Application: 21-06-021
(U 39 M)
Exhibit No.: (PG&E-3)
Date: February 28, 2022
Witness(es): Various

PACIFIC GAS AND ELECTRIC COMPANY

2023 GENERAL RATE CASE

EXHIBIT (PG&E-3)

GAS OPERATIONS

WORKPAPERS SUPPORTING CHAPTERS 10-13

[INCLUDES AUGUST 27, 2021 REVISED WORKPAPERS AND ERRATA THROUGH FEBRUARY 28, 2022]

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Table 10-1
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10
Gas Operations Leak Management
Expenses by Major Work Category
(Thousands of Nominal Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	DE	G Dist Leak Survey	25,439	19,967	23,638	28,400	32,575	35,006	32,847	33,950	
2	FI	G Dist Corrective Maint	51,156	47,706	47,155	53,508	71,905	73,407	80,697	96,895	
3	JO	GT Pipeline Maintenance	6,177	5,753	7,021	6,735	8,413	12,152	13,695	16,856	
4	JP	GT Station Maintenance	370	427	4,515	4,306	4,700	5,481	5,446	5,629	
5	JQ	G Dist Integrity Mgt (Non Bal)	252	375	183	654	890	791	821	849	
6	JU	Gas Distrib Leak Srvy & Repair	20,416								
7	LW	GAS LEAK ABATEMENT PROGRAM			34,598	26,299	931		19,128		
8	**Total**		**103,811**	**74,228**	**117,111**	**119,901**	**119,413**	**126,837**	**152,634**	**154,179**	

Notes: (A) Line 8, 2021, 2023 Forecast vary from the values listed in Testimony due to errata. These amounts align to the Results of Operations (RO) model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-2
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10
Gas Operations Leak Management
Expenses by Major Work Category
(Thousands of Base Year Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	DE	G Dist Leak Survey	28,672	21,519	24,736	28,774	32,575	34,410	31,299	31,351
2	FI	G Dist Corrective Maint	58,014	51,381	49,622	54,499	71,905	72,049	76,826	89,326
3	JO	GT Pipeline Maintenance	6,802	6,189	7,252	6,768	8,413	11,917	13,016	15,513
4	JP	GT Station Maintenance	399	445	4,592	4,299	4,700	5,379	5,180	5,185
5	JQ	G Dist Integrity Mgt (Non Bal)	283	412	208	687	890	770	774	773
6	JU	Gas Distrib Leak Srvy & Repair	22,065							
7	LW	GAS LEAK ABATEMENT PROGRAM			35,417	26,307	931		18,091	
8	**Total**		**116,234**	**79,946**	**121,828**	**121,334**	**119,413**	**124,526**	**145,186**	**142,148**

Table 10-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10
Gas Operations Leak Management
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	DE	DEA	Leak Survey	11,500	6,492	9,165	13,913	10,696	10,645	9,557	9,878	
2		DEB	Special Leak Survey	273	1,916	134	617	1,992	5,194	2,606	2,693	
3		DEC	Downgrade No Repair	3,152	1,879	3,883	3,047	3,125	2,648	3,266	3,376	
4		DED	Rechecks	2,921	1,671	2,129	2,632	2,243	2,299	2,376	2,455	
5		DEE	Customer Calls	1,514	648	1,476	1,470	617	708	732	756	
6		DEF	Advanced MobileTechnology	11,626	6,529	6,526	5,574	13,144	10,787	11,495	11,881	
7		DEG	Picarro Special Survey	12	2	3		5				
8		#	Not assigned	(5,560)	829	322	1,146	752	2,725	2,816	2,911	
9	**DE Total**			**25,439**	**19,967**	**23,638**	**28,400**	**32,575**	**35,006**	**32,847**	**33,950**	
10	FI	FIG	Maint-Corr-G Main Lk	28,550	13,475	16,089	16,345	25,526	34,829	40,048	46,406	
11		FIH	Maint-Corr_G_Svc Leak_AG	7,267	4,084	1,481	1,225	4,101	5,724	6,020	4,013	
12		FIJ	Maint-Corr G Main Dig-in	1,655	1,264	1,147	420	1,052	970	925	957	
13		FIK	Maint-Corr G Svc Dig-in	1,231	803	1,688	1,499	950	1,461	1,483	1,533	
14		FIM	Major Event-Distribution Gas		1,696	53	368	501		456	471	
15		FIP	Maint-Corr_G_Svc Leak_BG	22,627	12,171	15,117	15,421	22,295	14,312	16,617	22,019	
16		FIQ	Atmospheric Corrosion Monitorg	4,733	10,244	6,439	9,308	6,886	2,569	1,260	1,303	
17		FIS	Leak Survey Meter Repair	5,492	2,825	4,603	6,326	6,952	10,166	10,031	16,209	
18		#	Not assigned	(20,400)	1,145	537	2,598	3,643	3,376	3,856	3,986	
19	**FI Total**			**51,156**	**47,706**	**47,155**	**53,508**	**71,905**	**73,407**	**80,697**	**96,895**	
20	JO	JOE	Ground Leak Survey	1,905	1,621	1,458	1,202	895	907	937	968	
21		JOP	CM G Main Lk	2,619	2,560	2,737	3,192	5,828	8,513	10,168	13,210	
22		JOR	Leak Rechecks	378	549	899	364	235	464	248	256	
23		JOW	Aerial Leak Survey	1,275	1,023	1,927	1,976	1,455	2,268	2,343	2,421	
24	**JO Total**			**6,177**	**5,753**	**7,021**	**6,735**	**8,413**	**12,152**	**13,695**	**16,856**	
25	JP	JPQ	CARB Leak Survey		368	3,401	3,384	2,962	3,385	3,059	3,162	
26		JPR	CARB Leak Repairs	370	58	1,114	922	1,738	2,097	2,387	2,467	
27	**JP Total**			**370**	**427**	**4,515**	**4,306**	**4,700**	**5,481**	**5,446**	**5,629**	
28	JQ	JQA	DIMP Leak Survey	252	375	183	654	890	791	821	849	
29	**JQ Total**			**252**	**375**	**183**	**654**	**890**	**791**	**821**	**849**	
30	JU	#	Not assigned	20,416								
31	**JU Total**			**20,416**								
32	LW	LWB	GD 3yr Leak Survey-Traditional			2,519	3,301					
33		LWC	GD 3yr Leak Survey - Picarro			6,094	4,732					
34		LWD	GD Special Leak Surveys			397	543					
35		LWG	GD Rechecks			9,525	3,418	495		10,071		
36		LWH	GD Below Gound Svc Leak Repair			7,384	4,095	436		9,057		
37		LWI	GD Above Gound Svc Leak Repair			7,525	8,503					
38		LWJ	GT Policy Procedures Training			10	160					
39		LWO	GD R&D Methane Abatement			1,091	1,515					
40		LWP	GT R&D Methane Abatement			53	31					
41		#	Not assigned									
42	**LW Total**					**34,598**	**26,299**	**931**		**19,128**		
43	**Total**			**103,811**	**74,228**	**117,111**	**119,901**	**119,413**	**126,837**	**152,634**	**154,179**	

Notes: (A) Line 43, 2021, 2023 Forecast vary from the values listed in Testimony due to errata. These amounts align to the Results of Operations (RO) model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-4
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10
Gas Operations Leak Management
Expenses by MAT Code
(Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	DE	DEA	Leak Survey	12,834	7,064	9,677	14,125	10,696	10,454	9,100	9,115
2		DEB	Special Leak Survey	306	2,075	142	632	1,992	5,132	2,481	2,485
3		DEC	Downgrade No Repair	3,490	2,029	4,025	3,085	3,125	2,601	3,110	3,115
4		DED	Rechecks	3,251	1,818	2,245	2,693	2,243	2,258	2,262	2,266
5		DEE	Customer Calls	1,694	708	1,563	1,510	617	695	697	698
6		DEF	Advanced MobileTechnology	12,779	6,963	6,759	5,593	13,144	10,594	10,945	10,962
7		DEG	Picarro Special Survey	13	2	4		5			
8		#	Not assigned	(5,697)	860	322	1,137	752	2,676	2,703	2,711
9	**DE Total**			**28,672**	**21,519**	**24,736**	**28,774**	**32,575**	**34,410**	**31,299**	**31,351**
10	FI	FIG	Maint-Corr-G Main Lk	31,382	14,407	16,798	16,497	25,526	34,242	38,189	42,892
11		FIH	Maint-Corr_G_Svc Leak_AG	8,073	4,431	1,762	1,435	4,101	5,628	5,740	3,709
12		FIJ	Maint-Corr G Main Dig-in	2,019	1,463	1,271	455	1,052	954	882	884
13		FIK	Maint-Corr G Svc Dig-in	1,739	1,057	1,871	1,564	950	1,436	1,414	1,417
14		FIM	Major Event-Distribution Gas		1,853	54	377	501		435	435
15		FIP	Maint-Corr_G_Svc Leak_BG	24,929	13,053	15,791	15,631	22,295	14,071	15,846	20,351
16		FIQ	Atmospheric Corrosion Monitorg	5,337	10,826	6,606	9,345	6,886	2,501	1,199	1,201
17		FIS	Leak Survey Meter Repair	6,169	3,103	4,897	6,517	6,952	9,898	9,444	14,753
18		#	Not assigned	(21,633)	1,189	573	2,677	3,643	3,319	3,677	3,684
19	**FI Total**			**58,014**	**51,381**	**49,622**	**54,499**	**71,905**	**72,049**	**76,826**	**89,326**
20	JO	JOE	Ground Leak Survey	2,148	1,768	1,547	1,237	895	890	890	891
21		JOP	CM G Main Lk	2,887	2,759	2,849	3,217	5,828	8,349	9,664	12,157
22		JOR	Leak Rechecks	414	599	932	369	235	455	236	236
23		JOW	Aerial Leak Survey	1,353	1,062	1,925	1,945	1,455	2,224	2,227	2,228
24	**JO Total**			**6,802**	**6,189**	**7,252**	**6,768**	**8,413**	**11,917**	**13,016**	**15,513**
25	JP	JPQ	CARB Leak Survey		381	3,440	3,363	2,962	3,321	2,910	2,912
26		JPR	CARB Leak Repairs	399	64	1,153	936	1,738	2,057	2,270	2,272
27	**JP Total**			**399**	**445**	**4,592**	**4,299**	**4,700**	**5,379**	**5,180**	**5,185**
28	JQ	JQA	DIMP Leak Survey	283	412	208	687	890	770	774	773
29	**JQ Total**			**283**	**412**	**208**	**687**	**890**	**770**	**774**	**773**
30	JU	#	Not assigned	22,065							
31	**JU Total**			**22,065**							
32	LW	LWB	GD 3yr Leak Survey-Traditional			2,593	3,283				
33		LWC	GD 3yr Leak Survey - Picarro			6,319	4,787				
34		LWD	GD Special Leak Surveys			406	540				
35		LWG	GD Rechecks			9,700	3,397	495		9,525	
36		LWH	GD Below Gound Svc Leak Repair			7,533	4,084	436		8,566	
37		LWI	GD Above Gound Svc Leak Repair			7,712	8,521				
38		LWJ	GT Policy Procedures Training			10	164				
39		LWO	GD R&D Methane Abatement			1,091	1,500				
40		LWP	GT R&D Methane Abatement			53	31				
41		#	Not assigned								
42	**LW Total**					**35,417**	**26,307**	**931**		**18,091**	
43	**Total**			**116,234**	**79,946**	**121,828**	**121,334**	**119,413**	**124,526**	**145,186**	**142,148**

Workpaper Table 10-5
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 10, Gas Operations Leak Management
Summary of Expenses

Gas Distribution Expense

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	Reference	Notes
1	Downgrade No Repair	DE	DEC	3,151,964	1,879,318	3,882,847	3,047,488	3,125,272	2,647,978	3,265,955	3,375,692	WP 10-18	
2	Leak Survey Support	DE	DE#	(5,559,949)	829,421	321,727	1,145,551	752,385	2,725,293	2,816,045	2,910,664	WP 10-24	
3	Leak Survey	DE	DEA	11,500,415	6,492,448	9,165,273	13,913,356	10,695,534	10,645,003	9,557,036	9,878,153	WP 10-11	
4	Special Leak Survey	DE	DEB	273,494	1,915,792	133,635	617,144	1,992,392	5,193,934	2,605,738	2,693,291	WP 10-17	
5	Rechecks	DE	DED	2,921,232	1,671,379	2,128,708	2,632,168	2,243,287	2,299,050	2,375,653	2,455,430	WP 10-20	
6	Customer Calls	DE	DEE	1,514,325	648,253	1,476,027	1,469,876	617,315	708,118	731,699	756,284	WP 10-22	
7	Advanced MobileTechnology	DE	DEF	11,625,913	6,528,759	6,526,467	5,574,114	13,143,655	10,786,700	11,494,567	11,880,565	WP 10-13	
8	Picarro Special Survey	DE	DEG	12,075	1,971	3,488	170	4,827	-	-	-		1
9	Leak Repair Support	FI	FI#	(20,399,922)	1,145,041	536,568	2,597,645	3,643,034	3,375,962	3,856,195	3,985,690	WP 10-64	
10	Maint-Corr-G Main Lk	FI	FIG	28,550,224	13,475,013	16,089,392	16,344,608	25,525,857	34,829,352	40,048,005	46,406,363	WP 10-47	
11	Maint-Corr_G_Svc Leak_AG	FI	FIH	7,266,612	4,083,755	1,481,208	1,224,692	4,100,549	5,724,118	6,019,591	4,012,718	WP 10-51	
12	Maint-Corr G Main Dig-in	FI	FIJ	1,655,251	1,264,192	1,147,474	420,338	1,052,028	969,937	925,437	956,513	WP 10-53	
13	Maint-Corr G Svc Dig-in	FI	FIK	1,231,147	802,977	1,687,648	1,498,519	950,022	1,461,029	1,483,314	1,533,125	WP 10-55	
14	Major Event-Distribution Gas	FI	FIM	-	1,695,805	53,403	367,704	500,908	-	455,656	470,957	WP 10-57	
15	Maint-Corr_G_Svc Leak_BG	FI	FIP	22,627,340	12,170,534	15,117,466	15,420,543	22,295,076	14,312,086	16,617,372	22,018,887	WP 10-49	
16	Atmospheric Corrosion (AC) Meter Inspectio	FI	FIQ	4,732,811	10,243,792	6,438,549	9,308,186	6,885,679	2,568,600	1,260,404	1,302,730	WP 10-15	
17	Meter Set Leak Repair	FI	FIS	5,492,473	2,824,721	4,603,445	6,325,995	6,951,951	10,166,255	10,031,158	16,208,518	WP 10-61	
18	DIMP Leak Survey	JQ	JQA	251,537	375,093	182,714	654,161	889,513	790,672	821,467	849,053	WP 10-25	
19	Leak Management Balancing Account	JU	JU#	20,416,220	31	-	-	45	-	-	-		2
20	Leak Abatement Program Other	LW	LW#	-	-	-	-	192	-	-	-		3
21	GD 3yr Leak Survey-Traditional	LW	LWB	-	-	2,519,241	3,301,278	-	-	-	-		3
22	GD 3yr Leak Survey - Picarro	LW	LWC	-	-	6,094,040	4,731,670	368	-	-	-		3
23	GD Special Leak Surveys	LW	LWD	-	-	396,805	542,821	-	-	-	-		3
24	GD Below Ground Main Repair	LW	LWG	-	-	9,525,453	3,418,033	494,663	-	10,070,869	-		3
25	GD Below Gound Svc Leak Repair	LW	LWH	-	-	7,383,686	4,095,021	435,542	-	9,057,139	-		3
26	GD Above Gound Svc Leak Repair	LW	LWI	-	-	7,525,328	8,502,907	-	-	-	-		3
27	GD R&D Methane Abatement	LW	LWO	-	-	1,091,213	1,515,490	0	-	-	-		3
28	**Total Expenses**			**97,263,162**	**68,048,295**	**105,511,806**	**108,669,477**	**106,300,093**	**109,204,086**	**133,493,301**	**131,694,630**		

Notes

(A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

(1) MAT DEG has been discontinued and not forecasted.
(2) MAT JU# was part of balancing account but is not forecasted for this rate case period.
(3) MWC LW was part of the NERBA balancing account for Leak Abatement OIR to capture 2018 and 2019 incremental costs only and is not forecasted for this rate case period with the exception of MAT LWG and MAT LWH. Those two MATs were granted an extention through 2022 to track below ground grade 3 costs.

Gas Transmission Expense

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	Reference	Notes
29	Ground Leak Survey	JO	JOE	1,904,597	1,620,920	1,457,619	1,202,097	895,271	907,077	936,829	968,306	WP 10-69	
30	CM G Main Lk	JO	JOP	2,619,114	2,560,397	2,736,681	3,192,457	5,827,891	8,512,788	10,167,516	13,210,155	WP 10-67	
31	Leak Rechecks	JO	JOR	378,412	548,852	899,452	363,626	235,152	463,500	247,808	256,134	WP 10-71	
32	Aerial Leak Survey	JO	JOW	1,275,148	1,022,567	1,926,929	1,976,402	1,454,729	2,268,186	2,342,583	2,421,293	WP 10-73	
33	CARB Leak Survey	JP	JPQ	-	368,491	3,401,097	3,383,553	2,961,979	3,384,642	3,059,132	3,161,919	WP 10-75	
34	CARB Leak Repairs	JP	JPR	370,178	58,201	1,114,265	922,325	1,737,954	2,096,631	2,386,696	2,466,889	WP 10-76	
35	GT Policy Procedures Training	LW	LWJ	-	-	9,853	160,255	(1)	-	-	-		4
36	GT R&D Methane Abatement	LW	LWP	-	-	52,881	31,238	-	-	-	-		5
37	**Total Expenses**			**6,547,449**	**6,179,427**	**11,598,777**	**11,231,953**	**13,112,975**	**17,632,824**	**19,140,563**	**22,484,696**		

Notes

(A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

(4) MAT LWJ was part of the balancing account for Leak Abatement OIR to capture 2018 and 2019 incremental costs only and is not forecasted for this rate case period
(5) MAT LWP was part of the balancing account for Leak Abatement OIR to capture 2018 and 2019 incremental costs only and is not forecasted for this rate case period

Total Expense

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast
38	**Total Expenses**	All	All	**103,810,611**	**74,227,723**	**117,110,583**	**119,901,430**	**119,413,068**	**126,836,910**	**152,633,864**	**154,179,327**

Table 10-6
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Introduction to the Leak Survey Forecast Workpapers

Line No. **Surveys by Division**

1 This workpaper includes eleven different tables that are used to derive the forecast number of Traditional (Foot) surveys, Advanced Mobile surveys, and Leak Survey and Atmospheric Corrosion Can't Get In (CGI) inspections for 2021-2023.
2
3 **Table 1** Annual Survey maps. Certain surveys are conducted every year and not on the 3-year compliance cycle.
4 **Table 2** 3-year compliance surveys planned for 2021-2023. Includes SF and Colma.
5 **Table 3** Comprehensive Survey (Overlap of 1-year and 3-year maps)
6 **Table 4** Comprehensive surveys planned for 2021-2023, with SF and Colma maps removed. SF and Colma surveys are performed only via Traditional (Foot) survey. (A)
7 Planned Advanced Mobile Technology survey, MAT Code DEF (2021-2023). Excludes San Francisco, Colma, Humboldt, and North Valley. To reach 80% MAT DEF goal, 83.5% was used (from Table 4) for each active division (B)
8 **Table 5** The number of surveys on this table are the basis for the MAT Code DEF forecast on WP 10-14, Line 1.
9 **Table 6** SF, Colma, HB, and NV Comprehensive survey maps (Data from Table 3)
10 **Table 7** Annual survey maps outside of Comprehensive survey plan (Annual units that was not included in the Comprehensive plan)
11 **Table 8** Comprehensive traditional survey. Total Comprehensive survey (Table 3) minus the Comprehensive Advanced Mobile Technology Survey (Table 5) for all divisions except SF, Colma, NV and HB. (C)
12 **Table 9** Planned Traditional (foot) survey (2021-2023), MAT Code DEA. Includes San Francisco, Colma, Humboldt, and North Valley surveys (from Table 7 and Table 8).
13 The number of surveys on this table are the basis for the MAT Code DEA forecast on WP 10-12, Line 3.
14 **Table 10** Leak Survey CGI Find rates, MAT DEA (2021-2023)
15 **Table 11** Atmospheric Corrosion (AC) CGI Find Rates, MAT FIQ (2021-2023)
16
17 Overall, PG&E has approximately 3.5 million services in its territory and approximately 1.3 million services are surveyed each year as shown in Tables 1-10.
18

	By Survey Cycle	2023	
19			
20	Table 1 - Annual Surveys	194,647	WP 10-7, Line 22
21	Table 2 - 3-year Compliance Surveys	1,167,069	WP 10-7, Line 45
22	**Total - Surveys per Year**	**1,361,716**	
23			
24	By Type of Survey (D)	2023	
25	Table 5 - Advanced Mobile Technology Survey (MAT DEF)	905,956	WP 10-7, Line 112
26	Table 9 - Traditional (Foot) Survey (MAT DEA)	455,760	WP 10-7, Line 194
27	**Total - Surveys per Year**	**1,361,716**	

28
29 Notes:
30 (A) 21,537 surveys for the Colma division are removed from the PN (Peninsula) division in 2023.
31 (B) 20% of the Advanced Mobile Technology surveys are conducted by Traditional (foot) survey when conditions are present that it is not possible to use the Advanced Mobile Technology survey vehicle.
32 (C) SF, Colma, NV and HB are represented by the total overall comprehensive survey (Table 3) only.
33 (D) The MAT Code descriptions use different terms, "routine" and "traditional" to refer to the same type of survey. This is the Traditional (foot) survey conducted
34 with a hand-held device.

Table 10-7
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecast Services to be Surveyed by Division, by Year - MWC DE (A) (C)
MWC DE, MAT DEA, Traditional Leak Survey
MWC DE, MAT DEF, Advanced Mobile Technology Leak Survey

Table 1: Annual survey maps planned for 2021-2023. (A)

Division	Division Code	No. of Surveys
Central Coast	CC	11,522
De Anza	DA	6,131
Diablo	DI	7,993
East Bay	EB	15,785
Fresno	FR	12,300
Humboldt	HB	3,034
Kern	KE	8,547
Mission	MI	13,190
North Bay	NB	7,715
North Valley	NV	8,666
Penninsula	PN	10,548
Sacramento	SA	22,086
San Francisco	SF	11,748
Sierra	SI	8,885
San Jose	SJ	12,891
Santa Rosa	SO	10,026
Stockton	ST	10,602
Yosemite	YO	12,978
Total		**194,647**

Table 2: 3-year compliance maps planned for 2021-2023, includes SF and Colma maps.

Division	2021	2022	2023
CC	49,547	59,147	59,147
DA	38,407	40,475	40,475
DI	72,369	76,702	76,702
EB	68,984	68,616	68,616
FR	63,952	70,778	70,778
HB	11,218	11,733	11,733
KE	38,500	42,594	42,594
MI	81,108	86,299	86,299
NB	50,120	51,209	51,209
NV	31,399	37,909	37,909
PN	57,944	58,841	58,841
SA	173,096	173,605	173,605
SF	48,618	45,052	45,052
SI	55,320	63,064	63,064
SJ	88,849	88,353	88,353
SO	54,979	43,513	43,513
ST	60,318	67,726	67,726
YO	69,458	81,458	81,458
Total	**1,114,186**	**1,167,069**	**1,167,069**

Table 3: Comprehensive Survey (Overlap of Annual and 3-year Compliance Maps)

Division	2021	2022	2023
CC	51,899	60,666	60,666
DA	40,515	42,124	42,124
DI	75,416	78,262	78,262
EB	74,495	73,473	73,473
FR	67,909	73,809	73,809
HB	12,187	11,984	11,984
KE	40,983	44,543	44,543
MI	84,702	90,121	90,121
NB	52,930	51,686	51,686
NV	34,328	37,981	37,981
PN	60,714	61,878	61,878
SA	180,510	179,005	179,005
SF	52,724	48,873	48,873
SI	57,378	63,835	63,835
SJ	91,876	91,558	91,558
SO	59,790	43,034	43,034
ST	62,916	69,130	69,130
YO	73,704	83,390	83,390
Total	**1,174,976**	**1,205,352**	**1,205,352**

Table 10-7
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecast Services to be Surveyed by Division, by Year - MWC DE (A) (C)
MWC DE, MAT DEA, Traditional Leak Survey
MWC DE, MAT DEF, Advanced Mobile Technology Leak Survey

Table 4: Comprehensive Survey with San Francisco and Colma removed. (D)
SF and Colma surveys are performed only via Traditional (Foot) survey.

Division	2021	2022	2023
CC	51,899	60,666	60,666
DA	40,515	42,124	42,124
DI	75,416	78,262	78,262
EB	74,495	73,473	73,473
FR	67,909	73,809	73,809
HB	12,187	11,984	11,984
KE	40,983	44,543	44,543
MI	84,702	90,121	90,121
NB	52,930	51,686	51,686
NV	34,328	37,981	37,981
PN	37,063	40,341	40,341
SA	180,510	179,005	179,005
SI	57,378	63,835	63,835
SJ	91,876	91,558	91,558
SO	59,790	43,034	43,034
ST	62,916	69,130	69,130
YO	73,704	83,390	83,390
Total	**1,098,601**	**1,134,942**	**1,134,942**

Table 5: Advanced Mobile Technology survey - MAT Code DEF.
Note: This table represents 80% of overall Comprehensive survey plan (Table 4), excluding San Francisco, Colma, Humboldt, and North Valley. (B)

Main Work Center	2021	2022	2023
CC	43,336	50,656	50,656
DA	33,830	35,174	35,174
DI	62,972	65,349	65,349
EB	62,203	61,350	61,350
FR	56,704	61,631	61,631
KE	34,221	37,193	37,193
MI	70,726	75,251	75,251
NB	44,197	43,158	43,158
PN	30,948	33,685	33,685
SA	150,726	149,469	149,469
SI	47,911	53,302	53,302
SJ	76,716	76,451	76,451
SO	49,925	35,933	35,933
ST	52,535	57,724	57,724
YO	61,543	69,631	69,631
Total	**878,492**	**905,956**	**905,956**

(D) To WP 10-14, MAT DEF, Line 1

Table 6: SF, Colma, HB and NV compliance maps (Data from Table 3). (C)
Note: Colma is within Peninsula Division.

Main Work Center	2021	2022	2023
SF	52,724	48,873	48,873
Colma	23,651	21,537	21,537
HB	12,187	11,984	11,984
NV	34,328	37,981	37,981
Total	**122,890**	**120,375**	**120,375**

Table 10-7
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecast Services to be Surveyed by Division, by Year - MWC DE (A) (C)
MWC DE, MAT DEA, Traditional Leak Survey
MWC DE, MAT DEF, Advanced Mobile Technology Leak Survey

Table 7: Annual survey maps outside of Comprehensive survey plan.
Note: This table represents the total Annual service unit count that was not included in the Comprehensive survey. The sum of Table 1 and Table 2 minus Table 3 = Table 7.

Division	2021	2022	2023
CC	9,170	10,003	10,003
DA	4,023	4,482	4,482
DI	4,946	6,433	6,433
EB	10,274	10,928	10,928
FR	8,343	9,269	9,269
HB	2,065	2,783	2,783
KE	6,064	6,598	6,598
MI	9,596	9,368	9,368
NB	4,905	7,238	7,238
NV	5,737	8,594	8,594
PN	7,778	7,511	7,511
SA	14,672	16,686	16,686
SF	7,642	7,927	7,927
SI	6,827	8,114	8,114
SJ	9,864	9,686	9,686
SO	5,215	10,505	10,505
ST	8,004	9,198	9,198
YO	8,732	11,046	11,046
Total	**133,857**	**156,364**	**156,364**

Table 8: Comprehensive traditional survey plan.
Note: This table represents the total Comprehensive Survey (Table 3) minus the Comprehensive Advanced Mobile Technology Survey (Table 5) for all Divisions except SF, Colma, NV, HB. SF, Colma, NV and HB is represented by the total overall Comprehensive Survey (Table 3) only.

Division	2021	2022	2023
CC	8,563	10,010	10,010
DA	6,685	6,950	6,950
DI	12,444	12,913	12,913
EB	12,292	12,123	12,123
FR	11,205	12,178	12,178
HB	12,187	11,984	11,984
KE	6,762	7,350	7,350
MI	13,976	14,870	14,870
NB	8,733	8,528	8,528
NV	34,328	37,981	37,981
PN	29,766	28,193	28,193
SA	29,784	29,536	29,536
SF	52,724	48,873	48,873
SI	9,467	10,533	10,533
SJ	15,160	15,107	15,107
SO	9,865	7,101	7,101
ST	10,381	11,406	11,406
YO	12,161	13,759	13,759
Total	**296,484**	**299,396**	**299,396**

Table 9: Traditional (Foot) Survey - MAT Code DEA
Note: This table represents the traditional Comprehensive Survey (Table 8) plus the additional Annual survey units outside of the Comprehensive Survey plan (Table 7).

Division	2021	2022	2023
CC	17,733	20,012	20,012
DA	10,708	11,432	11,432
DI	17,390	19,346	19,346
EB	22,566	23,051	23,051
FR	19,548	21,447	21,447
HB	14,252	14,767	14,767
KE	12,826	13,947	13,947
MI	23,572	24,238	24,238
NB	13,638	15,766	15,766
NV	40,065	46,575	46,575
PN	37,544	35,704	35,704
SA	44,456	46,221	46,221
SF	60,366	56,800	56,800
SI	16,294	18,647	18,647
SJ	25,024	24,793	24,793
SO	15,080	17,605	17,605
ST	18,385	20,604	20,604
YO	20,893	24,805	24,805
Total	**430,341**	**455,760**	**455,760**

(C) To WP 10-12, MAT DEA, Line 3

Table 10-7
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecast Services to be Surveyed by Division, by Year - MWC DE (A) (C)
MWC DE, MAT DEA, Traditional Leak Survey
MWC DE, MAT DEF, Advanced Mobile Technology Leak Survey

Table 10: Leak Survey CGI Inspections (New Finds) - MAT Code DEA (E)
Note: This table assumes 2.8% CGI find rate in PN, 50% find rate in SF in 2021 due to COVID-19, 40% find rate in SF in 2022-203, and 1% for the remainder of the territory in 2021-2023.

Division	2021	2022	2023	
CC	611	707	707	
DA	445	466	466	
DI	804	847	847	
EB	848	844	844	
FR	763	831	831	
HB	143	148	148	
KE	470	511	511	
MI	943	995	995	
NB	578	589	589	
NV	401	466	466	
PN	1,918	1,943	1,943	
SA	1,952	1,957	1,957	
SF	30,183	22,720	22,720	
SI	642	719	719	
SJ	1,017	1,012	1,012	
SO	650	535	535	
ST	709	783	783	
YO	824	944	944	
Total	**43,901**	**37,018**	**37,018**	(C) To WP 10-12, MAT DEA, Line 2

Table 11: AC CGI Inspections (New Finds) - MAT Code FIQ (F)
Note: This table assumes 1.14% CGI find rate across all divisions.

Division	2021	2022	2023	
CC	696	806	806	
DA	508	531	531	
DI	916	966	966	
EB	966	962	962	
FR	869	947	947	
HB	162	168	168	
KE	536	583	583	
MI	1,075	1,134	1,134	
NB	659	672	672	
NV	457	531	531	
PN	781	791	791	
SA	2,225	2,231	2,231	
SF	688	648	648	
SI	732	820	820	
SJ	1,160	1,154	1,154	
SO	741	610	610	
ST	808	893	893	
YO	940	1,077	1,077	
Total	**14,921**	**15,524**	**15,524**	(C) To WP 10-16, MAT FIQ, Line 3

Notes:
(A) Table 1 lists all divisions. Table 1 lists those surveys that are completed every year, not on the 3-year compliance survey cycle.
(B) MAT Code DEF is calculated using 83.5% of Comprehensive survey (Table 4) for each active division to reach the overal 80% goal of completing compliance survey via Advanced Mobile Technology.
(C) PG&E has approximately 3.5 million services in its territory. Approximately 1.3 million services are surveyed each year.
(D) Table 4 lists all divisions except San Francisco and Colma. Table 6 lists San Francisco, Colma, Humboldt and North Valley only.
(E) Leak Survey CGI Program began in late 2019 and was not previously forecasted in the 2020 GRC due to timing. 2021 had an additional 19,614 backlog CGIs forecasted in MAT Code DEA due to challenges faced from COVID-19.
(F) AC Inspections transitioned to the Leak Survey work group in 2021 and is performed simultaneously with leak survey inspections. Table 11 represents AC CGI inspections only. 2021 had an additional 28,114 backlog CGIs forecasted in MAT Code FIQ due to challenges faced from COVID-19.

Table 10-8
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEA - Routine Leak Survey - Unit Cost Forecast

MAT DEA (UNIT OF MEASURE: SERVICES SURVEYED)

Note:
(1) MAT DEA unit cost is a combination of: (a) Leak Survey non-CGI unit cost, and (b) Leak Survey CGI unit cost.

Leak Survey Non-CGI Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost	$8,044,269.06	(A)
2020 Recorded Units	572,955	
2020 Average Unit Cost	$14.04	Line 7/Line 8
2020 Adjustments to Forecast Basis (Unitized)	$0.00	(B)
Cost Basis for Forecast	$14.04	Line 9 + Line 10

Note:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.

Leak Survey CGI Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost	$2,648,004.60	(A)
2020 Recorded Units	25,389	
2020 Average Unit Cost	$104.30	Line 19/Line 20
2020 Blended Internal/External Labor Cost	$87.16	(C)
Adjustments to Forecast Basis	-$280,000.00	(D)
2021 CGI Unit Forecast	61,577	WP 10-12, Line 2
2021 Cost Forecast	$5,086,993.72	Line 22 * Line 24 + Line 23
2021 Unit Cost Forecast	$82.61	Line 25/Line 24
2022 Cost Basis for Forecast	**$5,366,993.72**	(E)
2022 Unit Cost Basis for Forecast	**$87.16**	Line 27/Line 24

Note:

(C) CGI Unit cost is based on 2020 internal and external labor costs. It assumes 30% of the internal cost and 70% of external cost to account for the resource allocation completing this work. This blended cost also includes fixed IT costs to support the CGI program.

(D) Reduction in cost from Field Service completing Leak Survey CGI units during their routine maintenance work outside MAT DEA. This adjustment was only included in 2021 due to timing.

(E) 2022 and 2023 Unit Cost forecast is based on 2021 unit cost forecast basis without adjustment from Line 23. This was not included in forecast due to timing.

	2021 (J)	2022 (K)	Notes and References
Escalation Factor	2.44%	3.33%	(G)
Non-CGI Escalation Amount	$0.34	$0.48	(H)
Non-CGI Unit Cost	$14.38	$14.86	(I)
CGI Escalation Amount	-	$2.90	(H)
CGI Unit Cost	$82.61	$90.06	(I)
Non-CGI Unit	386,441	418,741	WP 10-12, Line 1
CGI Unit	61,577	37,018	WP 10-12, Line 2
Total Non-CGI Cost	$5,558,017.37	$6,223,126.34	Line 38 * Line 41
Total CGI Cost	$5,086,993.72	$3,333,895.18	Line 40 * Line 42
Total DEA Cost	$10,645,011.09	$9,557,021.52	Line 43 + Line 44
Forecast Unit Cost	$23.76	$20.97	Line 45 / Line 41 + Line 42

	2021	2022	2023 (K)	Notes and References
Escalation Factor	-	-	3.36%	(G)
Escalation Amount	-	-	$0.70	(H)
Forecast Unit Cost	**$23.76**	**$20.97**	**$21.67**	(I)
Forecast Units	**448,018**	**455,760**	**455,760**	WP 10-12, Line 3
Forecast Total Cost	**$10,645,003.11**	**$9,557,036.30**	**$9,878,152.72**	Line 51 * Line 52

Notes:
(G) See Exhibit (PG&E-3), Chapter 2.
(H) Previous year unit cost x Escalation Factor.
(I) Previous year unit cost + Escalation Amount.
(J) 2022-2023 Unit cost forecast shows a decrease from 2021 even with escalation rates due to the increase in regular leak survey units and a decrease in CGI units. CGI units are more costly, thus dropping the overall cost forecast total.
(K) 2021 is an anomoly due to the large amount of CGI units so 2022 is used as the base year for 2023 forecast.

Table 10-9
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEA - Routine Leak Survey - Volume Forecast

		Recorded	Forecast			
Line	**MAT Code (E) (F)**	**2020**	**2021**	**2022**	**2023**	**Notes and References**
1	DEA - Routine Leak Survey	572,955	386,441	418,742	418,742	(A), (B), To WP 10-7, (Line 194 - Line 218)
2	DEA - CGI Leak Survey	25,389	61,577	37,018	37,018	(A), (B), (C), To WP 10-7, Line 218
3	**Total**	**598,344**	**448,018**	**455,760**	**455,760**	(D)
4						

5 **Notes:**
6 (A) 2023 Forecast units are based on a 3-year survey cycle.
7 (B) Routine leak survey units include the total DEA planned units minus CGI find rate. The forecast is split into two buckets.
8 (C) 2021 CGI Leak survey forecast includes an additional 19,614 forecasted units due to COVID-19 impacts.
9 (D) The MAT Code descriptions use different terms, "routine" and "traditional" to refer to the same type of survey. This is the traditional (foot) survey conducted
10 with a hand-held device.

Table 10-10
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEF - Advanced Mobile Technology Leak Survey - Unit Cost Forecast

MAT DEF (UNIT OF MEASURE: SERVICES SURVEYED)

Line	Description	Value	Notes and References
2	2020 Recorded Cost	$13,143,654.52	
3	2020 Recorded Units	1,096,569	
4	2020 Average Unit Cost	$11.99	Line 3/Line 4
5	2020 Adjustments to Forecast Basis	$0.00	(A)
6	**Cost Basis for Forecast**	**$11.99**	Line 5 + Line 6

Line		2021	2022	2023	Notes and References
9	Escalation Factor	2.44%	3.33%	3.36%	(B)
10	Escalation Amount	$0.29	$0.41	$0.43	(C)
11	**Forecast Unit Cost**	**$12.28**	**$12.69**	**$13.11**	(D)
12	**Forecast Units**	**878,492**	**905,956**	**905,956**	WP 10-14, Line 1
13	**Forecast Total Cost**	**$10,786,697.91**	**$11,494,564.66**	**$11,880,562.23**	Line 12 * Line 13

Notes:

(A) No adjustments were made to the forecast basis.

(B) See Exhibit (PG&E-3), Chapter 2.

(C) Previous year unit cost x Escalation Factor.

(D) Previous year unit cost + Escalation Amount.

(E) Line 12, Column C-E values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-11
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEF - Advanced Mobile Technology Leak Survey - Volume Forecast

		Recorded	Forecast			
Line	MAT Code (E)	2020	2021	2022	2023	Notes and References
1	DEF - Advanced Mobile Technology Leak Survey	1,096,569	878,492	905,956	905,956	(A), (B), To WP 10-7, Line 112
2						
3	**Notes:**					
4	(A) 2023 Forecast is based off a 3 year survey cycle.					
5	(B) The units represent 80% of overall Comprehensive survey plan driven by the advacned mobile technogology, excluding San Francisco, Colma, Humboldt, and North Valley.					

Table 10-12
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIQ - Atmospheric Corrosion Can't Get In Meter Inspection - Unit Cost Forecast

MAT FIQ (UNIT OF MEASURE: # OF SVC LEAK REPAIRS BELOW GROUND)

Line	Description	Value	Notes and References
2	September 2020 YTD Costs	$1,727,247	(A)
3	September 2020 YTD Units	19,957	(A)
4	2020 Average Unit Cost	$86.55	Line 3/Line 4
5	2020 Adjustments to Forecast Basis	-$200,000.00	(B)
6	**Cost Basis for Forecast**	**$76.53**	Line 3 + Line 6 / Line 4

Line		2021 (F)	2022	2023 (G)	Notes and References
9	Escalation Factor	2.44%	3.33%	3.36%	(C)
10	Escalation Amount	$1.87	$2.61	$2.73	(D)
11	**Forecast Unit Cost**	**$78.39**	**$81.19**	**$83.92**	(E)
12	**Forecast Units**	**42,600**	**15,524**	**15,524**	WP 10-16, Line 3
13	**Forecast Total Cost**	**$3,339,598.45**	**$1,260,368.08**	**$1,302,692.34**	Line 12 * Line 13

Notes:

(A) 2020 values used do not align with control file because this includes AC CGI costs only. 2020 recorded costs include all AC inspections. Starting in 2021, this MAT wil only capture AC CGI inspections only. The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) Reduced cost basis by $200,000 to remove IT related costs that incurred in 2020 and are not foreseen to occur in outer years
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.
(F) Line 12, Column C and E values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model
(G) 2023 forecast has an immaterial variance from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to rounding difference.

Table 10-13
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIQ - Atmospheric Corrosion (AC) Meter Inspection - Volume Forecast

		Recorded	Forecast			
Line	**MAT Code (E)**	**2020**	**2021**	**2022**	**2023**	**Notes and References**
1	FIQ - AC Meter Inspection	394,053				(C)
2	FIQ - CGI AC Inspection	30,010	42,600	15,524	15,524	(A), (B), (C), To WP 10-7, Line 242
3	**Total**	**424,063**	**42,600**	**15,524**	**15,524**	
4						

5 **Notes:**

6 (A) 2021-2023 Forecast is based off a 1.14% system wide find rate from a 1-year and 3-year survey cycle.

7 (B) 2021 Forecast includes an additional 28,114 backlog units due to COVID-19.

(C) 2020 Recorded units are significantly higher because it is a combination of AC inspections and CGI inspections. In 2021, AC Inspections will be completed in conjunction with Leak Survey inspections.

8 MAT FIQ will only capture CGI work.

Table 10-14
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEB - Special Leak Survey - Unit Cost Forecast

MAT DEB (UNIT OF MEASURE: NON-UNITIZED)

Note:

(1) MAT DEB is a combination of Super Emitter survey and special survey request surveys (ie. from cities, paving companies, other customers, natural disasters or special DIMP survey outside the annual plan).

Super Emitter Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost	$1,127,675.73	(A), (C)
2020 Recorded Units	2,124,796	(D)
Average Unit Cost	$0.53	Line 7/Line 8
2020 Adjustments to Forecast Basis	$0.00	(B)
2021 Super Emitter Units Planned	2,450,032	(D)
Unit Cost Basis for Forecast	**$0.53**	Line 9 + Line 10
Total Cost Basis for Forecast	**$1,300,285.59**	Line 11 * Line 12

Note:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

(B) No adjustments were made to the forecast basis.

(C) 2020 recorded used as basis for Super Emitter cost forecast. PG&E did not include 2019 recorded because efficiencies were made in 2020 with dedicated Super Emitter drivers that reduced overall overtime costs.

(D) MAT DEB is non-unitized. Super Emitter units are for illustrative purposes only to demonstrate the cost forecast methodology.

Other Special Survey Request Cost Forecast

Description	Value	Notes and References
2017 Recorded Cost	$1,915,792.40	(A), (E)
2017 Recorded Units	1	(E)
2018 Recorded Cost	$728,955.22	(A), (E)
2018 Recorded Units	1	(E)
2019 Recorded Cost	$839,471.44	(A), (E)
2019 Recorded Units	1	(E)
Average Unit Cost	$1,161,406.35	Line 23 + Line 25 + Line 27/Line 24 + Line 26 +Line 28
Adjustments to Forecast Basis (Unitized)	$0.00	(B)
Cost Basis for Forecast	**$1,161,406.35**	Line 29 + Line 30

Note:

(E) 2017-2019 Average cost were used as basis for Other Special Survey Request cost forecast. This work is not planned, thus a 3-year historical average was more represenative of this work.

	2021	2022	2023	Notes and References
Escalation Factor	2.44%	3.33%	3.36%	(F)
Escalation Amount	$60,071.43	$83,974.72	$87,552.80	(G)
Forecast Unit Cost	**$2,521,763.37**	**$2,605,738.09**	**$2,693,290.89**	(H)

Notes:

(F) See Exhibit (PG&E-3), Chapter 2.

(G) Previous year unit cost x Escalation Factor.

(H) Previous year unit cost + Escalation Amount.

(I) Work that was formally done under MAT DEG will be performed under MAT DEB. MAT DEG has been discontinued.

Table 10-15
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEC - Leak Downgrade, No Repair - Unit Cost Forecast

MAT DEC (UNIT OF MEASURE: SERVICES SURVEYED)

Line	Description	Value	Notes and References
3	2020 Recorded Cost	$3,203,497.67	(A)
4	2020 Recorded Units	9,278	
5	Average Unit Cost	$345.28	Line 3/Line4
6	Adjustments to Forecast Basis	$0.00	(B)
7	**Cost Basis for Forecast**	**$345.28**	Line 5 + Line 6

Line		2021	2022	2023	Notes and References
10	Escalation Factor	2.44%	3.33%	3.36%	(C)
11	Escalation Amount	$8.43	$11.78	$12.28	(D)
12	**Forecast Unit Cost**	**$353.70**	**$365.48**	**$377.76**	(E)
13	**Forecast Units**	**8,936**	**8,936**	**8,936**	WP 10-19, Line 1
14	**Forecast Total Cost**	**$3,160,704.05**	**$3,265,955.49**	**$3,375,691.60**	Line 12 * Line 13

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

(B) No adjustments were made to the forecast basis.

(C) See Exhibit (PG&E-3), Chapter 2.

(D) Previous year unit cost x Escalation Factor.

(E) Previous year unit cost + Escalation Amount.

(F) Line 12, Column D and E values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-16
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEC - Leak Downgrade, No Repair - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	DEC - Leak Downgrade, No Repair	9,373	8,936	8,936	8,936	(A)
2						
3	**Notes:**					
4	(A) PG&E's 2021-2023 forecast is based on a three year historical average, 2018-2020 data.					
5						

	2018	2019	2020	3 Yr Average
6				
7 **Grand Total**	8,507	8,929	9,373	8,936

Table 10-17
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DED - Leak Recheck - Unit Cost Forecast

MAT DED (UNIT OF MEASURE: # OF RECHECKS PERFORMED)

Description	Value	Notes and References
2020 Recorded Cost	$2,244,283.47	(A)
2020 Recorded Units	43,484	
2020 Average Unit Cost	$51.61	Line 3/Line 4
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$51.61**	Line 5 + Line 6

	2021	2022	2023	Notes and References
Escalation Factor	2.44%	3.33%	3.36%	(C)
Escalation Amount	$1.26	$1.76	$1.83	(D)
Forecast Unit Cost	**$52.87**	**$54.63**	**$56.47**	(E)
Forecast Units	**43,484**	**43,484**	**43,484**	WP 10-21, Line 1
Forecast Total Cost	**$2,299,049.59**	**$2,375,653.30**	**$2,455,429.82**	Line 12 * Line 13

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

(B) No adjustments were made to the forecast basis.

(C) See Exhibit (PG&E-3), Chapter 2.

(D) Previous year unit cost x Escalation Factor.

(E) Previous year unit cost + Escalation Amount.

(F) Line 12, Column C-E values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-18
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DED - Leak Rechecks - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	DED - Leak Rechecks	43,484	43,484	43,484	43,484	(A), (B)
2						

3 **Notes:**
4 (A) PG&E's 2021-2023 forecast is based on 2020 recorded data.
5 (B) The recorded reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to
6 timing differences.

Table 10-19
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEE - Customer Callouts - Unit Cost Forecast

MAT DEE (UNIT OF MEASURE: # OF CUSTOMER CALLS)

Description	Value	Notes and References
2020 Recorded Cost	$617,314.61	
2020 Recorded Units	3,298	
2020 Average Unit Cost	$187.18	Line 3/Line 4
2020 Adjustments to Forecast Basis	$0.00	(A)
Cost Basis for Forecast	**$187.18**	Line 5 + Line 6

	2021	2022	2023	Notes and References
Escalation Factor	2.44%	3.33%	3.36%	(B)
Escalation Amount	$4.57	$6.39	$6.66	(C)
Forecast Unit Cost	**$191.75**	**$198.13**	**$204.79**	(D)
Forecast Units	**3,693**	**3,693**	**3,693**	WP 10-23, Line 1
Forecast Total Cost	**$708,118.34**	**$731,698.68**	**$756,283.75**	Line 12 * Line 13

Notes:
(A) No adjustments were made to the forecast basis.
(B) See Exhibit (PG&E-3), Chapter 2.
(C) Previous year unit cost x Escalation Factor.
(D) Previous year unit cost + Escalation Amount.

Table 10-20
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DEE - Customer Callouts - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	DEE - Customer Callouts	3,298	3,693	3,693	3,693	(A)

Notes:

(A) PG&E's 2021-2023 forecast is based on a three year historical average, 2018-2020 data.

	2018	2019	2020	3 Yr Average
Grand Total	3,979	3,801	3,298	3,693

Table 10-21
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT DE# - Leak Survey Support - Unit Cost Forecast

MAT DE# (UNIT OF MEASURE: NON-UNITIZED)

Line	Description	Value	Notes and References
2	2020 Recorded Cost	$752,384.77	
3	2020 Recorded Units	1	
4	2020 Average Unit Cost	$752,384.77	Line 3/Line 4
5	2020 Adjustments to Forecast Basis	$2,000,000.00	(A)
6	2020 Adjustments to Forecast Basis	-$45,452.31	(B)
7	**Cost Basis for Forecast**	**$2,706,932.46**	Line 5 + Line 6 + Line 7

Line		2021	2022	2023	Notes and References
10	Escalation Factor	2.44%	3.33%	3.36%	(C)
11	Escalation Amount	$18,360.07	$90,752.24	$94,619.10	(D)
12	**Forecast Unit Cost**	**$2,725,292.52**	**$2,816,044.76**	**$2,910,663.87**	(E)

Notes:

(A) Advanced mobile technology support contract allocated to MAT DE# starting in 2021; previously captured under MAT JVA.
(B) Reduced 2021 forecast to account for finalized O&M Advanced Mobile Technology costs billed in January 2021.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.

(F) Line 13, Column C-E values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-22
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JQA - DIMP Leak Survey - Unit Cost Forecast

MAT JQA (UNIT OF MEASURE: NON-UNITIZED)

Description	Value	Notes and References
2019 Recorded Cost	$654,161.04	
2019 Recorded Units	1	(A)
2020 Recorded Cost	$889,513.06	
2020 Recorded Units	1	(A)
Average Unit Cost	$771,837.05	Line 3 + Line 5/Line 4 + Line 6
Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$771,837.05**	Line 7 + Line 8

	2021	2022	2023	Notes and References
Escalation Factor	2.44%	3.33%	3.36%	(C)
Escalation Amount	$18,834.75	$30,795.43	$27,585.59	(D)
Forecast Unit Cost	**$790,671.80**	**$821,467.23**	**$849,052.82**	(E)

Notes:

(A) MAT JQA became non-unitized starting in 2021. 2019 and 2020 recorded units are for illustrative purposes for the model to work.

(B) No adjustments were made to the forecast basis.

(C) See Exhibit (PG&E-3), Chapter 2.

(D) Previous year unit cost x Escalation Factor.

(E) Previous year unit cost + Escalation Amount.

(F) Line 14, Column C and E values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-23
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Introduction to the Leak Repair Forecast Workpapers

Line No.	**Leak Repair Calculations**	
1	Leak Repair Calculations - Table A supports the forecast number of surveys	
2		
3	Table A1	2021 projected leak find rate by MAT code and leak grade. The total number of leaks found come from WP 10-31, Line 10 (leak find rate calculations).
4	Table A2	2022 projected leak find rate by MAT code and leak grade. The total number of leaks found come from WP 10-32, Line 10 (leak find rate calculations).
5	Table A3	2023 projected leak find rate by MAT code and leak grade. The total number of leaks found come from WP 10-33, Line 10 (leak find rate calculations).
6	Table A4	2024 projected leak find rate by MAT code and leak grade. The total number of leaks found come from WP 10-34, Line 10 (leak find rate calculations).
7	Table A5	2025 projected leak find rate by MAT code and leak grade. The total number of leaks found come from WP 10-35, Line 10 (leak find rate calculations).
8	Table A6	2026 projected leak find rate by MAT code and leak grade. The total number of leaks found come from WP 10-36, Line 10 (leak find rate calculations).
9		
10	Table B	The projected 2020 EOY Above Ground grade 3 Leak backlog will be evenly split as repairs between 2021 and 2022.
11		
12	Notes:	
13	Per Leak Abatement OIR decision, only 2,000 below ground grade 3 leak repairs are to be done per year from 2023-2026.	
14	Grade 1 and grade 2 leak repairs will be the same number of finds that same year.	
15	Above ground grade 3 leak repairs for 2023-2026 will be the number of leaks found from two years prior.	

Table 10-24
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculations Supporting Leak Repair Rates for MWC FI and MWC 50
MWC FI, MAT FIH, Above Ground Leak Repair
MWC FI, MAT FIG, Below Ground Main Leak Repair
MWC FI, MAT FIP, Below Ground Service Leak Repair
MWC 50, MAT 50G, Below Ground Single Service Replacement
MWC 50, MAT 50M, Below Ground Complex Service Replacement

Summary: This workpaper shows the leak repair calculations for above and below ground leak repair and service replacements.

Table A: Projected Leak Repair Rates 2021-2026

Table A1: 2021 Forecast

2021	Grade			
MAT Code	**1**	**2**	**3 (A)**	**MAT Total**
FIH	2,093	683	9,574	**12,349**
FIG	2,546	2,035	900	**5,482**
FIP	3,001	1,100	1,848	**5,949**
50G	959	345	240	**1,544**
50M	35	15	12	**61**
Grade Total	**8,633**	**4,178**	**12,574**	**25,385**

Table A2: 2022 Forecast

2022	Grade			
MAT Code	**1**	**2**	**3 (A)**	**MAT Total**
FIH	2,144	718	9,574	**12,435**
FIG	2,589	2,080	900	**5,569**
FIP	3,053	1,135	1,848	**6,036**
50G	967	348	240	**1,556**
50M	35	15	12	**62**
Grade Total	**8,788**	**4,296**	**12,574**	**25,658**

Table A3: 2023 Forecast

2023	Grade			
MAT Code	**1**	**2**	**3**	**MAT Total**
FIH	2,144	718	5,129	**7,990**
FIG	2,589	2,080	600	**5,269**
FIP	3,053	1,135	1,232	**5,420**
50G	967	348	160	**1,476**
50M	35	15	8	**58**
Grade Total	**8,788**	**4,296**	**7,129**	**20,213**

Table A4: 2024 Forecast

2024	Grade			
MAT Code	**1**	**2**	**3**	**MAT Total**
FIH	2,093	683	5,332	**8,108**
FIG	2,546	2,035	600	**5,182**
FIP	3,001	1,100	1,232	**5,333**
50G	959	345	160	**1,464**
50M	35	15	8	**57**
Grade Total	**8,633**	**4,178**	**7,332**	**20,143**

Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.
Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.
Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.

Table 10-24
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculations Supporting Leak Repair Rates for MWC FI and MWC 50
MWC FI, MAT FIH, Above Ground Leak Repair
MWC FI, MAT FIG, Below Ground Main Leak Repair
MWC FI, MAT FIP, Below Ground Service Leak Repair
MWC 50, MAT 50G, Below Ground Single Service Replacement
MWC 50, MAT 50M, Below Ground Complex Service Replacement

Table A5: 2025 Forecast

2025	Grade			
MAT Code	**1**	**2**	**3**	**MAT Total**
FIH	2,144	718	5,332	8,194
FIG	2,589	2,080	600	5,269
FIP	3,053	1,135	1,232	5,420
50G	967	348	160	**1,476**
50M	35	15	8	**58**
Grade Total	**8,788**	**4,296**	**7,332**	**20,417**

Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.
Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.
Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.

Table A6: 2026 Forecast

2026	Grade			
MAT Code	**1**	**2**	**3**	**MAT Total**
FIH	2,144	718	5,129	7,990
FIG	2,589	2,080	600	5,269
FIP	3,053	1,135	1,232	5,420
50G	967	348	160	**1,476**
50M	35	15	8	**58**
Grade Total	**8,788**	**4,296**	**7,129**	**20,213**

Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.
Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.
Expense MAT codes for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.

Table B: Projected EOY Backlog for 2020

MAT Code	Grade 3
FIH	19,148

Note:
(A) The number of Grade 3 leak repairs in 2021 and 2022 will be captured through the Balancing Account under MAT LWG, LWH, 3PB and 3PC.

Table 10-25
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Summary of Workpaper tables supporting Leak Repair forecast

The following workpapers have been developed to forecast the leak find rate shown on WPs 10-31 to 10-36 and are divided into two groups:

Group 1: Six workpapers that summarize the leak find rate for one year - 2021 (WP 10-31), 2022 (WP 10-32), 2023 (WP 10-33), 2024 (WP 10-34), 2025 (WP 10-35) and 2026 (WP 10-36). Ultimately, the leak find rate is used to develop the forecast leak repair rate (WP 10-26 and WP 10-27).

1) WP 10-31: Leak Find Rate 2021

Step 1: Calculates the total leak find volume for each type of leak - above ground grade 1, 2, and 3 leaks and below ground grade 1, 2 and 3 leaks.
Calculated as: (Forecast Leak Finds per 1,000 Services x Forecast Leak Survey Volume) + Leaks from Customer Call-Ins = Total Leak Finds
Step 2: Converts 15% of the total leak volume from above ground leaks to below ground leaks based on historic conversion rates (WP 10-45).
Step 3: Allocates the total number of leaks found by type of leak to 5 MAT Codes based on historic MAT code splits.
FIH - Service Leak Repair, Above Ground
FIG - Main Leak Repair
FIP - Service Leak Repair, Below Ground
50G - Leak Management, Simple Service Replacement
50M - Leak Management, Complex Service Replacement
Step 4: The total leak find volume is the basis for the leak repair rates, WP 10-27 to WP 10-28

2) WP 10-32: Leak Find Rate 2022
Follows the same processes as described above for the Leak Find Rate 2021 workpaper.

