held detectors are straightforward and require minimal setup time. However, there will be instances where it is not practicable to use these and the In Situ Object Counting System (ISOCS) will be required to perform scans. The ISOCS system relates direct gamma-spectroscopy-obtained data to concentration levels in the soil for surface area scans using the system. The ISOCS requires more maintenance and setup time for operation, due to needing more mechanical support for cranes, which in turn requires more operators and riggers. Use of the ISOCS, therefore, will extend the time required to perform the survey.
  - *Weather-related factors.* Heat and cold have a relatively minimal effect at HBPP. However, because the scanning process depends on electronics, surveying during the rainy season will be problematic. Rain also impedes access to excavations, due to slippery conditions, as well as presenting a water-control issue. In addition, storm water run-off and groundwater in excavations may also potentially cross-contaminate areas that are remediated, and careful planning, timing, and consultation with FSS is required to mitigate this risk.
  - *Survey investigations.* If a large number of investigations are triggered during the survey, the survey time will be extended. Investigations may be due to either the presence of an abundance of naturally occurring radioactive materials or the presence of plant related activity.
  - *"Piggy backing" of complex survey units.* Complex survey units will typically require the use of the entire FSS survey staff. If, due to unforeseen circumstances, two or more complex units are to be surveyed simultaneously, then the survey staff will be reduced in each unit, resulting in a longer time to survey.

- Phase 4 Data Analysis—The data analysis phase consists of a review of the survey and all data generated to verify that the survey was performed as written and the data were of sufficient quantity and quality to support the assumptions of the survey. Graphical representation of the data is generated for inclusion in the final report for the survey area. Figure 3.3.7 depicts a typical flow path for a simple Class 3 area. The numbers above certain tasks represent the average time, in days, for the completion of that task. The numbers in black represent FSS surveyor's time, and the numbers in red represent FSS Engineer's time.

FIGURE 3.3.7—TYPICAL FSS PROCESS



- Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual
-

Because of the similarity between MARSSIM and MARSAME, the FSS group also prepares packages and performs surveys for disposition of various types of material and equipment that are to be released from the site. Much of this work was performed during the demolition of the fossil units on the HBPP site. However, even during the Unit 3 decommissioning, there are times when it is beneficial to use the MARSAME process to better plan and document surveys to disposition items such as office trailers, major pieces of equipment, or building debris. Like MARSSIM surveys, the MARSAME surveys are quality records subject to NRC oversight.

NRC Oversight of the FSS Process

During decommissioning, FSS staff coordinates with the NRC, which independently reviews the process. Routine conference calls and periodic meetings are scheduled to update the NRC on decommissioning progress and anticipated future FSS survey work. The NRC will, at times, request that split samples be sent to its contractor for independent analysis. Additionally, its contractor will at times be present on site to observe FSS performance and perform independent measurements of areas being surveyed.

Survey Unit Documentation and License Termination

Once all survey units within a given larger survey area are complete, a submission report is developed for providing all documentation to the NRC for review and approval. To assist in the data review, extensive site mapping and geospatial representations with overlaid sample data are developed for the final area report. Once again, a quality check process of the entire area report is utilized prior to submittal to the NRC. During the NRC review, requests for additional information are answered by the technical FSS staff.

Once all survey areas have been submitted and approved by the NRC, an LAR for the termination of the 10 CFR Part 50 license is developed and submitted to the NRC for approval. Requests for additional information must be addressed during the review of the LAR and any final survey area packages submitted along with the LAR.

To implement the above processes, the following key staffing positions for this functional area are required:

- Final Status Survey (FSS) Consulting Engineer
- FSS Engineer
- FSS Report Writer
- Operations Foreman
- Radiological Control Technician/FSS Technician

- Radiological Decontamination Technician/FSS Labor

Count Room

The responsibility for measuring the radiological constituents of samples taken in the field was originally assigned to the RP organization. Since the major radiological source terms have been removed and the residual concern is for measuring at an environmental background, the responsibility was shifted to the Site Closure organization. The Count Room Supervisor supervises and coordinates the activities of foremen and laboratory technicians to ensure work in the laboratory is performed safely, correctly, and in a timely manner. The Count Room functional area is responsible for: analyzing radiological constituents of work area and environmental samples; calibrating and maintaining instrumentation; bioassay sampling (due to potential intakes of transuranics); assessing internal and external doses; evaluating emergent radiological hazard; developing ALARA reviews and controls, coordinated with Engineering/Project work packages; evaluating post-decommissioning building and area status relative to DCGLs for buildings, soils, and groundwater; revising procedures and programs; and generating reports to the NRC and State of California regulators.

Count room staffing began the triennium with approximately seven personnel assigned and remains constant through 2018, with decreases toward the end of 2019 as the field work requiring samples ends, records are closed out, and the count room is shut down.

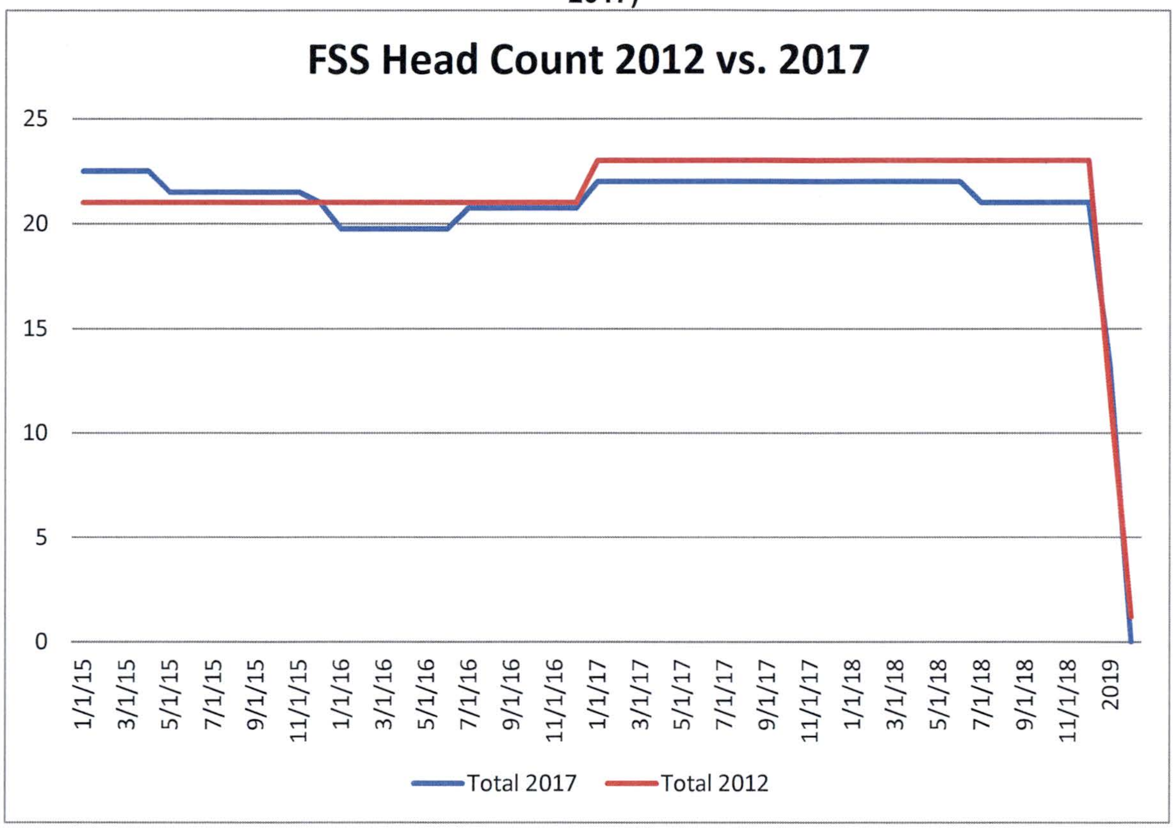
Final Status Survey Staffing

The FSS is staffed by experienced site termination personnel, both professionals and technicians. Within the group, there is experience from SONGS Unit 1, Yankee Rowe, Fermi 1, Maine Yankee, Connecticut Yankee, and various DOE and research reactor and facility decommissionings. In addition to the experienced personnel from other decommissionings, local-hire personnel who were trained and qualified by the RP group have been transferred to FSS and aligned with experienced personnel for additional qualification to supplement the experienced core group of technicians.

Staffing levels at the beginning of the triennium were approximately 23, which is slightly higher than expected in the 2012 filing. Management actively reviewed the survey plans and administrative requirements to confirm the need for a sustained staffing level. The review identified approximately five positions that were unnecessary for about a one year period and that, after that period, the ramp-up did not need to be as steep. Accordingly, the 23 positions were temporarily ramped down to approximately 20 after RPV removal, and then ramped back up to 21 at about the mid-point of caisson removal. The increase coincides with increased sampling required to confirm the radiological status of the soils remaining around the caisson and to clear any caisson

rubble for reuse. The next ramp-down coincides with completion of site restoration at the end of 2019, then decreases through the year to just a few persons in 2020, depending on the workload associated with responding to license termination questions. The staffing reevaluation resulted in a savings for labor of about 7 percent. Figure 3.3.8 shows a comparison of the levels submitted in the 2012 filing with the current predictions going forward.

FIGURE 3.3.8— NDCTP FINAL STATUS SURVEY STAFFING COMPARISON (2012 TO 2017)



Final Status Survey Consulting Engineer

The overall responsibility of the FSS Consulting Engineer is to advise the FSS Supervisor on technical matters regarding the development and operation of the FSS program. This position is responsible for developing and maintaining procedures, processes, Technical Basis, license bases, and license termination plans and documents. The FSS Consulting Engineer advises management and staff on preferred

means and methods for interfacing with stakeholders and regulatory agencies and for completing assigned tasks.

Final Status Survey Engineer

The overall responsibility of the FSS Engineer is the planning and development of Survey Package(s) and supporting documentation (i.e., technical position papers, procedures, work instructions, and calculations). This position is responsible for developing and maintaining procedures, processes, and plans for executing MARSSIM-compliant implementation strategy(s) for effective FSS of the HBPP footprint, including open land areas and building surfaces, and compiling associated data and reports.

Final Status Survey Report Writer

The overall responsibility of the FSS Report Writer is the preparation and packaging of FSS-related documentation and data required to support license termination. The FSS Report Writer assists the FSS Engineer(s) and FSS Consulting Engineer in the preparation of Survey Packages and other FSS Program documentation, including regulatory submittals, LTP, and Data Quality Analysis reports.

Final Status Survey Foreman

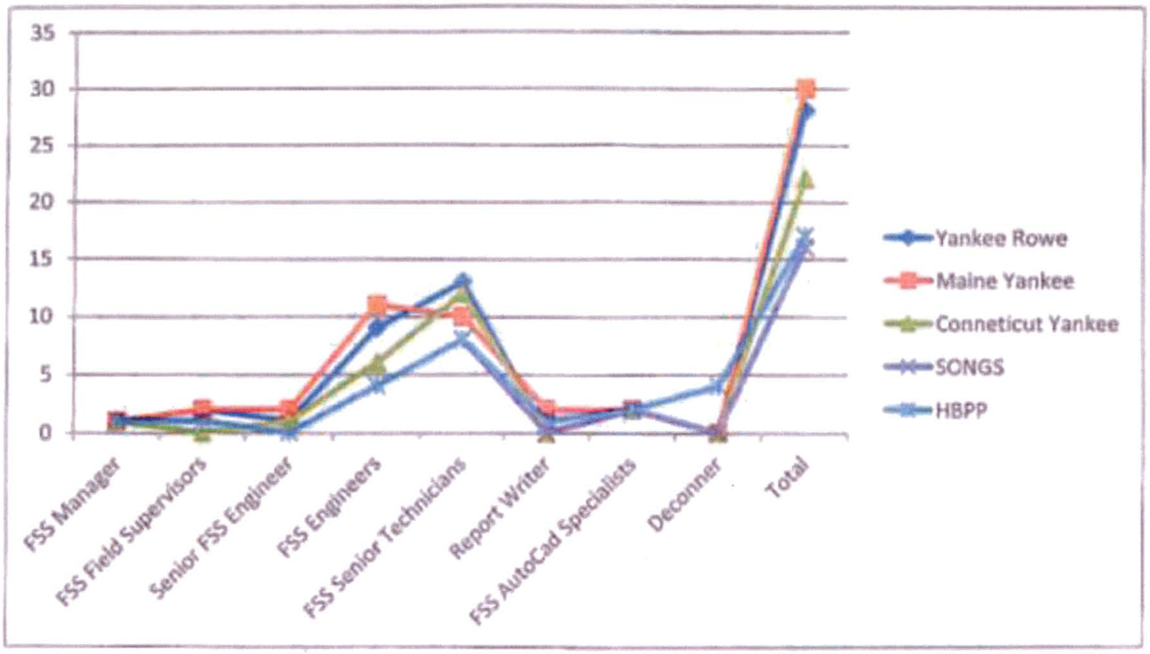
The overall responsibility of the FSS Foreman is to provide guidance to FSS Technicians. The FSS Foreman provides radiological safety input for planning activities at the site to and confers with cross-departmental supervision and management to ensure dose and safety goals are accomplished.

Final Status Survey Technician

The FSS Technician's primary responsibility is to ensure the successful completion of the project while maintaining safety as the first priority. Personnel assigned to this position perform radiological surveys and use those data to ensure that personnel in the field are informed of the hazards and know the appropriate protective equipment and procedures to use while completing assigned tasks.

Figure 3.3.9 shows the FSS manpower that PG&E will require to complete the decommissioning effort, compared to the manpower required by other nuclear decommissioning projects completed recently.

FIGURE 3.3.9—HBPP FINAL STATUS SURVEY MANPOWER BENCHMARKED AGAINST INDUSTRY



To implement the FSS program at HBPP, PG&E developed the following new Quality Program procedures:

- RCP FSS-1, Survey Unit Classification
- RCP FSS-2, Preparation of FSS Survey Plans
- RCP FSS-3, Final Status Survey Background Assessment
- RCP FSS-4, Isolation and Control of Areas for Final Status Survey
- RCP FSS-6, Operation of the Leica Geosystems GPS
- RCP FSS-7, Determination of Number and Location of FSS Samples
- RCP FSS-8, Collection of Site Characterization and FSS Samples
- RCP FSS-11, Split Sample Assessment for FSS
- RCP FSS-13, Area Surveillance Following FSS
- RCP FSS-14, Data Quality Assessment
- RCP FSS-15, Statistical Tests
- RCP FSS-16, ALARA Evaluations for FSS Areas
- RCP FSS-17, Preparation of FSS Survey Reports
- RCP FSS-18, Computer Determination of Number and Locations of FSS Samples

3.3.1.2 Programs

Programs are those activities that are required by regulation, license, or the company in order to ensure that the decommissioning is accomplished safely and efficiently. While there are many such programs in operations at HBPP, the ones that have the most financial impact include implementing and maintaining the Corrective Actions, Enterprise Risk, Work Control, and Procedure Manual Programs.

3.3.1.2.1 HBPP Decommissioning Corrective Action Program

HBPP's 10 CFR Part 50 license requires that PG&E develop and maintain a CAP. PG&E's CAP is compliant with NRC regulations. At HBPP, PG&E utilizes a function within the SAP enterprise risk management software known as "SAP Notifications" to identify, track, and resolve issues potentially requiring corrective action. Each worker at HBPP has access to SAP Notifications, either directly or through their Supervisor.

The CAP is used to document deficiencies and errors that could affect worker and public safety, the environment, or compliance with regulatory requirements. It is used to identify declining performance trends and lessons learned, and it provides a vehicle for effective management action to improve overall performance. The CAP classifies problems based on significance, risk, and consequence, and it uses tiered analysis methods to identify causes and effective corrective actions.

The effectiveness of the CAP is dependent on the participation of the work force to identify and report problems, and on leadership to address and correct any problems. Management must make a strong commitment to train staff and to develop a safety culture where problem reporting is viewed as a tool to improve performance, rather than a punitive function to identify poor performance. From the worker in the field to the supervisor, the CAP coordinator, and the management team, everyone has a role and responsibility that is defined in implementing procedures. There is a requirement and expectation that problems are reported and addressed in a timely manner, and this is closely monitored in monthly CAP performance metrics. Additional CAP oversight is provided through the Management Observation Program, Quality Assurance audits, and NRC inspections.

From before the start of decommissioning, HBPP successfully implemented an effective CAP that has contributed to the overall safe and compliant decommissioning progress. The CAP has also identified adverse trends of recurrent minor problems that indicated the need for further analysis and extended corrective actions.

Another challenge and success of the HBPP CAP has been the integration of primary and sub-contractor work forces in the CAP. Various contractor personnel, often without

previous CAP experience or a skeptical attitude, have embraced the program and integrated it into their own programs. CAP metrics have shown healthy performance in problem identification and resolution, and in meeting self-imposed performance goals.

3.3.1.2.2 Enterprise Risk Program

At the Corporate Risk Management program level, the HBPP Decommissioning Manager supports and participates in the Corporate Risk Management Vision and Strategy, as well as the Enterprise and Operational Risk Management (EORM) System. The Decommissioning Manager ensures that the decommissioning risk process complies with specific EORM risk management requirements applicable to the decommissioning project. The Decommissioning Manager further ensures that identified high-risk items are addressed at the EORM level and that the required risk data form is entered into the EORM database (ECTS-Risk).

At the project level, the HBPP Decommissioning Project Team has developed, implemented, and executed a functional and effective Risk Management Program. The Decommissioning Project Risk Management Program (DRM) provides for systematic evaluation and management of decommissioning Work Process and Work Process Activity risk elements. It provides a methodology for identifying, evaluating, assessing, mitigating, tracking, and reviewing Decommissioning Work Processes and Activities that pose a potential risk to the public, the employees, or the Company. The DRM process integrates management, safety, engineering, Subject Matter Experts, and workers into risk identification and evaluation, risk response planning, risk monitoring, and periodic risk review and reassessment.

DRM has successfully integrated the essential elements of several available risk management resources into a coherent and productive risk management process. Those resources include the Corporate EORM Program, the existing HBPP Risk Management Program, HBPP Industrial and Occupational Safety Programs, HBPP RAD Safety, Environmental safety, Systems Safety Engineering, and subject matter experts. This integrated Risk Management process has resulted in outstanding safety performance and demonstrable risk reduction throughout the decommissioning process. Finally, DRM products have facilitated several major design and process changes that have proven to be beneficial to the project's safe and environmentally sound production performance.

The Corporate Risk Management Program Vision, as it relates to the HBPP Decommissioning project, is a consistent, comprehensive, transparent, rigorous, and integrated data-driven, risk-based decision-making process. The Corporate Risk

Management Strategy implements the EORM Program to address risk governance, identification and evaluation, response, monitoring, and review.

HBPP has achieved H&S residual risk forecasts in RPV removal and facility and utility decommissioning to date. HBPP is on track to achieve forecasted residual H&S project risks with regard to future waste transportation and caisson removal activities. The following are benchmark highlights of waste transport and caisson removal risk reduction and risk mitigation progress:

- HBPP has driven public safety and industry benchmarking in the decommissioning of HBPP facilities and continues that drive early in the design phase for caisson and subsurface structure removal. Subject matter experts knowledgeable in water cutoff walls and SOE are on contract to provide oversight. PG&E requested the contractor to benchmark seismic design criteria with other recent projects and evaluate the application of those methodologies at HBPP. Key decisions were made (e.g., to eliminate installation of steel ring beams and leave SOE in the ground) to eliminate hazard scenarios and reduce personnel hazard exposure time during caisson excavation. Continuing situational awareness with regard to this project and its inherent environmental risks, and potential construction and personnel risks, have led the Contractor to design sufficient length into the new CSM equipment to reach the F Clay layer (170 feet below grade). This eliminates the risk of having to work heavy equipment and personnel in potentially unstable soil conditions.

- Caisson removal design changes that integrate water cutoff wall design with excavation support have resulted in the reduction of the Risk Impact Scores associated with the removal process. The rescore is being done by the Decommissioning Manager upon recent completion of integration of the water cutoff wall design with SOE by the Contractor and maturity of design development that has been approved through two RRB meetings at HBPP. Appropriate independent oversight has been provided by PG&E (the Engineer of Record for the caisson feasibility removal study) and Subject Matter Expertise consultation on water cutoff and SOE.

3.3.1.2.3 Work Control

Decommissioning work control is an approved program that meets NRC requirements for decommissioning a nuclear licensed facility. The Work Control Program (WCP) for the PG&E self-perform work was defined in Humboldt Bay Administrative Procedure HBAP C-45, Work Control Process. This procedure met regulatory requirements, and it brought together site programs, requirements, and the decommissioning strategy to

provide detailed instructions for execution of physical work in the field. The primary program objective is to assure work is performed safely, with exposure kept ALARA and no adverse impact to the public or environment.

As the site transitioned from self-performed work to a civil works project, the work control process had to transition, too. A new procedure, HBAP C-17, Work Control Process for Civil Works Projects, was developed for use by the primary CWC. HBAP C-17 also contains the necessary regulatory elements and site programs to assure safe and effective decommissioning. It also provides the interfaces between PG&E and the CWC to ensure work planning meets contract requirements, through PG&E review and approval of contractor submittals.

All site work is now under the HBAP C-17 civil works program. HBAP C-45 was also necessary to complete remaining self-perform work.

Trained Work Planners with decommissioning experience are a key element of the WCP. They create work packages through systematic planning and documented coordination with all affected organizations to assure safe and compliant decommissioning. Planners use their experience to provide valuable lessons learned and best practices developed through trial and error and events at other sites. They provide an experienced perspective to the planning strategies, decommissioning sequencing, and preparation work.

Early strategic planning provides opportunities to identify preparatory work or infrastructure investments that can maximize proficiency and minimize hazards and other impacts. For example, the up-front investment to install fabric buildings manufactured by the Rubb Group (hereafter referred to as "Rubb tents") for waste management areas had significant dividends. The tents provide an area to dry and stockpile excavation spoils for disposal shipment or later use. They reduce environmental and radiological cross-contamination risks, and provide significant cost saving over having to dispose of wet soils and using other methods to manage large volumes of waste within a small site footprint.

Work planning interfaces with a wide range of programs, regulations, organizations, and concurrent work activities to develop a work package ready for field execution by various contractor craft. Comprehensive planning draws from the broad experience and expertise of all disciplines and assures that critical program elements are captured. Benefits are realized across the board, from the site's excellent safety and exposure record, to industry-leading decommissioning successes and practices that are internationally recognized. Key elements and considerations of the work planning process include:

- Strategic planning
- H&S
- Environmental protection
- NRC License Basis Impact Evaluation
- Design engineering and configuration control
- Operations and Maintenance
- RP
- Radiological waste packaging, transportation, and disposal
- FSS
- Cost and scheduling
- Quality Assurance Program
- Safety Clearances
- Excavations and ground penetrating controls
- Post Maintenance and Modification testing
- Contract work forces
- Hazardous material abatement and controls
- Permitting
- CAP
- Rigging and Lifting
- Temporary power
- Fire protection and loss prevention

The HBPP Unit-3 decommissioning project is continually challenged with unique features and issues due to the age of the facility, radiological conditions, operating history, small site footprint, competing projects, area weather, and proximity to operating units. These challenges require many innovative and first-of-a-kind work evolutions, close coordination with multiple agencies and site organizations, and interface with operating facilities and active Unit-3 equipment. Some of the challenges include:

- Innovative and first-of-a-kind CSM wall for the caisson removal had to consider significant risks, such as fire and earthquake hazards
- Complex design of a restricted space ventilation system for caisson removal that uses computer models to address personnel air quality and heavy equipment exhaust
- Critical increase of the capacity of the GWTS to handle predicted El Niño rainfall increases, while maintaining the system in operable condition
- Unique design of a hanging staircase for caisson entry and exit that can manage changing excavation elevations

Work Planners prepare work packages that contain detailed instructions, drawings, and procedures necessary for the craft to execute the work safely and effectively. Support organizations are engaged in the planning process to assure that proper controls and permits are addressed, and necessary resources, equipment, and materials are staged and ready. Engineers provide technical evaluations and design changes in support of the work plans.

The overall development and approval of work plans often requires complex sequencing and coordination. For example, the installation of sheet piling and the coastal trail

relocation to facilitate outfall canal work required cross-organizational coordination to address potential environmental impacts and to minimize public trail closures.

Most planning involves coordination with the waste group to receive, survey, package, and ship waste, and with the FSS team to avoid cross-contamination. Specific controls are implemented by Environmental to evaluate hazardous material such as asbestos and mercury, to assure proper personnel protection controls, and to prevent generation of mixed waste. Work in yard areas requires excavation permits that provide controls to prevent contact with active systems, mixing of spoils with clean material, and proper environmental BMPs. Planning must consider natural challenges for the area such as the high rainfall average, near-surface water table, and tidal effects that increase the risk of flooding.

While work planners prepare packages to support work well ahead of the work execution schedule, they are also fully engaged in active work execution. They conduct transfer-of-knowledge tailboards to provide craft with the overall planning strategy and methodology used to develop the plan. This is effective to build teamwork, to reduce replanning, and to engage craft knowledge. Planners engage the craft to help resolve unknown conditions and configurations in the plant, and both parties are involved in problem solving and work plan modification as needed. The gained experience and lessons learned are incorporated into work plan development, which contributes to decommissioning successes.

While high-risk or unique activities require specific planning, a population of standardized work packages and engineering evaluations was developed for routine activities and minor site or equipment maintenance. These activities are controlled under separate approvals, requirements, and funding. This type of preplanning reduced overall burden and impact on the planning organization.

Starting from the early phases of decommissioning, through transition to OAD, the WCP continues to evolve to meet the challenges of unique HBPP hazards, non-nuclear-experienced craft, first-of-a-kind work evolutions, lessons learned, unsafe events, and trends. The WCP underwent significant revisions following safety stand-downs where craft and management came together to identify program weaknesses and improvements. Changes continue to evolve for transition to a civil works project.

Work control training is provided for decommissioning personnel as part of their required training profile. The training is an overview of the entire planning process, from conceptual planning through package completion. It describes work package development and review, transfer of knowledge meetings between planners and job

supervisors, management and control of the packages in the field, and final work verification and closure.

Procedure writers are integrated into the WCP to develop and revise procedures that are an integral part of the work package planning and execution. Approved procedures provide detailed instructions for many repetitive or complex tasks performed during decommissioning activities. Procedures are necessary to implement the NRC license basis such as the Quality Assurance Plan, the Fire Loss Protection and Prevention Program, the Emergency Plan, and the Security Plan. Procedures provide processes to evaluate work that could affect the license basis, and they implement administrative controls for record keeping, document control, organization structure, training and qualifications, design control, and many other programs. Refer to Section 3.3.1.2.4 below for additional detail regarding the procedure manual.

3.3.1.2.4 Procedure Manual

At the start of decommissioning, there were more than 700 hundred mature HBPP Unit-3 procedures that were required for maintaining Unit-3 in SAFSTOR status and assuring safe storage of spent fuel and radioactive waste. This number did not include procedures used by support organizations such as DCPP for Regulatory Services, Quality Assurance, Procurement, Records, Laboratory testing, and Calibrations. As the radioactive waste source term is reduced during decommissioning, and the project transitions to OAD, the number of procedures has been reduced to about 250, with additional procedures slated for cancellation or consolidation at the completion of upcoming project milestones.

The hierarchal structure of HBPP Unit-3 procedures conforms to regulatory requirements and nuclear industry standards. It is a top-down structure that begins with the NRC issued 10 CFR Part 50 license for possession of special nuclear material. The license invokes various programs that comprise the licensing basis, and changes to the license basis are subject to review and approval by the NRC. The licensing basis documents contain commitments to regulations, regulatory guidance, and industry standards that are implemented through various procedures. The conditions of the License, the License Basis, and the implementing procedures are all subject to administrative controls, NRC inspections, and independent quality assurance audits.

The HBPP Unit 3 procedures are organized in the procedure manual volumes as shown below:

- Volume 0 Contractor Procedures
- Volume 1 Administrative Procedures
- Volume 2 Equipment description and Operating Instructions

- Volume 3 Emergency Procedures
- Volume 4 License
- Volume 5 Maintenance Procedures
- Volume 6 Surveillance Test Procedures
- Volume 7 Radiation Protection Procedures
- Volume 8 Chemistry Procedures
- Volume 9 Temporary Procedures
- Volume 10 Environmental Procedures
- Volume 10a Safety Health and Management Procedures
- Volume 11 Security Procedures
- Volume 11b Security Procedures for Areas Containing Category 2 Quantity of Radioactive Material
- Volume 12 Technical Basis Documents
- Volume QA Humboldt Bay QA Manual
- Volume 14 Decommissioning Procedures
- Volume 15 Waste Procedures

Some of the revisions to the License Basis were significant milestones during decommissioning, and they had extensive impact on site organizations, associated programs, and numerous implementing procedures. These types of changes are carefully planned, coordinated, and executed within defined implementation periods that consider completion of cross-discipline reviews, approvals, and training and qualification updates.

Reductions of the Site Emergency Plan as the project source term was reduced to OAD levels was a significant license basis revision. This change was coordinated with the transition to a stand-alone ISFSI, and permanent shutdown of the main plant exhaust system and gaseous effluent monitoring. This change resulted in the cancellation of numerous procedures and the reduction of the quality classifications of many others.

Procedures will be under constant change as other decommissioning milestones are met. They will change to reflect the decommissioning status, organizational changes, and reduced radiological hazards. A balance is maintained between reduction of procedure burden to keep up with incremental decommissioning, and the creation of burden from frequent revision of procedures.

The procedures group includes nuclear-experienced procedure writers, who are responsible for managing the procedure change process, and the document control group, who are responsible to prevent the use of outdated procedures, word processing, revision tracking, and record retention. This organization sponsors license

basis changes and coordinates the implementation. Procedure writers are involved in the WCP to develop and revise procedures that are an integral part of decommissioning planning and execution. Decommissioning procedures also provide detailed instructions for unique and first-of-a-kind activities, and for repetitive or complex tasks.

Procedure changes that are initiated by the responsible owner organizations are carefully controlled and reviewed by the procedures group to identify and prevent adverse impact on the license basis, and related programs. These procedure changes can have wide-ranging consequences or potential impacts on the license conditions or NRC commitments. Changes can introduce unanalyzed conditions, or deviate from controls that could prevent a postulated accident. All changes are subject to review by trained and qualified individuals that are designated as Independent Safety Reviewers, based upon their backgrounds and relevant experience.

Many of the decommissioning activities involve quality-related SSCs, and quality-related activities governed by the Humboldt Bay Quality Assurance Plan. These quality-related SSCs and activities are controlled by quality-related procedures that invoke regulatory administrative requirements for record keeping, document control, organization structure, training and qualifications, design control, and other programs. All quality-related SSCs and activities are subject to independent Quality Assurance audits per regulatory requirements. Quality-related programs include:

- RP controls
- Effluent monitoring
- Radwaste shipping
- Site characterization
- Fire Loss Protection and Prevention Program
- Emergency Plan
- Security Plan
- Off-site Dose Calculation Manual

3.3.1.3 Remainder of Plant Systems/PG&E Civil Works Support

The remainder of plant systems and support of civil works is comprised primarily of direct labor costs and the cost of tools and equipment to support the ongoing efforts of the CWC.

3.3.1.3.1 Direct Labor

Table 3.3.5 highlights the budget analysis for direct labor between the 2012 NDCTP and this 2017 filing.

TABLE 3.3.5—DIRECT LABOR BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Remainder of Plant Systems / PG&E Civil Works Support	**17,842,068**	**18,633,496**	**16,810,325**	**15,748,319**	**2,743,043**	**18,257,949**	**375,547**	**(1,447,623)**
Radiation Protection	15,065,776	15,741,342	14,201,151	15,748,319	2,509,630	18,257,949	(2,516,607)	(4,056,798)
Contingency	2,776,292	2,892,153	2,609,174		233,413		2,892,153	2,609,174
Caisson	**553,834**	**592,542**	**592,542**	**-**	**1,338,207**	**1,104,794**	**(512,252)**	**(512,252)**
RP Discrete	395,596	426,112	426,112		1,104,794	1,104,794	(678,683)	(678,683)
Contingency	158,238	166,430	166,430		233,413		166,430	166,430
TOTAL	**18,395,902**	**19,226,037**	**17,402,867**	**15,748,319**	**4,081,250**	**19,362,743**	**(136,706)**	**(1,959,876)**
Prorated Reduction [1]			1,823,170 or 9.5%					

Note:
1. The prorated reduction represented $1.8M of the $47M. RP Discrete was expected to be reduced by 9.5% but increased 0.7%

At a summary level, HBPP is tracking about $0.1M over what was filed in the 2012 NDCTP for RP support of Plant Systems and Caisson removal ($2M overrun against the reduced value).

As previously discussed, PG&E remains attentive to the dynamic needs for staffing by routinely reviewing those needs and tracking actual expenditures against the expected expenditures. By developing the staffing plan early based on the planned execution of decommissioning and by frequently reviewing needs against actuals, PG&E has been able optimize the staffing levels. During this process, PG&E recognized two issues and was able to adjust the staffing levels accordingly.

The first issue involved the RP support needed to safely remove the highly contaminated and highly radioactive plant systems such as the RPV. Additional staffing was needed to adequately protect the work force, public, and environment. The need for additional staffing persisted until the end of 2015 when the RFB met OAD criteria and a forty-foot section of the building was demolished to grade. The designation of a Restricted Area or RCA was no longer required, and the staffing was reduced.

The second issue involved a reevaluation of the staffing needed to support OAD. During the routine review of the work plans, PG&E recognized that the RP support needed for safe caisson removal and site restoration was less than originally thought and that some of the work was redundant with work assigned to the FSS group. PG&E reduced the forecasted staffing requirements to better optimize and utilize the staffing resources.

This rigorous process has successfully adjusted the predicted staffing needs from 36.6 FTE-Years in the 2012 filing to 38 FTE-Years in the 2017 filing, which accounts for the $170K adjustment in forecasted costs. The 2012 NDCTP filing forecasted a reduced number of RP Discrete resources in 2017, with radiological field oversight support completing in mid-2017. Radiological clean-up of the intake and discharge canals were initially planned to be completed in early 2015, but have been replanned in the 2017 NDCTP filing to be completed by end of 2016. The LRWB retention wall and foundation is planned to be removed in mid-2018. This structure was found to be more

contaminated than previously planned and it remains one of last radiological field activities to be performed. Appropriate RP Discrete resources are being applied during 2017 and 2018 to remove the Reactor Equipment Drain Tank (REDT) at the bottom of the caisson near the end of 2017 and the remaining LRW substructures in 2018.

From the data, it is easy to conclude the PG&E has done a reliable job of forecasting staffing needs, managing staffing head count and billing rates to the forecasted values, adjusting to changing conditions, and seeking opportunities to further optimize the staffing. Therefore, PG&E believes that the methodology that it developed in the 2012 NDCTP filing to ascertain the staffing costs for RP support is sound, and that methodology was retained for the 2017 NDCTP.

3.3.1.3.1.1 Craft

Self-Perform work is completed, and there are no more costs associated with this section.

3.3.1.3.1.2 Radiation Protection

Throughout the decommissioning, the focus and purpose of the RP organization has been the protection of the employees, public, and environment from the potential deleterious effects of exposure to radioactive materials and ionizing radiation. The RP organization accomplishes its mission through a combination of monitoring, measuring, and controlling the radioactive materials and access to those materials.

The RP organization is divided into several functional areas. RP technicians provide all required RP functions and RP deconners maintain cleanliness and prevent contamination from spreading throughout the plant and to workers required to be in those areas. These combined teams of RP technicians and RP deconners provide all the required job coverage, including performing routine and special surveys and manning the radiological control points for each of the processes and activities, ensuring that the radiological dose and contamination remained in a controlled environment.

HBPP radiation protection rules and practices are established in accordance with NRC regulations, and PG&E company policy is to provide for the safety of HBPP workers occupationally exposed to radiation. Thus, it is of utmost importance that all HBPP radiation protection rules be strictly complied with by all individuals while in an HBPP RCA. All radiation workers occupationally exposed to radiation at HBPP are required by the NRC to have a basic knowledge of the risk associated with their radiation exposure. Each radiation worker understands of how to apply radiation protection principles and precautions to maintain personal exposure to levels that are ALARA. In addition,

individuals working in an RCA are expected to conduct themselves in such a manner as to minimize any occupational risks to themselves or others, using practicable means.

The number of technicians assigned to any particular job is generally predicated on the complexity—the more activities going on at once that can affect radiological controls, the more sets of hands and eyes that are required. To maintain the required controls needed for the levels of HBPP alpha contamination, most job coverage activities needed a minimum of two RP technicians and two RP deconners. In some of the larger activities (e.g., RPV removal and SFP work) the job could, at times, require as many as four RP Technicians and four RP Deconners, with the specific numbers on these teams changing as the course of the specific task's radiological conditions changed.

There are several reasons that job coverage is seldom limited to either one RP technician or one RP deconner—the need to maintain constant oversight of radiation levels, the multiple job responsibilities of RP deconners, and the nature of the work itself. Given that radioactivity can only be seen with a meter, it is easy for workers to challenge boundaries, which at times are largely conceptual, bound by policy and practice that go beyond simpler measures such as posting and other barriers. Because workers must focus on the completing task at hand, the role of RP is one of oversight and restraint, which can easily become compromised when members of the RP team become focused, necessarily, on specific tasks such as conducting a survey, or when a tech must leave the job area (e.g., to obtain supplies).

RP deconners have been used throughout the project in more than just RP-specific functions, often serving in the roles of laborer or utility worker. While this versatility has been useful, it has required more personnel in the field to ensure that laborer and utility worker tasks do not compromise the importance of RP functions. Furthermore, much of what RP deconners do is of such a nature that two or more workers are required for certain portions of an overall evolution, (e.g., wrapping and securing a large contaminated object in plastic sheeting).

The nature of decommissioning work is such that major job evolutions include multi-level prerequisite activities, (i.e., at times a team is required to wait while a sub-group completes preparatory work such as rigging or laydown of contamination control materials). Unlike a work environment where the process is unchanging and ongoing (e.g., assembly line, planned outages, and operational work), the decommissioning process is fraught with hold points which, while leaving some team members in a standby mode, are of short enough duration so as to not lend themselves to excusing other sub-groups to perform other tasks. The result is unavoidable nonproductive time that would be greatly increased if teams actually left the area, which would require doffing and then donning protective clothing and respirator equipment.

RP Technician

The RP technician's duties are performed without direct supervision. They include: performing contamination and radiation level surveys, including routine isotopic analysis, to assist in assuring that the limits in the Company's radiation control standards are not exceeded; maintaining survey and other appropriate records in support of the plant and environmental monitoring programs; instructing employees and others in proper radiation protection procedures; advising other employees on and performing the decontamination of spaces and equipment and the handling, packaging, storing, and shipping of solid radioactive wastes and other radioactive material; assuring that portable radiation detection and personnel radiation protection equipment are in satisfactory, operable condition; and making routine calibration checks of portable and counting room radiation detection equipment. In addition, the technician may be required to collect and analyze radioactive and nonradioactive samples in accordance with standard procedures and make recommendations to the appropriate supervisor based on the results of such analyses; maintain the appropriate records of analyses performed; advise other employees in operating chemical process equipment and waste disposal facilities; and assist plant engineers in writing procedures for calibrations, maintenance, testing, and other activities in his or her area of responsibility.

The RP technician's education, training, and experience must be sufficient to qualify him or her to perform these duties with skill and efficiency and meet the current NRC qualification requirements for "Health Physics Technician", to which Company is committed. Once the technician meets the NRC requirements, he or she required to make independent determinations of appropriate postings of radiological conditions. Qualified Technicians were required to pass a written examination.

RP Deconners

This position's principal duties consist of: collecting, packaging, and processing RCA waste, which includes removing bagged waste from surface contamination areas and transporting it to designated areas in the plant, and compacting waste; decontaminating areas and equipment, which includes operation of decontamination equipment and manual decontamination techniques; supporting radiation protection field activities, which includes area setup, portable ventilation equipment installation, containment device fabrication, and temporary shielding installation and removal; and operating the site laundry, including collecting and processing protective clothing.

Key qualifications for this position include the ability to read, understand, and follow technical procedures, to work in and around radiation and contamination fields, to successfully complete radiation worker and department -specific training, to attend work

as scheduled due to the finite nature of the assignment, to distinguish colors, to lift up to 60 pounds, to bend, stoop, and twist, to climb, including ladders and stairs, to walk up to five miles daily, to stand or sit for long periods of time, to wear and work in a respirator in radioactivity-contaminated or environmentally hazardous areas of the plant, to transport material up to 200 pounds in carts, to work in confined spaces, to work in up temperatures up to 120 degree Fahrenheit, and to obtain and maintain unescorted site access.

The radiologically significant work that was ongoing at the beginning of 2015 included RPV segmentation and removal and SFP Cleanup and removal. Both evolutions contained higher levels of risks from radioactivity and, therefore required higher RP Technician staffing levels in order to adequately monitor, measure, and control the risks. RP began the period with thirteen RP Technicians and RP Deconners. As the quantity of radioactive materials and, therefore levels of radiation and contamination, were reduced, the required amount of RP oversight was also reduced. Beginning in mid-2015, the RP staffing levels began a gradual ramp-down with a corresponding reduction in the associated costs.

By the end of 2015, the RPV and SFP projects were completed, and the facility entered into the controlled OAD portion of the decommissioning. The radiological focus shifted from intense, high-level radiological work to a lower level of radiological intensity associated with canal remediation and caisson removal. Both of the projects still have a potential for encountering radioactive materials and, therefore, require monitoring, measuring, and control. While it is understood that much of OAD will occur at a time when the operational RP Program is no longer in force, residual radiological concerns will continue to exist that require RP attention. By January 2016, the RP Technician staffing was reduced to fewer positions.

Prior to OAD, HBPP performed radiological surveys and provided the results to the CWC. Radiological controls will be required during OAD of embedded piping because the material will still be considered radiologically regulated. The CWC was directed to minimize excavation of contaminated piping and areas during the rainy season and to use methods such as tenting or glovebags as approved by PG&E when cutting contaminated piping.

The RP engineering controls that will be utilized during controlled OAD include: (1) water misting from portable power washing units consisting of spray units that are mounted directly on the arm of the hydraulic excavator during demolition activities, similar to units used during the Turbine Building foundation demolition; and (2) water misting from portable "snow maker" or "fog cannon" machines that can spray water mist into the work area with a variable water flow rate; (3) decontamination; (4) application of

spray fixative (including latex paint, special encapsulates designed for contamination, and spray glues to bind the contamination) on areas that are of concern to mitigate the spread of any potential contamination; and (5) localized ventilation such HEPA filters.

The project Work Plans for the caisson demolition scope of work were developed by the CWC's Engineering group. The RP and Waste controls were incorporated into the work plans to meet the necessary Radiological Engineering Controls and Exception requirements, as well as the Waste Segregation requirements. The work planners were provided with the tracking SAP Notification that included all of the RFB areas and listed the RP requirements and Rad Engineering controls for each area. The RFB team worked directly with the engineering team to ensure that all of the RP and Waste requirements were in place, fully understood, and practical for execution of OAD.

The most prominent residual radiological concerns involve the excavations planned in the east yard and the caisson.

East Yard Excavation

There are two LRW lines that are buried in the east yard. One is an abandoned radwaste line, which goes into the circulating water discharge, and the other is a tank discharge line, which travels under the road to the discharge canal. During plant operations, these lines were used to move LRW between the point of generation and either overboard discharge or processing for disposal. There are potentially significant quantities of radioactive contamination still in those lines that will require careful monitoring and handling to avoid unintentionally spreading contamination during removal.

Caisson Excavation

The caisson's surfaces and accessible embedded piping were either decontaminated or removed in preparation for excavation. However, there are areas where the residual contamination could not be removed safely or cost effectively in advance of caisson removal. Therefore, RP monitoring, measuring, and control will be required during caisson excavation and removal. Example areas of concern that will require RP Technician support include embedded pipe commodities, Drywell activated core region, and Suppression Chamber removal:

- Embedded pipe can include pipes that are simply piping stubs or complete floor drain systems. Embedded pipe will be removed by mechanical means with the use of hydraulic excavators equipped with large hammers and shear attachments. Pipe embedded within concrete and rebar mats will be removed intact to the greatest extent possible. However, due to the difficulty, 100-percent-

intact removal will not be achievable. RP Technicians will monitor, measure, and control contaminated materials during removal, segregation, and packaging of piping and surrounding materials. The CWC will employ the following generalized steps when 100-percent-intact removal pipe is not achievable because of breakage pipe deterioration:

- Broken pipe segments will be removed from the work area with an excavator and bucket/thumb attachment and placed in a rock box or other suitable vessel to separate, contain, and relocate the pipe. The excavator operators will be experienced and qualified individuals who will be able to detect if pipes are being broken.
- In the event of the pipe break, the excavator will take a scoop(s) in the localized area to capture potential contamination migration, and that material will also be placed within the rock box. Equipment will be evaluated periodically and following a contamination spill scenario.
- Prior to the end of each day's shift, the rock box will be relocated to a designated material handling and processing area. The pipe and any other material will be surveyed by an instrument-qualified individual and appropriately sealed if required, at the direction of RP personnel.
- The waste generated will be separated per the RP Technician's direction and loaded into the appropriate disposal container at the end of each day's shift, or covered appropriately until it can be removed from the excavation.
-

- Where 100-percent-intact removal of embedded commodities is achievable, the waste segregation and packaging process will utilize a more streamlined approach to be developed by Project and Waste Management.
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- The Activated Core Region located within the Bio Shield is located from approximately the -20 foot elevation to approximately the -30 foot elevation and is a heavily reinforced concrete wall which is sandwiched between the 5/8-inch thick Drywell Liner and the 3/16-inch stainless steel Suppression Chamber Liner. These materials were found to be activated during plant operations and must be separated for disposal. These materials will be removed by mechanical means with the use of hydraulic excavators equipped with large hammers and shear attachments. RP Technicians will monitor, measure, and control activated materials during removal, segregation, and packaging, which will be accomplished in the following manner:
  - Exact elevations of the activated core will be field verified.
  - The inside of the Drywell cavity will be cleared of rubble, and concrete from the caisson and rubble from the Suppression Chamber will be removed to a

level below the Activated region. This will leave the sandwiched section of the Activated Core to be removed.

- The area around the annulus of the Core will be assessed and delineated to ensure that all materials will be separated from surrounding soils and eliminate cross-contamination. This will be performed with steel plates, fabric, or other sacrificial materials to capture and segregate the waste materials.
- The first step of the removal sequence will be removal of the Suppression Chamber liner, to allow better access to the reinforced concrete. The last step will be removal of the Drywell liner, creating a separation from the inside Drywell area.
- All plate steel, rebar, and concrete from the Activated Core will be downsized at the delineated area of work within the Caisson and packaged per RP and Waste requirements.
- The waste generated will be separated per the waste technician's direction and directly loaded into the appropriate disposal container at the end of each day's shift, or covered appropriately until it can be removed from the excavation.
-

- The Suppression Chamber is narrowed to the East and West end walls of the chamber. Along these walls are large, wide-flange structural beams. These beams contained highly contaminated debris, which was remediated to the fullest extent possible and coated with fixative. Within the East and West chamber, there were legacy baffle plates discovered nestled in between two of these beams. These interior beams were also remediated to the fullest extent possible. However, not all areas were able to be remediated to the OAD limits stated in RCP-2G. The exception process was followed, and was approved by the PG&E RP department for OAD.
  -
- The plates and beams will be removed whole during the demolition process under controlled OAD. The West baffle plates have been secured to one another, so that they will be removed all together and limit the spread of any contamination that may be present. The baffle plates located in the East chamber will be fastened to each other during OAD, due to access restrictions. Extreme care will be taken during the removal process to limit the spread of any potential contamination. The waste will be segregated and packaged to be sent to the appropriate disposal site.

Upon completion of removal of contaminated material, HBPP RP and Environmental staff will take confirmation samples. The chemical confirmatory sampling will include Total Petroleum Hydrocarbons, polycyclic aromatic hydrocarbons, PCBs, and metals,

including Toxic Control Leaching Procedure and Solubility Threshold Limit Concentration testing. FSS sample and survey results are expected to take two weeks and disposition radiation surveys take two days. The excavated areas will be maintained until sample and survey results are returned. Based on results of radiation samples and surveys and chemical sampling, additional excavation of areas may be required to achieve sufficient levels of cleanliness.

During OAD, all tools and equipment used in the area will be surveyed for radiological contamination at the end of each shift, prior to removal from the area, after any suspected spill, and after completion of excavation of known contaminated areas or piping.

3.3.1.3.2 Liquid Radwaste System

Liquid Radwaste Systems removal work has been completed, and there are no more costs associated with this section.

3.3.1.3.3 Tools and Equipment

Typical tools and equipment purchased to support the decommissioning project include many general tools of varying sizes such as wrenches, hammers, screw drivers, and drills, as well as electrical equipment, carpentry materials, various cutting equipment, replacement blades, and pipe fitting tools. The 2012 DPR estimate included $17.9M ($16.2M reduced) and an additional $1.1M ($1M reduced) in contingency. The actual costs were lower than the 2012 to 2014 estimates due to aggressive cost savings initiatives in regards to tool and equipment usage and consumption.

Table 3.3.6 presents the 2012 NDCTP budget requirements as well as those prepared for this 2017 NDCTP filing.

TABLE 3.3.6—TOOLS AND EQUIPMENT BUDGET ANALYSIS

	2012 NDCTP					2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Base 2012 NDCTP 2012-2014 Nominal / $2014	Reduced 2012 NDCTP 2012-2014 Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Remainder of Plant Systems / PG&E Civil Works Support	**18,354,898**	**19,172,817**	**17,296,878**	**13,388,710**	**12,078,709**	**7,642,000**	**2,730,326**	**10,372,326**	**8,800,491**	**6,924,551**
Tools & Equipment	17,219,644	17,985,743	16,225,952	12,624,120	11,388,930	7,642,000	2,589,267	10,231,267	7,754,477	5,994,685
Common Tools	3,770,666	3,954,883	3,567,922	2,390,202	2,156,336	2,010,000	-	2,010,000	1,944,883	1,557,922
Rad Protection	12,628,468	13,182,903	11,893,039	9,385,961	8,467,603	5,046,000	2,589,267	7,635,267	5,547,636	4,257,772
Glove Bags	820,511	847,958	764,991	847,958	764,991	586,000	-	586,000	261,958	178,991
Contingency	1,135,254	1,187,074	1,070,926	764,590	689,780		141,060	141,060	1,046,014	929,866
Caisson	**2,580,169**	**2,712,054**	**2,712,054**	**-**	**-**	**-**	**1,253,037**	**1,253,037**	**1,459,017**	**1,459,017**
Tools and Supplies	2,345,608	2,465,351	2,465,351		-		1,145,473	1,145,473	1,319,878	1,319,878
Common Tools	621,041	652,744	652,744					-	652,744	652,744
Rad Protection	1,724,568	1,812,606	1,812,606				1,145,473	1,145,473	667,133	667,133
Caisson Contingency	234,561	246,704	246,704				107,565	107,565	139,139	139,139
TOTAL	**20,935,067**	**21,884,871**	**20,008,932**	**13,388,710**	**12,078,709**	**7,642,000**	**3,983,364**	**11,625,364**	**10,259,508**	**8,383,568**

Prorated Reduction [1] 1,875,939 or 8.6%

Level 2 Subtotals										
Common Tools	4,710,836	4,942,094	4,528,799	2,536,261	2,288,104	2,010,000	-	2,010,000	2,932,094	2,518,799
Rad Protection	15,371,965	16,061,799	14,685,353	9,971,471	8,995,826	5,046,000	3,983,364	9,029,364	7,032,435	5,655,989
Glove Bags	852,266	880,978	794,780	880,977	794,779	586,000	-	586,000	294,978	208,780

1. The prorated reduction represented $1.9M of the $47M. Tools and Equipment was expected to be reduced by 8.6% but was reduced 46.9%

The need to supply these items has mostly been transferred to the responsibility of CWC upon completion of Self-Perform work in June 2014 and RPV Shell Segmentation project in June 2015. PG&E continues to provide task-specific PPE, including full-face respirators, protective clothing, plastics, booties, gloves, and lapel monitors for all respirator-qualified Radworkers, as required inside of the RCA. The CWC will furnish all other materials, equipment, and appurtenances including:

- fall protection harnesses, lanyards, and carabiners, and will demonstrate they have a qualified fall protection program that monitors and inspects their fall protection equipment.
- for chemically contaminated areas, the contractor may supply half-face respirators, where allowed by law and when approved by PG&E

In the 2012 NDCTP CPUC filing, PG&E identified that HBPP Unit 3 had significant alpha radiological hazards which must be carefully handled. Experience to date had shown that the consumption rate for tools and equipment and radiation protection supplies was much higher than initially forecast in 2009. Addressing high alpha radiological contamination involves the controlled cutting and disassembly of each system, which requires extensive scaffolding and man-lifts to access the work locations. To facilitate radiological safety, and enhance personnel safety, scaffolding is erected multiple times in any given area. Various other tools and equipment, including one-of-a-kind specialty devices, are needed for rigging components out from their installed locations, and replacing permanently installed utilities with temporary utilities to perform the work. Once contaminated, tools and equipment often need to be disposed of as waste to protect workers and to avoid the spread of contamination.

Unlike other nuclear facilities, HBPP Unit 3 systems had to be incrementally removed to safely control the radiological hazards associated with the unique alpha contamination at this site. This process involves the controlled cutting and disassembly of each system, which required an extensive amount of various other tools and equipment, including one-of-a-kind specialty devices. There remains a level of radiological risk in removing the remainder of structures, piping, and other appurtenant equipment during caisson excavation or excavation work in the east yard (See Radiation Protection under Section 3.3.1.3.1.2).

In the 2012 NDCTP CPUC filing, the following methodology applied:

- The remaining work requiring the continued purchases of many tools and equipment was evaluated to determine the costs going forward to complete the project.

- An independent assessment was also done in order to calculate the projected forecast.
- By evaluating the previous purchases, an average burn rate was established to forecast the costs over the remainder of the project.
- Large, one-time purchases were removed from the average expenses. Some potential for additional one-time expenses exist and were included in the proposed forecast.
- Small hand tools and safety hardware has to be replaced on a regular basis. This was assumed in the evaluation of the average burn rate and is also included in the projected forecast.

Table 3.3.7 is from the 2012 NDCTP DPR and shows the forecasted costs for the tools and equipment—common tools—required to complete the project. The forecast decreases incrementally each year as the project continues. The decrease each year was determined based on the amount of remaining work according to the scheduled milestones to complete the project. The amounts in the table are in nominal dollars.

History	Proposed 2013 Budget	Proposed 2014 Budget	Proposed 2015 Budget	Proposed 2016 Budget	Proposed 2017 Budget	Proposed 2018 Budget
Tools and Hardware	$ 449,592.34	$ 396,534.86	$ 346,269.88	$ 262,494.91	$ 206,644.93	$ 189,889.93
Construction Supplies	$ 503,452.19	$ 444,038.58	$ 387,752.00	$ 293,941.03	$ 231,400.38	$ 212,638.19
Total Tools and Supplies	$ 953,044.53	$ 840,573.43	$ 734,021.87	$ 556,435.94	$ 438,045.31	$ 402,528.12
Monthly Burn Rate	$ 79,420.38	$ 70,047.79	$ 61,168.49	$ 46,369.66	$ 36,503.78	$ 33,544.01

TABLE 3.3.7—2012 NDCTP COMMON TOOLS AND EQUIPMENT FORECAST

With the exception of RPV Shell Segmentation, PG&E Self-Perform Work finished six months earlier than planned in 2014. In the 2012 NDCTP CPUC filing, the plan value for Project Tools and Equipment (common tools) was $2.4M (nominal as shown in Table 3.3.6) for the years 2012 through 2014. As shown in Table 3.3.8, actual costs shown below were $2M, or approximately $400K less. Therefore, the methodology developed was a reasonable approach to forecasting the remainder tools, hardware, and construction supplies for the project.

TABLE 3.3.8—ACTUAL TOOLS AND EQUIPMENT COSTS

Sum of Actual	2012	2013	2014	Grand Total
2 - Remainder of Plant Systems	**3,562,090**	**2,560,879**	**1,519,258**	**7,642,227**
Tools & Equipment	3,562,090	2,560,879	1,519,258	7,642,227
Common Tools	1,062,014	700,522	246,989	2,009,526
Glove Bags	455,918	91,940	38,489	586,346
Rad Protection	2,044,158	1,768,417	1,233,780	5,046,356

In the 2012 NDCTP, for the two and half years starting in 2016, the planned period for common tools that applied to caisson removal represents $653K. In the 2017 NDCTP CPUC filing, with the contract in place for caisson removal and established CLINs in place for Project Tools and Equipment in support of Civil Works and this work, this forecast is built into caisson "Field Work".

Any miscellaneous project tools and equipment relevant to PG&E needs are part of ISFSI O&M or captured within Health Physics Supplies/RP Tools and Equipment.

The remaining work requiring Health Physics Supplies/RP Tools and Equipment include radiological monitoring and surveying, caisson and soil, excavation, site grading, FSS, and site closure. Personal protective equipment (PPE) for PG&E, various lab supplies, contamination detection instrumentation, fire extinguishers, eyewash stations, first aid kits, blood borne pathogen kits, automated external defibrillators for Unit 3 decommissioning within the RCA and other specialty customized materials are still procured through the Health Physics Supplies/RP Tools and Equipment process.

Typical tools and equipment purchased to support this project include Air Samplers, HEPA Ventilation Systems, Radiation Detection Instrumentation (Count Room and field instruments), polyethylene plastic sheeting, sample containers, Radiation Personal Protective Gear, and other items to help control the spread of contamination and protect the public health and safety. Also captured here are General Office Supplies used by the RP, Count Room, and FSS departments, and rental of a Respirator Wash Facility. The use and cost of this Respirator Wash Facility was turned over to the CWC in 2015.

As the Decommissioning progresses, other large purchases or irregular purchases that are necessary to complete the project include:

- Specialized RAD-H-2000 sampling systems, along with other specialized equipment and instrumentation, to comply with an NRC requirement to ensure

that the remaining work is monitored and sampled to ensure the spread of contamination is controlled
- Specialty FSS equipment and monitoring instrumentation and detectors

HBPP also purchases ISOCS, Apex Gamma Equipment, Laboratory Sourceless Calibration Software (LabSOCS) system maintenance, and other various specialized equipment and parts as necessary, further described in the following paragraphs.

The ISOCS is commonly used to measure contaminated materials and areas, both in place or after removal from the facilities. It is also used for final status measurements to allow release of areas for general use, or general demolition activities. The LabSOCS mathematical efficiency calibration software brings a new level of capabilities to gamma sample assay in the laboratory by eliminating the need for radioactive sources for efficiency calibration. By combining the detector characterization produced with the Monte Carlo N-Particle modeling code, mathematical geometry templates, and a few physical sample parameters, the LabSOCS Calibration Software provides the ability to produce accurate quantitative gamma assays of most any sample type and size. Due to the FSS impacts on schedule, a minimum of two ISOCS will be needed to support the project. A third ISOCS will be needed as a backup to prevent schedule delays with costly impacts.

The Gamma Analyst is a dedicated turnkey instrument which maximizes instrument utilization and produces high-quality results. The automatic sample changer facilitates maximum sample throughput, with the added flexibility to handle multiple sample geometries in any combination in a single sample batch. In addition to the features which facilitate flexible batch maintenance, the sample changer design minimizes the use of critical laboratory space for the gamma spectrometer. The instrument's performance is further enhanced by the flexibility of the software which allows the operator to define a unique assay protocol (such as count time, geometry, data reduction sequence, library, or reports) on a sample-by-sample basis. A unique "Count to Minimum Detectable Activities feature makes the most efficient use of the limited counting time available, by actually calculating the count time required to achieve a specified Minimum Detectable Activities and counting only for that period of time, thus shortening the count time for most samples.

The Tri-Carb® 3110TR is a computer-controlled benchtop liquid scintillation analyzer for detecting small amounts of alpha, beta, and gamma radioactivity.

The Electronic Data Access and Reporting (EDAR) System provides Document and Field Analysis Lifecycle Management in support of the LTP and FSS. EDAR allows for

enhanced graphical data presentation to facilitate improved review of radiological data to support license termination.

Sentinel Software Suite Program is a Comprehensive Radiation-Protection Management Software System. Sentinel is composed of two application suites: Access Control and Exposure Management. In addition to these software suites, a plethora of interfaces and specialty applications are available to customize. The Access Control Suite is the core set of Sentinel modules for managing work in RCAs. The Exposure Management Suite provides comprehensive dosimetry tools. Specialty add-on applications are available for Bioassay, Radiological Sample Management, and Environmental Sample Management.

Environmental Cross-Check Samples are used to verify that the instrumentation is in compliance with the acceptable limits, in accordance with the NRC Regulatory Guide 4.15, *Quality Assurance for Radiological Monitoring Programs (Normal Operations)—Effluent Streams and the Environment.* Analysis of effluent and environmental samples split with one or more independent laboratories is an important part of the quality assurance program because it provides a means to detect error that might not be detected by intra-laboratory measurements alone. When possible, these independent laboratories should be those whose measurements are traceable to the National Bureau of Standards, now known as the National Institute of Standards and Technology (NIST).

The use of cross-checks obtained from an independent laboratory whose measurements are traceable to the NIST is particularly important in environmental monitoring as a method to provide independent testing of the ability of the laboratory to measure radionuclides at the low concentrations present in most environmental samples. Cross-check program participation ensures independent checks on the precision and accuracy of the measurements of radioactive materials in the REMP and FSS programs within the on-site radioactivity laboratory. The agreement criteria are consistent with the guidance for Confirmatory Measurements as described in NRC Inspection Procedure 83502.03, *Radiological Environment Monitoring Program and Radioactive Material Control Program.*

All instrumentation on site requires regular repair and maintenance throughout the course of decommissioning and FSS to keep instruments in working order and prevent project delays. Many instruments require regular calibration services for maintenance. The calibration process requires some of the instrumentation to be sent to a third party for service.

Nuclear-grade HEPA-filtered systems are used to maintain air quality during activities that can potentially create airborne contamination. They need a full range of

replacement parts and accessories including filters, mufflers or muzzlers, spark arrestors, carbon housing, incinerable ducting, and vacuum units.

The purpose of PPE is to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective to reduce these risks to acceptable levels. An example of an administrative control is the double glove requirement. It is strongly recommended that two pairs of gloves (nitrile or latex) be worn at all times when handling radioactive material. At a minimum, one pair shall be worn. By wearing two pairs of gloves, personnel greatly reduces the risk of radioactive material coming in contact with the skin via a hole or tear in the glove, or through the radioactive material migrating through the glove on its own. PPE has the serious limitation that it does not eliminate the hazard at source and may result in employees being exposed to the hazard if the equipment fails. At HBPP, PPE is needed for protection against radionuclides and occupational exposure to ionizing radiation and to protect personnel from exposure to physical, electrical, heat, and chemical hazards and biohazards and airborne particulate matter.

In order to prevent personnel contamination, appropriate lab attire and PPE are required at all times when handling radioactive material. PPE and Contamination Control supplies may include such items as protective clothing, respirators, radiological bags, containment catches, silicone sealant, smears, and radiological posting or signs. PPE also includes helmets, goggles, and other garments or equipment designed to protect the wearer's body from injury or infection. Protective clothing is applied to traditional categories of clothing, and protective gear applies to items such as pads, guards, shields, masks, and other items.

The purpose of PPE for PG&E oversight personnel is to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective to reduce these risks to acceptable levels. However, PPE has the serious limitation that it does not eliminate the hazard at source and may result in employees being exposed to the hazard if the equipment fails.

Sample analysis is necessary for Projects and Site Release for both environmental and radiological measurements. Sample Containers are a significant cost throughout the Decommissioning process and Final Site Release. These containers are consumed in the process of full-service analytical chemistry and radiochemistry analysis for Soil, Debris, Water, and other containerized samples used to calculate the Environmental and Radiological impact of decommissioning. All aspects and areas of the site must be continuously sampled throughout the decommissioning process in support of all departments and projects to ensure that the End State meets or exceeds the specific criteria required by the NRC and the state of California. As excavations and remediation

activities increase, there will be a significant increase in the need for sample containers going forward.

A Respirator Wash Facility is rented to facilitate the reuse of respirators and parts that otherwise would be disposed of, requiring constant purchase of new respirators. This contract was turned over to the CWC.

Various other tools and supplies include pumps, hoses, filters, nozzles, batteries, utility pans, adhesives, paints, brooms, and other common tools and equipment purchased to support the routine needs of these departments.

Office Supplies are purchased through an online catalog system to take advantage of discounted savings. These items include anything needed to prepare reports, encrypted thumb drives, CDs, DVDs, labels, white boards, easels, print copies, bindings, pencils, pens, sharpeners, paper clips, staplers, paper punches, highlighters, and many other items to support the daily office activities of the RP, Count Room, and License Termination general staff. Costs estimates for office supplies are based on previous purchase history, taking into consideration the staffing plan reduction through project closure.

Purchase Cards are also routinely used to expedite the purchase of small dollar items that can be purchased locally to save time and cost in processing and shipping. The estimate for tools and equipment is based on decommissioning experience to date and anticipated future needs.

In the 2012 NDCTP CPUC filing, the table that is labeled Table 3.3.7A in this document forecasted the expected cost of health physics supplies/RP tools and equipment. The average monthly burn rate was established based on the amount spent during 2011 and 2012. Materials considered for this calculation were those that were recurring purchases only; previous one-time purchases were not included. PG&E assumed that the burn rate for the recurring purchases would remain the same for each type of activity. The average burn rate decreases each year, based on the decreasing number of activities requiring specialty radiological tools and equipment as a percentage of the base year. For each year beyond 2013, each subsequent year was forecasted at 60 percent (2014), 40 percent (2015), 20 percent (2016), 10 percent (2017), and 0 percent (2018) for common supplies and equipment.

TABLE 3.3.7A—2012 NDCTP RP TOOLS AND EQUIPMENT FORECAST

RP Tools and Equipment Calculation (2012 $)	2013	2014	2015	2016	2017	2018
Average Monthly Burn Rate (See Backup next tab)	200,000	120,000	80,000	40,000	20,000	-
Percentage of Work Activities (from base year 2013)	100%	60%	40%	20%	10%	0%
Average Common Supplies/Equipment	$2,400,000	$1,440,000	$960,000	$480,000	$240,000	$0
Boat/Barge for canal samples	$5,000	$0	$0	$0	$0	$0
Cart(s)/Wagon(s)Instr/FSS/Supplies	$40,000	$0	$0	$0	$0	$0
Specialized Cameras, Monitors, Control Panels, Radiation Detection Systems, Instrumentation etc) See Table Below	$1,156,413	$721,413	$726,413	$486,413	$386,413	$0
	$29,808	$17,338	$10,950	$5,779	$3,042	$0
Additional Sample Containers above average usage	$8,148	$4,739	$2,993	$1,580	$831	$0
Misc Supplies (Count Room)	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000
Totals	**$3,699,369**	**$2,243,489**	**$1,760,356**	**$1,033,771**	**$690,286**	**$60,000**

In the 2012 NDCTP CPUC filing, the forecasted costs for Radiation Protection (Health Physics supplies/RP tools and equipment) was $9.4M (nominal as shown in Table 3.3.6) for the years 2012 through 2014. Actual costs during this period was $5M.

Actual costs for RP tools and equipment for 2013 and 2014 were $1.8M and $1.2M, respectively. The forecasted costs during this period is twice for each year as shown in Table 3.3.7A. Because the amount spent remained constant at a half of the planned value each year, the applied percentage reductions were reasonably applied. Therefore, the proposed average monthly burn rate or one-time equipment purchases are likely suspect in overforecasting this cost category.

For RP tools and equipment, a more thorough bottom-up estimate of the few remaining suppliers were forecasted over the remaining few years as shown in Table 3.3.9. An independent assessment was performed (see the end of this section) to gain insights on how to best improve the forecast for this category.

TABLE 3.3.9—TOOLS AND EQUIPMENT FORECAST BY MATERIAL TYPE

Tool & Equipment Forecast by Material Type	2015	2016	2017	2018	2019	2020	Grand Total
Total	**$1,260,387**	**$1,176,192**	**$667,846**	**$522,388**	**$296,572**	**$71,872**	**$3,995,257**
Common Tools	$ 146,248	$ -	$ -	$ -	$ -	$ -	$ 146,248
Crane Inspection/Certificate Services	$ 3,250	$ -	$ -	$ -	$ -	$ -	$ 3,250
Misc Computer Software/Equipment	$ 1,678	$ -	$ -	$ -	$ -	$ -	$ 1,678
Misc Tools&Equipment	$ 141,523	$ -	$ -	$ -	$ -	$ -	$ 141,523
Ventilation Materials	$ (203)	$ -	$ -	$ -	$ -	$ -	$ (203)
Count Room / FSS	$1,007,018	$ 771,151	$551,029	$430,817	$244,646	$59,398	$3,064,059
As-Needed Maintenance & Repair	$ -	$ -	$ 15,000	$ 15,000	$ 15,000	$ -	$ 45,000
Chemicals,Cleaners,Compounds & Lab Suppl	$ 162,764	$ 2,550	$ 2,550	$ 2,550	$ 1,275	$ -	$ 171,689
Cross Check Samples	$ 6,904	$ 9,500	$ 9,500	$ 9,500	$ 7,500	$ -	$ 42,904
Electrical Services	$ 4,144	$ 4,144	$ 4,144	$ 4,144	$ 4,144	$ -	$ 20,718
Instruments/Calibrations/Repairs	$ 21,768	$ 93,600	$ 28,600	$ 28,600	$ 16,550	$ -	$ 189,118
Laboratory Equipment Maintenance	$ 110,694	$ 27,634	$ 28,074	$ 28,522	$ 28,977	$ -	$ 223,901
Misc Computer Software/Equipment	$ 48,271	$ -	$ -	$ -	$ -	$ -	$ 48,271
Misc Tools&Equipment	$ 635,063	$ 582,323	$462,012	$341,601	$170,751	$59,398	$2,251,148
Office Supplies	$ 17,411	$ 1,400	$ 1,150	$ 900	$ 450	$ -	$ 21,311
Radiation Protection Personnel Tracking Program	$ -	$ 50,000	$ -	$ -	$ -	$ -	$ 50,000
RP	$ 64,454	$ 200,000	$ -	$ -	$ -	$ -	$ 264,454
As-Needed Maintenance & Repair	$ 26,322	$ 200,000	$ -	$ -	$ -	$ -	$ 226,322
Misc Tools&Equipment	$ 15,107	$ -	$ -	$ -	$ -	$ -	$ 15,107
Packaging Materials	$ 1,917	$ -	$ -	$ -	$ -	$ -	$ 1,917
Radiation Protection Personnel Tracking Program	$ (808)	$ -	$ -	$ -	$ -	$ -	$ (808)
Storage Rent	$ 21,915	$ -	$ -	$ -	$ -	$ -	$ 21,915
Contingency (10%)	$ -	$ 106,927	$ 60,713	$ 47,490	$ 26,961	$ 6,534	$ 248,625
Contingency (10%)	$ -	$ 106,927	$ 60,713	$ 47,490	$ 26,961	$ 6,534	$ 248,625
Material Burdern	$ 42,667	$ 98,115	$ 56,103	$ 44,082	$ 24,965	$ 5,940	$ 271,872
Material Burdern	$ 42,667	$ 98,115	$ 56,103	$ 44,082	$ 24,965	$ 5,940	$ 271,872

The forecasted cost by year for base and added scope (caisson) is summarized as follows:

The forecast amounts in Table 3.3.10 were calculated using analysis of current burn rates, job estimates, contract values, management expertise of project history, and bottom-up analysis of remaining suppliers. Each cost was evaluated based on its need during each of the four milestone periods—RPV, CSM Wall Installation, Caisson Removal, and FSS/License Termination. Table 3.3.11A presents the same forecast as it pertains the budget and variances from 2015 through 2020.

TABLE 3.3.10—TOOLS AND EQUIPMENT FORECAST 2015 THROUGH 2020

T&E Forecast	2015	2016	2017	2018	2019	2020	Total
Grand Total	**$ 1,260,387**	**$ 1,176,192**	**$ 667,846**	**$ 522,388**	**$ 296,572**	**$ 71,872**	**$ 3,995,257**
Base	$ 1,190,226	$ 661,608	$ 233,746	$ 430,970	$ 296,572	$ 71,872	$ 2,884,994
Added	$ 70,161	$ 514,584	$ 434,100	$ 91,418	$ -	$ -	$ 1,110,263

TABLE 3.3.11A—TOOLS AND EQUIPMENT COST ESTIMATE AND CASH FLOW

Tools and Equipment Cost Estimate and Cash Flow										
Includes Contingency	Nominal $			2014 $						
% Decrease over years	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
2012 NDCTP - Original	**$ 2,973,376**	**$ 6,154,381**	**$ 4,260,953**	**$ 3,487,415**	**$ 2,368,570**	**$ 1,885,845**	**$ 507,628**	**$ -**	**$ -**	**$21,638,168**
Base Civil Works	$ 2,973,376	$ 6,154,381	$ 4,260,953	$ 3,487,415	$ 996,540	$ 933,393	$ 366,759			$19,172,817
Caisson Removal					$ 1,372,030	$ 952,452	$ 140,869			$ 2,465,351
2012 NDCTP - Reduced	**$ 2,682,450**	**$ 5,552,213**	**$ 3,844,046**	**$ 3,146,193**	**$ 2,271,065**	**$ 1,794,518**	**$ 471,743**	**$ -**	**$ -**	**$19,762,228**
Base Civil Works	$ 2,682,450	$ 5,552,213	$ 3,844,046	$ 3,146,193	$ 899,035	$ 842,066	$ 330,874			$17,296,878
Caisson Removal					$ 1,372,030	$ 952,452	$ 140,869			$ 2,465,351
Actuals (thru Nov)	**$ 3,568,167**	**$ 2,563,035**	**$ 1,519,351**	**$ 1,260,387**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 8,910,939**
Base Civil Works	$ 3,568,167	$ 2,563,035	$ 1,519,351	$ 1,190,226						$ 8,840,778
Caisson Removal				$ 70,161						$ 70,161
2017 NDCTP	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,176,192**	**$ 667,846**	**$ 522,388**	**$ 296,572**	**$ 71,872**	**$ 2,734,870**
Base Civil Works					$ 661,608	$ 233,746	$ 430,970	$ 296,572	$ 71,872	$ 1,694,768
Caisson Removal					$ 514,584	$ 434,100	$ 91,418			$ 1,040,102

Delta from Original $ 9,992,359
Delta from Proposed Reduced $ 8,116,419

At a summary level, HBPP is forecasting about $10.3M less in the 2017 NDCTP filing than what was filed in 2012 for Tools and Equipment. This represents about a 47% underrun based on the $21.9M ($2014) 2012 filing.

The forecast methodology for the 2017 NDCTP CPUC filing was similar to that used in 2012. The significant differences in the two methodologies are:

- The historical burn rate for tools and equipment was evaluated to identify persisting costs such as lab supplies, one-time purchases such as specialty RP equipment not previously identified, and costs expected to be transferred to the CWC by contract.
- The forecast going forward was scrutinized line by line to determine the timing and impact of one-time purchases; changes to plant configuration such as the closure of the Radiologically Controlled Areas; transfer of costs to the CWC; and the completion of work projects.

From the lessons learned from the historical burn rate evaluation and the forecast going forward, a forecast burn rate was developed. Each line of the 2017 forecast was reviewed and the relevant budget owners were challenged to verify the accuracy of the forecast. For example:

- $85K per year was requested for sample containers while the historical burn rate was only $16K per year. The forecast was reduced to align with the historical burn rate.
- $360K was requested for miscellaneous supplies, tools and equipment near the end of the project. Rather than re-order inventories near the end of the project, the inventories will be allowed to be drawn down in order to fully expend them thus saving $360K plus restocking fees.

To better understand the forecasted $9M difference, the actual annual expenditures were compared to the annual forecasts for the years 2013 through 2015. The Tools and Equipment category captures three subcategories; Common Tools, Glove Bags, and Radiation Protection (RP). As seen in Table 3.3.11B, there were underruns of $3.6M, $2.7M, and $2.3M in 2013, 2014, and 2015 respectively as compared to the 2012 filed amount in nominal dollars. A closer look identifies that the forecasts for Common Tools and Glove Bags were relatively accurate from which PG&E concluded that the methodology used to develop the forecast was sound. The look into the RP Tools and Equipment showed that and over-estimate of the needs along with cancelation of one-time purchases led to the large underrun.

TABLE 3.3.11B—TOOLS AND EQUIPMENT YEARLY COST VARIANCE

Nominal $ w/ Contingency	2013 Original Budget	2013 Reduced Budget	2013 Actual Spend	2013 Original Variance	2013 Reduced Variance
Total	**$6,154,381**	**$5,552,213**	**$2,560,879**	**$ 3,593,502**	**$ 2,991,334**
Tools & Equipment	**$6,154,381**	**$5,552,213**	**$2,560,879**	**$ 3,593,502**	**$ 2,991,334**
Common Tools	$1,049,771	$ 947,057	$ 700,522	$ 349,248	$ 246,535
Glove Bags	$ 337,006	$ 304,032	$ 91,940	$ 245,066	$ 212,092
Radiation Protection	$4,767,604	$4,301,124	$1,768,417	$ 2,999,187	$ 2,532,707
Nominal $ w/ Contingency	**2014 Original Budget**	**2014 Reduced Budget**	**2014 Actual Spend**	**2014 Original Variance**	**2014 Reduced Variance**
Total	**$4,260,953**	**$3,844,046**	**$1,519,258**	**$ 2,741,695**	**$ 2,324,788**
Tools & Equipment	**$4,260,953**	**$3,844,046**	**$1,519,258**	**$ 2,741,695**	**$ 2,324,788**
Common Tools	$ 943,656	$ 851,325	$ 246,989	$ 696,667	$ 604,337
Glove Bags	$ 114,999	$ 103,747	$ 38,489	$ 76,510	$ 65,258
Radiation Protection	$3,202,298	$2,888,973	$1,233,780	$ 1,968,517	$ 1,655,193
Nominal $ w/ Contingency	**2015 Original Budget**	**2015 Reduced Budget**	**2015 Actual Spend**	**2015 Original Variance**	**2015 Reduced Variance**
Total	**$3,553,464**	**$3,205,780**	**$1,260,387**	**$ 2,293,077**	**$ 1,945,393**
Tools & Equipment	**$3,553,464**	**$3,205,780**	**$1,190,226**	**$ 2,363,238**	**$ 2,015,554**
Common Tools	$ 840,924	$ 758,645	$ 147,053	$ 693,871	$ 611,592
Glove Bags				$ -	$ -
Radiation Protection	$2,712,540	$2,447,135	$1,043,174	$ 1,669,367	$ 1,403,962
Added Tools & Supplies			**$ 70,161**	**$ (70,161)**	**$ (70,161)**
Radiation Protection			$ 70,161	$ (70,161)	$ (70,161)

Several contributors have been identified that led to the underrun:

- Some of the upfront purchases in 2012 negated the need for purchases forecast in subsequent years.
- The radiological experience prior to the 2012 filing led PG&E to conclude that tool and equipment wastage would be very high due to the extensive alpha contamination.

- Both management and field personnel actively sought ways to reuse contaminated tools and equipment to reduce wastage, radioactive waste and associated disposal costs, and repurchasing of like tools and equipment.
- Several large equipment and one-time purchases were determined to be unnecessary.
- The responsibility for supplying non-safety related tools such as hand tools was contractually transferred to the CWC.
- Utilization rates of consumables such as office supplies are expected to follow the head count reduction.

Many of the contributors to the underrun were unknowns in 2012. Based on what was known at the time, PG&E felt that the 2012 forecast was sound. The excellent collaboration of management and field personnel combined with the desire by all to ensure that costs incurred are prudent as well and effective in completing the decommissioning led to many cost savings opportunities. Additionally, as a part of PG&E's corporate learning philosophy, the company has actively reviewed the contributors and changes, and adjusted its forecasts going forward. PG&E has factored in the contributors and changes that have affected the costs of tools and equipment into the 2017 forecast using a similar, well vetted methodology.

From the data, it is easy to conclude the PG&E has done a reliable job of forecasting tool and equipment needs; managing utilization of tools, equipment, and consumables; adjusting to changing conditions; and seeking opportunities to further optimize the use and expenditure of tools, equipment and consumables. Therefore, PG&E believes that the methodology that it developed in the 2012 NDCTP filing to ascertain the those costs for was reasonable, and that methodology was retained for the 2017 NDCTP.

3.3.1.4 Site Infrastructure

Site Infrastructure work has completed. There are no more costs associated with this cost category.

3.3.1.5 Specific Project Costs

3.3.1.5.1 Reactor Vessel Removal

Reactor Vessel removal work has completed. There are no more costs associated with this cost category.

3.3.1.5.2 Turbine Building Demolition

Turbine Building Demolition work has completed. There are no more costs associated with this cost category.

3.3.1.5.3 Other Civil Works

Table 3.3.12 presents a comparison of projected costs in the 2012 NDCTP, as compared to this 2017 filing.

TABLE 3.3.12—SPECIFIC PROJECT COSTS (EXCLUDES DISPOSAL/CAISSON/CANAL) BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Specific Project Costs (Excludes Disposal / Caisson / Canal)	**82,656,868**	**87,510,394**	**78,948,053**	**9,783,021**	**102,275,383**	**112,248,610**	**(24,738,216)**	**(33,300,557)**
Civil Works Contract [2]	74,579,000	79,050,745	71,316,127	9,783,021	92,761,682	102,544,703	(23,493,959)	(31,228,576)
Facilities Demolition	62,079,000				55,954,113			
Office Trailer Demobilization	1,500,000				1,631,638			
Final Site Restoration	11,000,000				32,255,378			
Other Services/ Letter of Credit					2,920,554			
Disallowed Scope (Seismic Upgrades) *					(190,206)			
Contingency	8,077,868	8,459,649	7,631,926		9,703,906	9,703,906	(1,244,257)	(2,071,980)
TOTAL	**82,656,868**	**87,510,394**	**78,948,053**	**9,783,021**	**102,275,383**	**112,248,610**	**(24,738,216)**	**(33,300,557)**

Prorated Reduction [3] 8,562,341 or 9.8%

Note:
1. The Staffing is split differently in the forecast compared to the 2012 NDCTP methodology. The overall balance of staffing between the General Staffing section and Caisson Staffing section is favorable compared to the original estimate.
2. Civil Works contract forecast line includes a high level $20M increase in Final Site Restoration.
3. The prorated reduction represented $8.6M of the $47M. Civil Works was expected to be reduced by 9.8% but increased 28.3%%

3.3.1.5.3.1 Nuclear Facilities

Decommissioning and demolition of the remaining nuclear facilities includes the remaining above-ground permanent plant structures and facilities within the RCA including:

- RFB (Building 3)
- Plant Ventilation Stack Base
- Miscellaneous RCA Structures
- LRWB Foundation and Retaining Wall

Reactor Fuel Building (Building 3)

The RFB is an approximately 4,800-square-foot, heavily-shielded, radiologically-contaminated structure. Among other features, the structure houses the Reactor Caisson and associated Access Shaft, a 26-foot-deep SPF with an integrated 10-foot-deep cask pit, and various other subgrade elements. The RFB was maintained under negative pressure to minimize the spread of contaminants to the environment during work activities that had the potential to cause airborne contamination. A portion of the Turbine Building known as the Propane Engine Generator (PEG) shared the RFB's west wall and Air Handling Unit. Similarly, the former Turbine Building Demineralization Room (Demin room) shared the RFB's south wall.

Assessments have characterized hazardous building materials requiring extensive remediation including radiological, asbestos, mercury, chromate, lead, silica and PCBs. Federal and state regulations for abatement for hazardous or toxic material are prescriptive and labor and time intensive. Each waste stream is handled and managed differently. This requires additional staffing to develop, train, manage, monitor, and report on programs to assure compliance with the regulations. Abatement of asbestos-containing paint or insulation materials requires a comprehensive training program and demonstrated competency by trained workers.

RFB exterior asbestos abatement activities included approximately 14,000 square feet of painted surfaces, 5,000 square feet of roofing material, and RPV Thermal Systems Insulation. These large-scale asbestos abatement activities require developing engineered, designed scaffold systems, and personnel baskets for accessibility when working within confined spaces. They also require construction of airtight negative pressure enclosures with HEPA filter units attached to clean and dirty change rooms, for donning and doffing street and protective clothing, and functional shower facilities for workers. Construction of these enclosures is a unique craft and is usually performed by specialty contractors. Compounding the challenges posed by the presence of asbestos is the additional requirement for radiological safety, made more significant by the presence of Alpha contamination. Maintaining radiological safety requires site-specific training and integration with existing site work activities, adding time and cost for building demolition.

Radiological remediation activities were performed under negative pressure provided by RFB ventilation and the Stack Particulate Alpha Monitoring Systems. The ventilation system drew outside fresh air into the RFB and then through exhaust ductwork to Plenum No.2, where it was directed through a filter bank located north of the structure before being directed up the exhaust stack.

The process of preparing the RFB and Caisson for OAD included an in depth review of the legacy structures, systems, and components that were left in the RFB and Caisson structure. This review was performed by the CWC project team which included the RPV Project Manager, RPV Project Engineer, Industry Experts in Radiological decontamination and Characterization (from several other Decommissionings in the United States and the United Kingdom), and experienced RP Technicians. The RPV Project Manager and Project Engineer were chosen for the legacy information that this team brought to the group. These two individuals were part of the PG&E Self-Perform project and knowledgeable of the left-behind SSCs.

The physical work of characterization was performed in a systematic level-by-level examination of all rooms and areas within the RFB and Caisson proper. The

characterization included all remaining piping, penetrations, embedded pipes, and concrete surfaces. Radiological data such as surface contamination, gamma and beta dose rate analyses were documented and submitted to the project team to determine what course of removal or remediation was needed, if any. The bounding limits for OAD were governed by PG&E Procedures for OAD. These procedures included the calculations based on the site-specific radionuclide distribution, and bounding that with the NRC regulations for site boundary dose rates. These values were used in the determination of removal, remediation, or no action.

The project team, using the above-mentioned data and criteria, were able to develop a list of SSCs that had to be removed or remediated to meet the OAD criteria. Many systems, like embedded floor drains could not be removed, as it would affect the structural stability of the RFB and Caisson. A unique mixture of remediation techniques involving paints, epoxies, glues, and foams was successfully executed to remediate the nonremovable SSCs, and bring the RFB and Caisson to OAD status. The project team also utilized specialty subcontractors to effectively abate and remove any accessible hazardous materials that were discovered during the characterization process. All materials that were removed were packaged and properly disposed of by the CWC Waste team.

While the physical work was being performed, the CWC Waste team was also evaluating the data that were collected by the characterization team, to ensure that the Waste Acceptance Criteria (WAC) of the planned disposal locations could be met without risk of a noncompliant shipment. The project team, Waste Team, and PG&E team all worked together to ensure that the end result of OAD would be within acceptable risk limits for Personnel and Radiological Safety and for Regulatory Compliance. The project team developed a demolition guidance document that would be used to develop the detailed demolition work plans of the Caisson. This document included the demolition process for the areas of high risk, both radiological and environmental, and defined how the remaining radiological waste would be segregated and packaged during the caisson demolition. Part of PG&E's approval to proceed with the RFB OAD included a Readiness Review Board approval of the work that had been completed and of the guidance document for RFB and Caisson OAD.

All piping, equipment, furnishings, and components that interfere with access to structural surfaces of floors, walls and ceilings have been removed to allow decontamination and then demolition. Extensive surface decontamination methods included wet wipes and mechanically shaving or removing the paint from the concrete to a specified depth. Decontamination facilitated OAD for the above-grade structure and supported license termination objectives for residual contamination.

Specialty demolition equipment is often not readily available, requiring an additional procurement period. Prior to entering demolition service, equipment requires upgraded safety features (e.g., operator cab protection, upper carriage frame guards, and armored undercarriages) and additional hydraulic systems complimenting various demolition attachments. Additionally, demolition equipment operation and maintenance are extremely expensive, requiring a comprehensive preventative maintenance program. Maintenance activities are typically performed outside of normal work hours, which causes significant increases in labor cost.

Currently, the decontamination and abatements processes have been completed and verified by sampling and surveys, the Main Plant Exhaust System has been secured, abandoned and removed. The first 40 feet of the RFB east wall has been demolished, and the 75 ton overhead crane has been removed. PG&E compared the actual cost to remove the first 40 feet of the RFB east wall to the estimate and found that it was consistent with the OTB. This finding provided management confidence that the remainder of the building will be completed within the estimates.

The CSM wall installation created a potential scheduling conflict between the CSM work and the building demolition. The two evolutions were to be performed in close proximity to each other. To enhance the safety margin and to save on contractor costs, the CWC subcontractor for RFB demolition was demobilized while CSM wall installation was being finished.

PG&E plans to continue demolishing the RFB concrete superstructure from east to west, systematically demolishing concrete and seismic steel bracing from the top down, bay by bay. The RFB concrete superstructure and seismic steel bracing will be demolished using conventional demolition methods. Specialty large heavy demolition equipment that may be mobilized includes high-reach demolition excavators with concrete processors or metal cutting shear, standard demolition excavators with concrete breakers, a concrete processor, a bucket/thumb or metal cutting shear, loaders, and off-road trucks.

Concrete demolition and processing necessitate a heightened emphasis on the control of fugitive dust. Throughout demolition, dust will be controlled by wetting concrete demolition surfaces, roadways, and waste stockpile areas. Dust control measures may include direct spraying of the demolition surface by water foggers, use of equipment-mounted hose, spraying from a man-lift, or ground-based spraying of the rubble impact area. As building demolition progresses, debris will be sized and segregated into stockpiles then transferred to the Soil Management Facility (SMF) for packaging in accordance with the Project Waste Plan (PWP).

Plant Ventilation Stack Base

While operational, the power plant exhausted through a 250-foot concrete stack. In 1998, the stack was removed down to Elevation +40 feet, 9 inches. The remaining stack is approximately 20 feet in diameter, with 10-inch-thick walls. The Plant Ventilation Stack Base houses several floors that contained monitoring and ventilation equipment. Beneath the Plant Ventilation Stack Base is a foundation structure down to Elevation -2 feet. This foundation is integrally connected to the RFB substructure.

Plant Ventilation Stack Base superstructure will be removed to ground level at Elevation +12 feet. Once the above-ground work is completed, the CWC may choose to either protect and cover the substructure or take a sequenced approach that will allow for Plant Ventilation Stack Base demolition in concert with other demolition work so these protections are not necessary.

Miscellaneous RCA Structures

The miscellaneous RCA Structures work included complete removal of structures and equipment within the RCA to ground level at Elevation +12 feet. The structures included:

- The Ventilation Fan Base located immediately north of the RFB
- The RFB Air Handling Unit used in the ventilation system located in the PEG Room on the west wall of the RFB
- The above-grade pipe racks and conduit located between the RFB and the LRWB
- The Cold and Dark Power lines, which run from Load Center 24 south, to the northwest corner of the RFB and southwest corner of the LRWB in an above-grade utility corridor/walkway
- Other temporary utilities, including temporary electrical power cabling and distribution panels, air supply piping, and water supply piping, located throughout the RCA
- Miscellaneous structures, including stairs, handrails, and wiring, located throughout the RCA boundary

The miscellaneous RCA structures were demolished using conventional demolition methods. Specialty large heavy demolition equipment that was mobilized included high-reach demolition excavators with a concrete processor or metal cutting shear, Standard demolition excavators with concrete breakers, a concrete processor, a bucket/thumb or metal cutting shear, loaders, and off-road trucks. Demolition debris was loaded into intermodals in accordance with the PWP.

Liquid Radwaste Building Foundation and Retaining Wall

The LRWB is an approximately 3,500 square foot structure built into the excavated hillside north of the RFB. The structure was a heavily reinforced concrete structure surrounded by a pre-engineered steel building that was constructed around the concrete structure years after plant startup.

The concrete walls are up to three feet thick, and the slab is three and a half feet thick (nominal), with thicker sections beneath interior walls and the former Rad Waste tanks. The foundation is supported by concrete piers installed as part of a structural upgrade. The structure contains a Rad Waste sump, trench, and access to the Off Gas Tunnel that connects many of the RCA structures.

The LRWB was maintained under negative pressure to minimize the spread of contaminants to the environment during work activities that have the potential to cause airborne contamination. Once all required decontamination and abatement work was completed, the ventilation system was isolated and LRWB steel demolition was completed.

Demolition of the LRWB included removal of the steel superstructure and any remaining components to the slab at Elevation +12 feet. PG&E has already removed the tanks and equipment from the LRWB. The concrete building's structural features include external buttress walls (east and west elevations) as well as a retaining wall (north elevation) that are to remain in place until planned removal as part of subgrade demolition. Similarly, the internal vault walls, which are an integral part of the ground support system provided by the north wall, will remain in place until subgrade demolition. The CWC protected and covered the sump, trench and access to the Off Gas Tunnel during the work.

As with the RFB, assessments characterized hazardous building materials requiring extensive remediation, including asbestos, mercury, lead, PCBs, and radioactive contamination. The approach to remediation of the LRWB is the same as for the RFB.

Equipment operation within a negative pressure enclosure required extensive planning and equipment modifications to eliminate carbon monoxide fumes within the LRWB, including selecting the appropriate size machines capable of maneuvering within a confined work space, and engineering and installation of specialty exhaust manifolds with flexible ducting routed to the building exterior. Compounding these challenges is the additional requirement for radiological safety, made more significant by the presence of Alpha contamination. Mitigating the radiological hazard required site-specific training and integration with existing site work activities, adding time and cost for building demolition.

The LRWB interior concrete remediation was accomplished using conventional demolition methods. Concrete removal required large excavators with metal cutting shears, concrete breaker, and bucket/thumb attachments. Initial interior concrete demolition began on the Rad Waste Demin Room, followed by the Rad Waste Concentrator Room and Pump Room. The concrete was demolished methodically, from the top to bottom, bay by bay. Access into the Concentrated Waste Tank and Resin Disposal Tank room required breaching through three-foot-five-inch thick walls to enable the removal of contaminated concrete tank pads. Contaminated sumps and embedded drain pipes were also removed throughout the building footprint.

Processing of demolition debris was consistently challenging, due to the building's configuration and radiological controls, resulting in multiple handling and stockpiling activities within a constricted work space. Concrete debris was loaded into large nylon bags lifted via an overhead crane and staged on the upper floor. Upon radiological release, waste bags were then loaded onto carts and transferred out of the building. Ultimately, the nylon waste bags were loaded into intermodals for disposal in accordance with the PWP. This required extensive coordination, communication and support from multiple groups, significantly increasing time and cost to perform the work.

Demolition of the exterior steel building was a prerequisite to CSM wall installation and clearing of areas for material storage. There were several obstructions within close proximity to the LRWB, including active electrical distributions panels, dewatering sumps, and equipment exclusion zones protecting the hillside retaining wall. Installation of protective measures and equipment operation within this limited space significantly affected the schedule and cost to perform the work.

Structural steel demolition was accomplished using conventional demolition methods. Steel removal required large excavators equipped with metal cutting shears and bucket/thumb attachments. Initial demolition began on the west end, demolishing the structure methodically bay-by-bay. Multiple excavators were employed throughout the demolition process to ensure positive control of building components. Components were processed and loaded into intermodals in accordance with the PWP.

3.3.1.5.3.2 **Office Facility Demobilization and Demolition**

Demolition and restoration of the HBPP site involves a major change in site operations and facilities. The HBPP site contains numerous leased and owned buildings, trailers, and structures used for office space, personnel access, and equipment storage. In order to proceed with decommissioning at the site, the personnel working in the office spaces and using the equipment storage locations need to relocate out of those facilities.

However, the decommissioning work assigned to those personnel is still in progress and critical to the continued success of the decommissioning.

The Scope of Work for this project includes demolition and removal of office facilities, including buildings and structures owned and leased by PG&E. Most of the buildings and structures to be removed are modular or trailer-type construction. Leased trailers and structures are to be isolated, disconnected, removed from the HBPP site, and returned to the owner. Buildings and structures owned by PG&E will be isolated, disconnected, demolished, and disposed as waste, or released for salvage or recycling. An estimated 32 building units having approximately 40,000 square feet will be demolished or removed from the site.

Within Trailer City, much of the building removal work is already complete. This work was undertaken so the area could be used to support soil management and Discharge Canal operations, including construction of two large structures on the footprint of the former structures.

The following remaining buildings and facilities are scheduled for removal:

- Administrative Area—Buildings 9 and 10A, temporary warehouse tent, sea vans, Bravo Gate entrance and components, and walking bridge
- New Generation Area—Load Center 50, concrete containment area, utilities, subpanels, handicap ramps, parking, and concrete walks; the CWC completed coordination and removal of the New Generation Area in 2014 to support the Discharge Canal Remediation: three singlewide trailers, three doublewide, one triple wide, and one six-wide trailer were either returned to the leasing agent or turned over to PGE Asset Recovery: the area was graded and two 20,000-square-foot Waste Management Facilities were installed to manage waste generated by the canal remediation
- Decommissioning Support Area—Trailers 12-1 through 12-7, Trailer 25, sea vans, Building 26, Load Center 24, PEG Area, stairs, and hazardous waste storage
- Count Room Area—Trailers 13A and 13B, guard shack, and temporary transformer power shed
- Miscellaneous Area—sea vans, sewage lift station, Rubb Tent, Access Control Building 35, and Buildings 19, 20, and 32; the Scope of Work includes removal of sewer and water lines and other buried utilities serving the structures, excavated and removed; removal of all unattached internal furnishings; removal of all decks, stairs, steps, ramps, railings, piers, and wing walls; removal of concrete walkways and landings; removal of pressure-treated wood timbers; and removal of fencing and fence posts

Sequencing of work and close coordination with demobilization of buildings and structures will be critical to meeting scheduled commitments. Personnel relocation needed to be completed prior to demolition of buildings and is discussed in Section 3.3.2.3.

Asset recovery must be coordinated with PG&E and the leasing company. Most Information Technology (IT) equipment (computers, phones, Wi-Fi, satellite) will be removed. Some sewer systems, utilities, monitoring wells, infrastructure, and IT equipment for ISFSI and HBGS must be preserved and protected.

The end state for this Scope of Work is that all identified Buildings and Structures have been demolished or removed from the HBPP site, and the site is stabilized and turned over for FSR. The CWC is coordinating with PG&E on the removal of structures in a manner that does not affect other demolition activities when the structure is no longer needed.

For building removal work that has already been conducted in Trailer City, clearances were obtained and utilities to each of the trailers were disconnected and air gapped. The Contractor removed all trailer skirting, decks, steps, walkways, and landings, and sorted the waste. All waste was disposed of according to the approved PWP.

Electrical service for Trailer City resides in the southeast corner of the property. Primary service is supplied overhead with a pole-mounted transformer, and secondary distribution panel (LP-50) is pad mounted adjacent to the pole. LP-50 feeds the trailers, lift station, lights, and Building 21. At LP-50, all electrical feeders to all loads will be de-energized and leads will be properly lifted, isolated, and tagged. LC-50 remained in service during the demolition of Trailer City. Load Center 50 supplies power to the two Soils Handling Facilities. When power is no longer needed, LC-50 and its associated concrete pad will be demolished.

For the domestic water system, the water main that feeds Trailer City was cut and capped at the intersection of RCA Way and D-Com Ave. Fire Hydrant #192 is in the vicinity of the GWTS. This hydrant will be left in service to provide domestic water for construction activities.

A sewage lift station is located along the southern boundary of Trailer City. A sewage force main runs from Trailer City Lift Station to Lift Station 3, near the Oily Water Separator. Sewage lines coming from trailers were cut and capped below grade. The force main coming from the Trailer City lift station was cut and capped in both directions in a concrete vault located to the south of the trailers, and the vault was filled with slurry.

Communications and data lines existed in some of the trailers. Feeds for those lines were isolated, and the communications/data vault was filled with slurry.

There was no hazardous material removed as part of this scope; however, adjacent to Building 22 is a spoils pit that contains asbestos. The asbestos pit will be remediated later in the project during site restoration work, funded separately (General Rate Case) for Fossil Remediation.

At the completion of this work scope, the site was cleared and graded. Existing storm water control BMPs and any new BMPs were maintained for the duration of the project.

3.3.1.5.3.3 Site Restoration

This scope of work consists of site restoration to fulfill the requirements of various state permits and to assist with obtaining the NRC's termination of the Part 50 license. It includes demolition of remaining miscellaneous structures (other than the Office Facility Demobilization) to support FSR plans. Main features of this scope of work include removal of buried asbestos containing materials; demolition of reinforced concrete settling basins, the truck ramp and associated piping; soil excavation, backfilling, and compaction; wetlands construction; site grading; storm drain system installation; topsoil placement; vegetation establishment; installation of erosion control features; ground cover installation; final surfacing; removal of portal monitors and truck scales; road construction and repairs; fencing and site lighting; and other final site development work to achieve the end state condition. The parcel containing the restoration area is approximately 102 acres

PG&E's plan must meet the LID requirements of the NCRWQCB. The "Humboldt Bay Power Plant Final Site Restoration Hydrology Report" dated May 28, 2015, details the requirements of PG&E's compliance with Condition 12 of PG&E's HBGS 401 Water Quality Certification, issued in October 2008 by the NCRWQCB. This condition requires that a post-construction storm water management plan for the HBPP site be submitted to the NCRWQCB. The HBGS 401 certification was issued prior to the development of HBPP Unit 3 decommissioning plans and the NCRWQCB wanted to ensure that HBPP storm water management was addressed as part of decommissioning so a permit condition regarding the HBPP Unit 3 site was included as part of the HBGS 401 Water Quality Certification. The 2012 DCR identified the need for a site restoration plan and PG&E included the requirement to develop a comprehensive post-construction storm water management program in the Civil Works Contract Specification Section 32 71 00, FSR. The conceptual Site Restoration Plan that formed the basis of the bid specification included areas of open water, mud flats, northern coastal salt marsh, and upland habitat. The conceptual plan provided for filling the Discharge Canal at a constant slope

from about the current outfall location to approximately El.+12′ at the current location of the circulation water pipe discharge structure. Each area would be revegetated with plant species consistent with coastal wetlands in the Eureka/Humboldt region.

Subsequent to the 2012 NDCTP application, PG&E worked with governmental and permitting agencies to obtain final site remediation permits. The final site remediation permit and proposed storm water management plan represents the resolution to a hybridization of requests and permit conditions from the NCRWQCB, USACE, CCC, and additional local agencies. In addition, portions of the HBPP site will be taken into HBGS ownership and will thereby come into the regulatory jurisdiction of the California Energy Commission and the HBGS California Energy Commission license. Portions of the property will remain outside the HBGS boundary. An application was submitted to the CCC in April 2015 and associated drawings in June 2015. As a result of consultation with the agencies, the original plan has increased in scope, expanding in areas such as improved site runoff treatment and wetlands dedication as well as biological treatment capacity integrated into the water runoff system. Figure 3.3.11 shows the preliminary final plan developed through discussions with NCRWQCB and other agencies.

The agreed physical approach to achieve the objective differs from the conceptual plan that accompanied the bid specification. As explained below, the current plan is much more robust than originally conceptualized and includes significantly reshaped fill for the Discharge Canal, development of a sizeable wetland area to the east of the Discharge Canal, and the addition of the bio-detention basins to treat the storm water discharges from the site. The change to the physical configuration of the Discharge Canal and drainage area results in significant changes to cut and fill requirements to achieve the final plan. The original conceptual plan shown in Figure 3.3.10 included estimated cut and fill quantities of 45,800 and 38,100 cubic yards of soil, respectively. The preliminary plan shown in Figure 3.3.11 indicates a total of 89,300 cubic yards of cut and 100,900 cubic yards of fill. In addition, the preliminary plan includes seven engineered bio-detention basins requiring initial construction efforts and ongoing occasional maintenance.

For the Intake Canal and adjacent areas, the Site Restoration Plan used for the bid specification is also shown in Figure 3.3.10. This included areas of open water, mud flats, northern coastal salt marsh, high elevation northern coastal salt marsh, and upland habitat. The conceptual Site Restoration Plan provided for filling the Intake Canal at a constant slope from the King Salmon Avenue Bridge to approximately El.+12′ at the current location of the intake structure. Upon reconfiguration of Alpha Road (see Area I), a portion of the former road area would be contoured to provide additional salt marsh area. In addition, excavation would be done to connect the open water area of the Intake Canal to the existing salt marsh area south of the Intake Canal. Each area

would be revegetated according to the plant species typical of these areas. Design would incorporate features that will minimize siltation back into the Fisherman's Channel. In addition to these features, the current preliminary final design adds the bio-detention basins, bordering the canal on the west, east, and middle, and includes the much larger bio-detention basins north of the Intake Canal and west of existing structures, which are retained. As shown in Figure 3.3.10, Alpha and Bravo Roads are retained, but Charlie Road has been removed and the current Charlie parking area has been excavated to become a new wetland area. The Intake Canal depth will be retained to ensure adequate water supply to tidal basin/ Eel Grass area in the former Alpha parking lot area.

The proposed FSR storm water management system at HBPP complies with governing LID principles of the NCRWQCB by using seven customized bio-detention basins to capture and treat runoff generated by the proposed FSR configuration. This unique basin design was developed in coordination with NCRWQCB and combines LID Best Management Practices (BMPs) that will adequately treat all the on-site storm water runoff for reuse in the adjacent wetland habitats that surround HBPP. These basins have been designed to comply with NCRWQCB recommendations and the condition of the Industrial General Permit, which will govern the maintenance of these features into the future. In accordance with NCRWQCB methods, which account for the specific cover types of the proposed FSR site plan within each basin's watershed, these basins have been designed to capture 150 percent of the minimum required volume of storm water runoff generated by the recommended 85th percentile, 24-hour design storm.

To ensure a robust basin design for these unique features, the proposed storm water management system includes the use of 62 years of local, historical, hourly precipitation data (approximately 560,000 data points) to model basin performance under observed historical storms of interest, which span days, weeks, and months. These additional data and analyses provide critical consideration to overall design and performance with much greater resolution than would be possible with simple traditional methods. The proposed HBPP FSR grading plan (shown in Figure 3.3.11) features extensive alterations to large portions of the HBPP site while other areas are unmodified from current topology. The alterations to surface topography necessitate the installation of a new network of surface flow features to convey storm water runoff from the upper reaches of watersheds to their respective bio-detention treatment basin. Portions of the existing storm water conveyance system that can be integrated into the proposed system will be retained. The proposed FSR storm water management system routes all storm water runoff through one of the seven proposed bio-detention basins. To work within the site constraints, this route necessitates low slope surface features (0.25-0.5 percent) and excludes the use of subterranean pipes.

The proposed bio-detention basins are on the scale of a constructed wetland, but feature a layer of sand/soil filter media above a network of perforated pipes to facilitate discharge of treated storm water into adjacent wetlands and water bodies. The proposed bio-detention basins will feature the desired capture volume, as determined in accordance with the LID manual, above the soil/sand filter media. Storm water runoff will enter and accumulate in a proposed bio-detention basin, before being passively filtered and treated through a combination of physical and biological processes, as it migrates through a layer of sand/soil filter media below.

This unique proposed bio-detention design was reviewed with representatives of the NCRWQCB to ensure the design was acceptable. This design is ideal for the HBPP FSR plan for the following reasons:

- Aligns with PG&E's environmental management goals by providing treatment of storm water discharges for the entire site.
- Complies with and exemplifies LID methods and the NCRWQCB expectations.
- Provides a single type of treatment features for implementation across the site, simplifying maintenance and avoiding impacts to the desired site uses.
- Provides 100 percent of the on-site storm water capture and treatment, so no other LID BMPs are required. Additional BMPs currently in use could continue to be used as deemed appropriate (see Section 3.4.3).

Seven bio-detention basins will provide the treatment for the entire site (Figure 3.3.11). Three large basins provide the majority of treatment to the HBPP core region. Two of these basins are hydraulically connected in a manner that will enable them to function as a single large basin; these basins cannot be joined because existing utilities cross this area and need to be preserved. The four additional basins are comparatively small; these basins provide treatment for water being released from the access roadways.

Governing BMPs and pollution prevention measures will be implemented in accordance with the governing SWPPP and Industrial General Permit in effect at the time of FSR completion. BMPs currently employed at HBPP will be carried into the transition and continue after FSR, as deemed appropriate.

As part of a statewide mandate, HBGS adopted a revised site-specific SWPPP in July 2015. This SWPPP includes BMPs that encompass all the generic site features and activities anticipated at an industrial power generation site. Although this revision to the SWPPP makes no specific accommodations for BMPs at HBPP, nor does it facilitate the incorporation of the HBPP site after FSR, it is anticipated that due to the similar site uses and storm water management features, the BMPs applied at HBGS

will encompass the drainage features at HBPP after restoration (e.g., drain inlet inspection, good housekeeping). The only unique storm water management and treatment system proposed as part of implementing the HBPP FSR plan are the bio-detention basins, which will be maintained. These unique drainage features will depart from typical BMPs. Other generic BMPs, like spill prevention and good housekeeping, will be adopted in accordance with the governing HBGS SWPPP and are not detailed herein.

No known or anticipated sources of storm water pollution will be present after the completion of FSR that are not already described in the HBGS SWPPP. Therefore, the set of BMPs contained in the current HBGS SWPPP are expected to be appropriate for expansion to the regions of HBPP turned over to HBGS control at the completion of FSR.

The submitted final site remediation permit also addresses other aspects of the HBPP final end state. The specific details of the preliminary FSR plan result in a significant cost impact as compared to the original conceptual plan. PG&E still must perform site grading and drainage, ground cover placement including vegetation and other surfacing, road construction and repairs, fencing and site lighting, and other final site development work to achieve the required end state condition for PG&E's future industrial use. While PG&E's mission has remained consistent, the overall result is enhanced and the site's impact on the surrounding native vegetation minimized.

The CCC has issued numerous CDPs authorizing the activities associated with demolition of power generating Units 1, 2, and 3; conducting site remediation activities; and terminating the NRC license. These CDPs include a provision for PG&E to prepare an FSR plan of the HBPP site, including where power generating Units 1, 2, and 3 and associated buildings, storage facilities, and appurtenant structures once stood. These areas will be restored to repurpose the former HBPP area for supporting the operating HBGS and potential future power generation-related activities on the property. Areas already committed for other operational needs, such as the Independent Spent Fuel Storage Installation (ISFSI), will continue. PG&E has worked closely with the CCC and other regulatory agencies to ensure necessary permits and approvals are in place to meet the requirements of the overall decommissioning project.