3) WP 10-33: Leak Find Rate 2023
Follows the same processes as described above for the Leak Find Rate 2021 workpaper.

4) WP 10-34: Leak Find Rate 2024
Follows the same processes as described above for the Leak Find Rate 2021 workpaper.

5) WP 10-35: Leak Find Rate 2025
Follows the same processes as described above for the Leak Find Rate 2021 workpaper.

6) WP 10-36: Leak Find Rate 2026
Follows the same processes as described above for the Leak Find Rate 2021 workpaper.

Group 2: Seven workpapers (WP 10-37 to WP 10-46) that are the inputs into the leak find rate summary calculation for each year (WP 10-31 to WP 10-36).

1) WP 10-37: Find Rate per 1,000 Services
This workpaper calculates the find rate per 1,000 services and is used in Step 1 of the leak find rate calculation.
The find rate per 1,000 services is calculated as:
(Number of leaks forecast / Number of surveys) x 1,000

Table 10-25
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Summary of Workpaper tables supporting Leak Repair forecast

2) WP 10-38: Forecast Leaks by Type

This workpaper calculates the number of leak finds by leak type (above/below ground and leak grade).
Forecast leaks by type are an input into the find rate per 1,000 services calculation.

3)WP 10-39: Leak Find Rate by Division

Lists the historic leak find rate per 1,000 services in each division for 2018- 2020 through YTD June.
Calculates the forecast leak find rate per 1,000 services in each division for 2018-2020 based on a three year average:
(2018 find rate + 2019 find rate + 2020 YTD June)/3
Note: Leak find rate by division is an input into the forecast leaks by type calculation.

4)WP 10-40: Survey Volume

Forecasts the number services that will be surveyed by division each year, by Traditional survey and by Picarro survey.
The survey volume is used in Step 1 of the leak find rate calculation.

5) WP 10-44: Call-In Leak Volume

A number of leaks are identified as a result of customers calling in suspicious leaks to PG&E.
This workpaper summarizes the forecast call-in leaks that is used in Step 1 of the leak find rate calculation.

6) WP 10-45: Above Ground to Below Ground Conversion Factor

A portion (15%) of the leaks initially identified as above ground leaks are re-classified to below ground leaks.
This workpaper develops the conversion factor that is used in Step 2 of the leak find rate calculation.

7) WP 10-46: Percent of Above Ground Grade 2 & 3 Leaks Moved from FIH to FIS

A calculation of the percent of above ground leaks categorized as FIS instead of FIH due to riser thread leaks no longer being captured as a gradable leak as of March 2020.
This percentage reduced the number of forecasted above ground grade 2 & 3 call-ins for WP 10-44.

Table 10-26
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculating the Forecast Leak Volume by MAT Code (2021)

Total Leak Volume

Line		Forecasted Leak Find Rate (per 1k services surveyed)	x	Forecasted Leak Survey Volume (in 000s)	=	Forecasted Leak Find Volume from Survey	+	Forecasted Leak Find Volume from Call-Ins	=	Forecasted Leak Volume Total	
3		(A)		(B)				(C)			
4	**Above-Ground Grade 1 Leak Finds**	1.14	x	1,309	=	1,498	+	819	=	2,317	to Line 15
5	**Above-Ground Grade 2 Leak Finds**	0.57	x	1,309	=	744	+	50	=	794	to Line 16
6	**Above-Ground Grade 3 Leak Finds**	4.48	x	1,309	=	5,866	+	142	=	6,008	to Line 17
7	**Below-Ground Grade 1 Leak Finds**	2.73	x	1,309	=	3,579	+	2,737	=	6,316	to Line 18
8	**Below-Ground Grade 2 Leak Finds**	2.26	x	1,309	=	2,962	+	422	=	3,383	to Line 19
9	**Below-Ground Grade 3 Leak Finds**	6.12	x	1,309	=	8,010	+	336	=	8,346	to Line 20
10									**Total**	**27,166**	

Above-Ground to Below-Ground Conversion (D)

		Forecasted Leak Volume Total	+/-	Convert 15% of AG to BG	=	Forecasted Leak Volume (Adjusted)	
14							
15	**Above-Ground Grade 1 Leak Finds**	2,317	-	(2,317) x 15%	=	1,970	to Line 27
16	**Above-Ground Grade 2 Leak Finds**	794	-	(794) x 15%	=	675	to Line 28
17	**Above-Ground Grade 3 Leak Finds**	6,008	-	(6,008) x 15%	=	5,107	to Line 29
18	**Below-Ground Grade 1 Leak Finds**	6,316	+	2,317 x 15%	=	6,663	to Line 30
19	**Below-Ground Grade 2 Leak Finds**	3,383	+	794 x 15%	=	3,503	to Line 31
20	**Below-Ground Grade 3 Leak Finds**	8,346	+	6,008 x 15%	=	9,248	to Line 32

Adjusted Leak Volume by MAT

				Historic MAT Splits (Based on 2016-2017 Recorded Data)						Total Leak Volume by MAT				
25		Forecasted Leak Volume (Adjusted)	x	FIH %	FIG %	FIP %	50G %	50M %	=	FIH	FIG	FIP	50G	50M
26														
27	**Above-Ground Grade 1 Leak Finds**	1,970	x	100%	0%	0%	0%	0%	=	1,970	-	-	-	-
28	**Above-Ground Grade 2 Leak Finds**	675	x	100%	0%	0%	0%	0%	=	675	-	-	-	-
29	**Above-Ground Grade 3 Leak Finds**	5,107	x	100%	0%	0%	0%	0%	=	5,107	-	-	-	-
30	**Below-Ground Grade 1 Leak Finds**	6,663	x	0%	24%	67%	8%	0.5%	=	-	1,577	4,491	562	33
31	**Below-Ground Grade 2 Leak Finds**	3,503	x	0%	43%	49%	7%	0.4%	=	-	1,505	1,723	262	13
32	**Below-Ground Grade 3 Leak Finds**	9,248	x	0%	34%	58%	7%	0.8%	=	-	3,172	5,356	644	76
33									**Total**	**7,752**	**6,254**	**11,571**	**1,467**	**122**
34									**Grand Total**					**27,166**

Details on Tab	References to Supporting Workpapers
(A) Find Rate per 1K Svc	The forecast find rate by leak type is shown on WP 10-37, Lines 1-6
(B) Survey Volume	The total forecast survey volume, summarized by survey type and division, is shown on WP 10-40, Line 4.
(C) Leak Call-In Volume	The call-in leak volumes are shown on WP 10-44: Line 4 (AG1), Line 9 (BG1), Line 14 (AG2), Line 19 (BG2), Line 24 (AG3), Line 29 (BG3).
(D) Above Ground - Below Ground	The above ground leak to below ground leak conversion rate is shown on WP 10-45, Line 23.

Table 10-27
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculating the Forecast Leak Volume by MAT Code (2022)

Total Leak Volume

Line		Forecasted Leak Find Rate (per 1k services surveyed)	x	Forecasted Leak Survey Volume (in 000s)	=	Leak Find Volume from Survey	+	Leak Find Volume from Call-Ins	=	Leak Volume Total	
3		(A)		(B)				(C)			
4	**Above-Ground Grade 1 Leak Finds**	1.1	x	1,362	=	1,558	+	819	=	2,377	to Line 15
5	**Above-Ground Grade 2 Leak Finds**	0.6	x	1,362	=	786	+	50	=	836	to Line 16
6	**Above-Ground Grade 3 Leak Finds**	4.5	x	1,362	=	6,106	+	142	=	6,248	to Line 17
7	**Below-Ground Grade 1 Leak Finds**	2.7	x	1,362	=	3,674	+	2,737	=	6,411	to Line 18
8	**Below-Ground Grade 2 Leak Finds**	2.2	x	1,362	=	3,039	+	422	=	3,460	to Line 19
9	**Below-Ground Grade 3 Leak Finds**	5.9	x	1,362	=	8,070	+	336	=	8,407	to Line 20
10									**Total**	**27,739**	

Above-Ground to Below-Ground Conversion (D)

		Forecasted Leak Volume Total	+/-	Convert 15% of AG to BG	=	Forecasted Leak Volume (Adjusted)	
14							
15	**Above-Ground Grade 1 Leak Finds**	2,377	-	(2,377) x 15%	=	2,021	to Line 27
16	**Above-Ground Grade 2 Leak Finds**	836	-	(836) x 15%	=	710	to Line 28
17	**Above-Ground Grade 3 Leak Finds**	6,248	-	(6,248) x 15%	=	5,311	to Line 29
18	**Below-Ground Grade 1 Leak Finds**	6,411	+	2,377 x 15%	=	6,768	to Line 30
19	**Below-Ground Grade 2 Leak Finds**	3,460	+	836 x 15%	=	3,586	to Line 31
20	**Below-Ground Grade 3 Leak Finds**	8,407	+	6,248 x 15%	=	9,344	to Line 32

Adjusted Leak Volume by MAT

				Historic MAT Splits (Based on 2018-2020 YTD June Recorded Data)						Total Leak Volume by MAT				
25		Forecasted Leak Volume (Adjusted)	x	FIH %	FIG %	FIP %	50G %	50M %	=	FIH	FIG	FIP	50G	50M
26														
27	**Above-Ground Grade 1 Leak Finds**	2,021	x	100%	0%	0%	0%	0%		2,021	-	-	-	-
28	**Above-Ground Grade 2 Leak Finds**	710	x	100%	0%	0%	0%	0%		710	-	-	-	-
29	**Above-Ground Grade 3 Leak Finds**	5,311	x	100%	0%	0%	0%	0%		5,311	-	-	-	-
30	**Below-Ground Grade 1 Leak Finds**	6,768	x	0%	24%	67%	8%	0.5%		-	1,602	4,561	570	34
31	**Below-Ground Grade 2 Leak Finds**	3,586	x	0%	43%	49%	7%	0.4%		-	1,540	1,764	268	13
32	**Below-Ground Grade 3 Leak Finds**	9,344	x	0%	34%	58%	7%	0.8%		-	3,205	5,412	650	77
33									**Total**	**8,042**	**6,347**	**11,737**	**1,489**	**123**
34									**Grand Total**					**27,739**

	Details on Tab	References to Supporting Workpapers
36		
37	(A) Find Rate per 1K Svc	The forecast find rate by leak type is shown on WP 10-37, Lines 8-13.
38	(B) Survey Volume	The total forecast survey volume, summarized by survey type and division, is shown on WP 10-40, Line 52.
39	(C) Call-In Leak Volume	The call-in leak volumes are shown on WP 10-44: Line 4 (AG1), Line 9 (BG1), Line 14 (AG2), Line 19 (BG2), Line 24 (AG3), Line 29 (BG3).
40	(D) Above Ground - Below Ground	The above ground leak to below ground leak conversion rate is shown on WP 10-45, Line 23.

Table 10-28
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculating the Forecast Leak Volume by MAT Code (2023)

Total Leak Volume

	Forecasted Leak Find Rate (per 1k services surveyed)	x	Forecasted Leak Survey Volume (in 000s)	=	Leak Find Volume from Survey	+	Leak Find Volume from Call-Ins	=	Leak Volume Total	
	(A)		(B)				(C)			
Above-Ground Grade 1 Leak Finds	1.1	x	1,362	=	1,558	+	819	=	2,377	to Line 15
Above-Ground Grade 2 Leak Finds	0.6	x	1,362	=	786	+	50	=	836	to Line 16
Above-Ground Grade 3 Leak Finds	4.5	x	1,362	=	6,106	+	142	=	6,248	to Line 17
Below-Ground Grade 1 Leak Finds	2.7	x	1,362	=	3,674	+	2,737	=	6,411	to Line 18
Below-Ground Grade 2 Leak Finds	2.2	x	1,362	=	3,039	+	422	=	3,460	to Line 19
Below-Ground Grade 3 Leak Finds	5.9	x	1,362	=	8,070	+	336	=	8,407	to Line 20
							Total		**27,739**	

Above-Ground to Below-Ground Conversion (D)

	Forecasted Leak Volume Total	+/-	Convert 15% of AG to BG	=	Forecasted Leak Volume (Adjusted)	
Above-Ground Grade 1 Leak Finds	2,377	-	(2,377) x 15%	=	2,021	to Line 27
Above-Ground Grade 2 Leak Finds	836	-	(836) x 15%	=	710	to Line 28
Above-Ground Grade 3 Leak Finds	6,248	-	(6,248) x 15%	=	5,311	to Line 29
Below-Ground Grade 1 Leak Finds	6,411	+	2,377 x 15%	=	6,768	to Line 30
Below-Ground Grade 2 Leak Finds	3,460	+	836 x 15%	=	3,586	to Line 31
Below-Ground Grade 3 Leak Finds	8,407	+	6,248 x 15%	=	9,344	to Line 32

Adjusted Leak Volume by MAT

			Historic MAT Splits (Based on 2018-2020 YTD June Recorded Data)						Total Leak Volume by MAT				
	Forecasted Leak Volume (Adjusted)	x	FIH %	FIG %	FIP %	50G %	50M %	=	FIH	FIG	FIP	50G	50M
			(f)										
Above-Ground Grade 1 Leak Finds	2,021	x	100%	0%	0%	0%	0%		2,021	-	-	-	-
Above-Ground Grade 2 Leak Finds	710	x	100%	0%	0%	0%	0%		710	-	-	-	-
Above-Ground Grade 3 Leak Finds	5,311	x	100%	0%	0%	0%	0%		5,311	-	-	-	-
Below-Ground Grade 1 Leak Finds	6,768	x	0%	24%	67%	8%	0.5%		-	1,602	4,561	570	34
Below-Ground Grade 2 Leak Finds	3,586	x	0%	43%	49%	7%	0.4%		-	1,540	1,764	268	13
Below-Ground Grade 3 Leak Finds	9,344	x	0%	34%	58%	7%	0.8%		-	3,205	5,412	650	77
							Total		**8,042**	**6,347**	**11,737**	**1,489**	**123**
							Grand Total						**27,739**

Details on Tab	References to Supporting Workpapers
(A) Find Rate per 1K Svc	The forecast find rate by leak type is shown on WP 10-37, Lines 15-20.
(B) Survey Volume	The total forecast survey volume, summarized by survey type and division, is shown on WP 10-40, Line 100.
(C) Call-In Leak Volume	The call-in leak volumes are shown on WP 10-44: Line 4 (AG1), Line 9 (BG1), Line 14 (AG2), Line 19 (BG2), Line 24 (AG3), Line 29 (BG3).
(D) Above Ground - Below Ground	The above ground leak to below ground leak conversion rate is shown on WP 10-45, Line 23.

Table 10-29
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculating the Forecast Leak Volume by MAT Code (2024)

Total Leak Volume

Line		Forecasted Leak Find Rate (per 1k services surveyed)	x	Forecasted Leak Survey Volume (in 000s)	=	Forecasted Leak Find Volume from Survey	+	Forecasted Leak Find Volume from Call-Ins	=	Forecasted Leak Volume Total	
3		(A)		(B)				(C)			
4	Above-Ground Grade 1 Leak Finds	1.14	x	1,309	=	1,498	+	819	=	2,317	to Line 15
5	Above-Ground Grade 2 Leak Finds	0.57	x	1,309	=	744	+	50	=	794	to Line 16
6	Above-Ground Grade 3 Leak Finds	4.48	x	1,309	=	5,866	+	142	=	6,008	to Line 17
7	Below-Ground Grade 1 Leak Finds	2.73	x	1,309	=	3,579	+	2,737	=	6,316	to Line 18
8	Below-Ground Grade 2 Leak Finds	2.26	x	1,309	=	2,962	+	422	=	3,383	to Line 19
9	Below-Ground Grade 3 Leak Finds	6.12	x	1,309	=	8,010	+	336	=	8,346	to Line 20
10								Total		**27,166**	

Above-Ground to Below-Ground Conversion (D)

Line		Forecasted Leak Volume Total	+/-	Convert 15% of AG to BG	=	Forecasted Leak Volume (Adjusted)	
14							
15	Above-Ground Grade 1 Leak Finds	2,317	-	(2,317) x 15%	=	1,970	to Line 27
16	Above-Ground Grade 2 Leak Finds	794	-	(794) x 15%	=	675	to Line 28
17	Above-Ground Grade 3 Leak Finds	6,008	-	(6,008) x 15%	=	5,107	to Line 29
18	Below-Ground Grade 1 Leak Finds	6,316	+	2,317 x 15%	=	6,663	to Line 30
19	Below-Ground Grade 2 Leak Finds	3,383	+	794 x 15%	=	3,503	to Line 31
20	Below-Ground Grade 3 Leak Finds	8,346	+	6,008 x 15%	=	9,248	to Line 32

Adjusted Leak Volume by MAT

Line				Historic MAT Splits (Based on 2018-2020 YTD June Recorded Data)						Total Leak Volume by MAT				
25		Forecasted Leak Volume (Adjusted)	x	FIH %	FIG %	FIP %	50G %	50M %	=	FIH	FIG	FIP	50G	50M
26														
27	Above-Ground Grade 1 Leak Finds	1,970	x	100%	0%	0%	0%	0%	=	1,970	-	-	-	-
28	Above-Ground Grade 2 Leak Finds	675	x	100%	0%	0%	0%	0%	=	675	-	-	-	-
29	Above-Ground Grade 3 Leak Finds	5,107	x	100%	0%	0%	0%	0%	=	5,107	-	-	-	-
30	Below-Ground Grade 1 Leak Finds	6,663	x	0%	24%	67%	8%	0.5%	=	-	1,577	4,491	562	33
31	Below-Ground Grade 2 Leak Finds	3,503	x	0%	43%	49%	7%	0.4%	=	-	1,505	1,723	262	13
32	Below-Ground Grade 3 Leak Finds	9,248	x	0%	34%	58%	7%	0.8%	=	-	3,172	5,356	644	76
33									Total	**7,752**	**6,254**	**11,571**	**1,467**	**122**
34									Grand Total					**27,166**

Details on Tab	References to Supporting Workpapers
(A) Find Rate per 1K Svc	The forecast find rate by leak type is shown on WP 10-37, Lines 22-27
(B) Survey Volume	The total forecast survey volume, summarized by survey type and division, is shown on WP 10-40, Line 147.
(C) Leak Call-In Volume	The call-in leak volumes are shown on WP 10-44: Line 4 (AG1), Line 9 (BG1), Line 14 (AG2), Line 19 (BG2), Line 24 (AG3), Line 29 (BG3).
(D) Above Ground - Below Ground	The above ground leak to below ground leak conversion rate is shown on WP 10-45, Line 23.

Table 10-30
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculating the Forecast Leak Volume by MAT Code (2025)

Total Leak Volume

	Forecasted Leak Find Rate (per 1k services surveyed)	x	Forecasted Leak Survey Volume (in 000s)	=	Leak Find Volume from Survey	+	Leak Find Volume from Call-Ins	=	Leak Volume Total	
	(A)		(B)				(C)			
Above-Ground Grade 1 Leak Finds	1.1	x	1,362	=	1,558	+	819	=	2,377	to Line 15
Above-Ground Grade 2 Leak Finds	0.6	x	1,362	=	786	+	50	=	836	to Line 16
Above-Ground Grade 3 Leak Finds	4.5	x	1,362	=	6,106	+	142	=	6,248	to Line 17
Below-Ground Grade 1 Leak Finds	2.7	x	1,362	=	3,674	+	2,737	=	6,411	to Line 18
Below-Ground Grade 2 Leak Finds	2.2	x	1,362	=	3,039	+	422	=	3,460	to Line 19
Below-Ground Grade 3 Leak Finds	5.9	x	1,362	=	8,070	+	336	=	8,407	to Line 20
							Total		**27,739**	

Above-Ground to Below-Ground Conversion (D)

	Forecasted Leak Volume Total	+/-	Convert 15% of AG to BG	=	Forecasted Leak Volume (Adjusted)	
Above-Ground Grade 1 Leak Finds	2,377	-	(2,377) x 15%	=	2,021	to Line 27
Above-Ground Grade 2 Leak Finds	836	-	(836) x 15%	=	710	to Line 28
Above-Ground Grade 3 Leak Finds	6,248	-	(6,248) x 15%	=	5,311	to Line 29
Below-Ground Grade 1 Leak Finds	6,411	+	2,377 x 15%	=	6,768	to Line 30
Below-Ground Grade 2 Leak Finds	3,460	+	836 x 15%	=	3,586	to Line 31
Below-Ground Grade 3 Leak Finds	8,407	+	6,248 x 15%	=	9,344	to Line 32

Adjusted Leak Volume by MAT

			Historic MAT Splits (Based on 2018-2020 YTD June Recorded Data)						Total Leak Volume by MAT				
	Forecasted Leak Volume (Adjusted)	x	FIH %	FIG %	FIP %	50G %	50M %	=	FIH	FIG	FIP	50G	50M
Above-Ground Grade 1 Leak Finds	2,021	x	100%	0%	0%	0%	0%		2,021	-	-	-	-
Above-Ground Grade 2 Leak Finds	710	x	100%	0%	0%	0%	0%		710	-	-	-	-
Above-Ground Grade 3 Leak Finds	5,311	x	100%	0%	0%	0%	0%		5,311	-	-	-	-
Below-Ground Grade 1 Leak Finds	6,768	x	0%	24%	67%	8%	0.5%		-	1,602	4,561	570	34
Below-Ground Grade 2 Leak Finds	3,586	x	0%	43%	49%	7%	0.4%		-	1,540	1,764	268	13
Below-Ground Grade 3 Leak Finds	9,344	x	0%	34%	58%	7%	0.8%		-	3,205	5,412	650	77
								Total	**8,042**	**6,347**	**11,737**	**1,489**	**123**
								Grand Total					**27,739**

Details on Tab	References to Supporting Workpapers
(A) Find Rate per 1K Svc	The forecast find rate by leak type is shown on WP 10-37, Lines 29-34.
(B) Survey Volume	The total forecast survey volume, summarized by survey type and division, is shown on WP 10-40, Line 194.
(C) Call-In Leak Volume	The call-in leak volumes are shown on WP 10-44: Line 4 (AG1), Line 9 (BG1), Line 14 (AG2), Line 19 (BG2), Line 24 (AG3), Line 29 (BG3).
(D) Above Ground - Below Ground	The above ground leak to below ground leak conversion rate is shown on WP 10-45, Line 23.

Table 10-31
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculating the Forecast Leak Volume by MAT Code (2026)

Total Leak Volume

Line		Forecasted Leak Find Rate (per 1k services surveyed)	x	Forecasted Leak Survey Volume (in 000s)	=	Leak Find Volume from Survey	+	Leak Find Volume from Call-Ins	=	Leak Volume Total	
3		(A)		(B)				(C)			
4	Above-Ground Grade 1 Leak Finds	1.1	x	1,362	=	1,558	+	819	=	2,377	to Line 15
5	Above-Ground Grade 2 Leak Finds	0.6	x	1,362	=	786	+	50	=	836	to Line 16
6	Above-Ground Grade 3 Leak Finds	4.5	x	1,362	=	6,106	+	142	=	6,248	to Line 17
7	Below-Ground Grade 1 Leak Finds	2.7	x	1,362	=	3,674	+	2,737	=	6,411	to Line 18
8	Below-Ground Grade 2 Leak Finds	2.2	x	1,362	=	3,039	+	422	=	3,460	to Line 19
9	Below-Ground Grade 3 Leak Finds	5.9	x	1,362	=	8,070	+	336	=	8,407	to Line 20
10									Total	**27,739**	

Above-Ground to Below-Ground Conversion (D)

		Forecasted Leak Volume Total	+/-	Convert 15% of AG to BG	=	Forecasted Leak Volume (Adjusted)	
14							
15	Above-Ground Grade 1 Leak Finds	2,377	-	(2,377) x 15%	=	2,021	to Line 27
16	Above-Ground Grade 2 Leak Finds	836	-	(836) x 15%	=	710	to Line 28
17	Above-Ground Grade 3 Leak Finds	6,248	-	(6,248) x 15%	=	5,311	to Line 29
18	Below-Ground Grade 1 Leak Finds	6,411	+	2,377 x 15%	=	6,768	to Line 30
19	Below-Ground Grade 2 Leak Finds	3,460	+	836 x 15%	=	3,586	to Line 31
20	Below-Ground Grade 3 Leak Finds	8,407	+	6,248 x 15%	=	9,344	to Line 32

Adjusted Leak Volume by MAT

				Historic MAT Splits (Based on 2018-2020 YTD June Recorded Data)						Total Leak Volume by MAT				
25		Forecasted Leak Volume (Adjusted)	x	FIH %	FIG %	FIP %	50G %	50M %	=	FIH	FIG	FIP	50G	50M
26				(f)										
27	Above-Ground Grade 1 Leak Finds	2,021	x	100%	0%	0%	0%	0%		2,021	-	-	-	-
28	Above-Ground Grade 2 Leak Finds	710	x	100%	0%	0%	0%	0%		710	-	-	-	-
29	Above-Ground Grade 3 Leak Finds	5,311	x	100%	0%	0%	0%	0%		5,311	-	-	-	-
30	Below-Ground Grade 1 Leak Finds	6,768	x	0%	24%	67%	8%	0.5%		-	1,602	4,561	570	34
31	Below-Ground Grade 2 Leak Finds	3,586	x	0%	43%	49%	7%	0.4%		-	1,540	1,764	268	13
32	Below-Ground Grade 3 Leak Finds	9,344	x	0%	34%	58%	7%	0.8%		-	3,205	5,412	650	77
33									Total	**8,042**	**6,347**	**11,737**	**1,489**	**123**
34									Grand Total					**27,739**

	Details on Tab	References to Supporting Workpapers
38	(A) Find Rate per 1K Svc	The forecast find rate by leak type is shown on WP 10-37, Lines 36-41.
39	(B) Survey Volume	The total forecast survey volume, summarized by survey type and division, is shown on WP 10-40, Line 242.
40	(C) Call-In Leak Volume	The call-in leak volumes are shown on WP 10-44: Line 4 (AG1), Line 9 (BG1), Line 14 (AG2), Line 19 (BG2), Line 24 (AG3), Line 29 (BG3).
41	(D) Above Ground - Below Ground	The above ground leak to below ground leak conversion rate is shown on WP 10-45, Line 23.

Table10-32
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecast Leak Find Rate by Leak Type (per 1k services surveyed) (2021-2026)

Line	Leak Type	Year	No. of Leaks Forecast (A)	No. of Surveys per Year (B)	Find Rate per 1K Services (C)	
1	Above Ground Grade 1	2021	1,498	1,308,833	1.14	to 2021 Find Rate, WP 10-31, Line 4
2	Above Ground Grade 2	2021	744	1,308,833	0.57	to 2021 Find Rate, WP 10-31, Line 5
3	Above Ground Grade 3	2021	5,866	1,308,833	4.48	to 2021 Find Rate, WP 10-31, Line 6
4	Below Ground Grade 1	2021	3,579	1,308,833	2.73	to 2021 Find Rate, WP 10-31, Line 7
5	Below Ground Grade 2	2021	2,962	1,308,833	2.26	to 2021 Find Rate, WP 10-31, Line 8
6	Below Ground Grade 3	2021	8,010	1,308,833	6.12	to 2021 Find Rate, WP10-31, Line 9
7						
8	Above Ground Grade 1	2022	1,558	1,361,716	1.14	to 2022 Find Rate, WP 10-32, Line 4
9	Above Ground Grade 2	2022	786	1,361,716	0.58	to 2022 Find Rate, WP 10-32, Line 5
10	Above Ground Grade 3	2022	6,106	1,361,716	4.48	to 2022 Find Rate, WP 10-32, Line 6
11	Below Ground Grade 1	2022	3,674	1,361,716	2.70	to 2022 Find Rate, WP 10-32, Line 7
12	Below Ground Grade 2	2022	3,039	1,361,716	2.23	to 2022 Find Rate, WP 10-32, Line 8
13	Below Ground Grade 3	2022	8,070	1,361,716	5.93	to 2022 Find Rate, WP 10-32, Line 9
14						
15	Above Ground Grade 1	2023	1,558	1,361,716	1.14	to 2023 Find Rate, WP 10-33, Line 4
16	Above Ground Grade 2	2023	786	1,361,716	0.58	to 2023 Find Rate, WP 10-33, Line 5
17	Above Ground Grade 3	2023	6,106	1,361,716	4.48	to 2023 Find Rate, WP10-33, Line 6
18	Below Ground Grade 1	2023	3,674	1,361,716	2.70	to 2023 Find Rate, WP 10-33, Line 7
19	Below Ground Grade 2	2023	3,039	1,361,716	2.23	to 2023 Find Rate, WP 10-33, Line 8
20	Below Ground Grade 3	2023	8,070	1,361,716	5.93	to 2023 Find Rate, WP 10-33, Line 9
21						
22	Above Ground Grade 1	2024	1,498	1,308,833	1.14	to 2024 Find Rate, WP 10-34, Line 4
23	Above Ground Grade 2	2024	744	1,308,833	0.57	to 2024 Find Rate, WP 10-34, Line 5
24	Above Ground Grade 3	2024	5,866	1,308,833	4.48	to 2024 Find Rate, WP 10-34, Line 6
25	Below Ground Grade 1	2024	3,579	1,308,833	2.73	to 2024 Find Rate, WP 10-34, Line 7
26	Below Ground Grade 2	2024	2,962	1,308,833	2.26	to 2024 Find Rate, WP 10-34, Line 8
27	Below Ground Grade 3	2024	8,010	1,308,833	6.12	to 2024 Find Rate, WP 10-34, Line 9
28						
29	Above Ground Grade 1	2025	1,558	1,361,716	1.14	to 2025 Find Rate, WP 10-35, Line 4
30	Above Ground Grade 2	2025	786	1,361,716	0.58	to 2025 Find Rate, WP 10-35, Line 5
31	Above Ground Grade 3	2025	6,106	1,361,716	4.48	to 2025 Find Rate, WP 10-35, Line 6
32	Below Ground Grade 1	2025	3,674	1,361,716	2.70	to 2025 Find Rate, WP 10-35, Line 7
33	Below Ground Grade 2	2025	3,039	1,361,716	2.23	to 2025 Find Rate, WP 10-35, Line 8
34	Below Ground Grade 3	2025	8,070	1,361,716	5.93	to 2025 Find Rate, WP 10-35, Line 9
35						
36	Above Ground Grade 1	2026	1,558	1,361,716	1.14	to 2026 Find Rate, WP 10-36, Line 4
37	Above Ground Grade 2	2026	786	1,361,716	0.58	to 2026 Find Rate, WP 10-36, Line 5
38	Above Ground Grade 3	2026	6,106	1,361,716	4.48	to 2026 Find Rate, WP 10-36, Line 6
39	Below Ground Grade 1	2026	3,674	1,361,716	2.70	to 2026 Find Rate, WP 10-36, Line 7
40	Below Ground Grade 2	2026	3,039	1,361,716	2.23	to 2026 Find Rate, WP 10-36, Line 8
41	Below Ground Grade 3	2026	8,070	1,361,716	5.93	to 2026 Find Rate, WP 10-36, Line 9

42 **Notes**

43 (A) The number of forecast leaks is shown on WP 10-38, Forecast Leaks by Grade

44 (B) The forecast number of surveys per year is shown on WP 10-40, Line 4 (2021), Line 52 (2022), Line 100 (2023), Line 147 (2024), Line 194 (2025), Line 242 (2026)

45 (C) The find rate is calculated as = (No. of Leaks/No. of Surveys per Year) x 1,000. See Note A, WP 10-38.

Table 10-33
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecast Number of Leaks Found by Grade (per 1k services surveyed) (2021-2026)

Line	Leak Type	2021 No. of Leaks Forecast (A)	2022 No. of Leaks Forecast (A)	2023 No. of Leaks Forecast (A)	2024 No. of Leaks Forecast (A)	2025 No. of Leaks Forecast (A)	2026 No. of Leaks Forecast (A)
1	Above Ground Grade 1	1,498	1,558	1,558	1,498	1,558	1,558
2	Above Ground Grade 2	744	786	786	744	786	786
3	Above Ground Grade 3	5,866	6,106	6,106	5,866	6,106	6,106
4	Below Ground Grade 1	3,579	3,674	3,674	3,579	3,674	3,674
5	Below Ground Grade 2	2,962	3,039	3,039	2,962	3,039	3,039
6	Below Ground Grade 3	8,010	8,070	8,070	8,010	8,070	8,070

7 Notes:
8 (A) The forecast number of leaks per year is calculated as: the sum of the leak find rate x number of services surveyed for each division.
9 For example, Table 1 below shows how the number of 2021 Above Ground Grade 1 leaks are calculated.
10
11 Table 1 - Calculating the Number of Above Ground Grade 1 Leaks

12 Division	Leak Find Rate by Division	No. Services Annual Survey	No. Services 3 Year Survey	Total Survey	Forecast No. of Leaks Found per 1,000 Services	Notes
13 CC	1.91	11,522	49,547	61,069	116	(B), (C), (D)
14 DA	1.10	6,131	38,407	44,538	49	
15 DI	1.04	7,993	72,369	80,362	84	
16 EB	1.41	15,785	68,984	84,769	120	
17 FR	0.86	12,300	63,952	76,252	65	
18 HB	1.67	3,034	11,218	14,252	24	
19 KE	2.07	8,547	38,500	47,047	97	
20 MI	1.98	13,190	81,108	94,298	187	
21 NB	1.72	7,715	50,120	57,835	100	
22 NV	0.17	8,666	31,399	40,065	7	
23 PN	4.34	10,548	57,944	68,492	297	
24 SA	0.45	22,086	173,096	195,182	87	
25 SF	1.30	11,748	48,618	60,366	79	
26 SI	0.25	8,885	55,320	64,205	16	
27 SJ	0.79	12,891	88,849	101,740	81	
28 SO	0.27	10,026	54,979	65,005	18	
29 ST	0.48	10,602	60,318	70,920	34	
30 YO	0.45	12,978	69,458	82,436	38	
31 Total Above Ground Grade 1 Leaks					1,498	To Line 1 Above

32
33 (B) From WP 10-39, Line 3
34 (C) From WP 10-40, Line 4
35 (D) From WP 10-40, Line 28

Table 10-34
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecast Leak Find Rate by Division (per 1k services surveyed) (2021-2026)

Line			2021-2026 Forecast (A) (B)			2018-2020 YTD June Blend			2020 YTD June		
2	Leak Type	Division	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3
3	AG	CC	1.91	2.06	4.12	1.91				2.06	4.12
4	AG	DA	1.10	0.09	4.28	1.10				0.09	4.28
5	AG	DI	1.04	0.20	7.57	1.04				0.20	7.57
6	AG	EB	1.41	0.87	7.26	1.41				0.87	7.26
7	AG	FR	0.86	0.25	4.29	0.86				0.25	4.29
8	AG	HB	1.67	0.99	3.96	1.67				0.99	3.96
9	AG	KE	2.07	0.39	2.30	2.07				0.39	2.30
10	AG	MI	1.98	0.14	8.13	1.98				0.14	8.13
11	AG	NB	1.72	1.11	5.57	1.72				1.11	5.57
12	AG	NV	0.17	0.26	0.99	0.17				0.26	0.99
13	AG	PN	4.34	0.87	5.62	4.34				0.87	5.62
14	AG	SA	0.45	0.45	3.44	0.45				0.45	3.44
15	AG	SF	1.30	1.01	6.38	1.30				1.01	6.38
16	AG	SI	0.25	0.36	2.82	0.25				0.36	2.82
17	AG	SJ	0.79	0.14	3.82	0.79				0.14	3.82
18	AG	SO	0.27	0.24	0.60	0.27				0.24	0.60
19	AG	ST	0.48	0.69	2.85	0.48				0.69	2.85
20	AG	YO	0.45	0.91	3.96	0.45				0.91	3.96
21	BG	CC	1.88	1.88	2.61	1.88	1.88	2.61			
22	BG	DA	1.62	1.21	4.02	1.62	1.21	4.02			
23	BG	DI	1.39	1.77	3.74	1.39	1.77	3.74			
24	BG	EB	4.19	6.07	10.80	4.19	6.07	10.80			
25	BG	FR	2.37	1.26	4.80	2.37	1.26	4.80			
26	BG	HB	1.58	1.45	3.19	1.58	1.45	3.19			
27	BG	KE	3.76	2.79	8.97	3.76	2.79	8.97			
28	BG	MI	1.62	1.84	4.41	1.62	1.84	4.41			
29	BG	NB	2.98	3.17	5.75	2.98	3.17	5.75			
30	BG	NV	1.54	2.33	1.37	1.54	2.33	1.37			
31	BG	PN	4.86	4.69	12.28	4.86	4.69	12.28			
32	BG	SA	3.47	2.23	3.44	3.47	2.23	3.44			
33	BG	SF	7.20	3.68	38.99	7.20	3.68	38.99			
34	BG	SI	2.53	1.14	1.44	2.53	1.14	1.44			
35	BG	SJ	1.85	1.04	3.92	1.85	1.04	3.92			
36	BG	SO	1.48	1.73	1.80	1.48	1.73	1.80			
37	BG	ST	1.98	1.02	2.39	1.98	1.02	2.39			
38	BG	YO	1.52	1.16	2.12	1.52	1.16	2.12			

Notes

(A) Forecast Leak Find Rate for years 2021-2026 used a blend of 2018-2020 YTD June for AG1 & BG1-BG3 and 2020 YTD June for AG2 & AG3.
(B) AG2 & AG3 only uses 2020 YTD thru June to account for the change in procedure categorizes above ground riser thread leaks as non-gradable moving forward.

Table 10-35
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecasted Leak Survey Volume (2021-2026)

Line	2021 Forecasted Services (Annual Survey)	
1		
2		
3	**Division**	**Div Total**
4	**CC**	11,522
5	**DA**	6,131
6	**DI**	7,993
7	**EB**	15,785
8	**FR**	12,300
9	**HB**	3,034
10	**KE**	8,547
11	**MI**	13,190
12	**NB**	7,715
13	**NV**	8,666
14	**PN**	10,548
15	**SA**	22,086
16	**SF**	11,748
17	**SI**	8,885
18	**SJ**	12,891
19	**SO**	10,026
20	**ST**	10,602
21	**YO**	12,978
22	**Surveys**	**194,647**
23		**Total**

2021 Summary of Services	
Annual	194,647
3 Year	1,114,186
Total	**1,308,833**

24		
25	**2021 Forecasted Services (3 Year Survey)**	
26		
27	**Division**	**Div Total**
28	**CC**	49,547
29	**DA**	38,407
30	**DI**	72,369
31	**EB**	68,984
32	**FR**	63,952
33	**HB**	11,218
34	**KE**	38,500
35	**MI**	81,108
36	**NB**	50,120
37	**NV**	31,399
38	**PN**	57,944
39	**SA**	173,096
40	**SF**	48,618
41	**SI**	55,320
42	**SJ**	88,849
43	**SO**	54,979
44	**ST**	60,318
45	**YO**	69,458
46	**Total**	**1,114,186**
47		
48		
49	**2022 Forecasted Services (Annual Survey)**	
50		
51	**Division**	**Div Total**
52	**CC**	11,522
53	**DA**	6,131
54	**DI**	7,993
55	**EB**	15,785
56	**FR**	12,300
57	**HB**	3,034
58	**KE**	8,547
59	**MI**	13,190
60	**NB**	7,715
61	**NV**	8,666
62	**PN**	10,548
63	**SA**	22,086
64	**SF**	11,748
65	**SI**	8,885
66	**SJ**	12,891
67	**SO**	10,026
68	**ST**	10,602
69	**YO**	12,978
70	**Total**	**194,647**
71		

2022 Summary of Services	
Annual	194,647
3 Year	1,167,069
Total	**1,361,716**

Table 10-35
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecasted Leak Survey Volume (2021-2026)

2022 Forecasted Services (3 Year)	
Division	**Div Total**
CC	59,147
DA	40,475
DI	76,702
EB	68,616
FR	70,778
HB	11,733
KE	42,594
MI	86,299
NB	51,209
NV	37,909
PN	58,841
SA	173,605
SF	45,052
SI	63,064
SJ	88,353
SO	43,513
ST	67,726
YO	81,458
Total	**1,167,069**

2023 Forecasted Services (Traditional Crew)	
Division	**Div Total**
CC	11,522
DA	6,131
DI	7,993
EB	15,785
FR	12,300
HB	3,034
KE	8,547
MI	13,190
NB	7,715
NV	8,666
PN	10,548
SA	22,086
SF	11,748
SI	8,885
SJ	12,891
SO	10,026
ST	10,602
YO	12,978
Total	**194,647**

2023 Summary of Services	
Annual	194,647
3 Year	1,167,069
Total	**1,361,716**

2023 Forecasted Services (3 Year)	
Division	**Div Total**
CC	59,147
DA	40,475
DI	76,702
EB	68,616
FR	70,778
HB	11,733
KE	42,594
MI	86,299
NB	51,209
NV	37,909
PN	58,841
SA	173,605
SF	45,052
SI	63,064
SJ	88,353
SO	43,513
ST	67,726
YO	81,458
Total	**1,167,069**

Table 10-35
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecasted Leak Survey Volume (2021-2026)

2024 Forecasted Services (Annual Survey)	
Division	Div Total
CC	11,522
DA	6,131
DI	7,993
EB	15,785
FR	12,300
HB	3,034
KE	8,547
MI	13,190
NB	7,715
NV	8,666
PN	10,548
SA	22,086
SF	11,748
SI	8,885
SJ	12,891
SO	10,026
ST	10,602
YO	12,978
Surveys	**194,647**
	Total

2024 Summary of Services	
Annual	194,647
3 Year	1,114,186
Total	**1,308,833**

2024 Forecasted Services (3 Year Survey)	
Division	Div Total
CC	49,547
DA	38,407
DI	72,369
EB	68,984
FR	63,952
HB	11,218
KE	38,500
MI	81,108
NB	50,120
NV	31,399
PN	57,944
SA	173,096
SF	48,618
SI	55,320
SJ	88,849
SO	54,979
ST	60,318
YO	69,458
Total	**1,114,186**

2025 Forecasted Services (Annual Survey)	
Division	Div Total
CC	11,522
DA	6,131
DI	7,993
EB	15,785
FR	12,300
HB	3,034
KE	8,547
MI	13,190
NB	7,715
NV	8,666
PN	10,548
SA	22,086
SF	11,748
SI	8,885
SJ	12,891
SO	10,026
ST	10,602
YO	12,978
Total	**194,647**

2025 Summary of Services	
Annual	194,647
3 Year	1,167,069
Total	**1,361,716**

Table 10-35
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecasted Leak Survey Volume (2021-2026)

2025 Forecasted Services (3 Year)	
Division	**Div Total**
CC	59,147
DA	40,475
DI	76,702
EB	68,616
FR	70,778
HB	11,733
KE	42,594
MI	86,299
NB	51,209
NV	37,909
PN	58,841
SA	173,605
SF	45,052
SI	63,064
SJ	88,353
SO	43,513
ST	67,726
YO	81,458
Total	**1,167,069**

2026 Forecasted Services (Traditional Crew)	
Division	**Div Total**
CC	11,522
DA	6,131
DI	7,993
EB	15,785
FR	12,300
HB	3,034
KE	8,547
MI	13,190
NB	7,715
NV	8,666
PN	10,548
SA	22,086
SF	11,748
SI	8,885
SJ	12,891
SO	10,026
ST	10,602
YO	12,978
Total	**194,647**

2026 Summary of Services	
Annual	194,647
3 Year	1,167,069
Total	**1,361,716**

2026 Forecasted Services (3 Year)	
Division	**Div Total**
CC	59,147
DA	40,475
DI	76,702
EB	68,616
FR	70,778
HB	11,733
KE	42,594
MI	86,299
NB	51,209
NV	37,909
PN	58,841
SA	173,605
SF	45,052
SI	63,064
SJ	88,353
SO	43,513
ST	67,726
YO	81,458
Total	**1,167,069**

Table 10-36
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Forecast Leak Volume from Call-Ins (2021-2026)

Grade 1 - Traditional Above Ground Leaks Forecasted for 2021-2026 (average of 2018-2019 actuals) (A)

Month	January	February	March	April	May	June	July	August	September	October	November	December	
Call-Ins	82	75	68	63	63	72	65	66	65	75	60	65	
											Total:	**819**	(E)

Grade 1 - Traditional Below Ground Leaks Forecasted for 2021-2026 (average of 2018-2019 actuals) (B)

Month	January	February	March	April	May	June	July	August	September	October	November	December	
Call-Ins	267	220	263	202	197	196	187	205	218	247	239	295	
											Total:	**2,737**	(F)

Grade 2 - Traditional Above Ground Leaks Forecasted for 2021-2026 (average of 2018-2019 actuals reduced by 65% to account for AG2 leaks moving to FIS) (C)

Month	January	February	March	April	May	June	July	August	September	October	November	December	
Call-Ins	6	5	6	4	4	3	3	4	3	6	4	3	
											Total:	**50**	(G)

Grade 2 - Traditional Below Ground Leaks Forecasted for for 2021-2026 (average of 2018-2019 actuals)

Month	January	February	March	April	May	June	July	August	September	October	November	December	
Call-Ins	53	47	46	25	23	21	26	34	28	32	35	51	
											Total:	**422**	(H)

Grade 3 - Traditional Above Ground Leaks Forecasted for 2021-2026 (average of 2018-2019 actuals reduced by 74% to account for AG3 leaks moving to FIS) (D)

Month	January	February	March	April	May	June	July	August	September	October	November	December	
Call-Ins	10	9	10	12	13	10	13	21	12	13	10	9	
											Total:	**142**	(I)

Grade 3 - Traditional Below Ground Leaks Forecasted for for 2021-2026 (average of 2018-2019 actuals)

Month	January	February	March	April	May	June	July	August	September	October	November	December	
Call-Ins	24	26	30	23	20	24	28	53	30	32	27	19	
											Total:	**336**	(J)

Notes:
(A) The average of 2018-2019 recorded number of call-ins was used as the basis for the above ground leak call-in forecast.
(B) The average of 2018-2019 recorded number of call-ins was used as the basis for the below ground leak call-in forecast.
(C) In 2020, the standard for above ground riser thread leaks was changed to be repaired under FIS rather than FIH moving forward. This accounts for 65% of above ground grade 2 leaks. See WP 10-46.
(D) In 2020, the standard for above ground riser thread leaks was changed to be repaired under FIS rather than FIH moving forward. This accounts for 74% of above ground grade 3 leaks. See WP 10-46.
(E) To WP 10-31, 2021 Find Rate, Line 4; WP 10-32, 2022 Find Rate, Line 4; WP 10-33, 2023 Find Rate, Line 4.
(F) To WP 10-31, 2021 Find Rate, Line 7; WP 10-32, 2022 Find Rate, Line 7; WP 10-33, 2023 Find Rate, Line 7.
(G) To WP 10-31, 2021 Find Rate, Line 5; WP 10-32, 2022 Find Rate, Line 5; WP 10-33, 2023 Find Rate, Line 5.
(H) To WP 10-31, 2021 Find Rate, Line 8; WP 10-32, 2022 Find Rate, Line 8; WP 10-33, 2023 Find Rate, Line 8.
(I) To WP 10-31, 2021 Find Rate, Line 6; WP 10-32, 2022 Find Rate, Line 6; WP 10-33, 2023 Find Rate, Line 6.
(J) To WP 10-31, 2021 Find Rate, Line 9; WP 10-32, 2022 Find Rate, Line 9; WP 10-33, 2023 Find Rate, Line 9.

Table 10-37
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Above Ground Leak to Below Ground Leak Conversion Rate

Line No.

1 2019-2020 YTD June Grade 1 and Grade 2 leaks repaired in MAT codes FIH, FIG, FIP, 50G, 50M (A)

Leak Type	Total Repairs
Above Ground (B) (C) (D)	
FIH	5,516
Total Above Ground	5,516
Below Ground	
FIG	27
FIP	780
50G	144
50M	3
Total Below Ground	954
Above Ground	5,516
Below Ground	954
Total Repairs	6,470

Above ground to below ground conversion rate:

Below Ground Repairs	A	954
Total Repairs	B	6,470
Conversion Rate	C = A/B	15%
Conversion Rate Rounded		15%

To WP 10-31, Lines 15-20; WP 10-32, Lines 15-20; WP 10-33, Lines 15-20

Notes:
(A) Excludes Grade 3 repairs because they were not required in 2019-2020.
(B) 2019-2020 YTD June Above-ground Grade 1 & 2 Leaks Repaired: Includes Distribution leaks identified as above-ground and subsequently repaired in 2019-2020 YTD June under one of the 5 MATs: FIH, FIP, FIG, 50G, 50M.
(C) Excludes above-ground leaks that are caused by Dig-ins/Excavation.
(D) Excludes above-ground leaks that are repaired under a MAT other than FIH, FIP, FIG, 50G, 50M.

Table 10-38
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Adjustment to Above Ground Leak Repair from FIH to FIS

Table A: FIS Incremental Leak Find Rate per 1,000 Services (A)

Line No.	Leak Type	2018-2020 YTD Blended Leak Find Rate	-	2020 YTD thru June Leak Find Rate	=	FIS Incemental Find Rate (B)	/	2018-2020 YTD Blended Leak Find Rate	=	% Change to FIS
3	**Above Ground Grade 2**	1.7	-	0.6	=	1.1	/	1.7	=	65%
4	**Above Ground Grade 3**	17.4	-	4.5	=	12.9	/	17.4	=	74%

Notes:

(A) As of March 2020, all above ground riser thread leaks are to be categorized as a non-gradable leak. Therefore, the leak work will be charged under MAT FIS instead of MAT FIH.

(B) Overall FIS incremental Find Rate is 14.0 leaks per 1,000 services or 1.4%.

Table 10-39
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIG - Main Leak Repair - Unit Cost Forecast

MAT FIG (UNIT OF MEASURE: # OF MAIN LEAKS REPAIRED)

2021 and 2022 Unit Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost (Grade 1 and 2 only)	$25,002,862.85	(A), (C)
2020 Recorded Units (Grade 1 and 2 only)	3,115	
Average Unit Cost	$8,026.60	Line 3/Line 4
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$8,026.60**	Line 5 + Line 6

Note:
(A) 2021 and 2022 unit cost forecast is based on 2020 Grade 1 and Grade 2 recorded costs only. Grade 3 costs will be captured under Balancing Account MAT LWG

2023 Unit Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost (All Grades)	$25,507,987.78	(C)
2020 Recorded Units (All Grades)	3,211	
Average Unit Cost	$7,943.94	Line 15/Line 16
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$7,943.94**	Line 17 + Line 18

	2021 (G), (J)	2022 (G)	2023 (H), (I)	Notes and References
Escalation Factor	3.00%	3.75%	3.75%	(D)
Escalation Amount	$240.80	$310.03	$863.49	(E)
Forecast Unit Cost	**$8,267.40**	**$8,577.43**	**$8,807.43**	(F)
Forecast Units	**4,582**	**4,669**	**5,269**	WP 10-48, Line 1
Forecast Total Cost	**$37,881,223.47**	**$40,048,005.48**	**$46,406,362.56**	Line 24 * Line 25

Note:
(B) No adjustments were made to the forecast basis.
(C) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences. Order detail information was needed in order to identify leak grades and control file did not provide that level of detail.
(D) 3.75% escalation rate was used to account for annual IBEW wage increases in 2022 and 2023.
(E) Previous year unit cost x Escalation Factor.
(F) Previous year unit cost + Escalation Amount.
(G) 2021 and 2022 unit cost forecast includes costs associated only with Below Ground Grade 1 and Grade 2 leak repairs.
(H) 2023 unit cost forecast includes all costs associated with Below Ground Grade 1, 2 and 3 leak repairs.
(I) 2023 forecast has an immaterial variance from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to rounding difference.

(J) 2021 Forecast Total Cost on line 26 is for illustrative purposes in order for the forecast model to work. The actual 2021 forecast is based on approved 2021 budget and can be be found in WP 10-5, line 10.

Table 10-40
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIG - Main Leak Repair - Volume Forecast

Line	MAT Code	Recorded 2020	Forecast 2021	2022	2023	Notes and References
1	FIG - Main Leak Repair	3,136	4,582	4,669	5,269	(A)
2	LWG - BA - Below Ground 3 Main Repair	71	900	900		(A), (B)
3	**Total**	**3,207**	**5,482**	**5,569**	**5,269**	

4 **Notes:**
5 (A) 2021-2023 Forecast is based off a 3 year survey cycle.
6 (B) MAT Code LWG is a MAT Code that was established to track Leak Abatement Balancing Account costs in 2018 and 2019 as part of the Leak Abatement
7 Order Instituting Rulemaking (OIR). The balancing account was extended through 2022. PG&E discusses the Leak Abatement OIR and the balancing account in Exhibit (PG&E-3), Chapter 10, Section D.
8
9

MAT FIG	Grade				
Year	1	2	3 (C)	Total (D)	
2021	2,546	2,035	900	5,482	From WP 10-27, Line 7
2022	2,589	2,080	900	5,569	From WP 10-27, Line 17
2023	2,589	2,080	600	5,269	From WP 10-27, Line 27

14
15 **Notes:**
16 (C) Grade 3 leaks are based on PG&E completing 2,000 Below ground 3 leaks year over year. See Note 1, WP 10-26, Line 13.
17 (D) Refer to WP 10-29 and 10-37 to 10-46 for detailed calculations.

Table 10-41
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIP - Service Leak Repair, Below Ground - Unit Cost Forecast

MAT FIP (UNIT OF MEASURE: # OF SVC LEAK REPAIRS BELOW GROUND)

2021 and 2022 Unit Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost (Grade 1 and 2 only)	$21,921,824.33	(A), (C)
2020 Recorded Units (Grade 1 and 2 only)	5,904	
Average Unit Cost	$3,713.05	Line 3/Line 4
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$3,713.05**	Line 5 + Line 6

Note:
(A) 2021 and 2022 unit cost forecast is based on 2020 Grade 1 and Grade 2 recorded costs only. Grade 3 costs will be captured under Balancing Account MAT LWH.

2023 Unit Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost (All Grades)	$22,274,849.32	(C)
2020 Recorded Units (All Grades)	6,079	
Average Unit Cost	$3,664.23	Line 15/Line 16
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$3,664.23**	Line 17 + Line 18

	2021 (G), (J)	2022 (G)	2023 (H), (I)	Notes and References
Escalation Factor	3.00%	3.75%	3.75%	(D)
Escalation Amount	$111.39	$143.42	$398.30	(E)
Forecast Unit Cost	**$3,824.44**	**$3,967.85**	**$4,062.53**	(F)
Forecast Units	**4,101**	**4,188**	**5,420**	WP 10-50, Line 1
Forecast Total Cost	**$15,684,018.23**	**$16,617,372.20**	**$22,018,886.54**	Line 24 * Line 25

Note:
(B) No adjustments were made to the forecast basis.
(C) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences. Order detail information was needed in order to identify leak grades and control file did not provide that level of detail.
(D) 3.75% escalation rate was used to account for annual IBEW wage increases in 2022 and 2023.
(E) Previous year unit cost x Escalation Factor.
(F) Previous year unit cost + Escalation Amount.
(G) 2021 and 2022 unit cost forecast includes costs associated only with Below Ground Grade 1 and Grade 2 leak repairs.
(H) 2023 unit cost forecast includes all costs associated with Below Ground Grade 1, 2 and 3 leak repairs.
(I) 2023 forecast has an immaterial variance from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to rounding difference.
(J) 2021 Forecast Total Cost on line 26 is for illustrative purposes in order for the forecast model to work. The actual 2021 forecast is based on approved 2021 budget and can be be found in WP 10-5, line 15.

Table 10-42
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIP - Service Leak Repair, Below Ground - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	FIP - Service Leak Repair	5,953	4,101	4,188	5,420	(A)
2	LWH - BA - Below Ground 3 Service Repair	139	1848	1848		(A), (B)
3	**Total**	**6,092**	**5,949**	**6,036**	**5,420**	
4						

5 **Notes:**
6 (A) 2023 Forecast is based off a 3 year survey cycle.
7 (B) MAT Code LWH is a MAT Code that was established to track Leak Abatement Balancing Account costs in 2018 and 2019 as part of the Leak Abatement
8 Order Instituting Rulemaking (OIR). The balancing account was extended through 2022. PG&E discusses the Leak Abatement OIR and the balancing account in Exhibit (PG&E-3), Chapter 10, Section D.
9

10	MAT FIP	Grade				
11	Year	1	2	3 (C)	Total (D)	
12	2021	3,001	1,100	1,848	5,949	From WP 10-27, Line 8
13	2022	3,053	1,135	1,848	6,036	From WP 10-27, Line 18
14	2023	3,053	1,135	1,232	5,420	From WP 10-27, Line 28

15
16 **Notes:**
17 (C) Grade 3 leaks are based on PG&E completing 2,000 Below ground 3 leaks year over year. See Note 1, WP 10-26, Line 13.
18 (D) Refer to WP 10-29 and 10-37 to 10-46 for detailed calculations.

Table 10-43
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIH - Service Leak Repair, Above Ground - Unit Cost Forecast

MAT FIH (UNIT OF MEASURE: # OF SVC LEAK REPAIRS ABOVE GROUND)

Line	Description	Value	Notes and References
3	2020 Recorded Cost	$4,093,121.93	(A)
4	2020 Recorded Units	9,036	
5	2020 Average Unit Cost	$452.98	Line 3/Line 4
6	2020 Adjustments to Forecast Basis	$0.00	(B)
7	**Cost Basis for Forecast**	**$452.98**	Line 5 + Line 6

Line		2021 (F)	2022	2023	Notes and References
10	Escalation Factor	3.00%	3.75%	3.75%	(C)
11	Escalation Amount	$13.59	$17.50	$18.15	(D)
12	**Forecast Unit Cost**	**$466.57**	**$484.07**	**$502.22**	(E)
13	**Forecast Units**	**12,349**	**12,435**	**7,990**	WP 10-52, Line 1
14	**Forecast Total Cost**	**$5,761,829.80**	**$6,019,590.57**	**$4,012,717.58**	Line 12 * Line 13

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences
(B) No adjustments were made to the forecast basis.
(C) 3.75% escalation rate was used to account for annual IBEW wage increases in 2022 and 2023.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.
(F) 2021 Forecast Total Cost on line 14 is for illustrative purposes in order for the forecast model to work. The actual 2021 forecast is based on approved 2021 budget and can be be found in WP 10-5, line 11.

Table 10-44
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIH - Service Leak Repair, Above Ground - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	FIH - Service Leak Repair, Above Ground	9,033	12,349	12,435	7,990	(A)

Notes:
(A) 2023 Forecast is based off a 3 year survey cycle.

MAT FIH	Grade				
Year	1	2	3 (B)	Total (C)	
2021	2,093	683	9,574	12,349	From WP 10-27, Line 6
2022	2,144	718	9,574	12,435	From WP 10-27, Line 16
2023	2,144	718	5,129	7,990	From WP 10-27, Line 26

Notes:
(B) See Note 1, WP 10-26, Line 15.
(C) Refer to WP 10-29 and 10-37 to 10-46 for detailed calculations.

Table 10-45
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIJ - Main Dig-in Repair - Unit Cost Forecast

MAT FIJ (UNIT OF MEASURE: # OF MAIN DIG-INS REPAIRED)

Line	Description	Value	Notes and References
2	2018 Recorded Cost	$1,147,478.65	(A)
3	2018 Recorded Units	351	
4	2019 Recorded Cost	$420,341.08	(A)
5	2019 Recorded Units	290	
6	2020 Recorded Cost	$1,052,030.58	(A)
7	2020 Recorded Units	252	
8	2020 Average Unit Cost	$2,933.76	Line 3 + Line 5 + Line 7/Line 4 + Line 6 +Line 8
9	2020 Adjustments to Forecast Basis	$0.00	(B)
10	**Cost Basis for Forecast**	**$2,933.76**	Line 9 + Line 10

Line		2021	2022	2023	Notes and References
13	Escalation Factor	2.44%	3.33%	3.36%	(C)
14	Escalation Amount	$71.59	$100.14	$104.29	(D)
15	**Forecast Unit Cost**	**$3,005.35**	**$3,105.49**	**$3,209.78**	(E)
16	**Forecast Units**	**310**	**298**	**298**	WP 10-54, Line 1
17	**Forecast Total Cost**	**$931,659.77**	**$925,436.52**	**$956,513.49**	Line 16 * Line 17

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.

Table 10-46
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIJ - Main Dig-in Repair - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	FIJ - Main Dig-in Repair	250	310	298	298	(A), (B)

Notes:

(A) PG&E's 2021 forecast is based on imputed unit target.

(B) PG&E's 2022 and 2023 forecast is based on a three year historical average, 2018-2020 data. The values in line 1 and line 8 do not match due to rounding difference.

	2018	2019	2020	3 Yr Average
Grand Total	351	295	250	299

Table 10-47
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIK - Service Dig-in Repair - Unit Cost Forecast

MAT FIK (UNIT OF MEASURE: # OF SVC DIG-INS REPAIRED)

Line	Description	Value	Notes and References
2	2018 Recorded Cost	$1,687,656.45	(A)
3	2018 Recorded Units	1,667	
4	2019 Recorded Cost	$1,498,528.54	(A)
5	2019 Recorded Units	1,587	
6	2020 Recorded Cost	$970,020.47	(A)
7	2020 Recorded Units	1,542	
8	2020 Average Unit Cost	$866.60	Line 3 + Line 5 + Line 7/Line 4 + Line 6 +Line 8
9	2020 Adjustments to Forecast Basis	$0.00	(B)
10	**Cost Basis for Forecast**	**$866.60**	Line 9 + Line 10

Line		2021	2022	2023	Notes and References
13	Escalation Factor	2.44%	3.33%	3.36%	(C)
14	Escalation Amount	$21.15	$29.58	$30.80	(D)
15	**Forecast Unit Cost**	**$887.75**	**$917.32**	**$948.13**	(E)
16	**Forecast Units**	**1,502**	**1,617**	**1,617**	WP 10-56, Line 1
17	**Forecast Total Cost**	**$1,333,393.69**	**$1,483,314.37**	**$1,533,125.37**	Line 16 * Line 17

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.

Table 10-48
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIK - Service Dig-in Repair - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	FIK - Service Dig-in Repair	1,522	1,502	1,617	1,617	(A), (B)
2						
3	**Notes:**					
4	(A) PG&E's 2021 forecast is based on imputed unit target.					
5	(B) PG&E's 2022 and 2023 forecast is based on a three year historical average, 2018-2020 data.					
6						

		2018	2019	2020	3 Yr Average
7					
8	**Grand Total**	1,687	1,641	1,522	1,617

Table 10-49
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIM - Leak Management, Major Event - Unit Cost Forecast

MAT FIM (UNIT OF MEASURE: NON-UNITIZED)

Line	Description	Value	Notes and References
3	2019 Recorded Cost	$367,155.07	(A)
4	2019 Recorded Units	1	
5	2020 Recorded Cost	$493,762.35	(A)
6	2020 Recorded Units	1	
7	2020 Average Unit Cost	$430,458.71	Line 3 + Line 5/Line 4 + Line 6
8	2020 Adjustments to Forecast Basis	$0.00	(B)
9	**Cost Basis for Forecast**	**$430,458.71**	Line 7 + Line 8

Line		2021	2022	2023	Notes and References
12	Escalation Factor	2.44%	3.33%	3.36%	(C)
13	Escalation Amount	$10,504.27	$14,692.77	$15,301.32	(D)
14	**Forecast Unit Cost**	**$440,962.98**	**$455,655.74**	**$470,957.06**	(E)

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.

Table 10-50
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Introduction to Meter Set Leak Repair Forecast Calculations

Meter Set Leak (MSL) Find Rate Forecast using 3 Year Average

Work Year	Leak Survey Volume (A)	Finds Recorded (B)	Find %
2018	1,238,404	99,210	8.01%
2019	1,032,232	96,502	9.35%
2020	896,875	60,184	6.71%
Sub Total (C)	3,167,511	255,896	8.08%

Note:
(A) 2020 Leak Survey inspection and Find volume is through June 30, 2020.
(B) The Meter Set Leak Find Rate is calculated as the total number of services surveyed (2018-June 2020) divided by the volume of finds loaded into AOC Tool.
(C) Applied 8.08% Find Rate for MSL is based on 3 year average 2018-June of 2020 percentage of AOC Finds.

Volume Assumptions using MSL Find Rate and Riser Thread Leak (RTL) Find Rate

MAT Code FIS Forecast Finds					
2020 Survey	Find Rate (D)		Survey (E)		Leaks
Meter Set Leak	6.71%	x	1,609,671	=	108,009
Riser Thread Leaks (F), (G)	1.40%	x	1,469,882	=	20,578
Total Finds					**128,587**
2021 Survey					
Meter Set Leak	8.08%	x	1,308,833	=	105,754
Riser Thread Leaks	1.40%	x	1,308,833	=	18,324
Total Finds					**124,077**
2022 Survey					
Meter Set Leak	8.08%	x	1,361,716	=	110,027
Riser Thread Leaks	1.40%	x	1,361,716	=	19,064
Total Finds					**129,091**
2023 Survey					
Meter Set Leak	8.08%	x	1,361,716	=	110,027
Riser Thread Leaks	1.40%	x	1,361,716	=	19,064
Total Finds					**129,091**

Note:
(D) Meter Set Leak Find Rate- used 2020 actuals (thru July) for 2020 forecast, and a 3 year average find rate for 2021 - 2023 (shown in above table)
(E) Survey is based on total number of 1 year and 3 year services planned each year. See WP 10-7.
(F) Riser Thread Leak Procedure changed in March; find rate forecast is based on volume of services from the procedure change through end of year. See Supplemental Workpaper: TD-4110P-09 Leak Grading & Response.
(G) Refer to WP 10-46 for MAT FIS incremental Leak Find Rate calculation for Riser Thread Leaks.

Table 10-50
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Introduction to Meter Set Leak Repair Forecast Calculations

Volume of Riser Thread Leaks Impact to MAT Code FIS

Riser Thread Leaks	Imputted Units/GRC Units (H)	x	M&C Referral Rate (H)	=	M&C Leaks	x	M&C FIS Rate (I)	=	M&C to FIS	Field Service to FIS	Other M&C MAT Code (referral - not to FIS) (K)
	(a)		(b)		(a) x (b) = (c)		(d)		(c) x (d) = (e)	(a) - (e) - (f) = (g)	(c) - (e) = (f)
2021	12,762	x	0.15	=	1,914	x	0.88	=	1,685	10,848	230
2022	10,385	x	0.15	=	1,558	x	0.88	=	1,371	8,827	187
2023	19,064	x	0.15	=	2,860	x	0.88	=	2,516	16,204	343

Note:
(H) Imputted GRC Units (2021/2022) for MAT FIS. Imputted units from MAT FIH were calculated by taking 15% of imputted to determine the volume of units that M&C would work. Of that volume, 88% are completed to MAT Code FIS.
(I) M&C FIS Rate represents the volume of units that are initially assigned to M&C and gets corrected to MAT FIS for Field Service to complete.
(J) 85% of units are forecast to be worked by Field Service
(K) A portion of M&C work will not be completed to MAT Code FIS.

Volume of Repairs per Year (Includes Meter Set Leak-MSL and Riser Thread Leak-RT)

Repair Forecast	MSL	MSL 10% Add	MSL Units	RTL FS	RTL M&C	Total
2021 (L)	78,467		78,467	10,848	1,685	91,000
2022 (L)	80,800		80,800	8,827	1,371	90,998
2023 (M)	110,027	11,003	121,029	16,204	2,516	139,750

Note:
(L) Received increased funding in 2021/2022 to complete additional repairs over 2020 GRC imputted repair. Total repairs in 2021 and 2022 was determined by Subject Matter Expert and Leadership.
(M) 2023 forecast includes the find rate volume for MSL plus a 10% adder to address pending units, and find volume for RTL (minus RTL units that will not be repaired to MAT FIS).
(N) Volume of RTL found will not result in the same repair volume to MAT Code FIS. A small portion of RTL will not be repaired to MAT FIS and thus are not included in the financial unit projection.

Total Volume of Work Transferred to AMP System and Volume Pending at 2020 YE

Meter Set Leak	Total in AMP (O)	Complete (P)	Pending (Q)
Meter Set Leak Found 2017	57,712	56,057	1,655
Meter Set Leak Found 2018	93,861	79,081	14,780
Meter Set Leak Found 2019	91,038	54,866	36,172
Meter Set/Riser Thread Leak Found 2020 (A)	127,772	29,394	98,378
(2020 Meter Set Leaks Delivered to AMP)	108,173		
(2020 Riser Thread Leaks Delivered to AMP)	19,599		
Total Meter Set Leak Found 2017-2020	370,383	219,398	**150,985**

Note:
(O) Total Volume of Leaks successfully delivered to AMP System.
(P) Total Volume of Leaks complete by 1/1/2021.
(Q) Total Volume of Leaks pending on 1/1/2021.

Table 10-50
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Introduction to Meter Set Leak Repair Forecast Calculations

Forecast / Repair Walk	SAP Units	AMP Units (T)
Forecast of Repairs 2020 - 2026		
2020 YE Pending	150,985	150,985
2021 Forecst FIS Finds	124,077	124,077
Sub Total	275,062	275,062
2021 Repair Forecast	**91,000**	**104,650**
2021 YE Pending	184,062	170,412
2022 Forecast Finds	129,091	129,091
Sub Total	313,153	299,503
2022 Repair Forecast	**90,998**	**104,648**
2022 YE Pending	222,155	194,855
2023 Forecast Finds	129,091	129,091
Sub Total	351,245	323,946
2023 Repair Forecast	**139,750**	**160,713**
2023 YE Pending	211,495	163,233
2024 Forecast Finds	129,091	129,091
Sub Total	340,586	292,324
2024 Repair Forecast	**139,750**	**160,713**
2024 YE Pending	200,836	131,611
2025 Forecast Finds	129,091	129,091
Sub Total	329,926	260,702
2025 Repair Forecast	**139,750**	**160,713**
2025 YE Pending	190,176	99,989
2026 Forecast Finds	129,091	129,091
Sub Total	319,267	229,079
2026 Repair Forecast	**139,750**	**160,713**
2026 YE Pending	179,517	68,367

Note:
(R) Expense forecast for MAT FIH for 2023-2026 are included only for the model to function correctly. Expense amounts are forecast only through 2023.
(S) Repair forecast includes annual find volume and would be a combination of prior year and current year finds.

(T) SAP units are based on the financial charges. AMP units include bundling capability. PG&E assumes 15% of MSL can be bundled while performing other routine maintenance work (ie. Meter Change, various AOC work types, Gas Leak & Emergency Calls).
(U) Company goal is to have approxiametely 70,000 pending units at the end of this Rate Case period. With bundling and completing MSL work while performing maintenance at the meter, that goal can be achieved.

Table 10-51
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIS - Meter Set Leak Repair - Unit Cost Forecast

MAT FIS (UNIT OF MEASURE: # OF METERS REPAIRED)

Note:
(1) MAT FIS includes two types of repairs: meter set leak repair and riser thread leak repair.
(2) MAT FIS unit cost is a combination of: (a) cost to repair meter set leak, (b) cost to repair riser thread leak by Field Services (FS), and (c) cost to repair riser thread leak by M&C.

Meter Set Leak Unit Cost Forecast

Description	Value	Notes and References
2019 Recorded Cost	$6,325,995.49	(A)
2019 Recorded Units	68,158	(A)
2019 Average Unit Cost	$92.81	Line 8/Line 9
Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$92.81**	Line 10 + Line 11

Note:

(A) 2019 Recorded costs was used as cost basis for meter set leak repair due to COVID-19. There were delays in job times that impacted overall cost in 2020 that is not represenative of the scope of work.
(B) No adjustments were made to the forecast basis.

Field Services Riser Thread Leak Unit Cost Forecast

Description	Value	Notes and References
2018-2020 Mid-Year Cost (Grade 2)	$225,953.18	(C)
2018-2020 Mid-Year Units (Grade 2)	978	(C)
Average Unit Cost (Grade 2)	$231.04	Line 20/Line 21
2018-2020 Mid-Year Cost (Grade 3)	$3,143,001.63	(C)
2018-2020 Mid-Year Units (Grade 3)	19,998	(C)
Average Unit Cost (Grade 3)	$157.17	Line 23/Line 24
Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$160.61**	Line 20 + Line 23/Line 21 + Line 24

Note:
(C) Field Service unit cost for Riser Thread Leaks takes the total cost charged to MAT FIH (prior to procedure update) and the units completed by Field Service from 2018 to July YTD 2020. It is a blended cost of Grade 2 and Grade 3 leaks only.

M&C Riser Thread Leak Unit Cost Forecast

Description	Value	Notes and References
2018-2020 Mid-Year Cost (Grade 2)	$585,205.92	(D)
2018-2020 Mid-Year Units (Grade 2)	1,752	(D)
Average Unit Cost (Grade 2)	$334.02	Line 34/Line 35
2018-2020 Mid-Year Cost (Grade 3)	$1,803,417.62	(D)
2018-2020 Mid-Year Units (Grade 3)	6,074	(D)
Average Unit Cost (Grade 3)	$296.91	Line 37/Line 38
Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$305.22**	Line 34 + Line 37/Line 35 + Line 38

Note:
(D) M&C unit cost for Riser Thread Leaks takes the total cost charged to MAT FIH (prior to procedure update) and the units completed by M&C from 2018 to July YTD 2020. It is a blended cost of Grade 2 and Grade 3 leaks only.

Table 10-51
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIS - Meter Set Leak Repair - Unit Cost Forecast

MAT FIS Unit Cost

	2020 (E)	2021 (F)	2022	2023	Notes and References
Escalation Factor	1.88%	2.44%	3.33%	3.36%	(F)
Meter Repair	$94.56	$96.87	$100.09	$103.45	(G)
FS Riser Thread Leak	-	$164.53	$170.01	$175.72	(G)
M&C Riser Thread Leak	-	$312.66	$323.08	$333.93	(G)
Forecast Unit Cost	-	**$111.72**	**$110.23**	**$115.98**	(H)

Note:
(E) The 2020 unit cost shown for Meter repair is for illustrative purposes for the model to work and do not tie to 2020 actual recorded costs.
(F) See Exhibit (PG&E-3), Chapter 2.
(G) Previous year unit cost + Escalation Amount.

(H) The forecast unit cost is the average unit cost of: (a) meter set repair, (b) FS riser thread repair, and (c) M&C riser thread repair. It takes the total cost (Line 74) divided by the total unit forecast (Line 64).

MAT FIS Unit Forecast (I)

	2021	2022	2023
Meter Repair	78,467	80,800	121,029
FS Riser Thread Leak	10,848	8,827	16,204
M&C Riser Thread Leak	1,685	1,371	2,516
Total Units Forecast	**91,000**	**90,998**	**139,749**

Note:
(I) The table above is for illustrative purposes for the model to work. Refer to WP 10-58 for MAT FIS Unit workpapers.

MAT FIS Total Cost Forecast (J)

	2021 (F)	2022	2023
Meter Repair	$7,854,601.53	$8,087,521.82	$12,520,971.16
FS Riser Thread Leak	$1,784,813.40	$1,500,690.00	$2,847,374.31
M&C Riser Thread Leak	$526,839.58	$442,945.88	$840,172.22
Total Cost Forecast	**$10,166,254.51**	**$10,031,157.70**	**$16,208,517.68**

Note:

(J) The table above is for illustrative purposes for the model to work. Total cost is calculated based on individual unit cost plus escalation (Line 48-50) multiplied by the total unit forecast (Line 64).
(K) Line 74, Column C value varies from the value listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. This amount does not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-52
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FIS - Meter Set Leak Repair - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	FIS - Meter Set Leak Repair	64,166	91,000	90,998	139,749	(A)
3						
4	**Notes:**					
5	(A) Refer to WP 10-58 through WP 10-60 for volume calculation and assumptions.					

Table 10-53
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT FI# - Leak Repair Support - Unit Cost Forecast

MAT FI# (UNIT OF MEASURE: NON-UNITIZED)

Line	Description	Value	Notes and References
3	2020 Recorded Cost	$3,642,953.89	(A)
4	2020 Recorded Units	1	
5	2020 Average Unit Cost	$3,642,953.89	Line 3/Line 4
6	2020 Adjustments to Forecast Basis	$0.00	(B)
7	**Cost Basis for Forecast**	**$3,642,953.89**	Line 5 + Line 6

Line		2021	2022	2023	Notes and References
10	Escalation Factor	2.44%	3.33%	3.36%	(C)
11	Escalation Amount	$88,897.17	$124,270.64	$129,494.42	(D)
12	**Forecast Unit Cost**	**$3,731,851.06**	**$3,856,195.32**	**$3,985,689.75**	(E)

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.

Table 10-54
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Introduction to the Transmission Leak Repair Forecast Calculations

Line	
	Leak Repair Calculations
1	Leak Repair Calculations - Tables 1-4 support the number of leaks forecast for repair (WP 10-66, Lines 30-32)
2	
3	**Table 1** Historical Below Ground Transmission leaks found 2017-2019
	Table 2 Historical Above Ground Transmission leaks found 2017-2019
4	**Table 3** Open Above Ground Grade 3 leaks 2018-2020 YTD (Source from 6/8/2020)
5	**Table 4** 2021-2023 Overall Transmission Leak Repair forecast
6	
7	**Notes**
8	(A) 2021-2023 forecast uses 2019 leak find rate to develop forecast.
9	(B) General Order 112-F went into effect in 2017 which required Grade 2 and Grade 3 below ground leaks to be repaired within 12 months.
10	(C) To address the above ground Grade 3 leak backlog to meet Leak Abatement Best Practice 21 requirements, all open above ground Grade 3 leaks will be repaired within 36 months.
11	(D) Leak repair forecast assumes active open Grade 3 above ground leaks found in 2018-2020 YTD will be repaired in 2021-2023 as leaks come due.

Table 10-55
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
Calculations Supporting Leak Repair Rates for MWC JO
MWC JO, MAT JOP, Transmission Leak Repair

Summary: This workpaper shows the leak repair calculations for transmission leak repairs.
Note: This calculation excludes leaks found during CARB and CalGEM survey. Those repairs are captured under MAT JPR.

Line

Table 1 Historical Below Ground Transmission leaks found 2017-2019

MAT JOP	Grade			
Year	1	2	3	Total
2017	29	419	97	**545**
2018	38	560	16	**614**
2019	44	712	-	**756**
Grand Total	**111**	**1,691**	**113**	**1,915**

Note: In 2019, PG&E chose to eliminate Grade 3 classification for below ground transmission leaks.

Table 2 Historical Above Ground Transmission leaks found 2017-2019

MAT JOP	Grade			
Year	1	2	3	Total
2017	8	406	112	**526**
2018	12	754	240	**1,006**
2019	33	1,113	427	**1,573**
Grand Total	**53**	**2,273**	**779**	**3,105**

Table 3 Open Above Ground Grade 3 leaks 2018-2020 YTD (Source from 6/8/2020)

MAT JOP	Grade
Year	3
2018	46
2019	291
2020 YTD	476
Grand Total	**813**

Table 4 2021-2023 Overall Transmission Leak Repair forecast

MAT JOP	Above Ground (B), (C)			Below Ground (A)			
Year	1	2	3	1	2	3	Total
2021	33	1,113	473	44	712	-	**2,375**
2022	33	1,113	718	44	712	-	**2,620**
2023	33	1,113	1,379	44	712	-	**3,281**
Grand Total	**99**	**3,339**	**2,570**	**132**	**2,136**	**-**	**8,276**

Note:
(A) Below Ground leak repair forecast is based on 2019 Below Ground leaks found. See Table 1, Line 6.
(B) Above Ground leak repair forecast for Grade 1 and Grade 2 leaks are based on 2019 Above Ground leaks found. See Table 2, Line 16.
(C) Above Ground Grade 3 leak repair forecast is based on 2019 Above Ground leaks found plus active open leaks.
(D) 2021 Above Ground Grade 3 = 2019 Above Ground Grade 3 leaks found + 2018 Open Above Ground Grade 3 leaks (Line 16 + Line 22).
(E) 2022 Above Ground Grade 3 = 2019 Above Ground Grade 3 leaks found + 2019 Open Above Ground Grade 3 leaks (Line 16 + Line 23).
(F) 2023 Above Ground Grade 3 = 2019 Above Ground Grade 3 leaks found + 2020 YTD Open Above Ground Grade 3 leaks(x2) (Line 16 + Line 24). Line 24 is doubled to account for the second half of the year.

Table 10-56
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JOP - Transmission Leak Repairs - Unit Cost Forecast

MAT JOP (UNIT OF MEASURE: # LEAKS REPAIRED)

Description	Value	Notes and References
2019 Recorded Cost	$3,192,465.91	(A)
2019 Recorded Units	936	
2020 Recorded Cost	$5,828,225.73	(A)
2020 Recorded Units	1,548	
Average Unit Cost	$3,631.52	Line 3 + Line 5/Line 4 + Line 6
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$3,631.52**	Line 7 + Line 8

	2021 (F)	2022	2023	Notes and References
Escalation Factor	3.00%	3.75%	3.75%	(C)
Escalation Amount	$108.95	$140.27	$ 145.53	(D)
Forecast Unit Cost	**$3,740.46**	**$3,880.73**	**$ 4,026.26**	(E)
Forecast Units	**2,375**	**2,620**	**3,281**	WP 10-68, Line 1
Forecast Total Cost	**$8,883,601.82**	**$10,167,516.06**	**$13,210,154.95**	Line 14 * Line 15

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

(B) No adjustments were made to the forecast basis.

(C) 3.75% escalation rate was used to account for annual IBEW wage increases.

(D) Previous year unit cost x Escalation Factor.

(E) Previous year unit cost + Escalation Amount.

(F) 2021 Forecast Total Cost on line 16 is for illustrative purposes in order for the forecast model to work. The actual 2021 forecast is based on approved 2021 budget and can be found in WP 10-5, line 30.

Table 10-57
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JOP - Transmission Leak Repair - Volume Forecast

		Recorded	Forecast			
Line	MAT Code (D)	2020	2021	2022	2023	Notes and References
1	JOP - Transmission Leak Repair	1,501	2,375	2,620	3,281	(A)

Notes:
(A) 2021-2023 forecast is based on 2019 leaks found.

MAT JOP	Grade (F)				
Year	1	2	3	Total (G)	
2021	77	1,825	473	2,375	From WP 10-66, Line 30
2022	77	1,825	718	2,620	From WP 10-66, Line 31
2023	77	1,825	1,379	3,281	From WP 10-66, Line 32

Notes:
(F) Refer to WP 10-66 for detailed calculations.
(G) See WP 10-66, Table 4.

Table 10-58
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JOE - Ground Leak Survey - Unit Cost Forecast

MAT JOE (UNIT OF MEASURE: MILES SURVEYED)

Description	Value	Notes and References
2020 Recorded Cost	$895,269.01	(A)
2020 Recorded Units	444	
2020 Average Unit Cost	$2,016.37	Line 3/Line 4
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$2,016.37**	Line 5 + Line 6

	2021	2022	2023	Notes and References
Escalation Factor	2.24%	3.28%	3.36%	(C)
Escalation Amount	$45.17	$67.62	$71.54	(D)
Forecast Unit Cost	**$2,061.54**	**$2,129.16**	**$2,200.70**	(E)
Forecast Units	**440**	**440**	**440**	WP 10-70, Line 1
Forecast Total Cost	**$907,076.88**	**$936,829.00**	**$968,306.46**	Line 12 * Line 13

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.

(F) Line 12, Column C-E values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-59
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JOE - Transmission Ground Leak Survey - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	JOE - Ground Leak Survey	444	440	440	440	(A)
2						
3	**Notes:**					
4	(A) PG&E's 2023 forecast is based on 2020 Spring survey actuals and doubled to account for Fall survey.					

Table 10-60
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JOR - Transmission Leak Rechecks - Unit Cost Forecast

MAT JOR (UNIT OF MEASURE: # OF RECHECKS PERFORMED)

Description	Value	Notes and References
2020 Recorded Cost	$229,066.07	(A)
2020 Recorded Units	2,818	
2020 Average Unit Cost	$81.29	Line 3/Line 4
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$81.29**	Line 5 + Line 6

	2021 (F)	2022	2023	Notes and References
Escalation Factor	-	3.28%	3.36%	(C)
Escalation Amount	-	$3.00	$2.96	(D)
Forecast Unit Cost	**$85.00**	**$88.00**	**$90.96**	(E)
Forecast Units	**2,816**	**2,816**	**2,816**	WP 10-72, Line 1
Forecast Total Cost	**$239,360.00**	**$247,808.00**	**$256,134.35**	Line 12 * Line 13

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.
(F) 2021 unit cost forecast was originally $155. As part of an internal, leadership driven affordability challenge, the unit cost was reduced to $85. It used 2020 actuals as the base with an additional buffer.

Table 10-61
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JOR - Transmission Leak Rechecks - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	JOR - Transmissiom Recheck	2,816	2,816	2,816	2,816	(A)
2						
3	**Notes:**					
4	(A) PG&E's 2021-2023 forecast is based on 2020 recorded data.					

Table 10-62
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JOW - Aerial Leak Survey - Unit Cost Forecast

MAT JOW (UNIT OF MEASURE: MILES SURVEYED)

Line	Description	Value	Notes and References
2	2020 Recorded Cost	$1,454,729.27	(A), (F)
3	2020 Recorded Units	12,832	
4	2020 Average Unit Cost	$113.37	Line 3/Line 4
5	2020 Adjustments to Forecast Basis	-$198,408.46	(B)
6	**Cost Basis for Forecast**	**$128.83**	Line 5 + Line 6

Line		2021 (F)	2022	2023	Notes and References
9	Escalation Factor	-	3.28%	3.36%	(C)
10	Escalation Amount	-	$5.81	$6.15	(D)
11	**Forecast Unit Cost**	**$177.11**	**$182.91**	**$189.06**	(E)
12	**Forecast Units**	**12,807**	**12,807**	**12,807**	WP 10-74, Line 1
13	**Forecast Total Cost**	**$2,268,186.00**	**$2,342,582.50**	**$2,421,293.27**	Line 12 * Line 13

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

(B) In 2020, MAT JOW started with a $0.2M negative balance due to a double accrual error.

(C) See Exhibit (PG&E-3), Chapter 2.

(D) Previous year unit cost x Escalation Factor.

(E) Previous year unit cost + Escalation Amount.

(F) 2021 forecast is based on vendor invoice. 2020 recorded costs are shown for comparison only.

(G) Line 12, Column D and E values vary from the values listed in the Standard Workpapers and Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 10-63
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JOW - Transmission Aerial Leak Survey - Volume Forecast

		Recorded	Forecast			
Line	MAT Code	2020	2021	2022	2023	Notes and References
1	JOW - Aerial Leak Survey	12,832	12,807	12,807	12,807	(A) WP 10-73, Line 13
2						
3	**Notes:**					
4	(A) PG&E's 2023 forecast is based on 2020 Spring survey actuals and doubled to account for Fall survey.					

Table 10-64
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JPQ - CARB Leak Survey - Unit Cost Forecast

MAT JPQ (UNIT OF MEASURE: NON-UNITIZED)

Line	Description	Value	Notes and References
3	2020 Recorded Cost	$2,961,979.41	(A)
4	2020 Recorded Units	1	
5	2020 Average Unit Cost	$2,961,979.41	Line 3/Line 4
6	2020 Adjustments to Forecast Basi	$0.00	(B)
7	**Cost Basis for Forecast**	**$2,961,979.41**	Line 5 + Line 6

Line		2021	2022	2023	Notes and References
10	Escalation Factor	-	3.28%	3.36%	(C)
11	Escalation Amount	-	$97,152.50	$102,786.83	(D)
12	**Forecast Unit Cost**	**$2,961,979.41**	**$3,059,131.91**	**$3,161,918.74**	(E)

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.

Table 10-65
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT JPR - CARB Leak Repair - Unit Cost Forecast

MAT JPR (UNIT OF MEASURE: NON-UNITIZED)

Line	Description	Value	Notes and References
2	2018 Recorded Cost	$1,114,264.17	(A)
3	2019 Recorded Cost	$922,323.48	(A)
4	2020 Recorded Cost	$1,744,096.57	(A)
5	2020 Recorded Units	1	
6	Average Unit Cost	$1,260,228.07	(Sum of Line 3, Line 4, Line 5/3)/Line 6
7	2020 Adjustments to Forecast Basis	$1,000,000.00	(B)
8	**Cost Basis for Forecast**	**$2,260,228.07**	Line 7 + Line 8

Line		2021 (F)	2022	2023	Notes and References
11	Escalation Factor	2.24%	3.28%	3.36%	(C)
12	Escalation Amount	$50,629.11	$75,797.52	$80,193.04	(D)
13	**Forecast Unit Cost**	**$2,310,900.00**	**$2,386,697.52**	**$2,466,890.56**	(E)

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) Adjustments made to the forecast basis to account for additional funding needed for GPOM resources to support CARB leak repairs.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.
(F) The 2021 unit costs shown are for illustrative purposes only to demonstrate the unit cost methodology and do not tie to the 2021 forecast amounts.

PACIFIC GAS AND ELECTRIC COMPANY
2023 General Rate Case
Exhibit 3, Chapter 10, Leak Management
Project Summary

Project Title: Distribution Leak Survey
Major Work Categories: MWC DE, MAT FIQ, MAT JQA
Planning Order Numbers: 5055368, 5055372, 5055342, 5055371, 5055341, 5055339, 5055369, 5055506, 5055591
Project Start Date: Ongoing
Project Completion Date: Ongoing
Operative Date (only applies to Capital): N/A

Project Description

In 2020, PG&E continued conducting a 3-year compliance leak survey. This requirement is outlined in the California Public Utilities Commission (CPUC or the Commission) decision in the Leak Abatement OIR.[1] This project summary also addresses PG&E's "Super Emmitter" leak survey project.

Each of PG&E's 18 divisions performs daily leak surveys, including both traditional surveys conducted by operator-qualified leak surveyor technicians and mobile surveys using the Advanced Mobile Leak Survey technology. The PG&E Gas Distribution service territory is divided into approximately 22,000 plats (maps), each covering approximately 1 mile x ½ mile of territory, which are covered within the 18 divisions. PG&E surveys gas distribution pipeline systems, including services, mains and other gas assets. A centralized leak survey analytics team schedules and manages survey work to maintain compliance with PG&E standards and Commission requirements.

PG&E anticipates surveying 1,361,716 services in 2023.[2] Part of this plan, includes approximately 37,000 Can't Get In (CGI) inspections. These inspections are performed in indoor meter sets or inaccessible locations. In 2019, PG&E implemented the CGI program to better track, monitor and execute these inspections. Majority of this work takes place in the San Francisco division where the service or meter are located behind a locked or otherwise inaccessible place. This work resulted in an additional 13 leak survey contractors, bringing the total number of leak survey contractors to 93 across the system for 2023. PG&E does not anticipate hiring additional employees for this work.

PG&E conducts routine leak surveys, special leak surveys, DIMP surveys,leak rechecks and atmospheric corrosion inspections. The routine leak survey schedule requires:

- Annual Survey – Business districts[3] and public assembly locations[4]; and
- 3-Year Survey – All other assets (e.g. meters, services).

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[1] Decision (D.) 17-06-015, Section 8.2.1, Best Practice 15, Pages 77-80.

[2] Number of services surveyed are the sum of MAT codes DEA (Leak Survey) and DEF (Picarro Rollout).

[3] A Business District, or the principal business areas of a community, are further defined in WP 10-112, Utility Procedure TD-4110P-01 Leak Survey Process.

[4] For leak survey purposes, public building locations include the schools, hospitals, and churches.

PACIFIC GAS AND ELECTRIC COMPANY
2023 General Rate Case
Exhibit 3, Chapter 10, Leak Management
Project Summary

Special leak surveys are performed on PG&E's gas distribution system for operating reasons or to assess the integrity of the pipe, and are conducted as needed and not at any pre-determined interval. For example, a special leak survey occurs when:

- A possible gas leak is reported;
- Before and after maximum allowable operating pressure uprates of gas distribution facilities (see PG&E's Exhibit 3, Chapter 11 Gas System Operations);
- Before, during and after certain major third-party construction projects;
- After natural disasters such as earthquakes and mudslides;
- As a follow-up after a gradable leak is "zeroed out" (i.e., PG&E had initially detected gas at the location, but, upon recheck, no gas is detected);
- As part of the Distribution Integrity Management Program leak surveys and
- For required leak rechecks.

Leak rechecks are scheduled outside of a routine leak survey. Leak rechecks are based on need and include checks of previously identified Grade 2 or 3 leaks to confirm the grade and priority has not changed. Leak grading is discussed below.

In June 2017, CPUC issued a decision in the Leak Abatement OIR (D. 17-06-105) requiring that all Grade 3 leaks must be repaired within 3 years of discovery and that all Grade 3 leaks discovered before June 2017 be repaired by June 2020 (Best Practice 21).[5] PG&E submitted for the Commission's review a compliance plan for complying with Best Practice (BP) 21 that was approved in 2018. PG&E's compliance plan for complying with BP 21 includes a plan to repair approximately 2,000 below ground Grade 3 leaks each year as well as a Super Emitter survey plan. In March, 2020, PG&E submitted it's 2020 Leak Abatement Compliance Plan to address the continuation of the accelerated leak detection and repair program for the largest emitting leaks, known as Super Emitter leaks, which will result in significantly greater emission reductions at far lower cost, than the requirement to repair all below ground Grade 3 leaks within three years. Super Emitter survey uses advanced mobile technology to identify and prioritize repairs for the highest volume non-hazardoes leaks; and maximize emissions reductions consistent with the intent of the Leak Abatement Best Practices OIR. PG&E defines a super emitter leak as a leak that emits more than 10 standard cubic feet per hour (scfh) of methane.

Using the advanced mobile technology, PG&E will collect data on an annual basis to identify super emitting leaks across its system. Each year the advanced mobile technology vehicles will cover the portion of the service territory not covered by PG&E's 3-year compliance survey. The data from both the Super Emitter and PG&E's compliance survey will be reviewed to prioritize leaks with a flowrate greater than 10 scfh.

The advanced mobile technology surveyor is the primary method PG&E uses to conduct the 3-year compliance survey. Depending on wind and other factors, the advanced mobile technology identifies the Field of View (FOV). The FOV is overlaid onto the gas distribution asset plat maps so that the

[5] D. 17-06-015, Best Practice 21, Section 8.3.1, Pages 89-92.

operator can determine what portion of PG&E's system the technology is surveying. The operator can take multiple passes over the same street to increase the FOV. Any part of the system not covered by the FOV is surveyed by foot. PG&E's experience to-date shows that the FOV will cover approximately 75 percent of the areas driven within the system.

There are four instances where the Advanced Mobile Technology survey is followed by a walking survey:

FIGURE 1
INSTANCES WHEN PICARRO SURVEY IS FOLLOWED BY A WALKING SURVEY

1 – LISA	When the advanced mobile technology identifies a LISA (Leak Indication Search Area), the area is then surveyed by foot with traditional leak survey equipment to pinpoint and grade the leak.
2 – Gap	When the advanced mobile technology survey identifies a gap in its FOV (field of view), the area is then surveyed by foot with traditional leak survey equipment.
3 - Meter and Gas Service	After the area is surveyed with the advanced mobile technology, a traditional foot survey is performed on each meter and five feet of the service leading to the meter.
4 - Ambient Air above 5 ppm	The advanced mobile techonology driver will perform an immediate walking survey when the technology identifies an indication of methane 5ppm above ambient levels. Ambient air above 5 ppm in an indication of a possible grade 1 leak. The driver will pinpoint and identify if the indication is in fact a grade 1 leak and needs immediate repair.

A traditional leak survey is conducted in areas where advanced mobile technology is either not efficient or not suitable for the technology. PG&E conducts compliance surveys on all of its approximately 22,000 maps covering the service territory. Maps with fewer than 51 services are surveyed using traditional foot surveys because there is significant added cost to perform advanced mobile technology survey on maps with low service counts. The advanced mobile technology is often not suitable for surveys in San Francisco and Colma, due to the inability to pinpoint leaks based on the accuracy of GPS in these locations. Additionally, traditional survey may be used when advanced mobile technology resources are not available.

As part of conducting the 3-year compliance survey, PG&E operator qualified technicians grade each leak found on the system.

- Grade 1 leaks (also referred to as "hazardous" leaks) represent existing or probable hazards to persons or property and require immediate repair or continuous action until conditions are no longer hazardous;
- Grade 2 leaks are non-hazardous to persons or property at the time of detection, but still require a scheduled repair because they present probable future hazards. Grade 2 leaks must be repaired within 15 months, and rechecked every six months until repaired; and

- Grade 3 leaks are non-hazardous at the time of detection and can reasonably be expected to remain non-hazardous.

PG&E recently revised its survey procedures requiring the compliance leak survey team to also inspect for atmosphere corrosion (AC inspections) (See WP 10-207, PG&E Standard 4188P-01, Atmospheric Corrosion Inspections of Cutomer-Connected Riser and Meter Sets. Any AC identified in the field by the leak survey team will be noted on the survey form for follow-up by the responsible team.

Quality Management

The Leak Survey team is governed by CPUC requirements and PG&E procedures outlining the gas leak survey and detection program. The procedures set forth PG&E's standards, guidelines and requirements for the leak survey, detection, and leak grading program (see WP 10-112, PG&E Standard 4110P-01, Leak Survey Process.

All PG&E employees and contractors who perform leak surveys are trained, tested and operator-qualified. In addition, all leak surveyors, internal and external, are listed in a PG&E database and work quality assessments are conducted on randomly selected leak surveyors to provide consistency of performance in relation to standards, procedures and quality of work. The Quality Management (QM) department performs the random assessments and uses the same equipment as the Leak Surveyor to compare leak survey results. As part of the random assessment, PG&E implemented a new program to increase quality of internal and external leak surveys. If a surveyor misses a Grade 1 leak in a field survey (that is subsequently identified by the random QM survey), the Leak Survey employee's operator qualifications are suspended and they are required to go through a remediation process which includes a side by side evaluation and/or procedure review.

Technology:

PG&E will continue to use the advanced mobile technology as the primary method for conducting its compliance surveys and Super Emitter emissions surveys. PG&E works closely with the manufacturer to identify improvements to the software. Software updates are periodically sent to improve the accuracy and functionality of the advanced mobile technology. For example, the recent P3300 update enabled the advanced mobile technology to better identify the ethane levels in the gas detected.

Justification

PG&E conducts its leak surveys as required by CPUC and PG&E standards and guidelines. In 2018, the Commission adopted 26 leak management Best Practices in the Leak Abatement OIR Decision (17-06-15) that PG&E implemented. In March 2020, PG&E submitted an updated compliance plan to the CPUC. [6] In addition, PG&E's Super Emitter survey will

[6] PG&E's 2020-2021 Leak Abatement Compliance Plan (March 2020)

result in significantly greater emissions reductions at far lower cost, than simply repairing all below ground Grade 3 leaks within three years.

Cost

PG&E's cost forecast considers: the number of services that will be surveyed each year; the time required to conduct the survey using both advanced mobile technology and traditional walking surveys; the number of leaks that require follow-up and re-checking; and time for quality control procedures.

PG&E's costs to perform Super Emitter survey are incorporated in PG&E's expense MAT DEB, Special Leak Survey. The costs for MWC DE, MWC FI and MWC JQA are shown on Exhibit (PG&E-3), Chapter 10, WP 10-3.

Program Spending Forecast
(Thousands of Nominal Dollars)

	Recorded					Forecast							
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total	Workpaper Reference
EXPENSE													
MAT DE#	(5,560)	829	322	1,146	752	2,725	2,816	2,911				5,941	WP 10-5, Line 2
MAT DEA	11,500	6,492	9,165	13,913	10,696	10,645	9,557	9,878				81,847	WP 10-5, Line 3
MAT DEB	273	1,916	134	617	1,992	5,194	2,606	2,693				15,425	WP 10-5, Line 4
MAT DEC	3,152	1,879	3,883	3,047	3,125	2,648	3,266	3,376				24,377	WP 10-5, Line 1
MAT DED	2,921	1,671	2,129	2,632	2,243	2,299	2,376	2,455				18,727	WP 10-5, Line 5
MAT DEE	1,514	648	1,476	1,470	617	708	732	756				7,922	WP 10-5, Line 6
MAT DEF	11,626	6,529	6,526	5,574	13,144	10,787	11,495	11,881				77,561	WP 10-5, Line 7
MAT DEG	12	2	3	0	5							23	WP 10-5, Line 8
MAT FIQ	4733	10244	6439	9308	6886	2569	1260	1298				42,736	WP 10-5, Line 16
MAT JQA	252	375	183	654	890	791	821	849				4,814	WP 10-5, Line 18
												-	
Expense Total	30,424	30,586	30,259	38,362	40,350	38,365	34,929	36,097	-	-	-	279,373	
TOTAL PROJECT COST	30,424	30,586	30,259	38,362	40,350	38365	34929	36097	-	-	-	279373	

The key cost driver in MWC DE is the addition of the advanced mobile technology support contract that was previously captured under the IT program.

Benefits

PG&E's leak compliance survey improves safety and reliability on the gas distribution system by finding and fixing hazardous leaks.

Alternative Technologies Considered

N/A

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Project Summary

Project Title: Transmission Leak Survey
Major Work Categories: MATs JOE, JOR, JOW, MATs JPQ and JPR
Planning Order Numbers: 5055638, 5055687, 5055498, 5055531, 5055530
Project Start Date: Ongoing
Project Completion Date: Ongoing
Operative Date (only applies to Capital): N/A

Project Description

In 2017, PG&E transitioned to a semi-annual transmission leak survey. This transition was a requirement of General Order (GO) 112-F, Subpart C Section 143 Distribution and Transmission Systems[1]. Each of PG&E's 18 divisions performs semi-annual leak surveys, including both ground surveys conducted by operator qualified leak surveyor technicians and aerial survey using LiDAR technology. The PG&E Gas Transmission territory covers over 13,000 miles of gas trasnsmission pipeline, which are covered with the 18 divisions. This semi-annual survey, also includes leak survey of all Class 1, 2, 3 and 4 stations and gathering lines. A centralized leak survey analytics team schedules and manages survey work to maintain compliance with PG&E standards and Commission requirements. Leak rechecks are scheduled outside of a routine leak survey. Leak rechecks are based on need and include checks of previously identified Grade 2 or 3 leaks to confirm the grade and priority has not changed. Leak grading is discussed below.

As part of conducting the semi-annual survey, PG&E operator qualified technicians grade each leak found on the system.

- Grade 1 leaks (also referred to as "hazardous" leaks) represent existing or probable hazards to persons or property and require immediate repair or continuous action until conditions are no longer hazardous;
- Grade 2 leaks are non-hazardous to persons or property at the time of detection, but still require a scheduled repair because they present probable future hazards. Grade 2 leaks must be repaired within 12 months, and rechecked every six months until repaired; and
- Grade 3 leaks are non-hazardous at the time of detection and can reasonably be expected to remain non-hazardous. GO 112-F stated that all transmission leaks that are not Grade 1,

[1] General Order No. 112-F, Subpart C, Section 143 Distribution and Transmission Systems, 143.1 Leakage Surveys and Procedures

must be repaired within one year of discovery. PG&E has chosen to eliminate Grade 3 below ground transmission leaks from its grading criteria and only allow Grade 1 and Grade 2 below ground transmission leaks. Therefore, only above ground Grade 3 transmission leaks exist. These leaks require a recheck every 15 months of the reporting date.

On February 6, 2016, CalGEM, formerly known as the Division of Oil, Gas and Geothermal Resources (DOGGR) put into effect Emergency Regulation 1724.9 Underground Gas Storage Projects following an emergency order that included the requirement of a daily inspection of the gas storage wellheads, using gas leak detection technology. PG&E operator-qualified leak surveyor technicians perform this work at PG&E's three underground storage facilities. In 2017, California Air Resource Board (CARB) then passed their Oil and Gas rule that went into effect on January 1, 2018 that required quarterly leak detection and repair. CARB's statewide greenhouse gas emission standard for Oil and Gas sector impacted PG&E's 3 underground storage facilities and 9 compressor stations. This rule focused on above ground leaks with much more stringent repair timelines based on leak quantifications. Currently, operator-qualified leak survey contractors performs the leak survey portion of this work, while PG&E's Gas Pipeline Operations and Maintenance (GPOM) organization performs the leak repairs associated with CARB and CalGEM identified leaks.

The repair timelines are listed below. All leaks identified during CalGEM and CARB survey are also graded following the grading criteria mentioned above.

- Leak concentrations greater than 50,000 parts per million volume (ppmv) requires a successful repair in 2 calendar days.
- Leak concentrations between 10,000 ppmv and 49,999 ppmv requires a successful repair in 5 calendar days.
- Leak concentrations between 1,000 ppmv and 9,999 ppmv requires a successful repair in 14 calendar days.

Quality Management

The Leak Survey team is governed by CPUC requirements and PG&E procedures outlining the gas leak survey and detection program. The procedures set forth PG&E's standards, guidelines and requirements for the leak survey, detection, and leak grading program (see WP 10-112, PG&E Standard 4110P-01, Leak Survey Process).

All PG&E employees and contractors who perform leak surveys are trained, tested and operator-qualified. In addition, all leak surveyors are listed in a PG&E database and work quality assessments are conducted on randomly selected leak surveyors to provide consistency of performance in relation to standards, procedures and quality of work. The Quality Management (QM) department performs the random assessments and uses the same equipment as the Leak Surveyor to compare leak survey results. As part of the random assessment, PG&E implemented a new program to increase quality of leak surveys. If a leak surveyor misses a Grade 1 leak in a field survey (that is subsequently identified by the random QM survey), the Leak Surveyor'soperator qualifications are suspended and they are

required to go through remediation process which includes a side by side evaluation and/or procedure review.

Technology:

PG&E will continue to use LiDAR technology as the primary method for conducting its semi-annual aerial surveys. PG&E works closely with the vendor to identify improvements to the technology and process.

In 2018, PG&E began using Digital Catalyst technology as a way to document leaks in the field within 30-45 seconds of discovery, compared to a previous state wherein it requires approximately 24 hours to identify potential hazards. In addition, in 2019 transmission leak maps were made available electronically, eliminating all paper maps and streamlining the process.

Justification

PG&E conducts its leak surveys as required by CPUC, CARB, CalGEM and PG&E standards and guidelines.

Cost

PG&E's cost forecast considers: the number of miles that will be surveyed each year; the time required to conduct the survey using both aerial survey technology and traditional walking surveys; the number of leaks that require follow-up and re-checking; the time required to perform the daily and quarterly survey; and time for quality control procedures.

The costs for MWC JO and MWC JP are shown on Exhibit (PG&E-3), Chapter 10, WP 10-3.

Program Spending Forecast
(Thousands of Nominal Dollars)

	Recorded					Forecast							
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total	Workpaper Reference
EXPENSE													
MAT JPQ	-	368	3,401	3,384	2,962	3,385	3,059	3,162				**19,721**	**WP 10-5, Line 33**
MAT JPR	370	58	1,114	922	1,738	2,097	2,387	2,467				**11,153**	**WP 10-5, Line 34**
MAT JOE	1,905	1,621	1,458	1,202	895	907	937	968				**9,893**	**WP 10-5, Line 29**
MAT JOR	378	549	899	364	235	464	248	256				**3,393**	**WP 10-5, Line 31**
MAT JOW	1,275	1,023	1,927	1,976	1,455	2,268	2,343	2,421				**14,688**	**WP 10-5, Line 32**
												-	
Expense Total	**3,928**	**3,619**	**8,799**	**7,848**	**7,285**	**9,120**	**8,973**	**9,275**	**-**	**-**	**-**	**58,847**	
TOTAL PROJECT COST	**3,928**	**3,619**	**8,799**	**7,848**	**7,285**	**9,120**	**8,973**	**9,275**	**-**	**-**	**-**	**58847**	

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The key cost driver in transmission leak survey is the additional funding needed for GPOM resources to support the increase in CARB leak repair (MAT JPR) volume due to updates to the repair timelines stated in the rule. In addition, the increase in MAT JOW is due to increased vendor costs to complete this work.

Benefits

PG&E's leak compliance survey improves safety and reliability on the gas transmission system by finding and fixing hazardous leaks. In addition, CARB and CalGEM required surveys protects the environment by reducing greenhouse gas emissions in California.

Alternative Technologies Considered

N/A

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Project Summary

Project Title: Leak Repair, Reliability, and Emergent Work
Major Work Categories: MWC FI (FI#, FIS, FIG, FIH, FIJ, FIK, FIP, FIM), MWC 50 (50G, 50M, 50K), MWC 52 (52B, 52C), MAT JOP
Planning Order Numbers:
MWC FI – 5055711, 5055703, 5055699, 5055696, 5055697, 5055700, 5055690
MWC 50 – 5542192, 5542171, 5542162
MWC 52 – 5542170, 5542169
MWC JO - 5055564

Project Start Date: Ongoing
Project Completion Date: Ongoing
Operative Date (only applies to Capital): OAI

Project Description

The Distribution Leak Repair, Reliability, and Emergent Work program is broken down into three major work categories:

- MWC FI – Corrective Maintenance and Repair
- MWC 50 – Reliability and Service Replacements
- MWC 52 – Emergency Responses to Dig-Ins

The transmission leak repair program is categorized under MWC JO, in MAT JOP, transmission leak repair.

Leak Repair, Reliability, and Emergent Work is performed by PG&E's Maintenance and Construction (M&C), Field Services, Gas Pipeline Operations and Maintenance (GPOM) and General Construction (GC) organizations. Each organization is responsible for safely maintaining and constructing PG&E's gas distribution and transmission facilities during repair and replacement activities.

The M&C, GC and Field Services organizations divide the service territory into two regions and 18 divisions reporting to two directors. Each regional director has a staff of superintendents and supervisors dispersed geographically who oversee field construction and support employees. GPOM manages its work in one region with one director and multiple managers and supervisors that provide oversight for their workgroup. While M&C, Field Services, GPOM and the GC organizations support Leak Management by performing leak repair, they also perform work that is described in other Gas Distribution chapters.

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Project Summary

In 2023, PG&E forecasts repairing 31,135 distribution leaks compared to 20,835 leaks repaired in 2020.[1] For transmission leak repairs, PG&E forecasts repairing 3,281 leaks in 2023 compared to 3,503 leaks in 2020.

Gas facilities requiring repair are mostly identified through leak surveying activities, while a small percentage of leaks are identified through customer odor complaints, by employees performing other maintenance, or as a result of third party dig-ins. Regardless of how the leak was identified, the leak will be entered into the work management process and SAP system, where the repair work activities are then scheduled and planned based on the grade of the leak. When PG&E finds leaks on services an engineering decision is made to determine whether the leak should be repaired or the service should be replaced based on PG&E's leak management standards (see WP 10-201, PG&E Standard 4801-S, Service Replacement Criteria).

Leak repairs are prioritized and work is planned by the Resource Management team and follow the leak repair criteria described below. The priority of a leak repair depends on the the leak grade, the compliance date, the leak size, work volume and available resources. Once the leaks are graded and prioritized, 30, 60, and 90 day plans are scheduled at the local level to repair leaks. In addition to graded leaks, PG&E repairs non-graded meter set leaks (MAT FIS). Non-graded leaks are above ground leaks found on or above the inlet of the service valve on a customer meter set facility. This includes leaks found on the riser threads. Meter set leaks tend to be mostly non-hazardous leaks and are repaired within 36-months. Any meter set leak that is found to be hazardous, will require an immediate response and will be treated similarly to a Grade 1 leak.

Leak Management has a weekly leak call to review all open leaks in the system and to confirm that plans are in place to repair Grade 2 leaks by the compliance date.

Leak repair criteria:

Grade 1 (G1)

- Grade 1 leaks must be either repaired within 24 hours or continuous action must be takenuntil the leak is no longer hazardous.
- There is no Grade 1 leak backlog.

Grade 2 (G2)

- Distribution Grade 2 leaks must be repaired within 15 months, while transmission Grade 2 leaks must be repaired within 12 months.
- PG&E has a rolling Grade 2 backlog, with the goal of average days open at 150 days.
- Grade 2 compliance dates are monitored weekly.

Grade 3 (G3)

- All Grade 3 leaks must be rechecked annually to determine updated leak grade.

[1] Leaks repaired is the sum of MAT codes 50G, 50K, 50M, 52B, 52C, FIG, FIH, FIJ, FIK and FIP.

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- In 2017, General Order (GO) 112-F[2] went into effect and stated that all transmission leaks that are not Grade 1, must be repaired within one year of discovery. PG&E has chosen to eliminate Grade 3 below ground transmission leaks from its grading criteria (see WP 10-141, PG&E procedure TD-4110P-09 Leak Grading and Response) and grade all below ground transmission leaks either a Grade 1 or Grade 2.
- On December 18, 2020 the Commission approved PG&E's 2020 Natural Gas Leak Abatement Compliance Plan[3] and forecast. PG&E's plan consists of repairing 2,000 below ground Grade 3 leaks per year.

Repair vs. Replace Criteria:

There are two types of responses to remediate leaks: corrective maintenance (MWC FI, expense) or asset replacement (MWC 50, capital). Corrective maintenance consists of repairing damaged or failed facilities. In certain cases, the leak is addressed by replacing the asset. When PG&E finds leaks on services,an engineering decision is made to determine whether the leak should be repaired or the service should be replaced. This is based on PG&E's standards 4801-S, Service Replacement Criteria for service replacements (See WP 10-201). See Similarly, when PG&E finds multiple leaks in the same general vicinity of a main distribution pipeline, an engineering analysis is performed to determine whether to repair or replace the leaking pipe.

The decision to perform a repair vs replacement is made by considering the following criteria:

- Leak history and repairs on the pipeline
- Age of the service
- Location of the leak
- Material

PG&E classifies replacement of more than 100 feet of gas main to remediate a leak as "emergent work."

Emergency Response (MWC 52):

Leak Management Emergency Response includes work and materials required to replace damaged or failed facilities due to gas dig-ins and external forces such as landslides or earthquakes.

Transmission Leak Repair (MWC JO):

A transmission leak repair is a leak that is identified on a transmission pipeline or facility.

Quality Management

All PG&E employees and contractors conducting leak repair must maintain active operator qualifications (OQs). PG&E maintains an active list of the OQs required for each type of work

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2 General Order 112-F, Subpart C, Section 143 Distribution and Transmission Systems, 143.1 Leakage Surveys and Procedures.

3 PG&E's 2020-2021 Leak Abatement Compliance Plan (March 2020).

performed. The list of required OQs is also contained in every job package. Additionally, each worker must have on their person a scannable OQ card so that OQs can be validated in the field.

Supervisors provide oversight for leak repair work activities. The Quality Management (QM) team also performs random work assessments while the job is being performed.

For Above-Ground Grade 3 (AG3) leak repairs, random 30-day quality management assessments are completed.

Justification

PG&E conducts its leak repairs as required by CPUC and PG&E standards and guidelines. In 2018, the Commission adopted 26 leak management Best Practices in the Leak Abatement OIR Decision (17-06-15) that PG&E implemented. PG&E recently published a new leak repair procedure (see WP 10-186, PG&E Procedure TD-5100P-04 Leak Repair).

Cost

The costs for MWC FI, MWC 50, MWC 52 and MWC JO are shown on Exhibit (PG&E-3), Chapter 10, WP 10-3 for expense and WP 10-71 for capital.