At this point, PG&E has not received the Coastal Commission permit for the FSR, which means there is a possibility some of the intended design may change further. However, because of CC's participation in the design to this point, significant changes are not expected.

FIGURE 3.3.10--ORIGINAL CONCEPTUAL PLAN

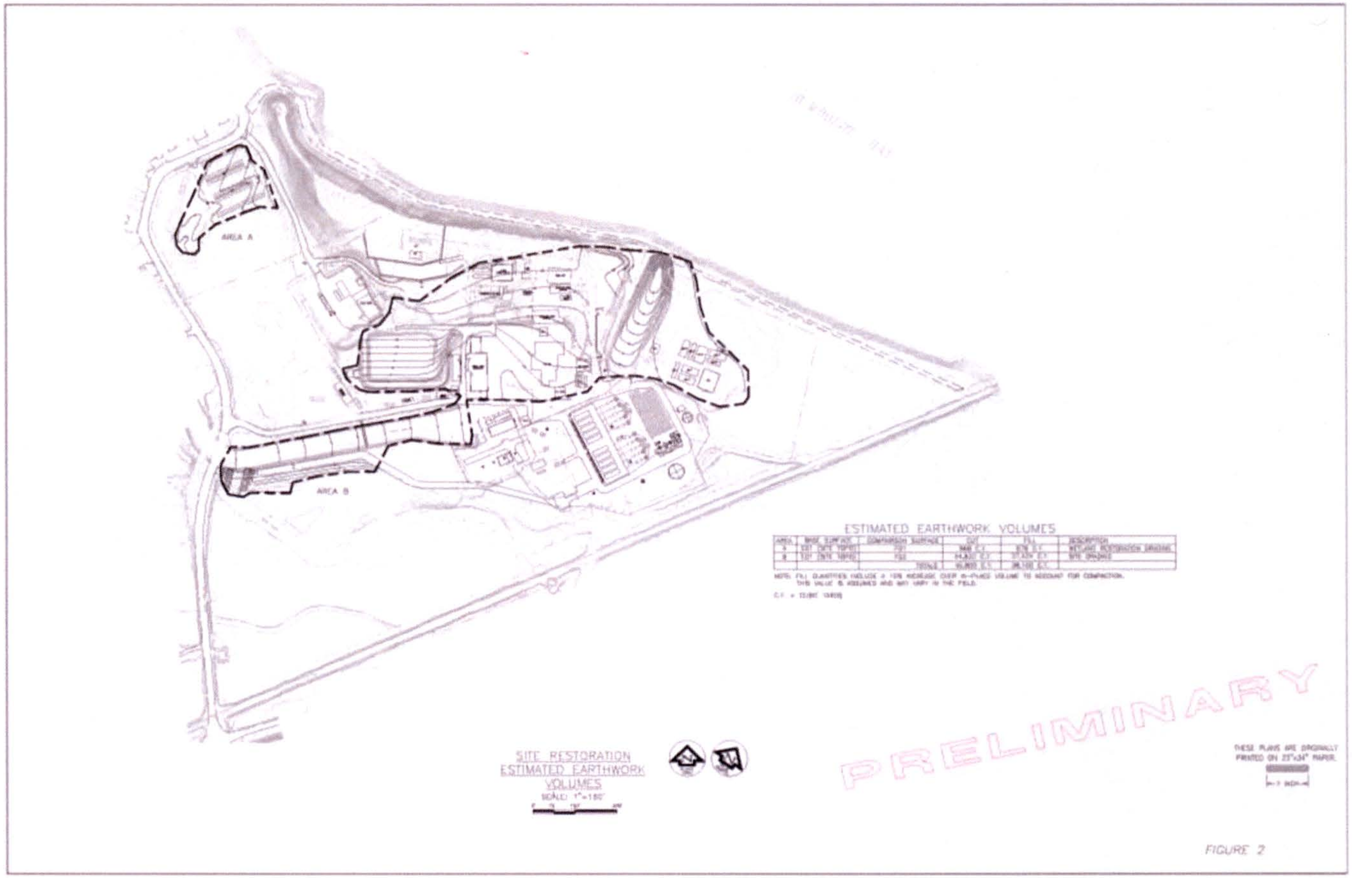
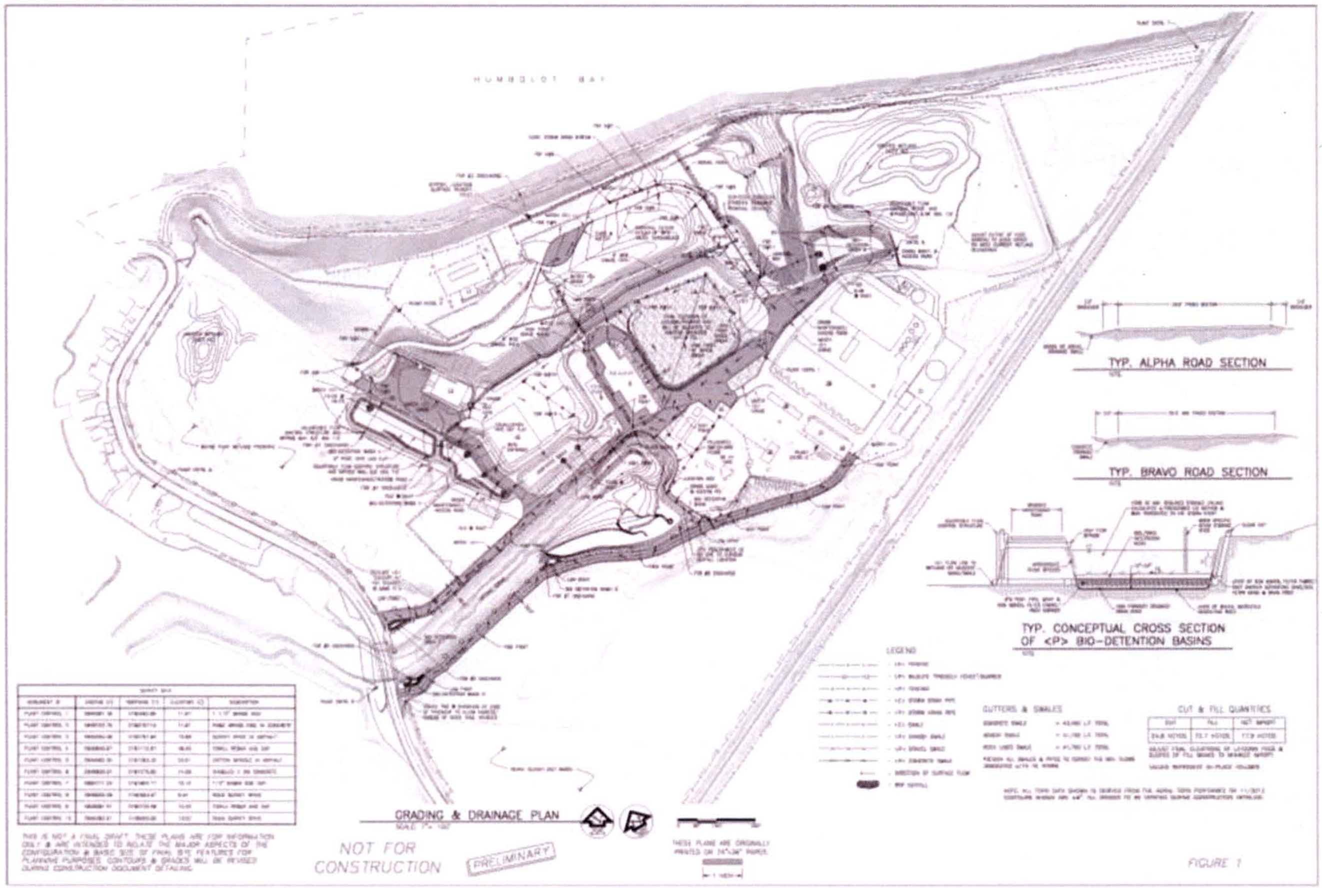


FIGURE 3.3.11—PRELIMINARY FINAL PLAN



3.3.1.6 Waste Disposal

3.3.1.6.1 Labor, Packaging and Handling

The scope of this work primarily pertains to intermodal shipping containers (intermodals), but also extends to other standard package configurations, specialty packages, oversized containers, or unusual shipping configurations. It includes the labor, equipment, and supervision to deliver, unload, move, manipulate, and reload intermodals on site and at marshalling yards in Arcata (about 14 miles north of HBPP). It also includes preventive and corrective maintenance of the intermodals—repairing or replacing, as necessary, the temporary liners and the permanent hardware, including hasps, eyes, hinges, latches, chain binders, gasket materials, protective coatings, and lid alignment. Additionally, it includes labor resources to load demolition debris into the intermodals and the planning, characterization, radiological surveys, and logistical support services necessary to execute the radiological and mixed-waste packaging and transportation function for nuclear decommissioning.

The Scope of Services includes the following:

- Component and package sampling, evaluation, and characterization
- Packaging oversight and compliance
- Shipment scheduling
- On-site logistics of containers and packages
- Shipment preparation
- Shipment manifest preparation
- Waste profiling
- Program procedure development
- Disposal site WAC compliance
- Packaging plans
- Support planning activities
- Procurement document preparation support
- Radiological protection services, including surveys, management of radiological material areas, onsite escort of radioactive material movements, and truck portal monitor administration
- Heavy equipment operation, as needed
- On-site intermodal handling and movement
- Intermodal transportation to and from facilities and disposal sites
- Intermodal maintenance and repair, including touch-up painting and structural repairs

- Intermodal cleanout
- Waste handling and packaging within the RCA and the remainder of Unit 3

In order to minimize handling, packaging, and transportation risk, it is important to formalize the process by eliminating as many potential problems as practical throughout the planning and execution phases. Key risk mitigation tasks include minimizing the number of off-site shipments to the lowest level practical to reduce the potential for off-site incidents, infractions, or violations and applying stringent oversight for on-site shipment preparation, packaging, and loading.

The HBPP project footprint is very small compared to other nuclear facility sites, with approximately 15 acres of usable land on the site. There is neither direct rail access nor direct barge access to the Bay. Trucks and intermodals are relied upon for transportation of material to and from the plant.

The disposal contractor returns empty intermodals from disposal of Department of Transportation (DOT) exempt waste in Idaho and moves them to a nearby off-site facility for morning delivery to the HBPP site. The intermodals are received at the Waste Management Facility (WMF) or at the northeast staging area. Alternatively, other trucking subcontractors deliver empty intermodals and other containers to HBPP. The incoming intermodals are radiologically surveyed by a RP Technician and visually inspected for roadworthiness by the Shipping Coordinator (SC). The SC documents and coordinates any required repairs. The repaired intermodals are returned to the WMF or the northeast staging area. Intermodals are taken from each of the staging areas and delivered to job-site locations within the plant for loading of demolition wastes. The Packaging Specialist inventories and catalogs wastes by WBS number for tracking and recordkeeping as they are loaded into the intermodals. The loaded intermodals are returned to the WMF or staging area for radiological survey, final inspection, and manifest preparation.

This work is a collaborative effort by the RP Technician, the SC, and the Packaging Specialist. Manifested intermodals are scheduled for off-site shipment on an established schedule.

Packaged waste containers are transported off site using PG&E-approved containers, vehicles, and transporters. Inspections of off-site transports are performed in accordance with approved procedures. If a package is found to be hazardous, it must be appropriately marked, along with the intermodal carrying the package and the vehicle transporting the intermodal.

PG&E's goal for container optimization is to load containers to either 97 percent of the weight capacity (for bulk items such as soil or concrete) or 97 percent of the volume

capacity (for loose items such as reinforcing steel and old equipment), depending on the material. Scales are situated in multiple locations to monitor the weight of these containers.

Selection and use of containers is specific to each type of waste being packaged and it is vital that the waste's physical, chemical, and radiological characteristics are considered when choosing packaging. The most commonly used shipping containers for the Decommissioning Project include the following:

- Industrial Packaging (IP)—1
- Industrial Packaging (IP)—2
- SeaVan or Sealand (also known as ISO) container
- Custom made IP-1, IP-2, Type A containers (e.g., the Lower Head box)
- Type A B-25 container—one-time use
- 30-gallon drum—one-time use
- 55-gallon drum—one-time use
- 85- or 110-gallon overpack drum—one-time use
- Paint cans—1-gallon, 5-gallon, 10 gallon, 20-gallon, 25-gallon, 30-gallon, and 55-gallon
- Pails
- Poly drums—open- or closed-top with a bung
- Metal drums— open- or closed-top with a bung
- B-12 boxes

Each package used for Class 7 (radioactive) materials must be designed to be physically and chemically compatible with the material being shipped.

Drums containing hazardous waste and other small containers in a workplace accumulation area must be labeled with their contents, including physical characteristics and any hazardous properties. The location of the accumulation area must be at or near where the waste is generated.

Intermodals returned from the disposal site must be assumed to be internally contaminated until monitoring and survey survey results are obtained. If the exterior of the intermodal is found to be contaminated, PG&E performs a comprehensive survey on the accessible surfaces of the transport vehicle.

If a leaking intermodal container is found on site, the container must be temporarily patched or sealed and transported. A work plan is developed to remediate the container. The container is not handled until the work plan is approved by PG&E.

From a waste management standpoint, activities are not considered complete until all reusable shipping containers (e.g., intermodals) are decontaminated and returned to the lessor or otherwise disposed. This requires strict adherence to technical and administrative specifications from all involved in this process.

Functional Waste Management Work Locations

There are seven primary functional work areas on and near the HBPP site. Due to changing site conditions, these areas are subject to modification in number and location.

- WMF
  - Fork lift offloads and onloads intermodals from and to delivery vehicles
  - Intermodals moved from staging area to and from scales, WMF, NE Staging Area
  - Intermodals surveyed, inspected, maintained, weighed, and prepared for off-site transportation

- Soil Management Facilities 1 and 2
  - Two 100-foot by 200-foot canvas tents—concrete slab floors with footings and electrical lighting inside
  - Are used for draining and drying soil removed from excavations
  - One tent for soils with some radiological activity and the other for "radiologically clean" soil

- Rubb Tent
  - Tent-like structure large enough to receive trucks for handling and packaging waste
  - Blocking and bracing waste loads

- Northeast Staging Area ("Area 51")
  - Fork lift offloads and onloads intermodals from and to transfer flatbed trailer
  - Empty and full intermodals moved and staged in yard for on-site loading and off-site shipment
  - Intermodals surveyed, inspected, maintained, weighed, and prepared for off-site transportation

- Upper Yard (adjacent to gate 13, or top of the hill, adjacent to the Rubb Tent)
  - Waste removed from building and handed off to Radwaste for off-site shipment loading

- Skip pans loaded within the building
- Waste handlers transfer demolition debris from skips to intermodals with Radwaste oversight

- Off-site Facility in Arcata, California
  - Full intermodals and the returning empty intermodals may be staged in the yard for a day or more before being transported
  - Maintenance performed on containers, equipment, and vehicles

Intermodal Flow Path

There is an established flow path for intermodals on site. Incoming trucks are radiologically surveyed to ensure they are clean. Their cargo intermodals undergo an incoming radiological survey, are logged and recorded. The intermodal is inspected for physical damage, logged, repaired if required, staged on site, and annotated ready to load. The intermodals are loaded with appropriate content and inventory logs completed. The filled intermodals are weighed with weights recorded. The loaded intermodals are radiologically surveyed, with the shipper recording the survey number, labeled with content and weight and staged for off-site shipment. On the scheduled departure day, the intermodal is inspected for securement to the truck and final markings. The truck is radiologically surveyed on its egress from the site.

On-site Movement of Containers

In order to handle the increased truck traffic during busy shipping periods, the traffic flow pattern must obey strict safety guidelines, while also efficiently moving material through the plant. Containers that are considered hazardous are staged for loading outside the busy areas at the Upper Yard inside the Rubb Tent or in a posted restricted area. Nonradioactive waste is staged and loaded onto trucks in a more convenient location, at the concrete pad in front of the WMF.

The safe and environmentally sound transfer of waste from the point of generation to a designated staging area is one of the most important activities during execution of the project. Having dedicated equipment in both the contamination zone and the clean area avoids cross-contamination and prevents radioactive material from entering uncontrolled areas.

Movement of waste materials and reuse materials on site is performed using inspected and approved transport vehicles and containers. Transport vehicles moving from an excavation are cleared of loose dirt or debris and must be released by Radiological Protection prior to being allowed to exit a Radiologically controlled area.

Waste materials not direct loaded at the point of generation of that require additional handling and packaging may be transferred to a location such as the WMF, the SMF, or an alternative approved location, using appropriate containers such as end dump, dewatering bags, or super sacks. Further handling and packaging of waste materials is performed by qualified personnel until the waste is acceptable for transport to the offsite facility.

Any type of work involving radioactive materials is conducted under the control of a Radiological Work Permit, Special Work Permit, or Work Plan with direct support of RP Personnel as directed by the RP Manager.

Additional equipment is required on site including three 50,000-pound capacity fork trucks (Hyster 550s), which are used for loading and off-loading trucks. Transport trailers are added for moving containers in locations unsuitable for fork trucks.

Intermodal Inspection

Pre-use inspection of intermodals takes place in a radiological material area. Once this is completed, the prepackage quality inspection takes place. No packages are loaded onto a transport trailer until these inspections are performed.

Trained maintenance staff working under a Transportation Quality Control Specialist are in charge of container repairs and preventive maintenance. Minor problems are repaired with commercial grade consumable products, while more substantial problems, such as holes in the container, are repaired under an approved work order by a qualified welder.

Material Management

Prior to excavation, materials are precharacterized using physical sampling and subsequent laboratory analysis. Samples are processed and evaluated by an approved laboratory, and analytical results are provided to the Project Chemist and Waste Engineer for review. The GARDIAN System is used to support radiological confirmations for on-site reuse materials. Materials must pass radiological, hazardous, and the Interim Measures Removal Action Work Plan (IMRAW) for chemical reuse criteria before final on-site backfill placement.

Remotely handled equipment is used to access piping by breaking and cutting through concrete surrounding the pipe exterior. Once the piping is extracted, it is placed in the appropriate container (intermodal container or B-25 box) for shipment.

Water Management

Water destined for shipping goes through a rigorous process of sampling and analysis before it is cleared for shipment. The tanker must be surveyed and found to meet the applicable DOT criteria for waste shipment. After the fill operation has been completed and the tanker has been sealed, the volume is recorded and the tanker is ready for shipment.

Civil Works Labor Packaging and Handling Approach

Labor, packaging, and handling associated with remediation of the canals is included in this cost line item, but canal disposal costs are included in Table 3.3.1.4.

Table 3.3.13 presents the budget request from the 2012 NDCTP as well as the updated estimates for this 2017 filing. The amount allocated for caisson work is now included within the field work cost category as the work is being performed by the CWC and as a result, there are no ongoing costs in this category.

TABLE 3.3.13—PACKAGING AND HANDLING BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Waste Disposal (Excludes Caisson / Canals)	**20,178,596**	**21,749,670**	**19,621,602**	**10,874,350**	**2,221,071**	**13,095,421**	**8,654,249**	**6,526,180**
Labor (Packaging and Handling)	18,994,489	20,509,272	18,502,569	10,874,350	2,221,071	13,095,421	7,413,851	5,407,148
Contingency	1,184,107	1,240,398	1,119,033			-	1,240,398	1,119,033
Caisson	**14,225,134**	**15,673,386**	**15,673,386**	**-**	**-**	**-**	**15,673,386**	**15,673,386**
Packaging / Material Handling	12,931,940	14,313,245	14,313,245			-	14,313,245	14,313,245
Contingency	1,293,194	1,360,141	1,360,141			-	1,360,141	1,360,141
TOTAL	**34,403,730**	**37,423,056**	**35,294,988**	**10,874,350**	**2,221,071**	**13,095,421**	**24,327,635**	**22,199,567**
Prorated Reduction [1]			2,128,068 or 5.7%					

Note:
1. The prorated reduction represented $2.1M of the $47M. Material Handling was expected to be reduced by 5.7% but was reduced 65%

Canal Excavation

During canal excavation, traffic management will be conducted in accordance with the Traffic and Pedestrian Control and Routing Plan. The scheduling of the Discharge Canal activities will be coordinated on a daily basis at the Plan of the Day.

Adjoining PG&E and public property must be protected from damage during the scope of work covered in canal remediation. Protection must be provided for utilities, footings, foundations, buildings, and streets. The location of all existing utilities and service lines must be determined and verified by PG&E, and adequate measures taken or devices provided, to safeguard the property before such utilities are disturbed. Waste dumpsters, debris boxes, and skip boxes must be secured by rope, cable, or chocking at wheels at the end of the workday in order to prevent movement. Containers

containing debris or waste must be covered at the end of the workday and at any time when full to near the rim.

Additional activities associated with the canal remediation include:

- Seining the Canals to protect and relocate sensitive animal species is required prior to dewatering the Canals.
- Liquid from the initial dewatering will be pumped to the Humboldt Bay side of the Canals, while contaminated sediments and riprap will be mechanically removed from the Intake and Discharge Canals.
- Excavation of the Discharge Canal included removal of material on either side of the cooling water headwalls and demolition of the discharge structure. The demolished concrete shall be loaded into intermodal containers for disposal off site by PG&E.
- Excavation areas will be dewatered to the extent practical, with a goal to have no more than one inch of standing water, to facilitate PG&E radiological sampling and surveys.
- All excavated materials will be considered potentially contaminated and must be handled as radioactively contaminated material until determined otherwise.
- Once the water is down to a minimal level and the appropriate radiological tests have been completed, the soil excavation will commence.

The team will excavate uncontaminated soil requiring removal and stockpile it, closely coordinating stockpiling activities with PG&E. However, contaminated dry soil will be excavated directly into Intermodal Containers for final characterization. If Waste soil contains moisture above WAC, quicklime mixing will be implemented.

Precautions/Limitations

The Job Safety Analysis is to be reviewed by the work crew prior to performing this work. The Activity Hazard Analysis calls out special precautions to be followed during initial activities until it is proven that excessive dust or mist is not generated that might spread to workers.

Work performed within the RCA and or work with radioactive materials will be conducted under the control of either a Radiological Work Permit or a Special Work Permit, or with direct support of RP Personnel as directed by the RP Manager.

Quicklime Mixing

The purpose of quicklime (calcium oxide) addition is to reduce the moisture content of wet soil and sand. Quicklime may be in granule or pebble form. Pebble is the preferred

form, as it reacts more slowly and is less prone to dusting. Granule quicklime requires a bit more operator skill to apply and mix without dusting.

Along with adding quicklime to wet materials, the excavator will also transfer limed materials within the Rubb Tent from the mix area to the bulk stockpile, the disposal waste bags, or the disposal intermodal containers. It is important that the mix area is well drained and not within a zone of standing water.

As these piles are combined into larger stockpiles, the team must track their origin and destination to meet PG&E reporting requirements for soil management.

3.3.1.6.2 Third Party Disposal Sites

HBPP utilizes waste disposal sites in Idaho, Utah and Texas to achieve the best value for PG&E and the stakeholders. Best value is defined as protecting the workers, the public and the environment, while achieving the greatest risk mitigation at the lowest cost. In almost all cases, the disposal cost is proportional to the quantity of licensed or radioactive material in the waste; generally the higher the activity, the higher the waste disposal cost. For bulk waste disposal, PG&E negotiated standard rates on a per-container (intermodal) or per-shipment basis. PG&E has contracts in place, as described below for each waste type for the expected volume of waste planned to be generated. In addition, PG&E has contingency plans in place should one disposal option become unavailable. For example, should disposal of exempt waste in Idaho become unavailable, although not a preferred option due to increased cost, the exempt waste could be sent for disposal in Texas or Utah as Class A waste. Similarly, if disposal of Class A waste in Utah is unavailable the waste could be shipped to Texas.

Table 3.3.14 presents the 2012 NDCTP cost estimate as well as the new estimates prepared for this 2017 NDCTP filing.

TABLE 3.3.14—WASTE DISPOSAL BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Waste Disposal (Excludes Caisson / Canals)	**55,760,990**	**59,792,367**	**53,942,061**	**37,389,482**	**32,601,773**	**69,991,255**	**(10,198,888)**	**(16,049,194)**
Third Party Disposal Sites	52,315,427	56,195,189	50,696,844	37,389,482	30,349,040	67,738,523	(11,543,333)	(17,041,678)
Contingency	3,445,562	3,597,177	3,245,216		2,252,732	2,252,732	1,344,445	992,484
Caisson	**26,441,182**	**29,133,143**	**29,133,143**	**-**	**23,313,034**	**23,313,034**	**5,820,108**	**5,820,108**
Waste Disposal	24,037,438	26,604,960	26,604,960		21,824,507	21,824,507	4,780,453	4,780,453
Contingency	2,403,744	2,528,183	2,528,183		1,488,528	1,488,528	1,039,656	1,039,656
Canal Remediation	**22,246,620**	**24,511,535**	**24,511,535**	**-**	**12,560,726**	**12,560,726**	**11,950,810**	**11,950,810**
Disposal	20,224,200	22,384,417	22,384,417		11,660,406	11,660,406	10,724,010	10,724,010
Canal Contingency	2,022,420	2,127,119	2,127,119		900,319	900,319	1,226,800	1,226,800
Subtotal Caisson / Canal / GWTS	**48,687,802**	**53,644,678**	**53,644,678**	**-**	**35,873,760**	**35,873,760**	**17,770,918**	**17,770,918**
TOTAL	**104,448,792**	**113,437,045**	**107,586,739**	**37,389,482**	**68,475,533**	**105,865,015**	**7,572,030**	**1,721,724**
Prorated Reduction [1]			5,850,306 or 5.2%					

Note:
1. The prorated reduction represented $5.9M of the $47M. Disposal was expected to be reduced by 5.2% but decreased 6.7%

The number of exempt shipments is estimated to increase, while the Class A shipments decrease, resulting in approximately the same total cost for waste disposal.

3.3.1.6.2.1 Waste Processor

Noncompliant waste is waste that does not meet criteria for direct disposal or that cannot be processed on site. HBPP has utilized waste processors in Washington, Tennessee, Florida, and South Carolina for noncompliant waste. With the exception of the GTCC waste stored in the ISFSI, there are no waste types or forms remaining that cannot be processed or disposed. Waste processing contracts cover multiple different types of radioactive waste and include the following:

- Lead shielding and waste recycle
- Asbestos packaging and disposal
- Dry Active Waste Repackaging/compaction or size reduction
- Resin processing
- Liquid processing via evaporation, solidification, or stabilization
- Component dewatering or processing
- Mixed waste treatment per EPA treatment standards

Due to the location of the waste processors, transportation costs can be a significant cost factor. HBPP strives to minimize the quantity of waste requiring processing and select the compliant process option with the best value.

3.3.1.6.2.2 Exempt Waste

NRC Letter dated December 19, 2012, "HBPP Unit 3—Request for 10 CFR 20.2002 Alternate Disposal Approval and 10 CFR 30.11 Exemption for Plant Waste Disposal at US Ecology Idaho (TAC No. J00369)" provides for disposal of very low-activity waste at the Grand View, Idaho, disposal facility. The Idaho facility is located in the remote Owyhee desert of southwest Idaho, an area with arid climate and ideal geology for permanent waste isolation. The disposal facility consists of triple-lined disposal cells with a leachate collection system, and secondary collection and leak detection capability. The composite liner consists of a protective fabric, high density polyethylene (HDPE) geonet for drainage, a 60-mil HDPE synthetic liner, a second HDPE geonet for drainage, and a final 80-mil HDPE synthetic liner over three feet of compacted clay.

The existing contract allows for up to 20 shipments of exempt waste per week over the duration of the HBPP demolition project. The first waste shipments went to Idaho in 2010.

A significant cost benefit is the negotiated rate for processing mixed wastes (both radioactive and chemically hazardous). Mixed waste is included in the standard disposal fee, which means that mixed waste meeting the exemption criteria can be processed and disposed for no additional cost above the bulk disposal fee. This results in $10K to $50K savings per shipment.

As discussed below, low-activity radiological and mixed wastes may also be shipped as Class A waste to Texas, exempted by the State of Texas, and disposed to the RCRA Cell.

3.3.1.6.2.3Class A Waste

Low Level Waste is classified according to its radiological hazard. The classifications include Class A, B, and C, with Class A being the least hazardous and accounting for 96 percent of the nation's Low Level Waste. Class B is more hazardous, and Class C is the most hazardous of the Low Level Wastes. As the waste class and hazard increase, the regulations established by the NRC require progressively greater controls to protect the health and safety of the public and the environment.

Class A waste is usually segregated from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in 10 CFR §61.56(a). If the waste also meets the stability requirements set forth in 10 CFR §61.56(b), it is not necessary to segregate the waste for disposal. Lower activity wastes containing licensed material are considered exempt from 10 CFR §61 disposal criteria, but are still transported off site for disposal to a landfill in Grand View, Idaho.

Class A wastes are disposed in Utah or Texas. PG&E strives to minimize the quantity of Class A waste requiring disposal and select the disposal option with the best value.

Currently, all Class A waste shipments are planned for disposal at the Clive, Utah, site. The Utah site was started in the late 1970s, when the DOE and the state of Utah began cleanup of an abandoned uranium mill site. The site is located in Utah's West Desert approximately 75 miles west of Salt Lake City. The site's remote location, low precipitation, naturally poor groundwater and low-permeability clay soils make the site attractive for radioactive waste disposal. The site uses an above-ground engineered disposal cell that provides a long-term disposal solution. The site is licensed to receive, treat, and dispose Class A LLRW. HBPP is responsible to characterize, classify, schedule, manifest, package, and transport the waste to Utah.

Although not the primary facility for disposal of Class A waste, HBPP has the ability to transport Class A waste to the Andrews, Texas, facility. The site is a fully licensed

1,338-acre facility located on 14,900 acres in western Andrews County, Texas. It is located within a 1,200-foot-thick, nearly impermeable, red-bed clay formation, and the site ensures safe and permanent disposal of radioactive waste by combining this unique natural barrier with a custom-designed and engineered 7-foot-thick, steel-reinforced concrete liner system. As described above, HBPP does not currently use this facility for Class A waste but retains contracts as a contingency should this capacity become necessary.

3.3.1.6.2.4State Disposal Fees

There is no Idaho State fee for exempt waste shipped to Idaho for disposal. However, the States of California, Utah, Texas, Tennessee, and South Carolina assess various fees for export, import, disposal, and processing of wastes.

The State of California Southwestern Low-Level Radioactive Waste (SWLLRW) Commission regulates radioactive waste exported from the state. Pursuant to SWLLRW Disposal Compact Consent Act (Public Law 100-712, Article VI, Subdivision [A], and Article III Subdivision [G][20]), the commission requires an export permit for radioactive waste leaving the state. In the past, separate export permits were required for waste disposal and processing at different facilities. Currently, PG&E has an export permit for processing and disposal of radioactive waste sent to Clive, Utah, and a separate export permit for disposal of radioactive waste sent to Andrews, Texas. The fee structure has changed over the past years, with separate petitions for disposal and processing. Today there are separate petitions for disposal (including processing) for Utah and Texas. The export permit is renewed annually and costs $1.50 per cubic foot. In 2015 PG&E obtained an export permit for $22.5K for 15,000 cubic feet of Class A radioactive waste to be transported to Clive, Utah. Table 3.3.15 summarizes the petition fee for Utah disposal for the prior years (this table excludes processor and Texas disposal petition fees).

TABLE 3.3.15—PETITION FEE FOR DISPOSAL AT CLIVE, UTAH

Year	Petition Fee
2012	$60K
2013	$60K
2014	0 *
2015	$22.5K
2016	$22.5K
* No petition fee was paid in 2014 because of prior year overpayment.	

The Utah Radiation Control Rules, R313-26-3, establish the terms for a Generator Site Access Permit (GSAP) Program, which authorizes waste generators, waste processors, and waste collectors to deliver radioactive wastes to a land disposal facility located within Utah. The State of Utah, Department of Environmental Quality, Division of Radiation Control, issues PG&E a GSAP for accessing a Land Disposal Facility within Utah under the permit requirements in R313-26-3. Radioactive waste exported from California by PG&E is disposed in Utah pursuant to the GSAP. The GSAP for PG&E to dispose of radioactive waste to Utah is renewed annually and costs $2.5K.

Pursuant to Department of Environment and Conservation Rule 0400-20-10-.32, a Tennessee Radioactive Waste License-For-Delivery is required to be obtained by all shippers who transport radioactive waste or have radioactive waste transported into or within the State of Tennessee. The State of Tennessee, Department of Environment and Conservation, Division of Radiological Health, issues a Tennessee Radioactive Waste License-For-Delivery. The Tennessee Radioactive Waste License-For-Delivery for PG&E to process radioactive material and waste in Tennessee is renewed annually and costs $850.00.

State of South Carolina, South Carolina Department of Health and Environmental Control, requires a Radioactive Waste Transport Permit for any radioactive waste disposed, stored, processed or transported in the state. PG&E maintained the Radioactive Waste Transport Permit 0200-04-12-Y in 2012 and 2013 for an annual fee of $300.00. HBPP utilized this permit for processing of GTCC waste. This permit has not been renewed, as HBPP does not currently utilize any processing or disposal in South Carolina.

Class B and C radioactive waste disposed in Andrews, Texas, requires an Import permit and fee. In addition to the import permit, the Texas Department of State Health Services assesses an additional $10-per-cubic-foot fee for shipment of waste to the Low-Level Radioactive Disposal Site. Class A radioactive waste sent to the RCRA Cell that is exempted by the state of Texas does not require an import permit.

3.3.1.7 Small Value Contracts

Table 3.3.16 presents the 2012 NDCTP estimates for Small Value Contracts, as well as costs incurred and estimated to complete this category.

TABLE 3.3.16—SMALL VALUE CONTRACTS BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Small Value Contracts	**38,195,706**	**39,758,493**	**35,868,375**	**21,610,723**	**16,069,098**	**37,679,821**	**2,078,673**	**(1,811,445)**
Small Dollar Vendors	10,751,075	11,239,798	10,140,055	2,715,658	1,857,790	4,573,447	6,666,351	5,566,608
Specialty Contracts	25,291,138	26,274,027	23,703,279	18,895,065	12,569,999	31,465,064	(5,191,037)	(7,761,785)
EPC Services	(388,197)	(477,572)	(430,844)			-	(477,572)	(430,844)
Contingency	2,541,690	2,722,239	2,455,886		1,641,309	1,641,309	1,080,931	814,577
Caisson	**3,558,814**	**3,790,117**	**3,790,117**	**-**	**7,751,736**	**7,751,736**	**(3,961,620)**	**(3,961,620)**
Other	3,842,250	4,097,728	4,097,728		6,613,112	6,613,112	(2,515,385)	(2,515,385)
Small Dollar Vendors	3,437,250	3,665,799	3,665,799		786,949	786,949	2,878,849	2,878,849
Specialty Contracts	405,000	431,929	431,929		5,826,163	5,826,163	(5,394,234)	(5,394,234)
EPC Services	(728,411)	(775,622)	(775,622)			-	(775,622)	(775,622)
Contingency	444,975	468,011	468,011		1,138,624	1,138,624	(670,613)	(670,613)
TOTAL	**41,754,520**	**43,548,610**	**39,658,492**	**21,610,723**	**23,820,834**	**45,431,557**	**(1,882,947)**	**(5,773,065)**

Prorated Reduction [1] 3,890,118 or 8.9%

Level 2 Subtotals								
Small Dollar Vendors	14,736,165	15,474,751	14,318,686	2,715,658	2,818,349	5,534,007	9,940,744	8,784,679
Specialty Contracts	27,018,356	28,073,860	25,339,807	18,895,065	21,002,485	39,897,550	(11,823,690)	(14,557,743)

Note:
1. The prorated reduction represented $3.9M of the $47M. Small Value Contracts was expected to be reduced by 8.9% but increased by 4.3%

TABLE 3.3.17—SMALL VALUE CONTRACTS ESTIMATES TO COMPLETE

2017 NDCTP Nuclear Decommissioning-Small Value Contracts (with Contingency) 2015 Actuals

Row Labels	Total Costs	2015	2016	2017	2018	2019	2020	2021	2022	2023
Small Dollar Vendors	2,818,349	226,955	1,310,224	608,190	469,480	173,800	29,700			
Specialty Contracts	21,002,485	4,886,104	6,972,052	3,260,033	2,979,187	1,323,254	1,249,454	140,400	96,000	96,000
Grand Total	23,820,834	5,113,060	8,282,276	3,868,223	3,448,667	1,497,054	1,279,154	140,400	96,000	96,000

2017 NDCTP Nuclear Decommissioning-Small Value Contracts (without Contingency) 2015 Actuals

Row Labels	Total Costs	2015	2016	2017	2018	2019	2020	2021	2022	2023
Small Dollar Vendors	2,644,739	226,955	1,253,084	552,900	426,800	158,000	27,000			
Specialty Contracts	18,396,162	4,886,104	5,889,784	2,716,694	2,482,656	1,102,712	1,041,212	117,000	80,000	80,000
Grand Total	21,040,901	5,113,060	7,142,868	3,269,594	2,909,456	1,260,712	1,068,212	117,000	80,000	80,000

Small Value Contracts include Small Dollar Vendor and Specialty Contract costs. The 2012 estimate included $40.4M ($36.7M Reduced) and an additional $3.2M ($2.9M Reduced) in contingency. The actual costs were lower than the 2012-2014 estimates for the recurring costs associated with essential services to support a large staffing organization due to the fact that a portion of these services became civil works scope to consolidate services. These consolidated contract cost categories include, but are not limited to: janitorial services, building maintenance services, portable toilet rental and maintenance, temporary lighting and trash and refuse collection. Specialty contracts for subject matter experts and other specific scope of work contracts as well as services for parking lot striping and maintenance, signage, furniture rental and office supplies, employee travel for training, communications services and Industrial Security services for security at site gates remain part of the ongoing project oversight costs. The ETC estimates in Table 3.3.17 were established based on costs incurred to date for small dollar vendors and specialty contracts. The forecasts in Tables 3.3.16 and 3.3.17 are in nominal dollars for years 2012 through 2014, and 2014 dollars for 2015 through 2023 forecasts.

3.3.1.7.1 Small Dollar Vendors

The $2.6M dollar forecast (without contingency) for small dollar vendors was calculated using analysis of current burn rates, job estimates, contract values and management expertise of project history. Many recurring costs are assumed to continue as the project moves forward. Each cost was evaluated based on their need during each of the four milestone periods–Reactor Pressure Vessel, CSM Wall Installation, Caisson Removal, and FSS. These recurring costs include phone and other utility costs; circuit leases; printer rental; office supplies; hardware and software updates; preventative maintenance contracts; rubbish and recycling collection and disposal; Environmental Sampling Analysis; Mitigation and Monitoring; Electric Power Research Institute, Decommissioning Technology Program Membership; and miscellaneous employee expenses, including travel and training.

Small dollar contracts include general recurring costs associated with operation of ongoing decommissioning activities. They include:

- Circuit Leasing and Internet Services
- Computer Software and Hardware
- Employee Training, Travel, and Meal Expense
- Electric Power Research Institute Membership
- Mitigation and Monitoring Implementation
- Office Supplies
- Printer Rental and Maintenance Support
- Safety Awards
- Shuttle Services
- Water and Sewer Services
- Decommissioning Plant Coalition Representation
- Lock and Alarm Services
- Landscape and Site Maintenance
- Printing and Document Shredding Services
- Confined Space Rescue Operation Services
- Department of Public Health Fees
- State Water Resource Control Fees
- Department of Housing Portable Trailer Permits

This scope of work is estimated at $2.6M without contingency.

3.3.1.7.2 Specialty Contracts

Specialty Contracts expenses for the remainder of this project are estimated to be $18.4M without contingency. Specialty Contracts are issued for specific skill services not performed by overhead staffing. They include various elements such as permitting fees, environmental contracts, NRC fees, and other miscellaneous specialty consultations.

Services provided by this component include NDCTP Subject Matter Experts (SME), Slurry Wall Oversight SME, ORAU SME, System Safety Risk SME, Industrial Security Services, FSR O&M Services, Relocation Services, Biological Monitoring and Reporting Services, LTS Chemical Analysis Sampling Services, Hazardous Waste Disposal, Care On-Site Services, Schedule and Costing Support, Legal Representation and Support, Oracle P6 System Software and Services, Other Support and Training, NRC Licensing, Permitting and Permitting Assistance, and other necessary services to support the project on an ongoing basis.

3.3.1.7.2.1 NDCTP Subject Matter Experts

NDCTP Filing SME

The NDCTP filing SME reports directly to the HBPP Plant Manager and works closely with the HBPP Decommissioning Team to develop documentation needed to support PG&E's NDCTP filing with respect to both Testimony and the DPR. Services performed include: preparation of detailed descriptions and funding justification for completed projects, site staffing planning expense updates with justifications, updating or preparing additional subsections of the DPR, and other duties as requested by PG&E's Technical Coordinator or their delegates.

NDCTP Filing Technical Writer SME

The NDCTP SME reports directly to the HBPP Plant Manager and works closely with the HBPP Decommissioning Team to develop documentation needed to support PG&E's NDCTP with respect to both Testimony and the DPR. Services performed include: preparation of detailed descriptions and funding justification for completed projects, site staffing planning expense updates with justifications, updating and preparation of additional subsections to the DPR and other duties as requested by PG&E's Technical Coordinator or their delegates.

NDCTP Prudency Review SME

The NDCTP Prudency Review SME reports directly to the HBPP Director/Plant Manager. This position will perform project controls oversight services on an as-needed

basis. These services provide validation that PG&E's Nuclear Decommissioning Project is being performed in a prudent and reasonable manner. Deliverables include: project controls documentation in support of civil works and self-perform contracts that have the potential to result in changes to the 2012 NDCTP DPR, tracking of modifications to contracts and cost impacts, documentation of decisions and contract, scope, or specification modifications, support to the Director/Plant Manager with preparation of NDCTP testimony and filings, and expert witness testimony as may be requested by the Director/Plant Manager.

This scope of work is estimated at $680K.

3.3.1.7.2.2 Slurry Wall Oversight Subject Matter Expert

HBPP Nuclear Generating Station Unit 3 included a subgrade caisson structure to house the reactor vessel. Removal of the reactor vessel requires mitigating the effects of high groundwater influence and stabilizing the caisson for demolition and excavation. A five-ring CSM wall will be constructed around the caisson structure to allow for safe demolition and excavation. The Slurry Wall Oversight SME provides specialized technical services including design review, technical engineering document review, and review of work plan submittals to minimize project risk.

This scope of work is estimated at $650K.

3.3.1.7.2.3 Oak Ridge Associated Universities Subject Matter Expert

The ORAU SME provides subject matter expertise and technical support to project personnel utilizing extensive site experience and knowledge gained from previous on-site assignments. Deliverables include assistance in records retrieval, operating history, unique involvement with site-specific events, and the application of knowledge to current decommissioning project.

This scope of work is estimated at $50K.

3.3.1.7.2.4 System Safety Risk Subject Matter Expert

The System Safety Risk SME reports directly to the HBPP Plant Manager and has been instrumental in the development, implementation, and execution of a functional and effective Risk Management Program. The DRM provides for systematic evaluation and management of decommissioning Work Process and Work Process Activity risk elements. For further information refer to section 3.3.1.2.2, Enterprise Risk Program.

This scope of work is estimated at $100K.

3.3.1.7.2.5 Industrial Security Services

HBPP on-site Industrial Security Services include security personnel and oversight of gated entrances. Oversight includes employee verification and ingress/egress, visitor notification, service vehicle clearance, emergency support, package delivery, parking lot patrol, and minor security issue support.

This scope of work is estimated at $1.8M.

3.3.1.7.2.6 Final Site Restoration Operations and Maintenance Services

Following FSR, HBPP shall ensure that site remediation is sustained. This service includes vegetation and environmental oversight, maintenance, and reporting. FSR O&M is required for a five-year period commencing at the completion of each site-specific restoration task.

This scope of work is estimated at $1.3M.

3.3.1.7.2.7 Relocation Services

HBPP Relocation Services are necessary to facilitate movement of staffing and personnel to off-site facilities to support on-site decommissioning efforts. These services include relocation supplies, IT support and hardware relocation, moving service support, and off-site demobilization.

This scope of work is estimated at $1.5M.

3.3.1.7.2.8 Biological Monitoring and Reporting Services

A mitigation measure for on-site spent fuel storage by HBPP included a wetland preserve and walking trail. Ongoing monitoring and maintenance by HBPP is required in accordance with the Buhne Point Wetlands Preserve Mitigation and Monitoring Plan. These services are a requirement of the agreement with CCC and include oversight of wildlife surveys, wetland hydrology assessments, vegetation monitoring, Phase 1 maintenance, contractor coordination and planning, agency meeting and coordination, and annual reporting.

This scope of work is estimated at $3.4M.

3.3.1.7.2.9 Final Status Survey Chemical Analysis Sampling Services

This task includes contract services to perform HBPP on-site sampling and analysis for radioscope and environmental analysis in order to support the termination license.

This scope of work is estimated at $190K.

3.3.1.7.2.10 Hazardous Waste Disposal

This work includes transport and disposal of various low-level hazardous wastes associated with ongoing decommissioning efforts. Hazardous wastes and recyclable materials include used oil, oily debris, mercury, lead, batteries, bulbs, PCB Ballasts, universal wastes and E wastes, etc., and are picked up on a routine quarterly basis to comply with RCRA and CA State 90 day waste accumulation regulations.

This scope of work is estimated at $165K.

3.3.1.7.2.11 Care On-Site Medical Services

HBPP Care On-Site Services provide oversight and support of occupational injury and illness programs. These services include training, consultation, technical support, physician services, quality assurance and monitoring of the program, and medical liability coverages.

This scope of work is estimated at $500K.

3.3.1.7.2.12 Schedule and Costing Support

The CWC provides schedule and costing support for review and approval by PG&E's Project Controls Office in support of HBPP schedule integration, maintenance, and operations. The scope of work includes:

- Earned value metric details and reporting at the work package level (WBS Level 4)
- Project Controls Support Personnel
- Report Writer Personnel
- Earned Value Cost Processor Personnel
- Support PG&E with California Public Utilities Commission (CPUC) reporting requirements
- Evaluate the actual funding requirements necessary to perform the Services and adjust the authorized CWA value as may be required to fund the PG&E required/requested Services
- Provide variance analysis on weekly basis
- Track performance reports on monthly basis
- Track actual costs on monthly basis
- Estimate to complete analysis on monthly basis

This scope of work is estimated at $3.7M.

3.3.1.7.2.13 Legal Representation/Support

This scope of work includes legal services provided to support PG&E in dealings with the California Public Utilities Commission, Department of Energy, California Coastal Commission and other agencies.

This scope of work is estimated at $540K

3.3.1.7.2.14 Oracle P6 System, Support, and Training

This element covers program software, hosting and implementation support services for the deployment of Primavera P6 (scheduling and project management software), including:

- Implementation, including planning, initial design, module architecture, workflow, internal communication, and end user support.
- Training, including instructions and on-site training for CM14 users and administrator(s).
- Business Intelligence, including development of standard and custom form and reports, training, and module object development.
- Contract Management Interface (CMI) Implementation, including initial design, custom architecture, and on-site training.
- Cloud-based hosting for CM14 and CMI (25 user maximum).

This scope of work is estimated at $185K

3.3.1.7.2.15 NRC Licensing

HBPP licensing for decommissioning is administered by the NRC. Fees associated with licensing are covered under this element. They include:

- LTP Revisions and Reviews
- FSS Package Reviews
- ORAU visits and reviews
- Partial Site Release Review
- Site License Termination Review
- NRC Project Manager Interface Oversight
- NRC Headquarters site visits

This scope of work is estimated at $1M.

3.3.1.7.2.16 Permitting and Permitting Assistance

The decommissioning process is regulated by numerous federal, state, and local agencies. Regulatory permitting and associated fees are a necessary component of

decommissioning a nuclear facility. This element includes certain agency permitting fees and permitting assistance by outside contractors. They include:

- FSR—outside service contracts covering permitting assistance and support of HBPP's submittal of FSR permits to regulatory agencies
- CCC—coastal development review and permitting of caisson removal and various restoration projects
- Humboldt County—development permits
- State of California—Hazardous substance fees
- Excavation and concrete penetration permits

This scope of work is estimated at $1.2M.

3.3.1.7.2.17 Other Services

Other necessary services to support the project on an ongoing basis include:

- Site Alarm Monitoring Services
- Administrative Support Services
- Information System Technology Services
- Hydrologic Impact Study and Support
- Environmental Coordinator, Support and Training Services
- ISIP V3 Maintenance
- Haz Mat Business Plan
- REMP Analysis
- Aerial Mapping of HBPP
- J.L. Shepard & Associates Model 89 Source Calibrator Turnover
- Transmission support

This scope of work is estimated at $1.2M.

3.3.1.8 Spent Fuel Management Costs

The operation and maintenance of an ISFSI requires much more than just security of the canisters that contain spent nuclear fuel and GTCC wastes. Some of the multitudes of activities include:

- Developing, controlling, and maintaining procedures and processes
- Performing routine and nonroutine radiological and environmental sampling
- Maintaining alignment and compliance with evolving and changing regulatory requirements
- Training and qualifying new staff and maintaining qualification of existing staff
- Tracking the performance of the security and containment systems
- Preparing for renewal, extension, or revision of the various licenses and permits required for operation and maintenance of an ISFSI

The staffing required to complete all of these activities is significant in both numbers of personnel and the overhead costs. PG&E has two ISFSIs; one at HBPP and another at DCPP. The two ISFSIs are both licensed by the NRC under 10 CFR §72 and have similar security systems, staffing requirements, and Operations and Maintenance requirements. Rather than have two separate and redundant staffs working on similar tasks, PG&E has sought to leverage the experience at both ISFSIs to minimize the replication of efforts. The "Fleet" concept is a well-proven method in the nuclear industry that has been used to reduce redundancy and cost without a reduction in safety or efficacy.

Four specific areas where the fleet concept will directly benefit the HBPP ISFSI are:

- Support of ISFSI license renewal
- Radiological support for compliance with NRC requirements
- Engineering support for system upgrades
- Updating the training tracking system

The HBPP ISFSI License was issued for a 20-year period in November 2005. It will expire prior to transferring the spent nuclear fuel and GTCC wastes to a national repository. PG&E will be required to request an extension or renewal for that license approximately at least two years prior to expiration. However, because it can take up to ten years, PG&E intends to file approximately six years before HBPP ISFSI expiration.

In order to complete the transition to a fleet concept, the tracking system for training of HBPP staff will need to meet the more up-to-date requirements of the DCPP QA program. The existing training database that is used at HBPP is based on an old program that was developed when the plant went into SAFSTOR and has not been classified as a Quality Training Database. Very few modifications have been made to the system over the last several decades. The effort to update the existing HBPP system to a Quality Program was determined to be cost prohibitive. Thus, a project is underway to convert the old training database to a Quality Program that is currently used at DCPP. This will allow the HBPP ISFSI and DCPP organizations to accept training records from the other facility as applicable.

The ISFSI will continue to operate under a separate and independent license (10 CFR §72) following the termination of the Unit 3 10 CFR §50 operating license. The ISFSI will continue in operation until all spent fuel and GTCC material has been transferred to the DOE. This study assumes that the DOE will commence the transfer of spent fuel and GTCC material from HBPP Unit 3 ISFSI beginning in 2028, completing the transfer in 2029.

At the conclusion of the transfer process, the ISFSI will be decommissioned. PG&E assumes that one additional year (2030) will be needed to restore the site to final end-state conditions (See Section 1.6). For this analysis the vaults are not assumed to be activated, because of the age of fuel and the relatively short residence time in the vaults. Consequently, this estimate does not include the cost of any significant decontamination of the ISFSI facility. Confirmation of the radiological status will be obtained through surveys and sampling of the vaults..

The NRC will terminate the ISFSI 10 CFR §72 license when it determines that site remediation has been performed in accordance with the LTP, and the documented terminal radiation survey demonstrates that the structure is suitable for release. Once these requirements are satisfied, the NRC will be in a position to terminate the licensing of on-site ISFSI.

Table 3.3.18 presents estimated costs associated with Spent Fuel Management from the 2012 NDCTP filing alongside current estimates to complete within this 2017 NDCTP filing, showing the variance between the two filings. Discussions regarding these variances are embedded within the following Spent Fuel Management subsections.

TABLE 3.3.18—SPENT FUEL MANAGEMENT BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP					
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014	ETC 2015 To 2025	Total EAC 2012 To 2025	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)	2026-2030 Estimate
Spent Fuel Management	73,607,565	78,917,475	71,293,127	14,279,397	89,337,377	103,616,774	(24,699,299)	(32,323,647)	47,809,066
Security (PG&E)	47,243,286	51,004,286	46,013,838	11,235,555	58,225,757	69,461,312	(18,457,026)	(23,447,474)	21,094,303
ISFSI O&M	7,925,034	8,416,526	7,593,022	1,632,172	5,530,894	7,163,067	1,253,459	429,955	2,000,000
ISFSI Staffing / Engineering / Specialty Contracts	2,945,587	3,100,203	2,877,996	1,089,192	5,674,259	6,763,451	(3,663,248)	(3,885,455)	892,000
ISFSI Infrastructure Expenses				77,231	6,713,000	6,790,231	(6,790,231)	(6,790,231)	830,000
NRC Fees	2,940,000	3,133,692	2,827,080	245,246	1,842,559	2,087,805	1,045,887	739,275	1,115,000
ISFSI Removal	2,000,000	2,132,983	1,924,284	-	-	-	2,132,983	1,924,284	11,744,264
Transfer to DOE	2,500,000	2,666,229	2,405,355	-	-	-	2,666,229	2,405,355	2,666,229
Contingency	8,053,659	8,463,556	7,651,551		11,350,908	11,350,908	(2,887,352)	(3,699,356)	7,467,269
TOTAL	73,607,565	78,917,475	71,293,127	14,279,397	89,337,377	103,616,774	(24,699,299)	(32,323,647)	47,809,066
Prorated Reduction [1]			7,624,348 or 9.7%						

Note:
1. The prorated reduction represented $7.6M of the $47M. Spent Fuel Management was expected to be reduced by 9.7% but increased by 31.3%

At a summary level, the 2017 HBPP forecast for the period 2012 through 2025 is about $24.7M above what was filed in 2012 for that same period. Several significant changes have occurred between the two filings, including:

- The ISFSI transitioned early to a stand-alone facility, and that resulted in significant early changes to staffing (see 3.3.1.8.1) and to Engineering Services and Specialty Contracts (see 3.3.1.8.3).
- The ISFSI has identified additional required infrastructure modifications needed to maintain conformance with regulatory and license requirements (see 3.3.1.8.4).

As a result of the delay in transfer of Spent Nuclear Fuel by the DOE for an extended period beyond 2025, the 2017 NDCTP includes an additional $47.8M in forecast costs.

These costs are comprised primarily of staffing, O&M, Engineering, Infrastructure improvements, ISFSI FSR, and NRC fees.

3.3.1.8.1 Security Staff Costs

As specified in HBPP's license, the HBPP ISFSI Security unit, including ISFSI specialists, are responsible for the safe and secure storage of 390 spent fuel assemblies from the decommissioned HBPP Unit 3. PG&E ISFSI specialists, who also function as the Armed Security Officers (ASO), are trained and qualified, in accordance with the Guard Training Plan and the ISFSI FSAR. They conduct 24-hour surveillance of the spent fuel and comply with NRC security requirements, as specified in NRC orders EA 06-276 and EA 06-277, and the NRC-approved Physical Security Plan. ISFSI specialists' duties include conducting patrols and searches and verification of authorized personnel and activities in the ISFSI. They provide important functions and elements, demonstrating compliance with ISFSI security included in the FSAR.