Program Spending Forecasts
(Thousands of Nominal Dollars)

	Recorded					Forecast							
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total	Workpaper Reference
EXPENSE													
MAT FI#	(20,400)	1,145	537	2,598	3,643	3,376	3,856	3,986				**(1,260)**	**WP 10-5, Line 9**
MAT FIG	28,550	13,475	16,089	16,345	25,526	34,829	40,340	46,749				**221,903**	**WP 10-5, Line 10**
MAT FIH	7,267	4,084	1,481	1,225	4,101	5,724	6,063	4,042				**33,986**	**WP 10-5, Line 11**
MAT FIJ	1,655	1,264	1,147	420	1,052	970	925	957				**8,391**	**WP 10-5, Line 12**
MAT FIK	1,231	803	1,688	1,499	950	1,461	1,483	1,533				**10,648**	**WP 10-5, Line 13**
MAT FIM	-	1,696	53	368	501	-	456	471				**3,544**	**WP 10-5, Line 14**
MAT FIP	22,627	12,171	15,117	15,421	22,295	14,312	16,738	22,179				**140,860**	**WP 10-5, Line 15**
MAT FIS	5,492	2,825	4,603	6,326	6,952	10,166	10,031	16,209				**62,605**	**WP 10-5, Line 17**
MAT JOP	2,619	2,560	2,737	3,192	5,828	8,513	10,242	13,306				**48,997**	**WP 10-5, Line 30**
Expense Total	**49,042**	**40,022**	**43,453**	**47,393**	**70,847**	**79,352**	**90,135**	**109,430**	**-**	**-**	**-**	**529,674**	
Capital													
MWC 50	43,510	16,572	10,694	12,345	17,187	25,687	26,689	28,624	29,442	30,681	31,762	**273,195**	**WP 10-99, Lines 3-5, Lines 13-15**
MWC 52	1,571	3,775	1,744	1,206	1,599	1,832	1,583	1,631	1,675	1,719	1,764	**20,100**	**WP 10-99, Lines 6-9, Lines 16-19**
Capital Total	**45,081**	**20,348**	**12,438**	**13,551**	**18,787**	**27,519**	**28,272**	**30,255**	**31,117**	**32,399**	**33,526**	**293,295**	
TOTAL PROJECT COST	**94,123**	**60,370**	**55,892**	**60,943**	**89,634**	**106,871**	**118,407**	**139,686**	**31,117**	**32,399**	**33,526**	**822,969**	

The Leak Repair, Reliability, and Emergent Work program cost drivers from 2020 recorded costs to 2023 forecast costs are:

- Increase in below ground Grade 3 leak repairs due to approved compliance plan.[6] In 2020, PG&E did not repair all 2,000 below ground Grade 3 since it was pending decision from the Comission.

6 PG&E's 2020 Leak Abatement Compliance Plan, March 16, 2020.

- A shift in resources that execute above ground leak repairs. Riser thread valve repairs were reclassified as non-gradable leaks as of March 2020 and are now being captured under MAT FIS. These leaks are primarily repaired by the Field Services organization. Majority of above ground repairs remaining in MAT FIH are completed by M&C crews and are more costly. The volume of MAT FIH repairs has gone down as a result of shifting riser thread valve repairs to MAT FIS.
- Increased costs due to first responder labor charges for M&C crews.
- Increased restoration costs due to contract labor rates and material costs.

Benefits

PG&E's leak repair programs improves safety and reliability on the gas distribution system by fixing hazardous leaks.

Alternatives Considered

In June 2017 the California Public Unitlity Commission (CPUC or the Commission) issued a decision in the Leak Abatement OIR (D. 17-06-105) requiring that all Grade 3 leaks must be repaired within 3 years of discovery and that all Grade 3 leaks discovered before June 2017 be repaired by June 2020 (Best Practice 21).[7] PG&E submitted a lower cost proposal for complying with Best Practice 21.[8] On October 11, 2018 the Commission issued Resolution G-3538 approving portions of PG&E's proposed alternative plan. In March, 2020, PG&E submitted an amended 2020 Leak Abatement Compliance plan proposing to continue the lower cost proposal for complying with Best Practice 21 (ie. Continuing Super Emitter survey and repairing 2,000 below ground Grade 3 leaks). On December 18, 2020, the Comission approved PG&E's 2020 Compliance plan.

[7] D. 17-06-015, Best Practice 21, Section 8.3.1, Pages 89-92.

[8] PG&E's proposal calls for conducting a survey to identify leaks that emit the most methane and repairing those leaks along with repairing a portion of the Below Ground Grade 3 leak backlog. PG&E sets forth its 2018-2019 proposed approach in its 2018 Gas Safety Plan, March 15, 2018, Attachment 1, BP 21, pages Atch1-182 – Atch1-200. PG&E further describes its proposal in the 2020 Natural Gas Leak Abatement Compliance Plan (March 16, 2020).

Table 10-66
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 10, Gas Operations Leak Management
Expense Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC DE	MWC FI	MWC JQ	MWC JU	MWC LW	Detailed Description/Explanation
1	**2016**	**97,263**	**25,439**	**51,156**	**252**	**20,416**	**0**	
2			(5,472)					Decrease due to reduced weekday overtime and weekend work.
3				(3,450)				
4					124			Increase due to more volume of work completed. DIMP identified more services that fit criteria for survey.
5						(20,416)		Discontinuation of balancing account.
6							0	
7	**2017**	**68,048**	**19,967**	**47,706**	**375**	**0**	**0**	
8			3,671					Shift from 4 year to 3 year leak survey.
9				(551)				
10					(192)			Vintage pipe leak survey began in 2018 targeting pre-1985 plastic and pre-1940 steel pipe as part of Leak Abatement OIR. Majority of work was captured under balancing account (MAT LWD).
11						(0)		Discontinuation of balancing account.
12							34,536	
13	**2018**	**105,512**	**23,638**	**47,155**	**183**	**0**	**34,536**	
14			4,762					Increase due to unplanned units due to internal audit review as well as increased labor costs.
15				6,353				Increase in volume of third-party dig-ins as well as longer processing time of invoices and billing to third parties for damages. These include CEMA eligible costs.
16					471			Increase due to more volume of work completed. DIMP identified more services and miles of main that fit criteria for survey.
17						0		
18							(8,429)	2019 decreased the amount of below ground Grade 3 repairs due to exceeding approved funding by the Commission for this type of work.
19	**2019**	**108,669**	**28,400**	**53,508**	**654**	**0**	**26,107**	
20			4,175					Increase due to carry over units from 2019 to 2020.
21				18,397				Increase due to higher leak find rates and higher unit costs as a result of higher labor, paving, permitting and traffic control costs.
22					235			Continued to perform Leak Abatement OIR vintage pipe survey in 2019 with costs transferred to balancing account (MAT LWD). In 2020, all costs remained under base MAT JQA.
23						0		
24							(25,176)	Balancing account only captured below ground Grade 3 costs. All other costs moved to base MATs.
25	**2020**	**106,300**	**32,575**	**71,905**	**890**	**0**	**931**	

Note: Total amounts and amounts for each MWC are obtained from WP 10-5 by summing the relevant lines for each MWC.

Table 10-67
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 10, Gas Operations Leak Management
Expense Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC DE	MWC FI	MWC JQ	MWC JU	MWC LW	Detailed Description/Explanation
1	**2020**	**106,300**	**32,575**	**71,905**	**890**	**0**	**931**	
2			2,431					Increase due to reallocation of Advanced Mobile Technology contract that was previously captured under MAT JVA.
3				1,502				Increase in leak find rates and additional Grade 3 repairs due to Best Practice 21.
4					(99)			Forecast was based on 2019 and 2020 historical average. 2019 was much lower than 2020 recorded.
5						(0)		
6							(931)	PG&E's 2021 forecast reflects the approved budget as of March 5, 2021.
7	**2021**	**109,204**	**35,006**	**73,407**	**791**	**0**	**0**	
8			(2,159)					Decrease in Leak Survey CGI units.
9				7,746				Increase is due to higher units forecasted in below ground expense leak repairs.
10					31			Increase due to standard escalation.
11						0		
12							19,128	2021 forecast was not included due to pending decision from Commission.
13	**2022**	**133,950**	**32,847**	**81,154**	**821**	**0**	**19,128**	
14			1,103					Increase due to standard escalation.
15				16,273				Reallocation of Grade 3 repairs under Base expense MATs. Discontinue of NERBA balancing account. Increase in non-hazardous meter set leak repairs in effort to reduce backlog.
16					28			Increase due to standard escalation.
17						0		
18							(19,128)	Discontinuation of NERBA balancing account MATs
19	**2023**	**132,226**	**33,950**	**97,427**	**849**	**0**	**0**	

Note: Total amounts and amounts for each MWC are obtained from WP 10-5 by summing the relevant lines for each MWC.

Table 10-68
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 10, Gas Operations Leak Management
Expense Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC JO	MWC JP	MWC LW	Detailed Description/Explanation
1	**2016**	**6,547**	**6,177**	**370**	**0**	
2			(425)			Reduction in rechecks due to adoption of revised General Order (GO) 112-F that requires repair of previously identified below ground grade 3 leaks. In addition, 2016 had a one-time audit of pipeline markers that increased the ground survey vs aerial survey mileage (ground survey has a higher unit cost than aerial survey).
3				57		Orders were created for this work prior to MAT creation. MAT code JPQ and JPR were created in 2018 and the orders created were moved to the new MAT code. These orders were capturing costs from daily wellhead surveys (CalGEM). In 2017, PG&E began pilot to implement CARB quarterly survey requirements.
4					0	
5	**2017**	**6,179**	**5,753**	**427**	**0**	
6			1,268			Adoption of Revised GO 112-F requires the repair of all below ground grade 3 leaks, which results in an additional cost for previously identified below ground grade 3 leak repairs.
7				4,089		MAT JPQ and JPR were creaed in Q4 2018 to track all CARB and CalGEM related costs. CARB regulation went into effect 1/1/2018, resulting in higher costs that were not previously captured.
8					63	
9	**2018**	**11,599**	**7,021**	**4,515**	**63**	
10			(286)			
11				(209)		
12					129	Implementation of Leak Abatement OIR Best Practice 21.
13	**2019**	**11,232**	**6,735**	**4,306**	**191**	
14			1,678			Transition of station survey from GPOM to Leak Survey increased leak find rate. Previously, leaks were captured via corrective and not as gradable under MAT JOP.
15				394		Increase in volume of CARB Leak Repairs due to regulation update in repair timeline.
16					(191)	Did not use balancing account MAT in 2020. This balancing account MAT was not part of NERBA extension.
17	**2020**	**13,113**	**8,413**	**4,700**	**(0)**	

Note: Total amounts and amounts for each MWC are obtained from WP 10-5 by summing the relevant lines for each MWC.

Workpaper Table 10-69
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 10, Gas Operations Leak Management
Expense Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC JO	MWC JP	MWC LW	Detailed Description/Explanation
1	**2020**	**13,113**	**8,413**	**4,700**	**(0)**	
2			3,739			Increase in leak find rates and labor costs tied to leak repairs.
3				781		Adjustment made to forecast to account for additional funding needed for GPOM resources to support increase in volume of CARB Leak repairs.
4					0	
5	**2021**	**17,633**	**12,152**	**5,481**	**0**	
6			1,543			Increase due to escalation.
7				(35)		imm change
8					0	
9	**2022**	**19,141**	**13,695**	**5,446**	**0**	
10			3,161			Increase in Grade 3 leak repairs that are coming due are included in this year's forecast.
11				183		Increase due to standard escalation.
12					0	
13	**2023**	**22,485**	**16,856**	**5,629**	**0**	

Note: Total amounts and amounts for each MWC are obtained from WP 10-5 by summing the relevant lines for each MWC.

Table 10-70
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 10
Gas Operations Leak Management
Capital Expenditures by Major Work Category
(Thousands of Nominal Dollars)

				Capital Expenditures										
No.	MWC	MAT	MAT Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	3P	3PB	GD Below Ground Service Repair	-	-	2,471	1,328	562	4,839	3,573	-	-	-	-	
2	3P	3PC	GD Below Ground Srvc Rpr Cmplx	-	-	345	431	125	227	243	-	-	-	-	
3	50	50G	Impr Rel/Dep-Gas Svc Repl Leak	24,197	8,837	7,478	7,786	13,566	20,557	20,307	21,729	22,359	23,389	24,266	
4	50	50K	Emergent Leaking Main Replace	10,306	6,152	2,608	4,155	3,330	4,334	5,555	5,725	5,879	6,032	6,190	
5	50	50M	Complex-Gas Svc Repl Leak	9,007	1,583	609	403	292	797	674	1,004	1,034	1,081	1,121	
6	52	52B	Emerg Resp-G-Dig-Ins-Svcs	1,245	1,733	1,621	1,424	681	1,424	1,297	1,336	1,372	1,408	1,445	
7	52	52C	Emerg Resp-G-Dig-Ins-Main	320	2,042	123	(218)	918	408	286	295	303	311	319	
8	52	52D	Major Emergency Gas Distribtn	2	-	-	-	-	-	-	-	-	-	-	
9	52	#	Not assigned	5	-	-	-	-	-	-	-	-	-	-	
10			**Grand Total**	**45,081**	**20,348**	**15,254**	**15,310**	**19,474**	**32,585**	**31,935**	**30,090**	**30,947**	**32,221**	**33,341**	

Table 10-71
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 10
Gas Operations Leak Management
Forecast Capital Expenditures Summary
(Thousands of Nominal Dollars)

		Capital Expenditures							
Line No.	Description	2020 CWIP	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	Projects > $3 Million*	888	29,730	31,406	29,795	30,644	31,911	33,022	
2	Other Work	43	2,855	529	295	303	311	319	
3	**Total**	**931**	**32,585**	**31,935**	**30,090**	**30,947**	**32,221**	**33,341**	

4 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Table 10-72
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 10
Gas Operations Leak Management
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over $3 Million*
(Thousands of Nominal Dollars)

					CWIP	Capital Expenditures							
Line No.	Planning Order	Description	MWC	Operative Date	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Subtotal	Reference
	MAT - 3PB	**GD Below Ground Service Repair**											
1	5529882	Leak Abt - Scvs Replace (Leak) - Plan OR	3P		-	4,839	3,573	-	-	-	-	8,412	
2	**Total**				**-**	**4,839**	**3,573**	**-**	**-**	**-**	**-**	**8,412**	
	MAT - 50G	**Impr Rel/Dep-Gas Svc Repl Leak**											
3	5513475	GAS SVCS REPLACEMENT(LEAK) - SF	50		-	20,557	-	-	-	-	-	20,557	
4	5542192	2023 GRC Impr Rel/Dep-Gas Svc Repl Leak	50		-	-	20,307	21,729	22,359	23,389	24,266	112,051	
5	**Total**				**-**	**20,557**	**20,307**	**21,729**	**22,359**	**23,389**	**24,266**	**132,608**	
	MAT - 50K	**Emergent Leaking Main Replace**											
6	5514411	EMERGENT LEAKING MAIN REPL-SF	50		888	4,334	-	-	-	-	-	5,222	
7	5542171	2023 GRC Emergent Leaking Main Replace	50		-	-	5,555	5,725	5,879	6,032	6,190	29,382	
8	**Total**				**888**	**4,334**	**5,555**	**5,725**	**5,879**	**6,032**	**6,190**	**34,604**	
	MAT - 50M	**Complex-Gas Svc Repl Leak**											
9	5542162	2023 GRC Complex-Gas Svc Repl Leak	50		-	-	674	1,004	1,034	1,081	1,121	4,914	
10	**Total**				**-**	**-**	**674**	**1,004**	**1,034**	**1,081**	**1,121**	**4,914**	
	MAT - 52B	**Emerg Resp-G-Dig-Ins-Svcs**											
11	5542170	2023 GRC Emerg Resp-G-Dig-Ins-Svcs	52		-	-	1,297	1,336	1,372	1,408	1,445	6,859	
12	**Total**				**-**	**-**	**1,297**	**1,336**	**1,372**	**1,408**	**1,445**	**6,859**	
13		**Grand Total**			**888**	**29,730**	**31,406**	**29,795**	**30,644**	**31,911**	**33,022**	**187,396**	

14 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Table 10-73
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 10
Gas Operations Leak Management
Recorded and Forecast Capital Expenditures Details - Other Work*
(Thousands of Nominal Dollars)

				Capital Expenditures											
Line No.	MWC	MAT	MAT Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	3P	3PB	GD Below Ground Service Repair	-	-	-	3	-	-	-	-	-	-	-	
2	3P	3PC	GD Below Ground Srvc Rpr Cmplx	-	-	345	431	125	227	243	-	-	-	-	
3	50	50G	Impr Rel/Dep-Gas Svc Repl Leak	22,853	7,956	6,562	7,283	12,786	-	-	-	-	-	-	
4	50	50K	Emergent Leaking Main Replace	10,227	6,151	2,607	3,273	3,193	-	-	-	-	-	-	
5	50	50M	Complex-Gas Svc Repl Leak	9,007	1,583	609	403	292	797	-	-	-	-	-	
6	52	52B	Emerg Resp-G-Dig-Ins-Svcs	1,245	1,733	1,621	1,424	681	1,424	-	-	-	-	-	
7	52	52C	Emerg Resp-G-Dig-Ins-Main	320	2,042	123	(218)	918	408	286	295	303	311	319	
8	52	52D	Major Emergency Gas Distribtn	2	-	-	-	-	-	-	-	-	-	-	
9	52	#	Not assigned	5	-	-	-	-	-	-	-	-	-	-	
10		**Grand Total**		**43,659**	**19,465**	**11,866**	**12,600**	**17,995**	**2,855**	**529**	**295**	**303**	**311**	**319**	
11		* Excludes projects greater than $3M													

Workpaper Table 10-74
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 10, Gas Operations Leak Management
Summary of Capital Expenditures

Gas Distribution Capital

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast (A)	2022 Forecast (A)	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	Reference	Notes
1	GD Below Ground Service Repair	3P	3PB	-	-	2,471,058	1,327,913	562,153	4,839,312	3,572,531	-	-	-	-	-		1
2	GD Below Ground Srvc Rpr Cmplx	3P	3PC	-	-	344,635	431,271	125,385	226,774	243,155	-	-	-	-	-		1
3	Impr Rel/Dep-Gas Svc Repl Leak	50	50G	24,196,522	8,837,180	7,478,242	7,786,431	13,565,668	19,535,921	20,307,171	21,728,973	22,359,444	23,389,202	24,266,297	**91,743,917**	**WP 10-100**	
4	Emergent Leaking Main Replace	50	50K	10,306,156	6,151,996	2,607,618	4,154,745	3,329,759	4,333,611	5,555,437	5,725,453	5,878,895	6,032,335	6,189,778	**23,826,461**	**WP 10-104**	
5	Complex-Gas Svc Repl Leak	50	50M	9,007,471	1,583,104	608,571	403,376	292,002	641,358	674,081	1,004,139	1,033,542	1,080,861	1,121,393	**4,239,935**	**WP 10-102**	
6	Emergency Response Other	52	52#	4,596	-	-	-	-	-	-	-	-	-	-	-		2
7	Emerg Resp-G-Dig-Ins-Svcs	52	52B	1,244,617	1,732,911	1,621,437	1,424,285	681,426	1,423,779	1,296,810	1,336,493	1,372,311	1,408,129	1,444,881	**5,561,814**	**WP 10-106**	
8	Emerg Resp-G-Dig-Ins-Main	52	52C	319,764	2,042,437	122,599	(217,880)	917,821	408,000	286,144	294,906	302,810	310,713	318,823	**1,227,252**	**WP 10-108**	
9	Major Emergency Gas Distribtn	52	52D	1,921	-	-	-	-	-	-	-	-	-	-	-		2
10	**Total Capital Expenditures**			**45,081,046**	**20,347,628**	**15,254,159**	**15,310,142**	**19,474,215**	**31,408,756**	**31,935,328**	**30,089,964**	**30,947,002**	**32,221,240**	**33,341,173**	**126,599,379**		

Notes

(A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.
(1) MWC 3P was part of the NERBA balancing account for Leak Abatement OIR to capture 2018 and 2019 incremental costs only. An extension was granted through 2022 to track below ground grade 3 costs.
(2) These MATs were discontinued in 2016 and thus not forecasted for this rate case period

Table 10-75
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 50G - Simple Service Replacement - Unit Cost Forecast

MAT 50G (UNIT OF MEASURE: # OF SERVICES REPLACED)

2021 and 2022 Unit Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost (Grade 1 and 2 only)	$13,227,070.69	(A), (C)
2020 Recorded Units (Grade 1 and 2 only)	916	
Average Unit Cost	$14,440.03	Line 4/Line 5
2020 Adjustments to Forecast Basis (Unitized)	$0.00	(B)
Cost Basis for Forecast	**$14,440.03**	Line 6 + Line 7

Note:
(A) 2021 and 2022 unit cost forecast is based on 2020 Grade 1 and Grade 2 recorded costs only. Grade 3 costs will be captured under Balancing Account MAT 3PB.

2023 Unit Cost Forecast

Description	Value	Notes and References
2019 Recorded Cost	$9,114,377.94	(C)
2019 Recorded Units	735	
2020 Recorded Cost (All Grades)	$13,568,431.12	(C)
2020 Recorded Units (All Grades)	973	
Average Unit Cost	$13,280.33	Line 15 + Line 17/Line 16 + Line 18
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$13,280.33**	Line 19 + Line 21

	2021 (G), (I)	2022 (G)	2023 (H)	2024 (H)	2025 (H)	2026 (H)	Notes and References
Escalation Factor	3.00%	3.75%	3.75%	3.75%	3.75%	3.75%	(D)
Escalation Amount	$433.20	$557.75	$1,443.55	$552.15	$572.85	$594.33	(E)
Forecast Unit Cost	**$ 14,873.23**	**$15,430.98**	**$14,723.88**	**$15,276.03**	**$15,848.88**	**$16,443.21**	(F)
Forecast Units	**1,304**	**1,316**	**1,476**	**1,464**	**1,476**	**1,476**	WP 10-101, Line 1
Forecast Total Cost	**$19,394,697.80**	**$20,307,170.74**	**$21,728,973.05**	**$22,359,444.13**	**$23,389,202.40**	**$24,266,297.49**	Line 26 * Line 27

Note:
(B) No adjustments were made to the forecast basis.

(C) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences. Order detail information was needed in order to identify leak grades and control file did not provide that level of detail.
(D) 3.75% escalation rate was used to account for annual IBEW wage increases.
(E) Previous year unit cost x Escalation Factor.
(F) Previous year unit cost + Escalation Amount.
(G) 2021 and 2022 unit cost forecast includes costs associated only with Below Ground Grade 1 and Grade 2 leak repairs.

(H) 2023 and beyond unit cost forecast includes all costs associated with Below Ground Grade 1, 2 and 3 leak repairs. Unit Cost Methodology: Average of 2019 recorded and 2020 recorded total dollars and units (Cost Basis for Forecast on Line 21) plus 3.75% escalation rate.
(I) 2021 Forecast Total Cost on line 28 is for illustrative purposes in order for the forecast model to work. The actual 2021 forecast is based on approved 2021 budget and can be found in WP 10-99, line 3.

Table 10-76
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 50G - Leak Management - Simple Service Replacement - Volume Forecast

		Recorded	Forecast						
Line	MAT Code (D)	2020	2021	2022	2023	2024	2025	2026	Notes and References
1	50G - Leak Management - Simple Service Replacement	928	1,304	1,316	1,476	1464	1,476	1,476	(A)
2	3PB - BA - Below Ground 3 Simple Service Replacement	42	240	240					(A), (B)
3	**Total**	**970**	**1,544**	**1,556**	**1,476**	**1,464**	**1,476**	**1,476**	
4									
5	**Notes:**								
6	(A) 2021-2026 Forecast is based off a 3 year survey cycle.								
7	(B) MAT Code 3PB is a MAT Code that was established to track Leak Abatement Balancing Account costs in 2018 and 2019 as part of the Leak Abatement								
8	Order Instituting Rulemaking (OIR). The balancing account was extended through 2022. PG&E discusses the Leak Abatement OIR and the balancing account in Exhibit (PG&E-3), Chapter 10, Section D.								
9									

10	MAT 50G	Grade				
11	Year	1	2	3 (C)	Total (D)	
12	2021	959	345	240	1,544	From WP 10-27, Line 9
13	2022	967	348	240	1,556	From WP 10-27, Line 19
14	2023	967	348	160	1,476	From WP 10-27, Line 29
15	2024	959	345	160	1,464	From WP 10-27, Line 39
16	2025	967	348	160	1,476	From WP 10-27, Line 49
17	2026	967	348	160	1,476	From WP 10-27, Line 59
18						
19	**Notes:**					
20	(C) Grade 3 leaks are based on PG&E completing 2,000 Below ground 3 leaks year over year. See Note 1, WP 10-26, Line 13.					
21	(D) Refer to WP 10-29 and 10-37 to 10-46 for detailed calculations.					

Table 10-77
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 50M - Complex Service Replacement - Unit Cost Forecast

MAT 50M (UNIT OF MEASURE: # OF SERVICES REPLACED)

2021 and 2022 Unit Cost Forecast

Description	Value	Notes and References
2020 Recorded Cost (Grade 1 and 2 only)	$239,701.11	(A), (C)
2020 Recorded Units (Grade 1 and 2 only)	19	
Average Unit Cost	$12,615.85	Line 4/Line 5
2020 Adjustments to Forecast Basis (Unitized)	$0.00	(B)
Cost Basis for Forecast	**$12,615.85**	Line 6 + Line 7

Note:
(A) 2021 and 2022 unit cost forecast is based on 2020 Grade 1 and Grade 2 recorded costs only. Grade 3 costs will be captured under Balancing Account MAT 3PC.

2023 Unit Cost Forecast

Description	Value	Notes and References
2019 Recorded Cost	$819,948.91	(C)
2019 Recorded Units	43	
2020 Recorded Cost (All Grades)	$292,003.16	(C)
2020 Recorded Units (All Grades)	28	
Average Unit Cost	$15,661.30	Line 15 + Line 17/Line 16 + Line 18
2020 Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$15,661.30**	Line 19 + Line 21

	2021 (G), (I)	2022 (G)	2023 (H)	2024 (H)	2025 (H)	2026 (H)	Notes and References
Escalation Factor	3.00%	3.75%	3.75%	3.75%	3.75%	3.75%	(D)
Escalation Amount	$378.48	$487.29	$1,702.36	$651.14	$675.55	$700.89	(E)
Forecast Unit Cost	**$ 12,994.32**	**$13,481.61**	**$17,363.66**	**$18,014.79**	**$18,690.35**	**$19,391.24**	(F)
Forecast Units	**49**	**50**	**58**	**57**	**58**	**58**	WP 10-103, Line 1
Forecast Total Cost	**$636,721.84**	**$674,080.52**	**$1,004,138.59**	**$1,033,542.02**	**$1,080,861.06**	**$1,121,393.35**	Line 26 * Line 27

Note:
(B) No adjustments were made to the forecast basis.
(C) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences. Order detail information was needed in order to identify leak grades and control file did not provide that level of detail.
(D) 3.75% escalation rate was used to account for annual IBEW wage increases.
(E) Previous year unit cost x Escalation Factor.
(F) Previous year unit cost + Escalation Amount.
(G) 2021 and 2022 unit cost forecast includes costs associated only with Below Ground Grade 1 and Grade 2 leak repairs.

(H) 2023 unit cost forecast includes all costs associated with Below Ground Grade 1, 2 and 3 leak repairs. Unit Cost Methodology: Average of 2019 recorded and 2020 recorded total dollars and units (Cost Basis for Forecast on Line 21) plus 3.75% escalation rate.
(I) 2021 Forecast Total Cost on line 28 is for illustrative purposes in order for the forecast model to work. The actual 2021 forecast is based on approved 2021 budget and can be found in WP 10-99, line 5.

Table 10-78
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 50M - Leak Management - Complex Service Replacement - Volume Forecast

		Recorded	Forecast						
Line	MAT Code (D)	2020	2021	2022	2023	2024	2025	2026	Notes and References
1	50M - Leak Management - Complex Service Replacement	22	49	50	58	57	58	58	(A)
2	3PC - BA - Below Ground 3 Complex Service Replacement	6	12	12					(A), (B)
3	**Total**	**28**	**61**	**62**	**58**	**57**	**58**	**58**	

Notes:
(A) 2021-2026 Forecast is based off a 3 year survey cycle.
(B) MAT Code 3PC is a MAT Code that was established to track Leak Abatement Balancing Account costs in 2018 and 2019 as part of the Leak Abatement Order Instituting Rulemaking (OIR). The balancing account was extended through 2022. PG&E discusses the Leak Abatement OIR and the balancing account in Exhibit (PG&E-3), Chapter 10, Section D.

MAT 50M	Grade				
Year	1	2	3 (C)	Total (D)	
2021	35	15	12	61	From WP 10-27, Line 10
2022	35	15	12	62	From WP 10-27, Line 20
2023	35	15	8	58	From WP 10-27, Line 30
2024	35	15	8	57	From WP 10-27, Line 40
2025	35	15	8	58	From WP 10-27, Line 50
2026	35	15	8	58	From WP 10-27, Line 60

Notes:
(C) Grade 3 leaks are based on PG&E completing 2,000 Below ground 3 leaks year over year. See Note 1, WP 10-26, Line 13.
(D) Refer to WP 10-29 and 10-37 to 10-46 for detailed calculations.

Table 10-79
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 50K - Emergent Leaking Main Replacement - Unit Cost Forecast

MAT 50K (UNIT OF MEASURE: FEET OF MAIN INSTALLED)

Line	Description	Value	Notes and References
3	2019 Recorded Cost	$4,154,746.59	(A)
4	2019 Recorded Units	8,129	
5	2020 Recorded Cost	$3,329,759.21	(A)
6	2020 Recorded Units	2,709	
7	Average Unit Cost	$690.58	Line 3 + Line 5/Line 4 + Line 6
8	Adjustments to Forecast Basis	$0.00	(B)
9	**Cost Basis for Forecast**	**$690.58**	Line 7 + Line 8

Line		2021	2022	2023	2024 (F)	2025 (F)	2026 (F)	Notes and References
12	Escalation Factor	1.36%	2.98%	3.06%	2.68%	2.61%	2.61%	(C)
13	Escalation Amount	$9.39	$20.86	$22.06	$19.91	$19.88	$20.39	(D)
14	**Forecast Unit Cost**	**$699.97**	**$720.83**	**$742.89**	**$762.80**	**$782.68**	**$803.07**	(E)
15	**Forecast Units**	**7,707**	**7,707**	**7,707**	**7,707**	**7,707**	**7,707**	WP 10-105, Line 1
16	**Forecast Total Cost**	**$5,394,683.17**	**$5,555,444.73**	**$5,725,453.00**	**$5,878,929.03**	**$6,032,113.04**	**$6,189,288.47**	Line 14 * Line 15

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.
(F) 2024-2026 forecast has an immaterial variance from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to rounding difference.

Table 10-80
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 50K - Emergent Leaking Main Replacement - Volume Forecast

		Recorded	Forecast						
Line	MAT Code	2020	2021	2022	2023	2024	2025	2026	Notes and References
1	50K - Emergent Leaking Main Replacement	2,709	7,707	7,707	7,707	7,707	7,707	7,707	(A)
2									
3	**Notes:**								
4	(A) PG&E's 2021-2026 forecast is based on a three year historical average, 2017-2019 data.								
5									

6	Division	2017	2018	2019	3 Yr Average
7	CC				
8	DA			180	180
9	DI	50			50
10	EB	733	110	283	375
11	FR	431		4,562	2,497
12	HB				
13	KE				
14	MI	135		204	170
15	NB	118	965		542
16	NV		1,562		1,562
17	PN		104		104
18	SA	207		1,865	1,036
19	SF			748	748
20	SI				
21	SJ	1,306	126		716
22	SO	103	102	291	165
23	ST	8,504		431	4,468
24	YO				
25	**Total**	**11,587**	**2,969**	**8,564**	**7,707**

Table 10-81
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 52B - Emergency Response, Gas, Dig-Ins, Services - Unit Cost Forecast

MAT 52B (UNIT OF MEASURE: # OF SERVICES REPLACED)

Description	Value	Notes and References
2018 Recorded Cost	$1,621,441.24	(A)
2018 Recorded Units	198	
2019 Recorded Cost	$1,424,292.13	(A)
2019 Recorded Units	174	
2020 Recorded Cost	$681,428.08	(A)
2020 Recorded Units	162	
Average Unit Cost	$6,979.70	Line 3 + Line 5 + Line 7/Line 4 + Line 6 +Line 8
Adjustments to Forecast Basis	$0.00	(B)
Cost Basis for Forecast	**$6,979.70**	Line 9 + Line 10

	2021	2022	2023	2024 (F)	2025 (F)	2026 (F)	Notes and References
Escalation Factor	1.36%	2.98%	3.06%	2.68%	2.61%	2.61%	(C)
Escalation Amount	$94.92	$210.82	$222.93	$201.27	$200.89	$206.12	(D)
Forecast Unit Cost	**$7,074.63**	**$7,285.45**	**$7,508.39**	**$7,709.65**	**$7,910.54**	**$8,116.66**	(E)
Forecast Units	**203**	**178**	**178**	**178**	**178**	**178**	WP 10-107, Line 1
Forecast Total Cost	**$1,436,149.29**	**$1,296,810.27**	**$1,336,492.66**	**$1,372,318.58**	**$1,408,076.32**	**$1,444,765.79**	Line 16 * Line 17

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.
(F) 2024-2026 forecast has an immaterial variance from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to rounding difference.

Table 10-82
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 52B - Emergency Response, Gas, Dig-Ins, Services - Volume Workpapers

		Recorded	Forecast						
Line	MAT Code	2020	2021	2022	2023	2024	2025	2026	Notes and References
1	52B - Emergency Response, Gas, Dig-Ins, Services	162	203	178	178	178	178	178	(A), (B)
2									
3	**Notes:**								
4	(A) PG&E's 2021 forecast is based on imputed unit target.								
5	(B) PG&E's 2022-2026 forecast is based on a three year historical average, 2018-2020 data.								
6									

	2018	2019	2020	3 Yr Average
7				
8 **Grand Total**	198	174	162	178

Table 10-83
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 52C - Emergency Response, Gas, Dig-Ins, Mains - Unit Cost Forecast

MAT 52C (UNIT OF MEASURE: FEET OF MAIN REPLACED)

Line	Description	Value	Notes and References
3	2018 Recorded Cost	$122,600.32	(A)
4	2018 Recorded Units	768	
5	2019 Recorded Cost	-$217,879.95	
6	2019 Recorded Units	608	
7	2020 Recorded Cost	$917,821.22	(A)
8	2020 Recorded Units	1,991	
9	Average Unit Cost	$244.33	Line 3 + Line 5 + Line 7/Line 4 + Line 6 +Line 8
10	Adjustments to Forecast Basis	$0.00	(B)
11	**Cost Basis for Forecast**	**$244.33**	Line 9 + Line 10

Line		2021	2022	2023	2024 (F)	2025 (F)	2026 (F)	Notes and References
14	Escalation Factor	1.36%	2.98%	3.06%	2.68%	2.61%	2.61%	(C)
15	Escalation Amount	$3.32	$7.38	$7.81	$7.05	$7.03	$7.22	(D)
16	**Forecast Unit Cost**	**$247.65**	**$255.03**	**$262.840**	**$269.89**	**$276.92**	**$284.13**	(E)
17	**Forecast Units**	**988**	**1,122**	**1,122**	**1,122**	**1,122**	**1,122**	WP 10-109, Line 1
18	**Forecast Total Cost**	**$244,682.44**	**$286,148.58**	**$294,906.16**	**$302,811.39**	**$310,701.58**	**$318,797.36**	Line 16 * Line 17

Notes:

(A) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.
(B) No adjustments were made to the forecast basis.
(C) See Exhibit (PG&E-3), Chapter 2.
(D) Previous year unit cost x Escalation Factor.
(E) Previous year unit cost + Escalation Amount.
(F) 2024-2026 forecast has an immaterial variance from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to rounding difference.

Table 10-84
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10, Leak Management
Workpapers Supporting Chapter 10 Forecast
MAT 52C - Emergency Response, Gas, Dig-Ins, Mains - Volume Forecast

		Recorded	Forecast						
Line	MAT Code	2020	2021	2022	2023	2024	2025	2026	Notes and References
1	52C - Emergency Response, Gas, Dig-Ins, Mains	1,991	988	1,122	1,122	1,122	1,122	1,122	(A), (B)
2									
3	**Notes:**								
4	(A) PG&E's 2021 forecast is based on imputed unit target.								
5	(B) PG&E's 2022-2026 forecast is based on a three year historical average, 2018-2020 data.								
6									

		2018	2019	2020	3 Yr Average
7					
8	**Grand Total**	768	608	1,991	1,122

Table 10-85
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 10, Gas Operations Leak Management
Capital Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 3P	MWC 50	MWC 52	Detailed Description/Explanation
1	**2016**	**45,081**	**0**	**43,510**	**1,571**	
2			0			
3				(26,938)		Decrease due to lower leak find rates and work not materializing.
4					2,204	Increase due to more emergency work than planned related to weather events.
5	**2017**	**20,348**	**0**	**16,572**	**3,775**	
6			2,816			
7				(5,878)		Decrease is due to a lower leak find rate materializing, re-evaluation and implementation of a new strategy for service repair leading to a lower number of below ground leak repairs recorded, and the transition of work to regional crews.
8					(2,031)	Reduction due to less dig-ins.
9	**2018**	**15,254**	**2,816**	**10,694**	**1,744**	
10			(1,057)			2019 decreased the amount of below ground Grade 3 repairs due to exceeding approved funding by the Commission for this type of work.
11				1,650		Increase in emergent leaking main replacement projects.
12					(538)	Reduction due to less dig-ins.
13	**2019**	**15,310**	**1,759**	**12,345**	**1,206**	
14			(1,072)			Balancing account only captured below ground Grade 3 costs starting in 2020. All other costs moved to base MATs.
15				4,843		Previously captured costs in balancing account was reallocated to base MATs. Balancing account only captures below ground Grade 3 costs starting in 2020.
16					393	Increase due to more emergency work than planned.
17	**2020**	**19,474**	**688**	**17,187**	**1,599**	

Note: Total amounts and amounts for each MWC are obtained from WP 10-99 by summing the relevant lines for each MWC.

Workpaper Table 10-86
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 10, Gas Operations Leak Management
Capital Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 3P	MWC 50	MWC 52	Detailed Description/Explanation
1	**2020**	**19,474**	**688**	**17,187**	**1,599**	
2			4,379			Increase in leak find rates and additional Grade 3 repairs due to Best Practice 21.
3				7,323		Increase in labor costs and higher volume of main leak repair forecasted.
4					233	Increase due to standard escalation.
5	**2021**	**31,409**	**5,066**	**24,511**	**1,832**	
6			(1,250)			2021 forecast was over forecasted for below ground Grade 3 repair volume.
7				2,026		Increase due to standard escalation.
8					(249)	2021 forecasted units was based on imputted, while 2022 was based on 3-year historical average leading to a reduction in units in MAT 52B.
9	**2022**	**31,935**	**3,816**	**26,537**	**1,583**	
10			(3,816)			Discontinuation of NERBA balancing account MATs
11				1,922		Reallocation of Grade 3 leak repairs under Base capital MATs. Discontinue of NERBA balancing account.
12					48	Increase due to standard escalation.
13	**2023**	**30,090**	**0**	**28,459**	**1,631**	
14			0			Discontinuation of NERBA balancing account MATs
15				813		Increase due to escalation.
16					44	Increase due to standard escalation.
17	**2024**	**30,947**	**0**	**29,272**	**1,675**	
18			0			Discontinuation of NERBA balancing account MATs
19				1,231		Increase due to escalation.
20					44	Increase due to standard escalation.
21	**2025**	**32,221**	**0**	**30,502**	**1,719**	
22			0			Discontinuation of NERBA balancing account MATs
23				1,075		Increase due to escalation.
24					45	Increase due to standard escalation.
25	**2026**	**33,341**	**0**	**31,577**	**1,764**	

Note: Total amounts and amounts for each MWC are obtained from WP 10-99 by summing the relevant lines for each MWC.

Leak Survey Process

SUMMARY

This utility procedure provides the process and instructions for performing, monitoring, and documenting gas leak surveys for Pacific Gas and Electric Company (PG&E or Company) gathering, transmission, and distribution pipeline facilities.

Level of Use: Informational Use

TARGET AUDIENCE

Personnel who manage, perform, or document leak surveys including, but not limited to, personnel in gas leak survey, gas pipeline operations and maintenance (GPOM), mapping, quality management (QM), and gas asset strategy (see Utility Standard TD-4110S, “Gas Leak Survey and Detection Program,” for roles and responsibilities).

Personnel that do not perform specific leak survey tasks but need to be aware of the requirements detailed in this utility procedure, include maintenance and construction (M&C) personnel, pipeline engineers, integrity management (IM) personnel (distribution integrity management program [DIMP], transmission integrity management program [TIMP], and facility integrity management program [FIMP] personnel), regulatory compliance, quality control, and compliance desk personnel.

SAFETY

Personnel completing this work must follow standard safe work practices and use standard-issue personal protective equipment (PPE). Hazards and abnormal operating conditions (AOCs) impacting this work include, but are not limited to:

- Explosive gases
- Dangerous animals
- Environmental surroundings, tripping and slipping, and traffic conditions
- Vegetation, including poison oak

Leak Survey Process

BEFORE YOU START

1.1 **Dog Bite Prevention**

1. Follow Corporation Standard SAFE-1038S, “Dog Bite Prevention Standard,” whenever working in locations where a dog might be present.

2. The following dog bite prevention tools are available for purchase through Supplies and Solutions (S&S):

   - Bulli Ray baton, S&S part number 2881241
   - Certified dog repellent, S&S part number 2721442
   - Dog Dazer II Ultrasonic Dog Deterrent, S&S part number 2824173

1.2 **Operator Qualifications (OQs):** This procedure contains covered tasks requiring qualifications. For covered task information, including date available and effective dates, please consult the *Guide to Operator Qualifications* in the Technical Information Library (TIL) or contact the Gas Qualifications department.

1.3 **Tools:** See Utility Procedure TD-4110P-21, “Calibration Verification for Leak Survey Instruments,” and Gas Design Standard (GDS) M-58, “Leak Survey and Leak Investigation Tools and Equipment,” for approved leak survey tools and equipment. The *Leak Survey Field Guide* also has recommended additional materials the line of business has identified to be used while performing leak survey.

1.4 **Training:** See the Academy training curriculum for most up-to-date available courses.

1.5 **PPE:** Personnel performing this procedure must have the minimum PPE per the Gas Operations PPE Matrix and PG&E’s *Code of Safe Practices (CSP)*.

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Leak Survey Process

PROCEDURE STEPS

1 Overall Process Steps

1.1 Performing gas leak surveys of PG&E assets is required per Federal Code and State of California requirements. Leak survey frequency is also governed by these requirements.

1.2 The major steps of completing leak survey are:

1. Prepare
    a. Understand your surroundings and requirements for designated areas and special leak survey
    b. Determine type of leak survey
2. Perform leak survey and rechecks
3. Document

1.3 If at any time the leak survey map does not align with field conditions, leak survey completes map correction Form TD-4460P-11-F01, “Gas Map Correction,” per Utility Procedure TD-4460P-11, “Gas Map Corrections,” to ensure the geographic information system (GIS) is updated. Create a Corrective Action Program (CAP) notification and submit Form TD-4460P-11-F01 to mapping personnel.

2 Leak Survey Frequency and Schedule

2.1 Complete leak surveys at the following intervals (see Table 1 for frequency by asset):

1. Quarterly. Four times each calendar year, not exceeding 4½ months, to the date.
2. Semi-Annually. Twice each calendar year, not exceeding 7½ months, to the date.
3. Annually. Once each calendar year, not exceeding 15 months, to the date.
4. 3-Year. Once every three calendar years, not exceeding 39 months, to the date.
5. 5-Year. Once every five calendar years, not exceeding 63 months, to the date.
6. PGE has accelerated the 5-year survey to 3 years to meet the California Public Utilities Commission (CPUC) leak abatement commitment.

Leak Survey Process

Table 1. Leak Survey Frequency

Facility Types[1]	Description	Survey Frequency
Distribution	Business districts and public assemblies	Annually
	Buried metallic facilities not under cathodic protection and not covered by an annual requirement	3 Years
	All copper facilities	3 Years
	Balance of underground distribution facilities	5 Years
Transmission	Department of Transportation (DOT) transmission all odorized transmission (including non-HCA pipe within a Class III and Class IV location)	Semi-Annually
Un-Odorized DOT Transmission and Un-Odorized DOT Gathering	Class I, Class II, and Class III	Semi-Annually
	Class IV	Quarterly
Gathering (odorized)	Class I, Class II, Class III, and Class IV	Annually
Transmission Stations	Class I, Class II, and Class III	Semi-Annually
Electric Substations	Any existing facilities within 150 feet of the structure	Semi-Annually (PG&E policy)

1. See Utility Procedure TD-4125P-10, "Identifying Gas Transmission Assets."

2.2 Semi-annually, typically in June and December, leak management (LM) must ensure a supplemental gas leak survey analysis is performed to identify facilities that have become operational since the previous annual analysis.

2.3 LM performs semi-annual review of gas distribution (GD) GIS plat to ensure all plats have one-year and three-year maintenance plans.

3 Leak Survey Preparation

3.1 Ensure leak survey instrument is entered in SAP with maintenance plans to schedule calibration. See Utility Procedure TD-4007P-02, "Measurement and Test Equipment Process," for additional instrument tracking requirements.

1. Request asset strategist to add new instruments in SAP via the Request for Work process.

3.2 Capture leak survey documentation electronically. The leak survey supervisor and mappers review documentation per the internal process plan.

1. Only use tech down paper forms when an approved electronic device is unavailable.

NOTE

Leaks cannot be closed in SAP until all required daily check log information has been provided electronically.

Leak Survey Process

3.2 (continued)

2. Ensure the following forms are available and printed prior to leak survey when electronic device is unavailable:

   a. Form TD-4110P-01-F01, “Daily Leak Survey Log”

   b. Form TD-4110P-01-F02, “Map Stamp”

   c. Form TD-4110P-01-F03, “Leak Survey CGI Log”

   d. Form TD-4110P-01-F04, “Gas Transmission Leak Survey Log”

   e. Form TD-4110P-01-F05, “Gas Transmission Station Leak Survey Report (GT Backbone)”

   f. SAP-generated leak recheck work ticket

3.3 Leak survey supervisor reviews maps assigned for leak survey.

1. Maps for scheduled leak surveys may be printed by distribution mapping personnel (excluding exceptions for specific DIMP leak surveys (see Section 6.2) or may be provided electronically on an approved electronic device.

   a. Print the most current survey map. Print the distribution leak survey map within 30 days before survey date to ensure map information is up-to-date when surveyed.

   b. Mapping personnel post all open leaks on maps to be surveyed.

   c. When generating tech down paper forms, include Form TD-4110P-01-F02 on the back of all printed distribution leak survey maps.

   d. Transmission maps (aerial and gas transmission [GT] GIS) are created by transmission analyst and printed by distribution mapping personnel or provided electronically on an approved electronic device.

3.4 The leak survey supervisor assigns recheck work tickets for each open leak on the specific plat scheduled to be surveyed. All open leaks identified must be surveyed.

1. SAP recheck work tickets must be generated within 30 days of a scheduled leak survey.

3.5 Surveyor compares recheck work ticket to open leaks identified on map to ensure the recheck work ticket includes all known leaks.

1. Recheck work tickets allow the surveyor to recheck any open leaks that are within the scope of the routine leak survey and prevents the duplication of leak number assignments and entry into SAP.

Leak Survey Process

3.6 The leak surveyor receives and reviews the survey documentation assigned by the leak survey supervisor that includes:

1. A distribution leak survey with all Company distribution facilities identified for the survey up to and including the customer's meter or end of pipe (e.g., a distribution service stub).

2. A transmission leak survey identifying transmission lines for leak survey and service taps from the main up to the outlet of a transmission farm tap regulator set.

   a. Transmission leak surveys include transmission pipelines, distribution feeder mains, and gathering pipelines with limitations for subsurface vaults and aboveground facilities.

3. For subsurface vaults a leak survey is performed at the surface and vents without opening lid. Further investigation is required when a leak indication is found (refer to Utility Procedure TD-4110P-09, "Leak Grading and Response").

4. Transmission station survey that includes all piping within the station fence line, excluding fuel lines (see Section 5.4).

3.7 LM ensures all leak survey tasks are documented and archived in SAP except CGI follow up (see Step 7.12). If electronic data entry is unavailable, use tech down forms (see Step 3.1).

1. Mapping personnel ensure tech down data is uploaded in electronic system as soon as possible so that data is available to PG&E personnel who perform required tasks after leak survey is complete (e.g., data review, repair, and scheduling rechecks).

3.8 Obtain the following additional required documentation for transmission leak survey, if not available electronically:

- Frequency table
- Aerial plat
- Overview Map

3.9 To plan an efficient survey route, review the maps to evaluate the footage of the main and condition of the area being surveyed (e.g., vegetative cover, water crossings, offsets, distance to headquarters, growth season, and residential and commercial areas).

1. It is also recommended to drive the route before performing leak survey to ensure access to all areas, plan walking route, and determine areas of high traffic.

2. See Section 4 for safe work practices when performing leak surveys in high-traffic areas.

3.10 Use only an approved leak survey instrument (refer to Utility Procedure TD-4110P-21) to perform a leak survey.

Leak Survey Process

4 Working Safely in High-Traffic Areas

4.1 When work is required in high-traffic areas, create a work safety plan considering best options for each situation, then review with the leak survey supervisor to determine which traffic safety method is best for the location being surveyed.

4.2 Do not enter a public roadway without the use of proper temporary traffic control.

4.3 When walking in a roadway, face traffic to maintain situational awareness.

4.4 Use tools and equipment as appropriate to reduce exposure to traffic (e.g., mobile system to survey main in roadways).

4.5 Review options for performing survey during hours when traffic is lighter with leak survey supervisor.

4.6 Wear high-visibility vests with reflective material (see Figure 1). This vest is required PPE for traffic areas with speed limits of 45 miles per hour (mph) or greater.

4.7 Use a mobile leak survey or remote methane leak detector (RMLD) per Utility Procedure TD-4110P-21 when necessary.

Figure 1. Class 3 Vest with Sleeves

4.8 Use traffic control or additional personnel to ensure visibility and personal safety.

1. In residential areas, place signs to notify motorists that work is occurring in the roadway.
    a. Recommend working in pairs, starting on opposites sides and moving towards each other. Signs would be placed at the starting position of each survey location.
2. Appropriately colored or marked vehicles with high-intensity rotating, flashing, oscillating, or strobe lights may be used in place of signs.
    a. Vehicles must be near the personnel performing the work.
    b. Use when performing stationary work such as leak investigation.
3. A shadow vehicle may be used when walking in a roadway.
    a. Consult responsible supervisor before using a shadow vehicle.
    b. Shadow vehicle must have operating light bar or arrows.

Leak Survey Process

5 Survey Requirements for Specifically Designated Areas

5.1 Public Assemblies (Schools, Hospitals, and Churches)

1. Perform a survey near identified public building locations, including tests of the atmosphere in gas, electric, telephone, sewer, and water system manholes, at cracks in pavement and sidewalks, and at other locations that provide an opportunity for finding gas leaks. Refer to CPUC General Order 112-F (GO 112-F), §143.1, "Leakage Surveys and Procedures."

2. For distribution facilities, a public building survey must include:

   a. All Company facilities feeding the public building assembly.

   b. Service lines, including stubs, branch services, and all connected branch services to a customer meter.

   c. Services and main per Table 2.

   d. Leak surveyors can identify main and service line lengths in the field by using maps, installation records, and drawings as references.

Table 2. Public Assembly Survey Requirements for Distribution Facilities

Condition	Action
Service Line (200 feet or less)	Survey Entire Service Line[1] and 50 Feet of Main in Each Direction
Service Line (greater than 200 feet)	Survey Entire Service Line[1] and Tee
Service Line in Known Casing	Survey Entire Service Line[1], Pausing at Each Suspected Casing Opening
Distribution Main Lines	Survey Any Main Within 25 Feet of Structure

1. Service line includes stubs and branch services.

NOTE

New public buildings may also require extension of business district boundaries.

3. Survey any new public building locations. Complete Form TD-4460P-11-F01, create a CAP notification and submit to mapping personnel to update GIS.

5.2 Business Districts

1. A leak survey must include both main and service lines in the building districts identified on leak survey map.

   a. Business districts are programmatically highlighted on leak survey maps.

2. Survey any new business districts. Complete Form TD-4460P-11-F01 when map does not reflect observed conditions and create a CAP report to submit to mapping personnel to update GIS.

Leak Survey Process

WARNING

Qualified electric personnel (electrician or higher) must accompany leak surveyor whenever entering a substation.

5.3 Designated Enclosed Electric Substations and Switching Stations

1. Request qualified electrical worker (QEW) support before performing leak survey at substation.

2. At frequency per Table 1, perform a leak survey at the following locations:

   a. Sub/switching station building foundation line

   b. Any existing gas facilities located within 150 feet from the outermost edge(s) of the structure

   c. Nearest electric substructure(s)

5.4 Transmission Station Survey

1. If necessary, contact GPOM to obtain access into station.

2. Survey all facilities within fence line except fuel lines. Fuel lines (from regulation to compressor) are not included in station survey.

NOTE

Buried piping connects regulator and monitor facilities with remote terminal unit (RTU) facilities.

5.5 Supervisory Control and Data Acquisition (SCADA) and Electronic Recorder (ERX) facilities

1. Survey all venting locations around SCADA and ERX facilities located next to transmission and distribution regulator stations for leaks.

5.6 Inaccessible Facilities Under Waterways

1. Operators of PG&E watercraft must successfully complete a boating safety course approved by the California Department of Boating and Waterways (CDBW).

   a. It can take up to six weeks to receive an operator certificate after the boating safety course has been completed.

2. Ensure watercraft speed does not exceed 3.9 knots (4.5 mph).

Leak Survey Process

5.6 (continued)

3. Maintain the height of a RMLD to the waterline at 6 feet or less and maintain the height of the laser on a background target to the waterline between 12 inches (minimum) and 24 inches (maximum), as shown in Figure 2.

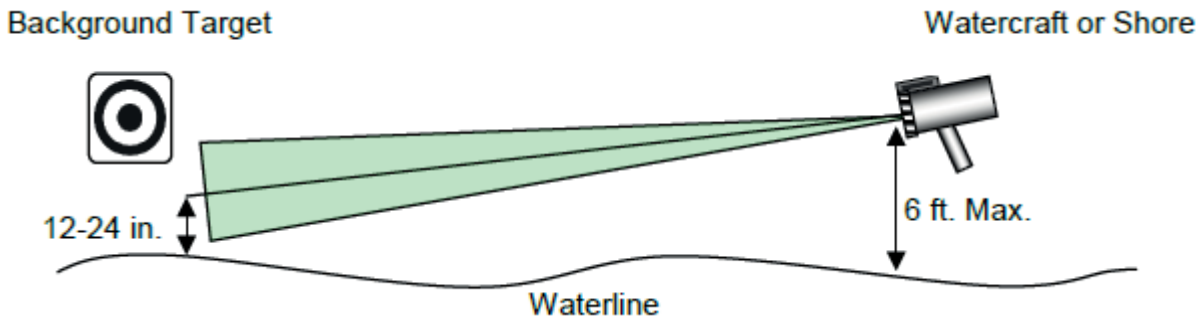

Figure 2. Maximum Laser Light

4. For surveys less than 75 feet where the shoreline is flat and background reflection is not possible, use a second person to hold a background target.

5. For surveys between 75 feet and 120 feet use the RMLD at a distance of 75 feet (maximum) from the watercraft to a shoreline OR background target. Two people may be required, with one on shore and one in the watercraft.

6. For surveys greater than 120 feet, use the RMLD to shoot watercraft-to-watercraft or shore-to-watercraft. Shooting distance must be 75 feet or less. At least two people are required, with one on shore and one in the watercraft OR watercraft to watercraft.

7. Any leaks found must be confirmed with Detecto Pak Infrared (DP-IR) or visually (bubbles) and graded per Utility Procedure TD-4110P-09.

Leak Survey Process

6 Types of Leak Survey

NOTE

Visual inspection and vegetation leak surveys are NOT Company-approved leak survey methods.

6.1 Use only the Company-approved gas leak survey methods listed below. Refer to Utility Procedure TD-4110P-21 for approved tools and calibration requirements for each method:

- Mobile
- Aerial
- Foot
- Picarro

6.2 Integrity Management (IM) Planned and Leak Abatement Order Institute Rulemaking (OIR) Leak

1. Determine leak survey areas through IM internal process per Utility Procedure TD-4850P-01, “Gas Distribution Integrity Management Program.”
   a. Planned survey is determined by periodic risk assessment.
   b. Additional fusion failure survey may be requested through IM recommendation.
   c. Leak survey areas are identified through IM internal process.
   d. Mapping personnel print plats and provide open leak work tickets for leak survey.
   e. Any changes to regular leak survey locations or public assembly points will follow the map correction process, see Utility Procedure TD-4460P-11, “Gas Map Corrections.”

6.3 Special Leak Survey and Ad Hoc Requests

1. Assigned personnel (engineering, IM, PG&E leadership, etc.) determines the need for special leak surveys based on event, typically after an extraordinary event.
2. Appropriate supervisor provides special leak survey maps when maps are digital or by Mapping for tech down process with exception below.
   a. Leak survey or GPOM supervisor may print tech down maps for events occurring outside of core business hours.
3. Personnel submits special leak survey requests via email to: SpecialLeakSurveyNotification@PGE.com.

Leak Survey Process

6.3 (continued)

4. Special leak surveys are required for the following situations:

   a. Before any scheduled street work is performed.

   b. Before, during, and after maximum allowable operating pressure (MAOP) uprates of gas distribution facilities. Refer to Utility Procedure TD-4125P-03, "Revising the MAOP of Pipelines Operating at 60 psig or Less."

   c. Following exposure of the gas facilities to unusual stresses caused by significant events (see Section 6.4).

   d. When requested by IM or electric substations personnel:

      (1) Perform special leak surveys near designated PG&E substations and known third-party electric substations where transformers and switching equipment are located inside an enclosed building.

      (2) Control buildings inside fenced substations are excluded.

   e. When mapping personnel receives a map correction form from non-leak survey personnel to add facilities AND map is not scheduled for survey in the current year, mapping personnel must submit a special leak survey request for the area.

      (1) A special leak survey (off cycle from normal schedule of the map) is performed and documented per this procedure.

      (2) After a special leak survey is performed, mapping personnel will work with appropriate groups to update GIS with facility location to ensure facilities are included in next scheduled leak survey.

6.4 Leak Survey Requirements After Significant Events

1. Significant events are natural or manmade occurrences (earthquakes, floods, mudslides, wildfires, etc., as determined by IM) that could have a potentially large impact on PG&E facilities.