ISFSI Shift Managers are responsible for supervision of officers and shift activities, and implementation of the site's emergency plan. In addition to their normal duties, they must qualify as ASOs and can revise nuclear quality and department-level procedures. Officers are required to enter issues into the CAP for resolution. They are responsible for operations, emergency response, and security reporting to the NRC and are responsible for declaration of Emergency Action Levels, pursuant to the HB Site Emergency Plan, and immediate action in response to emergencies

For the purpose of this estimate, PG&E is assuming a four-year delay, until 2028, in the time at which DOE will commence taking the spent nuclear fuel and GTCC wastes. DOE's shipping matrix allows for the transfer of one cask in the first year (2028), with the remaining four casks planned for transfer in the following year (2029). The 2012 NDCTP assumption was that the DOE would commence taking the materials in 2024 and the site would be decommissioned and restored by 2025. Based on the assumed time required for the DOE to secure a suitable facility for storage of high-level radioactive waste (spent nuclear fuel) and its shipping matrix, five years were added to the security scope. This change in scope increases ISFSI staffing cost estimates by roughly $21.1M (in 2014 dollars). The additional cost is primarily related to the additional time that security personnel will be at the site.

In 2012, the estimate for security staffing was $51.0M. The current estimate for this same period is $69.5M. When compared to the 2012 NDCTP CPUC filing, current estimated security staff costs for the period from 2012 to 2025 are approximately $18.5M (36 percent) higher.

To support itself as a separate entity, additional site personnel were integrated into the ISFSI organization including: a part-time Director of Security (based at DCPP); a full-time Manager ISFSI Support; a Regulatory Assurance Manager; an ISFSI Systems and Work Control Manager; an ISFSI Expert Trainer; and a part-time Director's Assistant. From the variance analysis discussed above, this amounts to an additional $1M per year in security staff costs and $300K per year in additional overhead costs. This additional cost over a period of 11 years amounts to $14.3M. Also included in the variance is new scope of work totaling $1.5M for additional services of a DOE Litigation Specialist and part-time DOE Litigation Legal Counsel, as well as $3.2M in PG&E labor for the ISFSI License Renewal Project (See Section 3.3.1.8.4.1).

The NRC approved a LAR on September 23, 2015, on changes to the Humboldt Bay Site Emergency Plan, in accordance with 10 CFR §50.54. By the end of 2015, the ISFSI was separated from Unit 3 decommissioning and became responsible for full implementation of the Emergency Plan for the site as a stand-alone ISFSI reporting up through DCPP.

3.3.1.8.2 Independent Spent Fuel Storage Installation Operating Costs

ISFSI O&M functions include effective and efficient ongoing management, safety, and compliance necessary to meet NRC requirements.

Overhead costs to maintain the ISFSI include: Security Officer's mandatory Personal Protection Equipment; physical, auditory, and psychological testing for Fitness for Duty requirements; uniform supplies; arms and ammunition; radio and cellular equipment and service; specialty training; office supplies; and facility services and maintenance.

In the 2012 NDCTP filing, the methodology for estimating O&M costs was based upon actual costs over a period of four years (2009 to 2012), in $2011, and averaged. An average cost of $575K was estimated (in $2011).

In the 2017 NDCTP filing, the methodology for estimating O&M costs was based upon actual costs over a period of three years (2012 to 2014), in $2014, and averaged. An average cost of $500K is estimated.

Therefore, ISFSI O&M costs, when averaged over varying periods of performance (2009 to 2011 and 2012 to 2014), remain reasonably predictable. The methodology to develop the estimated costs remains the same between the 2012 and 2017 NDCTP filings.

A refined average of $500K (in $2014) instead of $575K (in $2011) is forecasted in the 2017 NDCTP CPUC Filing.

3.3.1.8.3 Engineering Services/Specialty Contracts

In the 2012 NDCTP CPUC Filing, Engineering and Specialty Contracts for ISFSI were primarily captured within plant staffing costs because ISFSI remained integrated with the Unit 3 decommissioning organization. In 2015, ISFSI separated from Unit 3 and now remains its own stand-alone organization, reporting to DCPP. Therefore, the planning costs that were previously captured within Unit 3 decommissioning are reallocated and reforecasted under Spent Fuel Management. These costs include Engineering/Specialty Contracts, as this work will be sourced through the DCPP Supply Chain and quality assurance program, and the engineering work managed through the DCPP design control program. This change allows the remainder of Unit 3 Civil Works to be done under a streamlined procedure program that was updated when ISFSI separated, lessening the stringent quality programs and procedures for Unit 3 decommissioning.

The forecast costs for these services under ISFSI includes an expected learning curve, because previous Unit 3 decommissioning in-house engineering services will transition to contract services through DCPP. ISFSI engineering support, design, and review must now be provided by PG&E DCPP engineers and contract engineers. The scope of work includes System Equipment Failure Evaluation and Design, Safe Guard Information (SGI) Scope, ISFSI Security/Communication System, Communication Panel Replacement, and License Renewal Support.

Civil and structural support for the ISFSI will continue through its operation. For example, actual costs were $41K in 2012, $91K in 2013, and $68K in 2014. Work included:

- Installation of the ISFSI French Drain—This modification was done to reduce the risk of localized shallow sliding along the bluff slope due to erosion activities. Protection of the bluff face is critical to ensuring that erosion does not extend to the ISFSI structure. Subsequent surveys have been conducted on an annual basis with positive results and will continue to be done for the foreseeable future.
- Modification to the ISFSI Vehicle Barrier System (Installation of the Nasatka Barrier)—In the past, a passive vehicle barrier system was used outside the ISFSI to prevent vehicles from intruding into the Security Area. The system consisted of two rows of concrete jersey barriers outside the perimeter of the Security Area on all sides where approach by land vehicle is possible. This configuration satisfies regulatory requirements for resisting design basis vehicle impact and for enforcing a safe vehicle stand-off distance from the spent fuel storage installation as protection against a vehicle bomb. However, this arrangement lacked in the ability to get vehicles in and out of the system efficiently, as it requires the use of heavy equipment to reconfigure the barriers in

the event that vehicular access is needed (support that will not be available post-decommissioning).
- The Nasatka MB XV hydraulic gate is an active vehicle barrier that was originally in service during the Spent Fuel transfer in 2008 (implemented through DCP HB3-C-496, ref 11). Active vehicle barriers have two positions: one position that denies passage of a vehicle and a second position that allows vehicle passage via hydraulic operation of the barrier. A vehicle barrier system incorporating both the passive jersey barriers and the active Nasatka barrier will provide a higher level of flexibility for security personnel to control vehicular access and will eliminate the costs associated with movement of the jersey barriers.

Other activities included:

- Vault Lid Caulking Project
- Concrete Cask Annual Surveys
- Installation of new concrete pad and containment for the ISFSI diesel generator
- Work Planner for all SGI related work activities (WO 243)
- Topographic Survey for potential new surfacing material to replace gravel within Security Boundary Fence

The average annual expense during this period for Civil Structural work was $67K.

Electrical engineering and security system support for the ISFSI will continue through its operation. Actual costs were $181k in 2012, $167K in 2013, and $366K in 2014.

The major work activities included the following:

- As-Built Drawing Update—revised as-built drawings with field changes reflected in the Design Change Notices
- Backup server Installation
- Diesel Generator Replacement
- UPS Failure Repair and Analysis
- Equipment Description and Operating Instructions (EDOI) creation
- Alarm Response Manuals creation
- Post Maintenance Testing (PMT) Support
- Routine Maintenance and support for HVAC, Roofing, and Guard Shacks
- ISFSI Equipment Repair
- Electrical Work Instructions Generated
- QVP Support
- ISFSI System Software support for the software contractor, as well as factory and site acceptance testing for the software system

Specialty contractors include use of subject matter experts and consultants to perform scope-specific work. During initial construction of the ISFSI and the transfer of spent nuclear fuel and GTCC wastes to the ISFSI, the procedures used were developed, controlled, and maintained, using the processes in place for Unit 3. The processes are robust and appropriate for activities associated with plants that were operating in SAFSTOR or the early phases of decommissioning. The processes, while very thorough, are also labor intensive. As the complexity of the remaining systems and the associated risks are reduced, it is appropriate to simplify the processes accordingly. The industry experience at other nuclear plants that have undergone decommissioning is that the processes and total numbers of procedures can be reduced without a reduction in any safety margins. Section 3.3.1.2.4 contains a discussion of the Unit 3 procedures.

In 2014, Security and Decommissioning Management began a process to separate the active procedures that were overlapping between the ISFSI and Unit 3. The separation was intended to create a truly independent ISFSI that would be able to develop, control, and maintain a germane set of procedures using only those resources that would remain available after the completion of Unit 3 decommissioning. The separation process was scheduled to coincide with a significant change to the Site Emergency Plan. The NRC approved the Site Emergency Plan in 2015. By regulation, once approved, the plan is required to be implemented within 90 days. That implementation included implementation of the procedure changes necessary to support plan implementation. Separating the procedures at the same time that they also were required to be revised was a cost-effective and efficient way to accomplish both goals.

To create a stand-alone set of procedures for the ISFSI, Security Management procured a contractor with direct experience with procedure reduction and procedure separation at other decommissioned plants. The contractor was able to provide several alternative methods to accomplish the work and create the core set of processes and procedures that were needed at the ISFSI. The first phase was completed in November 2015, with the implementation of the procedures needed to support the newly approved Site Emergency Plan. The second phase includes other residual procedures needed for the operation and maintenance of the ISFSI. The second phase is scheduled to be completed in the first quarter of 2016.

The scope of work is estimated at $700K.

3.3.1.8.4 Independent Spent Fuel Storage Installation Infrastructure Expenses

3.3.1.8.4.1 Independent Spent Fuel Storage Installation License Extension

The current HBPP ISFSI license for Special Nuclear Material (SNM) expires in 2025. Since as many as ten years can be required to perform all activities required to obtain a

license extension, HBPP is initiating this work. An extension is necessary, as the DOE is currently not expected to have a repository to take used fuel by the time the license expires. As NRC Regulations (10 CFR §72.42[b]) state, "Applications for renewal of a license should be filed . . . at least two years before the expiration of the existing license." If the license were not renewed, continued operation of the ISFSI would risk an NRC violation and the possibility of fine. Presently, the NRC ISFSI license renewal process is undergoing alteration, and by starting the extension process early, PG&E can integrate any changes the process may require. PG&E plans to submit an application in 2018, with NRC approval expected by the end of 2021.

$3.2M is included in the ISFSI Infrastructure section of this filing, and another $3.2M is captured under Security Staffing.

The scope of work is estimated at $6.4M.

3.3.1.8.4.2Independent Spent Fuel Storage Installation System Upgrade

ISFSI System Upgrades are required due to aging technology and a continual evolution of threat. Specific upgrades required at this time include video capture, operating software system updates, and workstation hardware replacement; all of which assure regulatory requirements are met. Also identified at this time are access control technologies, which may include biometrics at building ingress and egress. The current system hardware has reached its expected lifespan and is no longer supported by its manufacturer, which requires additional replacement hardware and annual maintenance.

The scope of work is estimated at $1.9M.

3.3.1.8.4.3Weapon Simulator

Since the World Trade Center attacks on September 11, 2001, and in response to the continued threat, the ISFSI Security Force is, in part, tasked with the physical protection of the facility and the spent nuclear fuel and GTCC Wastes that it contains. The purpose of protecting the facility is to protect the public from the potential deleterious impacts of attacks on or sabotage to the spent nuclear fuel or GTCC wastes. A key preparation for this task is the training of those who would respond to the threat. Simulators have been used for many years to train law enforcement and military in how, when, and why to respond to various threats. The ISFSI will apply a similar philosophy in training its staff. The main benefit of using a simulator is safety because live rounds are not required during training activities with the simulator. Additional benefits include allowing low light training, acting as an attentiveness aid, and allowing "use of force simulation", including less-than-lethal options.

The ISFSI is scheduled to procure a simulator in 2016 for training of its staff. The costs for the simulator include acquisition of the hardware and software, installation and testing, training of the ISFSI training staff, initial training of the response staff, and a maintenance contract for the hardware and software.

The scope of work is estimated at $540K.

3.3.1.8.4.4 Building Conversion to On-site Gun Range

The ISFSI Security Force currently utilizes an off-site facility for weapons qualification and training, which limits training opportunities because of limits to the availability of the facility. For example, the facility is closed during hours of darkness and there are use limitations due to inclement weather. In addition, the staff has to travel to and from the range in a company-supplied vehicle and they have to use the range during off-shift time, which means that PG&E incurs overtime cost for transport to and from the range and while on the range, in addition to the vehicle costs. The total annual cost is approximately $74K per year. The cost to use the off-site facility includes:

- $28.8K per year for staff labor, range master labor, and transportation time
- $10K per year for indoor range fees, which includes both training time and qualification time
- $1.6K per year for outdoor range fees
- $15.5K per year for a PG&E fleet vehicle, plus mileage and fuel for the vehicle

PG&E investigated the feasibility of converting an existing building to a range. The estimate to convert the selected building includes:

- Demolishing and remediating interior structures, surfaces, and systems
- Constructing new interior walls, ceilings, plumbing, fire suppression systems, rest facilities, and an HVAC system
- Installing self-contained firing ranges with HVAC upgrades to control fumes and airborne contaminants that result from discharge of firearms

The estimated cost of the remodeling is about $703K, which yields a 9.5 year payback period. The expected useful life of the range is in excess of 12 years, thus resulting in a determination that the building conversion is both prudent and cost effective.

There are also several intangible benefits from converting the building and performing the training and qualification on site. The on-site gun range will allow for the Armed Responders to train on a more consistent basis, which includes being able to train while on their shift. Having an on-site range will limit the travel time and expense of ISFSI Personnel travelling to and from the off-site range, will allow for training and qualification

during inclement weather, and will reduce reliance on contracted third-party facilities. Having an on-site gun range will also remove the need for transporting weapons and ammunition off site for training and qualification purposes, which simplifies compliance with State, Federal, and Local Requirements.

The scope of work is estimated at $703K.

3.3.1.8.4.5Care on Site

Off-site Response Organizations (ORO)-Radiologically Contaminated Injury Drill/Care on Site—includes the cost for a renowned Subject Matter Expert to travel to HBPP for one week to train ORO—Fire, Ambulance, and Hospital Emergency Departments—in Handling Radiologically Contaminated Injured Persons. This is an expenditure required by the NRC for certain Part 50 requirements tied to the approved LAR for the site Emergency Plan. In 2019 when the site transitions from a part 50 license, the requirement to drill for Radiologically Contaminated Injured Persons at the ISFSI will remain a requirement of the 10 CFR §72 license. In 2019 the ISFSI staff will transition to relying on the Care-on-Site program for all of their physical examinations and license-required medical testing and for any emergency medical conditions that may arise.

The current protocol for physicals and injury care for ISFSI staff is to use the local hospital. The current cost is $40K per year plus the costs for travel time, overtime for the staff to travel, and the liability of travel or transport. The startup fee for Care-on-Site is about $50K. The annual cost for Care-on-Site is $30.9K for annual physicals and $3.8K for Telemedicine for injury coverage. The payback period for the startup costs is about eight years and the Care-on-Site is expected to be in use for at least ten years, resulting in a net savings.

The scope of work is estimated at $490K.

3.3.1.8.4.6Review and Revise InfoQual Program

The existing training database that is used at HBPP is based on an old program that was developed when the plant went into SAFSTOR and has not been classified as a Quality Training Database. Due to negative Internal Audit findings for using the InfoQual (IQ) Training database as a “quality” database, ISFSI Management decided to migrate the training documentation to the DCPP quality-verified training documentation database system in PG&E’s “MyLearning”. This was necessary to comply with NRC regulations.

Validating qualifications of personnel performing quality-related activities is a key aspect to providing assurance that PG&E satisfies the requirement that those personnel are trained and qualified (10 CFR §50, Appendix B, Criterion 2). This validation must

depend on quality-related information that documents those persons' training and qualification related to the activity.

The scope of work is estimated at $500K.

The effort to migrate the data into MyLearning includes:

- Finalizing Course, Training Element, and Qualification catalog; this requires coordination between the ISFSI and DCPP Learning Services
- Training ISFSI cognizant staff on the back-end and front-end functionality of SAPLearning Solutions; DCPP Learning Services and HR Systems would provide the training
- Preparing Change Management Plan for switching to the new system
- Establishing the course catalogs compatible with HR Systems and training data
- Executing and validating the migration

The scope of work is estimated at $500K.

3.3.1.8.5 Nuclear Regulatory Commission Permits and Fees

3.3.1.8.5.1 NRC Part 50 License Fee

Regulations at 10 CFR Part 50 are promulgated by the NRC pursuant to the Atomic Energy Act of 1954, as amended (68 Stat. 919), and Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242), to provide for the licensing of production and utilization facilities. This part also gives notice to all persons who knowingly provide to any licensee, applicant, contractor, or subcontractor, components, equipment, materials, or other goods or services, that relate to a licensee's or applicant's activities subject to this part, that they may be individually subject to NRC enforcement action for violation of 10 CFR §50.5.

NRC Part 50 Licensing fees are split between Nuclear Decommissioning, FSS, and ISFSI through Decommissioning of the plant in 2018. After decommissioning is complete, the licensing fees associated will be associated with the ISFSI will change to solely a Part 72 license in 2019 until the DOE transfers the spent fuel is picked up and GTCC material from the ISFSI.

3.3.1.8.5.2 NRC Part 72 License Fee

NRC Part 72 License regulations establish requirements, procedures, and criteria for the issuance of licenses to receive, transfer, and possess nuclear power reactor spent fuel, power reactor-related GTCC waste, and other radioactive materials associated with spent fuel storage in an ISFSI, and the terms and conditions under which the

Commission will issue these licenses. The regulations in this part also establish requirements, procedures, and criteria for the issuance of licenses to the DOE to receive, transfer, package, and possess power reactor spent fuel, high-level radioactive waste, power reactor-related GTCC waste, and other radioactive materials associated with the storage of these materials in a monitored retrievable storage installation (MRS). The term MRS, as defined in 10 CFR §72.3, is derived from the NWPA and includes any installation that meets this definition. The regulations in this part also establish requirements, procedures, and criteria for the issuance of Certificates of Compliance approving spent fuel storage cask designs.

The forecast for NRC costs assumes HBPP Unit 3 license termination occurs in 2019, and the HB ISFSI license is terminated in 2029. Future costs are based on previous NRC costs and estimated time for NRC future reviews.

NRC permit fees are currently $223K annually. Because NRC permit fees are based on the number of licensees plus the number of NRC staff, it is difficult to predict future NRC permit fees. For this reason, the amount of $223K is assumed to remain the same for the future years of HB ISFSI operation.

Current NRC personnel review costs are $274 per hour. PG&E assumes $300 per hour for NRC review costs for the future years 2016 through 2029.

NRC routine inspections and security inspections are each scheduled to occur every three years. The most recent security inspection occurred in 2015; therefore, the next three-year cycle security inspection should occur in 2018. The most recent routine inspection occurred in 2013; therefore, the next three-year cycle routine inspection should occur in 2016. Future NRC inspection costs are based on the number of hours charged for previous NRC inspections.

Currently, HB ISFSI licensing documents, such as the Quality Assurance Plan and the Emergency Plan are joint documents that apply to HBPP Unit 3 as well as the HB ISFSI. These licensing documents will have to be revised when the HBPP Unit 3 license is terminated. Future costs to revise these licensing documents are based on reasonable estimates of NRC review time, considering previous NRC document reviews. PG&E submits required annual HB ISFSI reports such as the Decommissioning Funding Report, and required biennial reports, including the FSAR update, the 10 CFR §72.48 report, and technical bases update. Estimated NRC review costs are assumed to be four hours review time for the Decommissioning Funding Report every year, and four hours review time for the FSAR Update, 10 CFR §72.48 report, and technical bases update every other year.

The scope of work is estimated at $3M.

3.3.1.8.6 Transfer to DOE

PG&E will maintain the ISFSI until the DOE is ready to accept the spent nuclear fuel and GTCC wastes. The DOE is assumed to begin taking the fuel and wastes in 2028. Once the DOE provides the schedule accepting packages, PG&E can begin the planning and processes needed to transfer the spent fuel and GTCC to the DOE.

The planning phase for fuel and GTCC transfer is expected to take six months to a year of effort prior to the first dry runs for fuel transfer and transport to the DOE. During the planning phase, PG&E will establish the following:

- Plans to mobilize and demobilize the Vertical Cask Transporter (VCT)
- Hardware and components necessary to facilitate the transfer (e.g., rigging, M&TE such as torque wrenches, transport components such as over-packs and rail cars, and consumables such as lubricants)
- Support services required to facilitate the transfer (e.g., RP monitoring and support, Quality Control oversight; and Industrial Safety Technicians)
- Stakeholder interfaces with local, State, and Federal regulatory and oversight authorities including the CCC, NRC, EPA, and the DOE
- Permitting for material transfer, ISFSI demolition, and final site grading
- Updated procedures and processes necessary to facilitate the transfer of fuel and the demolition of ISFSI structures
- Crew size, crew training and qualification requirements, schedule, and duration to support the transfer of the canisters containing the spent nuclear fuel and GTCC from the ISFSI vaults to the shipping conveyance
- Plans for ISFSI demolition, FSS, and final site grading
- A termination plan for the 10 CFR §72 license

The planning process costs will be composed primarily of overhead staffing costs. Once the plans are approved, PG&E will procure the tools, equipment, components, and systems necessary to support the fuel and GTCC transfer to the DOE. Finally, prior to beginning the transfer process, PG&E will procure crews to perform the transfer and the support services needed to facilitate the transfer.

PG&E expects to self-perform the transfer of fuel and GTCC to the DOE. The transfer process involves a limited number of simple, albeit risky steps. Those steps include:

- Removing a vault lid and verifying the radiological parameters of the vault contents

- Bringing the VCT into the ISFSI through the security screening check point: the VCT is required equipment because a single failure-proof rating is required for heavy lifts of fuel and of components adjacent to fuel
- Lifting the fuel or GTCC package from the vault
- Moving the VCT to the transport conveyance and loading the contents onto the conveyance
- Performing transport radiation surveys and delivering package and transport documentation to the carrier

Once the carrier has accepted the package, it becomes the property of the DOE and PG&E's responsibilities for the material is terminated.

There are six packages to be transported. Transfer of the six packages is expected to take about one year (two months per package). After the last package is accepted by the carrier, the requirements to maintain Security can be terminated. The site can then be demolished, surveyed, graded, and released.

3.3.1.8.7 Independent Spent Fuel Storage Installation Removal

PG&E expects that the ISFSI demolition, site restoration, FSS, and final site grading will be performed using a bid specification and competitive bid process similar to that used for the Civil Works projects.

HBPP has gathered valuable experience and insights on the costs and effort necessary to decommission and restore a site. The costs of permitting and fees, field work, and waste disposal are significantly higher than originally anticipated. A detailed cost estimate was prepared by PG&E SMEs for the Unit 3 FSR. Using that estimate as a basis, a ratioed approach was utilized to establish a cost estimate for the ISFSI FSR. These costs are now expected to add about $9.6M to the original estimate of $2.1M.

3.3.1.9 Contingency

The assumptions, basis and definition of contingency as defined in Establishing an Appropriate Contingency Factor for Inclusion in the Decommissioning Factor for Inclusion in the Decommissioning Revenue Requirements, Study Number: DECON-POS-H002 Revision B, Status: Final April 2009 apply. However, contingencies were estimated on a line-item basis.

Contingency estimates to complete for 2016 through 2030 are provided in Table 3.3.19.

TABLE 3.3.19—CONTINGENCY ESTIMATES TO COMPLETE

Contingency Cost Estimate and Cash Flow (in thousands)	
2017 NDCTP ($2014)	37,453
General Staffing	4,662
Remainder of Plant Systems	374
Site Infrastructure	-
Specific Project Costs	9,704
Waste Disposal	2,253
Small Value Contracts	1,641
Spent Fuel Management	18,818

3.3.2 Caisson, Canals, Common Site Support

3.3.2.1 Caisson

A caisson is a water-tight structure used as a foundation or to carry out work under water. Caissons have been used for centuries as building foundations and, occasionally, as structures housing activities such as garages and pump stations. In the case of HBPP Unit 3, the caisson was a first-of-a-kind structure to house a nuclear containment structure, pressure suppression chamber, bio-shield wall surrounding an RPV, and nuclear steam supply system below grade. The advantages of this structure included additional shielding provided by the soils and external pressure to assist with pressure suppression in the event of an accident.

In the 2012 NDCTP, the CPUC found reasonable PG&E's plan to remove the entire caisson in light of recently developed information. The CPUC also found reasonable PG&E's estimated $126.9M in costs.

Decommissioning of Unit 3 achieved a significant milestone in June 2015 when the Caisson Removal project began. The awarded contract endorsed the October 2012 HBPP Caisson Removal Feasibility Study approach to install a cement-bentonite backfill in a slurry wall trench excavated to a depth of 174 feet and tied into the Unit F clay layer. The backfill approach included in the FS was to compact spoil from the installation of the slurry wall in multiple lifts.

The contracted Project Manager and Principal Engineer reevaluated the baseline design approach outlined in the original proposal and awarded contract. As the contractor further developed design plans, an option to complete the perimeter wall with CSM technology was developed. The contractor described the CSM process as a

modified trench cutter technique, to be used for both perimeter groundwater cutoff, and for caisson demolition SOE. CSM technology blends slurry while mixing soil on the down stroke, and injects cement into the blended soil cuttings on the upstroke to create a cemented "cutoff wall."

The contractor proposed several variations for three key support elements: the perimeter cutoff wall, the dewatering well system, and the caisson SOE shoring system. The proposed alternatives brought many enhancements to the design and to integration of the work to be executed. Contractor personnel were persistent in seeing their vision through, presenting their ideas to PG&E at three key rigorous Readiness Review Board meetings. PG&E evaluated the innovative approach, benchmarked the change against other similar projects in the country, and vetted the proposed change with the project risk profile. Ultimately, based on safety enhancements and schedule acceleration, PG&E accepted the contractor's proposal. The significant benefits in worker safety and schedule enhancement were realized, resulting in an estimate that the schedule will be decreased by five months.

3.3.2.1.1 Baseline Approach

The 2012 Feasibility Report provided a "proof of concept" level analysis and plans for the caisson excavation and demolition, consisting of the following SOE elements:

- cement bentonite slurry wall to minimize groundwater infiltration
- sloped soil nail wall for support of the upper excavation
- sheet pile wall and ring beam shoring system for support of the lower excavation

The FS considered lateral movement of the studied excavation system, and potential settlements resulting from the installation of the system, with particular attention to the adjacent HBGS.

The contractor's baseline approach included the installation of the 685-foot perimeter slurry wall identified in the 2012 FS and a 90-foot-diameter, 2.5-foot-thick CSM shoring system with eight separate levels of ring beam steel reinforcement to -79 feet Elevation. Once the Unit 3 caisson and tremie pad concrete were removed and the FSS completed, the shaft was to be backfilled to +12-feet Elevation in lifts. As backfilling operations progressed, ring steel reinforcement was to be removed, leaving the CSM SOE elements in place.

3.3.2.1.2 Baseline Work Plan Development

The primary contractor contracted with a specialty contractor to install the perimeter slurry wall. During Work Plan development, the contractors continued to revise their

planned slurry wall installation approach through the 60 percent and 90 percent Work Plan development stage. During this time, the projected installation cost for the perimeter slurry wall steadily rose. During design development, the specialty contractor expressed concern that tight vertical tolerances could only be met with great effort, potentially affecting cost and schedule further. The specialty contractor ultimately decided to use a combined clamshell bucket and hydromill approach to install slurry wall panels.

PG&E and specialty contractor personnel traveled to Rocanville, Saskatchewan, Canada, on September 9, 2014, to observe the specialty contractor installing a slurry wall. All in attendance were convinced that the slurry wall technology could create environmental challenges at the HBPP site. It should be noted that challenging groundwater conditions kept the specialty contractor from completing the Rocanville project.

- The clamshell rig excavated relatively shallow bites (20-30 feet deep) along a trench in an open field. During light wind, the observers standing 25 yards away noted that there was sparse slurry spray from the bucket. Spray would not be acceptable at HBPP because due to the potential for radiologically contaminated material, if encountered, to be sprayed beyond the restricted area. Due to the greatly improved verticality achievable with the hydromill compared to the clamshell, the specialty contractor considered switching to a hydromill for the primary panels and using a clamshell for the secondary panels, or alternately, using the hydromill for all panels. In addition, it might be necessary to case the "pre-drilled" holes in order to control verticality.

3.3.2.1.3 Alternate CSM Approach

After observing the slurry wall operation in Rocanville, the primary contractor expressed concerns regarding the Specialty Contractor's ability to control verticality and the technology's ability to address environmental challenges at HBPP. In addition, the primary contractor was concerned with the adequacy of the analysis of the technology in the Feasibility Report. In the Report, the perimeter slurry wall and deep shoring components appeared to have been analyzed separately as components, and not collectively as a system.

Because of these concerns, an alternate specialty contractor was retained to analyze the Feasibility Report approach and previously identified options. The analyses confirmed that the perimeter slurry wall and deep shoring option in the Feasibility Report would only work if the slurry wall was more than 100 feet from the deep shoring, to

eliminate excessive hydrostatic water pressure. Due to existing site restrictions, however, the slurry wall could not be moved from the location identified in the Feasibility Report.

The alternate specialty contractor also confirmed that hydrostatic pressures at depth were too great to allow installed CSM shoring to be removed as the excavation was backfilled to the surface. With Regulator acknowledgement that CSM materials were to remain in place (as with the original perimeter slurry wall), CSM alternatives that did not include ring steel were considered.

- PG&E and contractor personnel traveled to Los Angeles on September 23, 2014, to observe a CSM operation performed by the CWC specialty subcontractor for the LA Metro Expo line extension. All in attendance were convinced that the CSM technology was the best fit for the challenges of the HBPP Project site. The subcontractor was using two mixing rigs drilling panels 98 feet deep. The equipment manufacturer makes a bigger rig that can reach 140 to perhaps 160 feet; however none currently exists in the United States. The observers concluded that it would be possible to use CSM to replace slurry walls for water containment, in conjunction with CSM for shaft support. The CWC recognized the increased simplicity of mobilizing just one specialty contractor for two or three operations instead of two or three subcontractors.

PG&E also reevaluated the bids received and reconsidered the one bidder's proposal to apply the CSM method in lieu of a slurry wall. The CSM method provides groundwater control that is equal to or better than the slurry wall, and the bidder's experience has shown that the CSM method is equally cost-effective and environmentally advantageous. Mixing soil in place and using it in the resulting slurry wall considerably decreases the spoil volume compared to traditional walls, allowing stockpile areas to be minimized.

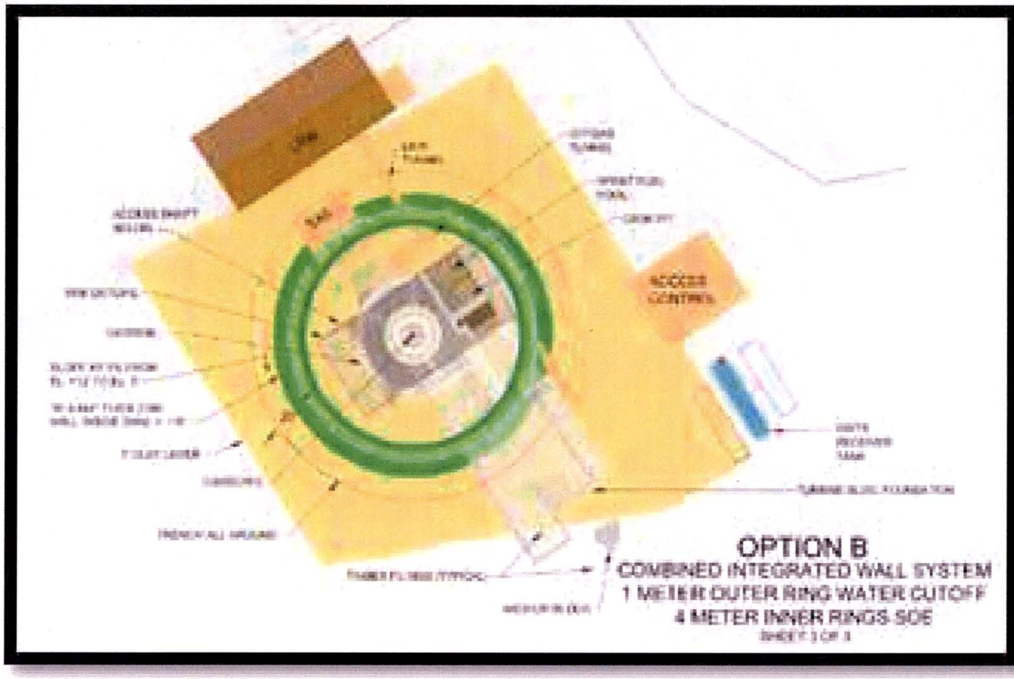
3.3.2.1.4 Final Design

Addressing the Unit 3 Turbine Building foundation piles with a shallow dewatering system allowed the contractor to design a much tighter cutoff, wall thus reducing construction costs. The alternative approach, use of deep shoring and cutoff wall CSM rings, included five concentric rings to varying depths, allowing for excavation to a depth of 96 feet.

The CWC increased the originally proposed 90-foot-inside-diameter shoring system to a 110-foot-inside-diameter system to encompass the RFB to allow deep segments of the

building to be removed and to capture any potential contamination release from beneath the SFP area. (See Figure 3.3.12.)

FIGURE 3.3.12—CSM SHORING SYSTEM



- The final design included installation of a 110-foot-diameter, 13-foot-thick CSM Shoring System with No Ring Steel, with the outside Ring tied into the Unit-F Clay Layer. Because the circular shoring is the cutoff wall, the water pressures cause a perfect circular compression load and are much easier to resist than the non-uniform load imposed by the perimeter wall cutoff proposed in the Feasibility Report.

Wet spoils produced from this operation were transported to the Discharge Canal, where they were stored temporarily and allowed to dry. Dried CSM spoils will most likely be utilized as backfill material after caisson removal.

The specialty contractor completed FLAC3D analyses on the final design considering 100- and 500-year earthquake events. Compared to the seismic demands for the 100-year earthquake event, the stresses caused by the 500-year event were estimated to be roughly 25 to 30 percent higher. Overall, the final design was considered to have

adequate capacity to resist the seismic effect caused by a 500-year earthquake event. PG&E Subject Matter Experts on Seismic Design have thoroughly reviewed the final design, and they consider the design conservative.

3.3.2.1.5 Key Elements Facilitating Change to Final Design

The Feasibility Report completed four geotechnical boring investigations, in part to confirm the presence of the Unit F Clay layer. This report identified the Unit F clay layer at -154- to -171-foot Elevation. The contractor completed five additional geotechnical investigations to more completely define the extent of the Unit F clay layer through the perimeter slurry wall alignment. The investigation more completely identifies the top of the Unit F clay layer at 148 to 171 feet below site grade. More important, the additional geotechnical investigations identify the depth of the Unit F clay layer through the final design alignment at -150 to -163 feet, shallow enough to be keyed into using CSM equipment equipped with a Kelly bar.

The Feasibility Report addressed removing the caisson by extending the perimeter slurry wall alignment around the Turbine Building, in part to facilitate the removal of deep foundation piles. The Turbine Building cutoff elevations range from El -3 to El +10 feet. The contractor recognized that the cutoff elevations of the Turbine Building piles were all within the First Bay clay layer close to the Upper Hookton sand interface. The contractor developed a shallow dewatering plan using surface sumps to control groundwater, instead of the perimeter slurry wall. To date, the Unit 3 foundation support piles have all been successfully removed using the shallow dewatering system.

Slurry walls, like the wall identified in the Feasibility Report, are start-to-finish construction operations along an alignment. CSM walls are constructed as individual overlapping panels, allowing the process to move from one area to another around other demolition activities such as the demolition of the RFB. Increasing the inside diameter of the system to 110 feet resulted in a majority of the Unit 3 RFB falling inside the deep shoring and cutoff wall footprint. Unlike the Project baseline approach, this approach allowed the majority of the panels to be constructed before the Unit 3 RFB was demolished.

3.3.2.1.6 PG&E Vetting of the Final Design

PG&E provided oversight to vet seismic criteria and design integration of the water cutoff wall with the SOE deep shoring system. Early in the design phase, project teams from PG&E and the primary contractor visited two sites to benchmark the project and to evaluate appropriate means and methods for similar work to be performed at HBPP. Appropriate independent oversight was implemented by PG&E through its Engineer of

Record for Caisson Feasibility Removal Study and an independent Subject Matter Expert consultation on water cutoff and SOE.

In preparing the FS, PG&E's primary focus was to maintain continuity of the record for the FS so that changes from the bids or the 2012 CPUC filing could be explained and justified, if needed. PG&E made use of its Technical Evaluation-Decommissioning tool, developed to assess, evaluate, and document positions on significant technical issues. This document explains the issue being addressed and describes any alternate approaches that exist to address the issue, explains the method of evaluating the approaches, and summarizes the results of the evaluation. This tool was used to describe and evaluate the Slurry Wall/Water Cutoff design options.

During the development of the design, HBPP invited the General Office risk analyst for Energy Supply to HBPP to meet the project team and to provide an overview of the PG&E risk initiative program, and explain its importance and specifics to the caisson removal project.

The technical benefits of the CSM wall design include:

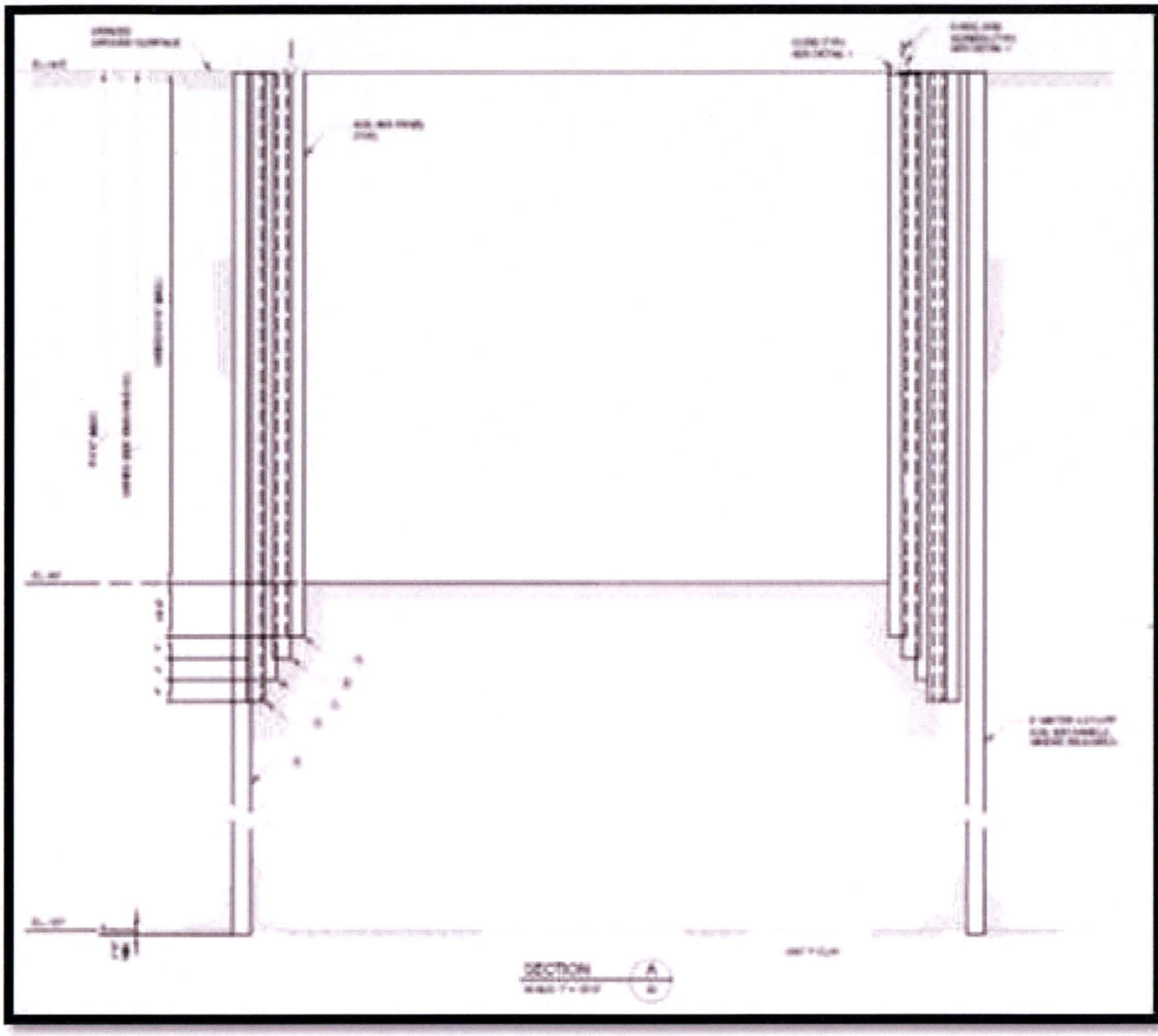
- The integration of the water cutoff wall with SOE validates the final design configuration of the two-wall system. Use of a single Specialty Contractor instead of two requires only one learning curve with respect to embracing work safety on site.
- The five-meter-thick CSM wall design does not rely on ring beams. Although more man-hours are spent installing the CSM, fewer man-hours are spent inside the excavation, which reduces risk to personnel.
- The combined circular cutoff wall and caisson SOE shaft system reduces the quantity of deep drilling work compared to the full perimeter wall alignment. For the combined system, approximately 430 lineal feet of wall would extend down to Unit F clay layer, and for the full perimeter wall alignment, 676 lineal feet of wall would extend to the Unit F clay layer.
- Groundwater isolation is limited to the confines of the circular shaft geometry, and focuses on only dewatering the caisson for removal, reducing the overall volume of water requiring management—and potentially treatment.

3.3.2.1.7 Field Work

The final design for caisson removal, shown in Figure 3.3.13, includes a deep shoring and cutoff wall that is composed of five concentric CSM rings installed to various depths, allowing for excavation to a depth of 96 feet. The inside ring will have an inside diameter of 110 feet, centered near the Unit 3 foundation support caisson. The inside ring will extend to a depth of 106 feet. The depths of the following three rings will

increase by 4 feet for each progressive ring. The outside ring will also serve as a deep shoring and a groundwater cutoff ring keyed a minimum 1 foot into the Unit F clay layer at a final depth of 174 feet.

FIGURE 3.3.13—CSM CROSS-SECTION



Four dewatering wells located inside the deep shoring system, extending to a depth of 126 feet, allow for dry excavation of deep structures. Four open-tube piezometers will be installed inside the CSM deep shoring and cutoff wall and seven vibrating-wire piezometers will be installed outside to monitor groundwater during excavation and backfill operations. Additionally, four inclinometers will be installed outside the CSM deep shoring and cutoff wall system to monitor mass ground movement. However, no movement is expected.

Each CSM ring will consist of individual panels, each approximately 3.28 feet thick and approximately 9.18 feet in length, with each panel overlapping the next. The panel overlapping technique ensures that the overlap extends the full depth of the wall, with the depth being measured at the center of the cutting wheels. The total thickness of the compression ring will be a minimum 13 feet and will contain a total of 255 panels.

Table 3.3.20 provides the 2012 NDCTP budgetary requirements alongside this 2017 NDCTP filing estimates.

TABLE 3.3.20—CAISSON FIELD WORK BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Caisson	**119,779,613**	**126,914,459**	**126,914,459**	**9,194,034**	**77,189,053**	**86,383,087**	**40,531,372**	**40,531,372**
Field Work (Civil Works Contract)	78,000,000	83,062,664	83,062,664	9,194,034	64,212,338	73,406,372	9,656,292	9,656,292
Caisson Contingency	41,779,613	43,851,795	43,851,795		12,976,715	12,976,715	30,875,080	30,875,080
Subtotal Caisson / Canal / GWTS	**119,779,613**	**126,914,459**	**126,914,459**	**9,194,034**	**77,189,053**	**86,383,087**	**40,531,372**	**40,531,372**
TOTAL	**119,779,613**	**126,914,459**	**126,914,459**	**9,194,034**	**77,189,053**	**86,383,087**	**40,531,372**	**40,531,372**

Prorated Reduction [1] 0 or 0%

Note:

1. The prorated reduction of $47M Did not apply to Caisson, Canals, and Common Site Support. Caisson reduced by 31.9%

3.3.2.1.8 CSM Shoring System and Cutoff Wall Installation

CSM is a method by which self-hardening slurry is mixed with native soil using a modified trench cutter technique for constructing cutoff walls, earth retaining walls, and foundation elements. The method uses in situ soil as a construction material. Construction proceeds one panel at a time, placing the cutter head of a rotary drill rig in the wall axis and driving the cutting/mixing tool into the ground to break up the soil. Water is pumped to nozzles set in the cutting wheels, where it is mixed thoroughly with the loosened soil. After reaching the wall's design depth, the cutting/mixing tool is slowly extracted while binding agent is continuously added. The components of the binding agent commonly used in the construction of CSM panels are cement and water. A portion of the in situ soil is incorporated into the mixture, and the excess soil is ejected from the process. Homogenization of the fluidized soil mixture with the binding agent is accomplished in situ by the rotation of the wheels of the drill rig.

The CWC will perform the work necessary to install a CSM deep shoring and cutoff wall system that will allow for the excavation and decommissioning of deep structures used to house the reactor in Unit 3 (also known as the Caisson). The CSM deep shoring and cutoff wall will allow for dewatering and instrumentation systems and maintenance of a dewatered excavation. The CWC will decommission the Unit 3 deep structures. The outermost CSM cutoff ring replaces the perimeter Slurry Wall (WP-08, CLIN 3.3) and

dewatering and instrumentation activities replace Dewatering and Instrumentation Systems Installations (WP-43, CLIN 3.4).

The deep shoring and cutoff wall is composed of five concentric CSM rings installed to various depths allowing for future excavation to a depth of 96 feet. The inside ring will have an inside diameter of 110 feet, centered near the Unit 3 foundation support caisson. The inside ring will extend to a depth of 106 feet. The depths of the following three rings will increase by 4 feet for each ring. The outside ring will also serve as a deep shoring and groundwater cutoff ring keyed a minimum of one foot into the Unit F clay layer. The 1-foot key will be determined by the operator, by a measured increase in drilling resistance and the distance traveled by the mixing head. The key will be confirmed from the contours included in the Slurry Wall Design Parameters Report. Four dewatering wells will be located inside the deep shoring, allowing for dry excavation of deep structures. Dewatering wells will extend to a depth of 126 feet (Figure 3.7.2, which depicts Figures 3 and 4 from the CWC's WP-40). All discharge from the construction dewatering system will be treated using the existing on-site GWTS. Once operational, the dewatering system will be maintained and operated 24 hours per day, 7 days per week.

FIGURE 3.7.1—REACTOR CAISSON REMOVAL

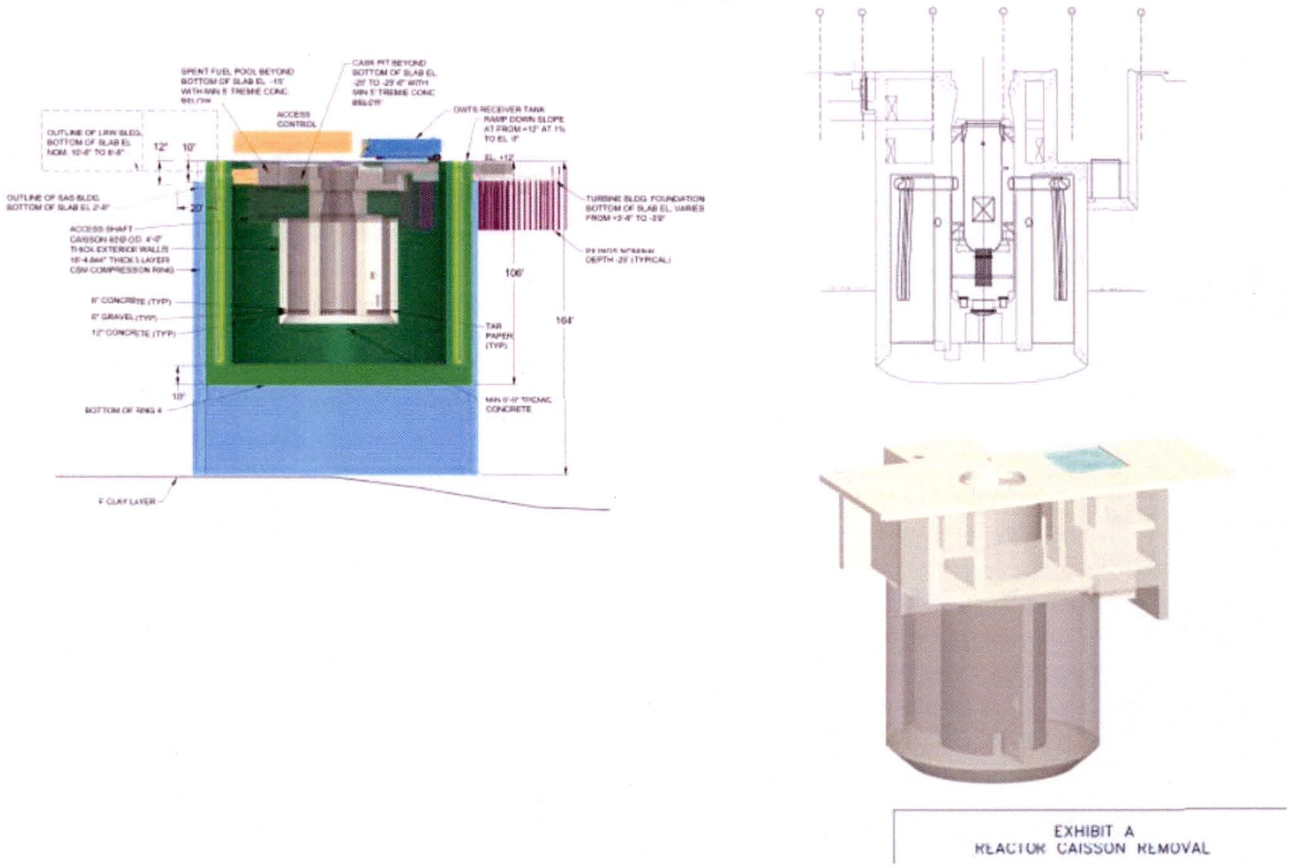


FIGURE 3.7.2—FIGURES 3 AND 4 FROM CWC WP-40

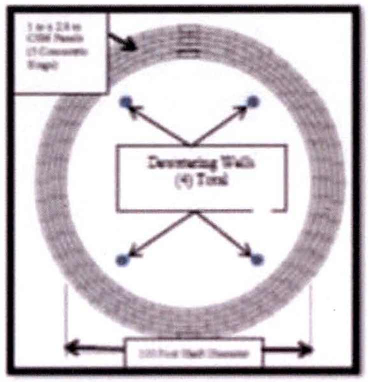


Figure 3 - CSM Deep Shoring and Cutoff Wall (Plan View)

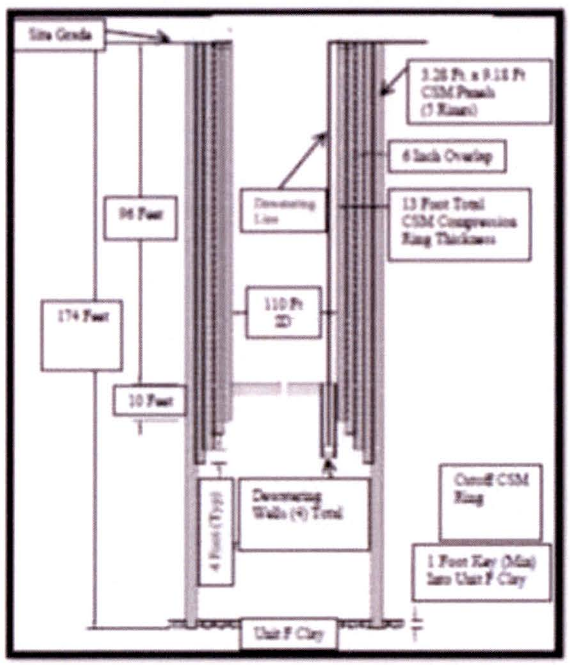


Figure 4 - CSM Deep Shoring and Cutoff Wall (Section View)

Each CSM ring will consist of individual panels approximately 3 feet thick and approximately 9 feet long. Panel overlaps will be approximately 12 inches. The panel overlapping techniques ensure that the overlap extends the full depth of the wall, with the depth being measured at the center of the cutting wheels. The total thickness of the compression ring will be approximately 13 feet. A movable barrier/curb system will be employed at the surface, around the perimeter of the CSM ring, for safety and security during the excavation phase of the deep structure removal.

The operational work phase requirements, or means and methods, associated with the installation of the CSM deep shoring and cutoff wall system panels include: mobilization of equipment; dewatering well and instrumentation installation; CSM materials; CSM mix design: CSM Wall excavation and construction; slurry mixing, placement and testing; backfill mixing and placement; CSM Wall QC Testing; as-built documentation; excavated material handling; protection of the completed trench; and demobilization.

Mobilized equipment may include the following equipment for the site:

- 1 Bauer BG-40 CSM Rig
- 1 Bauer BG-50 CSM Rig
- 2 Support Hyundai 140 Excavators
- 1 Kobelco 275 Ton Support Crane
- 1 Hyundai 760 Loader
- 1 Forklift 5 Ton
- 1 Diesel Generator, 400 kW
- 2 Diesel Generators, 500 kW
- 2 Material Batch Plants
- 4 18,000-Gallon Bentonite Hydration Tanks
- 4 Vertical Cement Silos
- 4 Agitators for preparation of slurry, cement, and cement-bentonite blending
- 1 Desander with Centrifuge Unit and conveyor system
- Other tools and minor equipment, as required to complete the CSM deep shoring and cutoff wall system installation

A Bauer BG-50 with a 173-foot Kelly bar system and tracks that are almost 5 feet tall and 9 feet wide was mobilized on September 18, 2015. This combination of specs makes the BG-50 on site a one-of-a-kind piece of equipment, specifically intended to install the deep cutoff wall panels in Ring E. The BG-50 allows the CSM Cutoff wall (Ring E) to tie into the Unit F clay layer to effectively control water and allow the Caisson excavation and demolition work face to be dewatered. It is estimated that 30,000 gallons of water will be required per 10-hour work shift per Bauer CSM drill rig.

With the BG-40 and BG-50 drill rigs both in operation, 60,000 gallons will be required per shift, up to 20,000 gallons of which will be reused.

Bentonite will be sodium cation base montmorillonite powder (Premium Grade Wyoming type bentonite) that conforms to the standards set forth in the API Specification 13A, Section 9.

Bentonite not meeting the specifications will be promptly removed from the site and replaced with bentonite conforming to the specification requirements. Cement will be Type I/II Portland Cement conforming to ASTM C150. Materials will be protected from moisture and contamination while in transit to and in storage at the project site. Admixtures of the type used in the control of oil field drilling mud such as thinners, dispersants, and flocculants may be used to control standard properties of the slurry such as apparent viscosity and filtration characteristics.

A continuous wall will be formed in a series of overlapping primary and secondary panels. Soil mixing will be performed using the Bauer CSM method. In the two-phase system, the soil is fluidified and homogenized in the downstroke phase by pumping of bentonite slurry into the soil. Guide trenches will be constructed to guide the cutting head around the design alignment and collect surplus slurry.

Before starting the cutter operation, the mud pump of the trench cutter must be fully submerged in the bentonite slurry. The cutter head is positioned along the axis alignment in the trench. The mixing tool is driven into the ground at a continuous rate. The soil matrix is broken up by the cutting wheels, and at the same time a fluid is pumped to the nozzles, set between the cutting wheels, where it is mixed thoroughly with the loosened soil. A compressed airstream may be added to improve the breaking and mixing process in the downstroke phase, if necessary.

When the downstroke is completed in a panel, the x-, y-, and z-coordinates of the completed panel (as obtained from the CSM rig data acquisition system) will be compared to the position measured at the surface to determine the verticality of the panel. After reaching the design depth, the mixing tool is slowly extracted while cement slurry is continuously added. Homogenization of the fluidified soil mixture with the fresh cement slurry is ensured by the rotation of the wheels. At the start of the upstroke, verify cement/bentonite mix fluid read outs and specification withdrawal rate to required values. At the completion of the upstroke overall mixing volumes will be compared to required volumes. Panels that are placed out of position, are damaged, or carry voids and anomalies, shall be considered suspect panels requiring DOR evaluation and disposition.

A prerequisite to end-of-shift washout is ensuring that erosion and sediment control BMPs are in place and functioning as intended in the Erosion and Sediment Control Plan.

The specialty contractor initiated the installation of the deep shoring panels in Rows A through D on July 13, 2015. To date, there have been 141 panels installed.

3.3.2.1.9 Packaging and Material Handling

Water

It is estimated that 30,000 gallons of water will be required per 10-hour work shift for each of the two Bauer CSM drill rigs. With the BG-40 and BG-50 drill rigs both in operation, 60,000 gallons will be required per shift. The CSM subcontractor will operate a desanding plant and will reuse water to the extent possible. Up to 20,000 gallons of water may be reused per 10-hour shift.

Supplied water for CSM panel construction will be clean, fresh, and comply with the standards set below:

- pH 7, plus or minus 1.0
- Total dissolved solids less than or equal to 500 parts per million
- Oil, organics, alkali, or other deleterious substances less than or equal to 50 parts per million each

Water supplied by a municipality is suitable, with no testing required. Coordination of any utility requirement changes must be made at the POD Meetings, to ensure that water needs are met.

Coordination with PG&E is necessary to ensure that the diesel fuel needs are met in the RCA. Equipment will be fueled once per shift by delivering the fuel directly to the equipment by truck.

There are several requirements to protect workers and the environment from potential hazards posed by fuel. No storage of fuel inside the RCA will be allowed. Fueling operations are not to be left unattended. Fuel tanks are not to be topped off. Mobile fueling trucks must follow BMP guidelines. Spill kits will be placed at both ends of fueling operations.

Bentonite

Bentonite will be sodium cation base montmorillonite powder (Premium Grade Wyoming type bentonite) that conforms to the standards set forth in the API Specification 13A, Section 9. No chemically treated bentonite will be allowed.

Bentonite will be protected from moisture during transit and storage. The CSM subcontractor will cover all bentonite delivered to the site with a tarp to protect the bentonite from inclement weather.

All bentonite will be subject to inspection, sampling, and verification of quality testing under the supervision of a subcontracted team. Bentonite not meeting the specifications will be promptly removed from the site and replaced with bentonite conforming to the specification requirements. All bentonite material certification submittals will be approved by a designated subcontractor.

Cement

Cement will be Type I/II Portland Cement conforming to ASTM C150. Reclaimed cement or cement containing lumps or deleterious matter will not be used. Cement will be protected from moisture and contamination while in transit to and in storage at the project site.

Admixtures

Admixtures of the type used in the control of oil field drilling mud such as thinners, dispersants, and flocculants may be used to control standard properties of the slurry, including apparent viscosity and filtration characteristics. Any use of admixtures is subject to the approval of PG&E. Once approved, the CWC is required to include the Safety Data Sheet with the work package, with a written statement as to the use of any such admixture, its potential effect on the slurry, its long-term stability, and its potential effect on personnel and the environment.

Mixing and Delivering Bentonite and Cement Slurry

Mixing and delivery equipment will include pumps, valves, hoses, supply lines, tools, and other equipment and materials required to adequately supply slurry to the CSM deep shoring and cutoff wall site and mixing areas. The CSM subcontractor will provide sufficient tanks for storage of bentonite and cement slurry. Tanks for storage of hydrated slurry will be mechanically or hydraulically agitated.

The cost for packaging and material handling are included in the field work cost estimate.

3.3.2.1.10 Project Staffing

Refer to Section 3.3.1.1 General Staffing for full detail. Based on amount of work activities scheduled during the Caisson field work time period, it was determined the most appropriate split for forecasting costs is 50/50. The costs associated with this portion of work is split 50% in above referenced section and 50% in Caisson scope of work during the years of 2016 – 2018.

TABLE 3.3.22—PROJECT STAFFING BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014	ETC 2015 To 2020	Total EAC 2012 To 2020 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
General Staffing (Excludes Caisson)	**107,761,959**	**113,552,612**	**102,442,205**	**73,759,966**	**44,453,015**	**118,212,981**	**(4,660,369)**	**(15,770,776)**
Overall Project	87,001,807	93,019,124	83,917,789	66,432,824	32,021,433	98,454,257	(5,435,133)	(14,536,469)
License Termination Survey (Excl	13,165,630	12,606,885	11,373,381	7,327,142	7,769,468	15,096,610	(2,489,724)	(3,723,229)
EPC Services	(962,235)	(1,175,125)	(1,060,146)			-	(1,175,125)	(1,060,146)
ISFSI Engineering / Specialty Con	(2,168,117)	(2,721,767)	(2,455,459)				(2,721,767)	(2,455,459)
Contingency	10,724,875	11,823,495	10,666,641		4,662,114	4,662,114	7,161,381	6,004,526
Caisson	**31,584,971**	**33,878,491**	**33,878,491**	**-**	**21,832,534**	**21,832,534**	**12,045,957**	**12,045,957**
Project Staffing	22,126,103	24,644,002	24,644,002		15,303,886	15,303,886	9,340,116	9,340,116
License Termination Survey	6,167,964	5,807,439	5,807,439		3,354,407	3,354,407	2,453,033	2,453,033
EPC Services	(1,102,622)	(1,177,936)	(1,177,936)				(1,177,936)	(1,177,936)
ISFSI Engineering / Specialty Con	(931,772)	(993,727)	(993,727)				(993,727)	(993,727)
Caisson Contingency	5,325,299	5,598,712	5,598,712		3,174,242	3,174,242	2,424,471	2,424,471
TOTAL	**139,346,930**	**147,431,103**	**136,320,695**	**73,759,966**	**66,285,549**	**140,045,515**	**7,385,588**	**(3,724,820)**
Prorated Reduction [2]			11,110,408 or 7.5%					
Level 2 Subtotals								
Overall Project Staffing	116,602,651	125,437,061	115,751,725	66,432,824	52,914,704	119,347,528	6,089,533	(3,595,803)
License Termination Survey	22,744,279	21,994,043	20,568,970	7,327,142	13,370,845	20,697,987	1,296,056	(129,017)

Note:

1. The Staffing is split differently in the forecast compared to the 2012 NDCTP methodology. The overall balance of staffing between the General Staffing section and Caisson Staffing section is favorable compared to the original estimate.
2. The staffing prorated reduction represented $11M of the $47M. Staffing was expected to be reduced by 7.5% but was reduced by 5%

3.3.2.1.11 Waste Disposal

The 2012 NDCTP volume and waste shipment estimates for the Upper and Lower Caisson are summarized in Table 3.3.23. Project planning divided the RFB and Caisson into three sections based on the expected work evolution. The RFB upper structure (+12-feet and above) is removed to allow access to the below-grade slab and concrete structure (+12 to +9 feet). The remaining Caisson was divided into two sections roughly at the bottom of the SFP at about -30 feet. The Caisson is to be removed after completion of the Slurry wall (now the CSM wall).

TABLE 3.3.23—2012 NDCTP VOLUME AND WASTE SHIPMENT ESTIMATES

Total Waste Disposal	2012 CPUC Estimates			2017 NDCTP	Delta
	CPUC 2012 Volume Estimate (ft3)	Weight 2012 CPUC Estimate (150pcf Concrete 130pcf Soil) (lbs)	Intermodals 2012 CPUC Estimate (30,970 lbs/IM)	Intermodals 2017 CPUC Estimate (32,000 lbs/IM)	2012 Estimate to 2017 Estimate
Caisson Removal	1,117,594	149,844,960	1,460	1,441	19
Concrete Total	305,026	34,183,050	864	760	103
Soil Total	896,226	109,039,710	596	681	(85)
Caisson	456,223	62,092,830	1,007	1,038	(31)
Caisson Soil (25% Disposed)	79,258	10,303,540	333	322	11
Caisson Soil (75% Re-Used)	237,773	30,910,490		-	-
Caisson Concrete	139,192	20,878,800	674	636	38
Caisson Upper Concrete	96,390	14,458,500	341	-	
Gas Stack Below Grade	(5,090)	(763,500)		-	
Spent Fuel Pool Walls	(12,716)	(1,907,400)		-	
Refueling Building	(8,269)	(1,240,350)		-	
Caisson Lower Concrete	68,877	10,331,550	334	-	
Tremie Layer	Included in Caisson for 2012 Filing			80	(80)
Turbine Building Slab	**75,600**	**11,340,000**	126	Inc in Below Ground Struct.	126
Turbine Soil				-	
Turbine Building Slab Concrete				-	
New Off Gas Vault (SAS Bldg)			-	-	
SAS Soil				-	
SAS Concrete				-	
Abandoned RW Discharge Line	-	-	-	-	
Abandoned RW Discharge				-	
RW Tankage Discharge Line				-	
Pre-Trench	126,771	16,742,130	327	403	(76)
Soil (inside RCA)	62,736	8,155,680	263	359	(96)
Soil (Outside RCA) - Reuse	50,940	6,622,200		-	-
Concrete	13,095	1,964,250	63	44	19
Slurry Wall					
Soil (Reuse)	459,000	59,670,000		-	-

There have been numerous changes since 2012, including the use of a CSM instead of the slurry wall. These changes resulted in the waste volume estimates being revised.

A three-dimensional computer model was used to estimate the upper caisson volume at 70,000 cubic feet from -14 feet to the RFB roof. This model includes the RFB walls

above +12 feet to the roof, but not the roof or parapet walls above the roof. Subtracting the RFB wall volume yields 55,700 cubic feet for the upper caisson. The computer model for the upper caisson volume includes the SFP walls and the gas stack below-grade structure (El.+12 down to El.+9). The 55,700-cubic-foot volume of concrete results in an estimate of 8.355M pounds, or 261 Intermodals.

The lower caisson volume calculation of 69,000 cubic feet did not include the tremie below the caisson. The estimate was revised on the lower caisson comparison take-off calculation to include the walls down to El.-69 elevation (as shown on the drawings), the three-foot-thick slab at El.-66 (above the tremie layer), the SFP slabs, and the six-foot-thick tremie layers, resulting in a concrete estimate of 80,000 cubic feet, 12,000,000 pounds, and 375 intermodals.

The tremie below the caisson is shown on plant drawings as six feet thick, at a minimum. At 60 feet diameter, this yields approximately 17,000 cubic feet or 2,550,000 pounds of concrete debris, about 80 Intermodals.

The above information is summarized in Table 3.3.24.

TABLE 3.3.24—ESTIMATED CAISSON EXCAVATION QUANTITIES

Section	Volume (cu ft)	Weight (lb) 150 lb/cu ft)	Intermodals (32,000 lb/IM)
Upper Caisson	55,700	7,500,000	261
Lower Caisson	80,000	12,000,000	375
Tremie Layer	17,000	2,550,000	80

Even though the RFB and Caisson have been declared OAD ready, there remain a number of Class A wastes to be removed from the Caisson for disposal in Clive, Utah. Radioactive waste from the Caisson for disposal in Utah includes many higher-activity items not suitable for the Grand View, Idaho, site. Contaminated areas that have the potential to contain material requiring disposal in Utah include portions of the Access shaft from El.-66 up to El.-2, embedded piping between the Off Gas Tunnel and the Caisson, Suppression chamber baffles, the Valve gallery, pipe chases, the Caisson sump, floor drains and piping, REDT, and TBDT, Drywell liner, and the activated core region.

Any area with alpha contamination must be carefully screened against Exemption 3 for compliance with Grand View, Idaho, WAC. The Idaho WAC allows Cs-137 up to around 45 picocuries per gram on a case-by-case basis, if the average is below 15 picocuries per gram. The allowable dose limit is an average dose less than 100 micoroentgens per hour, with no hot spot or individual reading above 500 microroentgens per hour (0.5

millirem per hour). One of the major areas of the RFB destined for Clive, Utah, includes the metal and the concrete from the activated core region. This consists of the activated metal of the drywell liner, the activated metal from the chromated cooling coils behind the drywell liner and the activated concrete. The metal and concrete is estimated at least 10 intermodals. Most of the metal from the Suppression Chamber is planned for disposal in Idaho. However, there are metal baffles located within both Suppression Chambers with external contamination that will require disposal in Utah.

The concrete walls around the SFP, with the exception of the embedded pipe at the bottom of the pool, are planned for disposal in Idaho. The quantity of radioactive material in cracks and the concrete expansion joints in the SFP and in the soil behind the walls has not been characterized and may require special handling. There are areas in the Access Shaft area, including the Vertical pipe chase, that will require disposal at the Clive, Utah, site. The vertical pipe chase includes the core spray pipe, Fuel pit drain, three-inch pipe from the REDT, and the Caisson floor drains that reads as high as 10 millirems per hour. The El-66-foot level of the RFB beneath the RPV, including the caisson sump, has areas reading above 2 millirems per hour that will require evaluation for disposal in Utah. Embedded grouted and foamed areas in the Valve Gallery reading in excess of 0.4 millirem per hour will be handled for disposal at Clive, Utah. Contaminated material in the concrete expansion joint and the soil beneath the Condensate Demineralizer room could result in another intermodal for Clive, Utah.

Most of the Caisson structures remain to be demolished, including the SFP, cask pit, gas stack base or foundation, and sheet piling. The structure has been declared ready for OAD, and demolition will be complete in 2017. Approximately 34 intermodals of Class A waste and 602 intermodals of exempt waste remain to be removed from the Caisson. As noted in Table 3.3.24 and described as the caisson tremie concrete, 80 intermodals are planned for disposal at the Idaho facility. In comparison, as shown in Table 3.3.25, the 206 intermodal shipments in the 2012 estimate from the below-grade RFB are now included in the lower Caisson estimate. This results in a net reduction of 164 intermodal shipments.

TABLE 3.3.25—COMPARISON OF 2012 NDCTP TO 2017 NDCTP ESTIMATED CONCRETE SHIPMENTS

Location of Concrete	2012 NDCTP	2017 NDCTP
Below Grade RFB	206	
Caisson Concrete	674	636
Tremie		80
Total difference from 2012 to 2017 estimated shipments is 164 shipments		

The bulk of the concrete structure will be removed and shipped as DOT-exempt waste meeting the NRC exemptions for disposal in Idaho. Table 3.3.26 presents the waste disposal budget analysis from the 2012 and 2017 NDTCP.

TABLE 3.3.26—WASTE DISPOSAL BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Caisson	26,441,182	29,133,143	29,133,143	-	23,313,034	23,313,034	5,820,108	5,820,108
Waste Disposal	24,037,438	26,604,960	26,604,960		21,824,507	21,824,507	4,780,453	4,780,453
Contingency	2,403,744	2,528,183	2,528,183		1,488,528	1,488,528	1,039,656	1,039,656
TOTAL	26,441,182	29,133,143	29,133,143	-	23,313,034	23,313,034	5,820,108	5,820,108

Prorated Reduction [1] 0 or 0%

Note:
1. The prorated reduction of $47M Did not apply to Caisson, Canals, and Common Site Support. Caisson Disposal decreased 20%

3.3.2.1.12 License Termination Survey

The primary contributor to the cost for license termination surveys is staffing. The staffing costs are split into two separate sub-categories: "License Termination Survey (Excluding Caisson)" under General Staffing, and "License Termination Survey" under Caisson. The split between the General and Caisson Staffing was made to better capture the specific costs associated with Caisson removal. Table 3.3.27 provides the details of the labor split between General and Caisson Staffing for License Termination Surveys. Staffing for the overall survey effort is discussed in section 3.3.1.1.7.

Based on amount of work activities scheduled during the Caisson field work time period, it was determined the most appropriate split for forecasting costs is 50/50. The costs associated with this portion of work is split 50% in above referenced section and 50% in Caisson scope of work during the years of 2016 – 2018.

Table 3.3.27 License Termination Survey Staffing

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014	ETC 2015 To 2020	Total EAC 2012 To 2020 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
General Staffing (Excludes Caisson)	**107,761,959**	**113,552,612**	**102,442,205**	**73,759,966**	**44,453,015**	**118,212,981**	**(4,660,369)**	**(15,770,776)**
Overall Project	87,001,807	93,019,124	83,917,789	66,432,824	32,021,433	98,454,257	(5,435,133)	(14,536,469)
License Termination Survey (Exclu	13,165,630	12,606,885	11,373,381	7,327,142	7,769,468	15,096,610	(2,489,724)	(3,723,229)
EPC Services	(962,235)	(1,175,125)	(1,060,146)			-	(1,175,125)	(1,060,146)
ISFSI Engineering / Specialty Con	(2,168,117)	(2,721,767)	(2,455,459)				(2,721,767)	(2,455,459)
Contingency	10,724,875	11,823,495	10,666,641		4,662,114	4,662,114	7,161,381	6,004,526
Caisson	**31,584,971**	**33,878,491**	**33,878,491**	**-**	**21,832,534**	**21,832,534**	**12,045,957**	**12,045,957**
Project Staffing	22,126,103	24,644,002	24,644,002		15,303,886	15,303,886	9,340,116	9,340,116
License Termination Survey	6,167,964	5,807,439	5,807,439		3,354,407	3,354,407	2,453,033	2,453,033
EPC Services	(1,102,622)	(1,177,936)	(1,177,936)				(1,177,936)	(1,177,936)
ISFSI Engineering / Specialty Con	(931,772)	(993,727)	(993,727)				(993,727)	(993,727)
Caisson Contingency	5,325,299	5,598,712	5,598,712		3,174,242	3,174,242	2,424,471	2,424,471
TOTAL	**139,346,930**	**147,431,103**	**136,320,695**	**73,759,966**	**66,285,549**	**140,045,515**	**7,385,588**	**(3,724,820)**
Prorated Reduction [2]			11,110,408 or 7.5%					
Level 2 Subtotals								
Overall Project Staffing	116,602,651	125,437,061	115,751,725	66,432,824	52,914,704	119,347,528	6,089,533	(3,595,803)
License Termination Survey	22,744,279	21,994,043	20,568,970	7,327,142	13,370,845	20,697,987	1,296,056	(129,017)

Note:
1. The Staffing is split differently in the forecast compared to the 2012 NDCTP methodology. The overall balance of staffing between the General Staffing section and Caisson Staffing section is favorable compared to the original estimate.
2. The staffing prorated reduction represented $11M of the $47M. Staffing was expected to be reduced by 7.5% but was reduced by 5%

3.3.2.1.13 Tools and Supplies

Table 3.3.28 presents the tools and supplies budget analysis from the 2012 and 2017 NDTCP.

TABLE 3.3.28—TOOLS AND SUPPLIES BUDGET ANALYSIS

	2012 NDCTP					2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Base 2012 NDCTP 2012-2014 Nominal / $2014	Reduced 2012 NDCTP 2012-2014 Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Remainder of Plant Systems / PG&E Civil Works Support	**18,354,898**	**19,172,817**	**17,296,878**	**13,388,710**	**12,078,709**	**7,642,000**	**2,730,326**	**10,372,326**	**8,800,491**	**6,924,551**
Tools & Equipment	17,219,644	17,985,743	16,225,952	12,624,120	11,388,930	7,642,000	2,589,267	10,231,267	7,754,477	5,994,685
Common Tools	3,770,666	3,954,883	3,567,922	2,390,202	2,156,336	2,010,000	-	2,010,000	1,944,883	1,557,922
Rad Protection	12,628,468	13,182,903	11,893,039	9,385,961	8,467,603	5,046,000	2,589,267	7,635,267	5,547,636	4,257,772
Glove Bags	820,511	847,958	764,991	847,958	764,991	586,000	-	586,000	261,958	178,991
Contingency	1,135,254	1,187,074	1,070,926	764,590	689,780		141,060	141,060	1,046,014	929,866
Caisson	**2,580,169**	**2,712,054**	**2,712,054**	**-**	**-**	**-**	**1,253,037**	**1,253,037**	**1,459,017**	**1,459,017**
Tools and Supplies	2,345,608	2,465,351	2,465,351		-		1,145,473	1,145,473	1,319,878	1,319,878
Common Tools	621,041	652,744	652,744					-	652,744	652,744
Rad Protection	1,724,568	1,812,606	1,812,606				1,145,473	1,145,473	667,133	667,133
Caisson Contingency	234,561	246,704	246,704				107,565	107,565	139,139	139,139
TOTAL	**20,935,067**	**21,884,871**	**20,008,932**	**13,388,710**	**12,078,709**	**7,642,000**	**3,983,364**	**11,625,364**	**10,259,508**	**8,383,568**
Prorated Reduction [1]			1,875,939 or 8.6%							
Level 2 Subtotals										
Common Tools	4,710,836	4,942,094	4,528,799	2,536,261	2,288,104	2,010,000	-	2,010,000	2,932,094	2,518,799
Rad Protection	15,371,965	16,061,799	14,685,353	9,971,471	8,995,826	5,046,000	3,983,364	9,029,364	7,032,435	5,655,989
Glove Bags	852,266	880,978	794,780	880,977	794,779	586,000	-	586,000	294,978	208,780

1. The prorated reduction represented $1.9M of the $47M. Tools and Equipment was expected to be reduced by 8.6% but was reduced 46.9%

Refer to Section 3.3.1.3.3 Tools and Equipment for full detail. Based on amount of work activities scheduled during the Caisson field work time period, it was determined the most appropriate split for forecasting costs is 50/50. The costs associated with this portion of work is split 50 % in above referenced section and 50% in Caisson scope of work during the years of 2016 – 2018.

3.3.2.1.14 Other

This category includes Small Value Contracts, Specialty Contracts, Environmental Contracts, and RP Direct Labor support of Caisson Removal. Table 3.3.29 presents a summary of the budget analysis for this category.

Refer to Section 3.3.1.3 - Remainder of Plant Systems/PG&E Civil Works Support and Section 3.3.1.7 - Small Value Contracts for full detail. Based on amount of work activities scheduled during the Caisson field work time period, it was determined the most appropriate split for forecasting costs is 50/50. The costs associated with this portion of work is split 50% in above referenced section and 50% in Caisson scope of work during the years of 2016 – 2018.

TABLE 3.3.29—OTHER BUDGET ANALYSIS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Small Value Contracts	**38,195,706**	**39,758,493**	**35,868,375**	**21,610,723**	**16,069,098**	**37,679,821**	**2,078,673**	**(1,811,445)**
Small Dollar Vendors	10,751,075	11,239,798	10,140,055	2,715,658	1,857,790	4,573,447	6,666,351	5,566,608
Specialty Contracts	25,291,138	26,274,027	23,703,279	18,895,065	12,569,999	31,465,064	(5,191,037)	(7,761,785)
EPC Services	(388,197)	(477,572)	(430,844)			-	(477,572)	(430,844)
Contingency	2,541,690	2,722,239	2,455,886		1,641,309	1,641,309	1,080,931	814,577
Caisson	**3,558,814**	**3,790,117**	**3,790,117**	**-**	**7,751,736**	**7,751,736**	**(3,961,620)**	**(3,961,620)**
Other	3,842,250	4,097,728	4,097,728		6,613,112	6,613,112	(2,515,385)	(2,515,385)
Small Dollar Vendors	3,437,250	3,665,799	3,665,799		786,949	786,949	2,878,849	2,878,849
Specialty Contracts	405,000	431,929	431,929		5,826,163	5,826,163	(5,394,234)	(5,394,234)
EPC Services	(728,411)	(775,622)	(775,622)			-	(775,622)	(775,622)
Contingency	444,975	468,011	468,011		1,138,624	1,138,624	(670,613)	(670,613)
TOTAL	**41,754,520**	**43,548,610**	**39,658,492**	**21,610,723**	**23,820,834**	**45,431,557**	**(1,882,947)**	**(5,773,065)**
Prorated Reduction [1]			3,890,118 or 8.9%					
Level 2 Subtotals								
Small Dollar Vendors	14,736,165	15,474,751	14,318,686	2,715,658	2,818,349	5,534,007	9,940,744	8,784,679
Specialty Contracts	27,018,356	28,073,860	25,339,807	18,895,065	21,002,485	39,897,550	(11,823,690)	(14,557,743)

Note:
1. The prorated reduction represented $3.9M of the $47M. Small Value Contracts was expected to be reduced by 8.9% but increased by 4.3%

Also refer to Table 3.3.5 for RP discrete labor costs.

3.3.2.1.15 Engineering, Procurement, and Construction Services

In the 2012 NDCTP filing, PG&E did not identify EPC as a blue-line item against which costs would be compared. However, much of the EPC costs were included within other blue-line items. PG&E is proposing that the blue-line items in Table 3.3.30 be reduced by the noted amounts, and that a new blue-line item be generated to account for the

EPC activities that are being collected against a single order number within PG&E's accounting system:

TABLE 3.3.30—EPC SCOPE ADJUSTMENTS

Blue-line Item	EPC Scope Adjustment ($)	2017 NDCTP Estimate
General Staffing (excludes caisson)	1,175,125	
Small Value Contracts	477,572	
Caisson	1,953,558	
Common Site Support—Caisson and Canals	480,434	
EPC 2012 NDCTP Allowance spread across other categories	**4,086,688**	
EPC 2017 NDCTP		**10,469,692**

Nominal $2014 base 2012 NDCTP

While $4.1M in projected EPC costs were captured in the 2012 NDCTP filing, another $6.4M in costs were not. The reason that these costs were not accounted for is simply that PG&E had not gone to industry for quotations on set scope at the time the 2012 NDCTP filing was made, unlike the manner in which the remainder of the pricing was conducted.

Recognizing that the selected CWC would be the optimal party to perform EPC work upon the contractor's takeover of site operations, PG&E solicited pricing from the shortlisted bidders during a Best and Final Offer (BAFO) request. Of the bids received for EPC in April 2013, the selected CWC contractor was the low bid at $6.5M (across 60 months), with the other two bids coming in at more than twice its value. The higher of the two bids was not considered because it was consistently and unrealistically high (i.e., across each scope area, including EPC). Ignoring the high bid, the average cost estimate for the EPC effort is approximately $10M, which is within about 5 percent of the EPC Scope Adjustment request included in this filing. The request is justified because it reflects significant planning effort (described below), and is well within the range of plausible pricing based upon the competitively solicited BAFO.

In March 2015, the Civil Works Contractor submitted an OTB to address a variety of anticipated cost and schedule overruns. An OTB is defined by the industry standard (American National Standards Institute/Electronic Industries Alliance Standard 748, EVMS) as "a new baseline for management when the original objectives cannot be met and new goals are needed for management purposes."

The major drivers influencing PG&E's decision to utilize an OTB included the decision to utilize CSM technology in lieu of the originally planned Slurry Wall; the decision to

transfer scope from a Subcontractor to the CWC; and the addition of the RPV scope to the Civil Works Contract.

Shortly after the March 2015 OTB submittal, PG&E and the Civil Works Contractor met through a series of focused meetings concerning EPC. The recently submitted OTB showed a substantial increase in the estimated cost, highlighting differences between PG&E's and the CWC's scope definition. Over a period of several weeks, the parties met to clarify the scope elements. The parties then performed independent costs estimates for each of the major EPC scope elements and negotiated final agreed pricing.

Based upon those meetings, PG&E estimated a range of $8.8M to $11.8M, and the CWC delivered an estimate of $10.6M. This final EPC value takes into account evolving site conditions, and has complete project team understanding and buy in. The value also approximates the average BAFO estimate for the two highest scored bidders.

Coincident with the CWC Over Target Baseline Submittal, PG&E issued an EPC Scope and Approval Desk Guide. This document responded to a fourth quarter 2014 internal audit conducted by PG&E for the purpose of verifying that internal cost control procedures were adequate. The audit identified the need for:

- A documented issue resolution process
- A documented invoice review, issue identification, and resolution process
- A chain-of-command path to issue resolution
- Regular meetings to discuss emergent issues

"The original philosophy was for EPC task support to be provided by optimizing under-utilized staffing available within the CWC's ranks. While the services provided are important and necessary, it was never intended by PG&E to create a dedicated staff just for the purpose of providing these. As PG&E moves forward with the HBPP D&D [demolition and disposal] project, the focus will remain on completing defined features of work with EPC tasks completed as prioritized and as resources become available." This Desk Guide establishes an EPC Technical Coordinator (TC) who manages the EPC scoping and work authorization process, ensuring work is contract compliant and supports budget and schedule requirements, and interfaces with the dedicated CWC Control Account Manager.

The Desk Guide defines the EPC as:

- SWPPP and BMP Support (outside specific Civil Work packages)
- Site Maintenance Support
- HBPP Safety

- Warehouse Operations
- General Site Maintenance (Subcontract and Vendors)
- Work Week Manager
- System Operations
- Training Coordination
- GWTS operations

In addition to providing for these activities, the Desk Guide defines the equipment allowed for use by the CWC, limiting exposure to unplanned costs without justification via scoping documents.

The Desk guide also addresses emergent work, but this requires its own scoping process that describes the newly identified work and provides visibility for the issue being addressed.

The Desk Guide lists effective time management, safety, environmental compliance, schedule, and overall budget management as expectations for EPC crew sets a general limitation on hours to 25 per day, or 100 hours per week.

With regard to general site maintenance, PG&E provided a listing of general services contracts to the CWC to maintain the site and keep the general services of the HBPP site working while decommissioning continued. These contracts include services for both permanent and temporary fencing, entry way floor mats for safety and cleanliness, inspections for backflow preventers, Heating, Ventilation, and Air Conditioning (HVAC) and air handlers for PG&E-owned or occupied buildings, such as buildings 5, 6, 7, 8, and 9, security trailers 12-1 to 12-7, the count room, the assembly building, and Access Control. The list also included contracts for janitorial services, pest control, locksmith services, plumbing and portable toilet services, office waste and recycling services, bottled water services, landscape and lawn maintenance, tree trimming and brush removal, compressed air, sump maintenance, sewer systems, site drainage, parking areas and parking area striping, siren systems, and non-fire-related water systems for all previously listed buildings and trailers. All of these services are on an as-needed basis, and should be viewed and forecast with the understanding that the conditions on the site are changing and fluid, and forethought is of utmost importance in determining when a contractor will called out.

An original Vendor list was supplied to the CWC upon award of the contract. This list enabled the CWC to expedite contracts to the local vendors already working on site for typical monthly maintenance activities. As part of an overall management strategy for the contractor and to enable PG&E Management Oversight to review and accept charges for these services, the CWC should provide a vendor list annually, listing

services received and costs associated with each. This list should be maintained by Central Work Control (PG&E's Contracts Administration) and distributed to the PG&E EPC TC for approval and confirmation of services.

Explanation of EPC Services

The original 2012 Civil Works Contract proposals did not include EPC services, as these were not included in the PG&E bid package. After discussion with the bidders, PG&E requested that bidders include these services in their BAFO proposals. The successful bidder's BAFO proposal included EPC services for general plant support. General plant support included implementation of the Safety Program; Fire Marshal and Industrial Hygienist services; plant training; general site maintenance, including the work Week Manager; GWTS Operations; Warehousing; electrician, carpenter and plumbing support; and general repair and maintenance of plant roads and grounds.

After contract award and through the first year of Civil Works contract performance, PG&E held substantive planning meetings with the CWC to discuss the intentions of both parties regarding CWC budgeting and proposal, as well as to clarify scope and anticipated staffing levels. PG&E executed the Master Service Agreement with the CWC on July 1, 2013. PG&E included this EPC service into the Master Services agreement with the CWC with a contract change order dated February 1, 2014.

3.3.2.1.16 Caisson Contingency

The assumptions, basis and definition of contingency as defined in Establishing an Appropriate Contingency Factor for Inclusion in the Decommissioning Factor for Inclusion in the Decommissioning Revenue Requirements, Study Number: DECON-POS-H002 Revision B, Status: Final April 2009 apply. However, contingencies were estimated on a line-item basis. The contingency values for Caisson are shown in Table 3.3.31.

Table 3.3.31 Caisson Contingency

	Total
Caisson Contingency	**19,119,086**
Field Work	**12,976,715**
Project Staffing	**2,339,300**
Waste Disposal	**1,488,528**
License Termination Survey	**834,941**
Tools & Equipment	**107,565**
Other	**1,372,037**

3.3.2.2 Canal Remediation

Significant changes that were incorporated into the Civil Works BAFO included:

- Performing multiple activities concurrently on a small site footprint (congestion)
- Managing large quantities of soil on site
- Optimizing waste shipments
- Managing water (controlling infiltration into sub-grade structures and dewatering sediments)

PG&E recognized that these challenges and other challenges were likely to come up during the course of the project, requiring a close alignment between PG&E and the CWC.

The BAFO shifted much of the characterization, handling, profiling, and shipping responsibilities for waste to the CWC. Consequently, additional personnel costs were included to provide management organization that worked side-by-side with PG&E to ensure that all waste, including soil would be handled compliantly and cost-effectively. Additional costs were also included for additional analytical testing to address waste and environmental characterization.

The CWC also allocated all storm water, SWPPP, Erosion and Sediment Control Plans, BMPs, and other activities within the Canal CLIN because the subcontractor initially responsible for canal remediation also owned this environmental scope of work. A dedicated Qualified Stormwater Practitioner (QSP) was also added as a key staff member.

For canal remediation, four initial bids were received in September 2012 from reputable, industry-leading companies. The relative prices were:

- Bidder A—½ other bidders
- Bidder B—7 percent lower than the average of B, C, and D
- Bidder C—4 percent higher than the average of bidders B, C, and D
- Bidder D—3 percent higher than the average of bidders B, C, and D

PG&E sought input from Sourcing, Finance, and Decommissioning Project Managers to develop a composite pricing from the bids received and estimate the planned value for the 2012 NDCTP CPUC filing. Sourcing selected Bidder B pricing, Finance selected the average of bidders B and C. The Decommissioning Project Manager selected the average of bidders B, C, and D.

As shown in Table 3.3.32 and 3.3.33, the removal cost for canal remediation was estimated at $21M (in 2011 dollars).

TABLE 3.3.32—Canal Bids

	NDCTP $2011 Table 4-1 Composite Bids	NDCTP $Nominal Table 4-1 Composite Bids	Baseline Sept 2014 PMO Reallocation	CB&I Forecast March 2015 Over Target Baseline	CB&I Forecast Sept 2015 OTB Over Target Baseline
Intake / Discharge Canal	21,000,000	27,102,568	30,117,257	34,899,715	36,677,295

TABLE 3.3.33—CANAL REMOVAL, DISPOSAL, AND CONTINGENCY COSTS

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Canal Remediation	27,184,000	28,900,465	28,900,465	8,379,236	31,681,987	40,061,223	(11,160,758)	(11,160,758)
Removal (Civil Works Contract)	21,000,000	22,396,325	22,396,325	8,379,236	28,294,233	36,673,469	(14,277,144)	(14,277,144)
Canal Contingency	6,184,000	6,504,140	6,504,140		3,387,754	3,387,754	3,116,386	3,116,386
TOTAL	27,184,000	28,900,465	28,900,465	8,379,236	31,681,987	40,061,223	(11,160,758)	(11,160,758)

Prorated Reduction [1] 0 or 0%

Note:

1. The prorated reduction of $47M Did not apply to Caisson, Canals, and Common Site Support. Canal Removal increased by 38.6%

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Canal Remediation	22,246,620	24,511,535	24,511,535	-	12,560,726	12,560,726	11,950,810	11,950,810
Disposal	20,224,200	22,384,417	22,384,417		11,660,406	11,660,406	10,724,010	10,724,010
Canal Contingency	2,022,420	2,127,119	2,127,119		900,319	900,319	1,226,800	1,226,800
Subtotal Caisson / Canal / GWTS	22,246,620	24,511,535	24,511,535	-	12,560,726	12,560,726	11,950,810	11,950,810
TOTAL	22,246,620	24,511,535	24,511,535	-	12,560,726	12,560,726	11,950,810	11,950,810

Prorated Reduction [1] 0 or 0%

Note:

1. The prorated reduction of $47M Did not apply to Caisson, Canals, and Common Site Support. Canal Disposal decreased 48.8%

At BAFO, Bidder A's removal cost increased to $21M and the remaining bidder, the awarded contractor, increased the work scope to $33M. After PMO reallocation across all CLIN in change order number 3, Canal remediation was estimated at $30M. The September 2015 Over Target Baseline estimates canal remediation at $37M.

3.3.2.2.1 **Canal Removal**

Work Scope Summary

The CWC is performing remediation of the Intake and Discharge Canal, as described in Specification Section 02 60 00 "Intake and Discharge Canal Remediation." Work required to conduct the canal remediation includes surveying, water management (water removal and treatment), shoring, asbestos abatement, demolition (Intake Structure, Discharge Structure, and Discharge Canal Outlet), sediment excavation, and levee restoration. The end state of this scope of work is to reach the interim restoration goal, which includes restoration of the levee to separate the canal from Humboldt Bay and temporary erosion controls in the canal.

The following list of equipment may be used for remediation of the canals. The list is not all-inclusive, and different types or brands of equipment may be substituted, as approved.

- Company vehicles (light duty trucks)
- 150-ton crane
- 35-ton crane
- Caterpillar 345 hydraulic excavator
- Caterpillar 365 hydraulic excavator
- Caterpillar 950H wheel loader
- Caterpillar 446D backhoe loader
- Caterpillar D6 RXL dozer
- Caterpillar 160H motor grader
- Caterpillar 623F motor scraper
- Caterpillar CS-563E smooth drum roller
- Peterbilt 4,000-gallon water truck
- Ingersoll-Rand DD65 double drum compaction rollers
- Articulated dump trucks
- Tractor/trailer transfer truck
- Forklift
- Aerial lift to perform radiological surveys
- ABI MOBILRAM (pile driver)

If work activity begins during the migratory bird breeding season (March 1 to August 30), the Environmental Coordinator may conduct a survey for migratory bird nests and nesting birds within two weeks prior to initiation of work activities. This survey covers suitable habitat within 250 feet of the work area boundaries, per Specification Section 01 57 19 "Supplemental Environmental Protection Requirements." If work activities begin in areas prior to the breeding season (between September 1 and February 28), work can proceed in these limited areas, under the conditions described in Specification Section 01 57 19. The following shows the general sequence of operations, means, and methods for Discharge Canal remediation. Some of these tasks may be completed concurrently. Tasks to complete the Intake Canal are expected to be similar but of lesser magnitude due to its smaller size and the presence of less contamination.

- Install soil erosion and sediment control measures
- Remove fence and install temporary fencing
- Reroute existing storm drains, as needed
- Demolish Discharge Canal Pump House (Sampling Shed)
- Install temporary road and crane mats, where needed

- Cap and plug pipes at canal inflow and outflow structures
- Seine canal and relocate sensitive species
- Install diesel pumps for dewatering canal and maintaining water levels
- Conduct pre-excavation RP survey of canal
- Remove rock riprap; survey and screen rock riprap for potential reuse
- Conduct pre-excavation topographic survey
- Install Satellite Treatment System (STS) and dewatering sumps
- Obtain representative sediment samples and characterize the samples for chemical constituents of concern at an approved off-site laboratory
- Construct the truck decontamination area
- Demolish the Canal Inflow Structure
- Excavate sediment from the Discharge Canal and perform RP surveys, as needed
- Collect confirmatory radiological and chemical samples from the excavation floor
- Conduct Post-Excavation Topographic Survey
- Continue dewatering and water management
- Install shoring in Humboldt Bay around Discharge Canal Outlet
- Remove crushed rock aggregate comprising the coastal levee to within one foot of the asbestos-containing material (ACM) and stage materials separate from the Discharge Canal spoils
- Stabilize and remove ACM from the Discharge Outlet and wrap for off-site disposal
- Load ACM into intermodal containers and stage for shipment to the disposal site
- Demolish the Discharge Outlet and transfer to material handling area
- Collect radiological and chemical confirmatory samples from the Canal Outlet excavation floor
- Perform chemical confirmation sampling
- Coordinate the FSS
- Reconstruct the coastal levee, including reinstallation of the riprap
- Remove shoring and discontinue dewatering and water management
- Backfill Discharge Canal to original lines and grades after approval of FSS (the canal may be used for temporary storage of reuse fill material)
- Conduct Final Topographic Survey
- Remove temporary fencing
- Dismantle the satellite treatment system for the interim prior to the commencement of the Intake Canal remediation in 2016

Background

Prior to shutdown of Units 1 and 2 in September 2010, HBPP used water from Humboldt Bay for cooling. Approximately one million gallons of water each day were conveyed through the Intake Canal into the plant and discharged through the Discharge Canal. There are three canal sections—the Fisherman's Channel, the Intake Canal, and the Discharge Canal.

Fisherman's Channel

PG&E has submitted an LTP to the NRC and is awaiting approval of that plan. According to the plan, the Fisherman's Channel is considered a single survey area. Characterization sampling has been performed to gather enough statistical radionuclide information to develop LTS sampling plans for this area. All characterization data performed to date indicate that radioactivity levels in both the Bay and Fisherman's Channel are statistically indistinguishable from background due to Cs-137 fallout.

Because PG&E is planning to perform a partial site release of the Fisherman's Channel area once NRC approves the LTP, a LTS has been conducted for that area. The report containing the survey methods and resultant data is currently in draft form, undergoing internal review by PG&E prior to submittal to NRC upon LTP approval. Similar to the characterization data, LTS results indicate that the levels of contamination are well below the DCLG clearance levels and statistically indistinguishable from background levels.

Intake Canal and Discharge Canal

The bed surface of the Intake Canal is approximately eight feet below sea level. A wetland salt marsh preserve to the northwest of the canal currently drains water into the Intake Canal and receives water from the Intake Canal during extreme high tides.

The Discharge Canal is located on the northern portion of the HBPP property. There are four 48-inch-diameter, unscreened outfall pipes connecting the Discharge Canal to Humboldt Bay. The bed surface of the Discharge Canal is approximately seven feet below sea level. It is surrounded by higher-elevation industrial lands to the west and a temporary construction laydown facility to the east.

Low levels of radiological and chemical constituents are known to have previously contaminated the Intake and Discharge Canals. Cs-137 is the primary radionuclide of concern and chemical contaminants include heavy metals and polycyclic aromatic hydrocarbons in the Discharge and Intake Canals, and total petroleum hydrocarbons (motor oil) in the Intake Canal. The contamination present in the Intake Canal was due

to an event around 1973 where radioactivity made its way into the North Yard Drain System and ultimately to the Intake Canal.

The activity present in the Discharge Canal is due to radioactive discharges and other events. The Discharge Canal was the normal release point for the LRW system. The Discharge Canal bottoms were a clay-like mixture, which tends to concentrate LLRW over time. The normal releases to the canal settled on the bottom and have been retained by the clay particles. Initial canal characterization identified activity at depths up to two feet. Since the initial characterization, radioactive discharges have continued, which would likely have increased the activity present in the sediment, and silting has occurred in the Discharge Canal, so now the activity is likely at greater depths.

The NRC requires PG&E to demonstrate HBPP site mitigation of residual radiological exposure to no more than 25 millirem per year, ALARA. In 2009, PG&E's cost estimate assumed an "Industrial Worker Scenario" to calculate the maximum allowable residual radioactivity; in 2012, PG&E assumed a "Residential Farmer Scenario". Although both critical group standards require meeting the same exposure limit, they differ in the estimated time encountering the exposure and the number of pathways by which a dose may be delivered. Based on 1998 data, the 2009 cost study assumed both canals would be backfilled with clean soil from off site, and 945 cubic feet of soil and no sediment or silt would be removed. Although all other nuclear sites use the Residential Farmer Scenario , PG&E assumed that its planned 30-year retention of the HBPP site for industrial use was similar to the Rancho Seco site, where the NRC permitted use of the Industrial Worker Scenario because residual radioactivity would meet Residential Farmer Scenario requirements after 30 years.

In 2012, PG&E significantly modified the scope of this project to demolish the Intake Canal and Discharge Canal concrete structures, remove silt and sediment, and excavate six inches into the walls and bottom of the canal. To meet the Residential Farmer Scenario standard, PG&E concluded that approximately 24,000 cubic feet of material must be removed from the Intake Canal and 160,000 cubic feet removed from the Discharge Canal. It is necessary to accurately model remediation of all contaminants to the required standards in order to properly scope the contract work, and to obtain license termination from the NRC. The LTP and the 2012 DPR are consistent.

Canal Remediation and Restoration Scope of Work

Specific scopes of work for the Intake and Discharge Canals for remediation of wetlands and tidal areas include the following:

- Obtain all the required permits from regulatory agencies to perform the work. The Intake and Discharge Canal permitting process requires that PG&E participate in mitigation efforts to improve the area, and provide for marine and aquatic species, and environmental habitat restoration.
- Install paving for the primary travel paths around the Soil Management Facility 1 and 2 and the general staging area at the former Trailer City location.
- Connect a water pretreatment system to be to the existing GWTS. The pretreatment system was added to remove entrained sediment to ensure that the GWTS was not overloaded and shut down, which would affect any work activities dependent on continuous water removal. Additionally, the pretreatment system frac tanks provided capacity to allow short GWTS outages while continuing to support work activities.
- Seine the canals at the start of remediation to remove and relocate animals and sensitive species.
- Dewater the canals and continually manage and dewater sediments and transfer water.
- Mechanically remove clean and radiologically and chemically contaminated sediment from the Intake and Discharge Canals.
- Demolish the discharge outfall and levee to Humboldt Bay.
- Restore the levee and coastal trail along the Bay.
- Demolish or remove the existing discharge outfall structure, which connects the Discharge Canal to Humboldt Bay and the intake and discharge structures in the Canals. All discharge pipes and concrete appurtenances will be removed, segmented, and loaded in waste containers to meet shipping requirements, properly handled, and transferred to PG&E for disposal. The outfall pipes include ACM, which will require special handling and disposal. The Outfall consists of four 60-foot long, 48-inch-diameter asbestos-bonded pipes and concrete structure.
- Remove the asbestos-containing outfall piping, the riprap around the outfall, and up to three feet of sediment. Conduct remediation with radiological and chemical sampling around the outfall to confirm LTP and chemical remediation requirements are met. Sediment and riprap determined to meet LTS and LTP requirements may be used as fill material. The NRC and ORAU will provide oversight and verification on canal remediation. After FSS activities are complete, the canal configurations will change as part of FSR.
- Construct an additional groundwater treatment structure to enable demolition of the discharge outfall structure.
- Provide all engineering analysis necessary to support the levee reconstruction.

- Demolish the Intake Canal structure, which involves removing and disposing of the approximately 27-foot-long by 13-foot-wide by 18-foot-tall concrete discharge structure. Additionally, the surrounding areas will require reconditioning, with slope and drainage toward the canal, to prepare for returning the canal to use.
- Excavate contaminated sediment to the clay liner and remove riprap to enable PG&E to conduct LTS in support of its NRC license termination. Any excavation beyond the limits set forth in the drawings and specification will continue as necessary until the DCGLs have been met.
- Construct a cofferdam in the Intake canal east of the walking bridge surrounding the known area of concern to prevent tidal flow into this portion of the canal. Contaminated sediment removal up to a depth of two feet below the bottom of the Intake Canal is anticipated, and will require continual dewatering.
- Remediate impacted riprap within the cofferdam area. Replacement soil and riprap will be installed to return the canal to its former shape and dimensions and the Intake Canal will be returned to use.

FSR of the Intake and Discharge Canals includes restoration and mitigation of the surrounding site areas. Restoration may include freshwater wetlands at or above the +12-foot elevation. The canals will be remediated from the +12-foot level, with Upland Habitat sloping downward to Coastal Salt Marsh, Mudflats, areas open to Humboldt Bay. Restoration of the canals will require significant backfill (some excavated material from remediation may be retained and used as backfill) and close interface with FSS and NRC/ORAU, as detailed in the FSR section.

The following paragraphs describe some of the more significant operational steps. Surveying activities at the canals include performing pre-excavation, progress, and post-excavation topographic surveys. The work will be conducted to complete surveys required by Specification Section 02 60 00. Bathymetric and topographic surveying will be completed as necessary to verify that target elevations have been reached and establish quantities of material removed.

Soil and erosion control measures, including placement of BMPs, are performed in the work areas to protect against storm water pollution and to protect adjacent wetlands, as identified in the preliminary wetlands map. All work is conducted in such a manner so as to avoid and minimize impacts to any ecological resources. BMPs for canal activities are or will be installed as described in the SWPPP, including the ESCP. BMPs will include the installation of erosion, sediment, and dust control measures, including air quality monitoring stations, if required. BMPs installed during implementation of this scope of work will remain and be inspected and maintained daily for the duration of the canal work. When the work is complete, the BMPs will be removed.

In order to demolish the Canal Intake and Outfall structures and remove sediment within the canals, it will be necessary to install temporary fencing to control the work site.

Dewatering the canal and controlling the influx of Humboldt Bay and groundwater is a significant challenge and is part of the Water Management Plan. For example, after initial dewatering of the canal in late fall 2014, a storm surge event overcame the sheet pile installation in the Bay and flooded the canal.

The Water Management Plan includes constructing a truck decontamination area, capping water pipes at the intake and outfall structure, installing temporary dams, dewatering, and removing the temporary dams. Water that requires treatment will be pumped directly to the Water Pretreatment System, which will be located on the east side of the Discharge Canal.

A portable truck decontamination area, located at the southeast corner of the Discharge canal will be used to wash and decontaminate equipment and trucks. This decontamination area is a prefabricated system that will contain and collect wash water. The pipes at both ends of the Discharge Canal will be capped or plugged in order to perform dewatering. The pipes that formerly discharged water from the power plant to the Discharge Canal will be capped at the Discharge Structure (at the south end of the Discharge Canal). The pipes at the Discharge Canal Outlet that connect the canal to Humboldt Bay (at the north end of the Discharge Canal) will be plugged with inflatable plugs. Temporary dams will be installed in the Discharge Canal, as necessary. The riprap along the canal banks will be removed, rinsed of algae, FSS-screened for future reuse on site, and staged in the Waste Management Area. The canal banks will be graded and prepared for installation of the temporary dam. The temporary dams will be installed using an excavator, loader, and cables.

Prior to dewatering, the discharge canal will be seined to protect and relocate sensitive animal species. After the seining is complete, the site inspected, and the water temporary dams placed, initial dewatering will begin. Initial dewatering will be done with two diesel-driven pumps with a pump capacity up to 4,000 gallons per minute (gpm) using the same system as planned for initial dewatering of the Intake Canal. During initial dewatering, water will be pumped directly to Humboldt Bay without treatment, in accordance with Specification Section 02 60 00. A velocity dissipation device will be installed at the outlet to reduce flow energy and erosion potential. The water will be pumped until turbidity levels start to cause a noticeable visual plume in the receiving waters. A hold point will be initiated to determine the cause of the turbidity and a decision will be made to continue or switch to another dewatering system. Once the bulk of dewatering is performed, two submersible sump pumps will be installed in the north end of the canal to lower the water level to the sediment surface for secondary

dewatering. During secondary dewatering, the water will be collected and pumped to the Water Pretreatment system for testing and treatment, if required, in accordance with Specification Section 02 60 00.

Additional dewatering sumps will be installed in areas of active sediment excavation, if required by field conditions. The sumps will have a pea gravel base and sump pumps placed inside slotted HDPE casings. Water from the sumps will be pumped to the Water Pretreatment System. Periodic checks of turbidity and pH will be conducted with field instrumentation, as required, to be used as indicators of system operation. For the discharge canal outlet (between the sheet pile shoring and the levee), initial dewatering will use diesel pumps with suction and discharge hoses to pump water back to the bay. After initial dewatering, two submersible sump pumps will be installed in the discharge canal outlet for secondary dewatering.

Once the dewatering is performed, an access ramp will be constructed to provide access into the Discharge Canal for excavating equipment. The rock riprap will be removed from the area where the ramp will be constructed, and then fill material will be placed to construct a ramp. Crane mats will be placed down the center of the canal to provide a working surface for demolition and excavation equipment. During construction of the access ramp and placement of crane mats, representative sediment samples within the canal will be obtained as prescribed in the sampling and analysis plan to appropriately characterize sediments prior to excavation and sediment removal. The Intake and Discharge Structure will be demolished using a large excavator with hydraulic crusher, which will reduce the concrete debris to less than 2 feet in size. The debris will be loaded into intermodal containers for off-site disposal.

Sediment removal for most of the discharge canal was completed in 2015. Excavation started near the Discharge Canal Outlet (at the north end of the canal) and proceeded south to the Discharge Structure (at the south end). An excavator along the Discharge Canal was used to remove the rock riprap. After removal, the rock was transported to the Laydown Area, assayed through the GARDIAN System, and returned to the Laydown area for further processing. After the riprap was removed from the slope, the contaminated sediment was excavated, mixed with lime, and loaded into dewatering bags, if necessary. The dewatering bags were determined not as effective as expected and the use of the dewater bags was curtailed. A man-lift is available to allow testing of the affected areas. Excavation will proceed until the area is confirmed clean.

After the outlet pipes and contaminated soil are removed and the FSS and chemical sampling completed, the levee will be restored. The restoration will be done by filling with the soil materials that are suitable for reuse on site. Imported fill will be required to replace the volume of the outlet pipes and contaminated soil around the pipes. The rock

riprap that was removed from the Humboldt Bay side of the levee will be replaced on the outside of the restored levee. Current plans include backfilling the discharge canal with excavated material from the CSM wall.

The pipes in the Discharge Canal Outfall contain asbestos materials; therefore, asbestos abatement is required during demolition of the pipes, the structure connected to the pipes, and the soil in contact with the pipes. The outfall pipe is asbestos bonded metal pipe that must be removed since it presents an environmental liability and is slightly radiologically contaminated. Demolition of the Discharge Canal Outlet and the soil in contact with the outfall is part of the Asbestos Abatement Plan. Work to complete demolition of the outfall pipes is expected to occur in 2016.

A shoring system must be installed in Humboldt Bay prior to demolition, to allow dewatering on the Bay side of the outlet, which is required to demolish the outfall and to restore the levee. After installation of the shoring system, the Discharge Canal outlet will be demolished, followed by a hold point to allow for FSS inspection and approval. Coordination with FSS will be established and maintained throughout the backfill process. After the levee is restored, the shoring system will be removed.

Radiological Issues.

Cs-137 is the primary radionuclide of concern for the sediments. This radionuclide is presumed dominant in the Canals. Non-radiological contaminants of concern also exist in Canal sediment and will be removed.

Water Drainage

Except for ground water, storm water, or tidal flows into the canals, prior to canal remediation, the CWC is required to terminate or redirect all facility drainage to minimize active inflow to the canals. Contaminated runoff or discharge to the canals needs to be prevented during and after remediation work to avoid recontaminating the canals or exceeding the capacity of the GWTS.