2. IM may request additional patrolling to determine if an additional leak survey is required.

3. Refer to Gas Emergency Response Plan (GERP) for instructions and post-event emergency action plans.

Leak Survey Process

6.4 (continued)

4. Blasting

   a. Ensure a 500 foot (minimum) blast area before and after any blasting is completed.

   b. IM determines if an additional survey is required beyond 500 feet. Submit special leak survey requests via email to SpecialLeakSurveyNotification@PGE.com.

   c. IM informs leak surveyor of blasting area and additional leak survey requirements.

   d. Leak surveyor schedules any leak survey before blasting and the post-blast survey immediately following the operation and after the area has been restored to normal conditions.

5. Building Explosions

   a. Conduct a survey of the area closest to safely accessible gas lines (within 300 feet of the outside of the debris perimeter) OR the survey area as determined by IM personnel or LM.

6. Earthquakes

NOTE

The Dynamic Automated Seismic Hazard (DASH) system automatically generates rapid, facility-specific damage estimates for use in prioritizing initial PG&E post-earthquake facility inspections. DASH reports are distributed automatically via company email after an earthquake to subscribers and are archived to the DASH website.

   a. A leak survey is required after any earthquake registering a magnitude of 6.0 or greater. Survey area is determined by IM personnel.

   b. A leak survey may also be performed after any earthquake registering a magnitude of less than 6.0, as determined by IM personnel.

Leak Survey Process

6.4 (continued)

7. Structure Fire (CPUC-Reportable Incident)

   a. Data collected after a reportable event is used in legal proceedings and must be captured as soon as possible after the event. Refer to Utility Procedure TD-4413P-01, “Procedure for Reportable Gas Incidents” to determine if an incident is reportable to CPUC.

   b. When regulatory compliance personnel requests a special post-event survey, survey must be performed within 24 hours of request.

   c. Perform a leak survey of the following facilities for any reportable event or if instructed by regulatory compliance:

      - All facilities within approximately 150 feet in every direction.
      - The gas service (including any branch) supplying the damaged structure.
      - Any other gas facilities on the residential parcel.
      - Any nearby Company gas facilities that could have potentially contributed as a leak source.

   d. See Utility Procedure TD-4110P-09 for support and actions to access all facilities.

6.5 Aerial Leak Survey

1. LM confirms that any third-party leak survey pilot holds current (non-expired) OQ status before performing an aerial survey.

2. LM identifies gas transmission facility segments requiring aerial leak survey (facilities not already assigned to other survey type), including facilities listed below, AND creates a list of transmission facilities to be surveyed by aerial method:

   - Transmission facilities in Class 1, 2, and 3 locations
   - Distribution feeder mains (DFMs)
   - Gas gathering lines

Leak Survey Process

6.5 (continued)

3. Facilities not approved to be surveyed by aerial method include:
   - Farm tap services
   - High-pressure regulator (HPR) sets
   - Facilities under waterways
   - Transmission lines in Class 4 locations
   - Distribution lines
   - Controller-operated stations
4. LM prepares to assign aerial portion of the leak survey to third party contractor.
   a. Create and provide supplemental transmission sign-off sheets, or electronic equivalent, for all pipeline segments to be surveyed (if applicable).
   b. Notify local M&C or GPOM supervisors of any scheduled aerial leak survey before it occurs to ensure resources are available for follow up and repair.
   c. Contact Company helicopter operations AND completing any/all required documentation before aerial leak survey occurs, per Utility Manual TRAN-4004M, “Helicopter Operations Field Manual.”
5. The aerial leak survey vendor must complete the following daily tasks:
   a. Generate an aerial survey report that includes:
      - Completed tech-down or electronic version of Form TD-4110P-21-F08, “Aerial Leak Survey Instrument Calibration”
      - Listing of each methane indication with GPS coordinates
      - Observed pipeline AOCs with GPS coordinates
      - GPS coordinates of assigned pipeline sections or segments leak surveyed and those that could not be surveyed with aerial
   b. Provide a daily aerial survey report to LM personnel by the close of the next business day from end of flight.

Leak Survey Process

6.5 (continued)

6. LM reviews data and completed maps, assigning leak indications for investigation by the close of the next business day.

7. All leak survey follow-up must be completed within two calendar days of leak investigation assignment.

8. Survey 250 feet (minimum) in each direction along the facility path from the recorded GPS coordinates and document the survey either electronically or on tech down forms per this procedure.

   a. Leak indications identified by an aerial leak survey may be located some distance from the recorded GPS coordinates.

   b. Expand the survey depending on the proximity to any distribution facility, as it may be the source of the leak indication.

7 Performing Leak Survey

7.1 Before performing a leak survey:

1. Review the area for gas facility locations to be surveyed and plan the survey route accordingly (see Section 3 and Section 4).

2. Take wind speed readings at the survey location using an approved wind meter.

   a. Wind speed meter readings are taken at the height the leak survey instrument will be used, approximately 3 feet from ground level.

NOTE

A second wind reading is taken at approximately the mid-point of the leak-survey day, typically after lunch.

   b. If wind speed exceeds 15 mph, DO NOT perform leak survey. Discontinue any leak survey already started. A second wind reading should be is taken at approximately the mid-point of the leak-survey day, typically after lunch.

7.2 Perform leak survey of any/all identified facilities, even if not shown on map.

1. When a facility is found that is not included on map, complete Form TD-4460P-11-F01, create a CAP notification for mapping personnel to update GIS.

Leak Survey Process

WARNING

Personal injury may result from entering premises where dogs are present.

7.3 To survey vaults, the vault lid does not need to be removed. If any indication of a leak is found, grade the leak per Utility Procedure TD-4110P-09.

7.4 Use survey wand or laser path of the leak survey instrument on ground at locations where gas might vent, including:

- Gas, electric, telephone, sewer, and water manholes
- Cracks in pavement and sidewalks
- Other locations providing an opportunity for finding gas leaks (venting locations). See the *Leak Survey Field Guide* for an extensive list of examples.

WARNING

Unexpected, induced, or stray voltage can cause injury to personnel who touch piping or metallic facilities conducting voltage greater than 15 volts (V).

7.5 Before making physical contact with a riser, valve, regulator, meter, or similar metallic Company facility, use a non-contact voltage tester to determine if stray voltage is present, per GDS M-84, “Non-Contact Voltage Tester.”

1. Rubber bellows of the survey probe may contact the facility without testing with the non-contact voltage tester (NCVT).

7.6 Pause for three seconds where leaks are commonly found (i.e., risers, valves, tees, service tie-ins, and transitions). See the *Leak Survey Field Guide* for an extensive list of examples.

Leak Survey Process

NOTE

The extension wand does not resolve difficult to reach AC inspections. Facilities must be visible to perform atmospheric corrosion (AC) inspections per Utility Procedure TD-4188P-01, “Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets.”

7.7 For CGI locations resulting from difficult to reach places, and if facility is visible, an extension wand may be used to complete the leak survey per the following requirements.

- Extension wand may be used only with DP-IR instruments.
- A flow check must be performed before each time the probe is used (at each CGI location) to ensure a leak free sample is being taken.
- Extension wand is allowed to be used only when standard wand is not able to reach the facility, up to the meter and the meter (CGI locations).
- The wand must be used in locations where it can be physically observed (where placement of the cone can be seen).
- The extension wand is not allowed for regular walking leak survey.
- Care needs to be taken when using the probe, to avoid damage to property, and injury from aboveground wiring.
- Extension wand must be set to pause for 6-10 seconds before it is used.

7.8 When leak surveying a meter, use a smooth and sweeping motion of the probe or laser not more than 12 inches from the aboveground piping, including the base of customer piping. Keep RMLD transceiver a minimum of 3 feet from the facility being surveyed.

7.9 Atmospheric Corrosion (AC) Inspections

1. Perform and document AC inspections per Utility Procedure TD-4188P-01, “Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets,” and Utility Procedure TD-4188P-02, “Atmospheric Corrosion Inspection of Metallic Piping Systems.”
2. Document inspections by using the check box on Form TD-4110P-01-F02, “Map Stamp,” or electronic equivalent.
3. Electronically record excessive corrosion as an AOC to assign to appropriate work group for remediation.

Leak Survey Process

7.10 AOCs

1. Document AOCs electronically to assign to appropriate work group for remediation. Ensure a photo of the AOC is attached for further evaluation.

   a. For tech down, use Other corrective work process (OCW) to report AOCs.

2. Immediately notify gas control personnel and your supervisor of any hazardous AOCs.

7.11 Can't Get In (CGI) Process

1. A Can't Get In (CGI) is a location that cannot be surveyed at the time the map is worked. Once a facility is identified as CGI, the data is entered into the Can't Get In (CGI) Tracker using Inspect data or Form TD-4110P-01-F03, "Leak Survey CGI Log."

   a. Recommend that if location cannot be surveyed within 10 business days after the last day the rest of the map was completed, then submit documentation to close map in SAP and document CGI in Inspect or on CGI log. The data will be automatically available from Inspect for scheduling by CGI team.

   b. Do not enter CGI in Inspect until it is ready to be uploaded to Can't Get In (CGI) Tracker (i.e., 10 business days).

2. On the leak survey map, document any facility (services, meter, etc.) that could not be surveyed. Complete Form TD-4110P-01-F03 or electronic equivalent.

   a. Circle around CGI for leak survey and AC locations in green that were not completed. Mark locations that are only AC CGI with an orange circle.

3. Leak survey personnel will work in partnership with CGI team to resolve all CGIs before any compliance deadline. Through customer communications (e.g., letters, emails, and calls), the CGI team will schedule appointments to perform leak surveys and AC inspections (see Section 7).

4. Company leak survey and AC inspection personnel perform required inspections and electronically documents all inspections into an approved electronic device (FAS, ProntoForms, etc.). Neither Inspect nor plat maps are required for these follow-up CGI inspections. AOCs must be documented in Inspect.

   a. Qualified and trained GSRs may perform leak survey at CGI inside meter sets on above ground piping. Leak survey of below ground facilities must be completed by a qualified leak surveyor.

   b. If below ground piping is found during leak survey, then GSR requests leak surveyor through Dispatch to respond same day to perform the below ground survey. GSR must remain on site until leak survey arrives.

   c. Wind speed will be defaulted to zero for the inside meter sets since wind is not a factor inside a structure.

Leak Survey Process

7.11 (continued)

5. CGI record will be closed in the CGI Tracker when the necessary inspection is completed (i.e., leak survey, AC inspection).

   a. The CGI team and leak management personnel report all completed leak survey and communicates any non-compliance to the regulatory compliance for reporting to CPUC.

7.12 Leak Surveying After Inclement Weather

CAUTION

Standing water will interfere with detecting small amounts of gas and may cause damage to leak survey instruments.

1. DO NOT perform a leak survey when standing water is present over the facility or if the area is unsafe to walk (i.e., diminished visibility in area or roadway).

NOTE

Rain rechecks are used to determine whether leaks can be found with the instrument on the surface (not in a barhole).

2. Before survey begins, determine if an open below ground leak is available with a reading from 1%– 5% gas in air in the general survey area. Do not select a leak on a valve or inside a substructure.

   - If there are no open leaks at reading 5% or less, expand to 6%–10%. Choose a rain recheck location with similar soil type and saturation conditions as the survey area.

   - One recheck may be used for multiple maps, as necessary, if the above conditions are met.

3. When there are no open leaks available or no open leaks are found, per above, it is recommended that the supervisor select an alternate area to be surveyed that meets criteria above, until conditions change.

4. IF there is a concern that a compliance due date may not be met,

   THEN leak management makes decision on when leak survey begins after inclement weather.

7.13 Always perform a recheck of any/all open leaks on the map and recheck work ticket.

7.14 Grade and document leaks per Utility Procedure TD-4110P-09.

Leak Survey Process

8 Leak Survey Documentation

8.1 All leaks found must be graded per Utility Procedure TD-4110P-09 and entered electronically into SAP or on paper tech down form for subsequent entry into SAP.

1. For tech down forms, Grade 1 leaks (when repair crew does not have access to SAP), provide the A-Form (see Form TD-5100P-01-F01, “Leak Repair, Inspection, Gas Quarterly Incident Report [A-Form]”) directly to the assigned crew to ensure they have information to begin leak repair. M&C personnel must submit tech down form to mapping personnel.

8.2 When recording leak survey results, record completed leak survey, all leaks, and AOCs at the time of discovery either electronically or on tech down forms (if used).

- Submit completed tech down forms daily.

8.3 Review documentation before submittal to ensure all information is accurate and complete.

8.4 Document the following (either electronically or on tech down form):

1. Survey type
   a. Transmission or distribution
   b. Frequency (annual, 3-year, 5-year, etc.)
2. Survey area (distribution), survey date and surveyor LAN ID; for transmission, survey area when multiple days, surveyors, or instruments are used on the same map
3. Approved instrument used, including serial number (see Utility Procedure TD-4110P-21) and calibration information
4. CGI locations (leak survey and AC inspections)
5. Number of services and length of main (in feet)
6. Completed AC inspection notation of any excessive AC found
7. AOCs found
8. Wind speed in mph
9. Completed recheck work tickets
10. Aerial leak survey documentation and follow up survey

Leak Survey Process

8.5 Provide all other applicable information (electronic and paper).

1. Provide map correction form (electronic or paper) to mapping personnel.

2. Provide A-form (Form TD-5100P-01-F01) documenting all leaks found.

9 Record Retention and Close Out

9.1 Mapping personnel conducts review of completed paper tech down leak survey documentation, uploads to SAP, and completes SAP notification with exception below. LM ensures record retention policy is followed.

1. IM manages the IM and OIR specific leak survey records retained for compliance purposes per Utility Procedure TD-4850P-01. Mapping personnel provides originals to IM. IM tracks and archives the leak survey data for these surveys.

9.2 Retain records per the record retention schedule.

END of Instructions

DEFINITIONS

Abnormal Operating Condition (AOC): A condition identified by the operator that may indicate a malfunction of a component or deviation from normal operations that may indicate a condition exceeding design limits or result in a hazard(s) to persons, property, or the environment.

Blasting: Underground use of explosives to remove dirt and rock, including but not limited to quarry operations, gas exploration, and construction.

Business District: The principal business areas of a community, typically at least entire blocks, where the vast majority of the buildings on both sides of the street are used for commercial, industrial, religious, educational, health, and/or recreational purposes.

Can’t Get In (CGI): A location where an attempt has been made to access a gas facility for maintenance purposes without success. CGIs are often accessed by making customer contact, or re-attempting access at another time.

Class Locations: Class locations apply to transmission lines only. Class locations are defined and classified by criteria set forth in Code of Federal Regulations (CFR) Title 49, Transportation, Part 192—Transportation of Natural and other Gas by Pipeline: Minimum Federal Safety Standards, Subpart A – General, Section 192.5, "Class locations."

Distribution Line: Refer to Utility Procedure TD-4125P-10, “Identifying Gas Transmission Lines.”

High Consequence Area (HCA): Refer to Utility Procedure TD-4127P-05, “Criteria for Identifying High Consequence Areas.”

Leak Survey Process

Definitions (continued)

Leak Grade: The classification of a leak, based on leak readings, public exposure, and location.

Leak Recheck: Any leak survey performed with a leakage detection instrument in the area of an existing, Grade 2, or Grade 3 leak.

Leak Survey: A search for gas leakage in any area where Company gas facilities exist or where a gas leak is reported or suspected.

Public Assemblies: For leak survey purposes, public assemblies include the following:

- Schools – University, community college, high school, middle, elementary, and licensed day care
- Hospitals – General hospitals, emergency hospitals
- Churches – Church, synagogues, temple, mosque, monastery

Service: A pipeline that serves as the common source of supply to an individual customer, to two adjacent or adjoining residential or small commercial customers, or to multiple residential or small commercial customers served through a meter header or manifold.

Station: For the purpose of leak surveying, all transmission gas pipes and appurtenances within the company property lines, including:

- Compressor stations
- Terminals
- Storage holder facilities
- Transmission to transmission pressure regulator stations
- Other gas operating installations

Transmission Line: Refer to Utility Procedure TD-4125P-10, “Identifying Gas Transmission Assets.”

Vegetation Survey: A gas leakage survey conducted by observing the conditions of the soil and the vegetation along the gas facilities. This type of survey is not an approved method.

Leak Survey Process

IMPLEMENTATION RESPONSIBILITIES

This utility procedure is a complete rewrite of leak survey procedures as part of a content simplification effort. LM will communicate the leak survey simplification effort, new information location, and process changes. As part of this effort, a new field guide is being created that provides additional information about performing leak surveys such as examples, scenarios, pictures, and step by step details.

PG&E Academy will update the curriculum with process changes. OQ will update impacted evaluations. QM will update impacted assessments.

The leak survey simplification effort also impacts leak investigation guidance which, in turn, impacts field services, M&C, and GPOM. LM will work with leaders from these groups to ensure impacted personnel are aware of the revised procedures and process changes.

GOVERNING DOCUMENT

Utility Standard TD-4110S, “Gas Leak Survey and Detection Program”

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

Code of Federal Regulations (CFR) Title 49, Transportation, Part 192—Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards, Section (§) 192.197, “Control of the pressure of gas delivered from high-pressure distribution systems.”

49 CFR §192.614, “Damage prevention program.”

49 CFR §192.615, “Emergency plans.”

49 CFR §192.621, “Maximum allowable operating pressure: High-pressure distribution systems.”

49 CFR §192.706, “Transmission lines: Leakage surveys”

49 CFR §192.709, “Transmission lines: Record keeping”

49 CFR §192.723, “Distribution systems: Leakage surveys”

49 CFR §192.933, “What actions must be taken to address integrity issues?”

California Public Utilities Commission (CPUC) General Order 112-F, §143.1, “Leakage Surveys and Procedures”

Leak Survey Process

Compliance Requirement / Regulatory Requirement (continued)

Records and Information Management:

Information or records generated by this procedure must be managed in accordance with the Enterprise Records and Information (ERIM) Policy, Standards and Enterprise Records Retention Schedule (ERRS). Refer to GOV-7101S, “Enterprise Records and Information Management Standard,” and related standards. Management of records includes, but is not limited to:

• Integrity

• Storage

• Retention and Disposition

• Classification and Protection

REFERENCE DOCUMENTS

Developmental References:

Utility Procedure TD-4110P-03, “Performing and Documenting Leak Survey”

Utility Procedure TD-4110P-08, “Performing Leak Survey After Significant Events”

Utility Procedure TD-4110P-20, “Leak Survey of Inaccessible Pipelines Under Waterways”

Utility Procedure TD-4110P-30, “Aerial Leak Survey”

Supplemental References:

PG&E’s *Code of Safe Practices*

Form TD-4460P-11-F01, “Gas Map Correction Form”

Form TD-5100P-01-F01, “Leak Repair, Inspection, Gas Quarterly Incident Report (A-Form)”

Gas Design Standard M-58, “Leak Survey and Leak Investigation Instruments and Tools”

Gas Design Standard M-84, “Non-Contact Voltage Tester”

Utility Procedure TD-4007P-02, “Measurement and Test Equipment Process”

Utility Procedure TD-4110P-09, “Leak Grading and Response”

Utility Procedure TD-4110P-21, “Leak Survey Instruments and Calibration”

Leak Survey Process

Reference Documents (continued)

Utility Procedure TD-4125P-03, "Revising the MAOP of Pipelines Operating at 60 PSIG or Less"

Utility Procedure TD-4125P-10, “Identifying Gas Transmission Assets”

Utility Procedure TD-4188P-01, “Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets”

Utility Procedure TD-4188P-02, “Atmospheric Corrosion Inspection of Metallic Piping Systems”

Utility Procedure TD-4413P-01, “Procedure for Reportable Gas Incidents”

Utility Procedure TD-4460P-11, “Gas Map Corrections”

Utility Procedure TD-4850P-01, “Gas Distribution Integrity Management Program”

Utility Standard TD-4127S, “Class Location and High Consequence Area Determination and Compliance”

APPENDICES

NA

ATTACHMENTS

Form TD-4110P-01-F01, “Daily Leak Survey Log”

Form TD-4110P-01-F02, “Map Stamp”

Form TD-4110P-01-F03, “Leak Survey CGI Log”

Form TD-4110P-01-F04, “Gas Transmission Leak Survey Log”

Form TD-4110P-01-F05, “Gas Transmission Station Leak Survey Report (GT Backbone)”

DOCUMENT RECISION

Utility Procedure TD-4110P-01, Rev. 1, “Leak Survey Process,” published 10/07

Form TD-4110P-03-F15, “Can’t Get In – Notice of Need to Inspect,” issued 12/28/2016, is being cancelled.

Form TD-4110P-03-F16, “Can’t Get In (CGI) Notification Record,” issued 05/22/2013, is being cancelled.

Form TD-4110P-03-F17, “Can’t Get In Location Notice – Notice of Need to Leak Survey PG&E Gas Facilities,” issued 05/22/2013, is being cancelled.

Leak Survey Process

Document Recision (continued)

Form TD-4110P-03-F18, “Interruption of Gas Service Notification,” issued 12/22/2017, is being cancelled.

Utility Bulletin TD-4110B-023, “Changes to Leak Survey Frequency,” Rev. 0, published 12/12/2016, is being cancelled.

Utility Procedure TD-4110P-02, “Leak Survey Qualification Strategy,” Rev. 1a, published 05/15/2013, is being cancelled.

Utility Procedure TD-4110P-03, “Performing and Documenting Leak Survey,” Rev. 2a, published 12/22/2017, is being cancelled.

Utility Procedure TD-4110P-08, “Performing Leak Surveys after Significant Events,” Rev. 3, published 11/30/2016, is being cancelled.

Utility Procedure TD-4110P-20, “Leak Survey of Inaccessible Pipelines Under Waterways,” Rev. 1a, published 08/19/2015, is being cancelled.

Utility Procedure TD-4110P-30, “Aerial Leak Survey Process,” Rev. 2a, published 09/30/2015, is being cancelled.

DOCUMENT APPROVER

[redacted], Superintendent, South, Leak Management

[redacted], Superintendent, North, Leak Management

DOCUMENT OWNER

[redacted], Principal Engineer, Standards Engineering

DOCUMENT CONTACT

[redacted], Expert Specialist, Methods and Practices

(Document contact may change after publication. To find the current document contact, see the Gas Standards and Procedures Responsibility List.)

Leak Survey Process

REVISION NOTES

Where?	What Changed?
Revision 2c	
Step 7.11.4	Added two sub-steps to allow qualified GSRs to perform leak survey at CGI inside meter sets on above ground piping. Also added that if below ground piping is found during leak survey, then GSR must contact Dispatch to request same-day leak surveyor to perform the below ground survey.
Compliance Requirement / Regulatory Commitment	Added updated record retention information.
Revision 2b	
Figure 1	Updated Class 3 vest image with newly required yellow Class 3 vest.
Step 7.7	Added requirements for performing leak survey using new DP-IR extension wand (i.e., flow check before every use and pause for 6-10 seconds.
Revision 2a (Publication Date 11/13/2019 Effective Date: 02/01/2020	
Before You Start	Incorporated dog bite information from TD-4001B-008.
7.11.2	Revised entire step, including replacing 1-20% with 1%-5% gas in air, expanding to 6-10%, removing “located on the plat or on adjacent plat,” and adding the Note preceding the step.
Revision 2 (Publication Date 09/18/2019 Effective Date: 02/01/2020)	
Global	This is a complete rewrite incorporating content from several leak survey procedures. Process changes include: • Reorganized content to improve flow and readability. Condensed information and removed unnecessary direction throughout. • Add reference to CPUC leak abatement commitment to change leak survey frequency from 5 years to 3 years. • A new Leak Survey Field Guide is available that provides detailed information on operations and maintenance of tools, detailed instruction, pictures, examples and various scenarios. • Revised the maximum distance allowed for RMLD from 100 feet to 75 feet and RMLD transceiver must be a minimum of 3 feet from facility. • Determination of when to perform rain rechecks updated to include only open leaks of from 1% gas to 20% on plat being surveyed or adjacent plat. • Can’t Get In (CGI) process is managed by leak management and the CGI team. Inaccessible locations are no longer tracked. Former CGI forms TD-4110P-03-F15, F16 and F17 have been canceled.

Leak Survey Process

Revision Notes (continued)

Where?	What Changed?
Global (continued)	• Forms previously associated with Utility Procedure TD-4110P-03 have been moved to this procedure (see Attachments section). DP-3 and DP-4 were removed from the forms. • Added direction for working safety in roadways per Mission Division Motor Vehicle Incident and causal evaluation corrective actions. • Added reference to new mailbox to submit special leak survey requests, email to “SpecialLeakSurveyNotification@PGE.com. • Wear high-visibility vests with reflective material (Class 3 vest with sleeves). This vest is required for traffic areas with speed limits of 45 mph or greater. • New facilities submitted to be added to map with map correction form must be leak surveyed; either as a special leak survey or next scheduled leak survey in the same year identified.

Leak Grading and Response

SUMMARY

This utility procedure provides instructions for grading and responding to all leaks discovered on Pacific Gas and Electric Company (PG&E or Company) gas storage, compressor, transmission, and distribution (T&D) facilities. The instructions ensure safety and compliance with federal and state regulations and requirements. This utility procedure describes the grades of gas leaks, criteria for assigning each grade, and required actions for each leak grade.

Level of Use: Informational Use

TARGET AUDIENCE

Gas operations personnel who perform leak investigation and are operator-qualified to perform leak grading. These functions include gas maintenance and construction (M&C), gas field service, leak survey, quality control, gas pipeline operations and maintenance (GPOM), and quality management (QM).

For awareness: Personnel involved in making decisions and support documentation of leak grading but not operator-qualified to perform leak grade include pipeline engineering, gas engineering, integrity management (IM), distribution mapping, transmission mapping, construction management, asset strategy, gas control, gas dispatch, and applied technology services (ATS) personnel.

SAFETY

Potential hazards associated with leak survey and leak investigation include, but are not limited to, the following:

- Explosion or ignition of escaping gas
- Asphyxiation due to oxygen displacement
- Personal injury that may occur when entering customer premises due to tripping hazards, uneven ground, hidden objects, or unrestrained animals
- Inadequate barriers from vehicular traffic

BEFORE YOU START

Training

See PG&E Academy My Learning for leak survey, leak investigation, leak grading, and instrument-specific training curriculum. Personnel must be trained before using this procedure, performing leak investigation, or grading leaks.

Leak Grading and Response

Before You Start (continued)

Operator Qualifications (OQ)

This procedure contains covered tasks requiring qualifications. For covered task information, including date available and effective dates, please consult the *Guide to Operator Qualifications* in the Technical Information Library (TIL) or contact the Gas Qualifications department.

Specific operator qualification (OQ) requirements depend on the task (such as leak investigation, using specific instruments, leak grading). Multiple OQs may be required.

Personal Protective Equipment (PPE)

Personnel performing tasks in this procedure **must** have the following personal protective equipment (PPE) available at a minimum, plus any other applicable PPE, as specified in the PPE matrix for Gas Operations:

- Gloves
- Safety glasses

Tools and Equipment

Gather the following Company-approved tools, materials, and equipment as necessary:

- Impact bar (see Gas Design Standard [GDS] M-54.1, “Impact Bar Probe”)
- Barhole probe (see GDS M-60, “Approved Locate and Mark Instruments, Equipment, Accessories, and Products”)
- Hilti battery-operated electric drill; see Attachment 1, “Hilti Drill Instructions for Use,” for use requirements
- Adjustable wrench
- Manhole cover lifting hook, coded material SRM #M200480 (see GDS M-92, “Lifting Hook for Manhole Covers”)
- Measuring tape or wheel
- Soap solution in a bottle or can (see GDS M-13.4, “Leak Detection Fluid”)
- Electronic device (tablet or laptop)
- Explosion-proof lighting (see GDS M-83, “Explosion-Proof Lights”)

Leak Grading and Response

Before You Start (continued)

- Maps, records, or documentation of leaks, as applicable, such as Form TD-5100P-01-F01, “Leak Repair, Inspection, Gas Quarterly Incident Report (A-Form)”
- Non-contact voltage tester (NCVT) (see GDS M-84, “Non-Contact Voltage Tester”)
- Pink paint or chalk for temporary survey marks
- Suitable fire extinguisher
- 10" × 14" Danger sign, coded material SRM #2821672

Dog Bite Prevention

Follow Corporation Standard SAFE-1038S, “Dog Bite Prevention Standard,” whenever working in locations where a dog might be present.

The following dog bite prevention tools are available for purchase through Supplies and Solutions (S&S):

- Bulli Ray baton, S&S part number 2881241
- Certified dog repellent, S&S part number 2721442
- Dog Dazer II Ultrasonic Dog Deterrent, S&S part number 2824173

Working Safely in Roadways

Whenever work is required in high-traffic areas, before performing task, create a work safety plan considering best traffic safety methods for each situation and each location being surveyed.

Before performing any task in a roadway, evaluate the work and the area to create a plan to ensure your safety. Ensure temporary traffic controls are used:

- Use signs or lights (on vehicle) to inform others work is being performed in the area
- Use barricades to limit access to area by motorists (barricades include PG&E vehicle, cones, etc.)

Class III vest is required PPE for traffic areas with speed limits of 50 miles per hour (mph) or greater.

Request traffic control when necessary (work is prolonged, lane closure is recommended, etc.)

Leak Grading and Response

TABLE OF CONTENTS

PROCEDURE STEPS

1 General Information

NOTE

A leak grade is based on the severity and location of the leak, the danger the leak presents to persons or property, and the likelihood that the leak will become more serious within a specified amount of time.

1.1 Every gas transmission and distribution leak found must be investigated and assessed. Based on the assessment, specific actions must be performed that include making safe, repair, and documentation.

Leak Grading and Response

1.1 (continued)

1. Only use Company-approved method or instrument to assess leak. See Utility Procedure TD-4110P-21, “Leak Survey Instruments and Calibration,” for approved leak investigation and leak grading instruments.

WARNING

Unexpected induced or stray voltage is dangerous and can cause injury to personnel who touch piping or metallic facilities with voltage greater than 15 volts.

2. Before making physical contact with a metallic object to be tested (such as riser valve, regulator, meter), use a non-contact voltage tester (NCVT) to determine if stray voltage is present, per GDS M-84.

1.2 By the end of the working day, identify, document, and submit documentation for all leaks found that day.

1.3 Refer to Section 2 for actions to take for non-gradable leaks.

1.4 Refer to Section 3 for requirements on grading leaks.

1.5 Refer to Section 10, Section 11, and Section 12 for leak grade criteria. Also see Job Aid TD-4110P-09-JA01, “Gas Leak Grade Checklist.”

1.6 See Figure 1 and Figure 2 for difference between graded facility and non-graded facility.

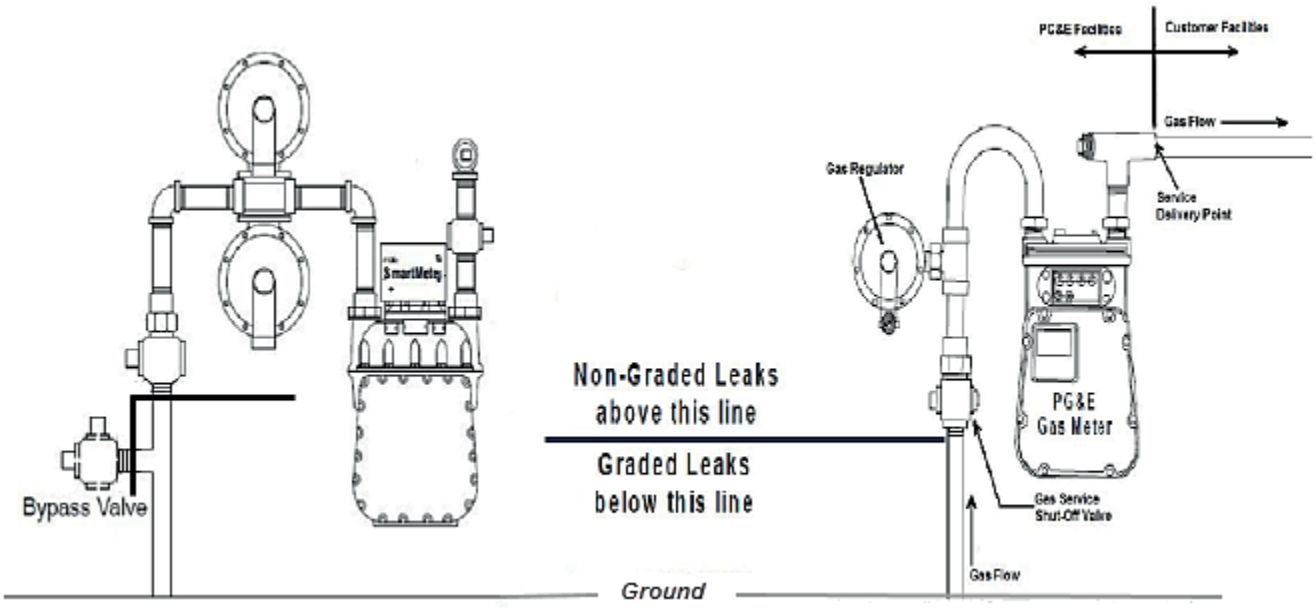

Figure 1. Graded and Non-Graded Aboveground Leak Locations

Leak Grading and Response

1.6 (continued)

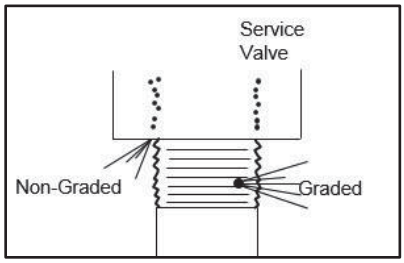

Figure 2. Gradable versus Non-Gradable Leak on Riser Threads

2 Non-Graded Leaks

NOTE

Aboveground gradable leaks include any leak found below the service valve (pitting on body of pipe or at other fittings). This does not include leaks at the threads at the inlet of the service valve or bypass valve due to pipe dope deterioration or poor thread quality.

2.1 Non-graded leaks are aboveground leaks found on or above inlet of service valve on PG&E customer meter set facilities or customer-owned facilities. Example: Any leak due to pipe dope or poor thread quality at the service valve are non-graded.

1. Graded leaks are found on the body of riser on the threads below the service valve. This includes:
   - Leak originates from body of pipe that is exposed under the valve
   - Leaks found on fitting (i.e., coupling) or threads below the service valve
2. See Figure 3, Figure 4, and Figure 5 for examples of non-graded and graded leaks.

Leak Grading and Response

2.1 (continued)

Figure 3. Example of Grade 1 Leak on the Body of the Riser

Figure 4. Example of Aboveground Grade 2 Leak on Fitting Below the Valve

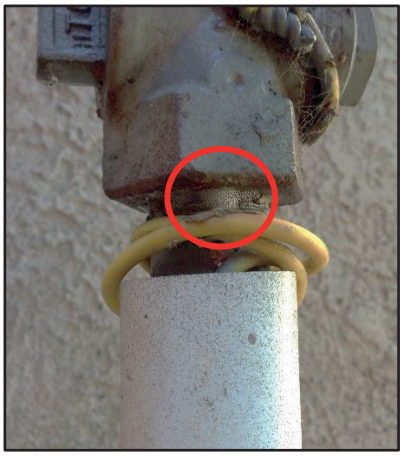

Figure 5. Example of Non-Graded Leak on Riser Threads

2.2 Non-graded leaks are documented by field services personnel in Field Automation System (FAS) and by M&C personnel on corrective work tickets.

2.3 Investigate aboveground leaks per Section 4. See Table 1 for actions to take for non-graded leaks.

Table 1. Non-Graded Leak Actions

Type of Leak	Actions to Take
Hazardous Non-Graded Leak. Leak found: • Is migrating below ground within 5 feet (ft.) of a structure (houseline) OR • Represents an immediate hazard (e.g., a leak on customer piping that meets Grade 1 criteria)	1. Notify gas dispatch personnel, requesting priority response. 2. Stand by for repair personnel (typically, Field Services personnel perform the repairs). 3. Document the leak in the appropriate system: • Leak surveyors use electronic device and enter as abnormal operating condition (AOC). • Field services personnel use FAS. See Utility Procedure TD-6100P-02, “Gas Leak and Odor Investigations.” 4. Consider turning off gas when it is safe and appropriate to do so (for example, characteristics of leak are equivalent to a Grade 1 leak, but on a customer line). 5. Notify gas control personnel immediately whenever gas flow cannot be shut off by personnel on scene due to an AOC or if any assistance is required.

Leak Grading and Response

2.3 (continued)

Table 1. Non-Graded Leak Actions (continued)

Type of Leak	Actions to Take
Non-Hazardous Non-Graded Leak. Leak found is one of the following: • NOT inside a structure and non-hazardous • Aboveground and non-hazardous (meets Grade 2 or 3 criteria, such as customer meter) • Belowground and non-hazardous (such as non-hazardous leak on customer line)	1. Non-hazardous leaks are scheduled for repair, usually by Field Services. 2. Field service personnel refer to Utility Procedure TD-6100P-02. 3. Leak surveyors document the leak electronically as an AOC. 4. Personnel qualified to make repairs (such as M&C crews, GPOM, field service personnel) perform repairs as appropriate.

2.4 Enter every non-graded leak found on meter set as an AOC via Inspect or FAS. These leaks are quantified for reporting greenhouse gas (GHG) emissions. See Job Aid TD-4110P-09-JA01 for examples of bubble classification photos.

1. Take photo of bubbles formed by soap test and upload photo to system of record.
2. Classify bubble size.
   a. A: immediate response that meets Grade 1 soap test criteria
   b. B: non-hazardous that meets Grade 2 soap test criteria
   c. C: non-hazardous leak that meets Grade 3 criteria and still forms clear small bubbles
   d. D: non-hazardous leak that meets Grade 3 criteria and soap creates foam
3. Enter only one AOC per meter set, using the highest bubble classification found (A is the highest, then B, C, and D respectively). When there are multiple leaks on the meter set, document the number of leaks and leak locations in the AOC comments.

2.5 Do **not** use Form TD-5100P-01-F01 (A-Form) to document non-graded leaks.

3 Grading Leaks General Requirements

3.1 Identify and report all Grade 1 leaks immediately upon discovery. See Section 10 for Grade 1 actions and Appendix A, "Evacuation Process," for evacuation process.

Leak Grading and Response

3.2 Grade the leak as soon as practical on the day of discovery after any hazards or potential hazards have been identified.Grade all leaks found (per Figure 1) and document graded leaks on TD-5100P-01-F01 (A-Form). See Section 17 for documentation requirements.

1. Document all readings in percent gas. See Job Aid TD-4110P-09-JA01 for conversion table to convert from parts per million (ppm) or % LEL (lower explosive limit) to percent gas.

2. Cancel any leak later found to not be PGE gas or not pipeline gas. See Section 13 for cancellation steps.

3.3 When the leak source on a gas riser cannot be determined because it is obscured by wrap or cover, grade as Grade 1 (immediately hazardous). See Job Aid TD-4110P-09-JA01.

NOTE

Leaks that meet multiple leak criteria are always assigned the higher leak grade.

More than one leak may exist at a location, and conversely, indications may be unrelated (for example, a leak over a main line may not necessarily be related to small indications in a sewer). Sampling and investigation are used to make the determination.

3.4 Before grading leak, perform leak investigation per Step 4.1 (aboveground) or Step 5.1 (belowground). Common leak sources include:

- Connection points along the main
- Service tee
- Transition or tie-in fitting at the base or tail of riser
- Where the riser interfaces with the ground
- Where a service stub ends
- Valves
- Pressure control fittings (such as Mueller fittings)
- Branch connections on a service line
- Casing and vent stacks
- Riser thread and service valve connection
- Body of the service valve
- All threaded connections below the service valve
- Body of riser and vents in casing or sleeve around riser

Leak Grading and Response

3.5 Ensure the instrument used to take readings during a recheck or investigation is as sensitive as the instrument used to originally grade the leak OR ensure that there are no leaks (i.e., perform pressure test). Examples are shown in Table 2.

Table 2. Hierarchy of Instruments for downgrading

Initial Grade Instrument	Downgrade Instrument Must Be	Downgrade Instrument Must NOT Be	Follow-up Actions
Combustible gas indicator (CGI)	CGI or DP-IR		
DP-IR	DP-IR	CGI	
Visual	Visual		1. Confirm no leak found using DP-IR readings. a. If readings are found with DP-IR and no indication visually (with soap), then continue investigation to determine source.

4 Aboveground Leaks

4.1 Use the following steps to assess and grade leaks on aboveground or exposed facilities.

NOTE

Aboveground leaks are often indicated while using a leak detection instrument.

1. Aboveground leaks must be graded visually with approved soap solution. Soap-test the aboveground facilities where the leak indication is detected.

   a. Apply soap solution (see GDS M-13.4) to the following locations:

   - All visible components; including fittings, connections, and welds
   - Meter index windows
   - Regulator vents

   b. Allow a **minimum** of 15 seconds for signs of a leak (bubbles) to form.

   c. Visually inspect the condition of the gas facility (look for a hole in a gas meter, corrosion at ground level, etc.).

5 Belowground Leaks

5.1 Use the following steps to investigate and grade leaks on underground or buried facilities.

1. Use only an approved leak-grading instrument, per Utility Procedure TD-4110P-21.

2. Investigate or survey the area to determine barhole locations. This saves time and effort and may reduce the number of barholes required to accurately grade the leak.

Leak Grading and Response

5.1 (continued)

WARNING

Injury or damage may result from impact bar probes contacting belowground facilities.

a. Create barholes carefully to determine the extent of gas migration and determine the grade of the leak.

b. Create barholes until a belowground reading of 0% gas is obtained in each direction (N-S-E-W) from the highest reading to center the leak. See Figure 6.

(1) Create barholes parallel and perpendicular to the gas facility where the leak is suspected.

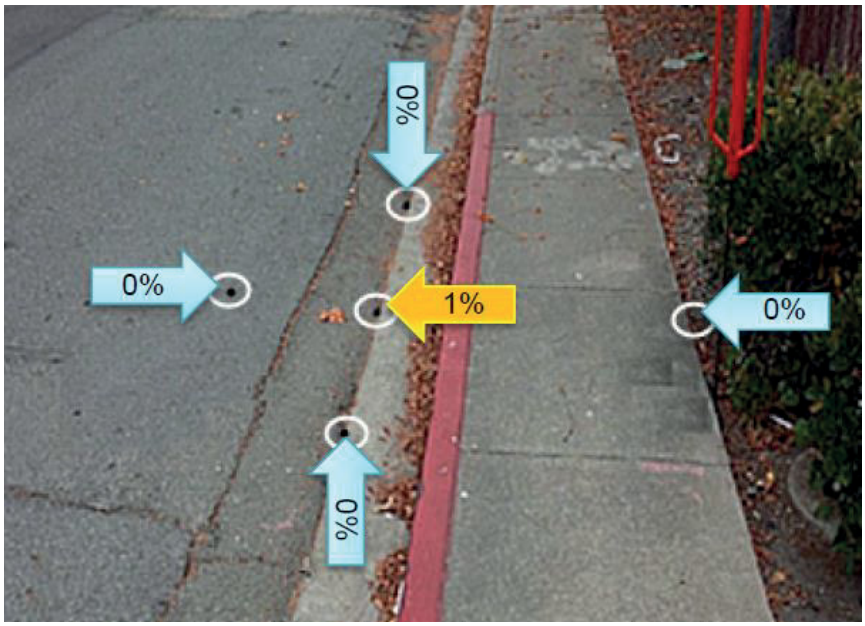

Figure 6. Finding 0% reads in each direction surrounding the highest belowground gas reading.

c. For barholes made during initial leak grading to determine leak grade and potential hazards, do not exceed a depth of 12 inches (in.).

(1) For barholes next to a riser, attempt to place the barhole 2 in. behind the riser to avoid damage.

(2) When resistance from a belowground facility is encountered when making a barhole, STOP and place a barhole in another location to avoid damage.

Leak Grading and Response

5.1 (continued)

(3) When a barhole cannot be placed due to ground cover (such as concrete), do one of the following:

- Request assistance from M&C crew to have a hole drilled.
- Drill hole using approved battery-operated Hilti drill (see Attachment 1).

d. For barholes made during leak pinpointing, refer to Utility Procedure TD-5100P-02, “Subsurface Leak Investigation and Pinpointing for Repair.”

3. Use the barhole attachment or probe for taking reading with approved leak grading instrument in a barhole below ground. Use sustained readings only.

4. Take readings at other locations at the leak site (manholes, catch basins, vaults, pits, boxes, valve covers and casings, vents, etc.).

   a. When reading is obtained in a sewer manhole, take additional readings at nearest manholes in each direction (i.e., N-S-E-W) as appropriate. To identify or rule out leak as pipeline gas, see Utility Procedure TD-4110P-34, “Ethane Identification and Gas Sample Collection Process.”

5. Place barholes adjacent to the sewer along gas facilities to determine if gas is present and migrating into the sewer.

   a. Whenever readings increase as the sewers are investigated, request assistance to determine leak source (potential leak sources farther away may be migrating into the sewer and additional resources may be necessary).

   b. Whenever readings do not indicate gas has migrated into a sewer, consider other leak investigation options, such as gas source sampling or use of ethane identifiers, to determine source of gas indications, per Utility Procedure TD-4110P-34.

6. When a leak location may be difficult for other personnel to find, document either in a photo with electronic device, or on TD-4110P-09-F01, “Barhole Record.”

   a. Upload the documentation (photo or form) to SAP so that it is available during recheck, preparing for repair or actual repair.

Leak Grading and Response

5.2 When a condition exists that impedes or prevents access to investigate a leak, such as wall-to-wall concrete, a can't get in (CGI) location, etc., perform the following steps:

1. Inform gas dispatch personnel AND the appropriate supervisor. Request assistance, if necessary.

   a. Assistance from supervisor or mapping personnel may be necessary to obtain additional resources, obtain customer care and billing (CC&B) information, reach animal control, obtain a ladder, etc.

2. Stand by at the location of the leak AND continue to search for a location to take a belowground reading until assistance is provided or access is gained.

5.3 Consider using a hydrocarbon (charcoal) filter in line with the CGI probe to filter out some non-pipeline gas sources, such as gasoline and heavier-than-air hydrocarbons, by performing the following steps:

1. Install the hydrocarbon filter in the sample line.

2. Perform a flow block or leak check of the sample line.

3. Draw a sample through the instrument for 45 seconds.

4. When instrument reads 0, the source is non-pipeline. Refer to Utility Procedure TD-4110P-34.

5.4 When determining the leak grade, consider the gas reading closest to a structure OR in a subsurface structure (e.g., vault, pit, excavation, utility box with a source of ignition).

5.5 Whenever a Grade 1 gas leak is encountered and both customer piping and Company piping may be affected, refer to Table 3 for appropriate steps to follow.

1. Always complete Form TD-5100P-01-F01 (A-Form) when a leak is found and the source is unknown (that is, cannot determine whether the leak is non-graded or graded).

Table 3. Company and Customer Line Leaks

Leak Location	Indications	Action
Leak suspected on customer and/or Company piping	Present over both facilities	• Contact Dispatch to request GSR to clock test. • If necessary, GSR contacts M&C crew to excavate and determine leak source. • M&C crew investigates and determines leak source through excavation and grades leak. • See Section 13 for how to cancel a leak determined to be on customer piping.
Leak suspected on only customer piping	Present only over customer piping	• Request field services to perform a clock test.

Leak Grading and Response

6 Grading Leaks With Gas Migration

6.1 If different readings are found in multiple locations, and the readings and conditions indicate that there is only one leak,

Then assign only one leak number AND document the leak using Form TD-5100P-01-F01 (A-Form), based on the most severe condition.

Otherwise, one Form TD-5100P-01-F01 (A-Form) is required for each unique leak found.

6.2 Consider temporarily marking the leak location (highest gas read) with an “X” in pink paint or chalk when the cover is pavement (such as street concrete or asphalt, but **not** in customer yards or driveways).

6.3 If field services personnel are performing an investigation and need assistance to either determine the spread or location of the belowground leak OR identify a non-hazardous leak location where a belowground reading is obtained,

Then field services personnel request assistance from other personnel operator-qualified in leak grading.

7 Leaks Found Inside Vaults, Enclosures, and Cabinets

7.1 Determine type of enclosure and open cover, when appropriate. Always wear gloves when removing cover. See Table 4 for types of enclosures and actions.

Leak Grading and Response

7.1 (continued)

Table 4. Leaks in Gas Enclosures

Enclosure type	Description	Action	Photo
Vault	Dimensions are usually 4 feet (ft) x 6 ft or larger. Typically houses filters, valves, sensing lines, ladder, fresh air ducts, and pilot-operated regulation equipment.	**GPOM personnel must be present to open.**	
Box	Dimensions are usually 18" x 24" or 24" x 36". Typically houses spring-operated HPR sets, valves, or meter sets. Example: pit.	Remove covers to determine if the leak is migrating to the enclosure or coming from a component housed within.	
Manhole	Dimensions are usually 24" or 36 " radius. Typically, the access point to a larger vault that is not visible from top. Typically houses many of the same components as a typical vault, such as filters, larger valves, sensing lines, ladder, pilot-operated regulation equipment.	**GPOM personnel must be present to remove these covers.**	

Leak Grading and Response

7.1 (continued)

Table 4. Leaks in Gas Enclosures

Enclosure type	Description	Action	Photo
G5 Box	Dimensions are usually 9" radius. Typically houses valve extensions and gauge taps.	Remove cover to determine if the leak is migrating to the enclosure or coming from a component housed within The same boxes can house ETS or locate wires. If exposed and gas assets are not present, the leak has most likely migrated.	
SCADA (Supervisory Control and Data Acquisition) cabinet		**GPOM personnel must be present to open.** Use instrument to sweep around the outside of the cabinet. If a leak indication is found, then barhole to determine migration and grade subsurface leak.	

7.2 Whenever GPOM assistance is required, do not remove cover. Contact GPOM supervisor to request assistance.

7.3 To remove cover (pit and G5 box), use the handle or appropriate lifting hook (see GDS M-92).

7.4 After entry is made into enclosure, soap-test fittings or components to determine leak source and grade leak.

7.5 If the cover cannot be removed (GPOM personnel are not present or not able to physically remove),

Then take a reading with a CGI or similar instrument, using the barhole attachment or probe AND grade as belowground.

Leak Grading and Response

NOTE

Utility Standard TD-4125S, “Maximum Allowable Operating Pressure Requirements,” provides additional information on the identification of various gas facility types and the Company definition of transmission and distribution facilities.

8 Distribution Asset Leaks

8.1 Distribution facilities, per Utility Standard TD-4125S, include piping from the farm tap regulator set or regulator station to the end of Company piping up to and including the customer meter or end of pipe (such as a service stub).

8.2 Contact the local pipeline engineer for confirmation when an asset (from the outlet of district regulators to the end of Company piping) cannot be confirmed as a distribution facility through use of available maps, diagrams, or drawings.

9 Transmission and Other Facility Asset Leaks

9.1 Transmission facilities, per Utility Standard TD-4125S, include piping (including mains and taps) up to distribution Company piping. Typically, this includes the pipeline between a compressor station OR up to the outlet of a farm tap OR distribution regulator station.

1. Contact local pipeline engineer to confirm transmission asset when asset cannot be confirmed as a transmission facility through use of available maps, diagrams or drawings.

NOTE

Leak repairs at the stations and storage facilities listed below have accelerated due dates per California Air Resource Board (CARB) requirements, as of 01/01/2018.

Leak Grading and Response

9.2 For aboveground leaks found at one of the stations listed below, contact GPOM personnel to ensure repairs are completed per CARB requirements:

- Bethany Compressor Station
- Burney Compressor Station
- Delevan Compressor Station
- Gerber Compressor Station
- Hinkley Compressor Station
- Kettleman Compressor Station
- Los Medanos Underground Storage Fields
- McDonald Island Underground Storage Fields
- Pleasant Creek Underground Storage Fields
- Santa Rosa Compressor Station
- Tionesta Compressor Station
- Topock Compressor Station

1. Document leak on Form TD-5100P-01-F01 (A-Form) for compliance reporting per Step 9.7.

   a. Enter required repair due date in the comments per PG&E Environmental Instructions “CARB O&G Rule Work Instruction: I-C83 Leak Repair.”

   b. GPOM personnel repair per the earlier of the two required timeframes, either CARB or California Public Utilities Commission (CPUC) General Order No. 112-F (GO 112-F), “State of California Rules Governing Design, Construction, Testing, Operation, and Maintenance of Gas Gathering, Transmission, and Distribution Piping Systems.”

9.3 Belowground transmission leaks must be graded either 1 or 2.

1. Do not grade belowground transmission leaks as grade 3. Per GO 112-F, Grade 2 and Grade 3 belowground transmission leaks have the same repair due date.

9.4 Aboveground transmission leaks may be graded 1, 2, or 3.

Leak Grading and Response

9.5 Communicate Grade 1 transmission leaks as follows:

1. Contact Gas Transmission Control Center (GTCC) and gas dispatch to dispatch personnel to assess and repair.
2. Inform supervisor of situation.
3. Stand by until repair crew arrives on site.

   Whenever, based on map, leak location is potentially in a high-consequence area (HCA), contact mapper, if available, to confirm.

   a. Include any HCA identification on the leak documentation.

   b. Route any HCA identification to local pipeline engineer for belowground transmission leaks.

      (1) For mapper documentation actions, see Step 17.4.

9.6 For leaks identified on transmission facilities (non-Grade-1), take the following actions.

1. Investigate and determine leak spread to confirm and center leak.
2. For all belowground or inaccessible aboveground leaks suspected to be on transmission facility in an HCA location per HCA Baseline layer in the geographic information system (GIS), the leak source must be determined within 30 days after date of discovery.

   a. Aboveground leaks that are visible and accessible are excluded because the source is known (such as leaks in vaults or leaks on valves, threaded components, or appurtenances).

      (1) The aboveground leaks in an HCA area are marked as such, but do not require engineer approval since the source is already known.

   b. Leak repair schedule is based on grade and may exceed 30-day timeframe.

3. Mapping personnel validate the HCA status of the leak locations based on the HCA Baseline layer in GIS that is certified by transmission integrity management (IM).

   a. If leak is identified belowground, pipeline or station engineer must determine the source of the leak.

Leak Grading and Response

9.6 (continued)

4. Group responsible for maintaining asset determines leak source. Evaluation to make determination usually includes excavation to daylight the leak source. Other options available are:

   - Leak investigations to determine the leak is on a distribution line rather than a transmission line
   - Gas sampling to determine whether the gas is from a non-pipeline gas source
   - Obtaining support from GPOM personnel to access enclosures (see Section 7)

5. After facility is exposed, re-evaluate and grade the leak based on soap test.

9.7 Document leaks on Transmission stations on the following, as appropriate:

1. Document **all** graded leaks on Form TD-5100P-01-F01 (A-Form) or electronic equivalent.

NOTE

After gas control centers notify local M&C or GPOM (for backbone facilities ONLY) personnel of a Grade 1 leak, the supervisor of the local group is responsible for excavation, leak source confirmation, and communication with affected stakeholders identified in this section.

10 Grade 1 Gas Leaks

NOTE

A Grade 1 gas leak, also referred to as a “hazardous leak,” is a gas leak that represents an existing or probable hazard to persons or property and requires prompt action, immediate repair, or continuous action until conditions are no longer hazardous.

10.1 Grade 1 criteria:

1. Any gas reading on belowground facilities in, at, or under a building or tunnel.

2. Any reading at the outside wall of a building or where the gas could potentially migrate to the outside wall of a building.

Leak Grading and Response

10.1 (continued)

NOTE

For the purposes of this procedure, “structure” includes offices, homes and buildings, public and private, where people can normally or occasionally enter and gas can accumulate.

3. Any gas reading on belowground facilities within the following distances:
   - 5 ft from structures in non-wall-to-wall locations
   - 10 ft from structures in wall-to-wall locations
4. Any reading of 4% gas or greater on or in small substructures not associated with gas facilities.
5. Any reading of 4% gas or greater in an enclosed space, including SCADA cabinet.
6. Any reading of 4% gas or greater on outside of enclosure that cannot be opened at the time of discovery.
7. Any leak, which in the judgment of operator-qualified personnel at the scene, is regarded as an immediate hazard.
8. Gas that can be seen, heard, or felt and is in a location that may endanger the general public or property.
9. Escaping gas igniting unintentionally, exploding, or blowing.
10. Escaping gas from body of pipe that is aboveground and below the riser threads (see Figure 1).
11. Belowground transmission leak found on body of pipe or weld after leak is exposed.
12. Any leak suspected to be on a copper service.
    a. Whenever leak is listed as on a copper service in GIS but, after investigation, is shown not to be a copper service, OR copper service is found in field but not noted in GIS, report the inconsistencies between as found in field and the GIS (or map) by completing and submitting Form TD-4460P-11-F01, “Gas Map Correction.”
13. Leak source on a gas riser cannot be determined because it is obscured by wrap or cover.
14. A leak that meets grade 2 criteria, but, in an operator-qualified person’s professional judgment, a repair must be completed within 30 days. Grade this leak as 1.

Leak Grading and Response

10.1 (continued)

15. Soap solution applied to an aboveground facility is blown off the facility, providing no opportunity for bubbles to form and hold (including on threaded fitting below the service valve).

16. Soap solution on an aboveground facility can hold a cluster of bubbles under special circumstances (such as when the meter set is in a cabinet).

10.2 Take immediate and continuous corrective action ("make safe actions") until conditions are no longer hazardous (leak is repaired or gas is controlled). Actions may include the following tasks:

1. Contact gas dispatch and gas control personnel, as appropriate, to report the leak and provide details of the location.

2. Contact supervisor and provide update with current leak status.

3. Evacuate the premises and restrict public access. See Appendix A.

4. Ventilate the area by removing manhole covers, creating barholes, installing vent holes, or other means appropriate to the situation.

   a. Whenever removing covers from belowground structures, place warning devices in accordance with *Code of Safe Practices* Section 708, "Open Enclosure Safeguards."