Waste Volume

Due to active siltation of the canals, excavation of the waste volume is a challenge. The outfall structure consists of asbestos bonded metal pipes and concrete structure. The volume of silt and sediment in the Discharge Canal has tripled in the past year.

Environmental and Permitting Compliance

Coordinating remediation work in wetland habitats, maintaining compliance with permit conditions, and protecting personnel and the environment will be a challenge. Wetlands

on and adjacent to the Site support a diverse assemblage of wildlife that forage, nest, and seek refuge in these habitats. Permits that were obtained, and requirements that must be met during canal remediation, are memorialized in the USACE 404 Permit, California Department of Fish and Wildlife Incidental Take Permit, Coastal Development Commission, Humboldt Bay Harbor District, and Water Quality Control Board permits.

Marine and shoreline habitats adjacent to the Site, including the Intake Canal and the Discharge Canal, serve as foraging and loafing habitat for a variety of birds dependent on aquatic habitat (e.g., osprey, cormorants, gulls, and herons). Harbor seals have been observed using the Site for resting or feeding. Special-status plants and animals have been documented in the Site vicinity, including Humboldt Bay owl's clover, Point Reyes bird's beak, and Northern red-legged frog. Additionally, the California brown pelican and bald eagle have been observed foraging directly adjacent to the Site. The Contractor will protect wetlands and habitat in accordance with the requirements of regulations, permits, and authorizations applicable to the project.

Coordination and Integration with Demolition Work

The site footprint is extremely small and constricted, which creates several challenges for demolition and restoration work. Very little space is available on site for laydown areas, soil stockpiling, demolition debris, and equipment operation, including demolition machines and truck traffic. Surveying, stockpiling, and management of clean excavated material designated for reuse will be limited to available space. In addition to limiting reuse of materials, the constricted space requires greater coordination between all crews performing work on site than would normally be required. Significant delays or inefficiencies may be unavoidable due to interference and coordination with other site activities. The constricted space may limit the pace of demolition and excavation. A well-developed traffic plan is essential to optimal demolition sequencing and material handling/management.

Climate

The climate of the greater Humboldt Bay region, including Eureka and the immediate coastal strip where the project site is located, is characterized as Mediterranean. Summers have little or no rainfall, and low overcast skies and fog are frequently observed. Winters are wet, with frequent passage of Pacific storms and mild temperatures. During the rainy season, generally October through April, Eureka receives about 75 percent of its average annual rainfall, with greatest monthly totals in December and January. The average annual rainfall over the 110-year period in Eureka is 38.87 inches. The rainy season will affect the Contractor's ability to load waste into shipping containers.

On December 10, 2014, a significant storm passed through Eureka affecting the Discharge Canal Remediation Project. High winds of 25 to 35 miles per hour, with gusts up to 50 miles per hour, strong surf, and 15- to 18-foot waves caused significant damage to the Coastal Access Trail and the Discharge Canal. The entire canal was filled with an estimated 1.4M gallons of storm and sea water in less than 45 minutes. The GWTS can process approximately 300 gallons per minute. All storm water was required to be treated prior to discharge to Humboldt Bay. This storm caused significant setback to the remediation project. Additionally, heavy surf caused significant damage to the cofferdam, creating in-water leakage exceeding GWTS capacity.

Intake Canal

A portion of the Intake Canal headwall structure is located inside the HBGS fence line, in proximity to HBGS. Installation of a cofferdam may be required to support the headwall demolition and pipe removal. HBGS switchyard equipment has specific vibration thresholds, posing a challenge to the CWC. The switchyard may need to be monitored during installation of the sheet pile.

Traffic Control

Planned remediation of the Intake Canal is in the peak demolition period of 2015 to 2016. Long-reach excavators, sheet pile driving equipment, dump trucks, and loaders, which will be removing riprap, sediment, and concrete headwall structures, will require a substantial footprint to perform activities. Construction activities will likely require closure of Bravo Road, the main access to HBPP. The closure of Bravo Road will require all other construction traffic to be rerouted to Charlie Gate. Additionally, Alpha Parking Area will be affected.

Asbestos Abatement

The discharge pipes contain asbestos materials. Some of the remediation may occur underwater. Proper equipment with GPS may be required to excavate and remove contaminated soils and asbestos piping underwater.

Soil Conditions

It is anticipated that once the silt is removed, the sediment will likely contain excess moisture. Wet soils are the most difficult to manage as waste. Significant time and effort are required to dry soils to meet shipping criteria. Excavated soils may be required to be mixed with lime and loaded into dewatering bags. The loaded bags, once dewatered, would then be transferred to the Waste Department for disposal.

Riprap

A portion of the excavated riprap will potentially survey below the DCGL and may be reused in the canal if chemical sampling results indicate non-radiological contaminants are at acceptable concentrations for on-site reuse. A radiation contamination detection system (GARDIAN System) was installed on the northwest end of HBPP, and is used to scan trucks with soil and sediment. The scanning process takes approximately 35 minutes to complete for a 10-cubic-yard dump truck and will ensure that soil is free from contamination. The trucks must traverse the site through other construction areas, potentially extending the time each truck must round-trip for scanning.

PG&E Oversight Team

Throughout this project lifecycle, the PG&E Oversight Team will perform real-time observation of the contractor performance of work planning, work in progress, risk management, conduct of operations, and implementation of plans, policies, procedures, guides, work methods, and safe practices.

During the Work Planning stage, PG&E Oversight attended tabletop meetings to provide Subject Matter Expertise in scope development, means and methods, and required sequences. They also provided direct feedback to planners throughout the planning process to the final design and gave input on discrete issues raised by contractors.

During the Work Execution Phase, PG&E Oversight resolved issues regarding safety, general quality assurance, contract compliance, procedural and work package compliance, and Requests for Information.

The main risk for the Intake and Discharge Canal is the substantial amount of specialty subcontractor performance needed to execute this phase of work. Subcontractors perform the following work in the Intake and Discharge Canal phase:

- Metal Building Installation
- Electrical installation for Groundwater Pretreatment System
- Groundwater Treatment Pretreatment System installation and processing
- Sheet Pile installation
- Seining the canals to remove and relocate sensitive species
- Excavation and Initial Grading
- Canal Remediation
- Crane support
- Surveying
- Final Grading and Paving

PG&E fosters a safety culture and expectation of exemplary safety performance. Protection of personnel and the environment is the first priority at PG&E. PG&E requires all contractor and subcontractor personnel to adopt and implement this safety culture in all aspects of work performance, behavior, and personnel interaction. PG&E Oversight provides safety and environmental guidance during the performance of the work to ensure the high standards of its culture are observed. Additionally, Oversight serves as a liaison to communicate PG&E expectations to the contractor and subcontractors to ensure continued compliance with contract requirements, policies and procedures, regulations, and the contractor's stated objectives. These costs are part of PG&E staffing.

3.3.2.2.2 Canal Disposal Cost Avoidance

A total of 1,099 intermodal shipments were estimated in 2012 NDCTP filing for demolition and disposition of the Intake and Discharge Canals. Most of the Discharge Canal silt and sediment was remediated and removed in 2015, and the radiological levels were found to be lower than expected. The Intake Canal, the North and South end of the Discharge Canal, and the Intake and Outfall Structures remain to be demolished and remediated. The Discharge canal sediment is characterized with a 95 percent upper confidence limit within the acceptance criteria for exempt waste. The weight of loaded intermodals was optimized to 32,000 to 35,000 pounds of silt and sediment, instead of the original basis of 30,970 pounds, further reducing the number of intermodal shipments. The reduced waste volume, along with the waste shipments being classified as exempt material for Idaho disposal (shown in Table 3.3.34), results in a significant cost avoidance.

TABLE 3.3.34—CANAL DISPOSAL SHIPMENT ESTIMATE, 2012 NDCTP

Total Waste Disposal	2012 CPUC Estimates			2017 NDCTP	Delta
	CPUC 2012 Volume Estimate (ft3)	Weight 2012 CPUC Estimate (150pcf Concrete 130pcf Soil) (lbs)	Intermodals 2012 CPUC Estimate (30,970 lbs/IM)	Intermodals 2017 CPUC Estimate (32,000 lbs/IM)	2012 Estimate to 2017 Estimate
Intake/Discharge Canals	256,163	34,033,950	1,099	718	380
Concrete Total	36,638	5,495,700	177	11	166
Intake Structure	34,390	5,158,500	167	-	167
Discharge Canal Inlet/Outlet Structures	2,248	337,200	11	11	(0)
Outfall Piping				-	-
Soil Total	219,525	28,538,250	921	707	214
Intake Canal Sediment	23,601	3,068,130	99	96	3
Discharge Canal Sediment	99,702	12,961,260	419	-	419
Discharge Canal Excavation	18,786	2,442,180	79	612	(533)
Discharge Canal Silt	40,338	5,243,940	169	-	169
Concrete Discharge Structures Soil	37,098	4,822,740	156	-	156

As shown in Table 3.3.34 for the 2017 NDCTP filing, the current estimate is 718 shipments to complete the Intake and Discharge Canal demolition and disposition. This equates to a 380-shipment reduction from the original estimate.

3.3.2.2.3 Canal Contingency

The assumptions, basis and definition of contingency as defined in Establishing an Appropriate Contingency Factor for Inclusion in the Decommissioning Factor for Inclusion in the Decommissioning Revenue Requirements, Study Number: DECON-POS-H002 Revision B, Status: Final April 2009 apply. However, contingencies were estimated on a line-item basis. The contingency values for Canal are shown in Table 3.3.35

Table 3.3.35 Canal Contingency

Canal Contingency	4,288,073
Field Work	3,387,754
Waste Disposal	900,319

3.3.2.3 Common Site Support

Preparing to relocate the affected staff required significant time, planning, and cost. HBPP had to consider the following to ensure that the decommissioning efforts would continue in a safe, timely, and effective manner:

- Adequate space to house the employees was needed. That included numbers of offices, desks and chairs, space for meetings, rest facilities, and parking. That space also needed to be a "Safe Space" meaning that it needed to be fire rated for the number of personnel; have adequate escape routes in case of emergency; have adequate access to emergency services such as fire and ambulance; contain sufficient lighting, heating, and air conditioning; and be securable to prevent unauthorized access during both working and off hours.
- The space required adequate infrastructure support, including telephone communications, internet access to connect with the PG&E servers, photocopiers, and sufficient electric power to run the associated equipment.
- The new location needed to be in close proximity to the site in order to allow for personnel to go to the site to continue facilitating work there.
- Transportation to and from the site was needed because parking at the site was also affected, thus restricting the available parking.

- A relocation plan was needed to efficiently move the personnel, their work-related belongs, files and filing cabinets, computers, printers, and consumables. The plan needed to facilitate the move in an expeditious and effective manner while minimizing the impact on personnel and ongoing work. Sufficient resources were needed to make the physical move and sufficient pre-move communications were required to prepare the staff for the move.

The College of the Redwoods was selected as the location for the off-site offices. The location met all of the needs for an off-site location at an economical cost. To provide for access to the site, a shuttle service was procured and a schedule set up for the service during normal working hours. The transition from the site to the off-site location was completed seamlessly.

Once the relocation of staff was completed, the area known as Trailer City was abandoned because the area was needed to accommodate soil remediation processing and groundwater treatment. The abandonment work included the removal of all pertinent above-ground infrastructure from Trailer City and the adjacent Trailer City Laydown Yard.

Trailer City encompassed approximately three acres at the east end of the HBPP site. At this site, 10 modular offices (trailers) of various dimensions were removed. Most were leased, and one was owned. The trailers, dimensions, and ownership are as follows:

- Trailer 22—60 x 72, PG&E owned
- Trailer 24A—24 x 60, Leased from Williams Scotsman
- Trailer 24B—36 x 60, Leased from Williams Scotsman
- Trailer 24C—10 x 60, Leased from Williams Scotsman
- Trailer 24D—24 x 60, Leased from Williams Scotsman
- Trailer 24E—10 x 40, Leased from Williams Scotsman
- Trailer 24F—12 x 56, Leased from Performance Modular
- Trailer 24H—24 x 60, Leased from Performance Modular
- Trailer 24I—24 x 60, Leased from Performance Modular
- Trailer 24J—24 x 60, Leased from Williams Scotsman

These trailers and associated walkways and roadways previously took up approximately 50 percent of the total acreage in Trailer City. The remainder of the area was utilized as a laydown yard and GWTS. The laydown yard was previously used for material storage. This area is currently used for canal remediation and dewatering of saturated soils.

Table 3.3.36 captures the costs associated with Common Site Support.TABLE 3.3.36—COMMON SITE SUPPORT

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
Common Site Support - Caisson and Canals	5,745,630	6,021,785	6,021,785	3,551,583	2,158,445	5,421,068	600,716	600,716
Relocation of Trailer City	2,542,000	2,688,812	2,688,812	888,774	1,542,565	2,431,338	257,474	257,474
Groundwater Treatment	2,892,636	3,020,620	3,020,620	2,391,763	292,342	2,684,104	336,516	336,516
Groundwater Treatment System Operation	761,474	792,786	792,786	271,047	34,579	305,626	487,160	487,160
EPC Services	(450,481)	(480,434)	(480,434)		-	-	(480,434)	(480,434)
Common Site Support Contingency					288,960			
TOTAL	5,745,630	6,021,785	6,021,785	3,551,583	2,158,445	5,421,068	600,716	600,716

Prorated Reduction [1] 0 or 0%

Note:

1. The prorated reduction of $47M Did not apply to Caisson, Canals, and Common Site Support. Common Site Support reduced by 10%

3.4 ENGINEERING, PROCUREMENT, AND CONSTRUCTION WORK SCOPE

The EPC work scope to be performed by the CWC includes furnishing all PG&E-requested and approved labor, transportation, materials, equipment, vehicles, and supervision necessary to perform general site services at HBPP and the project offices located at the College of the Redwoods. Table 3.4.1 presents a budget analysis for the 2012 and the 2017 NDCTP.

TABLE 3.4.1—EPC BUDGET ANALYSIS, 2012 AND 2017 NDCTP

	2012 NDCTP			2017 NDCTP				
	Base 2012 NDCTP (2011$)	Base 2012 NDCTP Nominal / $2014	Reduced 2012 NDCTP Nominal / $2014	Spent through 2014 Nominal	ETC 2015 To 2025 $2014	Total EAC 2012 To 2025 Nominal / $2014	Delta from Base (nominal / $2014)	Delta from Reduced (nominal / $2014)
EPC Services (including Quality Training)	3,832,663	4,086,688	3,924,982	199,315	10,270,378	11,121,347	(7,034,659)	(7,196,365)
EPC Services					9,085,128			
EPCServices Contingency					1,185,250			
TOTAL	3,832,663	4,086,688	3,924,982	199,315	10,270,378	11,121,347	(7,034,659)	(7,196,365)

Prorated Reduction [1] 161,706 or 4%

Note:

1. The prorated reduction represented $0.2M of the $47M. EPC was expected to be reduced by 4% but increased by 172%

This new work scope arises out of the transition from PG&E self-performing work to contracting several major operations at HBPP to the CWC, with PG&E providing management and oversight as the Owner's Representative. While many of the elements of EPC were anticipated in the 2012 NDCTP and the original Civil Works scope envisioned at the time, PG&E recognized that transferring additional O&M type scope to the CWC contractor stood to benefit the project by allowing the CWC to control all activities on site, balancing resources more effectively than multiple contractors conducting concurrent activities at the site possibly could. The EPC Work captures the additional support operations necessary to keep HBPP running efficiently and consolidates several scopes of work that fell outside the boundaries of the other Civil Works scope packages.

3.4.1 Site Maintenance Support Field Labor (Field Labor)

Site Maintenance Support requires sufficient staff to respond to repair requests and keep the site in good working condition and maintained to a safe level. Managing this

crew requires effective time management, proper use of equipment in order to prevent environmental incidents, and prevention of property damage and bodily injury during movement of equipment or heavy loads. Site maintenance examples include:

- Cleaning and maintaining HBPP Common Areas
- Performing "handyman" activities for PG&E-occupied facilities
    - Fixing doors—locks, hinges, closers, etc.
    - Replacing broken window glass
    - Painting
    - Repairing walls
    - Replacing burnt out light bulbs and tubes in accordance with applicable requirements
    - Setting up, moving, and maintaining desks, shelving, cabinetry, file cabinets, and other office furniture
- Performing preventive maintenance and minor repair for forklifts
- Operating forklifts for material moves
- Performing light electrical work as required, consisting of minor 110v/220v repairs or changes
- Performing general HVAC maintenance and upkeep
- Providing Vendor Support for vehicle escorts and spotters

3.4.2 General Site Maintenance (Sub-Contract/Vendors)

A listing of existing services contracts was provided to the CWC to maintain the site and keep the general services of the HBPP site working while the project continues. This list enabled the CWC to expedite contracts to the local vendors already working on site for typical monthly maintenance activities.

Subcontractor/Vendor Services include:

- Permanent and temporary fencing
- Entry way floor mats for safety and cleanliness
- Inspections for backflow preventers on the water system
- HVAC and air handler units for both permanent buildings and temporary trailers
- Janitorial services, pest control, locksmith services, plumbing and portable toilet services, and office waste and recycling services
- Bottled water services
- Landscape and lawn maintenance, tree trimming, and brush removal
- Compressed air, sump maintenance, sewer systems, and site drainage
- Parking areas and striping

- Siren systems and non-fire-related water systems for all previously listed buildings and trailers

3.4.3 Storm Water Pollution Prevention Plan and Best Management Practices

The routine BMP work includes installing, maintaining, and removing temporary erosion control and sediment control measures in accordance with the SWPPP for HBPP D&D common areas for which PG&E was previously responsible. This scope includes:

- Checking the 2 Vortechs® unit[5], 16 drain inlets, yard drains, and other areas, cleaning periodically to remove any debris or sediment accumulation, and clearing any blockage or obstruction to ensure performance of each structure
- Conducting general maintenance and repair of erosion control and sediment control BMPs, such as installing silt bags, replacing worn or damaged fiber rolls, or repairing torn silt fences, as needed
- Maintaining roadways clear of debris
- Placing sandbags, diffusion barriers, and wattles in high risk, runoff areas

The SWPPP boundary is defined as the entire area within the perimeter fence BMPs; Alpha, Bravo, and Charlie Parking Lots; the vehicle entrances to Alpha Parking Lot (Alpha Gate and Alpha Road), Bravo Parking Lot (Bravo Gate and Bravo Road), and Charlie Parking Lot (Charlie Gate and Charlie Road); the walk path from Charlie Parking Lot to Bravo Parking Lot; and the common drainage areas outside the RCA. Common drainage areas include: west of the Frog Pond; between the Assembly building and the WMF; below the back of the WMF to the old count room parking lot; along the seeded berm from the Frog Pond to building 6; between the walkway and the WMF; and the WMF staging lot.

Emergency or emergent events for SWPPP activities include :

- Scheduling and coordination for pre-rain events, rain events, and post-rain events
- Construction for unpredicted soil or sediment disruption
- Installation of temporary erosion control and sediment control BMPs, such as gravel bag berms, sandbag barriers, drain inlet protection, or slope drains
- Sweeping of hardscape surfaces, prior to a predicted rain event
- Broadcasting straw, or seed, or both on disturbed areas prior to a predicted rain event

[5] Vortechs® units are proprietary products of Contech Engineered Solutions, Inc. They are hydrodynamic storm water treatment devices used to remove pollutants from urban runoff and provide enhanced gravity separation of solids in a compact configuration.

- Removal of all deposited sediment at sediment control BMPs after every rain event or as determined from the weekly inspections

3.4.4 HBPP Safety

PG&E previously sponsored and led the Project Safety Program during its Self-Perform Phase, including conducting site-wide quarterly safety meetings, monthly employee safety committee meetings, weekly safety supervisors meetings, work planning meetings for EPC work scope, and maintenance of the HBPP safety program. These and other safety-related roles and responsibilities have been transitioned to the CWC under EPC, with the requirement that the Contractor's program meets or exceed PG&E's current program. In lieu of PG&E sponsoring and directing the quarterly site-wide safety meetings and committees, PG&E's role will be oversight in evaluating and providing feedback to the CWC.

3.4.5 System Operations

System operators and clearance personnel are responsible for operation of active systems and Man-on-Line clearance programs in alignment with PG&E programs and procedures. The clearance coordinator actively maintains and schedules preventive maintenance on the active ventilation system and air handling unit in the RFB, demineralized water system, active Fire Water system, domestic water system, yard drain system, sewage lift stations, the Stack Particulate Alpha Monitoring System, site alarm system, service air system, and cold and dark electrical systems.

Operators and clearance personnel also approve and monitor clearances on the access shaft man-lift, any operation of the FIXS, as well as any of the systems listed above. The clearance coordinator actively pursues all safety protocols with regard to electrical, mechanical, chemical, or industrial systems that may result in harm or injury to either personnel or equipment.

System operation and clearance activities include:

- Starting and stopping equipment
- Operating valves
- Responding to alarms
- Periodic equipment checks
- Calibration checks
- Record keeping and systems monitoring
- Enforcing "Man-on-Line" or clearance program compliance
- Marking equipment or systems as active or inactive

3.4.6 Groundwater Treatment System Operations

The GWTS is operated by the CWC as part of the water removal efforts associated with the discharge canal, intake canal, and substructures inside the RCA. Operation of the GWTS must meet all requirements of NPDES Permit Number CAS000002 General Permit and the local Basin Plan Water Quality Objectives.

Operations are performed by full- and part-time operators supervised by the on-site Clearance Coordinator. Operation of the GWTS by the CWC includes up to four operators for processing water through the GWTS for release, with 24/7 operation when necessary based on work requirements.

A one-time modification (upgrade) at approximately $150K is expected to increase the system capacity by 150 gallons per minute. This would allow for the ability to decrease schedule pressure by reducing volume through-put times and would afford schedule flexibility in cases of extreme weather conditions.

3.4.7 Work Week Manager

All site coordination is managed by the WWM. The daily work coordination process integrates the efforts of multiple organizations into a series of activities that build upon each other to support the project, SAFSTOR, and other site activities. The WWM ensures that the necessary preplanning and preparations for work execution are performed well in advance of implementing activities.

The WWM is responsible for oversight of the daily coordination process for the work being performed during the assigned work week. This includes supporting and assisting in managing all intergroup coordination issues, assessing the effect of emergent work on the schedule, and coordinating and managing schedule manipulations as required. The WWM is also responsible for evaluating the effect of planned activities on overall plant operations. The WWM works with the various crews to provide perspective to the daily work coordination process. This position is responsible for coordination of POD meetings.

The WWM coordinates emergent work, authorizes significant changes to the daily schedule inside the planned work week, approves work additions, and provides an interface with management to address any specific problems that may arise.

This scope of work is anticipated to end in 2016.

3.4.8 Warehouse Operations

Warehouse and Warehouse Operations personnel receive, maintain, control, stock and store, issue, and re-order materials, tools consumables, and other stock items, as

needed to support work at the site. Personnel assigned in the warehouse are qualified to operate forklifts and to maintain the normal documentation associated with a warehouse.

3.4.9 Training Coordinator/Liaison

The Training Coordinator/Liaison position is responsible for scheduling training for personnel; verifying that the training is appropriate, timely, and documented; managing training records; and properly conveying those records to management and auditors upon request.

3.4.10 Tool Crib

The purpose of the tool cribs is to provide, maintain, and control the necessary hand tools and personnel safety equipment that are required for the workers to perform daily field activities. The tool cribs were staffed to assure that adequate tools were available when need and in safe work order. The staff also conducted inspections, maintenance, and distribution of necessary safety equipment. The CPUC basis for funding the labor to man the tool cribs was tied to the plant systems removal. Self-performed activities for plant systems removal was completed in June 2014 and the remainder of self-performed activities were completed in early 2015. At that time, the tool crib staffing was turned over to the CWC and labor charges were removed from the EPC budget.

3.5 COST TO COMPLETE

Tables 3.5.1 and 3.5.2 contain the data for cost to complete the decommissioning and to manage the spent fuel from 2015 through 2030. Table 3.5.1 is in 2014 dollars and Table 3.5.2 is in nominal dollars.

Table 3.5.1 Cost to Complete in 2014 Dollars

$2014	PG&E	Material	Contract	Burial	Other	To-Go Total
2015	6,251,659	2,137,642	67,326,507	17,544,521	1,197,887	94,458,215
2016	9,242,706	1,245,633	94,602,919	24,013,636	20,690,321	149,795,215
2017	8,217,662	607,133	54,782,315	18,374,032	14,612,975	96,594,117
2018	6,942,611	474,898	46,113,298	10,371,726	10,536,513	74,439,046
2019	7,360,133	269,611	8,670,523		2,728,630	19,028,897
2020	5,269,264	65,338	3,945,439		1,528,300	10,808,341
2021	4,968,304		2,153,000		1,106,896	8,228,200
2022	4,968,304		1,616,000		999,496	7,583,800
2023	4,968,304		1,596,000		997,496	7,561,800
2024	4,968,304		1,536,000		983,496	7,487,800
2025	4,968,304		1,536,000		983,496	7,487,800
2026	4,968,304		2,081,000		1,087,996	8,137,300
2027	4,968,304		1,596,000		989,496	7,553,800
2028	4,968,304		1,578,246		1,006,557	7,553,107
2029	4,968,304		4,362,983		1,699,742	11,031,029
2030	291,086		7,787,833	2,771,431	2,683,479	13,533,829
$2014 Total	88,289,860	4,800,255	301,284,063	73,075,346	63,832,773	531,282,297

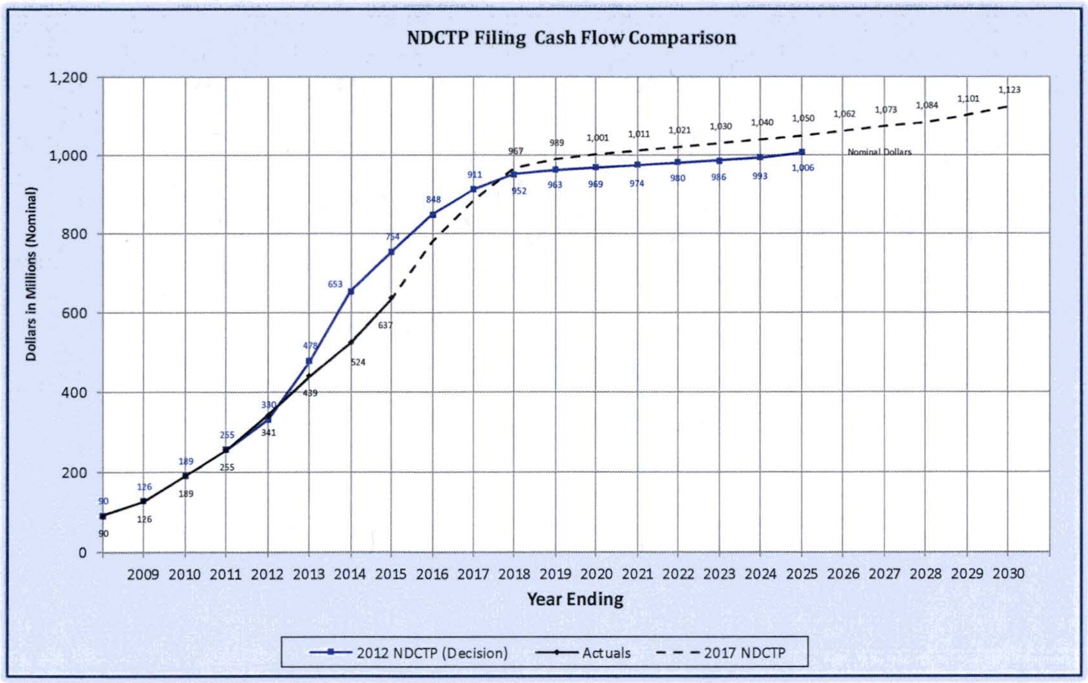
Table 3.5.2 Cost to Complete in Nominal Dollars

$Nominal	PG&E	Material	Contract	Burial	Other	To-Go Total
2015	6,426,080	2,158,763	68,720,810	18,421,747	1,210,494	96,937,894
2016	9,777,995	1,277,595	98,903,761	26,475,033	21,269,206	157,703,590
2017	8,947,438	633,622	58,958,788	21,270,239	15,298,143	105,108,229
2018	7,779,883	504,377	51,139,343	12,606,898	11,232,950	83,263,451
2019	8,488,591	291,652	9,916,732		2,964,874	21,661,849
2020	6,254,602	72,021	4,655,097		1,693,506	12,675,226
2021	6,069,567		2,621,260		1,251,826	9,942,652
2022	6,246,799		2,031,200		1,154,375	9,432,374
2023	6,429,205		2,070,850		1,176,500	9,676,555
2024	6,616,938		2,057,632		1,184,228	9,858,797
2025	6,810,152		2,124,673		1,209,102	10,143,928
2026	7,009,009		2,973,151		1,366,033	11,348,194
2027	7,213,672		2,354,495		1,268,939	10,837,106
2028	7,424,311		2,403,700		1,318,391	11,146,402
2029	7,641,101		6,858,739		2,274,172	16,774,012
2030	460,754		12,634,667	6,049,686	3,668,168	22,813,274
Nominal Tot	109,596,097	4,938,029	330,424,898	84,823,603	69,540,908	599,323,535

3.6 CASH FLOW

PG&E's cost performance to date is shown in the cash flow comparison table below. Figure 3.6.1 shows a graphical comparison of the 2012 NDCTP estimate through 2025, the actual costs through 2015, and the 2017 estimated costs through 2030.

Figure 3.6.1 NDCTP Filing Cash Flow Comparison



3.7 DECOMMISSIONING WASTE

The objectives of the decommissioning process include (1) termination of the NRC license and (2) removal of radioactive, hazardous, and other waste materials that would restrict the site's future use.

Radioactive material at the site in excess of applicable legal limits must be remediated. Under the Atomic Energy Act, the NRC is responsible for protecting the public from sources of manmade ionizing radiation. Title 10 of the CFR delineates requirements for the production, utilization and disposal of radioactive materials and processes. In particular, Part 71 defines radioactive material as it pertains to transportation and Part 61 specifies its disposition.

Soil Remediation and Management (SR&M)—encompassing excavations, handling, stockpiling, sampling, reuse, and off-site disposal—is an integral part of a nuclear decommissioning project and represents a significant portion of HBPP decommissioning expenditures.

Investigative radiological soil sampling was performed to validate leaving the CSM wall in place. A detailed discussion of the caisson demolition plan evolution is further described in the DPR Caisson Section 3.3.2.1.

The CWC is currently generating approximately 1,000 intermodal equivalents of SR&M waste per year. In addition to SR&M waste, demolition waste consists of concrete rubble and metal from structures and components. This section details the volume, number of intermodals, and cost estimates for Civil Works.

PG&E uses all the waste disposal options available to mitigate risk safely, compliantly, efficiently, and in a cost–effective manner. PG&E uses disposal options at Andrews, Texas, and Clive, Utah, and an approved exemption to dispose LLRW at a disposal site in Grand View, Idaho. Noncompliant waste (waste not meeting disposal criteria) is transported to processors in Richland, Washington; Oak Ridge Tennessee; or Gainesville, Florida, to ensure that the waste is treated or processed to meet WAC at a disposal facility. With the exception of GTCC, which is stored at the ISFSI, the remaining radioactive waste from Unit 3 is being disposed off-site.

The WAC threshold for disposal of radiologically contaminated soils and demolition debris in Grand View, Idaho, is isotope-specific. In most cases, waste shipped to Grand View, Idaho, under the exemption contains very low levels of measurable radioactivity and are also exempt under DOT regulation (49 CFR §173.436). Waste with greater concentrations of radioactive material is shipped to the Clive, Utah, disposal facility as Class A waste.

FIGURE 3.7.4—SOIL AND SUBSTRUCTURE EXCAVATIONS WITHIN UNIT 3 RCA

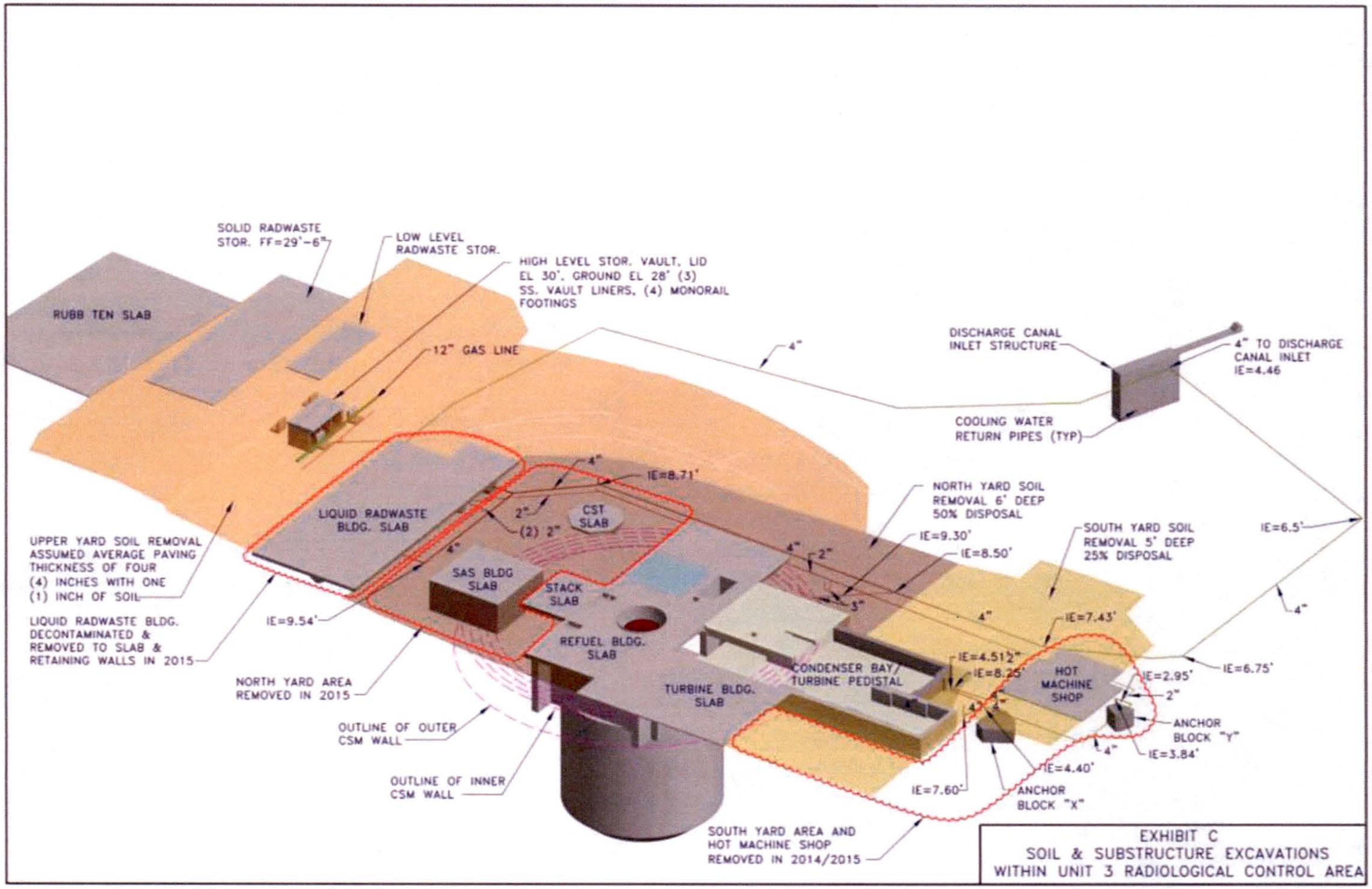
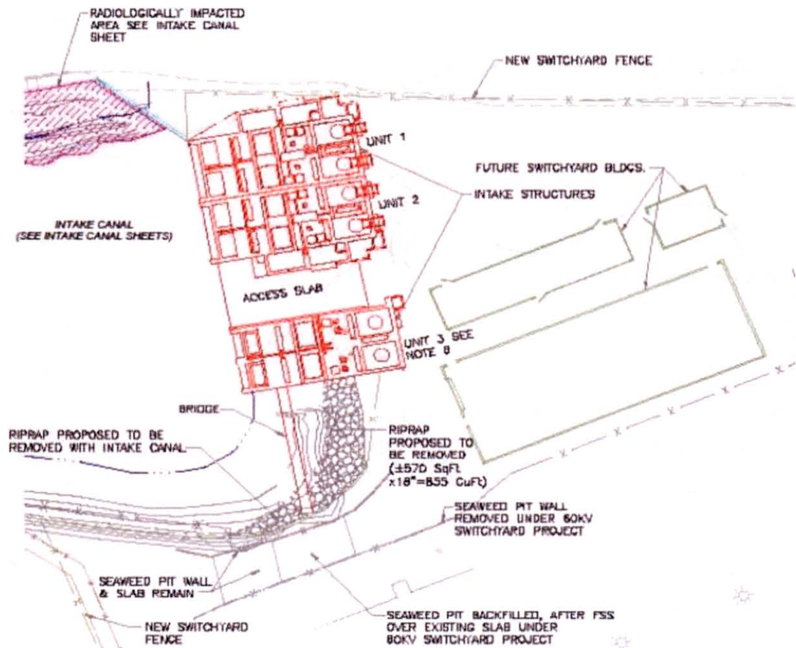


FIGURE 3.7.5—INTAKE STRUCTURES AND CANAL REMEDIATION



AERIAL VIEW OF INTAKE STRUCTURE

METAL BRIDGE FACED W/ WOOD PLANKS

INTAKE STRUCTURE & RETAINING WALL TAKEN FROM FORMER SEAWEED PIT

FORMER SEAWEED PIT

THE UNIT 3 INTAKE STRUCTURE IS A COMPARTMENTED, REINFORCED CONCRETE BOX WITH OVERALL DIMENSIONS OF 63' LONG x 22' WIDE x 24' DEEP, SIMILAR TO THE UNITS 1 AND 2 STRUCTURES. THE TOP SLAB OF THE STRUCTURE IS AT ELEVATION +12'. A PRECAST CONCRETE DECK IS PROVIDED BETWEEN UNITS 2 AND 3 INTAKE STRUCTURES FOR ACCESS WITH A 25-TON CAPACITY TRUCK CRANE FOR MAINTENANCE OF THE BAR RACKS AND TRAVELING SCREENS. THE INTAKE STRUCTURE WAS PROVIDED WITH AN EMBEDDED SHEET PILE SECTION TO ALLOW FUTURE EXPANSION IMMEDIATELY ADJACENT TO THE STRUCTURES.

EXHIBIT D
INTAKE STRUCTURES AND CANAL REMEDIATION

FIGURE 3.7.6—DISCHARGE CANAL REMEDIATION

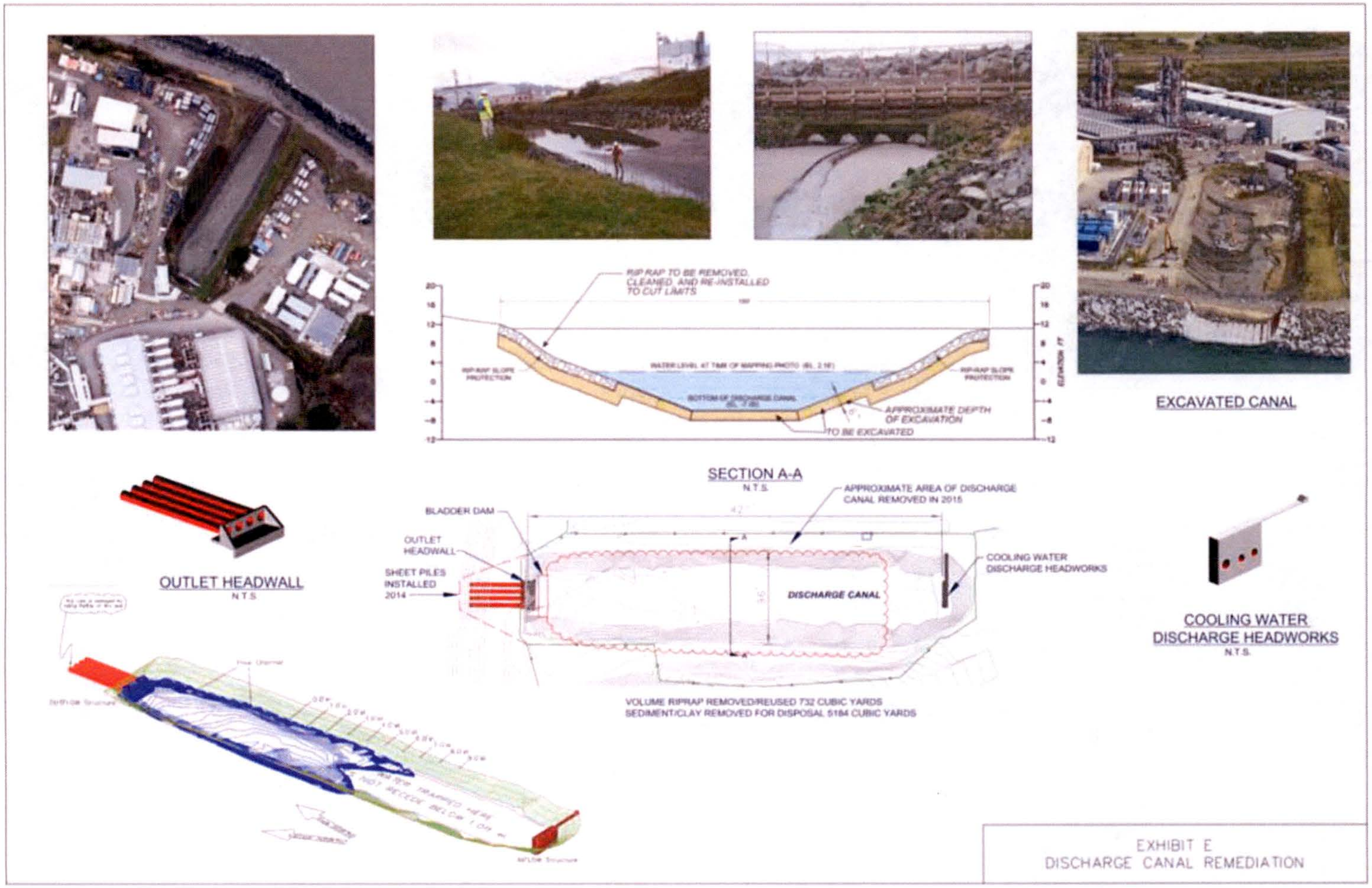


FIGURE 3.7.3—COOLING WATER SITE PLAN

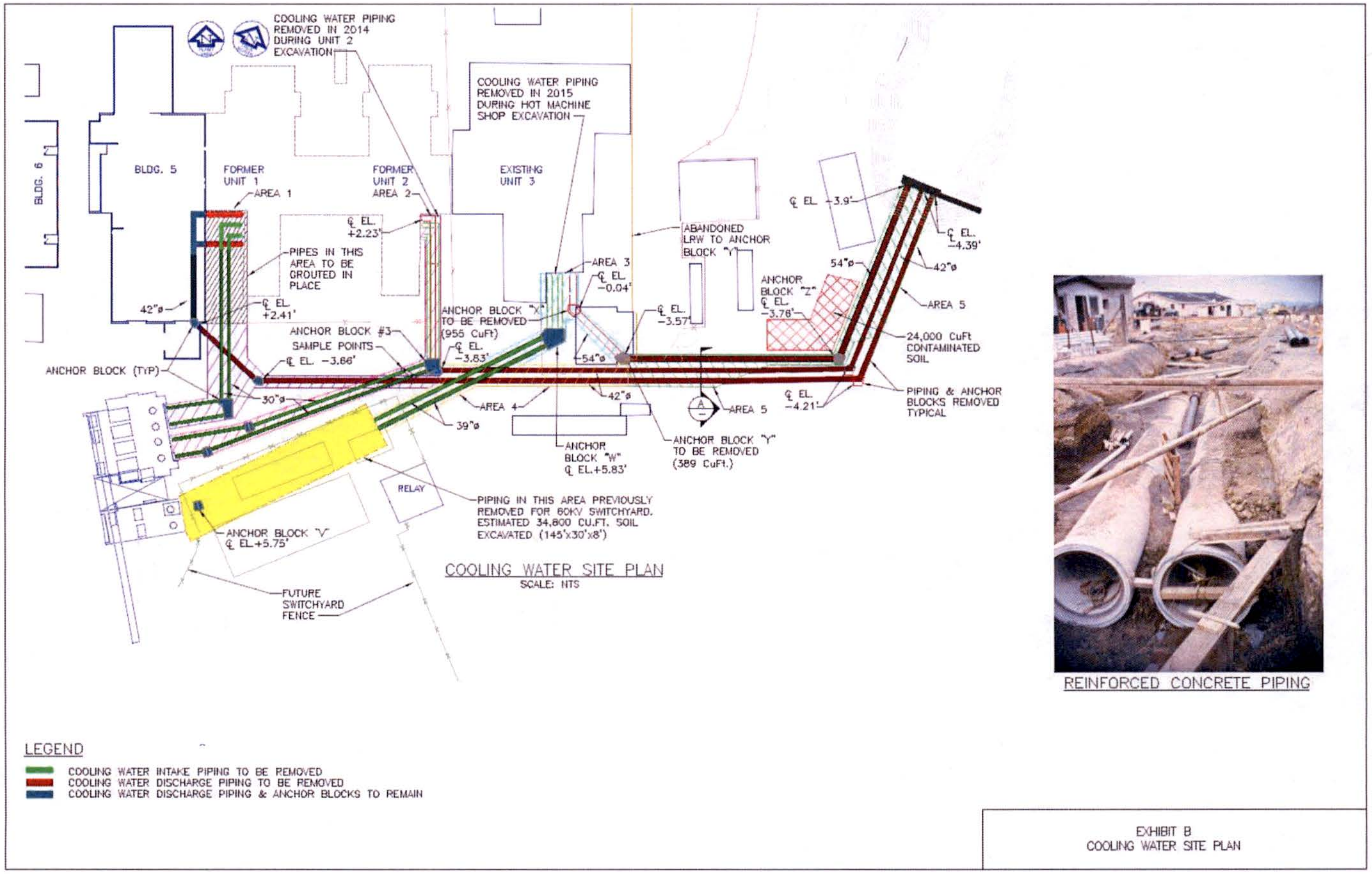


Table 5.1 Waste Disposal Summary – Soil

Area	Excavated (ft^3)	Reused	Disposed Total
Caisson Soil			
		75%	25%
Sheet pile & nail wall	317,030	237,773	79,258
110' Dia. CSM SOA	567,460	488,203	79,258
			100%
Pre-trench within RCA (15'dx6'w)	62,736		62,736
Pre-trench within RCA (15'dx15'w)	88,350		88,350
		100%	
Pre-trench outside of RCA (15'dx6'w)	50,940	50,940	
Pre-trench outside of RCA (15'dx15'w)	0		
Slurry wall	459,000	459,000	
CSM Water Cut-Off Wall/SOA Spoils		0	0
2012 NDCTP vol. (cu. ft.)	889,706	747,713	141,994
wt. (lb.)	115,661,780	97,202,625	18,459,155
2017 NDCTP vol. (cu. ft.)	655,810	488,203	167,608
wt. (lb.)	85,255,300	63,466,325	21,788,975
Circ. Water Lines		100% less local spill	Local spill
2012 NDCTP vol. (cu. ft.)	237,257	213,257	24,000
2012 NDCTP wt. (lb.)	30,843,410	27,723,410	3,120,000
2017 NDCTP vol. (cu. ft.)	237,257	213,257	24,000
2017 NDCTP wt. (lb.)	30,843,410	27,723,410	3,120,000
RCA Base Configuration		Δ (Excavated less disposed)	
Upper Yard (19,608 sq. ft. & depth 5")	8,170	0	8,170
Depth change to 1' (inc LRW excavation)	55,608	27,000	28,608
North Yard (13,870 sq. ft. & depth 6')	62,364	31,182	31,182
Continued cont. soil remediation	64,764	31,182	33,582
South Yard (10,027 sq. ft. & depth 5')	45,335	34,001	11,334
Depths up to 18'	45,335	34,001	11,334
2012 NDCTP vol. (cu. ft.)	115,869	65,183	50,686
2012 NDCTP wt. (lb.)	15,062,970	8,473,823	6,589,148
2017 NDCTP vol. (cu. ft.)	165,707	92,183	73,524
2017 NDCTP wt. (lb.)	21,541,910	11,983,823	9,558,088
Other Designated Areas		Δ (Excavated less disposed)	
Radwaste Discharge Line	1,050	971	79
Field Praticality	2,100	0	2,100
North Yard Drainage System	27,940	19,300	8,640
	27,940	0	27,940
Beneath LRW Footprint (4,488 sq. ft. x 6')	26,928	22,440	4,488
Actual characterization (core bore samples	26,928	13,464	13,464
Turbine Soil	0	0	0
Turbine Soil	24,615	0	24,615
Unit 2 Soil	0	0	0
Unit 2 Soil	53,908	0	53,908
Miscellaneous Soils	0	0	0
Miscellaneous Soils	27,323	0	27,323
2012 NDCTP vol. (cu. ft.)	55,918	42,711	13,207
2012 NDCTP wt. (lb.)	7,269,340	5,552,450	1,716,891
2017 NDCTP vol. (cu. ft.)	162,814	13,464	149,350
2017 NDCTP wt. (lb.)	21,165,790	1,750,320	19,415,470
Canals			100%
Intake canal			
Sediment	23,601		23,601
2017 NDCTP Intake Canal	23,601		23,601
Discharge canal			
Sediment	99,702		99,702
Excavation	18,786		18,786
Silt buildup	20,169		20,169
Silt buildup (future)	20,169		20,169
2012 NDCTP Discharge Canal Subtotal	158,826	0	158,826
2017 NDCTP Discharge Canal	150,552	0	150,552
2012 NDCTP vol. (cu. ft.)	182,427	0	182,427
2012 NDCTP wt. (lb.)	23,715,510	0	23,715,510
2017 NDCTP vol. (cu. ft.)	174,153	0	174,153
2017 NDCTP wt. (lb.)	22,639,890	0	22,639,890
2012 NDCTP Totals (ft^3):	1,481,177	1,068,864	412,313
2012 NDCTP Totals (lb):	192,553,010	138,952,307	53,600,703
2017 NDCTP Totals (ft^3):	1,395,741	807,107	588,634
2017 NDCTP Totals (lb):	181,446,300	104,923,878	76,522,423

Table 5.2 Waste Disposal Summary – Concrete

Area	Total Volume (ft^3)	Recycle	Disposed
			Total
Caisson Concrete			
Caisson Upper Concrete (2012 NDCTP)	70,315	-	70,315
Caisson Lower Concrete (2012 NDCTP)	68,877	-	68,877
Caisson Concrete (2017 NDCTP)	135,700		135,700
Pre-Trench (15'd x 6'w) (2012 NDCTP)	13,095	-	13,095
Pre-Trench (2017 NDCTP)	9,387	-	9,387
Tremie Layer			
Tremie Layer	17,067	-	17,067
2012 NDCTP vol. (cu. ft.)	227,887	-	227,887
wt. (lb.)	34,183,050	-	34,183,050
2017 NDCTP vol. (cu. ft.)	162,153	-	162,153
wt. (lb.)	24,323,000	-	24,323,000
RCA Base Configuration			
Above Ground Structures (2012 NDCTP)	122,162	-	122,162
Above Ground Structures (2017 NDCTP)	111,345		111,345
Below Grade (2012 NDCTP)	67,250	-	67,250
Below Grade (2017 NDCTP)	24,573		24,573
Embedded Pipe (2012 NDCTP)	3,509	-	3,509
Embedded Pipe (2017 NDCTP)	3,627	-	3,627
2012 NDCTP vol. (cu. ft.)	192,921	-	192,921
wt. (lb.)	27,344,489		27,344,489
2017 NDCTP vol. (cu. ft.)	139,545	-	139,545
wt. (lb.)	20,931,750	-	20,931,700
Other Designated Areas			
Misc Areas	467	-	467
	213	-	213
Radwaste Discharge Line	2,308	-	2,308
	2,347	-	2,347
Oily Water Separator	4,290	-	4,290
	4,480	-	4,480
Circ Water Piping (Unit 1, 2, & 3)	14,453	-	14,453
	16,000	-	16,000
Turbine Building Slab (2012 NDCTP)	75,600	-	75,600
Turbine Building Slab (2017 NDCTP)	46,507		46,507
Seismic Dissallowance			
	(2,453)	-	(2,453)
Inventory of Recyclable Concrete	10,151	10,151	-
	10,489	10,489	-
Rubb Tent Foundations			
	33,200	33,200	
2012 NDCTP vol. (cu. ft.)	107,268	10,151	21,517
wt. (lb.)	4,750,190	1,522,650	3,227,540
2017 NDCTP vol. (cu. ft.)	110,782	43,689	67,093
wt. (lb.)	16,617,290.28	6,553,290	10,064,000
Fossil Demolition			
Unit 1 Pad Concrete and Footings	16,283	16,283	-
	16,283	14,363	1,920
Unit 2 Slab	77,139	77,139	-
	77,139	67,752	9,387
2012 Subtotal vol. (cu. ft.)	93,422	93,422	-
Subtotal vol. (lb.)	14,013,300	14,013,300	-
2017 Subtotal vol. (cu. ft.)	93,422	82,115	11,307
Subtotal vol. (lb.)	14,013,300	12,317,300	1,696,000
Canals			
Intake Structure	34,390	34,390	-
	34,390	34,390	-
Discharge Canal Inlet/Outlet Structures	2,248	-	2,248
	2,347	-	2,347
2012 Subtotal vol. (cu. ft.)	36,638	68,780	2,248
Subtotal vol. (lb.)	5,495,700	10,317,000	337,200
2017 Subtotal vol. (cu. ft.)	36,737	34,390	2,347
Subtotal vol. (lb.)	5,510,500	5,158,500	352,000
2012 NDCTP Totals (ft3):	**658,137**	**172,353**	**444,574**
2012 NDCTP Totals (lb):	**85,786,729**	**25,852,950**	**65,092,279**
2017 NDCTP Totals (ft3):	542,639	160,194	382,445
2017 NDCTP Totals (lb):	81,395,840	24,029,090	57,366,700

Table 5.4 Waste Disposal Summary – Intermodals

Total Waste Disposal	2012 CPUC Estimates			2017 NDCTP	Variance
	CPUC 2012 Volume Estimate (ft3)	Weight 2012 CPUC Estimate (150pcf Concrete 130pcf Soil) (lbs)	Intermodals 2012 CPUC Estimate (30,570 lbs/IM)	Intermodals 2017 CPUC Estimate (32,000 lbs/IM)	2012 Estimate to 2017 Estimate
Total including Caisson	**2,190,599**	**295,338,372**	**4,676**	**4,521**	**155**
Total not including Caisson	1,073,005	145,495,412	3,217	3,080	[illegible]
Caisson Total	1,117,594	149,844,960	1,460	1,441	[illegible]
Total Concrete Removal	**582,537**	**85,786,729**	**2,601**	**1,793**	**140**
Concrete Recycled	137,963	20,694,450	668		
Disposed Concrete	444,574	65,092,279	1,933	1,793	140
Total Soil Excavation	**1,582,885**	**205,775,018**	**1,916**	**2,391**	**(475)**
Reused Soil	1,126,323	146,421,990	-		
Disposed Soil	456,562	59,353,028	1,916	2,391	(475)
Systems Removal	**25,178**	**3,776,625**	**54**	**115**	**(61)**
Systems Removal (Self Perform)				96	
Reactor Vessel Removal				21	
Seismic Disallowed - Steel			-	(2)	2
Building Demolition	**630,632**	**84,677,217**	**1,460**	**951**	**79**
Seismic Disallowed - Steel			-	(10)	10
Concrete Total	**193,702**	**27,461,579**	**1,030**	**949**	**79**
Above Ground Structures	126,918	17,177,741	427	543	(116)
Cont Equip Storage Bldg Concrete (LLRW Hard B	684	102,533	3	6	(3)
Cont Equip Storage Bldg Steel	67	3,115	0	-	0
Gas Stack Above Grade	2,237	335,555	11	11	(0)
Hot Machine Shop Concrete	2,909	439,328	14	14	0
Hot Machine Shop Steel	330	11,730	0	-	0
New Off Gas Vault (SAS Bldg)	10,984	1,647,594	53	88	(35)
Radwaste Treatment Building Concrete (LRW)	18,461	2,769,189	20	31	(11)
Radwaste Treatment Building Steel (LRW)	2,187	78,466	3	8	(5)
Refueling Building Concrete	17,857	2,678,624	89	115	(26)
Refueling Building Steel	6,364	226,917	7	17	(10)
Solid Radwaste Building Steel	767	27,375	1	4	(3)
Turbine Building +12 Concrete	48,178	7,226,645	175	180	(5)
Turbine Building +12 Steel	6,542	233,846	8	48	(40)
Yard Structures Above Grade	4,557	683,540	22	-	22
Oily Water Separator	4,290	643,500	21	21	(0)
Radwaste Discharge Line		-	-	-	-
Misc RCA Areas Incl Upper Yard	467	70,000	2	2	0
Below Ground Structures	503,714	67,499,476	603	408	195
Cont Equip Storage Bldg (LLRW Hard Bldg)	603	90,450	3	3	(0)
Gas Stack Below Grade	5,090	763,500	25	-	25
Turbine Building Slab	2012 Filing included in Caisson Removal			218	(218)
Hot Machine Shop Slab	1,087	451,120	15	15	(0)
New Off Gas Vault (SAS Bldg)	13,136	1,970,472	64	-	64
Radwaste Treatment Building	3,187	478,007	15	70	(55)
Spent Fuel Pool Walls	12,716	1,907,400	62	-	62
Refueling Building	20,253	3,037,875	208	-	208
Solid Waste Vault	1,418	128,291	4	7	(3)
Solid Radwaste Building Below Grade	1,510	305,608	10	8	2
Offgas Tunnel North, South, EW	8,129	1,219,425	39	12	27
Units 1, 2, & 3 Circ Water Piping	14,453	2,167,900	161	75	86
Embedded Pipe (TB, RFB, LRW, & HMS bldgs)	3,509	526,410	17	17	-
Radwaste Discharge Line	2,308	346,140	11	11	0
Soils Total	**416,194**	**54,105,188**	**399**	**673**	**(274)**
Radwaste Discharge Line Soil	79	10,270	0.3	9	(8)
Radwaste Discharge Line Soil (Reuse)	971	126,230		-	-
RW Tankage Discharge Line	-	-	-	-	-
Abandoned RW Discharge	-	-	-	-	-
North Yard Drainage	8,640	1,123,200	36	114	(77)
North Yard Drainage (Reuse)	19,300	2,509,000		-	-
South Yard Drainage	7,150	929,500	30	-	30
Refueling Building				-	-
Gas Stack Contaminated Soil				-	-
Abandoned Railroad Tracks				-	-
Misc RCA Areas Incl Upper Yard	50,686	6,589,180	213	299	(86)
Misc RCA Areas Incl Upper Yard (Reused)	[illegible]	[illegible]		-	-
Radwaste Treatment Building Soil	4,488	583,440	19	55	(36)
Radwaste Treatment Building (Reuse)	22,440	2,917,200		-	-
Spent Fuel Pool (Contaminated Soil)				-	-
Unit 1, 2, & 3 Circ Water Pipes Soil	24,000	3,120,000	101	98	3
Unit 1, 2, & 3 Circ Water Pipes Soil (Reuse)	[illegible]	[illegible]		-	-
Other Misc Soils (Turbine Soil)	2012 Filing included in Caisson Removal			100	(100)

Table 5.4 Cont'd Waste Disposal Summary – Intermodals

Total Waste Disposal	2012 CPUC Estimates			2017 NDCTP	Variance
	CPUC 2012 Volume Estimate (ft3)	Weight 2012 CPUC Estimate (150pcf Concrete 130pcf Soil) (lbs)	Intermodals 2012 CPUC Estimate (30,970 lbs/IM)	Intermodals 2017 CPUC Estimate (32,000 lbs/IM)	2012 Estimate to 2017 Estimate
Other	10,151	1,522,650	151	330	(179)
Scaffolding		-	-	5	(5)
Mixed Waste & DAW		-	22	43	(21)
DAW		-	-	-	-
Water Shipments			80	54	26
ISFSI Decontamination		-	-	-	-
Inventory of Recyclable Concrete	10,151	1,522,650	49	-	49
Sea-Van Disposal				10	(10)
Ancillary Structures Outside of RCA				83	(83)
Other - Miscellaneous Concrete				1	(1)
Other - Miscellaneous Soils				111	(111)
Other - Miscellaneous Pipe/Debris/Metal, etc.				23	(23)
Intake/Discharge Canals	256,163	34,033,950	1,099	718	380
Concrete Total	36,638	5,495,700	177	11	166
Intake Structure	34,390	5,158,500	167	-	167
Discharge Canal Inlet/Outlet Structures	2,248	337,200	11	11	(0)
Outfall Piping				-	-
Soil Total	219,525	28,538,250	921	707	214
Intake Canal Sediment	23,601	3,068,130	99	96	3
Discharge Canal Sediment	99,702	12,961,260	419	-	419
Discharge Canal Excavation	18,786	2,442,180	79	612	(533)
Discharge Canal Silt	40,338	5,243,940	169	-	169
Concrete Discharge Structures Soil	37,098	4,822,740	156	-	156
Fossil Demolition	150,881	21,482,970	452	272	180
Unit 1 Pad Concrete and Footings	16,283	2,442,450	79	-	79
Unit 1 Pad Concrete and Footings (Disposed)				9	(9)
Unit 2 (Clean and Recyclable)	134,598	19,040,520	374	-	111
Soil (Reuse 57,459ft3)	57,459	7,469,670	-	219	(219)
Concrete (Recycle 77,139ft3)	77,139	11,570,850	374	-	374
Concrete (Disposed)				44	(44)
Caisson Removal	1,117,594	149,844,960	1,460	1,441	19
Concrete Total	305,026	34,183,050	864	760	103
Soil Total	896,226	109,039,710	596	681	(85)
Caisson	456,223	62,092,830	1,007	1,038	(31)
Caisson Soil (25% Disposed)	79,258	10,303,540	333	322	11
Caisson Soil (75% Re-Used)	237,773	30,910,490		-	-
Caisson Concrete	139,192	20,878,800	674	636	38
Caisson Upper Concrete	96,390	14,458,500	341	-	
Gas Stack Below Grade	(5,090)	(763,500)		-	
Spent Fuel Pool Walls	(12,716)	(1,907,400)		-	
Refueling Building	(8,269)	(1,240,350)		-	
Caisson Lower Concrete	68,877	10,331,550	334	-	
Tremie Layer	Included in Caisson for 2012 Filing			80	(80)
Turbine Building Slab	75,600	11,340,000	126	Inc in Below Ground Struct.	126
Turbine Soil				-	
Turbine Building Slab Concrete				-	
New Off Gas Vault (SAS Bldg)			-	-	
SAS Soil				-	
SAS Concrete				-	
Abandoned RW Discharge Line	-	-	-	-	
Abandoned RW Discharge				-	
RW Tankage Discharge Line				-	
Pre-Trench	126,771	16,742,130	327	403	(76)
Soil (inside RCA)	62,736	8,155,680	263	359	(96)
Soil (Outside RCA) - Reuse	50,940	6,622,200		-	-
Concrete	13,095	1,964,250	63	44	19
Slurry Wall					
Soil (Reuse)	459,000	59,670,000		-	-

3.7.1 Waste Volume Estimates

The CWC used a methodology that relied on PG&E volume projections to estimate the number of waste containers and assumed swell factors for both debris and soil. The CWC reviewed and verified the waste volume estimates in the technical specifications. A Microsoft ® Excel spreadsheet was used to compile material quantity estimates from the technical specifications, CPUC filings, Humboldt County Permit applications, CWC internal reviews, and other sources. The spreadsheet is a tool for documenting the basis for material resource values used in the Project Schedule (P6).

In a few cases, volume estimates increased and, in some cases, decreased based on changes in work scope (e.g., replacing the slurry wall installation with the CSM wall, resulting in a 110-foot-diameter excavation instead of an 80-foot-diameter excavation). In the case of debris, the volume increase from in situ volumes (e.g., concrete walls) to loose stockpile volumes was calculated using a multiplier ("swell factor") of 1.3.

There are a few considerations with in situ soil volumes. First, if the soil is saturated when it is first excavated, there will be volume shrinkage due to drying. This scenario would apply to the canal sediments, where the sediments will dry for at least two weeks. In this case, the sediments were not adjusted for swelling because the drying effect would cancel the swell factor. For all other soils at the site, a swell factor of 1.2 was applied.

The next consideration in arriving at an estimate of container usage is packaged density. Even though the internal dimensions of an intermodal container allow up to 600 cubic feet of material to be placed inside the container (depending on the specific intermodal container), in practice, the density of the material prevents the container from being filled to capacity. Using weight calculations, the assumption is that about 150 pounds per cubic foot for concrete or 130 pounds per cubic foot for soil equates to 8.6 to 10 yards per full intermodal. For example, 35,000 pounds net waste weight at 130 pounds per cubic foot is approximately 270 to 300 cubic feet of material.

Currently, the HBPP site is shipping 20 waste shipments (5 shipments per day, four days per week) to the Grand View, Idaho, disposal site. Presently, there is a backlog of waste in the SMF and shipping will need to be accelerated to more than 20 shipments per week to complete the project on schedule. The SMF tents are able to hold 7,000 to 8,000 cubic yards of soil per tent. This allows the HBPP site to stockpile soil and spread the shipments over time so the shipment schedule can be leveled.

3.7.2 Container Optimization

The CWC has an incentivized goal to load waste containers to either 97 percent of the weight capacity or 97 percent of the volume capacity. Portable weight scales are situated in multiple locations during demolition and excavation activities to maximize or optimize loading waste containers. It is challenging to optimize waste loading when demolishing a concrete building with metal siding and roofing such as the LRWB, because concrete debris and soil fill intermodals based on weight, but low-density metal demolition debris fills intermodals based on volume.

From 2012 through 2014, intermodals were loaded on average with 30,970 pounds of waste. Currently, concrete, soil, and debris are rarely loaded to less than 43,000 pounds gross weight. This is an increase of approximately 12,000 pounds over the weight loaded previously. Depending on the intermodal, tare[6] weights vary up to a few thousand pounds. Based on the different tare weights, net waste weight consistently ranges between 32,300 and 35,000 pounds for concrete and soil debris.

Containers loaded with metal are usually light on weight but are fully loaded based on volume. The average net waste weight of all shipments to the waste disposal site in Grand View, Idaho, was about 32,600 pounds in 2014 and 33,550 pounds for 2015 data. In many cases, intermodals filled with bulky items, such as metal, are topped off with soil and concrete to optimize the waste weight. The average for net waste weight of all shipments to the disposal site in Clive, Utah, was about 15,350 pounds in 2014 and an estimated 26,800 pounds for 2015. The average for all 2014 shipments (to both disposal sites) was 31,024 pounds and an estimated 32,815 pounds for 2015 shipments. Through July 2015, the average the net waste weight in intermodals increased by about 1,800 pounds from 2014 to 2015. Effectively, this increased efficiency and optimization will save approximately 200 intermodals over the life of the project.

3.7.3 Reuse of Materials

Management of soil and reuse material at HBPP is subject to requirements in the IMRAW approved by DTSC, which describes the procedures and methods required for characterization and management of soil excavated during decommissioning activities. The IMRAW identifies criteria for determining when excavated soil can be reused on site and establishes requirements for documenting and reporting on soil excavation and management activities. In addition, radiologically contaminated areas are subject to the NRC-approved DCGLs, which define the acceptable levels of activity that may remain

[6] Tare Weight, sometimes called "unladen weight", is the weight of an empty container or vehicle.

on site after demolition. Subsequent processing of reuse materials for structural or Geotech purposes will be performed under a separate plan.

Prior to reuse material being placed into an excavation, the material must be evaluated and analyzed using the GARDIAN system or equivalent ISOCs process for radiological characterization. Details for backfill placement are provided in area-specific work plans.

Materials approved for reuse are stockpiled until final on-site backfill placement. In some cases, materials may be reused on site and then disposed during demolition, such as backfilling the SFP with excavated material for structural support prior to demolition of the RFB and SFP area. Reuse of materials (e.g., soil, riprap, and concrete) during project execution is limited to material that meets IMRAW (Arcadis, 2009) requirements or DTSC- and NRC-approved risk-based DCGLs. Soil is needed to complete interim backfill activities during demolition activities and for final backfill and grading activities during FSR. Reuse materials may be transferred to a stockpile using appropriate transport vehicles or containers, such as end dump, dewatering bags, or super sacks. Management of the material in the stockpile location will be in accordance with approved procedures. Where required, BMPs will be installed and maintained in accordance with the SWPPP.

Based on both radiological and chemical contamination data available in the 2012 DPR, PG&E made assumptions about the quantity or volume of material expected to be suitable for reuse. Areas known to be clean were assumed 100 percent reused. Other areas, such as clean overburden above a known contaminated pipe, were assigned 25 to 75 percent reuse, depending of specific circumstances associated with the demolition plans for the item, component, or area. The current estimate of soil that will be available for reuse during project execution is 807,107 cubic feet from areas such as Circulating Water Lines; beneath the LRW footprint; as well as North, South and Upper Yards.

3.7.3.1 Caisson

Once the CSM wall is installed and the upper or above grade sections of the RFB are demolished to grade, the below-grade sections of the RFB and caisson can be demolished. The caisson and remaining structures of the RFB include the drywell and liner, activated concrete around the core region, embedded piping systems and associated drains, suppression chamber and remaining downcomer piping, SFP walls, sheet piles around the SFP, timber piles, access shaft, emergency escape hatch, valve gallery and associated piping system, sumps and concrete tremie seal at the bottom of the caisson.

Various excavating tools and heavy equipment will be used to demolish the below grade structures. A crane platform will be installed outside the CSM wall to stage equipment

and transfer heavy equipment needed for demolition in and out of the caisson excavation area inside the CSM wall. As the excavation depth gets deeper, a crane will be used to lift and remove soil and concrete and metal demolition debris from the excavation and load intermodals and other waste containers. The demolition process continues until the caisson is removed and the concrete tremie seal and other structures at the -66 foot level are removed. At completion of the caisson removal the excavation will be back filled with stockpiled fill material and other imported structural fill materials. As needed, different excavation tools and equipment used for compacting soil fill material may lifted in and out of the excavation within the CSM wall.

Higher activity radioactive waste consisting of demolition debris and excavated soil such as embedded piping, activated concrete and contaminated soil will be packaged for transport to the disposal site in Utah. Lower activity material, the bulk of the caisson removal, will be transported to the disposal facility in Idaho. Excavated stockpiled material found suitable for reuse will be returned to the caisson excavation or reused elsewhere on site. From a radiological perspective, stockpiled material for reuse will be characterized as less than 5 picocuries per gram Cs-137. Radiological waste sent to Idaho for disposal must be less than an average of 100 microroentgens per hour with no measurements above 500 microroentgens per hour. Waste with activity exceeding the waste acceptance levels for disposal in Idaho is transported to disposal facility in Utah.

Detailed waste volumes estimates and a PWP are not yet complete for this area. The volumes as estimated for Caisson demolition and recorded in the P6 schedule are summarized in the attached tables.

3.7.3.2 Cutter Soil Mix Wall and Pre-Trench

Approximately 14,000 cubic yards of soil will be incorporated into the CSM wall matrix, with a similar amount of excess soil going through a desander, being placed in trucks that will be run through the GARDIAN radiological screening system, and then being used as backfill. Slurry remaining at the end of wall construction will either be stabilized in the Discharge Canal or shipped off site as waste.

Pre-trench excavation activities preceded the CSM installation activities and as a result, the alignment is clear of all known utilities and above and below-grade obstructions.

Chemically contaminated soils have been largely remediated during pre-trenching efforts; however, there are known areas of residual contamination in the Turbine Building footprint region. CSM installation in the region of suspected contaminated soils will be performed with Environmental Remediation oversight to ensure spoils are adequately sampled and segregated from other wastes.

Regulated Waste, if encountered, will be controlled in a manner that potential for spread of contamination. The preferred method will be to load directly into containers on a daily basis. Waste management, including excavated soil handling and disposal, contaminated water handling, and disposal of containerized radioactive or nonradioactive hazardous materials, is a critical step during CSM construction.

The CWC conservatively assumes that 550 gallons of waste (soil, water, and bentonite mix) may be produced during end-of-shift washout and must have the necessary container available to dispose of the water. To the extent possible, this material will be recycled by decanting water back into the system and disposing of solids at the soil management areas. Ideally, there will be no waste water after the washout process is complete.

During the installation of the CSM, radiological monitoring will be performed to provide information to support evaluation of existing conditions. Characterizations will ensure that work activities comply with the requirements of 10 CFR §20, 10 CFR §19, HBPP radiological procedures, PG&E FSS procedures, and Part 50 License Termination. In addition, the CWC's Waste Management Group will use the characterization data collected to support waste disposal pathway selection and to verify that the WAC for the disposal site are being met.

3.7.3.3 Radiological Control Area Yard

The RCA encompassed the Unit 3 structures and support areas and was enclosed by a fence, which was adjusted as needed to support control of radioactive material during demolition of structures and excavation of soils. For example, during demolition of the Turbine Building, the RCA was expanded around the Units 1 and 2 footprints when waste piles were located on the concrete pads. Later the RCA was reduced to surround only the Unit 3 structures. All RCA boundary modifications are controlled and managed by the RP Department. This is significant because excavated soils are handled and dispositioned differently in an RCA than in a non-RCA.

The RCA has rigorous and strict protocols for radiological surveying of vehicular traffic entering and exiting the RCA. The small footprint of the HBPP facility limits the number of entry and exit points and constrains traffic movement within the RCA. These constraints necessitate conservative approaches to work execution and do not allow for multiple debris containers, with traffic to each, for segregation of clean and contaminated materials within the RCA.

The depths of excavation vary from the 2012 NDCTP filing estimate, based on actual field conditions encountered, such as soil contamination levels, means and methods for excavation, construction-era features not identified on drawings, and the noncontiguous

sequence of work to accommodate multiple work activities in close proximity and their associated equipment operation envelopes. An updated summary of the amount of soil and concrete to be excavated, reused or disposed is delineated in Table 5.1 and Table 5.2, respectively.

The RCA was downposted to a RMA in late 2015.

3.7.3.3.1 Soils and Asphalt/Pavement (See Table 5.1)

Areas within the RCA are paved for contamination control and housekeeping considerations. It is assumed that two courses of paving, each two inches thick, are present. All of the paving will be stripped and disposed. The sub-paving soils within the RCA yard are segregated by general areas (Upper, North, and South) as shown in Exhibit C, based on subgrade commodities and structures, described as follows:

Upper Yard

This area is generally north and east of the LRWB to the RCA fence line, and includes the paved traffic ramp down to access control, at +12 feet. This area of approximately 19,608 square feet has minimal subgrade piping and structures and is considered relatively radiologically clean. RP estimates that most of the contamination is contained in the first inch of soil under the paving. For the 2012 NDCTP filing, the excavation estimate used an assumed average paving thickness of four inches and one inch of soil removed and disposed, yielding a disposal volume calculated at 8,170 cubic feet. The CWC anticipates removing and disposing the top foot of paving and soil, increasing the excavation volume to 55,608 cubic feet. This volume represents an additional 83 intermodals and does not include the soil excavations for the High Level Storage Vault and the LRWB, described below.

The remnant LRWB structure and foundation slab and the below-grade High Level Storage Vault are both situated in the Upper Yard. The LRWB serves as a 17-foot-deep (nominal) soil retaining wall on its north side. The soil slopes from elevation +29 feet on the north side to elevation +12 feet on the south side over a distance of approximately 38 feet. Excavating to the bottom of the LRWB slab and the eight-foot-deep High Level Storage Vault and sloping the excavated sides at 1.5:1 for stability will remove approximately 36,000 cubic feet of soil. Due to the migration of contaminated liquid spills out of the LRWB, and potential leaks from the High Level Storage Vault, PG&E estimates approximately 25 percent (9,000 cubic feet) of the additionally excavated soil will be disposed off site. This represents 37 additional intermodals.

North Yard

This area is generally located between the south side of the LRWB and the north side of the RFB. For the 2012 filing, the western edge aligned with the western edge of the RFB and the eastern edge was the base of the paved traffic ramp described in the Upper Yard narrative, wrapping around the east side of the RFB rail bay to the southern end of the off gas tunnel. The North Yard contained the off gas tunnel, the LRW tunnel, various process and utility piping systems, electrical duct banks, the SAS building below-grade rooms and foundation slab, and the Condensate Storage Tank foundation slab.

A six-foot average depth was previously considered sufficient to envelope all excavations for the subgrade commodities and structures in the North Yard. RP initially anticipated that half of the excavated soil would be disposed off site, based on a judgmental assessment of radiological conditions of the areas. This volume was calculated and reported at 31,182 cubic feet in the 2012 NDCTP filing.

The North Yard included a length of pre-trench commodity excavation for installation of a water cutoff wall surrounding the RFB and the Turbine Building foundations. The wall installation involves a cutting-wheel boring operation, mixing soil with bentonite and cement to create a subterranean basin to prevent groundwater intrusion to deep excavations. The cutoff wall and original alignment footprint evolved to a circular alignment wall enclosing the deep RFB caisson structure. Pre-trenching is required along the wall alignment to remove all below-grade obstructions, including utility and process piping, concrete foundations, timber piles, and steel sheet piles, to allow unimpeded operation of the drilling machines. The new wall alignment estimated volume of pre-trenching spoils increased from approximately 63,000 cubic feet to approximately 88,000 cubic feet. Based on pre-trenching experience to date, it is anticipated that most of the pre-trenching excavation debris and soil will be disposed off site.

The original basis for the North Yard excavation assumed a six-foot average depth. Due to unforeseen depths for remediation of radiological contamination and undocumented, remnant construction-era features (timber pile and steel sheet pile shoring), the actual average excavated depth is approximately nine feet. During the first phase of the North Yard excavation from the west edge of the RCA over to the electrical raceway, the excavated depth was about five feet. From the electrical raceway to the northeast corner of the SAS Building, the depth increased to about nine feet. This work face, including work package 38, went down to 12 feet to reach the bottom of the SAS foundation. All buried structures in this area were removed in support of clearing the path for the CSM wall. The next phase, from the SAS to the corner of the RFB, included the off gas tunnels and was excavated to a depth of 20 feet to remove a row of 16

timber shoring piles and steel sheet piling unearthed along the north and east sides of the off gas tunnel.

This area between the LRWB and the RFB is complete, and 138 intermodals of waste were removed from this area. However, note that the area on the east side of the railbay, south of the railbay doors, is not yet complete.

During pre-trenching excavation in the narrow corridor between the SAS below-grade structure and the LRWB foundation, radioactive contamination was detected in the soil below the location of a known spill. It is surmised that contaminated liquid ran down the face of the SAS below-grade structure. The trench depth excavation was approximately 10 feet deep, and concerns about trench side-stability precluded remediation of this area before removal of the LRWB slab and foundation. A Project decision was reached to backfill the trench with sacrificial fill and defer remediation until the LRWB slab and foundation are removed, which is planned for 2018. Fifty-nine intermodals of waste contained material from the SAS. Hot spots were found on the SAS when minimal radioactivity was expected.

Future remediation in this area will likely result in more than 10 additional intermodals for off-site disposal. The original basis assumed that 50 percent of the excavated material would be stockpiled for reuse. However, actual conditions in the field prevented the segregation of clean soil from contaminated soil and all excavated materials were sent off-site for disposal. Five intermodal loads containing the material below the known spill were radiologically contaminated enough to require disposal at the Clive, Utah, facility.

South Yard

This area is generally south of the RFB and east of the Turbine Building, extending to the east edge of the RCA. The South Yard includes surface paving, the off gas tunnel, radwaste drain lines, and utility and process piping. This area also includes the below-grade cooling water return tank, an instrument vault, and the condensate pump pit. It contained the Hot Machine Shop grade slab, which was removed in 2014. In the 2012 estimate, a five-foot average depth was considered sufficient to envelope all excavations for the subgrade commodities and structures in the South Yard.

The bulk of the South Yard excavation and Hot Machine Shop has been completed. The excavated depth went as deep as 18 feet in certain areas to remove the Hot Machine Shop source well, wood pilings, and concrete thrust block. The portion along the east side that abuts the North Yard remains to be excavated in 2016. So far, 102 intermodals have been generated from this area. All but 2 intermodals (sent to Clive, Utah, due to high activity) have been shipped to the Grand View, Idaho, facility.

The original planning basis for the South Yard was that 45,335 cubic feet of soil would be excavated, with 34,001 cubic feet reused and 11,334 sent for off-site disposal. Despite having to excavate deeper in certain spots, the original projections for soil reuse and disposal were not affected. This is due to the fact that not the entire 10,027 square foot area required excavation.

The 2012 NDCTP filing referenced a line item titled "South Yard Drainage" with 7,150 cubic feet and 30 intermodals projected. To date, 30 intermodals attributable to South Yard drainage have been shipped, representing the entire 7,150 cubic feet. The remaining South Yard drainage piping will be excavated with the Units 1, 2, and 3 circulating water piping removal project and the waste volumes will be included there. No additional South Yard drainage excavation volume is expected.

The Turbine Building below-grade soil was originally estimated at 91 intermodals for the 2012 NDCTP filing. Based on a phased approach (overlapping areas) for foundation demolition, soil excavation, and timber pile removal, the CWC has revised the soil volume estimate to 24,615 cubic feet, or 100 intermodals.

The caisson soil excavation volume is significantly greater for the 2017 filing than was listed in the 2012 filing, based on the 110-foot diameter CSM wall, but the disposal volume remains unchanged at 79,258 cubic feet. The estimate for disposal volume was based on known leakage of the SFP and the assumption that soils against the faces of the SFP walls, under the SFP floor slabs, and against the cylindrical caisson wall below the SFP are contaminated. The original estimate assumed contamination present in the first 4 feet of soil adjacent to the concrete faces. Recent experience with contaminated soil between the LRWB and SAS below-grade structure indicates contaminated liquids can migrate through soils laterally, away from its source, 6 feet or more. Based on this better understanding of liquid wicking through soils, the estimated thickness of soil along the concrete faces is increased to 8 feet for the 2017 filing. The original disposal volume (79,258 cubic foot) envelopes the reestimated 8-foot thickness, with additional margin for other pockets of contaminated soils, if found, within the caisson excavation.

3.7.3.3.2 Concrete and Building Debris Including Steel

Above-ground Structures

There were 15 above-ground structures to be demolished to grade. Their estimated volumes are delineated in Table 5.2 and 5.4 (Table nomenclature retained from 2012 DPR). Most of the buildings have been demolished to grade.

In 2015, the Low Level Radwaste Building (Building 15, also known as the Contaminated Equipment Storage Building) was removed. The 2012 structural material

take-off calculation estimated 100,000 pounds of concrete and 3,000 pounds of structural steel associated with this structure. About three intermodals were planned to be shipped. Steel and concrete were combined for disposal and six intermodals were shipped. The higher number of intermodals was due to volume capacity limitations of compacted sheet steel rather than weight limitations.

The Gas Stack remains standing adjacent to the RFB and is planned for demolition in 2016. The 2012 structural material take-off calculation estimated 336,000 pounds of concrete. About 11 intermodals are planned.

The Hot Machine Shop (Building 4) was removed in 2014. The 2012 structural material take-off calculation estimated 250,000 pounds of concrete and 11,000 pounds of structural steel. An earlier take-off estimated more than 400,000 pounds of concrete, and this value is used for the concrete volume estimate. About 15 intermodals were planned to be shipped, and 15 were actually shipped.

The SAS Building (Building 17, or New Off Gas Vault) was removed in 2015. The above-grade structure was demolished and a significant portion of the rubble was used to fill the below-grade structure void spaces. The intent was to establish a level surface at grade to operate heavy demolition equipment for north yard CSM wall pre-trenching excavations. The rubble-filled below-grade structure was capped with low-strength grout to fill the rubble voids and create a stable, level working surface for excavators, loaders, and debris truck traffic. The 12-foot-deep below-grade structure was later removed, along with the grout cap. To date, 60 intermodals have been shipped, with an additional 28 intermodals planned. The 2012 NDCTP Filing projected a combined above- and below-grade total of 53 intermodals, based on a conservative volume and weight provided in the original TLG Cost Estimate. The current number of intermodals shipped and projected for the SAS is 88 intermodals.

The Liquid Radwaste Treatment Building, or Building 16, was originally designed and constructed as a set of reinforced concrete equipment vaults and tank separator shield walls on a concrete support slab. An engineered steel superstructure was later erected over the concrete structure to provide weather protection and a ventilation control envelope for maintenance and operation of the LRW system. The 2012 NDCTP Filing estimated 2.8M pounds of concrete above grade and erroneously calculated 20 intermodals of demolition debris to be disposed. The estimated concrete weight was validated by comparison of an independently calculated material take-off with the original TLG estimated concrete weight. The number of intermodals should have been listed as 90, based on a target load weight of 31,000 pounds per intermodal. The original plan to demolish the structure to the grade slab was deferred until FSR due to slope stability concerns on the north side of the retaining wall. To date, 31 intermodals

have been shipped for disposal. The remaining above-grade concrete volume has been transferred to the below-grade volume estimate. The metal superstructure was estimated as 3 intermodals, based on calculated metal weight. Much of the superstructure debris was sheet metal, which did not compact well. Intermodal volume was the limiting factor and the actual number of intermodals was 8; 5 more than originally estimated.

The RFB (Building 3) is planned for removal in late 2016. Initial demolition of the RFB includes the above grade structure to El.+12. The 2009 TLG Decommissioning Cost Study estimated the RFB disposal volume at 63,317 cubic feet, weighing 6.3M pounds (assuming a density of 100 pounds per cubic foot). In 2012, TLG revised its estimated disposal volume to 84,907 cubic feet, weighing 5.9M pounds (a density of 70 pounds per cubic foot). PG&E considered several independent sources to confirm TLG's estimated volumes and weights. For the 2012 NDCTP filing, the above-grade concrete volume was reestimated at 17,857 cubic feet, and the corresponding intermodal container count was projected at 89.

Subsequent to the 2012 filing, it was recognized that several slabs, shield walls, crane rail haunches, and thickened beam sections in the precast roof panels were inadvertently omitted. Additionally, the condensate demineralizer room slab, walls, and roof, which were previously included with the Turbine Building, are now included with the RFB, because structural stability concerns and demolition sequence necessitated leaving the demineralizer room connected to the RFB until RFB demolition. The above-grade volume is reestimated at 23,665 cubic feet, which includes 3,280 cubic feet attributable to the Condensate Demineralizer Room structure. This equates to approximately 111 intermodals for RFB concrete disposal. Additionally, two intermodals of asbestos-laden paint have been stripped and shipped from the east 40-foot wall of the RFB. The remaining 100-foot wall section is estimated to generate another two intermodals of asbestos waste, bringing the total intermodal count to 115.

The 2012 filing estimated the RFB above-grade steel weight at 226,917 pounds and 7 intermodals based on approximately 31,000 pounds per intermodal. To exclude seismic upgrade steel, a detailed steel material take-off was calculated, estimating 206,288 pounds including 87,294 of seismic upgrade steel, yielding approximately 119,000 pounds of original structural and miscellaneous metal for disposal. Subsequent to the 2012 filing, the Reactor Containment Facility was installed within the RFB to execute in-situ Reactor Vessel segmentation. This building within the RFB is estimated at 51,000 pounds. The total disposal weight is approximately 170,000 pounds. As noted above, on-site experience demonstrates that steel loading in intermodals is volume-limited because such steel does not compact well or fit conveniently. Based on empirical data,

intermodal loading is estimated at 10,000 pounds steel per intermodal. The 2017 filing estimates 17 intermodals of steel for disposal.

The Solid Radwaste Building, or Building 14, was estimated at 767 cubic feet of structural steel and sheet metal. One intermodal was estimated based on weight, but four were shipped, due to volume limitations, as sheet steel does not compact well.

The Turbine Building above-grade structure weight, including structural steel, was originally estimated by TLG at 7,300,000 pounds. An independent material take-off calculation was performed, estimating the concrete weight above +9 feet at 7,200,000 pounds and the structural steel at 224,000 pounds, totaling 7,400,000 pounds and confirming TLG's estimate. PG&E projected 175 intermodals for above-grade concrete shipments, and 180 were shipped. These included transite wall panels, which were neglected in the concrete take-off calculation. PG&E projected 8 intermodals for steel based on weight, but 48 were attributed to steel shipments. Loading inefficiency for steel limited the intermodal weights to less than 1/3 of the original estimate, increasing the number by more than threefold. In addition, 5 shipments were attributable to the Cyclops gantry crane, which was originally part of the fossil units' decommissioning, but repurposed for waste removal during Unit 3 decommissioning. The control room instrumentation cabinets, consoles, panels, cable trays and wiring; the demineralizer control panel; and the ventilation ducting were not considered in the original steel estimate and added to the number of waste shipments.

Yard structures above grade included the main plant exhaust fan, filter housing, fan and filter housing foundations, duct, and cable tray structure; and the former PEG room, which housed the Stack Particulate Alpha Monitoring System. This category also included the condensate tank foundation pad, the gantry crane rail column foundations, transformer foundations, and the cold and dark duct bank. The number of demolition debris intermodals was estimated at 22; this estimate is unchanged.

Miscellaneous RCA areas, including the Upper Yard, were estimated at two intermodals. This scope includes the concrete stairs adjacent to the LRWB, hand rails, and cable tray.

The Oily Water Separator is a pair of open-top concrete basins installed for Units 1 and 2 operation, but situated south of Unit 3. It was left in place when the fossil units were decommissioned to avoid closure of Decom Ave. and potential modification to the transite fire line adjacent to the Oily Water Separator. The concrete volume was conservatively estimated at 4,290 cubic feet and 21 intermodals of concrete rubble debris for disposal.

Below-ground Structures

There were 13 below-ground structures to be excavated and demolished and their estimated volumes are delineated in Table 5.4. Most of the below-grade structures still remain.

The Low Level Radwaste Building grade slab was estimated at 603 cubic feet, 94,450 pounds, and 3 intermodals for the 2012 filing. These numbers remain unchanged for the 2017 filing.

The Gas Stack below-grade concrete was estimated in the 2012 filing at 5,090 cubic feet, 763,500 pounds, and 25 intermodals. The gas stack foundation is integral to, and will be removed with, the caisson. For the 2017 filing, this structure will be included with the caisson concrete volume estimate.

The Hot Machine Shop slab was estimated at 1,097 cubic feet, 451,120 pounds, and 15 intermodals in the 2012 NDCTP filing, and 15 intermodals were shipped.

The SAS Building below-grade concrete was combined with the above-grade concrete as described above.

The Radwaste Treatment Building was estimated at 3,197 cubic feet, 479,607 pounds, and 15 intermodals in the 2012 filing. Most of the above-grade concrete remains in place, as described above, and 70 intermodals are projected for disposal when the remainder of the building is demolished in 2018.

The SFP walls were estimated at 12,716 cubic feet, 1,907,400 pounds, and 62 intermodals. This volume will be included with the caisson estimate.

The RFB below-grade concrete (from +12 feet to +9 feet) was estimated in the 2012 filing at 20,253 cubic feet, 3,037,970 pounds, and 206 intermodals. The intermodal count was a combined total for above- and below-grade concrete, and mistakenly listed as a below-grade count. The current approach for demolition is to remove the RFB to grade, including the rail bay slab, the off gas tunnel below the rail bay, and the battered (inclined) steel piles under the rail bay to clear the CSM alignment path, allowing completion of the CSM wall installation. The remainder of the RFB grade slab will be removed with the caisson, down to the bottom of the tremie layer, estimated at -74 feet, in a continuous campaign. Therefore, the RFB below-grade structure, the gas stack foundation, and the SFP walls (including the cask pit tremie layer) will be a combined volume, weight, and intermodal count, and listed with the caisson.

The Solid Waste Vault was estimated and reported in the 2012 filing at 1,418 cubic feet, 128,291 pounds, and four intermodals. An incorrect density of 90 pounds per cubic foot was used to calculate the weight. For the 2017 filing, the density was corrected to 150

pounds per cubic foot, yielding 212,700 pounds and a revised, projected intermodal count of seven.

The Solid Radwaste Building below-grade was estimated and reported in the 2012 filing at 1,610 cubic feet, 305,608 pounds, and 10 intermodals. An incorrect density 190 pounds per cubic foot was used to compute the weight. For the 2017 filing, the weight is corrected to 241,500 pounds and the intermodal count is corrected to eight.

The Off Gas Tunnel South, North, and East-West volumes were combined and listed at 8,129 cubic feet on one line (Off Gas Tunnel North) in the 2012 filing. The volume was based on a conceptual plan to fill the tunnels with concrete prior to demolition to mitigate potential contamination spread during demolition. After tunnel piping was removed, it was determined that filling the tunnels with concrete was not necessary. The North and East-West Tunnels' debris were removed and included with the SAS Building and North Yard Pre-Trenching waste shipments, respectively, and five intermodals assigned to the Off Gas Tunnels were shipped. The remaining portion of the south Off Gas Tunnel will be excavated with the RFB rail bay slab to support CSM wall installation. Seven additional intermodals are estimated to complete.

The 2012 NDCTP filing estimated 13,095 cubic feet of concrete (63 intermodals) associated with slurry wall pre-trenching. The original estimate was based on known and anticipated concrete structures within a 15-foot-deep by 6-foot-wide cross-section for the bathtub-shaped slurry wall alignment. Subsequent to the 2012 filing, the bathtub-shape evolved to a circular wall much thicker in width. Pre-trenching is still necessary for the wall installation but the below-grade concrete demolition originally estimated with pre-trenching is now included with the below-grade structure volumes. To date, 44 intermodals have been attributed to pre-trenching work. For the 2017 NDCTP filing, there is no additional anticipated pre-trenching concrete volume as this area is nearly complete.

Units 1, 2 and 3 cooling water piping was estimated at 14,453 cubic feet, 2,167,900 pounds, and 161 intermodals in the 2012 filing. The number of intermodals was based on no size reduction of the large-diameter reinforced concrete pipe, which limited the number of pipe lengths per intermodal. Recent experience with the 54-inch reinforced concrete pipe discharge line, excavated with the Hot Machine Shop below grade, demonstrated that the pipe can be size-reduced to achieve the optimal concrete weight per intermodal. Eighteen intermodals have been shipped, containing Unit 3 discharge CWP and rubbled concrete from a large thrust block. Based on estimated linear feet of reinforced concrete pipe yet to be removed and industry-standard unit weights per foot, the estimated concrete weight is 1,820,000 pounds, including concrete anchor blocks

"X" and "Y". Using 32,000 pounds per intermodal, the revised estimate for the 2017 filing is 57 intermodals to be shipped.

The Caisson is a cylindrical concrete structure entirely below grade, supporting the rectangular RFB, grade slab, and superstructure. The caisson concrete volume was originally estimated at 139,192 cubic feet, including upper and lower caisson volumes. The upper caisson volume mistakenly double-counted integral volumes for the stack base, the SFP walls, and the RFB grade slab.

Lack of clarity and definition for the physical spaces that composed the upper caisson prompted a bottom-up reestimate for the entire caisson structure. Individual line item volumes for the stack base, the SFP walls, and the RFB grade slab have been removed from the tables for the 2017 filing and are now included within the reestimated caisson volume. The reestimated caisson volume excludes the tremie layer below the caisson, which was previously included but is now listed as a separate line item. The reestimated caisson volume was calculated manually and compared with a CAD-developed solid model. The more conservative volume estimates were used to envelope uncertainties in the original construction. The upper and lower caisson concrete volumes are estimated at 55,700 and 80,000 cubic feet, respectively. These volumes represent 8,400,000 pounds and 12,000,000 pounds, and 261 and 375 intermodals, respectively.

The caisson also contains approximately 200,000 pounds of metal, consisting of liner plates, concrete form decking, the drywell vessel, and the remnant ring header vent piping system. Demolition methods will make debris tracking impractical. The RFB above-grade structure will be used to fill the lower caisson spaces to create a working surface for demolition equipment, then re-excavated as the caisson is demolished. RFB upper and lower concrete rubble will be comingled with caisson rubble before it is finally removed from the ground and shipped for disposal.

The tremie concrete slab below the caisson is estimated 17,000 cubic feet, 2,600,000 pounds, and 80 intermodals. This is a minimal estimate based on a nominal thickness of 6 feet and a 60-foot caisson diameter. The tremie layer is an unknown volume, based on a minimum thickness shown on a plant design drawing. The actual thickness depends on the bottom elevation of the original caisson excavation, which is undocumented. The caisson excavation was well below the groundwater table and the slab depth may have been greater than the 6 feet shown on existing plant drawings.

Candidate waste from the RFB for the Clive, Utah, disposal site includes many higher-activity items not suitable for the Grand View, Idaho, site. Contaminated areas that have the potential for material requiring disposal in Utah include the Access shaft from -66 feet up to -2 feet, embedded piping between the Off Gas Tunnel and the RFB, soil

behind the SFP walls, Suppression chamber baffles, the Valve gallery, pipe chases, the Caisson sump, floor drains and piping, REDT, Drywell and activated core regions, and TBDT.

Any area with alpha contamination needs to be carefully screened against Exemption 3 for compliance with Grand View, Idaho, WAC. The Idaho WAC allows Cs-137 up to around 45 picocuries per gram on a case by case basis. The allowable dose limit is an average dose less than 100 microroentgens per hour and no hot spot or individual reading above 500 microroentgens per hour (0.5 millirems per hour).

A few areas remain that are above 2 millirems per hour and will require disposal at Clive, Utah. In addition, because the RFB was declared OAD-ready at less than 2 millirems per hour, there are many areas where the dose is between 0.5 and 2 millirems per hour that require disposal at Clive, Utah. One of the major areas of the RFB destined for Clive includes the metal and concrete from the activated core region. This consists of the activated metal of the drywell liner, the activated metal from the chromated cooling coils behind the drywell liner, and the activated concrete. The metal and concrete is estimated as 12 intermodals. In addition, there are areas in the Access Shaft area, including the Vertical pipe chase, that will require disposal at the Clive, Utah, site. The vertical pipe chase includes the core spray pipe, Fuel pit drain, three-inch pipe from the REDT, and the Caisson floor drains that read as high as 10 millirems per hour. Embedded grouted and foamed areas in the Valve Gallery reading in excess of 0.4 millirem per hour will be handled for disposal at Clive, Utah.

Materials that may require disposal at Clive, Utah, including the contaminated material in the concrete expansion joint and the soil beneath the Condensate Demineralizer room, could result in one intermodal. In addition, the El.-66 level of the RFB beneath the RPV, including the caisson sump, has areas reading above 2 millirems per hour that will require evaluation for disposal in Utah.

Most of the metal from the Suppression Chamber is planned for disposal in Idaho. However, there are metal baffles that are located within both Suppression Chambers with external contamination that will require disposal in Utah. The concrete walls around the SFP are planned for disposal in Idaho, with the exception of the embedded pipe at the bottom of the pool. The quantity of radioactive material in cracks and the concrete expansion joints in the SFP and in the soil behind the walls has not been characterized and may require special handling.

The Turbine Building below-grade structure upper bounding elevation is at El.+9, or 3 feet below nominal grade. The NDCTP 2012 filing listed the Turbine Building slab volume at 75,600 cubic feet and 11,340,000 pounds, but only 126 intermodals. The

volume appears to be a combined total for above- and below-grade concrete that was mistakenly entered as a below-grade volume. Present progress with the Turbine Building foundation excavation and loadout has yielded approximately 131 intermodals of concrete, 67 intermodals of soil, 6 intermodals of steel, and 4 intermodals of wood. With approximately 1/3 of the material yet to be excavated, the total forward estimate is 197 intermodals of concrete, 100 intermodals of soil, 9 intermodals of steel, and 6 intermodals of wood.

The Rubb Tent (Building 44) is a fabric-on-frame structure sitting on a concrete slab at the northeast corner of the RCA. Radioactive waste was prepared for shipment in Building 44 but the concrete slab is considered sufficiently "clean" for on-site reuse. The slab volume is approximately 3,800 cubic feet and the CWC plans to reuse the slab rubble as backfill material in the caisson excavation.

Other Designated Areas outside the Radiologically Controlled Area

There are areas outside the RCA that are not included in other discussions of the demolition project. These miscellaneous outliers are the Radwaste Discharge Line, the North Yard Drainage System, the LRWB soil, Area 51, temporary office trailer disposal, the soil management area at the east end of the site, the intake and discharge canal headworks, and the Units 1, 2, and 3 circulating water line excavation.

Radwaste Discharge Line—This line is 350 lineal feet of four-inch cast iron pipe at three feet nominal depth, discharging to the Discharge Canal. The discharge pipe runs outside the RCA in a southeastern direction, toward the discharge canal inlet structure. The bottommost 10-inches of the excavated trench, along the entire run, was assumed sufficiently contaminated for disposal at Clive. However, most excavated areas within the North Yard, including the discharge line piping, were sufficiently clean to warrant disposal at the Grand View, Idaho, facility. The balance of the uppermost excavated material was characterized using a 95 percent upper confidence level method for disposal at the Grand View, Idaho, facility.

Actual means and methods for shallow-depth excavation blend the materials, making it impractical to segregate. A two-foot-wide bucket-width by three-foot-deep trench for the entire pipe run (2,347 cubic feet, approximately nine intermodals) is now assumed sufficiently contaminated for off-site disposal.

North Yard Drainage System—The North Yard Drainage System consists of 508 lineal feet of perforated, corrugated metal pipe and reinforced concrete pipe, located outside of the North Yard and discharging to the Intake Canal. The drainage system runs from the RCA to the north end of Building 5, jogs under the northeast corner of Building 5, then runs south to the Inlet Canal. Portions of this drain system from within the RCA

North Yard were disposed to the Grand View, Idaho, facility. This drainage system from the RCA remains slightly contaminated from historical spills. Calculations assumed a full cross-section of 55 square feet of affected material, based on a five-foot excavated depth. Based on limited sampling characterization data, it was assumed that 75 percent of the excavated soil would be reused on site. However, PG&E now assumes 100 percent will be disposed off site in 114 intermodals.

LRWB—The LRWB is within the North Yard, but its 4,488-square-foot footprint was not included with the North Yard surface area computation because it would be excavated when the LRW concrete slab is removed at a different phase in the project. For the 2012 filing, it was assumed to be excavated to the nominal six-foot depth of the North Yard; and the top one-foot depth sufficiently contaminated to require off-site disposal. During above-grade demolition of the LRWB, isolated, local core-bores through the foundation slab were made to assess migration and leaching of contamination through the slab. Although these samples were not intended to characterize the below-slab soil, the sample results confirmed that contaminated liquids penetrated the slab and into the soil in localized areas. Given that the resin disposal tank bottom had corroded through and the resin disposal tank vault had flooded; and that the slab has construction joints and thickened foundation elements that can channel liquids, the estimated soil disposal volume has been increased from one foot to three feet average depth for the 2017 filing. This represents a 67 percent increase; from 18 intermodals to 55 intermodals of contaminated soil. Depending upon soil characteristics under the slab (for example, sand or gravel veins or fissures); and construction-era features not identified on plant design drawings, soil remediation may require significantly deeper excavations in some areas.

Area 51—This area was used for intermodal staging and preparation for off-site waste shipments. This previously unused hillside corner at the north end of the site was filled with approximately 3,000 cubic yards of overburden generated during construction of HBGS. Although the material has not been sampled for radiological constituents, the HBPP FSS Department is confident the material will meet requirements for reuse on site, to be confirmed via the GARDIAN System, and may be stockpiled on site for reuse. Based on site use knowledge, the HBPP Remediation Department has indicated a nominal depth of the undisturbed area will require environmental remediation, and anticipates approximately 70 cubic yards of soil will be stripped and sent to a Class 2 landfill. Using an industry-accepted unit rate of 22-tons per truckload, the estimated shipment will be six truckloads.

Temporary and mobile office trailers and ancillary structures—There are approximately two dozen mobile and semipermanent ancillary structures outside of the RCA that will be demolished to support decommissioning and FSR. This grouping includes Building

numbers: 7, 8, 9, 10, 10A, 10B, 12-1, 12-2, 12-3, 12-4, 12-5, 12-6, 12-7, 13A, 13B, 13C, 18, 20, 25, 26, and miscellaneous sheds and personnel shanties.

The intake structure headworks is estimated at 34,390 cubic feet of concrete. The lower portion of the structure will be left in-situ to support the HBGS switchyard. The upper portion will be demolished and reused on-site as backfill material. Currently, no off-site disposal of this structure is planned.

The discharge canal outlet headworks was estimated at 2,248 cubic feet of concrete and 11 intermodals for disposal in the 2012 filing. The volume and intermodal estimate remain the same for the 2017 filing.

The Units 1, 2, and 3 circulating water piping excavation soil volume designated for disposal remains consistent with the 2012 filing volume estimate at 24,000 cubic feet. The split between USEI and Clive is revised from: 50 percent/50 percent in 2012; to: 90 percent/10 percent, respectively, for the 2017 filing. The change is based on the revised RWDG-5 desk guide that allows for more waste to be routed to US Ecology based on dose averaging. US Ecology allows multiple dose measurements on a waste container, provided that the average of all measurements is below 100 microroentgens per hour and no single measurement exceeds 500 microroentgens per hour. Exemption 3 is based on a Cs-137 concentration of 15 picocuries per gram. Most waste shipments are well below this Cs-137 concentration. RWDG-5 allows case-by-case waste shipments above 15 picocuries per gram to US Ecology, as long as the average of waste shipments remains below 15 picocuries per gram. The HBPP RP Department is confident the split is conservative.

3.7.3.4 Canals

Dewatering the canal and controlling the influx of Humboldt Bay and groundwater is a significant challenge and is part of the Water Management Plan. Case in point, after initial dewatering the canal late fall 2014, a storm surge event overcame the sheet pile installation in the Bay and flooded the canal.

The Water Management Plan includes the construction of a truck decontamination area; capping water pipes at the intake and outfall structure; installation of temporary dams; dewatering; and removal of the temporary dams. Water that requires treatment will be pumped directly to the Water Pretreatment System, which will be located on the east side of the Discharge Canal.

At the Discharge Canal, a portable decontamination area, located at the southeast corner of the canal, will be used to wash and decontaminate equipment and trucks. This decontamination area is a prefabricated system that will contain and collect wash water.

The pipes at both ends of the Discharge Canal will be capped or plugged in order to perform dewatering. The pipes that formerly discharged water from the power plant to the Discharge Canal will be capped at the Discharge Structure, which is located at the south end of the Discharge Canal. The pipes at the Discharge Canal Outlet that connect the canal to Humboldt Bay, at the north end of the Discharge Canal are plugged with inflatable plugs.

Temporary dams were installed in the Discharge Canal, as necessary. The riprap along the canal banks was removed, rinsed of algae, FSS-screened for future reuse on site, and staged in the Waste Management Area. The canal banks were graded and prepared for installation of the temporary dams, which were installed using an excavator, loader, and cables.

Prior to dewatering, the Discharge Canal was seined to protect and relocate sensitive animal species. After the seining was complete, the site inspected, and the temporary dams placed, initial dewatering began. Once the dewatering was complete, an access ramp was constructed to provide access into the Discharge Canal for excavating equipment. The rock riprap was removed from the area where the ramp was constructed, and fill material was placed to construct a ramp. Crane mats were placed down the center of the Canal to provide a working surface for demolition and excavation equipment. During construction of the access ramp and placement of crane mats, representative sediment samples within the Canal were obtained as prescribed in the sampling and analysis plan to appropriately characterize sediments prior to excavation and sediment removal.

Sediment removal for most of the Discharge Canal was completed in 2015. Excavation started near the Discharge Canal Outlet, at the north end of the canal, and proceeded south to the Discharge Structure, at the south end. An excavator along the Discharge Canal was used to remove the rock riprap. After removal, the rock was transported to the Laydown Area, assayed through the GARDIAN System, and returned to the Laydown area for further processing.

After the riprap was removed from the slope, the canal was excavated to a depth about 0.5 feet into the sides and bottom of the clay layer. Excavation proceeded until sampling confirmed that the area was clean. After the outlet pipes and contaminated soil are removed and the FSS and chemical sampling completed, the levee will be restored. The restoration will be done by filling the area with the soil materials that are suitable for reuse on site. Imported fill will be required to replace the volume of the outlet pipes and contaminated soil around the pipes. The rock riprap that was removed from the Humboldt Bay side of the levee will be replaced on the outside of the restored levee.

The pipes in the Discharge Canal Outfall contain asbestos materials; therefore, asbestos abatement is required during demolition of the pipes, the structure connected to the pipes, and the soil in contact with the pipes. The outfall pipe is asbestos-bonded metal pipe that must be removed because it presents an environmental liability and is slightly radiologically contaminated. Work to complete demolition of the outfall pipes is expected to occur in 2016.

A shoring system must be installed in Humboldt Bay prior to demolition, to allow dewatering on the Bay side of the outlet, which is required to demolish the outfall and to restore the levee. The system will consist of metal sheet piling and reinforcement columns. After installation of the shoring system, the Discharge Canal outlet will be demolished, followed by a hold point to allow for FSS inspection and approval. The area will be backfilled to restore the levee after FSS approval. Coordination with FSS will be established and maintained throughout the backfill process. After the levee is restored, the shoring system will be removed.

Table 3.7.1 provides a summary of the waste volumes from the Intake and Discharge Canals.

TABLE 3.7.1—ESTIMATED VOLUMES TO BE REMOVED

Excavated Material	Volume Removed (ft^3)	
	Discharge Canal	Intake Canal
Contaminated Soil	150,552	23,601
Contaminated Concrete	2,347	-
Contaminated Asbestos Waste	485	-
Reuse Concrete	-	34,390
Backfill	-	81,590

Excavation and FSS of most of the Discharge Canal is complete. The outfall piping at the north end is to be removed in 2016. The Intake Structure and south end will also be excavated in 2016. As of August 2015, approximate 70 to 80 percent of the Discharge Canal was complete and the following volumes of material had been removed:

- Riprap—19,760 cubic feet
- Sediment/Clay—139,970 cubic feet

All the riprap removed to date has cleared the GARDIAN System for reuse on site. Approximately 60 to 70 percent of the riprap has already been reused in the canal.

Excavation and removal of the Intake Canal has not started but will follow the work execution approach similar to that of the Discharge Canal.

3.7.3.5 Circulating Water Lines

The intake and discharge cooling water lines or circulating water lines are 30, 39, 42 and 54-inch diameter, reinforced concrete pipes. The inlets to these pipes lie below the mean low water elevation in the intake canal. The outlet pipes to the Discharge Canal are also below the mean low water elevation. There is no anticipated environmental impact associated with the removal of the circulating cooling water intake piping.