5. Reroute traffic as necessary, avoiding use of road flares.

6. Eliminate hazard sources as follows:

   - Eliminate sources of ignition (open flames, hot engines, static electricity, etc.).
   - Prevent the spread of burning gas, but do not necessarily extinguish the burning gas.
   - Eliminate the source of gas.
   - Stop the flow of gas by closing valves or other means when appropriate.
   - Place fire extinguisher nearby in case it is needed.

NOTE

In some instances, a standby person or persons are identified to remain at the site of a hazardous leak to continuously monitor the leak area before a repair can be made. This standby person is **not** performing the OQ-0502, "Standby Pipeline," task.

7. Repair Grade 1 leaks immediately or take continuous action on site to repair or mitigate leak.

Leak Grading and Response

10.2 (continued)

8. If a leak repair cannot be made immediately or is in the process of being repaired, keep qualified personnel for leak survey or leak investigation on site (standing by) at all times until repair is complete or leak is downgraded. Do not vent to downgrade.

9. Leak standby personnel perform the following at hazardous leak sites:

   a. Continuously monitor leak spread with a CGI or similar instrument to ensure no additional hazards are created (e.g., leak migration or perimeter change requires additional action to protect people, property, or environment).

   b. Do not leave the leak site unless relieved by other leak survey OR leak investigation qualified PG&E personnel (OQ-0901, “Conduct Survey,” OR OQ-0902, “Leak investigation,” OR OQ-0903, “Field Services Leak Investigation” + OQ-0908, “Field Services Leak Grading”).

   c. Monitor the site to ensure no new sources of ignition are present.

   d. Maintain any barricaded areas for public and personnel safety.

   e. Keep fire extinguish and danger sign(s) in accessible area near leak site.

10. Implement the *Gas Emergency Response Plan* (GERP) as required. (See GERP.)

11. For all leaks meeting criteria for a reportable incident OR a safety-related condition (per Utility Standard TD-4413S, “Gas Event Reporting Requirements”), take additional steps per Utility Procedure TD-4110P-34.

11 Grade 2 Gas Leaks

NOTE

A Grade 2 leak is a gas leak that is recognized as being non-hazardous to persons or property at the time of detection, but requires periodic surveillance and a scheduled repair based on the potential for creating a future hazard.

11.1 Grade 2 criteria:

1. A reading of 2.0% gas or higher on belowground facilities within the following distances:
   - Greater than 5 ft and up to 25 ft from structures in non-wall-to-wall locations.
   - Greater than 10 ft and up to 50 ft from structures in wall-to-wall locations.

2. Any reading of 5% gas or greater where the leak does not otherwise qualify as Grade 1.

3. Any reading of 2% gas or greater in a wall-to-wall paved area (sidewalk or in street) where the leak does not otherwise qualify as Grade 1 and where gas could potentially migrate to the outside wall of a building.

Leak Grading and Response

11.1 (continued)

4. Any reading of 2% gas or greater AND lower than 4% gas, on or in small substructures **not** associated with gas substructures.

5. Any reading of 4% gas or greater in small gas-associated substructures, such as small meter boxes or gas valve boxes.

6. Any reading of 1% gas or greater AND lower than 4% gas in an enclosed space.

7. Any reading of 2% gas or greater AND lower than 4% gas in an enclosure that cannot be opened at the time of discovery.

8. Any belowground leak on transmission facilities that does not qualify as a Grade 1 leak (must not be graded Grade 3).

9. Soap solution on an aboveground facility holding a cluster of bubbles (including on threaded fitting below the service valve).

10. Any reading over a waterway that does not meet Grade 1 criteria (e.g., gas that is not blowing).

11. A leak that does not meet the above criteria, yet still poses a Grade 2 hazard in the judgment of personnel holding the OQs identified earlier in this procedure.

    a. Consider soil type and conditions, such as frost cap, moisture, and natural venting.

    b. Consider leaks requiring action ahead of ground freezing or other adverse changes in venting conditions, and any leak that could potentially migrate to the outside wall of a building, under frozen or other adverse soil conditions.

12. Any leak that is damaging trees, crops, or ornamental plants, excluding lawns.

13. Any leak that causes a public nuisance, anxiety, or apprehension.

11.2 Actions to take for aboveground transmission line and all distribution line (above and below ground) Grade 2 leaks:

1. Repair or clear the leak at the earliest of the following dates:

    a. No later than 15 months from the date reported, to the date

    b. By the end of the calendar year following the calendar year in which the leak is found

Leak Grading and Response

11.3 Actions to take for belowground transmission Grade 2 leaks:

1. Repair or clear the leak at the earliest of the following dates:
   - No later than 12 months from the date reported, to the date
   - Before the ground freezes or other adverse changes in venting conditions occur
2. Repair or clear all leaks on mains under street pavement and associated service lines before known street overlay work or known street reconstruction begins.

11.4 Recheck all open Grade 2 leaks at intervals no greater than 6 months.

12 Grade 3 Gas Leaks

NOTE

A Grade 3 leak is a gas leak that is non-hazardous at the time of detection and can reasonably be expected to remain non-hazardous.

12.1 For belowground leaks, whenever the leak does not meet Grade 1 or Grade 2 leak criteria, grade the leak Grade 3.

12.2 For aboveground leaks, when soap solution forms small bubbles (including on threaded fitting below the service valve), grade the leak Grade 3.

NOTE

Grade 3 belowground transmission leaks are not allowed.

12.3 Belowground transmission leaks must be graded as 1 or 2 per previous sections.

12.4 Action to take for Grade 3 leaks:

1. Until the leak is repaired, recheck each calendar year, not to exceed 15 months, to the date, or during the next scheduled survey, whichever comes first.

13 Leak Cancellation and Zero Out Process

13.1 When a graded leak indication is not a valid leak or no leak is found during follow-up leak investigation, refer to Table 5.

Leak Grading and Response

13.1 (continued)

Table 5. Leak Cancellation Requirements and Actions

Reason For No Reading	Description	Actions
Leak on customer line (such as houseline). A Form TD-5100P-01-F01 (A-Form) was completed at time leak was found. Meter set leak is not on customer line.	Leak cleared – on customer line; per Table 1 required actions	1. Request cancellation of leak. Update Form TD-5100P-01-F01 (A-Form) with findings and location of leak (buried or not buried). a. After field service personnel determine leak on houseline, document GSR LAN ID and FAS Field Order number on Form TD-5100P-01-F01 (A-Form) and in SAP. b. After M&C or GPOM determines houseline, update Form TD-5100P-01-F01 (A-Form) with LAN ID and actions taken. c. Document if gas was turned off and that facility owner was informed.
Leak on non-PG&E gas facility (such as Southwest Gas facility)	Leak cleared – non-PG&E facility	1. Request cancellation of leak. a. If possible, include picture of non-PG&E facility or marking showing non-PGE facility. b. Provide LAN ID of personnel that made the decision c. Upload documentation to SAP leak notification, including that facility owner was informed of leak.
Leak indication not pipeline gas (such as sewer gas or grease traps)	Leak cleared – not pipeline gas (see Utility Procedure TD-4110P-34)	1. Request cancellation and upload documentation to the SAP leak notification. See Utility Procedure TD-4110P-34 for documentation requirements. a. When Sensit IRED or GMI 700 is used, enter E for ethane identifier in SAP. b. GPOM personnel document LAN ID and corrective work ticket for any repairs made on non-natural gas PGE facility.
No leak found (NLF) or no readings identified on graded leak.	Initial recheck: No readings identified	1. Begin zero out process, below. 2. A second recheck of grade 0 NLF must be obtained to close leak notification. a. The recheck performed after the NLF must be performed within 6 months, not greater than 7 months, of recheck, with minimum of 7 calendar days after recheck. 3. Leak is closed after second consecutive 0.

13.2 Grade 1, 2, and 3 leaks may be documented as Grade 0 when no leak is found only once. If the same leak at the same location is graded again the leak must stay the grade.

- Example: Leak is graded a 2 or 3. No leak is found during the required recheck. If the leak is graded again during the second recheck, then it must remain at that grade.

13.3 A graded leak cannot be canceled on a corrective maintenance notification. For all graded leaks, complete Form TD-5100P-01-F01 (A-Form), including documenting repairs.

13.4 A pressure test may be performed to determine no leak at the PGE facility. When a pressure test is performed, document test data in SAP (chart, time frames).

13.5 Consider the soil type (sand, clay, rock, etc.), soil moisture level, and weather while grading a leak 0.

Leak Grading and Response

13.6 Grade 2 or Grade 3 leaks in clay soil may have been initially graded during a dry season. Re-evaluate these open leaks carefully during wet seasons before grading the leak 0.

13.7 Mapping personnel may determine a leak notification is a duplicate leak notification. Mapping personnel request and work with leak cancellation desk to cancel any duplicate leaks.

14 Downgrading Gas Leaks

14.1 To regrade a leak, use the same instrument or a more sensitive instrument (see Step 3.6).

14.2 Do not downgrade a leak more than once.

14.3 Do not downgrade a leak found during a rain recheck.

14.4 Downgrades are permissible when the following criteria have been met:

1. Grade 1 leaks may be downgraded to Grade 2 if the following are complete:
   - Hazards have been eliminated. Hazards include all Grade 1 criteria.
   - Work performed and reasoning for downgrade are documented on Form TD-5100P-01-F01 (A-Form).
2. Grade 2 leaks may be downgraded to Grade 3.

14.5 A leak that has been upgraded must not be downgraded. The leak must be repaired in the time frame required for the higher grade.

14.6 Do **not** downgrade a leak found on the body of pipe or a weld in an HCA pipeline when the leak source is known.

14.7 Do **not** downgrade a leak found on the body of a gas service riser.

15 Upgrading Gas Leaks

NOTE

When leak is downgraded, leak repair and maintenance timeframes are based on the original date of discovery, regardless of original grade. When leak is upgraded, the date of the recheck is the used for leak repair and maintenance timeframes.

15.1 Re-grade a leak whenever the conditions of the gas leak worsen OR the leak conditions meet criteria for a higher leak grade.

15.2 Leak grading, including upgrade, must be performed by personnel with appropriate OQs to investigate leak and grade leak.

15.3 Per Section 14, above, a leak that has been upgraded cannot be downgraded.

Leak Grading and Response

16 Performing a Leak Recheck

NOTE

Some leak rechecks are performed to monitor gas migration, and others are used to confirm the presence of gas still exists. The purpose of a recheck is to detect the presence of gas and evaluate grade, or to ensure that no leak exists.

16.1 In order to clear or close out a leak notification due to no readings during a leak recheck, the minimum recheck interval is 7 days. This ensures that enough time has elapsed between rechecks so that the following conditions are met:

- Water (rain, snow, sprinkler systems, etc.) has not blocked the migration of gas to the surface
- Migrating gas can reach the surface from the leak source (main, service, etc.)
- Aerated soil does not eliminate gas readings from an existing leak

16.2 Record the recheck on recheck work tickets, the open leak report, OR Form TD-5100P-01-F01 (A-Form) provided by mapping personnel.

16.3 Ensure instrument meets sensitivity requirements in Step 3.6.

16.4 Review maps to help determine the location of the leak.

16.5 Investigate and grade leaks per this procedure. Document any change in grade, whether downgrade or upgrade. For NLF, see Section 13.

16.6 If a belowground leak cannot be found using the location provided on the documents (Form TD-5100P-01-F01 [A-Form], recheck leak log, etc.),

Then see Table 7 for instructions for extending the leak survey, per Utility Procedure TD-4110P-03.

1. Refer to previous barhole locations and concentrations to aid in investigation, if available.

Table 6. Leak Survey to Find the Leak

Condition	Action
Leak on service line 200 ft or less	Survey entire service line and 25 ft of main in each direction.
Leak on service line greater than 200 ft	Survey 100 ft of service line in each direction from the original location provided.
Leak on service line that is in a casing	Survey entire service line and 25 ft of main in each direction.
Leak on a main line	Survey 25 ft in each direction.
Leak on a transmission main line	Survey 250 ft in each direction from the original location provided.

Leak Grading and Response

16.7 For post-repair rechecks, perform leak investigation or leak survey extending 25 ft from each side of the previous excavation (such as sampling old barholes, existing patch).

a. Review open leak reports to ensure that new leak reports are created as appropriate.

17 Documentation

NOTE
A person with the required OQ performs leak grading.

17.1 The person that grades the leak must complete appropriate documentation of any of the following leak-related activities:

- Discovering and confirming a leak
- Grading a leak
- Rechecking a leak
- Rechecking a zeroed or cancelled leak

17.2 The following are additional means of documentation that may be appropriate depending on the task being performed:

- Form TD-5100P-01-F01 (A-Form) for Grade 1 leaks
- Recheck work tickets
- Calibration records
- OQ records
- Open leak report
- Electronic device (tablet, laptop computer)
- Corrective work forms (such as Other Corrective Work [OCW] form, N-1 notification)
- Service Report Form (62-0362, stocked in service centers)

Leak Grading and Response

17.3 Document leaks on Form TD-5100P-01-F01 (A-Form), tablets, and SAP notifications as follows:

1. Document instrument readings in leak notification.
2. IF a Grade 1 leak is identified on an aboveground, belowground. or exposed facility using soap solution and confirmed visually OR blowing gas is present,

   THEN document a visual leak, using 100% GAS for the reading.
3. IF a leak other than a Grade 1 is identified on an aboveground, belowground. or exposed facility using soap solution and confirmed visually,

   THEN document a visual leak, using 0% GAS for the reading.

17.4 For transmission leaks found in potential HCA locations, do the following:

1. Mappers document the following after reviewing with engineering per Step 9.5 and Step 9.6.
   - For leak on the pipeline in an HCA, record “yes” in the leak notification.
   - For leak on a facility that is not an HCA pipeline, record “no” in the leak notification.
2. Consider recording the pipeline engineer contact information when review is required to determine HCA locations in SAP.

17.5 Supervisors who receive tech down leak documentation must ensure leak documentation is submitted to mapping personnel within 10 calendar days of leak discovery. This time is to allow for supervisor review and any necessary follow-up.

17.6 Mapper enters tech down leak data within 10 calendar days of leak documentation submission.

17.7 Retain records per the Record Retention Schedule.

END of Instructions

DEFINITIONS

Aboveground facilities: Facilities designed to be exposed to the atmosphere and readily accessible. The entire circumference of the facility is visible and can be inspected without excavation.

Belowground facilities: Facilities covered with earth or paving material (buried). The entire circumference of the facility is not readily visible and may require excavation to perform inspection.

Leak Grading and Response

Definitions (continued)

Blowing gas: A gas leak which can be heard, seen, or felt, in accordance with the following definitions.

- **Heard:** A gas leak that makes a blowing or hissing sound.
- **Seen:** A gas leak that does not hold foam or soap solution or a leak that blows visible dust, dirt or debris into the air. Bubbles coming through water may be included.
- **Felt:** A gas leak that is detectable by touch.

Building: Any structure normally or occasionally entered by humans for business, residential, or other purposes, and in which gas can accumulate. Company-owned structures whose sole purpose is to protect pipeline facilities from the environment (such as meter houses and regulator station houses) are not “buildings” for purposes of leak grading.

CGI: This acronym has the following two definitions, easily distinguished by the context in which they are used:

- **Can’t Get In:** A location where there is currently no access to perform maintenance work.
- **Combustible gas indicator:** A type of leak survey instrument capable of detecting and measuring gas concentrations (of transported gas) in the atmosphere.

Enclosed space: Any subsurface structure (vault, tunnel, catch basin, manhole, etc.) of sufficient size to accommodate a person and in which gas could accumulate. Some enclosed spaces may be considered a confined space by Occupational Safety and Health Administration (OSHA) definition.

Enclosure: A structure with an open top that is freestanding or attached to a building exterior wall with access doors; a cage; or walls and gate for the purpose of containing/protecting a gas meter set or meter set components.

Gas-associated substructure: A device or facility used by a gas company such as a valve box, vault, test box, or vented casing pipe, which is not intended for storing, transmitting, or distributing gas

Gas facilities: All Company-operated gas lines and related appurtenances.

High Consequence Area (HCA): Areas near gas transmission pipelines whose failure would have higher consequences than failures on other pipe segments due to the area’s higher population densities, or structures that contain people who would have difficulty evacuating (see Utility Procedure TD-4127P-05, “Criteria for Identifying High Consequence Areas”).

Leak: The unintentional escape of gas from containment.

Leak grade: The classification of a leak based on leak readings, public exposure, and location.

Leak recheck: Any leak survey performed with an approved instrument in the area of an existing Grade 2, or Grade 3 leak.

Leak Grading and Response

Definitions (continued)

Leak repair: An action to restore a gas facility to sound condition by eliminating a gas leak.

Leak survey: A patrol for gas leakage in any area where Company gas facilities exist or where a gas leak is reported or suspected.

Operator-qualified: Evaluated and qualified in accordance with the Operator Qualification Program.

Pit: An enclosure (usually underground) with no lid or cover. Also called “box.”

Small substructure: Any subsurface structure that is of insufficient size to accommodate a person and in which gas could accumulate or migrate (per American Society of Mechanical Engineers (ASME) Standard B-31.8-2007, “Gas Transmission and Distribution Piping Systems,” Appendix M). Examples: telephone and electrical ducts and conduit or non-gas-associated valve and meter boxes. For purposes of leak grading, small substructures are not gas-associated substructures. (See above for definition of gas-associated substructures).

Transmission line: See Utility Procedure TD-4125P-10, “Identifying Gas Transmission Assets.”

Tunnel: A subsurface structure 30 inches or greater in diameter.

Vault: An enclosure (usually underground) with a lid, cover, or doors (see Utility Standard S4446, “Vault Inspection Procedure”).

Venting: Drilling a hole or holes or excavating above or around a leak to allow gas to dissipate or escape.

Wall-to-wall pavement: Pavement in an area where either of the following conditions exists.

- There are buildings on both sides of the street with essentially uninterrupted pavement from the building walls on one side of the street to the building walls on the other side of the street.
- A gas main is under continuous pavement from its position to the nearest buildings and the distance from the gas main to the buildings is less than the distance to any other areas that allow significant venting.

IMPLEMENTATION RESPONSIBILITIES

This document will be communicated by leak management leadership and document approver, using required tailboard and conference calls to affected audience that performs leak grading. Quality Management supervisor will communicate with Quality Management personnel who perform leak survey.

GOVERNING DOCUMENT

Utility Standard TD-4110S, “Gas Leak Survey and Detection Program”

Leak Grading and Response

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

California Code of Regulations Title 17, “Public Health,” Division 3, “Air Resources,” Chapter 1, “Air Resources Board,” Subchapter 10, “Climate Change,” Article 4, “Regulations to Achieve Greenhouse Gas Emission Reductions,” Subarticle 13, “Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities” (California Air Resources Board [CARB] Oil and Gas Rule, October 2017).

Code of Federal Regulations (CFR) Title 49, Transportation, Part 192—Transportation of Natural and other Gas by Pipeline: Minimum Federal Safety Standards, Section (§) 192.605, “Procedural manual for operations, maintenance, and emergencies”

49 CFR §192.703(c), “General”

49 CFR §192.706, “Transmission lines: Leakage surveys”

49 CFR §192.723, “Distribution systems: Leakage surveys”

California Public Utilities Commission (CPUC) General Order No. 112-F, “State of California Rules Governing Design, Construction, Testing, Operation, and Maintenance of Gas Gathering, Transmission, and Distribution Piping Systems” (GO 112-F)

Senate Bill (SB) 1371, “An act to add Article 3 (commencing with Section 975) to Chapter 4.5 of Part 1 of Division 1 of the Public Utilities Code, relating to natural gas”

REFERENCE DOCUMENTS

Developmental References:

Guide for Gas Transmission and Distribution Piping Systems, Material Appendix G-192-11, “Gas Leakage Control Guidelines for Natural Gas Systems,” Gas Piping Technology Committee (GPTC)

Utility Procedure TD-4110P-01, “Leak Survey Process”

Utility Standard TD-4125S, “Maximum Allowable Operating Pressure Requirements”

Utility Procedure TD-4414P-04, “Assessing and Working with Hazardous or Gaseous Atmosphere”

Utility Procedure TD-6100P-04, “Gas Event Evacuation - For Gas Service Representatives (GSR)”

Supplemental References:

American Society of Mechanical Engineers (ASME) Standard B-31.8-2007, “Gas Transmission and Distribution Piping Systems”

Form TD-5100P-01-F01, “Leak Repair, Inspection, Gas Quarterly Incident Report (A-Form)”

Leak Grading and Response

Reference Documents (continued)

Code of Safe Practices

Environmental Instructions “CARB O&G Rule Work Instruction: I-C83 Leak Repair”

Gas Design Standard M-13.4, “Leak Detection Fluid”

Gas Design Standard M-54.1, “Impact Bar Probe”

Gas Design Standard M-60, “Approved Locate and Mark Instruments, Equipment, Accessories, and Products”

Gas Design Standard M-83, “Explosion-Proof Lights”

Gas Design Standard M-84, “Non-contact Voltage Tester”

Gas Design Standard M-91, “Valve Wrench”

Gas Design Standard M-92, “Lifting Hook for Manhole Covers”

Gas Emergency Response Plan (GERP)

Job Aid TD-4110P-09-JA01, “Gas Leak Grade Checklist”

Utility Procedure TD-4110P-21, “Leak Survey Instruments and Calibration”

Utility Procedure TD-4110P-34, “Ethane Identification and Gas Sample Collection Process”

Utility Procedure TD-4127P-05, “Criteria for Identifying High Consequence Areas”

Utility Procedure TD-4413P-05, “Gas Operations CPUC Self-Report and Safety Citation Assessment Process”

Utility Procedure TD-4460P-11, “Gas Map Corrections”

Utility Procedure TD-5100P-02, “Subsurface Leak Investigation and Pinpointing for Repair”

Utility Procedure TD-6100P-02, “Gas Leak and Odor Investigations”

Utility Standard S4446, “Vault Inspection Procedure”

Utility Standard TD-4413S, “Gas Regulatory Reporting Requirements”

APPENDICES

Appendix A, “Evacuation Process”

Leak Grading and Response

ATTACHMENTS

Attachment 1, “Hilti Drill Instructions for Use”

Form TD-4110P-09-F01, “Barhole Record”

Job Aid TD-4110P-09-JA01, “Gas Leak Grade Checklist”

Job Aid TD-4110P-09-JA03, “Gas Asset Examples and Grading Requirements”

DOCUMENT RECISION

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DOCUMENT APPROVER

[redacted], Superintendent, Leak Management Improvement

Erik Kurtz, Director, Gas Transmission and Distribution Maintenance and Construction

DOCUMENT OWNER

[redacted], Principal Engineer, Standards Engineering

DOCUMENT CONTACT

[redacted], Expert Specialist, Gas Methods and Procedures

[redacted], Supervisor, Gas Field Compliance

(Document contact may change after publication. To find the current document contact, see the Gas Standards and Procedures Responsibility List.)

Leak Grading and Response

REVISION NOTES

Where?	What Changed?
2.1	Added figures and content to clarify above ground gradable vs non gradable leaks on riser threads.
2.1.2 Figures 2, 3, 4 and 5	Added four new figures of examples of graded and non-graded leaks
Table 1	Updated Step 1 under Actions to Take column, for hazardous non-graded leaks from “immediate repair” to “priority response.”
2.4.3	Added new step with the following: Enter only one leak per meter set, using the highest bubble classification found (A is the highest, then B, C, and D, respectively).
12.1 and 12.2	Revised language to clarify Grade 3 leaks are any leak that does not meet grade 1 or grade 2 criteria.
Table 5, last row	Removed the following in the last row, first column: “Includes graded meter set leaks.”
13.2	Added example of not downgrading a leak more than once.
Job Aid TD-4110P-09-JA01, “Gas Leak Grade Checklist,” Rev. 6a	
Page 2	Added new row for leaks found in small gas associated gas structures to align with procedure. “
Soap Test Section Titles	Added Bubble Classification to section titles.
Revision 6 (Publication Date: 12/18/2019, Effective Date: 07/01/2020)	
Entire document	This is a major revision of the leak grading procedure and process that includes restructuring content and clarifying language. The major process changes are listed below.
Entire document	Incorporated content from Bulletin TD-4001B-007, “Working Safely in Roadways,” and Bulletin TD-4001B-008, “Dog Bite Prevention.”
Before You Start	• Replaced specific training and OQs with reference to Guide to Operator Qualifications and Academy intranet. • Incorporated Hilti drill and reference to new Attachment 1 for instructions on use. • Incorporated locate and mark barhole probe for creating barholes and reference to GDS M-60, “Approved Locate and Mark Instruments, Equipment, Accessories, and Products,” for material code.
Step 1.1.1	Added reference to Utility Procedure TD-4110P-21, “Leak Survey Instruments and Calibration,” for approved leak investigation and leak grading instruments.
Table 1	Removed next tag for non-graded leaks. Hazardous non-graded leaks will be dispatched as immediate response. All others, non-hazardous, will be scheduled for repair.
Step 2.1	Revised criteria for non-graded leaks to include distribution meter set facility riser threads.
Step 2.4	Added new requirement to classify bubble size A, B, C, or D and document as an AOC with a photo.

Leak Grading and Response

Revision Notes (continued)

Where?	What Changed?
Section 3	Added new table with hierarchy of leak investigation instruments for leak grading follow-up.
Section 6	Added documentation guidelines for barhole locations: electronic with photo of area and a new barhole record form, Form TD-4110P-09-F01, “Barhole Record.”
Section 7	• Added more information for performing leak investigation of subsurface structures: when to enter and when GPOM is required. • Added requirement to wear gloves when removing a cover.
Step 9.3.1	Removed all text on obtaining SMYS information. SMYS is not required to grade a leak.
Step 9.6.2	Clarified when HCA determination is required; visible and accessible aboveground is excluded.
Section 10	• Added new grade 1 criteria for belowground leaks on body of pipe or on a weld after leak is exposed. • Clarified to grade leak as a grade 1 if personnel judge that repair must be made within 30 days.
Section 11	• Changed belowground Grade 2 criterion gas reading level from 2.5% to 2%. • Any belowground leak found at 5% or greater is a grade 2. • Revised grade 2 criteria for leak found in substructure, removing the criterion of potential migration. • Combined all wall-to-wall into one step, gas found equal to or greater than 2% gas in air (previously separated sidewalk from roadway). • Aligned with GO 112-F on Grade 3 criterion for gas-associated substructures. • Aligned repair requirements with GO 112-F for aboveground and distribution leaks, increasing to 15 months.
Section 12	• Clarified and simplified Grade 3 leak criteria. • Clarified that belowground transmission leaks cannot be Grade 3 for ALL Grade 3s and added note about belowground transmission. • Removed Grade 3 rechecks for leaks found before 2017.
Table 3	• Clarified cancellation process and added information required to cancel leak. • Replaced “cancellation process” with “zero out process” when no leak found. • New requirement: rechecks for no leak found may not be performed within 7 days of leak found date.
Step 13.3	• Added new step to clarify leak repairs are not documented on OCW.
Step 13.4	• Added that a pressure test may be performed to determine no leak at a PG&E facility. When a pressure test is performed, must document test data in SAP (chart, time frames).
Step 14.1	• Clarified requirements for downgrading leaks.

Leak Grading and Response

Revision Notes (continued)

Where?	What Changed?
Section 16	Removed post-repair check requirements and TLA requirements. These actions are performed after a leak is graded; this content was moved to Utility Procedure TD-5100P-04, “Leak Repair.”
Step 16.6.1	Added step to document barhole locations, as necessary.
Step 17.6	Revised documentation submittal timeframes: enter into SAP 10 calendar days from date the documentation is submitted to mapping.
Compliance Requirement / Regulatory Commitment	Added regulatory citation for bubble classification to quantify gas emissions from meter set leaks.
Appendix A	• Added new appendix for evacuation. • Criteria to evacuate changed from 2% gas in air to 1% gas in air. • Content from Utility Procedure TD-6100P-04, “Gas Event Evacuation - For Gas Service Representatives (GSR),” moved to this appendix.
Attachment 1	Added Attachment 1, “Hilti Drill Instructions for Use.”
Form TD-4110P-09-F01	Added Form TD-4110P-09-F01, “Barhole Record.”
TD-4110P-09-JA01	Updated to include new bubble classification for research and development to estimate gas emissions.

Leak Grading and Response

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WHEN TO EVACUATE

A. When gas in air is found to be 1% or higher, take the following actions:

1. Immediately evacuate area.
2. Make area safe per Step 10.3 Grade 1 actions.
3. Using approved leak detection instrument (see Utility Procedure TD-4110P-21), determine perimeter of safe area using 1% gas in air.
4. Restrict access to exposure to 1% gas in air.
5. Evacuate premises in the area with 1% gas in air or gas that may potentially migrate to premises.

GAS EVENT EVACUATION

A. Evacuation is the process of rapid and controlled removal of people from hazardous buildings or outdoor areas to a safe zone.

1. Hazardous or unsafe conditions that require evacuation include:
   - Gas leakage at or above 1% gas-in-air
   - Carbon monoxide (CO) above 200 parts per million (ppm) ambient for adults or 25 ppm for minors or when occupants show physical symptoms that indicate a potential CO poisoning
2. Ensure the safety of everyone, including the first responders.
3. Protect the property as the second priority. Ask fire department for assistance in ventilating an unsafe structure. DO NOT place yourself in an unsafe environment.
4. If you need addition resources (police, fire department, PG&E personnel, etc.), call supervisor-in-charge or dispatch personnel from a safe location.
5. Turn off cell phones and hand-held radios before entering a potentially gaseous atmosphere. Do not bring electronic tablets or devices into the area until it is determined to be safe (i.e., there is a lack of gas readings).

Leak Grading and Response

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NOTE

Each approved leak investigation instrument is required to measure gas in air; some of the instruments also measure additional gases (CO and oxygen). Safe zone establishment is based on all possible gases that the instrument measures.

B. Establish a safe zone.

1. At a minimum, a safe zone is an area that:
   a. Contains less than 1% gas-in-air
   b. Has an oxygen level between 19.5% and 23.5%
   c. Has a CO level below 25 ppm ambient
   d. Is not currently in the path of gas migration both above and below ground. See this utility procedure for instructions to determine underground gas migration using barhole.
   e. Is a safe distance from potential destruction and debris that may occur (e.g., from pipe rupture, fire, or explosion)
   f. Does not contain the following gas leak characteristics:
      - A faint or momentary odor similar to rotten eggs or sulfur
      - Hissing or roaring sound
      - Water or dirt blowing into the air
2. Use leak investigation approved instrument to:
   - Determine the safe zone perimeter
   - Monitor to ensure safe zone perimeter has not moved
3. Adjust the safe zone location as conditions change.

C. Evacuate an outdoor area.

1. Evacuate people from the affected area. Leave vehicle or equipment engine “as-found” and evacuate on foot.
2. Attempt to eliminate sources of ignition.

WARNING

Natural gas EXPLOSION and/or FIRE may result from the use of flares.

3. Cordon off access to area. Do **not** use flares. Use:
   - Caution tape
   - Cones
   - Items from the site to barricade access to area (e.g., vehicles, etc.)
   - Emergency response or PG&E personnel to assist with securing the area
4. Remain in line of sight to monitor area and prohibit re-entry.
5. Contact supervisor-in-charge to update evacuation progress.

D. Evaluate the structure (if applicable).

1. Knock on the door of the closest structure or unit safely accessible. DO NOT RING the doorbell. Introduce yourself and explain the reason for your visit.
2. Take readings around door while waiting for customer to respond.
3. Evacuate structure if readings at door indicate CO level is at or above 25 parts per million (ppm) ambient or 1% or more gas-in-air.
4. If readings at door do not meet evacuation requirements, then do the following:
   a. Notify occupants about the potential hazardous situation.
   b. Ask for entry permission to take readings in living area.
      (1) Evacuate occupants if readings in living area meet evacuation requirements.
      (2) If readings in living area do not require evacuation, then advise occupants to be on alert in case situation escalates to require evacuation.
5. Call 911 or enlist the building manager for assistance with evacuating people from multiple units in the same structure (if necessary).

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6. Evacuate people from affected structures.

   a. If you must evacuate a minor occupant without an adult chaperone, do the following.

      (1) Ask the minor to evacuate. DO NOT leave minor alone. DO NOT enter the structure.

      (2) If the minor refuses to evacuate, do the following:

      - Briefly leave the minor to call supervisor from a safe area for assistance with evacuation.
      - Stand by to wait for emergency response.

      (3) From a safe location, assist the minor to call an adult (minor's guardian) to the location.

WARNING

EXPLOSION and/or FIRE may occur from electrical arcing resulting from operating thermostats or electric switches, opening doors to appliances, or creating static electricity.

7. Attempt to eliminate sources of ignition.

8. Give occupants the following instructions:

   a. DO NOT operate electrical switches, nor unplug operating appliances.

   b. DO NOT make any phone calls until after they have arrived at safe zone.

   c. DO:

      (1) Evacuate through the nearest safe exit. Do not use the elevator.

      (2) Leave doors and windows open unless structure is on fire.

      (3) Leave vehicle or equipment engine "as-found" and evacuate on foot.

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9. Do the following (enlist emergency response or PG&E personnel for assistance as necessary):

   a. Verify that the structure has been completely evacuated.

   b. Use caution tape to ensure no entries.

      (1) Use “CAUTION DO NOT ENTER” tape to set the perimeter of the safe zone and evacuation area, including doors, gates and fences, when safe to do so. See Figure A-1.

Figure A-1. Examples of Caution Tape Usage
Left, caution tape attached to a side gate door; right, caution tape attached to the front door.

   c. Remain in line of sight of evacuated structures to ensure there are no re-entries.

10. Direct evacuees to safe zone.

    a. If occupants resist evacuation or do not respond, do the following:

        (1) Request assistance from emergency response personnel on scene OR call 911 for assistance.

        (2) Attempt to ventilate structure (if safe and accessible).

11. Advise evacuees to seek medical assistance if they show physical symptoms that indicate potential carbon monoxide (CO) poisoning (e.g., headache, nausea, dizziness, fatigue, or loss of consciousness).

12. Contact supervisor-in-charge to update evacuation progress.

13. Evacuate additional structures if necessary.

E. Eliminate sources of ignition.

1. Attempt to turn off gas when conditions are safe and accessible.

    a. Shut off and seal meter set. See Utility Procedure TD-6100P-09.

        - Attempt to shut off curb valve if meter is inaccessible. Not all locations have curb valves.

2. Eliminate any external sources of ignition (e.g., barbecues, lamps).

3. Call supervisor if you are unable to eliminate sources of ignition (e.g., you have not been trained to work with curb valves, or if conditions are unsafe to operate valve).

WARNING

IGNITION or EXPLOSION may occur when power is physically or remotely disconnected at electric meters, electric panels, breakers, switches, or receptacles.

4. Contact dispatch for electric personnel to cut off service at pole or splice box.

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F. Notifying supervisor in-charge.

1. At the earliest opportunity, call the supervisor-in-charge to:

   a. Advise that an evacuation is in progress and provide details of emergency.

   b. Advise supervisor if event meets reportable requirements per Utility Procedure TD-4413P-05, “Gas Operations CPUC Self-Report and Safety Citation Assessment Process.”

   c. Request any additional resources needed, such as:

      - GSRs, electric, gas department personnel, etc.
      - Local fire and police support
      - Contact dispatch personnel if directed by supervisor.

Leak Repair

SUMMARY

This procedure provides the methods and processes to repair leaking gas transmission and distribution facilities.

Level of Use: Informational Use

TARGET AUDIENCE

Gas construction, maintenance and construction (M&C), and gas pipeline operations and maintenance (GPOM) personnel

SAFETY

Bodily injury, including respiratory difficulties and burns, and property damage could occur when working around gas leaks and combustible mixtures, should the gas ignite.

BEFORE YOU START

Operator Qualifications (OQ)

This procedure contains covered tasks requiring qualifications. For covered task information, including date available and effective dates, consult the Guide to Operator Qualifications in the Technical Information Library (TIL) or contact the Gas Qualifications department.

Personal Protective Equipment (PPE)

Personnel performing this procedure must have the minimum PPE per the Gas Operations PPE Matrix.

Traffic Safety

Before performing any task in a roadway, evaluate the work and the area to create a plan to ensure your safety. Ensure temporary traffic controls are used:

1. Use signs or lights (on vehicle) to inform others work is being performed in the area

2. Use barricades to limit access to area by motorists (barricades include PG&E vehicle, cones, etc.)

Class III vest is required PPE for traffic areas with speed limits of 50 miles per hour or greater.

Leak Repair

TABLE OF CONTENTS

PROCEDURE STEPS

1 General

1.1 Prior to entering the property, follow Corporation Standard SAFE-1038S, “Dog Bite Prevention Standard,” whenever working in locations where a dog might be present.

1. Use the following dog bite prevention tools, which are available for purchase through Supplies and Solutions (S&S):
   - Bulli Ray baton, S&S part number 2881241
   - Certified dog repellent, S&S part number 2721442
   - Dog Dazer II Ultrasonic Dog Deterrent, S&S part number 2824173
2. Use MAPS+, which is equipped with a field intel layer that includes details for reported dogs (purple paw print) and bad dogs (red dog face).

1.2 Prior to repairing a pipeline, consider the operating conditions, design, and maintenance history, as necessary, to ensure that repair actions do not further damage the pipe.

1.3 For actions that the construction supervisor and personnel must take to track activities during an emergency gas leak or odor investigation, see Utility Procedure TD-4470P-01, “Gas Crew Tracking Process for Gas Leak or Odor Investigation.”

1.4 For guidance concerning grading leaks and the time frame to repair leaks, see Utility Procedure TD-4110P-09, “Leak Grading and Response.”

1.5 For details about the gas event reporting process and reporting criteria, see Utility Procedure TD-4413P-01, “Reporting of Gas Events.”

Leak Repair

1.6 For reporting unsafe gas conditions, see Utility Procedure TD-4413P-02, “Reporting Safety-Related Conditions, Strength Test Failures, Over-Pressure Events, and Encroachments.”

1.7 When working in hazardous atmospheres, refer to these documents:

- Utility Procedure TD-4414P-04, “Assessing and Working with Hazardous/Gaseous Atmospheres”
- Job Aid TD-4414P-04-JA01, “Using Gas Flash Suit Equipment”
- Gas Design Standard (GDS) M-01, “Gas Flash Suit and Accessories Care and Storage”
- GDS M-02, “Air-Line Pressure Demand Respirator System”
- GDS M-03, “Constant-Flow Supplied Air Respirator System”
- GDS M-83, “Explosion-Proof Lights”

1.8 Complete Form TD-4640P-01-F01, “Hot Work Permit,” and follow the hot work control process outlined in Utility Procedure TD-4640P-01, “Hot Work Control – Fire Prevention.”

1.9 Conduct excavations per Utility Manual TD-4621M, *Excavation Safety Manual*, and Utility Procedure TD-4412P-05, “Excavation Procedures for Damage Prevention.”

1.10 Complete Form TD-4640P-02-F01, “Gas Carrier Pipe Checklist,” prior to performing any work on distribution pipelines, per Utility Procedure TD-4640P-02, “Field Gas Carrier Pipe Checklist for Gas Operations,” Section 1, “Checklist Requirements.”

1.11 Execute clearances per the requirements of Utility Standard TD-4441S, “Gas Clearances.”

1.12 Purge facilities per the requirements of GDS A-38, “Purging Gas Facilities,” GDS A-38.1, “Installation and Operation of Air Movers,” and GDS A-38.3, “Temporary Vent Stacks.”

1.13 Perform all welding per the requirements of Utility Manual TD-4160M, *Gas Welding Control Manual (TD-4160M)*.

1.14 Apply all coating per the requirements of Utility Manual TD-4180M, *Gas Transmission and Distribution Manual: Corrosion Control Volume (TD-4180M)*, Section 2, “Guidance Documents,” “General (TD-4180 Series),” “Coating and Wrapping (E Series).”

1.15 Backfill excavation per GDS A-03, “Gas Trench Design and Construction,” GDS A-04, “Cover and Clearance Requirements for Transmission Lines, Distribution Mains, and Service Lines,” and per encroachment permit.

Leak Repair

2 Leak Investigation

2.1 If the leaking gas facility is belowground, pinpoint and expose the gas leak by following instructions in Utility Procedure TD-5100P-02, “Subsurface Leak Investigation and Pinpointing for Repair.”

2.2 After personnel expose the facility and find the leak source, IF there is a likely leak source nearby that does not require a new excavation and IF there are no safety concerns,

THEN extend the excavation to expose the other likely leak source.

2.3 When personnel cannot expose and verify a leak location, or when the possibility of other leaks exist, follow the guidance in Table 1.

Table 1. Leak Scenarios and Their Actions and Results

Leak Location	Scenario	Action	Result
Gas service line	Leak is believed to be on service line, but gas crew cannot expose and verify leak. (Or leak is possibly not PG&E gas.) Plan is to run a new service in lieu of repair.	Isolate service line from the main, and perform leak test per GDS A-34, “Piping Design and Test Requirements.”	• IF pressure drops, indicating a leak, THEN assume leak has been found and replace main or service. • IF pressure holds, THEN assume leak is not verified and continue leak investigation.
Gas main line	Leak is believed to be on main, but gas crew cannot expose and verify leak. Plan is to run a new main in lieu of repair.	Isolate main within leak perimeter, and perform leak test per GDS A-34.	
Gas main in casing	Leak on a cased main is exposed, but gas crew needs to rule out gas migration from other possible leaks.	Take bar hole readings at next opening in casing, such as a service tee, on both sides of leak to confirm no other gas leak sources are present.	• IF leak investigation confirms no other leaks exist, THEN assume leak is repaired. • IF leak investigation indicates otherwise, THEN continue investigation.
Leak source possibly not PG&E gas (excludes single service lines)	Leak investigation cannot pinpoint leak source, and gas sampling is inconclusive.	Isolate main and service lines within leak perimeter, and perform leak test per GDS A-34. Chart the leak test, and attach chart to Form TD-5100P-01-F01, “Leak Repair, Inspection, Gas Quarterly Incident Report (A-Form).”	• IF pressure drops in accordance to a leak, THEN further investigate to pinpoint leak. • IF pressure holds, THEN supervisor contacts superintendent to determine next steps and submits a Corrective Action Program (CAP) issue to document all actions taken and their outcome.

Leak Repair

NOTE

A leak fixed with a single repair (one clamp or one cut-out) can be assumed to be one leak. For example, the gas crew uses a single clamp to fix a leak location that includes multiple corrosion pits and a crack. This is assumed to be one leak.

2.4 IF a leak is exposed in an excavation where none was anticipated, and an A-Form for the leak has not been initiated,

THEN, before the gas crew repairs the leak, have a qualified person grade the leak per Utility Procedure TD-4110P-09 and document each leak on a separate A-Form per Utility Procedure TD-5100P-01, “Leak Repair and Pipe Inspection Documentation.”

2.5 To grade, cancel, or downgrade a leak, follow the requirements set in Utility Procedure TD-4110P-09.

2.6 IF gas readings are detected that do not appear to be related to a natural gas leak,

THEN follow the instructions in Utility Procedure TD-4110P-34, “Ethane Identification and Gas Sample Collection Process.”

2.7 IF a gas distribution Grade 1 leak is found to be on a mechanical fitting,

THEN follow the instructions in Utility Procedure TD-5100P-09, “Reporting Grade 1 Leaks on Mechanical Fittings.”

3 Repair Methods for Leaking Gas Facilities

3.1 To determine if a service line should be replaced or repaired, refer to Utility Standard TD-4801S, “Service Replacement Criteria.”

1. IF meter location makes it difficult to perform a leak survey, to check for atmospheric corrosion, or to perform maintenance,

   THEN consider or assess moving meter during repairs, per GDS J-15.1, “Gas Meter Locations for PG&E-Initiated Reconstruction, Relocation, Replacement, and Meter Work.”

3.2 Repair steel pipelines.

- To repair steel gas transmission pipelines, refer to Utility Procedure TD-4820P-04, “Repair Method Selection for Steel Transmission Pipeline.”
- To repair steel distribution pipelines, refer to Utility Procedure TD-4820P-05, “Repair Method Selection for Steel Distribution Pipeline.”

3.3 To repair a polyethylene gas distribution system, refer to GDS A-93.1, “Installing and Maintaining a Polyethylene Gas Distribution System.”

Leak Repair

3.4 For meter valve repairs, refer to Utility Procedure TD-6100P-11, “Meter Valve Maintenance (60 psig or less).”

NOTE

Hazardous TLA leaks must be reported on A-Form and to PHMSA.

3.5 Qualified GPOM personnel determine whether a leak can be repaired through tightening, lubrication, or adjusting (TLA), and make those repairs per the guidance in Table 2 for non-hazardous leaks for facilities inside transmission stations, distribution regulator stations, compressor stations, or storage facilities ONLY.

Table 2. TLA Leak Conditions and Actions to Take

Leak Condition	Action to Take
Hazardous leak, TLA repair	Qualified personnel make repair. A-Form is required.
Non-Hazardous leak (grade 2 or 3), A-Form already exists, TLA repair	Qualified personnel make TLA repair. Document on A-Form. N-1 cannot be used to document repair.
Non-Hazardous leak (grade 2 or 3), no A-Form exists, TLA repaired during maintenance[1]	Qualified personnel make TLA repair as part of the normal maintenance of the facility. Document leak repair on appropriate maintenance form as applicable.
Non-Hazardous leak (grade 2 or 3), no A-Form exists, corrective created to fix TLA later	Qualified personnel grade and document leak on an A-Form.

1. Note that an A-form is required to document leak repair, except for non-hazardous leaks repaired with TLA during maintenance

4 Belowground Gas Transmission Leak Repair Process

NOTE

The M&C crew is responsible for the leak site until another work group arrives.

4.1 For scheduled work, the M&C resource supervisor notifies the gas transmission (GT) superintendent of the scheduled date prior to excavation.

4.2 M&C personnel perform these actions:

1. Pinpoint, expose, or assess belowground gas transmission leak.
   a. For complicated or difficult excavations, coordinate with GT.
2. If leak is repairable by TLA,

   THEN repair and inform pipeline engineer of repair type.

4.2 (continued)

3. If leak is not repairable by TLA,

   THEN

   a. Contact the gas transmission general construction (GTGC) superintendent as the point of contact.

   b. Remain on-site until GTGC arrival.

   c. Hand off all pertinent documentation to GTGC field engineer.

   d. For Grade 1 leaks, ensure that a person who is qualified to perform a leak investigation/survey remains on-site, per Utility Procedure TD-4110P-09.

4.3 Pipeline engineers perform these actions:

1. Determine repair for a non-TLA leak.

2. Provide drawings to GTGC field engineer for as-built redline.

NOTE
GTGC assumes responsibility for leak site upon arrival.

4.4 GTGC personnel perform these actions:

1. Make necessary repairs per pipeline engineer's direction.

2. Complete site restoration.

3. Complete as-built package.

5 Temporary Backfilling and Plating of Belowground Active Leaks

5.1 Before temporarily backfilling an active leak, make sure that all of the following conditions are met:

- A visual assessment of the exposed leak confirms that the leak does NOT meet Grade 1 criteria per Utility Procedure TD-4110P-09.
- The leak needs planning OR requires additional time to repair.
- Backfilling will not create a hazard to personnel or the public.

5.2 Once a belowground leak has been excavated, consider the temporary backfilling and plating of the active leak only after all practical options for repair have been exhausted.

Leak Repair

5.3 The PG&E competent person at the leak site determines if backfilling is appropriate. See Utility Manual TD-4621M for more information on competent persons.

5.4 Consider the following factors before backfilling the excavation:

- Leak migration effects, such as nearby substructures and venting locations
- Public perception and anxiety
- Structural integrity of the pipeline, such as corroded pipe that may be impacted by compaction methods
- General location
- Extent of leak
- New migration path, which may create a new or potential hazard

5.5 Enter the following information into the leak notification long text in SAP.

1. Type “Active Leak Backfilled.”
2. Record the date on which the active leak was backfilled.
3. Identify the name of the PG&E competent person.
4. Provide a reason for backfilling an active leak.

5.6 Evaluate all hazards at job site and implement additional controls over the activities listed in this document to eliminate any risk to personnel, the public, and company assets.

1. Use an approved instrument to monitor the job site for hazardous gases and a combustible atmosphere.
2. IF instrument reading indicates combustible gases are NOT present,

   THEN personnel may proceed with any hot work such as welding and grinding operations.

Leak Repair

5.7 To control the potential hazard of a gas-air mixture inside the bell hole, fill the excavation completely.

- IF vehicular traffic is NOT a possibility OR IF plates will be placed over the excavation as a load-bearing structure,

  THEN backfill the excavation with loosely placed dry sand that meets the requirements of Engineering Material Specification EMS-4123, “Backfill Sand.”

- IF vehicular traffic is a possibility and plates will NOT be used to bear the load,

  THEN backfill the excavation per the requirements of GDS A-03.

5.8 To control the potential hazard of gas migration, install a vent.

1. Use a high-density polyethylene corrugated drainage pipe or a Sonotube casting form as a vent over the leaking facility.

2. Consider contouring the bottom of the vent pipe to the curvature of the gas pipe.

3. Install vent system in a fashion that avoids transmitting external loads to the pipe.

4. Determine the termination point of the vent, based on specific hazards, constraints, and other factors evaluated at the job site to ensure gas will not migrate into structure, create a hazard, or be exposed to sources of ignition.

5. To mitigate the potential for a static discharge prior to removing the plastic vent, wet the pipe with soapy water.

5.9 Before leaving the job site, secure the area as follows:

- Ensure open holes are covered and no tripping hazards exist.

- Use an approved instrument to ensure leaking gas is traveling through temporary vent pipe as designed.

- Use an approved instrument to ensure a non-combustible atmosphere exists on and around the excavation.

5.10 Monitor the leak more frequently than the recheck schedule requires in Utility Procedure TD-4110P-09.

1. Review the following hazards when determining the appropriate recheck schedule.

   - Vehicular and pedestrian traffic travelling over the leak

   - Proximity of leak to customers or enclosed structures and potential for gas migration

5.10 (continued)

- Proximity of leak to potential ignition sources
- Nature of leak and potential to worsen over time
- Other field-identified hazards

6 Post-Repair Requirements

6.1 Do NOT leave area while a hazardous condition exists.

6.2 Before leaving area, the PG&E qualified person uses a combustible gas indicator (CGI) or Detecto-Pak – Infrared (DP-IR) to take belowground gas readings and ensures that no hazardous condition exists.

6.3 The PG&E qualified person confirms hazardous conditions are eliminated by taking reasonable and thorough steps to ensure no further actions are necessary at the site to eliminate gas, including:

1. Using methods such as aerating or replacing soil to remove gas.
2. Monitoring and confirming gas readings at base of structure have decreased below 0.5% gas in soil without any sign of increase.
   a. Wait a minimum of 15 minutes after removing gas, and then take additional readings.
      (1) IF gas readings increase,

      THEN continue method of removing gas or perform leak investigation per Utility Procedure TD-5100P-02.
3. Ensuring gas has not migrated into any sources of ignition, into a building, or into a tunnel.
4. Ensuring there are no active leaks (houseline, adjacent services, etc.) contributing to the gas readings within the leak spread.
5. Performing necessary actions to ensure readings have been reduced to a level that the qualified person believes will not result in continued leak migration to above ground structures or subsurface structures where gas might accumulate.

6.4 Qualified personnel determine the need for a post-repair check, based on factors such as residual gas, leak history, system age, and type of system, or as requested by other work groups such as Quality Management (QM).

6.5 IF the repair includes one of the following:

- Belowground repair on distribution steel facilities due to corrosion
- Repair on plastic main or plastic service lines due to cracking on body of pipe, excluding cracks on fittings such as tee caps
- Any gas readings at the base of a structure at the completion of post repair actions

THEN select the **Post Recheck Required: Yes** check box on the A-Form, indicating than a post-repair check is required within 60 days not to exceed 90 days.

6.6 The qualified person performing the original leak repair is to document the need for a post-repair check.

6.7 Repave or plug all bar holes made in paved areas by applying an approved plug, per the requirements of the encroachment permit. See GDS M-54.1, “Impact Bar Probe,” for approved plugs.

6.8 Follow Utility Procedure TD-5811P-1200, “Locating and Marking Subsurface (Underground) Facilities,” for requirements about verifying the gas facility is locatable and marking the ground over the facility.

7 Documentation

7.1 Document all leak repairs by using an A-Form.

7.2 IF multiple leaks are discovered,

THEN document each leak on a separate A-Form, which includes identifying how each leak was repaired.

7.3 Retain records per the Record Retention Schedule.

END of Instructions

DEFINITIONS

Aboveground facility: A facility exposed to the atmosphere and readily accessible. The entire circumference of the facility is visible and can be inspected without excavation.

Belowground facility: A buried facility covered by earth or paving material. The entire circumference of the facility is not readily visible and may require excavation to perform inspection.

PG&E competent person: A PG&E employee who can identify existing and predictable hazards in the surroundings or in working conditions deemed unsanitary or dangerous to employees and who has authorization to take prompt, corrective measures to eliminate them.

Leak Repair

Definitions (continued)

Gas leak: The unintentional escape of gas from containment.

Gas leak repair: An action to restore a gas facility to a stable condition by eliminating a gas leak.

Leak grade: The classification of a leak based on leak readings, public exposure, and location.

IMPLEMENTATION RESPONSIBILITIES

Directors, managers, superintendents, and supervisors in gas transmission and distribution (T&D) maintenance and construction and T&D general construction must ensure that personnel attend a tailboard briefing and are trained on and comply with the requirements of this procedure.

Gas pipeline operations and maintenance directors, managers, superintendents, and supervisors must ensure that personnel attend a tailboard briefing and are trained on and comply with the requirements of this procedure.

The publishing of this procedure will be communicated in tandem with the revised Utility Procedure TD-4110P-09, “Leak Grading and Response.”

GOVERNING DOCUMENT

NA

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

NA

REFERENCE DOCUMENTS

Developmental References:

NA

Supplemental References:

Engineering Material Specification EMS-4123, “Backfill Sand”

Form TD-4640P-01-F01, “Hot Work Permit”

Form TD-4640P-02-F01, “Gas Carrier Pipe Checklist”

Form TD-5100P-01-F01, “Leak Repair, Inspection, Gas Quarterly Incident Report (A Form)”

Gas Design Standard A-03, “Gas Trench Design and Construction”

Leak Repair

Reference Documents (continued)

Gas Design Standard A-34, “Piping Design and Test Requirements”

Gas Design Standard A-38, “Purging Gas Facilities”

Gas Design Standard A-38.1. “Installation and Operation of Air Movers”

Gas Design Standard A-38.3, “Temporary Vent Stacks”

Gas Design Standard A-93.1, “Installing and Maintaining a Polyethylene Gas Distribution System”

Gas Design Standard J-15.1, “Gas Meter Locations for PG&E-Initiated Reconstruction, Relocation, Replacement, and Meter Work”

Gas Design Standard M-01, “Gas Flash Suit and Accessories Care and Storage”

Gas Design Standard M-02, “Air-Line Pressure Demand Respirator System”

Gas Design Standard M-03, “Constant-Flow Supplied Air Respirator System”

Gas Design Standard M-54.1, “Impact Bar Probe”

Job Aid TD-4414P-04-JA01, “Using Gas Flash Suit Equipment”

Utility Manual TD-4160M, *Gas Welding Control Manual (TD-4160M)*

Utility Manual TD-4180M, *Gas Transmission and Distribution Manual: Corrosion Control Volume (TD-4180M)*, Section 2, “Guidance Documents,” “General (TD-4180 Series),” “Coating and Wrapping (E Series)”

Utility Manual TD-4621M, *Excavation Safety Manual*

Utility Procedure TD-4110P-09, “Leak Grading and Response”

Utility Procedure TD-4110P-34, “Ethane Identification and Gas Sample Collection Process”

Utility Procedure TD-4412P-05, “Excavation Procedures for Damage Prevention”

Utility Procedure TD-4413P-01, “Reporting of Gas Events”

Utility Procedure TD-4413P-02, “Reporting Safety-Related Conditions, Strength Test Failures, Over-Pressure Events, and Encroachments”

Utility Procedure TD-4414P-04, “Assessing and Working with Hazardous/Gaseous Atmospheres”

Leak Repair

Reference Documents (continued)

Utility Procedure TD-4470P-01, “Gas Crew Tracking Process for Gas Leak or Odor Investigation”

Utility Procedure TD-4640P-01, “Hot Work Control – Fire Prevention”

Utility Procedure TD-4640P-02, “Field Gas Carrier Pipe Checklist for Gas Operations”

Utility Procedure TD-4820P-04, “Repair Method Selection for Steel Transmission Pipeline”

Utility Procedure TD-4820P-05, “Repair Method Selection for Steel Distribution Pipeline”

Utility Procedure TD-5100P-01, “Leak Repair and Pipe Inspection Documentation”

Utility Procedure TD-5100P-02, “Subsurface Leak Investigation and Pinpointing for Repair”

Utility Procedure TD-5100P-07, “Maintenance and Construction Odor and Leak Investigation”

Utility Procedure TD-5811P-1200, “Locating and Marking Subsurface (Underground) Facilities.”

Utility Procedure TD-6100P-11, “Meter Valve Maintenance (60 psig or less)”

Utility Standard TD-4441S, “Gas Clearances”

Utility Standard TD-4801S, “Service Replacement Criteria”

APPENDICES

NA

ATTACHMENTS

NA

DOCUMENT RECISION

NA

DOCUMENT APPROVER

Erik Kurtz, Director, Gas Transmission and Distribution Operations, Maintenance and Construction

[redacted], Director, Gas Transmission and Distribution Operations, Maintenance and Construction

Leak Repair

DOCUMENT OWNER

[redacted], Expert Gas Engineer Standards Engineering

DOCUMENT CONTACT

[redacted], Senior Specialist, Gas Methods and Practices

[redacted], Superintendent, Gas Transmission and Distribution Operations, Maintenance and Construction

(Document contact may change after publication. To find the current document contact, see the Gas Standards and Procedures Responsibility List.)

REVISION NOTES

Where?	What Changed?
Revision 0a	
Note Before Step 2.4	Clarified what constitutes a single leak.
Step 3.5	• Updated non-hazardous TLA repair actions. • Added distribution regulator stations to TLA exception.
Section 6	• Removed previous Step 6.1 and added current Steps 6.1, 6.2, and 6.3 to modify post-repair requirements around eliminating grade 1 conditions • Updated steps 6.4 and 6.5
Revision 0 (Publication Date: 12/18/2019, Effective Date: 07/01/2020)	
NA	This is a new procedure.