At the time the original TLG Cost Estimate was developed and approved, it was assumed that radiological contamination levels of the circulating water intake lines would be low enough to meet threshold limits for leaving the piping in the ground. Due to a historic spill to the Intake Canal, the Final Site Survey (FSS) Division of the Radiation Protection Department (RP) has recommended removal of the intake and discharge pipes in lieu of the extraordinary labor efforts necessary to clean and sample the piping to allow it to remain in place.

During SAFSTOR operations of Unit 3, radioactive waste water was discharged to the intake canal and contaminated the canal bed and water at the intake pipes. Although minimal radiactive contamination is expected, performing FSS on buried piping is difficult to complete therefore piping is to be removed.

The Unit 1 discharge pipe under Building 5 and the Unit 1, 2, and 3 discharge pipe under the HBGS footprint and fence line is planned to be removed.

Portions of the circulating water lines associated with Unit 2 and the portions under the Hot Machine Shop have been removed by the Civil Works Contractor. The remaining Unit 1, 2, and 3 intake and discharge circulating water piping is planned for removal and must be coordinated with demolition activities, and remediation of the Intake and Discharge Canals. Work involved in removal of hazardous, nonhazardous, and radiological Contaminated Material associated with the piping will be documented in a demolition work plan. Except as noted, the large concrete anchor blocks associated with the circulation cooling water system are to be removed. After demolition of the piping, the CWC will repair or repave the roadways. FSS under this area will need to be coordinated with Environmental and other groups.

Deep excavations will be required for the circulation cooling water discharge piping systems. Storm water and groundwater accumulated during excavation will be monitored and controlled while removing the circulation cooling water system. The CWC

plans to use shoring, benching, sloping, nail walls, sheet piling, or other ground control during excavation.

A portion of the excavated volume is expected to survey as clean material. The CWC will control excavated areas to ensure excavated material suitable for reuse is stockpiled in designated areas and available as fill material. Only excavated material determined to contain chemical or radiological contaminants is to be transported off site for disposal. The demolition work plan will include the following elements:

- Compliance with all HBPP site requirements
- Integrate excavation with other site functions
- Mobilize and provide all labor, equipment, tools, and materials
- Provide all utilities, such as water, compressed air, fuel, and electricity
- Develop Subgrade Structures Demolition Work Plan and supporting documents
- Include engineering evaluations, as needed
- Define and execute the sequence of operations to remove the piping
- List of Work requiring notifications, authorizations and/or permits
- Provide dust suppression in support of removal of Contaminated Material
- Develop and perform schedule review and progress meetings
- Perform Work to the RP Program requirements and controls.
- Perform Waste handling and container packaging and loading
- Protect adjacent on-site structures, personnel, and HBPP site infrastructure
- Maintain asphalt/concrete paved areas undisturbed for as long as reasonably practical
- Arrange for transport or packaged waste for off-site disposal
- Process for closure documentation detailing the "as-left" condition
- Demobilize and remove all equipment, tools, and materials

Based on a vertical-side excavation, the estimated soil volume to be removed is 237,257 cubic feet and 16,000 cubic feet concrete and debris (see Table 3.7.2). It is envisioned that trench box or slip-wall shoring systems would be utilized in lieu of benched side slope excavation techniques on the deepest runs of pipe. All but 24,000 cubic feet are assumed sufficiently contaminant-free for reuse on site. The Civil Works Contractor revised the waste volume estimates and a summary is provided below. Detailed waste volumes estimates and a PWP are not yet complete for this area. The volumes as estimated for demolition and recorded in the P6 schedule are summarized in Table 3.7.2.

TABLE 3.7.2—ESTIMATED DEMOLITION VOLUMES

Excavation Description	Cubic feet
Backfill Soil	283,697
Contaminated Bulk Concrete and Debris	16,000
Contaminated Soil	24,000
Reuse Soil	213,257

4 ACCOUNTING METHODOLOGY

HBPP utilizes a matrix cost categorization structure for tracking decommissioning costs. (See Figure 4.1.) Actual costs are collected in SAP, the company-wide enterprise accounting system, and organized by accounting order number. Order numbers are established for each project area and grouped into planning orders. All labor, material, equipment, and contracts associated with each particular project area are charged to the appropriate SAP order number. This includes Engineering, Work Planning, Radiation Protection, physical work, and in some cases disposal costs. At the end of each reporting period all of the costs and relevant data are exported from the SAP program. The data contains individuals, vendors, cost element, order numbers, descriptions, time period, and purchase order numbers, along with the amount of each charge. The information is sorted, categorized, and summarized in various arrangements for analysis and reporting. Each expense is aligned with the organizational breakdown structure illustrated in Table 4-1 in the 2012 NDCTP DPR to facilitate tracking and reporting compared to the approved decommissioning cost estimate. HBPP developed the Table 4-1 organizational breakdown structure for recording of project costs in the internal accounting system. The matrix cost categorization structure established at HBPP allows for multiple data viewing capabilities. For example, the data can be summarized by SAP order work breakdown structure, organizational breakdown structure, or a combination to support the analysis of cost performance.

During the early project decommissioning “self-perform” phase, from 2009 through 2011, the organizational breakdown structure was divided into eight categories developed by PG&E in 2010. This organizational breakdown structure was first shared in Advice Letter 3932-E, Attachment 3, in October 2011. The eight categories include:

- Staffing and Specialty Consultants
- Field Work and Site Infrastructure

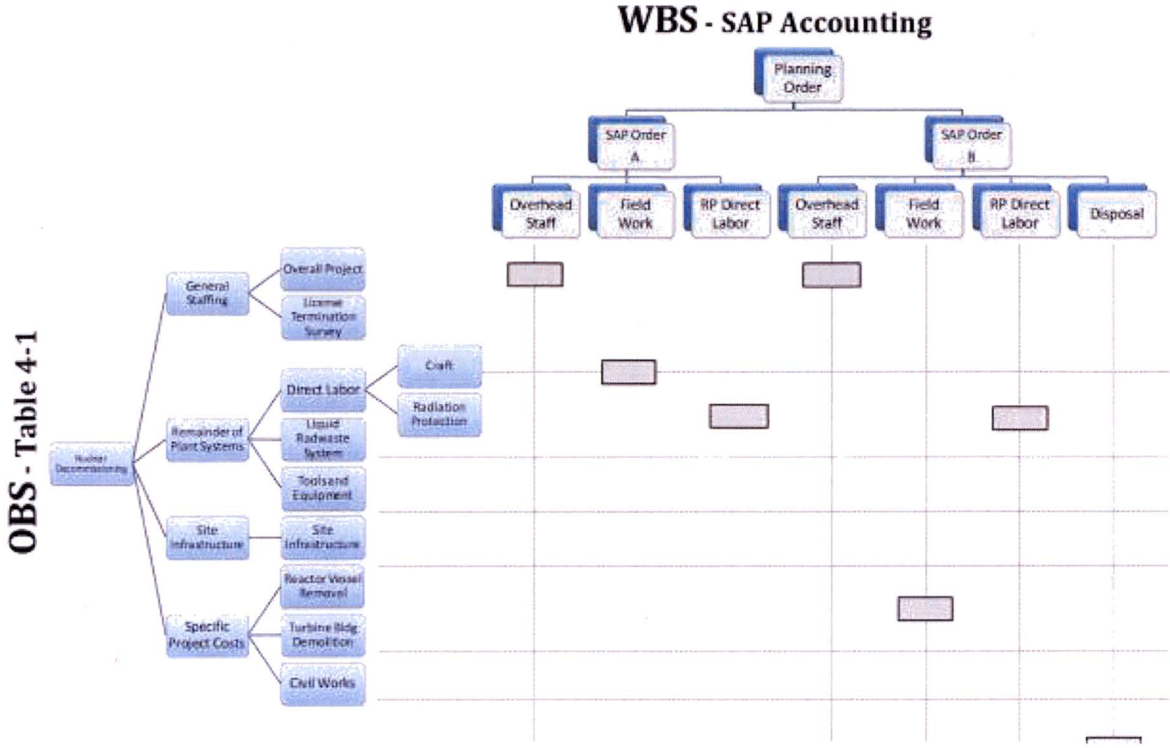
- Reactor Vessel
- Tools and Equipment
- Packaging and Disposal
- Building Demolition
- ISFSI O&M
- Other

The organizational breakdown structure was established for tracking and reporting actual cost to the approved 2009 NDCTP estimate (TLG Cost Estimate). Following the 2009 NDCTP submittal HBPP established contacts and began project execution. The structure of the 2009 cost estimate was incompatible with the collection of actual costs in some areas, such as waste disposal. Other areas, such as Staffing and Specialty Consultants, did appropriately align with the 2009 cost estimates. The 2009 cost estimate model was established prior to the start of decommissioning activities and was a budgetary planning tool, although not structured as a cost estimate baseline for performance measurement.

The 2009 NDCTP cost estimate divided waste costs for each activity line item by packaging, transportation, processing, and disposal. It was more advantageous and cost effective to arrange contracts with waste disposal facilities by combining transportation and burial costs.

Development of the 2012 NDCTP involved adding new scopes of work and the need for restructuring the organizational breakdown structure to better align with the project contracts, accounting system, work breakdown structure, and increased scope. The matrix cost categorization technique provided PG&E with improved analysis and department level accountability to ensure responsible cost performance measures.

FIGURE 4.1—WBS SAP ACCOUNTING



5 SCHEDULE ESTIMATE

PG&E has scheduled the remainder of the physical work to be completed by 2018. This is on pace with the early target that was reported in the Post Shutdown Decommissioning Activities Report (PSDAR), Revision 4. Despite identifying challenges and addressing risks, PG&E has been able to maintain focus on the overall outcome of the project.

Implementation of the civil scope of work commenced July 2013. Implementation of the civil work scope includes development and implementation of oversight capability including policy, procedures, and deployment of skilled, experienced, and trained oversight staff in the field.

HBPP achieved a significant milestone in June 2014 with completion of the Plant Systems Removal Phase, resulting in removal of all radiologically significant plant systems from the buildings after more than three decades in SAFSTOR. The HBPP historical design and construction, close proximity to the bay, and associated tidal interactions posed unique challenges to an effective decommissioning effort as the Site transitioned to Civil Works. PG&E still maintains its Part 50 license and in May 2013, submitted its LTP to the NRC.

Other significant milestones were achieved in the summer and fall of 2015 when the RPV Segmentation Project completed, the Caisson Removal project began, and the Unit 3 RFB and Main Plant Ventilation system were released for OAD. The last major large component removal project remaining was the segmentation and disposal of the RPV shell. The RPV project was integrated and executed under Civil Works, with PG&E performing solely in an oversight role across the site beginning in 2015. Experience obtained during start-up, systemization, and operating phases for the first-of-a-kind tooling, especially at error-prone interfaces, was invaluable, both from the PG&E and industry-wide perspectives.

RFB demolition is planned for 2016. The current schedule completes the CSM Wall installation in mid-2016. Once the CSM installation and RFB demolition are complete, a 20-month campaign will kick off to remove the caisson beginning in mid-2016 and completing early in 2018. Lastly, the team will work its way off the site, demobilizing the remaining Office Facilities and performing FSR. These major activities are forecasted to be complete by late 2018.

The completion of field work will be followed up by Administrative Close-out, which is expected to last 24 months, until 2020. Along with all contracts and invoicing closeouts, PG&E will utilize this time for License termination, preparing for the next NDCTP filing, and preparing the DPR testimony along with approximately $400M of reasonableness review. These activities all constitute the Administrative Closeout and will take place from 2019 to 2020.

After 2020, PG&E will be focused on ISFSI management, which is expected to last until 2030. The ISFSI removal is slated for 2029, as soon as all of the spent fuel and the GTCC cask are shipped off site, with the ISFSI site restoration to commence in 2030.

5.1 TRANSITION FROM SELF-PERFORM TO CIVIL WORKS OVERSIGHT

The first year of transitioning to Civil Works Oversight was focused in the following areas:

- Approval of CWC baseline schedule
- Revamp of key programmatic programs and plans
- Major civil works field activities, starting May 2014
- Efforts to segment the RPV

HBPP approved the CWC Baseline Schedule, which included effective technical approaches to remove structural elements such as the drywell, suppression chamber liners, and the activated concrete during caisson excavation. These were important

logical steps, as the early proposals and bids did not have to account for caisson removal.

Once the removal of the caisson became a major factor, the proposals had assumed, for the sake of expediency, that such activities would be performed in series prior to caisson excavation. By incorporating these key activities in parallel with the caisson excavation, PG&E was able to demonstrate that such a work flow was not only logical and feasible, but also constituted an essential element of completing the project within the previously estimated timeframe. This sound logic allowed PG&E to maintain its insistence throughout the Baseline Schedule approval process that the removal of activated concrete, the drywell, and suppression chamber liners be performed in parallel with the caisson excavation.

Detailed logic network checks and other important metrics were developed to ensure that the submitted schedule adhered to accepted industry standards and the contract specifications. The constructability and critical path of the schedule was reviewed by the HBPP Owner's Group to ensure that that the Contractor was in compliance with any agreed-upon activities, milestones, and other conditions that may have been established between the Owner and the Contractor.

Reaching an early consensus on a WBS that allotted authorized work into appropriate elements for planning, budgeting, scheduling, cost accounting, work authorization, measuring progress, and management control was an important first step. PG&E expected the WBS to display the following attributes:

- Contain all contract line items and end items
- Identify all WBS elements specified for external reporting
- Extend at a minimum to the level at which control accounts are established
- Provide a complete definition of work scope

An important element of HBPP oversight was to ensure that a product-oriented division of project tasks depicting the breakdown of work scope for work authorization, tracking, and reporting purposes was in place. That in turn, facilitated traceability and provided a control framework. The approved WBS ensured that the Statement of Work was entirely covered and allowed for the integration of technical, schedule, and cost information.

5.2 MAJOR PROJECT EXECUTION CHANGES AND INTEGRATION

The CWC was awarded the contract to complete the RPV Segmentation in December 2014. This work scope continued to use the first-of-a-kind segmentation equipment that was designed and fabricated for the HBPP Reactor Project. This was last significant large-component removal project that remained.

The new RPV team was able to successfully remove the first RPV window in February of 2015. It and the remaining window sections were then packaged in waste packages and ultimately into standard intermodals for shipment to the disposal site. The project team successfully removed all of the sections ahead of the originally scheduled three days per section, shortening it to one window per day, and in most cases two sections per day. The project included the removal of asbestos and mirror fiberglass insulation that surrounded the RPV, which was performed by a specialty contractor. This phase of the project posed its own unique set of challenges, including limited egress and highly contaminated materials. Once the insulation was removed, the project team successfully completed the removal of the last components of the RPV, which consisted of the top and bottom sections. These sections weighed more than 60,000 pounds each. All phases of the removal, including removal of the insulation, were completed by June 2015.

As with the first-of-a-kind evolutions experienced with the RPV Segmentation, the HBPP SFP also experienced its own integration of methods new to HBPP. The SFP previously contained several damaged fuel assemblies, in addition to significant amounts of dispersed activated metals from the segmentation of reactor vessel internals. The highly contaminated nature of the SFP was a significant radiation protection concern for the cleanup of the pool, considering the internal hazards from the distribution of alpha contamination on the surfaces of the pool liner. Another industrial hygiene hazard was the sealant coating (carboline) applied to the underlying concrete surface that was suspected to contain asbestos, which would require remediation. Based on previously identified fuel pool leakage, early pump-down of the SFP water was known to create a risk for groundwater intrusion. Because the site had gone to zero radiological discharge, and limited remaining water processing capability, there was a risk of creating contaminated water with little or no disposal pathway.

To mitigate the above concerns, it was decided to implement divers in the SFP to remove and package the liner under water; remediate the concrete coating containing asbestos under the liner; and coat the remediated surface with a sealant to prevent water in-leakage after drain-down. By doing the SFP liner removal and concrete remediation and sealing under water, the risk from groundwater intrusion was alleviated. The SFP liner was cut off the walls and floor in large sheets by mechanical means to limit heat impacts to mastic applied to the underlying concrete surface. The larger sheets were then segmented for packaging using arc gouging. A floating hood that was ducted to the plant ventilation system was used over the pool surface to capture potential airborne contaminants from the arc gouging operation. Once the liner was removed, the mastic and concrete surfaces were remediated, and an underwater sealant was applied to prevent leakage, to allow for early pool draining.

The innovative method outlined above eliminated the airborne concerns associated with plans to remediate the SFP in a dry condition. It also allowed the work to be performed in parallel with the RPV Segmentation. The underwater remediation and sealing of the SFP reduced the estimated exposure to personnel by eight person-rem. Finally, with SFPs being highly contaminated areas requiring cleanup and remediation prior to structural demolition, this innovative method to prepare future decommissioning sites for SFP demolition is considered transferrable.

A significant deviation from the previous project execution strategy is the decision to utilize CSM technology instead of the previous Slurry Wall to install the water cutoff system. Installation of the water-cutoff system is a critical precursor to beginning demolition of the Caisson. The execution change was predicated on positive safety and schedule impacts.

Another significant change in execution involves the demolition of the remaining RFB. The original plan entailed concurrent demolition operations with CSM installation, but that plan was modified to prevent any interferences with construction of the CSM wall. The remainder of the RFB demolition will now continue after completion of the CSM wall to mitigate delays and potential safety concerns with the close proximity of concurrent demolition operations with CSM.

These changes, integration of initiatives, and implementation of innovative methods to better execute the project by PG&E and the CWC has brought the project completion date in from May 2019 to December 2018.

5.3 COMPARISON CURRENT SCHEDULE TO 2012 NDCTP SCHEDULE

Table 5.3.1 compares the schedule supported by the 2012 to the current schedule. The table also shows actual starts and finishes for any activity that has started or finished respectively.

Table 5.3.1 Comparison of the Forecast Schedule to the Actual Schedule

HBPP Unit 3 Comparison Forecast to Actual Schedule					
Activity Name	2012 NDCTP Expected Start	2012 NDCTP Expected Finish	Most Recent Forecast Start	Most Recent Forecast Finish	Explanation of Major Changes
1) RPV Equipment & System Removal					
RPV Internals Removal & Segmentation	27-Mar-12	10-Sep-13	27-Mar-12 A	27-Sep-13 A	
Cask Operations & Loading - Casks 3, 4, 5, 7 & 8	28-Jun-13	8-Oct-13	28-Jun-13 A	7-Feb-14 A	
Control Rod Blade Loading & Shipping	1-Aug-13	10-Sep-13	2-Aug-13 A	4-Sept-13 A	
Contractor Final SFP Cleaning & Equipment Removal	11-Sep-13	9-Oct-13	22-Jul-13 A	27-Sep-13 A	
GTCC Mobilization & Cask 6 Loading	24-Oct-13	26-Dec-13	5-Nov-13 A	25-Nov-13 A	
Decon Facility Removal	27-Dec-13	31-Jan-14	9-Oct-13 A	22-Oct-13 A	
Drywell Containment Building	3-Feb-14	15-Apr-14	18-Nov-13 A	14-Feb-14 A	
RPV Shell Segmentation	16-Apr-14	24-Mar-15	18-Feb-14 A	11-Jun-15 A	
Drywell Insulation Removal	25-Mar-15	6-Jul-15	15-Jun-15 A	20-Jul-15 A	
Drywell Piping Removal	7-Jul-15	29-Sep-15	12-Aug-15 A	14-Jul-17	Work re-sequenced to be removed more efficiently with Caisson
Emergency Condenser Interference Removals	26-Jul-13	23-Sep-13	9-Aug-13 A	16-Oct-13 A	
2) Balance of Equipment & System Removals					
Emergency Condenser Vent Piping Removal	16-Apr-14	5-Jun-14	9-Aug-13 A	28-Sep-13 A	
Emergency Condenser Removal	6-Jun-14	24-Jul-14	6-Dec-13 A	20-Dec-13 A	
SFP Pumps & Filters Removal	28-Jan-14	28-May-14	14-Nov-13 A	14-Mar-14 A	
Condensate Demineralizer Equipment Removals	9-Jan-14	13-Apr-15	23-Jan-14 A	26-Jun-14 A	
LRW Phase 2 Equipment Removals	2-Jul-13	14-May-14	3-Jul-13 A	14-Mar-14 A	
FIXS Installation & Testing	2-Jan-13	24-Jul-13	2-Jan-13 A	1-Aug-13 A	
FIXS Collection & Process Readiness	3-Sep-13	5-Nov-13	14-Oct-13 A	11-Dec-13 A	
Suppression Chamber East Removals	5-Nov-12	10-May-13	21-Dec-12 A	26-Apr-13 A	
CRDM Removals	24-May-13	23-Oct-13	25-Jun-13 A	12-Feb-14 A	
Suppression Chamber West Removals	10-Jun-13	1-Aug-13	10-Jun-13 A	26-Feb-14 A	
Access Shaft Component Removal -66 Elev.	24-Oct-13	14-Jan-14	7-Jan-14 A	12-Jun-14 A	
Access Shaft Component Removal -54 to -44 Elev.	15-Jan-14	6-Jun-14	25-Feb-14 A	29-May-14 A	
Access Shaft Component & Block Walls Removals-34 to -2 Ele	2-Jul-13	14-Oct-14	2-Jul-13 A	28-Apr-14 A	
Valve Gallery Component Removals - Phase 2	9-Apr-13	8-May-14	9-Apr-13 A	21-Mar-14 A	
Trailer City Move & Staff Relocation	8-Jul-13	31-Oct-13	16-Jul-13 A	25-Nov-13 A	
Facility Water, Sewer & Road Modifications	14-Aug-13	5-Mar-14	14-Aug-13 A	25-Oct-13 A	
Hot Machine Shop Removals & Relocation	28-Mar-13	13-Sep-13	25-Jun-13 A	19-Nov-13 A	
3) Demolition & Civil Works					
LTP to NRC	N/A	3-May-13	N/A	3-May-13 A	
LTP Public Meeting	N/A	20-Aug-13	N/A	20-Aug-13 A	
Turbine Building Removal to +12 Civil Contract	1-Oct-12	16-Oct-13	1-Oct-12 A	12-Sep-13 A	
Civil Works Procurement, Contract Award & Mobilization	18-Dec-12	9-Jan-14	18-Dec-12 A	23-Jul-13 A	
Demo SAS Building	14-Jan-14	11-Mar-14	10-Sept-14 A	30-Oct-14 A	
Demo Hot Machine Shop	14-Jan-14	28-Apr-14	06-May-14 A	29-Sep-14 A	
Demo Liquid Rad Waste Building	15-May-14	23-Oct-14	08-Jan-15 A	4-Aug-15 A	Foundation remains scheduled for S 4/4/18 F 7/5/18
Demo Low Level Waste Building	3-Jun-14	24-Jul-14	24-Mar-15 A	10-Apr-15 A	Work re-sequenced to improve efficiency with no impact to overall project completion date (Slab still in place, will be removed with Upper Yard Work)
Demo Solid Rad Waste Handling Build (SRHB)	15-May-14	6-Aug-14	12-May-15 A	9-Jun-15 A	Work re-sequenced to improve efficiency with no impact to overall project completion date (Slab still in place, will be removed with Upper Yard Work)
Demo High Level Storage Vault Area	26-Jun-14	13-Nov-14	16-Jun-15 A	26-May-16	Work re-sequenced to improve efficiency with no impact to overall project completion date
Slurry Wall Prep & Mobilize	14-Jan-14	24-Jun-14	19-May-15 A	02-Jul-15 A	Planned to start just before Slurry Wall Construction (see Construct Slurry Wall).
Slurry Wall Pre-Trenching	25-Jun-14	13-Nov-14	23-Apr-14 A	6-Apr-16	Constraints with below grade structures & drainage modifications caused delay. Area necessary to install water cutoff wall completed.
Construct Slurry Wall	22-Oct-14	23-Jul-15	25-Jun-15 A	11-May-16	Impacted by Pre-Trenching delay due to constraints mentioned above
Drain Spent Fuel Pool & Apply Fixatives	28-Jul-15	12-Oct-15	02-Oct-14 A	10-Jun-15 A	Earlier finish with use of divers to remove liner and seal SFP
Units 1 & 2 Slab/Foundation Removals	22-Apr-15	22-Jun-15	22-May-14 A	26-Jan-17	Unit 2 foundation completed; Unit 1 area re-sequenced, no impact to overall project completion date
Remove TB Slabs	23-Jun-15	6-Oct-15	10-Apr-15 A	11-Apr-16	
Refuel Building Demo & Containment Installation	23-Aug-16	7-Feb-17	23-Oct-15 A	24-Aug-16	Earlier start with drywell liner being removed with Caisson excavation
SFP Removal/Backfill & CSM Wall Installation	8-Feb-17	9-Nov-17	1-Jul-15 A	11-Aug-16	SFP resequenced with Caisson and water cuttoff and support of excavation integrated with CSM technology and drywell liner removal with Caisson
Excavations & Concrete Demo to -22 ft	14-Nov-17	15-Mar-18	20-Sep-16	16-Feb-17	
Drywell Liner & Activated Concrete Removals	30-Sep-15	18-Aug-16	21-Feb-17	6-Apr-17	Work re-sequenced to be removed more efficiently with Caisson
Excavations & Concrete Demo to -74 ft	20-Mar-18	18-Sep-18	13-Apr-17	7-Dec-17	
Final Caisson Survey & Backfill to -28	19-Sep-18	31-Dec-18	12-Dec-17	12-Feb-18	
Circ Water & South Yard Piping Removals	28-May-14	28-Oct-14	25-Apr-17	27-Feb-18	Work re-sequenced to improve efficiency with no impact to overall project completion date
4) Remediation Restoration & Closeout					
Intake Canal Demolition & Remediation	30-Apr-14	10-Sep-14	10-May-16	15-Nov-16	Project start date changed to avoid potential site space constraints
Discharge Canal Demolition & Remediation	24-Jun-14	5-Feb-15	30-Dec-14 A	13-Oct-16	Adverse weather impacts prime contractor ownership of recovery plan
Final Site Restoration	19-Sep-18	14-May-19	10-May-16	22-Dec-18	Resequence and integration of work with the Caisson and early start in 2016
Project Administration & Close-out	15-May-19	13-May-20	23-Dec-18	22-Dec-20	

Note: An "A" appearing after the Start or Finish date indicates that the date is the Actual Start or Actual Finish.

5.4 MOST RECENT SCHEDULE REPORTED TO NRC

PG&E updated the decommissioning schedules at the request of the CPUC during the 2012 NDCTP filing. PG&E officially reported the schedules to the NRC in revision 4 of the PSDAR in July, 2013. There have been no subsequent schedules submitted to the NRC.

5.5 HBPP SUMMARY SCHEDULE WITH KEY MILESTONES

PG&E has scheduled the remainder of the decommissioning of the HBPP site over a period of approximately eight years finishing in 2019. The Refueling Building (RFB) will be demolished to grade during the third quarter of 2016. The CSM Wall installation is scheduled to complete in mid-2016. Once the CSM and RFB are reduced to grade, a 20 month campaign will kick off to remove the caisson beginning in early fall of 2016 and completing early-2018. Lastly, the team will work its way off the site by demolishing the remaining Office Facilities and performing FSR; forecast to finish in late 2018.

HBPP Summary Schedule with Key Milestones

The Level 1 Schedule Summary with Key Milestones in Figure 5.5.1 captures the work going forward to the end of the decommissioning project.

As seen in the schedule, the focus for 2016 and 2017 is to complete the CSM Wall installation, intake and discharge canal remediation, above ground structure removal, and preparation for caisson removal.

A significant deviation from the previous project execution strategy is the decision to utilize Cutter Soil Mix (CSM) technology as opposed to the previous Slurry Wall to install the water cut off system. Installation of the water-cutoff system is a critical precursor to beginning demolition of the Caisson. The execution change was predicated on positive safety and schedule impacts. After the new execution strategy was vetted, the project calculated a 6-month schedule savings when compared to the original Caisson strategy.

Another significant change in execution involves the demolition of the remaining RFB. The original plan entailed concurrent demolition operations with CSM installation, but was modified to prevent any interferences with construction of the CSM wall. The remainder of the RFB demolition will now continue after completion of the CSM wall to mitigate delays and potential safety concerns with the close proximity of concurrent demolition operations with CSM.

The FSR scope drives much of the remaining work. The FSR scope is to complete installation and construction of new components or repairs to existing features so that HBPP is in an appropriate condition for PG&E's future industrial use. Main features include demolition of the Assembly Building (Building 10); removal of ACM; demolition of reinforced concrete settling basins; soil excavation, backfilling, and compaction; wetlands construction; grading; storm drain system installation; topsoil placement; vegetation establishment; installation of erosion control features; ground cover installation; final surfacing; removal of portal monitors and truck scales; fencing and gate installation; lighting installation; and construction of new roads or repairs to existing roads.

5.6 CRITICAL PATH SCHEDULE

5.6.1 Critical Path Summary

The Project Critical Path for 2016 revolves around the construction of the CSM Wall and Phase 1, Caisson excavation. Demolition of the remainder of the west side of the RFB will be completed after completion of the CSM Wall. Dewatering construction and operation will be concurrently completed at the end of Section 3 of the CSM installation. This will allow for dewatering to immediately begin and run concurrently with Caisson excavation.

The 2017 Critical Path revolves completely around Caisson Excavation. Phase 1, Caisson Demolition, will be completed in early 2017, completing at a depth of -22 feet elevation. Activated drywell removal will then begin from a depth of -22 to -32 feet elevation. Once the activated drywell removal is complete, Phase 2 of Caisson demolition will commence in mid-2017, to a depth of -64 feet elevation. The final tremie layer will be removed to a depth of -74 feet. The bottom of the excavation will then be Final Site Surveyed by PG&E, which enable commencement of backfill at the start of 2018.

The 2018 Critical Path revolves around completing Caisson backfill and completing the remainder of FSR Work. Once Caisson backfill is complete, in mid-2018, FSR of the road near Unit 1, 2, and 3 pads will commence. Restoration of Unit 1, 2, and 3 pads' slope will then begin and be completed toward the end of 2018, after planting of native vegetation. The project will then continue to work its way off the site, concluding with the restoration of Charlie Parking Lot wetland and the count room parking lot in late 2018.

5.6.2 Major Work Activities, Assumptions and Risks by Year

5.6.2.1 2016 Activities

The CWC is completing East Yard Piping and Turbine Building Area C demolition while the specialty subcontractor completes CSM installation on the West Side and North side of the RFB through the first quarter of 2016. East Yard Piping and Turbine Building Area C demolition scope includes: Anion/Cation Room slab demolition, timber piling removal, subgrade structure demolition, Off gas tunnel demolition, FSS, and backfill of the area.

CSM Deep Shoring and Cutoff Wall Installation

The installation of the CSM deep shoring and water cutoff system will continue into second quarter of 2016 until conclusion. Activities include completion of CSM Section 3 through the East yard and Turbine building C areas. Details include the installation of the remaining deep shoring and water cutoff CSM panels within this area, in support of the ultimate removal the HBPP Unit 3 nuclear reactor Caisson.

Potential risks include the discovery of unknown commodities buried at depth, high levels of radiological or environmental contamination that could slow down, impede, or stop the equipment's ability to install the panels as planned, and the always-possible chance of a significant seismic event. Mitigation efforts to date include a robust radiological and environmental drilling and sampling campaign performed in late 2014 and early 2015, and continued real-time sampling and monitoring activities. Additionally, the CSM Deep Shoring and Water Cutoff System is well-documented with provisions in the design to handle the significant 500-year seismic event without collapse of the system, while providing sufficient factors of safety for worker safety during caisson removal (Jacobs Associates, Design Notes, Humboldt Bay Unit 3 Caisson Removal, Temporary Excavation Support, Rev 1, February 2015).

Refueling Building Remaining Demolition

RFB Demolition operations will pause through the second quarter of 2016 to allow CSM operations to complete in the East area of the RFB. Concurrently, the exterior asbestos abatement will continue and the Caisson dewatering system will be installed. The caisson dewatering system is composed of four deep wells installed within the 110-foot-diameter CSM Deep Shoring and Water Cutoff System. The wells will be installed by a large rotary drill rig (BG-40 or equivalent, set up in rotary drilling mode). Additionally, a small-tracked drill rig will be mobilized to the site for installation of several inclinometers and piezometers, installed to monitor the performance of the system. By concurrently working the dewatering system and completing exterior asbestos abatement with CSM panel installation, the CWC can mitigate schedule risk, allowing the remaining RFB to

be demolished and dewatering operations to begin immediately following the completion of the last deep panel. The dewatering process has two steps—an initial dewatering step and a long-term dewatering step. The initial dewatering step includes starting the pumps, drawing the water within the caisson structure down approximately 10 feet, then shutting off the pumps and taking readings from the inclinometer and piezometers, with data evaluation by the DOR and engineering team. A successful test drawdown should include minimal water movement or recharge. An unsuccessful test would include significant influx of water, which could possibly indicate a leak in the system or an improperly installed deep panel, which is a risk to the project as repairs or rework could be required. However, a significant amount of engineering design margin has been built into the CSM deep Shoring and Water Cutoff System, including significant evaluation of water movement through the cutoff wall by means of the hydrogeological reports and design studies produced by the CWC, its technical specialty subconsultants, and other Subject Matter Experts. Design values for hydraulic conductivity of the deep panels are $1x10^{-6}$ centimeters per second. In many cases, actual as-built values from in situ sampling are $1x10^{-7}$ centimeters per second, providing better than design margin for permeability.

Caisson Excavation

Excavation of the Caisson will begin the third quarter of 2016. The excavation and demolition of the structure can be broken into 3 phases:

1. October 2016 to March 2017—Remove and excavate the upper portion of the Caisson (from El. +12 to El. -20) and the exterior Caisson walls from El. -20 to El. -30 feet
2. April 2017 to May 2017—Remove and segregate the Activated Region from the drywell (interior ring of the Caisson) between El. -20 and El. -30
3. June 2017 to January 2018—Remove and excavate the remainder of the Caisson and adjacent soils (from El. -30 to approximately El. -84)

The caisson was decontaminated in preparation for excavation. The surfaces and accessible embedded piping were either decontaminated or removed. However, there are areas where the residual contamination could not be removed safely or cost effectively in advance of caisson removal. Therefore, RP monitoring, measuring, and control will be required during caisson excavation and removal. Example of areas of concern that will require RP Technician support include embedded pipe commodities, the Drywell activated core region, and Suppression Chamber removal. Except for the removal of the Activated Region, work will generally progress in the following manner.

Excavation will begin from El.+9.5 and shall proceed in approximately 4-foot lifts. First, soils between the concrete structure and the CSM wall will be removed from around the exterior of the Caisson. Following removal of the soils, the concrete structure will be excavated down to the next soil elevation. This process will repeat until the entire structure and the surrounding soils have been removed from within the bounds of the CSM wall. As the debris from these activities is generated, it will be used to fill void space within the structure to provide additional working surface for the demolition. The soil spoils will be processed through the GARDIAN System, stockpiled at a predetermined location on site, and saved for use in the backfilling process. Currently, PG&E assumes that about 75 percent of the material being excavated from the caisson will be suitable for reuse.

The first portion of the excavation and demolition activities will occur with the excavation equipment setup at locations around the top of the CSM wall and on the former SFP which has been filled in with demolition debris generated during the RFB demolition. As the excavation progresses and more working space within the CSM is available, a ramp will be left on the east side to allow the remaining equipment planned for the excavation work to be moved into the hole.

Excavation and demolition will continue to progress in lifts down to the -20-foot elevation, fully removing all soils and portions of the structure. At the -20-foot elevation, the demolition process will change slightly to address the Activated Region area. Starting from this elevation, the removal of the structure will be restricted to excavation of soils and the demolition of structure, exempting the inter-drywell concrete, interior suppression chamber liner plate, and the drywell liner. This restriction will be in effect to the elevation of approximately -30 feet. Following demolition of the exterior structure within this 10-foot elevation range, a 10-foot-tall section of the drywell will remain, protruding above the working surface elevation.

At this point, a sacrificial layer of materials will be put down at the working surface elevation, on both the soil surface and any debris-filled voids on the exterior of the drywell. This will be used as a barrier layer to segregate the activated region debris from the surrounding materials. Once the sacrificial layer has been laid, demolition of the Activated Region may commence as follows:

- First, the suppression chamber liner plate will be stripped from the drywell concrete (concrete and the interior drywell liner plate will remain in place). The liner will be direct-loaded for disposal following removal.
- Next, the activated concrete from the drywell will be rubbelized and direct-loaded into intermodal shipping containers for direct disposal. During concrete removal, the interior drywell liner plate will serve to prevent any activated region debris from falling into the drywell cavity.
- Following completion of the activated concrete removal and cleanup, the drywell liner plate will be removed and direct-loaded for disposal.
- At completion of the drywell liner plate removal, surveys will be taken, and the sacrificial material layer will be disposed of along with approximately six inches of soil and debris below the barrier layer.

Upon completion of the Activated Region removal, the remaining 55 feet of the Caisson and the surrounding soils will be removed in a manner similar to the first 32 feet of the excavation. This will continue until the entire structure and the base tremie concrete layer have been fully removed. At this point all equipment used for the excavation and demolition work will be removed from the excavation.

At the bottom level of the excavation, appropriate sampling, surveys, and verifications will be performed prior to commencing backfilling activities. Following release for backfill, the +12-foot elevation around the top of the hole will be reconfigured to support backfill operations.

Backfilling of the excavation will be performed by end-dumping or pouring material from the top of the excavation and compacting, in 10-foot lifts, using remote means, to a depth of approximately 85 feet, within 10 feet of the top of the excavation. The remaining top 10 feet will be backfilled with structural fill material, using conventional methods. A ramp will be constructed by breaching the CSM wall to allow equipment to access the work surface for placement and compaction of the structural backfill material. Backfilling and compaction of the upper 10 feet of the excavation will occur in 2-foot lifts until the hole has been fully backfilled, concluding the planned scope of work. Demobilization and cleanup of the area will be performed following approval from the client that the project objectives have been completed in accordance with the contract specs.

Discharge Canal Remediation

Discharge Canal work will commence the first quarter of 2016, in the south end of the canal. Work will begin by disconnecting the four above-ground pipes in the area of the headworks. The circulation water lines will be terminated into a French drain and pumping system that has a concrete plug on the downgradient side to prevent any potentially contaminated water from entering the canal. The remaining riprap and walkway will be removed to allow demolition of the upper portion of the headwall.

Once complete, the canal can be remediated and an FSS of the area will be done in the second quarter of 2016. PG&E then has the option to utilize the south discharge canal real estate for CSM spoil mixing operations.

There is a risk that the remediation efforts will require excavations low enough to intersect the upper Hookton sand layer. If this occurs, water pumping and GWTS operations may not be sufficient to keep up with the incoming water and this could adversely affect the schedule.

Cofferdam and Coastal Trail Remediation will continue the second quarter of 2016. It is assumed that crews working CSM spoil mixing will be operating on the south end of the discharge canal and will not interfere with Cofferdam and Coastal Trail Remediation. A 36-inch-diameter, 3/8-inch whaler, 25- by 35-foot silt curtain, and sheet pile will be installed, encapsulating the work area to provide the necessary engineering controls to allow crews to work safely and with minimal effect on the bay. Work activities near the ocean will be performed within the fish window, running June through October 2016. During this time the Cofferdam will be repaired and the coastal trail can be remediated. These work activities are forecasted to be completed the third quarter of 2016. PG&E is planning to perform this work within the 2016 fish window to minimize any environmental impact on the bay. If an unforeseen event prevents the completion of the

cofferdam and coastal trail remediation in 2016, PG&E can engineer a solution, and finish the work during the 2017 fish window without affecting the project.

Intake Canal Remediation

Work activities within the Intake Canal will begin the second quarter of 2016. Prior to the 2016 fish window, the CWC will install emergency power, temporary fencing, and roads. Once in place, PG&E will begin performing all work activities related to the fish window, including FSR. Activities include fish seining, installing a water cutoff system, dewatering, and remediating contaminated soils. Other activities include FSR work involving the reconfiguration of the water line in alpha parking lot, creating the Alpha Road Parking Lot Wetland, installing the MSE wall at Alpha Road entrance, Grading Alpha Road, and installing the bio-detention basin/swales. PG&E is planning to perform this work within the 2016 fish window to mitigate schedule risk to the project and environmental impacts to the intake canal waterway. PG&E will also be working closely with HBGS and switchyard stakeholders. Meetings are currently being held with those stakeholders as part of the work plan development. The following are PG&E's current assumptions:

- Temporary road and fencing will be constructed to mitigate traffic impacts to HBGS
- Temporary roads and fencing will be installed in a way that will not interfere with HBGS and Switchyard work operations
- Full buy-in of the work plan and work execution timing by HBGS and Switchyard at the time of Intake Canal remediation in order to not delay remediation activities
- Bravo road access will be sufficient for normal HBGS operations, and excludes major component replacements
- Planned demolition and remediation equipment will not interfere with HBGS operations
- The existing storm water discharge points into the Intake Canal can be rerouted to other existing discharge points on site until the permanent final site drainage systems are installed during the FSR project

Other FSR activities that will commence during mid-2016, pending approval of the CDP in March of 2016, include the Bravo Road bio-swale installation, WMF water main reconfiguration, frog pond detention basin/grassy swale creation, new ISFSI access road creation, and the Tsunami Siren relocation. This work is dependent on the performance of the Intake Canal during the 2016 fish window, so that the excavation materials and construction resources can be effectively utilized while in the same work location on site.

The CWC will install a second GARDIAN in mid-2016. A second GARDIAN will be installed at the count room parking lot adjacent to the first GARDIAN. The project waste volume forecast in 2016, 2017, and 2018 will be large enough to cause a schedule impact and hinder the project's critical path for scanning bulk soil for reuse with only one GARDIAN. The large amount of reuse soil is due to optimized parallel path schedule, including caisson demolition, circulation line excavation, and unit 1 pad demolition, Oily Water Separator demolition, TC remediation area. The addition of the second GARDIAN will mitigate schedule risk, preventing critical path activities from extending beyond their current forecast completion dates.

5.6.2.2 2017 Activities

As mentioned above, activities for Caisson Excavation and FSR that started in 2016 will continue into 2017. One major work activity that is slated to begin in 2017 is the Units 1, 2, and 3 circulation cooling water lines. This work begins with set up and mobilization activities in late February 2017, with excavation starting April 2017. This work is sequenced to follow efforts on the Intake Structure and Unit 1, which will work west to east. This facilitates a transition in moving from shallow to deep, starting at the Intake Canal area.

One of the anticipated challenges will be the rerouting of storm drains. Although identified early, the main challenge would be to implement a timely solution. PG&E's response to this challenge is still in development. The current plan is to reroute the storm drain water to another existing discharge point on the site. This will be in place until the FSR CDP and the new detention basins can be installed. This is a work in progress with the Engineering department as the work plan is developed and engineering finalized.

The current assumption is that all three circulation cooling water lines will be removed. Another key assumption, just as with Intake Canal Remediation, is that the work activities will not interfere with HBGS and the Switchyard. The team has also taken action to verify the limits of excavation, as documented in the preliminary work plan concerning the lines inside the HBGS.

5.6.2.3 2018 Activities

The removal of Units 1, 2, and 3 circulation cooling water lines that began in 2017 will continue into 2018 and is expected to be completed by the end of February 2018. FSR activities will also continue until the end of 2018. There are also two other major activities that will both start and finish this year—Caisson Backfill and LRW Retaining Wall Removal.

With the last of the Caisson excavation completing in early January 2018, PG&E will commence final surveying of the excavation footprint. This surveying is expected to last two weeks, completing in mid-January 2018. Following that, the backfilling of the entire Caisson excavation cavity will begin. The 110-foot-diameter and 100-foot-deep cavity will be filled back to +12-foot elevation. This is expected to be completed in April 2018, with the crew demobilization beginning in May 2018.

Once the Caisson excavation is backfilled to grade, the team can begin the second major activity of the LRW Retaining Wall Removal. Due to the contaminated nature of this concrete and the interest in preventing any cross-contamination, the concrete processing is expected to be direct-loaded at the job site into containers for disposal. The retaining wall removal, final survey, and backfilling to grade of the LRW footprint is expected to take approximately four months, completing in July 2018.

5.6.2.4 2019-2020 Activities

In the early part of 2019, PG&E will be completing FSS and generating the last area reports and summary report to be submitted to the NRC. Approximately 20 staff will be required to support this effort at the beginning of the year, with this number ramping down to approximately 2 by the end of 2019. In 2020 the last overall report and request to terminate the license will be sent to the NRC and final FSS close out of records will be performed.

In addition to FSS and FSS records closure, PG&E will perform administrative closeout during this 24-month period. In the 2012 filing, PG&E anticipated that five staff positions would be needed for about a year to close out contracts, invoices, and open work orders. Through industry benchmarking and direct experience, PG&E has learned that the scope of work remaining after Site Restoration is completed is larger and more highly varied than originally thought. In addition to closing out all contracts, invoices, and work orders, PG&E is anticipating many other concurrent activities during this time period.

Similar to many other aspects of HBPP decommissioning, the administrative closeout will also be yet another first-of-a-kind experience for both PG&E and the State of California. While the Rancho Seco Nuclear Generating Station was the first nuclear decommissioning in California, the critical difference is that its owner still maintains control and actively utilizes the site. With PG&E slated to transfer control of much of the HBPP site area to the non-nuclear HBGS, the administrative closeout is anticipated to bring its own set of challenges and brand new experiences for PG&E.

The following are some of the activities that PG&E will be expected to perform. It is important to note that closure of the following activities and the retention of the records

thereof, will each have to adhere to its own unique and separate standards set forth by Federal regulations, California regulations, local regulations, the nuclear industry standards, PG&E's nuclear insurer, PG&E standards, PG&E's commitments to the community, and the community's expectations. Accordingly, PG&E has adjusted the necessary staffing to five positions for two years. To meet the administrative closeout needs, PG&E is planning to retain a mixture of management- and clerical-level personnel who have the experience with the HBPP decommissioning and can accomplish the residual work.

Anticipated work during the two-year administrative period includes:

- Work Package Closeout—While this activity is a continuous aspect of any large project, some of the final work packages and standing work orders are expected to remain open until the completion of physical work. All work packages will be processed for final acceptance and verification to ensure that the work was indeed performed correctly and documented adequately. The records will then be entered into the Records Management System (RMS) for retention and archiving in accordance with the applicable regulations and requirements.
- Radiological Records—All radiological and FSS surveys and clearances must be brought to a closure. This will include any of the final surveys and clearances performed during caisson excavation and backfill and FSR. The records must be reviewed by management, approved, and entered into RMS.
- Industrial Hygiene (IH) and Environmental Sampling—All IH and Environmental sampling and records must be brought to closure per applicable regulations. By project closure, HBPP will have retained numerous such records related to asbestos, lead, PCBs, effluent, air and water monitoring, and treated water discharges. The records must be reviewed by management, approved, and entered into RMS
- Spent Nuclear Fuel (SNF) and GTCC records—PG&E will have to verify that all the records for SNF, GTCC, and associated packaging are complete, accurate, and retrievable. This is a long-term preparation for PG&E, since the DOE standards require adequate records and documentation prior to acceptance of any SNF or GTCC. Thus, PG&E will have to bring all packaging, fabricating, and construction records for disposition and prepare to transfer them to the ISFSI.
- Corrective Action Program—All remaining SAP notifications and outstanding corrective actions from the project will have to be brought to closure or, if required, transferred to ISFSI or other intra-company bodies. The final resolution of outstanding corrective actions will need to be entered into the existing SAP notifications, and issue dispositions submitted to RMS.

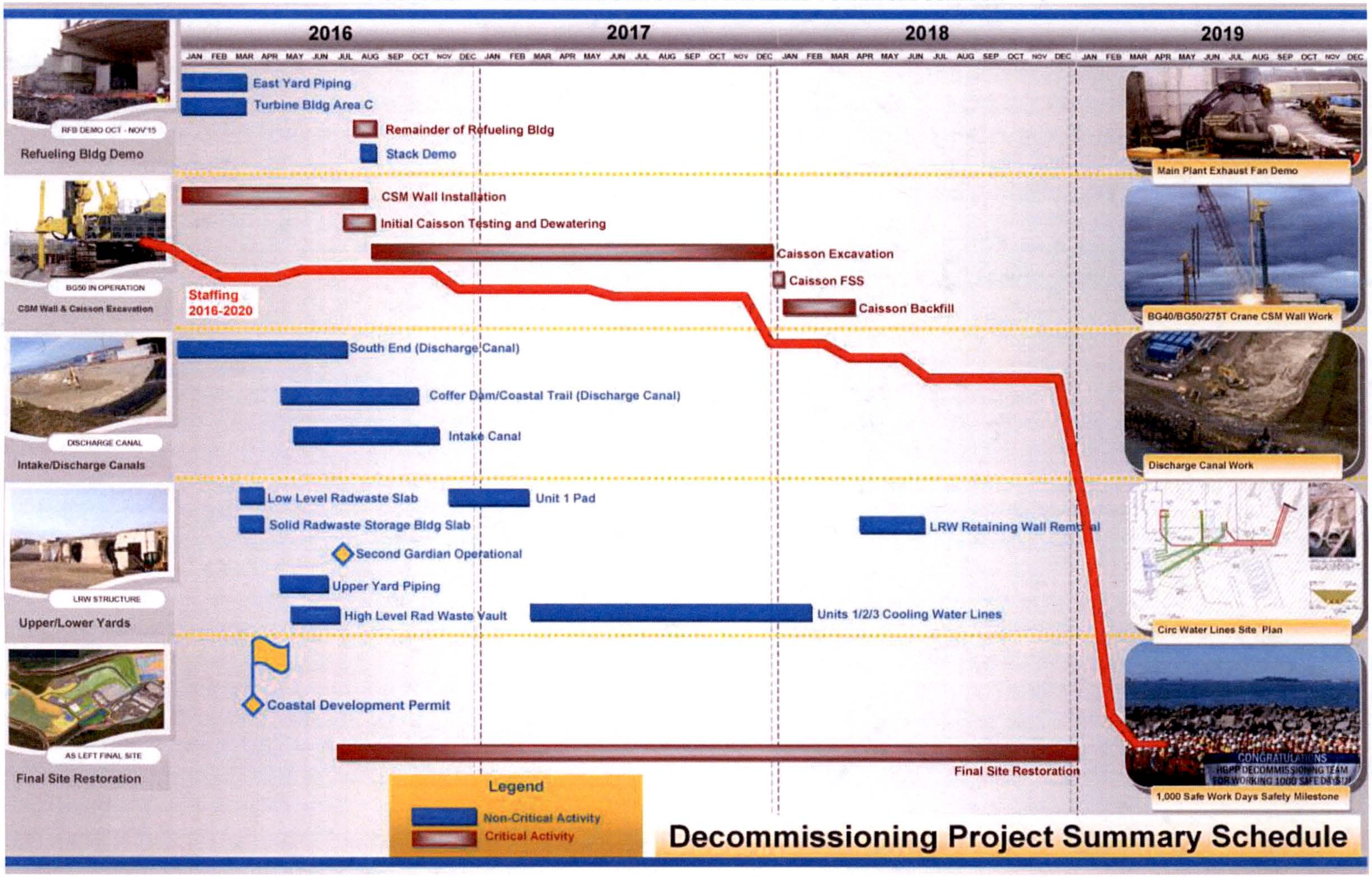
- Procedure termination or transfer—All plant procedures will be processed for termination or transfer to ISFSI or HBGS. Many of these procedures will require a regulatory safety review, per 10 CFR §50.59 or 10 CFR §72.48, and an internal management review by appropriate plant personnel prior to termination. The final resolutions for residual procedures will need to be submitted to RMS.
- Disposition of Permits—All permits will require modification, closure, or transfer to ISFSI or HBGS. PG&E will have to make the determinations based on consultations with the applicable regulatory bodies. Additionally, any pertinent stakeholders will have input into the closure, transfer, or modification processes. Once agreement is reached with the permitting authority and pertinent stakeholders, the final actions to reach the closure state can be taken, final closure documentation submitted to the permitting authority, and final permit termination inspections completed. Once the permitting authority notifies HBPP that the permit is officially terminated, all the relevant documentation can be submitted to RMS.
- Asset Recovery—PG&E will have to determine the processes to evaluate the remaining light and heavy equipment and tools. Based on contamination levels or industry standards, the remaining such assets will be sold, salvaged, scrapped, disposed, or transferred within the company.
- Final as-built drawings—PG&E will have to prepare the final drawings and applicable topography records indicating the status of site with the best available information at the end of the project. The final drawings include depictions of above-ground and below-grade piping, utilities, residual structures, active monitoring systems, and abandoned systems. For example, portions of the CMS wall will be left in place after site restoration; the associated drawings will be submitted to RMS. Depending on the requirements of existing permits, some drawings may be needed to obtain permit termination from the permitting authorities.
- License termination—The process of license termination with the NRC will continue well after the completion of physical work. PG&E will prepare for the final round of inspections and respond to requests for additional information as required. Once the License Termination Documentation is finalized, PG&E can set a baseline documentation package for the ultimate demolition and removal of the ISFSI with final termination of its license. Previous decommissionings at other sites have encountered an influx of requests for additional information just prior to final license termination. The requests were made primarily by the NRC and included requests for information that was not initially required by either the LTP or the driving regulation, NUREG 1757.

- License modifications—There are several license and license basis documents that will be required to be modified at the end of site restoration. (e.g., changes to the Site Emergency Plan). From previous experience with the NRC review and approval process, PG&E has learned that the NRC review process requires long lead times, frequent exchanges to answer Requests for Information, and frequent revisions to account for regulatory creep. Regulatory creep is small and iterative changes to requirements that occur during a review process. These changes are unknown at the beginning of the request for NRC approval of a particular document. Further, PG&E has learned that the NRC reviews are typically less than timely. For example, the last revision of the Site Emergency Plan took nearly two years to gain NRC approval.
- Preparation for NDCTP—PG&E will begin preparations for the NDCTP, including preparing the DPR testimony along with more than $300M of reasonableness review.
- Records Retention—PG&E will have to sort and archive all final records from the decommissioning project. The required retention periods and retrievability requirements will need to be determined for each record and the record processed accordingly. Most records will be disposed of within three years. However, many records, such as the radiological records, must be retained for a minimum of ten years after license termination and records associated with SNF must retained until well after the fuel is transferred to the DOE.
- Major Program closure—There are several major programs that will require a closure plan and plan implementation. Similar to procedure termination, the programs such as Fire Protection, Industrial Safety, and RP will be processed for termination or transfer to ISFSI or HBGS. Many of these procedures will require a regulatory safety review, per 10 CFR §50.59 or 10 CFR §72.48, and an internal management review by appropriate plant personnel prior to termination.
- Residual workload from all applicable stakeholders—Perhaps the greatest number of unknowns will be associated with stakeholder expectations. PG&E has made the utmost effort to maintain transparency about the status of project execution and to keep open lines of communications with local regulatory bodies and stakeholders. The amount and level of communications are expected to diminish after site restoration is complete. However, local stakeholders will continue to have an interest in the site as long as SNF and GTCC are in temporary storage at the ISFSI.

5.6.2.5 2021-2030 Activities

From 2021 onward, PG&E will be focused on ISFSI management. PG&E anticipates shipping the spent fuel off site and removing the ISFSI altogether in 2029. The ISFSI site restoration is expected to be completed in 2030.

FIGURE 5.5.1—WORK BREAKDOWN STRUCTURE LEVEL 1 SCHEDULE SUMMARY



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