Service Replacement Criteria

SUMMARY

This utility standard provides guidance for determining when to replace gas services for reconstruction projects, leak response, or service relocations.

TARGET AUDIENCE

This utility standard applies to personnel doing the following work:

- Gas division maintenance and construction
- Resource management
- Distribution engineering
- Distribution estimating
- Distribution integrity management
- General construction

SAFETY

Implementing this utility standard will not raise the risk of a specific hazard to personnel, the public, or equipment.

Specific safety and hazard issues are addressed in individual work procedures related to this standard.

TABLE OF CONTENTS

Service Replacement Criteria

REQUIREMENTS

1 General Information

1.1 Distribution Integrity Management and Asset Engineering have identified the gas service asset types and conditions for replacement. This requirement applies to both reconstruction work and leak response.

1.2 See Table 1 for service replacement criteria.

Table 1. Required Actions for Gas Service Leaks

CONDITIONS	ACTION
Grade 1 leak circumstances allow gas service replacement during the initial repair response.	Replace the gas service.
Grade 1 leak circumstances preclude replacing the gas service during the initial repair response.	Repair the service (Repair not permitted for copper services; see Section 2.2) AND Maintenance and Construction (M&C) supervisor (or delegate) submits an Other Corrective Work (OCW) form for a service replacement to take place within 90 days of the initial repair.
Grade 1 leak gas service cannot be replaced within the 90 day window from the initial repair response.	IF the condition of the service does not pose a potential safety risk, THEN replacement of the gas service is not required. OTHERWISE, bring any such condition to the attention of the local engineer, who will make the final decision regarding replacement.
Grade 2 or 3 leak gas service replacement.	Estimates are required for the service replacement if it can be reasonably assumed the leak is over the service and not the main.

2 Service Assets and Conditions

2.1 For the following gas service asset types and conditions, replace service during initial response to a leak, scheduled leak repairs, and reconstruction projects:

- All steel services.
- All Aldyl-A plastic services.
- All copper services.
- All inserted services if the inserted material is pre-1985 plastic.
- All inserted services if there is difficulty locating the leak source.

Service Replacement Criteria

2.1 (continued)

- Pre-1985 plastic services (for reconstruction and scheduled leak repair).
- All riser leaks on steel and Aldyl-A plastic services with the exception of valve thread leaks. Threaded leaks can be resolved by:
  a. Doping and tightening, per Utility Procedure TD-4820P-05, “Repair Method Selection for Steel Distribution Pipeline.”
  b. Riser cut-down not requiring breaking pavement.
- Leaks on streets with known resurfacing or redevelopment projects.
- Crew foreman and construction supervisor determine that either replacement will require less time than repair, or the condition of the service warrants replacement.

2.2 Additional requirements for copper services:

- Replace all leaking copper services (identified in the geographic information system [GIS], on the Gas Service Record [GSR], or found in the field) during the initial leak repair response.
- Replace plugged copper services on the same day as the plugged service detection.
- If found during excavation, replace all field identified non-leaking copper services the same day as they are found. If copper is identified by above-ground inspection, submit an OWC to have the copper service replaced.
- If a leaking or non-leaking copper service cannot be replaced during initial leak response or on the day it is found it must be deactivated at the main. Provide CNG to the customer as necessary until the service can be replaced.

3 Guidelines for Gas Service Replacement

3.1 Guidelines apply to all individual services. Branch services are handled case by case.

3.2 Plastic service replacements may include installing a tapping tee repair kit. Refer to Utility Procedure TD 4170P 57, “Polyethylene Tapping Tee Repair Kits.”

3.3 IF the existing service tee is listed in Utility Procedure TD-4170P-57,

THEN refurbish the existing service tee per Utility Procedure TD-4170P-57.

Meter set, including regulator vent separation, must be brought to current standards, per Gas Design Standard H-93, “Piping – Details, Regulator Vent Lines – Above Ground,” and Gas Design Standard J-15.1, “Gas Meter Locations for PG&E-Initiated Reconstruction, Relocation, Replacement, and Meter Work.” Coordinate with Gas Field Services when regulator venting is necessary.

4 Exceptions

Service Replacement Criteria

4.1 Except for copper services, local engineering may approve exceptions to this standard based upon:

1. Field conditions such as long services, retaining walls, difficult terrain, landscape, traffic, and substructures.

2. Other planned replacement projects.

4.2 Document exceptions to this standard in the SAP notification long text.

4.3 Tee-cap leaks on plastic or steel services may be repaired and do not require the service to be replaced. However, if the tee-cap leak is on a pre-1985 plastic service, replacement of the service is recommended.

4.4 Use Attachment 1, “Farm Tap Service Line Replacement Decision Tree,” to determine if a farm tap service should be replaced in conjunction with other work.

END of Requirements

DEFINITIONS

Field identified: a condition found in the field (such as pipe material) that is different than anticipated based on existing documentation.

IMPLEMENTATION RESPONSIBILITIES

The target audience will receive a tailboard from field supervisors and documentation of this standard through training services.

GOVERNING DOCUMENT

NA

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

NA

Service Replacement Criteria

REFERENCE DOCUMENTS

Developmental References:

NA

Supplemental References:

Gas Design Standard H-93, "Piping – Details, Regulator Vent Lines – Above Ground"

Gas Design Standard J-15.1, "Gas Meter Locations for PG&E-Initiated Reconstruction, Relocation, Replacement, and Meter Work"

Utility Procedure TD 4170P 57, "Polyethylene Tapping Tee Repair Kits"

Utility Procedure TD-4820P-05, "Repair Method Selection for Steel Distribution Pipeline"

APPENDICES

NA

ATTACHMENTS

Attachment 1, "Farm Tap Service Line Replacement Decision Tree"

DOCUMENT RECISION

NA

DOCUMENT APPROVER

[redacted], Director

DOCUMENT OWNER

[redacted], Senior Manager

DOCUMENT CONTACT

[redacted], Engineer

(Document contact may change after publication. To find the current document contact, see the Gas Standards and Procedures Responsibility List.)

Service Replacement Criteria

REVISION NOTES

Where?	What Changed?
Revision 1b	
Section 4.4	Added reference to new Attachment 1 for determining if a farm tap service should be replaced in conjunction with other work.
Attachment 1	Added new attachment with farm tap service line replacement decision tree.
Revision 1a (Publication Date: 11/21/2019 Effective Date: 02/25/2019)	
Table 1	• Added “Repair not permitted on copper services.” • Clarified M&C Supervisor or delegate to submit OCW for repair.
Section 2.1	• In 7th bullet, removed exception for repair on riser threads for copper services. • In item a. below the 7th bullet, replaced reference to TD-4100P-05 with a reference to TD-4820P-05.
Section 2.2	Added new section with additional copper replacement criteria.
Section 3.3	Replaced reference to TD-6436P-28 with reference to J-15.1.
Section 4.1	Clarified no exception allowed for copper services.
Definitions	Added definition for “Field identified.”
Appendix 1	Deleted Appendix 1.
Revision 1 (Publication Date: 08/28/2013)	
Section 1	Action requirement clarification based on leak grade.
Section 2 & 3	Replacement requirement clarification and added reference documents.
Section 4.2	Added guidance for pre-1985 plastic service, replacement of the service is recommended.
References	Added supplemental references.
Appendix 1	Added: “Does condition of service pose a potential safety risk? If NO, repair the service.”

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

SUMMARY

This utility procedure describes the process for inspecting Pacific Gas and Electric Company (PG&E or Company) gas distribution meter sets and idle risers for atmospheric corrosion.

Level of Use: Informational Use

TARGET AUDIENCE

Field personnel performing visual inspections of gas meters, their supervisors, and local superintendents, including atmospheric corrosion contractors, leak survey personnel, and field services personnel.

For information only: quality management personnel.

SAFETY

Performing this procedure will not raise the risk of a specific hazard to personnel, public, or equipment.

BEFORE YOU START

Personal protective equipment (PPE): Personnel performing this procedure must have the minimum personal protective equipment (PPE) per the Gas Operations PPE Matrix.

Tools: In addition to PPE, ensure you have the following tools:

- Electronic device for capturing inspection information
- Plat map designating the area to be inspected

Operator Qualifications (OQs): This procedure contains covered tasks requiring Qualifications. Please consult the PG&E Gas Qualifications Task List or contact the Gas Qualifications department for covered task information, including date available and effective dates.

TABLE OF CONTENTS

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

PROCEDURE STEPS

1 Pre-Inspection

1.1 Obtain and review assignment.

> **NOTE**
>
> Physical entry to the exposed gas facilities is required in order to perform proper atmospheric corrosion and field inspections.
>
> Performing atmospheric corrosion inspections from a distance using binoculars or other viewing aids is not permitted.

1.2 Locate the riser in the field.

2 Asset Identification

2.1 Identify all assets to be assessed for atmospheric corrosion, per Figure 1, "Gas Meter Set."

A. Riser (pictured with sunshield)

B. Shutoff valve

C. Regulator

D. Pipe

E. Meter

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

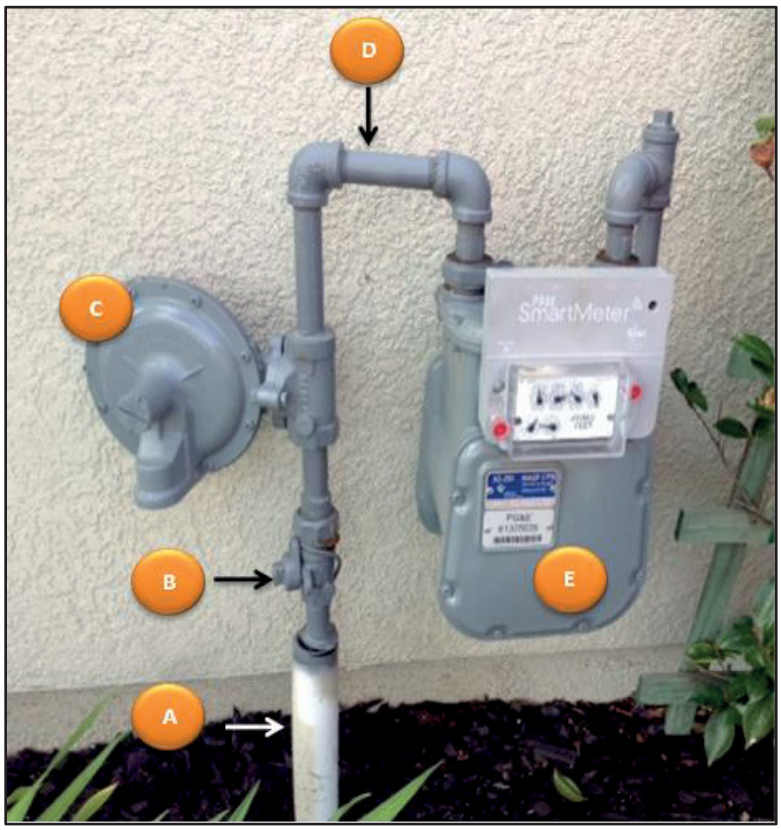

Figure 1. Gas Meter Set

2.2 Ensure all portions of the gas meter set are visible for inspection.

1. IF any portion of the gas meter set assembly is not visible, OR a representative portion of that asset cannot be inspected.

   THEN report the location as an Atmospheric Corrosion Can't Get In (AC CGI).

   a. IF a sun shield is around the riser,

      THEN do not report the location as an AC CGI.

2. IF any portion of the gas meter set assembly (e.g., meter, riser valve, regulator) comes in contact with the ground, is buried, or installed below grade,

   THEN report as a buried meter assembly or buried valve Abnormal Operating Condition (AOC), per Section 4, AND continue to inspect the visible portion of the meter set for atmospheric corrosion.

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

3 Asset Condition Inspection

3.1 Identify the Asset Groups.

1. Inspect and record exceptions on the meter set assembly based on two asset groups, meter assembly and riser. See Figure 2, "Asset Grading Groups," for what equipment is included in each asset group.

Figure 2. Asset Grading Groups

3.2 Grade the meter assembly.

1. Visually inspect meter assembly for signs of atmospheric corrosion, grading according to Table 1, "Atmospheric Corrosion Criteria: Shutoff Valve, Pipe, Regulator, and Meter Body."

   a. Inspect the entire meter set, with particular attention to the backside and bottom of the equipment.

2. Record only **severe** atmospheric corrosion in the mobile tablet for the meter assembly based on the most severe condition, as described in Table 1.

   a. Documenting **none to moderate** atmospheric corrosion is not required.

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

Table 1. Atmospheric Corrosion Criteria: Shutoff Valve, Pipe, Regulator, and Meter Body

Grade	Condition Description
None to moderate (not recorded)	• No observable corrosion and protective coating is in fair to good condition • Minimal surface rust present • Minimal surface rust on tool marks • Protective coating is deteriorated with no corrosion pitting • Threaded connections have oxide buildup
	Examples
	  

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

Table, 1, continued

Grade	Condition Description
Severe (recorded)	• Corrosion present with metal loss • Predominant flaking rust • Metal surface is pitted • Metal surface is gouged
	Examples
	 

3.3 Grade the riser

NOTE

The riser includes ALL exposed pipe below the bottom of the shut-off valve, including exposed piping by design (e.g., aboveground piping to a rooftop meter).

1. Visually inspect steel riser for signs of atmospheric corrosion, grading according to Table 2, “Atmospheric Corrosion Criteria: Riser.”

   a. Inspect the entire riser, with particular attention to the soil-to-air transition.

2. Record only **severe** atmospheric corrosion in the mobile tablet for the riser based on the most severe condition, as described in Table 2.

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

Table 2. Atmospheric Corrosion Criteria: Riser

Grade	Condition Description
None to moderate (not recorded)	• No observable corrosion and protective coating is in fair to good condition • Minimal surface rust present • Minimal surface rust on tool marks • Protective coating is deteriorated with no corrosion pitting
	Examples
	  
Grade	**Condition Description**
Severe (recorded)	• Corrosion present with metal loss • Predominant flaking rust • Metal surface is pitted • Metal surface is gouged • Protective coating is deteriorated AND metal loss
	Examples
	  

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

4 Abnormal Operating Conditions (AOCs)

4.1 Visually inspect meter assembly and surroundings for AOCs and record per Job Aid TD-4110P-03-JA15, "Abnormal Operating Conditions (AOCs) in Leak Survey," and take appropriate action as necessary.

1. IF any hazardous AOCs are observed, including atmospheric corrosion to the point where significant metal loss is observed,

   THEN follow the process for notifying gas control or gas dispatch for potentially reportable incidents in Utility Procedure TD-4413P-01, "Reporting of Gas Events."

5 Recording Results

5.1 Atmospheric corrosion inspections are documented in various systems depending on the work group performing the inspection. Records or maps must, at a minimum, show the following:

- All locations that were inspected for atmospheric corrosion
- Locations where severe atmospheric corrosion or an AOC was found
- Date the inspection took place
- Identifying information for the qualified personnel who performed the inspection

5.2 Personnel performing atmospheric corrosion inspections perform the following recordkeeping during the inspection:

1. Record all instances of severe atmospheric corrosion on the electronic device at the time of discovery.

   a. Record severe atmospheric corrosion on the shutoff valve, pipe, regulator, and meter body as "Atmospheric Corrosion (severe) Meter."

   b. Record severe atmospheric corrosion on the riser as "Atmospheric Corrosion (severe) Riser."

   c. Take picture(s) of any instances of severe atmospheric corrosion.

2. Document all AC CGIs on the electronic device.

3. Document all AOCs on the electronic device or corrective work form.

   a. Take picture(s) of the AOC.

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

5.2 (continued)

4. Document completion of the plat map.

   a. IF this is not available on the electronic device,

      THEN use the check box on Form TD-4110P-03-F07, "Leak Survey and Inspections Record of Detail" to document completion of the plat map.

5.3 Retain records per the Record Retention Schedule.

END of Instructions

DEFINITIONS

Abnormal operating condition (AOC): A malfunction of a component or deviation from normal operations that might: (a) indicate a condition exceeding design limits, OR (b) result in a hazard to people, property, or the environment.

Atmospheric corrosion (AC): Deterioration of a material (usually metal) by a reaction with the atmosphere. Indications of severe atmospheric corrosion include metal loss with pitting and/or flaking.

Can't Get In (CGI): A location where an unsuccessful attempt has been made to access a gas facility for maintenance purposes. CGIs are often accessed by making customer contact or re-attempting access at another time.

Gouge: An indentation or groove made by mechanical damage.

Hazardous AOC: A condition that represents an existing or probable hazard to persons or property, AND requires immediate repair OR continuous action until the condition is no longer hazardous.

Pitting: A form of extremely localized corrosion that leads to the creation of small holes in the metal.

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

IMPLEMENTATION RESPONSIBILITIES

This procedure will be communicated via Gas TDM Comms email.

Supervisors will communicate this procedure to personnel who perform inspection and grading of gas meter sets for atmospheric corrosion, and ensure that personnel are trained and qualified to perform these tasks. Tailboard with required documented sign-off is mandatory for personnel who perform these tasks.

Atmospheric corrosion inspection program manager will develop refresher training for target audience performing atmospheric corrosion inspections for how to record them on an exception basis, to coincide with the publication of this utility procedure AND ensure personnel complete refresher training before performing AC inspections.

Quality Management will update PG&E employee assessments to align with AC contractor assessments.

GOVERNING DOCUMENT

Utility Standard TD-4188S, “Atmospheric Corrosion Control of Gas Facilities”

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

Code of Federal Regulations (CFR),Title 49, Transportation, Part 192–Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards, Section 192.481, “Atmospheric corrosion control: Monitoring”

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

REFERENCE DOCUMENTS

Developmental References:

Utility Procedure TD-4413P-01, "Reporting of Gas Events"

Supplemental References:

Form TD-4110P-03-F07, "Leak Survey and Inspections Record of Detail"

Job Aid TD-4110P-03-JA15, "Abnormal Operating Conditions (AOCs) in Leak Survey"

Utility Procedure TD-4110P-03, "Performing and Documenting Leak Survey"

APPENDICES

NA

ATTACHMENTS

NA

DOCUMENT RECISION

TD-4188P-01, "Atmospheric Corrosion Inspection of Gas Distribution Meters," 03/20/2015, Rev. 0

TD-4188B-001, "New Optional OQ Allowed for Inspections of Atmospheric Corrosion on Gas Distribution Meters," 04/01/2015, Rev. 0

DOCUMENT APPROVER

[redacted] Manager, Corrosion Engineering and Services

DOCUMENT OWNER

[redacted], Gas Engineer, Gas Standards and Qualifications

DOCUMENT CONTACT

[redacted], Engineer, Corrosion Engineering and Services

Atmospheric Corrosion Inspection of Customer-Connected Risers and Meter Sets

REVISION NOTES

Where?	What Changed?
Revision 1a	
Step 4.1.1	Revised the step to eliminate confusion.
Revision 1	
Entire document	Changed document title from “Atmospheric Corrosion Inspection of Gas Distribution Meters” to reflect that with the change in definition of “transmission,” some large volume customer meter sets are now classified as transmission assets. Replaced three-tier grading of none, moderate, and severe atmospheric corrosion with exception-based reporting of severe atmospheric corrosion. Removed identification of Distribution Integrity Management Program (DIMP) assets.
Before You Start: OQ	Replaced list of specific OQs with reference to the PG&E Gas Qualifications Task List.
Section 2.2	Added guidance on CGI vs. buried meter or buried valve AOC.
Figure 1	Modified picture so the riser is directly below the bottom of the shutoff valve.
Table 1 and Table 2	Modified tables to reflect the exception-based reporting of severe atmospheric corrosion by grouping none and moderate into one category. Included more examples. Replaced the term "active corrosion" with descriptions of the physical characteristics that will indicate it is severe.
Section 4	Expanded section and changed instructions to calling GCC for hazardous AOCs (instead of gas dispatch).
Section 5	Renamed section “Recording Results” Expanded section to list how the exceptions (severe atmospheric corrosion and AOCs) and completed surveys are being recorded. Changed record retention instructions.
Definitions	Added definitions for the following: abnormal operation condition (AOC), atmospheric corrosion (AC), Can’t Get In (CGI), and hazardous AOC.

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10
Deferred Work Analysis Summary

The Gas Distribution deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work;

Check 2a: *The work is measured by units of work.*

Check 2b: PG&E expects to perform fewer of such units during the 2020-2022 period

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

								Check 2					Units Comparison			Dollar Comparison		
Line	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 1	*Check 2a*	*Check 2b*	Check 3	Deferred Work	Explanation	2020 Rec. Adj. + 2021 to 2022 Forecast	2020 to 2022 Imputed	Difference	2020 Rec. Adj. + 2021 to 2022 Forecast (A) (B)	2020 to 2022 Imputed	Difference
1	10	Capital	3P	3PB	GD Below Ground Service Repair	# of services	Y	Y	N	N	N	No deferred work - Work is demand-driven.	282	-	282	$ 8,973,996	$ -	$ 8,973,996
2	10	Capital	3P	3PC	GD Below Ground Main Repair	# of services	Y	Y	N	N	N	No deferred work - Work is demand-driven.	18	-	18	$ 595,314	$ -	$ 595,314
3	10	Capital	50	50G	Leak Management - Simple Service Replacement	# of services	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	3,521	4,835	(1,314)	$ 54,429,772	$ 77,580,653	$ (23,150,881)
4	10	Capital	50	50K	Emergent Leaking Main Replacement	feet of main	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	17,578	33,872	(16,294)	$ 13,218,807	$ 20,418,539	$ (7,199,733)
5	10	Capital	50	50M	Leak Management - Complex Service Replacement	# of services	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	121	1,320	(1,199)	$ 1,763,027	$ 21,426,782	$ (19,663,756)
6	10	Capital	52	52B	Emergency Response Gas Dig-Ins, Services	# of services	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	543	609	(66)	$ 3,402,015	$ 382,031	$ 3,019,985
7	10	Capital	52	52C	Emergency Response Gas Dig-Ins, Main	feet of main	Y	Y	N	N	N	No deferred work - Work is demand-driven.	4,101	2,965	1,136	$ 1,611,965	$ 2,325,396	$ (713,431)
8	10	Expense	DE	DE#	Leak Survey Support	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - This work is non-unitized and covers other support costs such as labor, and other support.	-	-	-	$ 6,293,722	$ 2,174,750	$ 4,118,972
9	10	Expense	DE	DEA	Routine Leak Survey	Services Surveyed	Y	Y	Y	N	N	No deferred work - All required work and survey was completed between MAT DEA and DEF to capture the 3-year and 1-year compliance survey plan.	1,476,732	1,619,344	(142,612)	$ 30,897,573	$ 23,629,489	$ 7,268,084
10	10	Expense	DE	DEB	Special Leak Survey	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 9,792,064	$ 17,595,241	$ (7,803,178)
11	10	Expense	DE	DEC	Leak Downgrade, No Repair	Services Surveyed	Y	Y	N	N	N	No deferred work - Work is demand-driven.	25,850	20,718	5,132	$ 9,039,206	$ 6,204,517	$ 2,834,689
12	10	Expense	DE	DED	Leak Rechecks	# of Rechecks Performed	Y	Y	N	N	N	No deferred work - Work is demand-driven.	123,086	63,873	59,213	$ 6,917,990	$ 4,735,355	$ 2,182,635
13	10	Expense	DE	DEE	Customer Calls	# Customer Calls	Y	Y	N	N	N	No deferred work - Work is demand-driven.	11,071	10,802	269	$ 2,057,132	$ 1,661,920	$ 395,211
14	10	Expense	DE	DEF	Picarro Leak Survey	Services Surveyed	Y	Y	N	N	N	No deferred work - All required work and survey was completed between MAT DEA and DEF to capture the 3-year and 1-year compliance survey plan.	2,881,016	1,979,086	901,930	$ 35,424,922	$ 18,529,318	$ 16,895,604
15	10	Expense	DE	DEG	Picarro Special Leak Survey	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 8,040	$ 4,720	$ 3,320
16	10	Expense	FI	FI#	Corrective Maintenance, Other	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - This work is non-unitized and covers other support costs such as labor, and other support.	-	-	-	$ 10,875,192	$ 3,922,732	$ 6,952,460
17	10	Expense	FI	FIG	Corrective Maintenance Main Leak	# of Main Leaks Repaired	Y	Y	N	N	N	No deferred work - Work is demand-driven.	12,316	8,899	3,417	$ 100,403,214	$ 60,640,864	$ 39,762,351
18	10	Expense	FI	FIH	Corrective Maintenance Service Leak, Above Ground	# Svc Leak Repairs_AB	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	33,786	72,989	(39,203)	$ 15,844,257	$ 17,536,213	$ (1,691,956)
19	10	Expense	FI	FIJ	Corrective Maintenance Service Dig-in	# of Svc dig-ins Repaired	Y	Y	N	N	N	No deferred work - Work is demand-driven.	805	742	63	$ 2,947,401	$ 2,836,004	$ 111,397
20	10	Expense	FI	FIK	Corrective Maintenance Main Dig-in	# of Main Dig-ins Repaired	Y	Y	N	N	N	No deferred work - Work is demand-driven.	4,656	4,376	280	$ 3,894,365	$ 1,724,236	$ 2,170,129
21	10	Expense	FI	FIM	Major Event	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 956,564	$ -	$ 956,564
22	10	Expense	FI	FIP	Corrective Maintenance Service Leak, Below Ground	# Svc Leak Repairs_BG	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	14,173	15,767	(1,594)	$ 53,224,534	$ 42,780,123	$ 10,444,412
23	10	Expense	FI	FIQ	Atmospheric Corrosion Monitoring	# Locations Inspected	Y	Y	Y	N	N	No deferred work - Due to change in Leak survey schedule from 4-year to 3-year cycle aligning with AC inspection, more units were inspected through routine leak survey in MAT DEA and fewer units in MAT FIQ.	479,959	581,733	(101,774)	$ 10,714,683	$ 6,321,766	$ 4,392,917
24	10	Expense	FI	FIS	Leak Survey Meter Repair	# of Meters Repaired	Y	Y	N	N	N	No deferred work - PG&E expects to perform all adopted levels of work.	246,164	188,999	57,165	$ 27,149,363	$ 15,628,641	$ 11,520,723
25	10	Expense	JQ	JQA	DIMP Leak Survey	Services Surveyed	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	139,805	161,918	(22,113)	$ 2,501,652	$ 2,049,843	$ 451,808
26	10	Expense	JU	JU#	Gas Distrib Leak Srvy & Repair, Other	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in	-	-	-	$ 45	$ -	$ 45
27	10	Expense	LW	LW#	Gas Leak Abatement Program, Other	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in	-	-	-	$ 192	$ -	$ 192
28	10	Expense	LW	LWC	GD 3yr Leak Survey - Picarro	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 368	$ -	$ 368
29	10	Expense	LW	LWG	GD Main Leak Repair	# of services	Y	Y	N	N	N	No deferred work - Work is demand-driven.	900	-	900	$ 10,565,532	$ -	$ 10,565,532
30	10	Expense	LW	LWH	GD Below Ground Svc Leak Repair	# of services	Y	Y	N	N	N	No deferred work - Work is demand-driven.	1,848	-	1,848	$ 9,492,681	$ -	$ 9,492,681
31	10	Expense	LW	LWO	GD R&D Methane Abatement	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 0	$ -	$ 0
32	10	Expense	LW	LWP	GT R&D Methane Abatement	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 31,238	$ -	$ 31,238
33															**Expense Total**	$ 349,031,930	$ 227,975,733	$ 121,056,200
34															**Capital Total**	$ 83,994,896	$ 122,133,401	$ (38,138,506)
35																		

36 (A) Recorded and forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

37 (B) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 10
Gas Transmission Deferred Work Analysis Summary

The Gas Transmissiondeferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks listed below.

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work;

Check 2a: *The work is measured by units of work.*

Check 2b: *PG&E expects to perform fewer of such units during the 2019-2022 period.*

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

Line	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 1	Check 2		Check 3	Deferred Work	Explanation	Units Comparison			Dollar Comparison		
								Check 2a	*Check 2b*				2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast	2019 to 2022 Imputed	Difference	2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast (A)	2019 to 2022 Imputed	Difference
1	10	Expense	JO	JOE	Ground Leak Survey	Miles Ground Leak Surveyed	Y	Y	Y	N	N	No deferred work - All required work is completed under MAT JOE and MAT JOW to capture the semi-annual compliance survey.	2,262.00	14,088.00	(11,826)	$ 3,941,274	$ 5,301,675	$ (1,360,401)
2	10	Expense	JO	JOW	Aerial Leak Survey	Miles Aerial Leak Surveyed	Y	Y	N	N	N	No deferred work - All required work is completed under MAT JOE and MAT JOW to capture the semi-annual compliance survey.	51,290.00	35,736.00	15,554.00	$ 8,041,900	$ 7,413,180	$ 628,720
3	10	Expense	JO	JOR	Leak Rechecks	Leak Rechecks	Y	Y	N	N	N	No deferred work - Work is demand-driven.	9,647.00	2,072.00	7,575.00	$ 1,310,086	$ 528,012	$ 782,075
4	10	Expense	JO	JOP	CM Gas Main Leak	Leaks Repaired	Y	Y	N	N	N	No deferred work - Work is demand-driven.	7,911.00	2,080.00	5,831.00	$ 27,700,652	$ 12,144,710	$ 15,555,942
5	10	Expense	JP	JPR	CARB Leak Repairs	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 7,143,606	$ -	$ 7,143,606
6	10	Expense	JP	JPQ	CARB Leak Survey	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 12,789,306	$ -	$ 12,789,306
7	10	Expense	LW	LWJ	GT Policy Procedures Training	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 160,254	$ -	$ 160,254
8	10	Expense	LW	LWP	GT R&D Methane Abatement	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 31,238	$ -	$ 31,238
9															**Expense Total**	$ 61,118,316	$ 25,387,576	$ 35,730,739
10																		

11 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony: ☐ **Workpapers:** ☒ **SOQ:** ☐

Exhibit Number: 3 **Chapter Number:** 10

Chapter Title: Leak Management

Witness Name: Erik Kurtz

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
WP 10-1	Table 10-1	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-1
WP 10-2	Table 10-2	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-2
WP 10-3	Table 10-3	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-3
WP 10-4	Table 10-4	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-4

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of February 28, 2022				
WP 10-1	Table 10-1	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-1
WP 10-2	Table 10-2	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-2
WP 10-3	Table 10-3	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-3
WP 10-4	Table 10-4	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-4
WP 10-47	Table 10-39, Line 22	FIG - Escalation Factor	2021: 3.75%	2021: 3.00%
WP 10-47	Table 10-39, Line-23	FIG - Escalation Amount	2021: $301.00 2022: $312.28 2023: $927.63	2021: $240.80 2022: $310.03 2023: $863.49
WP 10-47	Table 10-39, Line 24	FIG - Forecast Unit Cost	2021: $8,327.60 2022: $8,639.88 2023: $8,871.56	2021: $8,267.40 2022: $8,577.43 2023: $8,807.43
WP 10-47	Table 10-39, Line 26	FIG - Forecast Total Cost	2021: $38,157,057.62 2022: $40,339,617.17 2023: $46,744,272.97	2021: $37,881,223.47 2022: $40,048,005.48 2023: $46,406,362.56
WP 10-49	Table 10-41, Line 22	FIP - Escalation Factor	2021: 3.75%	2021: 3.00%
WP 10-49	Table 10-41, Line 23	FIP - Escalation Amount	2021: $139.24 2022: $144.46 2023: $427.88	2021: $111.39 2022: $143.42 2023: $398.30
WP 10-49	Table 10-41, Line 24	FIP - Forecast Unit Cost	2021: $3,852.29 2022: $3,996.75 2023: $4,092.11	2021: $3,824.44 2022: $3,967.85 2023: $4,062.53
WP 10-49	Table 10-41, Line 26	FIP - Forecast Total Cost	2021: $15,798,222.25 2022: $16,738,372.49 2023: $22,179,218.23	2021: $15,684,018.23 2022: $16,617,372.20 2023: $22,018,886.54
WP 10-51	Table 10-43, Line 10	FIH - Escalation Factor	2021: 3.75%	2021: 3.00%

Page No.	Line No.	Item	As Filed	As Corrected
WP 10-51	Table 10-43, Line 11	FIH - Escalation Amount	2021: $16.99 2022: $17.62 2023: $18.28	2021: $13.59 2022: $17.50 2023: $18.15
WP 10-51	Table 10-43, Line 12	FIH - Forecast Unit Cost	2021: $469.97 2022: $487.59 2023: $505.87	2021: $466.57 2022: $484.07 2023: $502.22
WP 10-51	Table 10-43, Line 14	FIH - Forecast Total Cost	2021: $5,803,784.87 2022: $6,063,422.54 2023: $4,041,936.40	2021: $5,761,829.80 2022: $6,019,590.57 2023: $4,012,717.58
WP 10-66	Table 10-55, Line 41	Footnote F	2019 Above Ground Grade 3 leaks found + 2020 YTD Open Above Ground Grade 3 leaks (Line 16 + Line 24).	2019 Above Ground Grade 3 leaks found + 2020 YTD Open Above Ground Grade 3 leaks(x2) (Line 16 + Line 24). Line 24 is doubled to account for the second half of the year.
WP 10-67	Table 10-56, Line 12	JOP - Escalation Factor	2021: 3.75%	2021: 3.00%
WP 10-67	Table 10-56, Line 13	JOP - Escalation Amount	2021: $136.18 2022: $141.29 2023: $146.59	2021: $108.95 2022: $140.27 2023: $145.53
WP 10-67	Table 10-56, Line 14	JOP - Forecast Unit Cost	2021: $3,767.70 2022: $3,908.99 2023: $4,055.58	2021: $3,740.46 2022: $3,880.73 2023: $4,026.26
WP 10-67	Table 10-56, Line 16	JOP - Forecast Total Cost	2021: $8,948,288.24 2022: $10,241,551.37 2023: $13,306,345.40	2021: $8,883,601.82 2022: $10,167,516.06 2023: $13,210,154.95
WP 10-95	Table 10-70	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-70
WP 10-96	Table 10-71	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-71
WP 10-97	Table 10-72	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-72
WP 10-98	Table 10-73	Updated forecast to reflect post-filing errata	Replaced in its entirety	See replaced Table 10-73
WP 10-100	Table 10-75, Line 24	50G - Escalation Factor	2021: 3.75%	2021: 3.00%

Page No.	Line No.	Item	As Filed	As Corrected
WP 10-100	Table 10-75, Line 25	50G - Escalation Amount	2021: $541.50 2022: $561.81 2023: $1,550.76 2024: $556.17 2025: $577.02 2026: $598.66	2021: $433.20 2022: $557.75 2023: $1,443.55 2024: $552.15 2025: $572.85 2026: $594.33
WP 10-100	Table 10-75, Line 26	50G - Forecast Unit Cost	2021: $14,981.53 2022: $15,543.34 2023: $14,831.10 2024: $15,387.26 2025: $15,964.29 2026: $16,562.95	2021: $14,873.23 2022: $15,430.98 2023: $14,723.88 2024: $15,276.03 2025: $15,848.88 2026: $16,443.21
WP 10-100	Table 10-75, Line 28	50G - Forecast Total Cost	2021: $19,535,921.33 2022: $20,455,038.49 2023: $21,887,193.73 2024: $22,522,255.62 2025: $23,559,512.13 2026: $24,442,993.83	2021: $19,394,697.80 2022: $20,307,170.74 2023: $21,728,973.05 2024: $22,359,444.13 2025: $23,389,202.40 2026: $24,266,297.49
WP 10-102	Table 10-77, Line 24	50M - Escalation Factor	2021: 3.75%	2021: 3.00%
WP 10-102	Table 10-77, Line 25	50M - Escalation Amount	2021: $473.09 2022: $490.84 2023: $1,828.79 2024: $655.88 2025: $680.47 2026: $705.99	2021: $378.48 2022: $487.29 2023: $1,702.36 2024: $651.14 2025: $675.55 2026: $700.89
WP 10-102	Table 10-77, Line 26	50M - Forecast Unit Cost	2021: $13,088.94 2022: $13,579.78 2023: $17,490.09 2024: $18,145.97 2025: $18,826.44 2026: $19,532.43	2021: $12,994.32 2022: $13,481.61 2023: $17,363.66 2024: $18,014.79 2025: $18,690.35 2026: $19,391.24

Page No.	Line No.	Item	As Filed	As Corrected
WP 10-102	Table 10-77, Line 28	50M - Forecast Total Cost	2021: $641,358.17 2022: $678,988.88 2023: $1,011,450.28 2024: $1,041,067.81 2025: $1,088,731.41 2026: $1,129,558.83	2021: $636,721.84 2022: $674,080.52 2023: $1,004,138.59 2024: $1,033,542.02 2025: $1,080,861.06 2026: $1,121,393.35

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EXHIBIT (PG&E-3) GAS OPERATIONS

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Table 11-1
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Gas System Operations
Expenses by Major Work Category
(Thousands of Nominal Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	AH	Maint Gas Storage Fac	2,068	2,090	2,667	2,787	2,812	3,340	2,963	3,059	
2	CM	GT Operate System	33,784	32,921	34,421	37,242	40,760	43,166	45,188	46,793	
3	CX	GT Marketing/Sales/Strategy	4,619	5,225	5,062	4,997	5,208	5,855	5,554	5,750	
4	DE	G Dist Leak Survey			3,933	2,950	2,569	8,150	2,262	2,338	
5	FG	G Dist Operate System	10,574	8,136	8,884	8,427	8,767	9,338	9,711	10,073	
6	GG	Gas Trans & Dist Sys Modeling	5,116	5,720	6,329	6,349	7,846	8,049	9,138	9,432	
7	JT	GT Reliability & General Maint	2,760	2,193	68	64	300	4,283	907	939	
8	**Total**		**58,921**	**56,285**	**61,364**	**62,815**	**68,262**	**82,181**	**75,722**	**78,383**	WP 11-5, Line 27

Notes: (A) Line 8, 2021 Forecast, vary from the values listed in Testimony due to errata. These amounts align to the Results of Operations (RO) model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 11-2
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Gas System Operations
Expenses by Major Work Category
(Thousands of Base Year Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	AH	Maint Gas Storage Fac	2,186	2,154	2,641	2,728	2,812	3,315	2,861	2,868
2	CM	GT Operate System	36,616	34,802	35,126	37,195	40,760	42,077	42,606	42,660
3	CX	GT Marketing/Sales/Strategy	5,223	5,690	5,356	5,137	5,208	5,695	5,221	5,224
4	DE	G Dist Leak Survey			3,993	2,916	2,569	8,004	2,154	2,157
5	FG	G Dist Operate System	11,816	8,835	9,361	8,632	8,767	9,094	9,145	9,171
6	GG	Gas Trans & Dist Sys Modeling	5,788	6,288	6,726	6,542	7,846	7,816	8,573	8,549
7	JT	GT Reliability & General Maint	2,974	2,330	71	65	300	4,235	872	875
8	**Total**		**64,603**	**60,099**	**63,274**	**63,214**	**68,262**	**80,236**	**71,433**	**71,504**

Table 11-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Gas System Operations
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	AH	AH4	Gill Ranch Operations & Maint	2,068	2,090	2,667	2,787	2,812	3,340	2,963	3,059	WP 11-5, Line 16
2	**AH Total**			**2,068**	**2,090**	**2,667**	**2,787**	**2,812**	**3,340**	**2,963**	**3,059**	
3	CM	CMA	GT&S Operations	12,878	12,513	12,684	12,416	13,745	15,805	16,650	17,297	WP 11-5, Line 17
4		CMB	ElecPwr CompFuel & Oth Elec Eq	20,906	20,408	21,737	24,826	27,015	27,361	28,538	29,496	WP 11-5, Line 18
5	**CM Total**			**33,784**	**32,921**	**34,421**	**37,242**	**40,760**	**43,166**	**45,188**	**46,793**	
6	CX	CXA	GT&S Marketing/Sales/Stratgy	8,672	5,225	5,062	4,997	5,208	5,855	5,554	5,750	WP 11-5, Line 19
7		#	Not assigned	(4,053)								WP 11-5, Line 20
8	**CX Total**			**4,619**	**5,225**	**5,062**	**4,997**	**5,208**	**5,855**	**5,554**	**5,750**	
9	DE	DEH	GD Capacity Uprates			3,933	2,950	2,569	8,150	2,262	2,338	WP 11-5, Line 3
10	**DE Total**					**3,933**	**2,950**	**2,569**	**8,150**	**2,262**	**2,338**	
11	FG	FGA	Gas Distribution Control Centr	7,846	6,952	7,659	7,395	7,650	8,175	8,519	8,838	WP 11-5, Line 4
12		FGB	Op Distr-G Mns/Svcs	1,556	1,352	1,089	899	957	911	1,020	1,056	WP 11-5, Line 5
13		FGC	Op Distr-G Reg Genl	133	135	131	132	161	253	172	178	WP 11-5, Line 6
14		#	Not assigned	1,038	(303)	5		(1)				WP 11-5, Line 7
15	**FG Total**			**10,574**	**8,136**	**8,884**	**8,427**	**8,767**	**9,338**	**9,711**	**10,073**	
16	GG	GGA	Gas System Planning_GSO	4,570	4,260	4,315	4,530	5,544	6,811	6,701	6,913	WP 11-5, Line 8
17		#	Not assigned	546	1,460	2,014	1,819	2,302	1,238	2,437	2,519	WP 11-5, Line 9
18	**GG Total**			**5,116**	**5,720**	**6,329**	**6,349**	**7,846**	**8,049**	**9,138**	**9,432**	
19	JT	JTM	Uprates	2,760	2,193	68	64	300	4,283	907	939	WP 11-5, Line 21
20	**JT Total**			**2,760**	**2,193**	**68**	**64**	**300**	**4,283**	**907**	**939**	
21	**Total**			**58,921**	**56,285**	**61,364**	**62,815**	**68,262**	**82,181**	**75,722**	**78,383**	WP 11-5, Line 27

Notes: (A) Line 8, 2021 Forecast, vary from the values listed in Testimony due to errata. These amounts align to the Results of Operations (RO) model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 11-4
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Gas System Operations
Expenses by MAT Code
(Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	AH	AH4	Gill Ranch Operations & Maint	2,186	2,154	2,641	2,728	2,812	3,315	2,861	2,868
2	**AH Total**			**2,186**	**2,154**	**2,641**	**2,728**	**2,812**	**3,315**	**2,861**	**2,868**
3	CM	CMA	GT&S Operations	14,498	13,706	13,474	12,801	13,745	15,406	15,699	15,769
4		CMB	ElecPwr CompFuel & Oth Elec Eq	22,119	21,096	21,652	24,394	27,015	26,670	26,907	26,891
5	**CM Total**			**36,616**	**34,802**	**35,126**	**37,195**	**40,760**	**42,077**	**42,606**	**42,660**
6	CX	CXA	GT&S Marketing/Sales/Stratgy	9,824	5,690	5,356	5,137	5,208	5,695	5,221	5,224
7		#	Not assigned	(4,601)							
8	**CX Total**			**5,223**	**5,690**	**5,356**	**5,137**	**5,208**	**5,695**	**5,221**	**5,224**
9	DE	DEH	GD Capacity Uprates			3,993	2,916	2,569	8,004	2,154	2,157
10	**DE Total**					**3,993**	**2,916**	**2,569**	**8,004**	**2,154**	**2,157**
11	FG	FGA	Gas Distribution Control Centr	8,770	7,533	8,059	7,573	7,650	7,961	8,022	8,047
12		FGB	Op Distr-G Mns/Svcs	1,758	1,482	1,158	925	957	887	961	962
13		FGC	Op Distr-G Reg Genl	150	147	139	134	161	246	162	162
14		#	Not assigned	1,137	(327)	5		(1)			
15	**FG Total**			**11,816**	**8,835**	**9,361**	**8,632**	**8,767**	**9,094**	**9,145**	**9,171**
16	GG	GGA	Gas System Planning_GSO	5,169	4,684	4,591	4,668	5,544	6,614	6,287	6,266
17		#	Not assigned	618	1,604	2,134	1,874	2,302	1,202	2,287	2,283
18	**GG Total**			**5,788**	**6,288**	**6,726**	**6,542**	**7,846**	**7,816**	**8,573**	**8,549**
19	JT	JTM	Uprates	2,974	2,330	71	65	300	4,235	872	875
20	**JT Total**			**2,974**	**2,330**	**71**	**65**	**300**	**4,235**	**872**	**875**
21	**Total**			**64,603**	**60,099**	**63,274**	**63,214**	**68,262**	**80,236**	**71,433**	**71,504**

Workpaper Table 11-5
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Summary of Expenses Expenditures

GAS DISTRIBUTION EXPENSE

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference
3	GD Capacity Uprates	DE	DEH	-	-	3,933,159	2,949,667	2,568,568	8,149,999	2,261,634	2,337,582	WP 11-6, Line 34
4	Gas Distribution Control Centr	FG	FGA	7,846,168	6,951,684	7,658,970	7,395,307	7,649,914	8,174,790	8,518,794	8,838,248	WP 11-6, Line 8
5	Op Distr-G Mns/Svcs	FG	FGB	1,556,191	1,352,426	1,089,141	899,272	956,653	910,890	1,020,236	1,056,148	WP 11-6, Line 12
6	Op Distr-G Reg Genl	FG	FGC	132,902	134,730	131,200	132,165	161,376	252,519	172,102	178,160	WP 11-6, Line 16
7	Operate Gas Distribution System Other	FG	FG#	1,038,468	(302,665)	5,131	(177)	(541)	-	-	-	WP 11-6, Line 4, and Note (A)
8	Gas System Planning_GSO	GG	GGA	4,570,120	4,260,365	4,314,819	4,529,932	5,543,909	6,810,954	6,700,533	6,912,978	WP 11-6, Line 27
9	Distribution Portfolio Management and Engineering	GG	GG#	546,125	1,459,960	2,014,300	1,818,754	2,302,450	1,237,812	2,437,224	2,519,069	WP 11-6, Line 23
10	**Total Expenses**			**15,689,975**	**13,856,501**	**19,146,719**	**17,724,920**	**19,182,330**	**25,536,964**	**21,110,523**	**21,842,185**	WP 11-6, Line 40

11 **Notes**
12 (A) FG# is used to record standard cost variance. It is not forecasted for this rate case period.

14 **GAS TRANSMISSION EXPENSE**

	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference
16	Gill Ranch Operations & Maint	AH	AH4	2,068,234	2,089,528	2,667,102	2,786,656	2,811,606	3,340,000	2,962,573	3,058,964	WP 11-13, Line 41
17	GT&S Operations	CM	CMA	12,877,675	12,512,547	12,683,916	12,415,968	13,745,444	15,805,232	16,650,098	17,296,632	WP 11-13, Line 4
18	ElecPwr CompFuel & Oth Elec Eq	CM	CMB	20,906,071	20,408,307	21,736,741	24,826,108	27,014,504	27,360,636	28,537,636	29,495,955	WP 11-13, Line 8
19	GT&S Marketing/Sales/Stratgy	CX	CXA	8,672,404	5,225,038	5,061,584	4,997,056	5,207,949	5,854,986	5,554,085	5,749,589	WP 11-13, Line 27
20	Gas Marketing, Sales and Strategy Other	CX	CX#	(4,053,232)	-	-	-	-	-	-	-	(B)
21	Uprates	JT	JTM	2,760,294	2,193,421	67,978	64,131	300,304	4,282,945	907,255	939,190	WP 11-13, Line 34
22	**Total Expenses**			**43,231,446**	**42,428,840**	**42,217,321**	**45,089,920**	**49,079,806**	**56,643,799**	**54,611,647**	**56,540,330**	WP 11-13, Line 45

23 **Notes**
24 (B) CX# was used to settle intra-company electrical meter usage. It is not forecasted for this rate case period.

25 **TOTAL EXPENSE EXPENDITURES**

	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference
27	**Total Expenses**	All	All	**58,921,421**	**56,285,341**	**61,364,040**	**62,814,840**	**68,262,136**	**82,180,763**	**75,722,170**	**78,382,515**	(C)

28 **Notes**
29 (C) Line 10 + Line 27.

Workpaper Table 11-6
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas Systems Operations
Calculation of Gas Distribution Expense Totals by MAT (A)

					Recorded	Forecast			
Line	Chapter	Program	MWC/MAT	Units	2020	2021	2022	2023	Reference
1	**11**	**Operate Gas Distribution System**	**FG**						
2		Operate Gas Distribution System	FG#	Unit Cost	$ (177)	$ (541)	$ -	$ -	WP 11-5, Line 7
3		Unit of Measure:	N/A	Volume	1	1	1	1	(B)
4				Total	$ (177)	$ (541)	$ -	$ -	WP 11-5, Line 7
5									
6		Gas Distribution Control Center Operations	FGA	Unit Cost	$ 7,649,914	$ 8,174,790	$ 8,518,794	$ 8,838,248	WP 11-8, Line 11
7		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-23, Line 5
8				Total	$7,649,914	$8,174,790	$8,518,794	$8,838,248	WP 11-5, Line 4
9									
10		Manual Field Operations, Mains and Services	FGB	Unit Cost	$ 956,653	$ 910,890	$ 1,020,236	$ 1,056,148	WP 11-9, Line 11
11		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-23, Line 6
12				Total	$956,653	$910,890	$1,020,236	$1,056,148	WP 11-5, Line 5
13									
14		Manual Field Operations, Other	FGC	Unit Cost	$ 161,376	$ 252,519	$ 172,102	$ 178,160	WP 11-10, Line 11
15		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-23, Line 7
16				Total	$161,376	$252,519	$172,102	$178,160	WP 11-5, Line 6
17									
18		Subtotal - MWC FG - Operate Gas Distribution System			$8,767,767	$9,337,658	$9,711,132	$10,072,556	
19									
20	**11**	**Gas Dist. Planning & Ops Eng.**	**GG**						
21		Gas Distribution Portfolio Management and Engineering	GG#	Unit Cost	$ 2,302,450	$ 1,237,812	$ 2,437,224	$ 2,519,069	WP 11-12, Line 11
22		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-24, Line 4
23				Total	$2,302,450	$1,237,812	$2,437,224	$2,519,069	WP 11-5, Line 9
24									
25		Gas Systems Planning	GGA	Unit Cost	$ 5,543,909	$ 6,810,954	$ 6,700,533	$ 6,912,978	WP 11-11, Line 13
26		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-24, Line 5
27				Total	$5,543,909	$6,810,954	$6,700,533	$6,912,978	WP 11-5, Line 8
28									
29		Subtotal - MWC GG - Gas Dist. Planning & Ops Eng.			$7,846,358	$8,048,766	$9,137,758	$9,432,047	
30									
31	**11**	**Gas Dist. Capacity Uprates**	**DEH**						
32		Gas Distribution Capacity Uprates	DEH	Unit Cost	$ 2,568,568	$ 8,149,999	$ 2,261,634	$ 2,337,582	WP 11-7, Line 8
33		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-22, Line 4
34				Total	$2,568,568	$8,149,999	$2,261,634	$2,337,582	WP 11-5, Line 3
35									
36		Subtotal - MWC DE - Gas Dist. Capacity Uprates			$2,568,568	$8,149,999	$2,261,634	$2,337,582	
37									
38									
39									
40		Chapter 11 Total			$19,182,693	$25,536,423	$21,110,523	$21,842,185	
41									

42 Notes:
43 (A) All recorded and forecast costs include escalation, and adjustments.
44 (B) MAT FG# is used to record standard cost variance. It is not forecasted for this rate case period.

Workpaper Table 11-7
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT DEH - Gas Distribution Capacity Uprates

MAT DEH - Gas Distribution Capacity Uprates - (Unit of Measure: Non-Unitized)

Cost Estimating Methodology: MAT DEH was forecast by using a three-year average of 2018, 2019, and 2020 recorded expenditures for uprate projects only. Distribution downrate projects performed under this MAT were excluded, as they are funded through the Gas Operations investment planning process for emergent work.

Cost Basis for Forecast	2018	2019	2020	2021 Escalation Purposes Only	2022 Escalation Purposes Only	2023	Note
Recorded Expenses - Uprate Projects Only	$ 2,286,322	$ 2,128,147	$ 1,845,217				(A)
Recorded Adjusted (in 2020 dollars)	$ 2,396,347	$ 2,168,145	$ 1,845,217				(B)
Escalation Rate	0.000%	2.879%	1.879%	2.440%	3.332%	3.358%	(C)
Forecast of recorded adjusted three-year average (2017-2019)				$ 2,188,707	$ 2,261,634	$ 2,337,582	(D)

Notes
(A) PG&E excluded recorded costs related to distribution downrate projects in its forecast cost calculations as these activities are not forecast for this GRC.
(B) Recorded Expenses + Escalation.
(C) Escalation rates are based on the Gas Transmission capital composite rate.
(D) Line 5: ((2018 + 2019 + 2020 Recorded Adjusted (in 2020 dollars) / 3) + Escalation.

Workpaper Table 11-8
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT FGA - Gas Distribution System Operations

Line

1 **MAT FGA - Gas Distribution System Operations - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology**: MAT FGA - Gas Distribution System Operations includes gas control personnel, systems operations, prevention and management of abnormal
3 conditions, emergency management of abnormal conditions, emergency response, damage prevention, compliance, data collection, clearance processes, contractor support,
4 apprentice training, and benchmarking.

Line	Cost Basis for Forecast	2020	2021 (F)	2022	2023	Note
6	Recorded Costs	$ 7,649,914				(A)
7	Escalation Factor		3.00%	3.75%	3.75%	(B)
8	Personnel Forecast		$ 7,879,411	$ 8,174,889	$ 8,481,448	(C)
9	Control Room Consolidation Cost Forecast		$ 36,096	$ 74,898	$ 77,707	(D)
10	GDCC Predictive Health Analytics Cost Forecast		$ 259,283	$ 269,006	$ 279,094	(E)
11	**Total MAT FGA Forecast**		**$ 8,174,790**	**$ 8,518,794**	**$ 8,838,248**	Line 8 + 9 + 10

12 **Notes**
13 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
14 (B) Annual escalation rates are determined by PG&E's union agreement with the IBEW for labor escalation rates.
15 (C) The forecast cost is calculated by multiplying the prior years recorded or forecast cost by the next years escalation factor, then adding the recorded or forecast cost used.
16 Example: ((2020 recorded cost * 2021 escalation factor) + 2020 recorded cost) = 2021 forecast cost.
17 (D) As part of PG&E's effort to operate the gas system under a geopgraphical structure (north-south) rather than the current functional structure (distribution-transmission), PG&E
18 has included a forecast for cross-training costs for system operators. While system operators under the north-south structure will remain dedicated to either transmission or
19 distributions on a given day, the operators will be trained and qualified to operate either systems. See Exhibit (PG&E), Chapter 11, WP 11-21 for details on how the Control Room
20 Consolidation Cost Forecast was prepared.
21 (E) PG&E included a forecast to incorporate work performed by the GOCTI team related to GDCC predictive health analytics. PG&E uses predictive health analytics to mine the vast
22 amounts of data that SCADA and other related systems provide to identify equpment behaviors and system risk not traditionally surfaced by Gas Control Center tools. This work
23 historically has been performed and funded as part of ongoing information technology projects given the need to commission or install foundational systems. However, PG&E has
24 since transitioned much of this work to ongoing research and continuous improvement efforts where foundational systems are mature enough to facilitate targeted sudies and
25 incremental improvements. See Exhibit (PG&E-3), Chapter 11, WP 11-19 for details on how the forecast for GTCC Predictive Health Analytics was prepared.

Workpaper Table 11-9
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT FGB - Gas Distribution Manual Field Operations, Mains and Services

Line

1 **MAT FGB - Gas Distribution Manual Field Operations, Mains and Services - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology:** MAT FGB was forecast using 2020 recorded costs plus escalation to 2023.

	Description	Value	Note
3			
4	2020 Recorded Cost	$ 956,653	(A)
5	2020 Recorded Units	1	(A)
6	2020 Average Unit Cost	$ 956,653	Line 4 / 5
7	**Cost Basis for Forecast**	$ 956,653	Line 6

		2021 (E)	2022 (E)	2023	Note
8					
9	Escalation Factor	3.020%	3.520%	3.520%	(B)
10	Escalation Amount	$ 28,891	$ 34,691	$ 35,912	(C)
11	**Forecast Unit Cost**	**$ 985,544**	**$ 1,020,236**	**$ 1,056,148**	(D)

12 **Notes**
13 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
14 (B) Escalation rates are based on the Gas Distribution expense labor rate.
15 (C) Previous year unit cost x Escalation Factor.
16 (D) Previous year unit cost + Escalation amount.
17 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-10
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT FGC - Gas Distribution Manual Field Operations,Other

Line

1 **MAT FGC - Gas Distribution Manual Field Operations, Other - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology:** MAT FGC was forecast using 2020 recorded costs plus escalation to 2023.

3	**Description**	**Value**	**Note**
4	2020 Recorded Cost	$ 161,376	(A)
5	2020 Recorded Units	1	(A)
6	2020 Average Unit Cost	$ 161,376	Line 4 / 5
7	**Cost Basis for Forecast**	$ 161,376	Line 6

8		**2021 (E)**	**2022 (E)**	**2023**	**Note**
9	Escalation Factor	3.020%	3.520%	3.520%	(B)
10	Escalation Amount	$ 4,874	$ 5,852	$ 6,058	(C)
11	**Forecast Unit Cost**	**$ 166,250**	**$ 172,102**	**$ 178,160**	(D)

12 **Notes**
13 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
14 (B) Escalation rates are based on the Gas Distribution expense labor rate.
15 (C) Previous year unit cost x Escalation Factor.
16 (D) Previous year unit cost + Escalation amount.
17 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-11
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT GGA - Gas System Planning Load Study

MAT GGA - Gas System Planning Load Study - (Unit of Measure: Non-Unitized)

Cost Estimating Methodology: MAT GGA - Gas System Planning performs capacity planning engineering and related technical, operational, and economic analysis. Gas System Planning focuses on computerized modeling of PG&E's hydraulically independent systems (HIS) in the gas distribution system to size and configure them so that they continue to meet design day service standards as forecasted peak loads change.

Cost Basis for Forecast	2020	2021	2022	2023	Note
Recorded Costs	$ 5,543,909				(A)
Escalation Factor		3.00%	3.75%	3.75%	(B)
Personnel Forecast		$ 5,710,226	$ 5,924,360	$ 6,146,523	(C)
Gas System Planning Information Technology Forecast		$ 125,000	$ 125,000	$ 125,000	(D)
Gas System Planning Additional Headcount (2 FTE) Forecast		$ 415,728	$ 441,174	$ 468,455	(E)
Union Periodic Wage Increase Forecast		$ -	$ 210,000	$ 173,000	(F)
Contractor Expenses		$ 560,000	$ -	$ -	
Total MAT GGA Forecast	**$ 5,543,909**	**$ 6,810,954**	**$ 6,700,533**	**$ 6,912,978**	Line 8 + 9 + 10 + 11 + 12

Notes
(A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
(B) Annual escalation rates are determined by PG&E's union agreement with the IBEW for labor escalation rates.
(C) The forecast cost is calculated by multiplying the prior years recorded or forecast cost by the next years escalation factor, then adding the recorded or forecast cost used.
Example: ((2020 recorded cost * 2021 escalation factor) + 2020 recorded cost) = 2021 forecast cost.
(D) Gas System Planning Information Technology includes software licesnses for hydraulic modeling tools.
(E) Forecast for the addition of two headcount necessary to support an increase in integrity management, gas system planning, and other transmission planning related work. See Exhibit (PG&E-3), Chapter 11, WP 11-20 for details on how the forecast for Gas System Planning Additional Headcount was prepared.
(F) Distribution Gas System Planning engineers in Gas System Operations come under a bargaining (union agreement that specifies pay raises ranging from 3.725 to 5.0 percent at regular intervals on top of any standard raises. PG&E has applied this adjustment for distribution engineers in our forecast for this case.

Workpaper Table 11-12
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT GG# - Gas Distribution Portfolio Management and Engineering

MAT GG# - Gas Distribution Portfolio Management and Engineering - (Unit of Measure: Non-Unitized)

Cost Estimating Methodology: MAT GG# was forecast using 2020 recorded costs plus escalation to 2023.

Line	Description	Value	Note
4	2020 Recorded Cost	$ 2,302,450	(A)
5	2020 Recorded Units	1	(A)
6	2020 Average Unit Cost	$ 2,302,450	Line 4 / 5
7	**Cost Basis for Forecast**	$ 2,302,450	Line 6

Line		2021 (E)	2022 (E)	2023	Note
9	Escalation Factor	2.440%	3.332%	3.358%	(B)
10	Escalation Amount	$ 56,186	$ 78,589	$ 81,844	(C)
11	**Forecast Unit Cost**	**$ 2,358,635**	**$ 2,437,224**	**$ 2,519,069**	(D)

Notes
(A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
(B) Escalation rates are based on the Gas Distribution expense labor rate.
(C) Previous year unit cost x Escalation Factor.
(D) Previous year unit cost + Escalation amount.
(E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-13
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas Systems Operations
Calculation of Gas Transmission Expense Totals by MAT (A)

Line	Chapter	Program	MWC/MAT	Units	Recorded 2020	Forecast 2021	Forecast 2022	Forecast 2023	Reference
1	**11**	**Operate Gas Transmission System**	**CM**						
2		Gas System Operations	CMA	Unit Cost	$13,745,444	$15,805,232	$16,650,098	$17,296,632	WP 11-15, Line 13
3		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-26, Line 4
4				Total	$13,745,444	$15,805,232	$16,650,098	$17,296,632	WP 11-5, Line 17
5									
6		Electric Power for Comrpessor Fuel and Other Electric Equipment	CMB	Unit Cost	$27,014,504	$27,360,636	$28,537,636	$29,495,955	WP 11-16, Line 11
7		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-26, Line 5
8				Total	$27,014,504	$27,360,636	$28,537,636	$29,495,955	WP 11-5, Line 17
9									
18		Subtotal - MWC CM - Operate Gas Transmission System			$40,759,948	$43,165,868	$45,187,734	$46,792,587	
19									
20	**11**	**Gas Transmission Marketing, Sales, and Strategy**	**CX**						
25		Gas Transmission Marketing, Sales, and Strategy	CXA	Unit Cost	$5,207,949	$5,854,986	$5,554,085	$5,749,589	WP 11-17, Line 11
26		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-27, Line 4
27				Total	$5,207,949	$5,854,986	$5,554,085	$5,749,589	WP 11-5, Line 18
28									
29		Subtotal - MWC CX - Gas Transmission Marketing, Sales, and Strategy			$5,207,949	$5,854,986	$5,554,085	$5,749,589	
30									
31	**11**	**Gas Transmission Capacity Uprates**	**JT**						
32		Gas Transmission Capaciy	JTM	Unit Cost	$24,818	$4,282,945	$907,255	$939,190	WP 11-18, Line 8
33		Unit of Measure:	N/A	Volume	12.1	1	1	1	WP 11-28, Line 5
34				Total	$300,304	$4,282,945	$907,255	$939,190	WP 11-5, Line 21
35									
36		Subtotal - MWC JT - Gas Transmission Capacity Uprates			$300,304	$4,282,945	$907,255	$939,190	
37									
38	**11**	**Gill Ranch Storage**	**AH4**						
39		Gill Ranch Storage Expense	AH4	Unit Cost	$2,811,606	$3,340,000	$2,962,573	$3,058,964	WP 11-13, Line 11
40		Unit of Measure:	N/A	Volume	1	1	1	1	WP 11-25, Line 4
41				Total	$2,811,606	$3,340,000	$2,962,573	$3,058,964	WP 11-5, Line 16
42									
43		Subtotal - AH - Gill Ranch Storage			$2,811,606	$3,340,000	$2,962,573	$3,058,964	
44									
45		Chapter 11 Total			$49,079,806	$56,643,799	$54,611,647	$56,540,330	
46									
47	Notes:								
48	(A) All recorded and forecast costs include escalation, and adjustments.								

Workpaper Table 11-14
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT AH4 - Gill Ranch Storage Expense

Line

1 **MAT AH4 - Gill Ranch Storage Expense - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology:** MAT AH4 was forecast using 2020 recorded costs plus escalation to 2023.

3	**Description**	**Value**	**Note**
4	2020 Recorded Cost	$ 2,811,606	(A)
5	2020 Recorded Units	1	(A)
6	2020 Average Unit Cost	$ 2,811,606	Line 4 / 5
7	**Cost Basis for Forecast**	$ 2,811,606	Line 6

8		**2021 (E)**	**2022 (E)**	**2023**	**Note**
9	Escalation Factor	2.101%	3.201%	3.254%	(B)
10	Escalation Amount	$ 59,065	$ 91,902	$ 96,391	(C)
11	**Forecast Unit Cost**	**$ 2,870,671**	**$ 2,962,573**	**$ 3,058,964**	(D)

12 **Notes**
13 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
14 (B) Escalation rates are based on the Gas Storage expense composite rate.
15 (C) Previous year unit cost x Escalation Factor.
16 (D) Previous year unit cost + Escalation amount.
17 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-15
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT CMA - Gas System Operations

MAT CMA - Gas System Operations - (Unit of Measure: Non-Unitized)

Cost Estimating Methodology: MAT CMA - Gas System Operations includes transmisison gas control personnel, systems operations, prevention and management of abnormal conditions, emergency management of abnormal conditions, emergency response, damage prevention, compliance, data collection, clearance processes, contractor support, apprentice training, transmission gas system planning, gas operations technology, and benchmarking.

Line	Cost Basis for Forecast	2020	2021	2022	2023	Note
6	Recorded Costs	$ 13,745,444				(A)
7	Escalation Factor		3.00%	3.75%	3.75%	(B)
8	Personnel Forecast		$ 14,157,807	$ 14,688,725	$ 15,239,552	(C)
9	Gas System Planning Information Technology Forecast		$ 125,000	$ 125,000	$ 125,000	(D)
10	Control Room Consolidation Cost Forecast		$ 223,823	$ 464,433	$ 481,849	(E)
11	Gas System Planning Additional Headcount (5 FTE) Forecast		$ 1,039,319	$ 1,102,934	$ 1,171,137	(F)
12	SCADA Predictive Health Analytics Cost Forecast		$ 259,283	$ 269,006	$ 279,094	(G)
13	**Total MAT CMA Forecast**	**$ -**	**$ 15,805,232**	**$ 16,650,097**	**$ 17,296,631**	Line 8 + 9 + 10 + 11 + 12

Notes
(A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
(B) Annual escalation rates are determined by PG&E's union agreement with the IBEW for labor escalation rates.
(C) The forecast cost is calculated by multiplying the prior years recorded or forecast cost by the next years escalation factor, then adding the recorded or forecast cost used.
Example: ((2020 recorded cost * 2021 escalation factor) + 2020 recorded cost) = 2021 forecast cost.
(D) Gas System Planning Information Technology includes software licesnses for hydraulic modeling tools.
(E) See Exhibit (PG&E-3), Chapter 11, WP 11-21 for details on how the Control Room Consolidation Cost Forecast was prepared.
(F) See Exhibit (PG&E-3), Chapter 11, WP 11-20 for details on how the forecast for Gas System Planning Additional Headcount was prepared.
(G) See Exhibit (PG&E-3), Chapter 11, WP 11-19 for details on how the forecast for GTCC Predictive Health Analytics was prepared.

Workpaper Table 11-16
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT CMB - Electric Power for Compressor Fuel and Other Electric Equipment

Line

1 **MAT CMB - Electric Power for Compressor Fuel and Other Electric Equipment - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology:** MAT CMB was forecast using 2020 recorded costs plus escalation to 2023.

3	Description	Value	Note
4	2020 Recorded Cost	$ 27,014,504	(A)
5	2020 Recorded Units	1	(A)
6	2020 Average Unit Cost	$ 27,014,504	Line 4 / 5
7	**Cost Basis for Forecast**	$ 27,014,504	Line 6

8		2021 (E)	2022 (E)	2023	Note
9	Escalation Factor	2.284%	3.280%	3.358%	(B)
10	Escalation Amount	$ 616,893	$ 906,239	$ 958,319	(C)
11	**Forecast Unit Cost**	**$ 27,631,397**	**$ 28,537,636**	**$ 29,495,955**	(D)

12 **Notes**
13 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
14 (B) Escalation rates are based on the Gas Transmission expense composite rate.
15 (C) Previous year unit cost x Escalation Factor.
16 (D) Previous year unit cost + Escalation amount.
17 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-17
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT CXA - Gas Transmission Marketing, Sales, and Strategy

MAT CXA - Gas Transmission Marketing, Sales, and Strategy - (Unit of Measure: Non-Unitized)

Cost Estimating Methodology: MAT CXA was forecast using 2020 recorded costs plus escalation to 2023.

Line	Description	Value	Note
4	2020 Recorded Cost	$ 5,207,949	(A)
5	2020 Recorded Units	1	(A)
6	2020 Average Unit Cost	$ 5,207,949	Line 4 / 5
7	**Cost Basis for Forecast**	$ 5,207,949	Line 6

Line		2021 (E)	2022 (E)	2023	Note
9	Escalation Factor	3.020%	3.520%	3.520%	(B)
10	Escalation Amount	$ 157,280	$ 188,856	$ 195,504	(C)
11	**Forecast Unit Cost**	**$ 5,365,229**	**$ 5,554,085**	**$ 5,749,589**	(D)

Notes
(A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
(B) Escalation rates are based on the Gas Transmission expense labor rate.
(C) Previous year unit cost x Escalation Factor.
(D) Previous year unit cost + Escalation amount.
(E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-18
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT JTM - Gas Transmission Capacity Uprates

Line

1 **MAT JTM - Gas Transmission Capacity Uprates - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology:** MAT JTM was forecast using a three-year average of 2017, 2018, and 2019 recorded costs plus escalation to 2023.

	Cost Basis for Forecast	**2017 (E)**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Note**
4	Recorded Expenses	$ 2,192,943	$ 67,978	$ 64,131	-	-	-	-	(A)
5	Escalation Rate	0.000%	3.300%	3.260%	3.180%	3.020%	3.520%	3.520%	(B)
6	Recorded Adjusted (in 2023 dollars)	$ 2,664,559	$ 79,958	$ 73,053					(C)
7	Forecast of recorded adjusted three-year average (2017-2019)							$ 939,190	(D)
8	**Adjusted 3-Year Average (in 2023 dollars)**							**$ 939,190**	

9 **Notes**
10 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-5.
11 (B) Escalation rates are based on the Gas Transmission expense labor rate.
12 (C) Recorded expenses x future escalation rates to 2023 dollars.
13 (D) 2017 + 2018 + 2019 recorded adjusted expenditures.
14 (E) The recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

Workpaper Table 11-19
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT FGA & CMA - SCADA Predictive Health Analytics

Line No.

1 **Summary**

2 PG&E included a forecast to incorporate work performed by the GOCTI team related to GDCC and GTCC SCADA predictive health analytics. PG&E uses predictive
3 health analytics to mine the vast amounts of data that SCADA and other related systems provide to identify equipment behaviors and system risk not traditionally
4 surfaced by Gas Control Center tools. This work historically has been performed and funded as part of an on-going information technology project given the need to
5 commission or install foundational systems. However, PG&E has since transitioned much of this work to ongoing research and continuous improvement efforts where
6 foundational systems are mature enough to facilitate targeted studies and incremental improvements. The benefits of this work are shared equally amongst transmission
7 and distribution control centers. As such, PG&E allocated 50 percent of the cost of this work to each MAT code supporting the GTCC and GDCC.

	Item	2021 Forecast	2022 Forecast	2023 Forecast	Notes
2	Escalation		3.75%	3.75%	
3	Gas Operations Control Technology Integration (GOCTI) Hourly Full Time Equivalent (FTE) Rate	$ 75.97	$ 78.82	$ 81.77	
4	GOCTI Overhead Rate	$ 42.16	$ 43.74	$ 45.38	
5	Fully-Burdened GOCTI Hourly Rate	$ 118.13	$ 122.56	$ 127.16	Line 3 + Line 4
6	FTE Requirement (hours)	3,120	3,120	3,120	(1.5 FTE * 2,080)
7	Forecast FTE Cost	$ 368,566	$ 382,387	$ 396,726	Line 5 * Line 6
8	Amazon Web Services Cloud Contract	$ 150,000	$ 155,625	$ 161,461	
9	**Forecast Total**	$ 518,566	$ 538,012	$ 558,187	Line 7 + Line 8

	MAT Allocation	2021 Forecast	2022 Forecast	2023 Forecast	
11	FGA	$ 259,282.80	$ 269,005.91	$ 279,093.63	Line 9 / 2
12	CMA	$ 259,282.80	$ 269,005.91	$ 279,093.63	Line 9 / 2

Workpaper Table 11-20
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT GGA & CMA - Gas System Planning Additional Headcount

Line No.

1 **Summary**
2 PG&E included a forecast for the addition of seven full time equivalent (FTE) positions to support an increase in system operations work such as clearance document
3 reviews, hydraulic modeling, and outage planning. Five FTEs are forecast to be dedicated to gas transmission actvities, and two FTEs are forecast to be dedicated to gas
4 distribution activities.

Line No.	Item	2021 Forecast	2022 Forecast	2023 Forecast	Notes
6	Escalation		3.75%	3.75%	(A)
7	Fully-Burdened Gas System Planning Engineer Hourly Rate	$ 117.57	$ 121.98	$ 126.55	(B)
8	FTE Requirement (hours)	2,080	2,080	2,080	
9	FTE Headcount Requirement	7	7	7	
10	Percent of Time Charged to Internal Labor	85%	85%	85%	(B)
11	Periodic Wage Increase (PWI) per FTE	$ -	$ 4,928	$ 5,369	(C)
12	Annual FTE Cost	$ 207,864	$ 220,587	$ 234,227	(D)
13	**Forecast Total**	$ 1,455,046	$ 1,544,107	$ 1,639,591	Line 9 * Line 12

Line No.	MAT Allocation	Forecast Headcount	2022 Forecast	2023 Forecast	
15	GGA	2	$ 441,174	$ 468,455	(E)
16	CMA	5	$ 1,102,934	$ 1,171,137	(E)

17 **Notes**
18 (A) Annual escalation rates are determined by PG&E's union agreement with the IBEW for labor escalation rates.
19 (B) Calculated by Prior year fully burdened gas system planning engineer hourly rate * escalation + previous base rate.
20 (C) PG&E's union agreement with the International Brotherwood of Electrical Workers (IBEW) requires PWI adjustments to be made to Gas System Planning Engineers salaries
21 on an annual basis in addition to normal escalations.
22 (D) (Line 7 * Line 8 * Line 10) + Line 11.
23 (E) Annual FTE Cost * Forecast Headcount.

Workpaper Table 11-21
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT FGA & CMA - Gas Control Consolidation

Line No.

1 **Summary**

2 As part of PG&E's effort to operate the gas system under a geopgraphical structure (north-south) rather than the current functional structure (distribution-transmission), PG&E has included a forecast for
3 cross-training costs for system operators. While system operators under the north-south structure will remain dedicated to either transmission or distributions on a given day, the operators will be trained
4 and qualified to operate either system. This reorganization is projected to allow PG&E to operate with fewer full-time equivalent employees than would otherwise be required. PG&E's forecast is based on
5 a 10 percent pay increase for certain Gas Control Room job classifications as part of a proposed agreement with the International Brotherhood of Electrical Workers (IBEW) union.

6	Item	2021 Baseline Labor Forecast (A)	2021 Control Room Consolidation Forecast	Cost of Consolidation	Notes
7	Gas Transmission Control Center	$ 5,442,484.64	$ 5,890,130.89	$ 447,646.25	(B)
8	Gas Distribution Control Center	$ 1,501,341.90	$ 1,573,533.19	$ 72,191.28	(B)

9	MAT Allocation	2021 Forecast	2022 Forecast	2023 Forecast	
10	Escalation		3.75%	3.75%	(C)
11	FGA	$ 223,823.12	$ 464,433	$ 481,849	(D)
12	CMA	$ 36,095.64	$ 74,898	$ 77,707	(D)
13	**Forecast Total**	$ 259,919	$ 539,331	$ 559,556	(E)

14 **Notes**

15 (A) Baseline labor cost is a component of the overall MAT CMA and FGA Control Room personnel cost.
16 (B) (2021 Control Room Consolidation Forecast - 2021 Baseline Labor Forecast) = Cost of Consolidation.
17 (C) Annual escalation rates are determined by PG&E's union agreement with the IBEW for labor escalation rates.
18 (D) To calculate the 2021 forecast, PG&E took the total cost of consolidation for 2021, and dividied it by 2 to reflect the slowed onboarding of new cross-trained Operators. To calculate 2022, PG&E took the
19 Cost of Consolidation and mutltiplied those costs by the annual escalation factor. PG&E then added the cost of consolidation to the escalated figure to reach the 2022 forecast.
20 Example: ((Cost of Consolidation (Line 7) * escalation (Line 10)) + Cost of Consolidation (Line 7)). PG&E calculated the 2023 forecast by escalating the 2022 Cost of Consolidation.
21 (E) Line 11 + Line 12.

Workpaper Table 11-22
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC DE - Gas Distribution Capacity Uprates

Summary: MWC DE - Gas Distribution Capacity Uprates is forecast to meet base capacity requirements, growth needs, and to eliminate high-risk manual operations by increasing pipeline capacity through performing pipeline and station modifications.

Line	MAT Code	Notes
3		
4	MAT DEH - Gas Distribution Capacity Uprates	MAT DEH is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT DEH costs on WP 11-7.

Workpaper Table 11-23
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC FG - Gas Distribution System Operations

Line

1 **Summary**: MWC FG - Gas Distribution System Operations includes gas control personnel, systems operations, prevention and management of abnormal conditions, emergency response,
2 damage prevention, compliance, data collection, clearance processes, contractor support, apprentice training, manual field operations, and benchmarking.

	MAT Code	Notes
3		
4	FG# - Operate Gas Distribution System	MAT FG# is forecast on a non-unitized basis. PG&E is not forecasting any costs in this MAT in 2023.
5	FGA - Gas Distribution System Operations	MAT FGA is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT FGA costs on WP 11-8.
6	FGB - Gas Distribution Manual Field Operations, Mains and Services	MAT FGB is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT FGA costs on WP 11-9.
7	FGC - Gas Distribution Manual Field Operations, Other	MAT FGC is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT FGA costs on WP 11-10.

Workpaper Table 11-24
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC GG - Gas Distribution Planning and Operations Engineering

Line

1 **Summary**: MWC GG - Gas Distribution Planning and Operations Engineering supports the Gas Distribution Control Center to enable daily system operability and seasonal reliability, and
2 designs capacity solutions that anticipate new customers, load growth, and pattern shifts.

3	MAT Code	Notes
4	MAT GG# - Gas Distribution Portfolio Management and Engineering	MAT GG# is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT GG# costs on WP 11-12.
5	MAT GGA - Gas System Planning Load Study	MAT GGA is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT GGA costs on WP 11-11.

Workpaper Table 11-25
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC AH - Gill Ranch Storage

Line

1 **Summary**: MWC AH - MWC AH includes expense projects related to Gill Ranch Storage field. PG&E has a 25 percent interest in the Gill Ranch Storage facility it co-owns with SENSA
2 Holdings Company. Gill Ranch is an underground storage site designed to hold 20 billion cubic feet (Bcf), providing 100 million cubic feet per day (MMcf/d) of withdrawl capacity.

	MAT Code	Notes
3		
4	AH4 - Gill Ranch Storage Expense	MAT AH4 is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT AH4 costs on WP 11-14.

Workpaper Table 11-26
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC CM - Gas Transmission System Operations

Line

1 **Summary**: MWC CM - Gas Transmission System Operations includes gas control personnel, systems operations, prevention and management of abnormal conditions, emergency response, damage
2 prevention, compliance, data collection, clearance processes, contractor support, apprentice training, and electricity for gas compressor stations and other electrically connected field equipment.

	MAT Code	Notes
3		
4	MAT CMA - Gas System Operations	MAT CMA is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT CMA costs on WP 11-15.
5	MAT CMB - Electric Power for Compressor Fuel and other Electric Equipment	MAT CMB is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT CMB costs on WP 11-16.

Workpaper Table 11-27
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC CX - Gas Transmission Marketing, Sales, and Strategy

Line

1 **Summary**: MWC CX - Gas Transmission Marketing, Sales, and Strategy includes PG&E's Wholesale Marketing and Business Development (WM&BD). WM&BD markets various pipeline
2 storage services to customers on behalf of PG&E.

	MAT Code	Notes
3		
4	MAT CXA - Gas Transmission Marketing, Sales, and Strategy	MAT CXA is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT CXA costs on WP 11-17.

Workpaper Table 11-28
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC JT - Gas Transmission Reliability & General Maintenance

Line

1 **Summary:** MWC JT - Gas Transmission Reliability and General Maintenance includes projects to increase pipeline capacity by increasing a system's pressure
2 rather than installing addition pipe.

3			Recorded	Forecast			Notes
4	**MAT Code**	**Unit of Measure**	**2020**	**2021**	**2022**	**2023**	
5	JTM - Gas Transmission Capacity Uprates	Miles of Pipe Uprated	12.1	Non-unitized	Non-unitized	Non-unitized	(A)
6	**MAT JTM Total**		**12.1**	**0**	**0**	**0**	

7 **Notes**
8 (A) PG&E is forecasting MAT JTM as non-unitized due to the varied work activities that take place to uprate transmission pipe. PG&E describes its
9 methodology for forecasting MAT JTM costs on WP 11-18.

Workpaper Table 11-29
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Expense Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC DE	MWC FG	MWC GG	Detailed Description/Explanation
1	**2016**	**15,690**	**0**	**10,574**	**5,116**	
2			0			Immaterial change in cost.
3				(2,438)		Program expenses were less than prior years due to a decrease in labor spend in the gas distribution control center due to unfilled vacancies and organizational redesign.
4					604	Program expenses increased compared to prior years due to lower charge out time to other unanticipated work orders (e.g.. Emergency response jobs, reprioritization of planned work), a higher than forecast application of overhead and indirect costs, and a slight increase in staff engineers.
5	**2017**	**13,857**	**0**	**8,136**	**5,720**	
6			3,933			Immaterial change in cost.
7				748		Increase due to a higher than anticipated labor spend in the gas distribution control center.
8					609	Increase due to a lower than anticipated charge out rate to other unanticipated work orders (e.g.. Emergency response jobs, reprioritization of planned work) and the backfilling of engineering staff to replace personnel who departed.
9	**2018**	**19,147**	**3,933**	**8,884**	**6,329**	
10			(983)			Decrease due to fewer gas distribution capacity uprates or downrates performed compared to prior years
11				(458)		Program expenses were less than prior years due to a decrease in labor spend in the gas distribution control center due to unfilled vacancies.
12					20	Immaterial change in cost.
13	**2019**	**17,725**	**2,950**	**8,427**	**6,349**	
14			(381)			Decrease due to fewer gas distribution capacity uprates or downrates performed compared to prior years
15				341		Immaterial change in cost.
16					1,498	Program expenses increased compared to prior years due to lower charge out time to other unanticipated work orders (e.g.. Emergency response jobs, reprioritization of planned work), and a slight increase in staff engineers backfilling positions.
17	**2020**	**19,182**	**2,569**	**8,767**	**7,846**	

Note: Total amounts and amounts for each MWC are obtained from WP 11-5 by summing the relevant lines for each MWC.

Workpaper Table 11-30
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Expense Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC DE	MWC FG	MWC GG	Detailed Description/Explanation
1	**2020**	**19,182**	**2,569**	**8,767**	**7,846**	
2			5,581			Increase in the amount of distribution capacity uprates and downrates compared to prior years.
3				571		Increase due to forecast escalation.
4					202	Increase due to forecast escalation.
5	**2021**	**25,537**	**8,150**	**9,338**	**8,049**	
6			(5,888)			Fewer distribution capacity uprates compared to prior years.
7				373		Increase due to forecast gas control room consolidation costs and the commencement of SCADA predictive health analytics work being charged to MWC FG.
8					1,089	Increase in gas system planning engineering staff to plan system operations for the greatly increased number of safety clearance work performed on the gas distribution system
9	**2022**	**21,111**	**2,262**	**9,711**	**9,138**	
10			76			Increase due to forecast escalation.
11				361		Increase due to forecast escalation.
12					294	Increase due to forecast escalation.
13	**2023**	**21,842**	**2,338**	**10,073**	**9,432**	

Note: Total amounts and amounts for each MWC are obtained from WP 11-5 by summing the relevant lines for each MWC.

Workpaper Table 11-31
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Expense Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC AH	MWC CM	MWC CX	MWC JT	Detailed Description/Explanation
1	**2016**	**43,231**	**2,068**	**33,784**	**4,619**	**2,760**	
2			21				Immaterial change in cost.
3				(863)			Immaterial change in cost.
4					606		Increase in headcount to support PG&E's gas strategy and wholesale marketing & business development efforts.
5						(567)	Decrease is driven by less capacity uprate work compared to prior years.
6	**2017**	**42,429**	**2,090**	**32,921**	**5,225**	**2,193**	
7			578				Increase in the amount of expense related maintenance costs for the Gill Ranch Storage field.
8				1,500			Immaterial change in cost.
9					(163)		Immaterial change in cost.
10						(2,125)	Decrease is driven by less capacity uprate work compared to prior years.
11	**2018**	**42,217**	**2,667**	**34,421**	**5,062**	**68**	
12			120				Immaterial change in cost.
13				2,821			Immaterial change in cost.
14					(65)		Immaterial change in cost.
15						(4)	Decrease is driven by less capacity uprate work compared to prior years.
16	**2019**	**45,090**	**2,787**	**37,242**	**4,997**	**64**	
17			25				Immaterial change in cost.
18				3,518			Immaterial change in cost.
19					211		Immaterial change in cost.
20						236	Increase is driven by an uptick in transmission capacity work to uprate the MAOP of pipeline segments.
21	**2020**	**49,080**	**2,812**	**40,760**	**5,208**	**300**	

Note: Total amounts and amounts for each MWC are obtained from WP 11-5 by summing the relevant lines for each MWC.

Workpaper Table 11-32
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Expense Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC AH	MWC CM	MWC CX	MWC JT	Detailed Description/Explanation
1	**2020**	**49,080**	**2,812**	**40,760**	**5,208**	**300**	
2			528				Increase in the amount of expense related maintenance costs for the Gill Ranch Storage field.
3				2,406			Increase in gas system planning engineering staff to plan system operations for the increased number of safety clearance work performed. Also driven by increased electricity costs necessary to operate PG&E's gas compressor stations.
4					647		Increase due to forecast escalation.
						3,983	Increase is driven by an uptick in transmission capacity work to uprate the MAOP of pipeline segments.
5	**2021**	**56,644**	**3,340**	**43,166**	**5,855**	**4,283**	
6			(377)				Decrease due to a lower volume of expense related maintenance costs for the Gill Ranch Storage field.
7				2,022			Increase in gas system planning engineering staff to plan system operations for the greatly increased number of safety clearance work performed on the gas transmission system and increased electricity costs to operate PG&E's gas compressor stations.
8					(301)		Decrease due to lower headcount in positions than forecast.
						(3,376)	Decrease in the volume of transmission capacity work to uprate the MAOP of pipeline segments.
9	**2022**	**54,612**	**2,963**	**45,188**	**5,554**	**907**	
10			96				Increase due to forecast escalation.
11				1,605			Increase due to forecast escalation.
12					196		Increase due to forecast escalation.
						32	Increase due to forecast escalation.
13	**2023**	**56,540**	**3,059**	**46,793**	**5,750**	**939**	

Note: Total amounts and amounts for each MWC are obtained from WP 11-5 by summing the relevant lines for each MWC.

p pe Table 11-33
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Gas System Operations
Capital Expenditures by Major Work Category
(Thousands of Nominal Dollars)

			Capital Expenditures											
No.	MWC	MWC Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	47	G Dist Capacity	39,756	28,712	26,095	36,610	35,394	39,071	34,364	40,607	41,696	42,786	43,904	
2	4A	G Dist Ctrl Operations Assets	29,134	24,561	24,393	27,807	27,815	26,908	28,722	23,270	23,893	23,529	3,102	
3	73	GT Pipeline Capacity	78,923	107,995	24,936	8,143	10,054	24,258	9,683	9,205	9,446	9,692	9,937	
4	76	GT Station Reliability	711	874	1,492	2,422	3,179	4,021	4,204	3,669	3,763	3,858	3,953	
5		**Grand Total**	**148,525**	**162,142**	**76,915**	**74,982**	**76,441**	**94,259**	**76,974**	**76,751**	**78,797**	**79,864**	**60,896**	WP 11-37, Line 35

Workpaper Table 11-34
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Gas System Operations
Forecast Capital Expenditures Summary
(Thousands of Nominal Dollars)

		Capital Expenditures							
Line No.	Description	2020 CWIP	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	Projects > $3 Million*	4,505	74,729	75,917	76,036	78,062	79,109	60,119	
2	Other Work	3,704	19,530	1,057	715	735	755	777	
3	**Total**	**8,210**	**94,259**	**76,974**	**76,751**	**78,797**	**79,864**	**60,896**	WP 11-37, Line 35
4	* Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.								

p pe Table 11-35
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Gas System Operations
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over $3 Million*
(Thousands of Nominal Dollars)

Line No.	Planning Order	Description	MWC	Operative Date	CWIP 2020 Recorded Adjusted	Capital Expenditures 2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Subtotal
	MWC - 47	**G Dist Capacity**										
1	5500749	INCR. CAPACITY G-EB	47		-	6,237	-	-	-	-	-	6,237
2	5500750	INCR. CAPACITY G-FR	47		-	3,296	-	-	-	-	-	3,296
3	5500753	INCR. CAPACITY G-NB	47		-	3,550	-	-	-	-	-	3,550
4	5500758	INCR. CAPACITY G-SF	47		-	4,575	-	-	-	-	-	4,575
5	5500762	INCR. CAPACITY G-YO	47		61	6,058	-	-	-	-	-	6,119
6	5508876	47C - CONS/ACQ NEW FAC-G-CAP-REGSTA - NB	47		-	6,918	-	-	-	-	-	6,918
7	5542164	2023 GRC Cons/Acq New Fac-G-Cap-Mains	47		-	-	32,294	34,708	35,638	36,568	37,522	176,730
8	5542165	2023 GRC Cons/Acq New Fac-G-Cap-RegSta	47		-	-	1,523	5,709	5,862	6,015	6,172	25,279
9	**Total**				**61**	**30,634**	**33,816**	**40,416**	**41,500**	**42,583**	**43,694**	**232,705**
	MWC - 4A	**G Dist Ctrl Operations Assets**										
10	5538080	RTU Installation Target/DET	4A		-	26,028	-	-	-	-	-	26,028
11	5542208	2023 GRC Reg Stat Mntr Dual No Flow-3	4A		-	-	28,213	22,745	23,355	22,976	2,535	99,824
12	**Total**				**-**	**26,028**	**28,213**	**22,745**	**23,355**	**22,976**	**2,535**	**125,852**
	MWC - 73	**GT Pipeline Capacity**										
13	5759543	Calistoga DFM 150-200 (0405-01)	73		4,444	18,067	-	-	-	-	-	22,511
14	5793326	2023 GRC Capacity Betterment (GTLTRAN)	73		-	-	1,452	880	903	926	950	5,110
15	5793327	2023 GRC Capacity Load Growth (GTLTRAN)	73		-	-	8,232	8,326	8,543	8,766	8,988	42,854
16	**Total**				**4,444**	**18,067**	**9,683**	**9,205**	**9,446**	**9,692**	**9,937**	**70,475**
	MWC - 76	**GT Station Reliability**										
17	5793377	2023 GRC Gill Ranch Capital (GTLTRAN)	76		-	-	1,500	883	903	924	944	5,154
18	5793385	2023 GRC GT SCADA Visibility (GTLTRAN)	76		-	-	2,704	2,787	2,860	2,934	3,008	14,293
19	**Total**				**-**	**-**	**4,204**	**3,669**	**3,763**	**3,858**	**3,953**	**19,447**
20		**Grand Total**			**4,505**	**74,729**	**75,917**	**76,036**	**78,062**	**79,109**	**60,119**	**448,478**

21 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

p pe Table 11-36
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Gas System Operations
Recorded and Forecast Capital Expenditures Details - Other Work*
(Thousands of Nominal Dollars)

			Capital Expenditures										
Line No.	MWC	MWC Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast
1	47	G Dist Capacity	34,794	19,707	19,543	18,002	15,331	8,437	548	190	196	203	209
2	4A	G Dist Ctrl Operations Assets	29,134	24,561	24,393	27,807	27,815	880	509	525	539	553	567
3	73	GT Pipeline Capacity	78,921	107,992	24,690	7,085	6,921	6,191	-	-	-	-	-
4	76	GT Station Reliability	711	874	1,492	2,422	3,179	4,021	-	-	-	-	-
5	**Grand Total**		**143,560**	**153,133**	**70,118**	**55,315**	**53,245**	**19,530**	**1,057**	**715**	**735**	**755**	**777**

6 * Excludes projects greater than $3M

Workpaper Table 11-37
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Summary of Capital Expenditures

GAS DISTRIBUTION CAPITAL

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	References
3	Cons/Acq New Fac-G-Cap-Mains	47	47B	27,341,432	20,721,265	20,467,025	32,324,348	31,397,781	31,658,987	32,293,800	34,707,743	35,637,911	36,568,060	37,522,487	**144,436,201**	WP 11-38, Line 8
4	Cons/Acq New Fac-G-Cap-RegSta	47	47C	9,794,928	6,784,533	4,641,223	3,557,388	3,626,952	6,918,000	1,522,641	5,708,699	5,861,692	6,014,682	6,171,665	**23,756,738**	WP 11-38, Line 12
5	Cons/Acq New Fac-G-Cap-ReplReg	47	47D	346,875	319,540	66,661	262,596	364,901	494,000	494,322	132,945	137,625	142,469	147,484	**560,523**	WP 11-38, Line 16
6	Con/AcquireNewFacil G-Cap-Betr	47	47E	506,087	86,245	478,106	412,069	-	-	-	-	-	-	-	-	(A)
7	Cons/Acquire New Fac G-Cap-Oth	47	47F	516,965	219,544	441,764	53,502	3,867	-	53,502	57,238	58,772	60,306	61,880	**238,196**	WP 11-38, Line 24
8	Gas Capacity, Spoils	47	47#	1,249,459	580,537	558	10	-	-	-	-	-	-	-	-	(A)
9	Reg Sta Montr & Contrl-1	4A	4AA	9,640,278	1,053,412	(824,994)	271,576	(337,321)	-	-	-	-	-	-	-	(A)
10	Reg Station Monitoring-3	4A	4AB	3,050,114	6,712,968	6,417,494	854,775	44,380	-	-	-	-	-	-	-	(A)
11	Real Time PSI Monitor-4	4A	4AC	3,810,743	2,867,899	2,729,119	734,969	(482)	-	-	-	-	-	-	-	(A)
12	Valve Monitor and Control	4A	4AE	-	-	189	-	-	-	-	-	-	-	-	-	(A)
13	ERX Pressure Monitoring-6	4A	4AF	(544,523)	2,591,713	(16,086)	1,410,090	1,203,604	879,862	509,017	524,593	538,652	552,711	567,136	**2,183,092**	WP 11-38, Line 35
14	Reg Stat Mntr Sngle No Flow-1	4A	4AH	23,135	4,879	189,862	1,412	-	-	-	-	-	-	-	-	(A)
15	Reg Stat Mntr Dual Flow-1	4A	4AI	47,069	-	-	-	-	-	-	-	-	-	-	-	(A)
16	Reg Stat Mntr Sngle No Flow-3	4A	4AK	7,026,551	5,853,874	3,777,144	1,607,500	899,822	-	-	-	-	-	-	-	(A)
17	Reg Stat Mntr Dual Flow-3	4A	4AL	732,683	3,788,441	7,788,394	948,727	(6,368)	-	-	-	-	-	-	-	(A)
18	Reg Stat Mntr Dual No Flow-3	4A	4AM	2,036,739	1,203,914	4,279,239	21,967,148	26,018,080	26,027,946	28,212,917	22,745,117	23,354,686	22,976,027	2,535,022	**71,610,852**	WP 11-38, Line 39
19	SCADA Support	4A	4A#	3,311,584	484,064	52,469	11,101	(7,089)	-	-	-	-	-	-	-	(A)
20	**Total Capital Expenditures**			**68,890,120**	**53,272,828**	**50,488,168**	**64,417,211**	**63,208,127**	**65,978,795**	**63,086,199**	**63,876,335**	**65,589,338**	**66,314,255**	**47,005,674**	**242,785,602**	

21 **Notes**
22 (A) These programs are not forecasted for this rate case period.

GAS TRANSMISSION CAPITAL

Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	Reference
Capacity for Load Growth	73	73A	78,908,944	107,984,865	24,932,624	8,126,781	10,048,576	22,350,140	8,231,519	8,325,651	8,542,951	8,765,922	8,987,700	**34,622,224**	WP 11-46, Line 4
Capacity Betterment	73	73B	14,379	8,758	4,415	15,912	5,664	1,908,292	1,451,756	879,629	902,587	926,145	949,576	**3,657,937**	WP 11-46, Line 8
Cpcty to Support NOP Rdctions	73	73C	-	1,407	(1,407)	-	-	-	-	-	-	-	-	-	(B)
Gill Ranch Capital	76	762	445,002	149,830	429,097	840,381	1,261,993	1,349,700	1,500,000	882,544	902,931	923,789	944,389	**3,653,653**	WP 11-46, Line 19
GT SCADA Visibility	76	76M	266,170	723,902	1,062,526	1,581,278	1,916,576	2,671,599	2,704,100	2,786,846	2,859,582	2,934,217	3,008,453	**11,589,098**	WP 11-46, Line 15
Total Capital Expenditures			**79,634,495**	**108,868,762**	**26,427,255**	**10,564,352**	**13,232,809**	**28,279,731**	**13,887,375**	**12,874,670**	**13,208,051**	**13,550,073**	**13,890,118**	**53,522,912**	

31 **Notes**
32 (B) PG&E's program to support Normal Operating Pressure reductions is not forecasted for this rate case period.

TOTAL CAPITAL EXPENDITURES

Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026
Total Capital Expenditure	All	All	**148,524,614**	**162,141,591**	**76,915,423**	**74,981,564**	**76,440,936**	**94,258,526**	**76,973,574**	**76,751,005**	**78,797,389**	**79,864,328**	**60,895,792**	**296,308,514**

Workpaper Table 11-38
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas Systems Operations
Calculation of Gas Distribution Capital Totals by MAT (A)

					Recorded		Forecast						
Line	Chapter	Program	MWC/MAT	Units	2019	2020	2021	2022	2023	2024	2025	2026	Reference
1	**11**	**Gas Distribution New Capacity**	**47**										
2		Spoils	47#	Unit Cost	$10	$0	$0	$0	$0	$0	$0	$0	(B)
3		Unit of Measure:	N/A	Volume	1	1	1	1	1	1	1	1	WP 11-51, Line 3
4				Total	$10	$0	$0	$0	$0	$0	$0	$0	WP 11-37, Line 8
5													
6		Gas Capacity, Mains	47B	Unit Cost	$702	$684	$645	$699	$751	$771	$792	$812	WP 11-39, Line 11
7		Unit of Measure:	Feet of Main Installed	Volume	46,032	45,918	49,054	46,200	46,200	46,200	46,200	46,200	WP 11-51, Line 4
8				Total	$32,324,348	$31,397,781	$31,658,987	$32,293,800	$34,707,743	$35,637,911	$36,568,060	$37,522,487	WP 11-37, Line 3
9													
10		Gas Capacity, Regulator Station	47C	Unit Cost	$1,778,694	$1,208,984	$1,383,600	$1,522,641	$1,902,900	$1,953,897	$2,004,894	$2,057,222	WP 11-40, Line 11
11		Unit of Measure:	Total # Reg Stations Addressed	Volume	2	3	5	1	3	3	3	3	WP 11-51, Line 5
12				Total	$3,557,388	$3,626,952	$6,918,000	$1,522,641	$5,708,699	$5,861,692	$6,014,682	$6,171,665	WP 11-37, Line 4
13													
14		Gas Capacity, Replace Regulator Station Component	47D	Unit Cost	$29,177	$52,129	$49,400	$123,581	$33,236	$34,406	$35,617	$36,871	WP 11-41, Line 11
15		Unit of Measure:	# Reg Station Components	Volume	9	7	10	4	4	4	4	4	WP 11-51, Line 6
16				Total	$262,596	$364,901	$494,000	$494,322	$132,945	$137,625	$142,469	$147,484	WP 11-37, Line 5
17													
18		Gas Capacity Emergent Work	47E	Unit Cost	$412,069	$0	$0	$0	$0	$0	$0	$0	(C)
19		Unit of Measure:	N/A	Volume	1	1	1	1	1	1	1	1	WP 11-51, Line 7
20				Total	$412,069	$0	$0	$0	$0	$0	$0	$0	WP 11-37, Line 6
21													
22		Gas Capacity, Other Enhancements	47F	Unit Cost	$53,502	$3,867	$0	$53,502	$57,238	$58,772	$60,306	$61,880	WP 11-42, Line 11
23		Unit of Measure:	N/A	Volume	1	1	1	1	1	1	1	1	WP 11-51, Line 8
24				Total	$53,502	$3,867		$53,502	$57,238	$58,772	$60,306	$61,880	WP 11-37, Line 7
25													
26		Subtotal - MWC 47 - Gas Distribution New Capacity			$36,609,912	$35,393,500	$39,070,987	$34,364,265	$40,606,625	$41,696,000	$42,785,517	$43,903,516	
27													
28	**11**	**Gas Distribution Control Operations Assets**	**4A**										
29		SCADA Support	4A#	Unit Cost	$11,101	($7,089)	$0	$0	$0	$0	$0	$0	(D)
30		Unit of Measure:	N/A	Volume	1	1	1	1	1	1	1	1	(D)
31				Total	$11,101	($7,089)	$0	$0	$0	$0	$0	$0	WP 11-37, Line 19
32													
33		Install ERX Pressure Monitoring Device	4AF	Unit Cost	$23,116	$38,826	$25,878	$50,902	$52,459	$53,865	$55,271	$56,714	(E)
34		Unit of Measure:	# Electronic Pressure Recorders	Volume	61	31	34	10	10	10	10	10	WP 11-52, Line 7
35				Total	$1,410,090	$1,203,604	$879,862	$509,017	$524,593	$538,652	$552,711	$567,136	WP 11-37, Line 13
36													
37		Install RTU Pressure Monitoring Device	4AM	Unit Cost	$310,408	$280,191	$234,486	$227,524	$234,486	$240,770	$247,054	$253,502	WP 11-45, Line 11
38		Unit of Measure:	Remote Terminal Units Installed	Volume	85	95	111	124	97	97	93	10	WP 11-53, Line 7
39				Total	$26,384,696	$26,618,111	$26,027,946	$28,212,917	$22,745,117	$23,354,686	$22,976,027	$2,535,022	WP 11-37, Line 18
40													
41		Subtotal - MWC 4A - Gas Distribution Control Operations Assets			$27,805,887	$27,814,626	$26,907,808	$28,721,934	$23,269,710	$23,893,338	$23,528,738	$3,102,158	
42													
43		Chapter 11 Total			$64,415,799	$63,208,127	$65,978,795	$63,086,199	$63,876,335	$65,589,338	$66,314,255	$47,005,674	
44													

45 **Notes:**
46 (A) All recorded and forecast costs include escalation, and adjustments.
47 (B) PG&E is not forecasting any costs under MAT 47# for this rate case period.
48 (C) PG&E is not forecasting any costs under MAT 47E for this rate case period.
49 (D) PG&E is not forecasting any costs under MAT 4A# for this rate case period.
50 (E) The 2022-2026 unit cost for MAT 4AF is calculated by taking the sum of unit cost shown in WP 11-43, Line 12 and WP 11-44, Line 12, and dividing the total by two ((WP 11-43, Line 12 + WP 11-44, Line 12) / 2).

Workpaper Table 11-39
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 47B - Gas Distribution Capacity, Mains

Line

1 **MAT 47B - Gas Distribution Capacity, Mains - (Unit of Measure: Feet of Main Installed)**

2 **Cost Estimating Methodology:** MAT 47B was forecast using 2019 recorded costs plus escalation to 2023.

	Description	**Value**	**Note**
3	2019 Recorded Cost	$ 32,324,352	(A)
4	2019 Recorded Units	46,032	(A)
5	2019 Average Unit Cost	$ 702	Line 4 / 5
6	**Cost Basis for Forecast**	$ 702	Line 6

		2020	**2021 (E)**	**2022 (E)**	**2023**	**2024**	**2025**	**2026**	**Note**
7	Escalation Factor	-0.550%	1.360%	2.980%	3.060%	2.680%	2.610%	2.610%	(B)
8	Escalation Amount	$ (4)	$ 9	$ 21	$ 22	$ 20	$ 20	$ 21	(C)
9	**Forecast Unit Cost**	**$ 698**	**$ 708**	**$ 729**	**$ 751**	**$ 771**	**$ 792**	**$ 812**	(D)

10 **Notes**
11 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
12 (B) Escalation rates are based on the Gas Distribution capital composite rate.
13 (C) Previous year unit cost x Escalation Factor.
14 (D) Previous year unit cost + Escalation amount.
15 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-40
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 47C - Gas Distribution Capacity, Regulator Stations

Line

1 **MAT 47C - Gas Distribution Capacity, Regulator Stations - (Unit of Measure: Regulator Stations Installed)**

2 **Cost Estimating Methodology:** MAT 47C was forecast using 2019 recorded costs plus escalation to 2023.

	Description	**Value**	**Note**
3	2019 Recorded Cost	$ 3,557,390	(A)
4	2019 Recorded Units	2	(A)
5	2019 Average Unit Cost	$ 1,778,695	Line 4 / 5
6	**Cost Basis for Forecast**	$ 1,778,695	Line 6

		2020	**2021 (E)**	**2022 (E)**	**2023**	**2024**	**2025**	**2026**	**Note**
7	Escalation Factor	-0.550%	1.360%	2.980%	3.060%	2.680%	2.610%	2.610%	(B)
8	Escalation Amount	$ (9,783)	$ 24,057	$ 53,430	$ 56,500	$ 50,998	$ 50,997	$ 52,328	(C)
9	**Forecast Unit Cost**	**$ 1,768,912**	**$ 1,792,969**	**$ 1,846,400**	**$ 1,902,900**	**$ 1,953,897**	**$ 2,004,894**	**$ 2,057,222**	(D)

10 **Notes**
11 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
12 (B) Escalation rates are based on the Gas Distribution capital composite rate.
13 (C) Previous year unit cost x Escalation Factor.
14 (D) Previous year unit cost + Escalation amount.
15 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-41
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 47D - Gas Distribution Capacity, Regulator Station Components

Line

1 **MAT 47D - Gas Distribution Capacity, Regulator Station Components - (Unit of Measure: Regulator Station Components Installed)**

2 **Cost Estimating Methodology:** MAT 47D was forecast using 2019 recorded costs plus escalation to 2023.

	Description	**Value**	**Note**
3	2019 Recorded Cost	$ 262,597	(A)
4	2019 Recorded Units	9	(A)
5	2019 Average Unit Cost	$ 29,177	Line 4 / 5
6	**Cost Basis for Forecast**	$ 29,177	Line 6

		2020	**2021 [E]**	**2022 [E]**	**2023**	**2024**	**2025**	**2026**	**Note**
7	Escalation Factor	3.180%	3.020%	3.520%	3.520%	3.520%	3.520%	3.520%	(B)
8	Escalation Amount	$ 928	$ 909	$ 1,092	$ 1,130	$ 1,170	$ 1,211	$ 1,254	(C)
9	**Forecast Unit Cost**	**$ 30,105**	**$ 31,014**	**$ 32,106**	**$ 33,236**	**$ 34,406**	**$ 35,617**	**$ 36,871**	(D)

10 **Notes**
11 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
12 (B) Escalation rates are based on the Gas Distribution capital labor rate.
13 (C) Previous year unit cost x Escalation Factor.
14 (D) Previous year unit cost + Escalation amount.
15 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-42
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 47F - Gas Distribution Capacity, Other Enhancements

Line

1 **MAT 47F - Gas Distribution Capacity, Other Enhancements - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology:** MAT 47F was forecast using 2019 recorded costs plus escalation to 2023.

	Description	**Value**	**Note**
3	2019 Recorded Cost	$ 53,502	(A)
4	2019 Recorded Units	1	(A)
5	2019 Average Unit Cost	$ 53,502	Line 4 / 5
6	**Cost Basis for Forecast**	$ 53,502	Line 6

		2020	**2021 (E)**	**2022 (E)**	**2023**	**2024**	**2025**	**2026**	**Note**
7	Escalation Factor	-0.550%	1.360%	2.980%	3.060%	2.680%	2.610%	2.610%	(B)
8	Escalation Amount	$ (294)	$ 724	$ 1,607	$ 1,699	$ 1,534	$ 1,534	$ 1,574	(C)
9	**Forecast Unit Cost**	**$ 53,208**	**$ 53,931**	**$ 55,538**	**$ 57,238**	**$ 58,772**	**$ 60,306**	**$ 61,880**	(D)

10 **Notes**
11 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
12 (B) Escalation rates are based on the Gas Distribution capital composite rate.
13 (C) Previous year unit cost x Escalation Factor.
14 (D) Previous year unit cost + Escalation amount.
15 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-43
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 4AF - Install ERX Pressure Monitoring Device
ERX Installations

Line

1 **MAT 4AF - Electronic Pressure Monitoring Device (ERX) - (Unit of Measure: Electronic Pressure Recorders Installed)**

2 **Cost Estimating Methodology:** MAT 4AF is broken up into two sub-unit forecasts: a forecast for standard ERX installations, and a forecast for RTU installations that converted to ERX installations. The unit cost
3 forecast for standard ERX installations used 2019 recorded costs plus escalation to 2023.

	Description	Value	Note
4			
5	2019 Recorded Cost	$ 1,381,992	(A)
6	2019 Recorded Units	61	(A)
7	2019 Average Unit Cost	$ 22,656	Line 5 / 6
8	**Cost Basis for Forecast**	$ 22,656	Line 7

		2020	2021 [E]	2022 [E]	2023	2024	2025	2026	Note
9									
10	Escalation Factor	-0.550%	1.360%	2.980%	3.060%	2.680%	2.610%	2.610%	(B)
11	Escalation Amount	$ (125)	$ 306	$ 681	$ 720	$ 650	$ 650	$ 667	(C)
12	**Forecast Unit Cost**	**$ 22,531**	**$ 22,837**	**$ 23,518**	**$ 24,238**	**$ 24,887**	**$ 25,537**	**$ 26,203**	(D)

13 **Notes**
14 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
15 (B) Escalation rates are based on the Gas Distribution capital composite rate.
16 (C) Previous year unit cost x Escalation Factor.
17 (D) Previous year unit cost + Escalation amount.
18 (E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-44
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 4AF - Install ERX Pressure Monitoring Device
RTU to ERX Conversions

MAT 4AF - Electronic Pressure Monitoring Device (ERX) - (Unit of Measure: Electronic Pressure Recorders Installed)

Cost Estimating Methodology: MAT 4AF is broken up into two sub-unit forecasts: a forecast for standard ERX installations, and a forecast for RTU installations that converted to ERX installations. The unit cost forecast for RTU installations that converted to ERX installation is based on project engineering estimates.

Description	Value [A]	Note
2020 Forecast Cost	$ 375,000	(B)
2020 Forecast Units	5	(C)
2020 Average Unit Cost	$ 75,000	Line 5 / 6
Cost Basis for Forecast	$ 75,000	Line 7

	2021 [H]	2022 [H]	2023	2024	2025	2026	Note
Escalation Factor	1.360%	2.980%	3.060%	2.680%	2.610%	2.610%	(D)
Escalation Amount	$ 1,020	$ 2,265	$ 2,396	$ 2,162	$ 2,162	$ 2,219	(E)
Forecast Unit Cost	**$ 76,020**	**$ 78,285**	**$ 80,681**	**$ 82,843**	**$ 85,005**	**$ 87,224**	(F)

Notes
(A) The 2020 forecast unit cost is based on project engineering estimates, detailed by the following breakdown:

Activity	Estimate	Description
Engineering & Labor	$ 49,500	Station / pipeline engnieering, design, and construction
Materials	$ 7,000	ERX cabinet, tubing, sensing lines, posts, and miscellaneous
Paving	$ 10,000	
Permits	$ 500	
Traffic Control	$ 3,000	
Land Acquisition	$ 5,000	Includes land work and appriasals
Total Unit Cost	$ 75,000	(G)

(B) Line 6 x Line 8.
(C) See Exhibit (PG&E-3), Chapter 11, WP 11-52.
(D) Escalation rates are based on the Gas Distribution capital composite rate.
(E) Previous year unit cost x Escalation Factor.
(F) Previous year unit cost + Escalation amount.
(G) Line 16 + Line 17 + Line 18 + Line 19 + Line 20 + Line 21.
(H) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-45
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 4AM - Install RTU Pressure Monitoring Device

MAT 4AM - Remote Terminal Unit (RTU) Pressure Monitoring Device - (Unit of Measure: Remote Terminal Units Installed)

Cost Estimating Methodology: MAT 4AM was forecast using 2019 recorded costs plus escalation to 2023.

Description	Value	Note
2019 Recorded Cost	$ 21,918,056	(A)
2019 Recorded Units	100	(A)
2019 Average Unit Cost	$ 219,181	Line 4 / 5
Cost Basis for Forecast	$ 219,181	Line 6

	2020	2021 (E)	2022 (E)	2023	2024	2025	2026	Note
Escalation Factor	-0.550%	1.360%	2.980%	3.060%	2.680%	2.610%	2.610%	(B)
Escalation Amount	$ (1,205)	$ 2,964	$ 6,584	$ 6,962	$ 6,284	$ 6,284	$ 6,448	(C)
Forecast Unit Cost	**$ 217,975**	**$ 220,940**	**$ 227,524**	**$ 234,486**	**$ 240,770**	**$ 247,054**	**$ 253,502**	(D)

Notes
(A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
(B) Escalation rates are based on the Gas Distribution capital composite rate.
(C) Previous year unit cost x Escalation Factor.
(D) Previous year unit cost + Escalation amount.
(E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-46
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas Systems Operations
Calculation of Gas Transmisison Capital Totals by MAT (A)

					Recorded		Forecast						
Line	Chapter	Program	MWC/MAT	Units	2019	2020	2021	2022	2023	2024	2025	2026	Reference
1	**11**	**Gas Transmission Capacity**	**73**										
2		Gas Transmission New Capacity	73A	Unit Cost	$8,126,781	$10,048,576	$22,350,140	$8,231,519	$8,325,651	$8,542,951	$8,765,922	$8,987,700	WP 11-47, Line 10
3		Unit of Measure:	N/A	Volume	1	1	1	1	1	1	1	1	WP 11-54, Line 4
4				Total	$8,126,781	$10,048,576	$22,350,140	$8,231,519	$8,325,651	$8,542,951	$8,765,922	$8,987,700	WP 11-37, Line 25
5													
6		Gas Capacity, Betterment	73B	Unit Cost	$15,912	$5,664	$1,908,292	$1,451,756	$879,629	$902,587	$926,145	$949,576	WP 11-48, Line 9
7		Unit of Measure:	N/A	Volume	1	1	1	1	1	1	1	1	WP 11-54, Line 5
8				Total	$15,912	$5,664	$1,908,292	$1,451,756	$879,629	$902,587	$926,145	$949,576	WP 11-37, Line 26
9													
10		Subtotal - MWC 73 - Gas Transmission Capacity			$8,142,694	$10,054,240	$24,258,432	$9,683,275	$9,205,280	$9,445,538	$9,692,067	$9,937,276	
11													
12	**11**	**Gas Transmission Station Reliability**	**76**										
13		Gas Transmission SCADA Visibility	76M	Unit Cost	$1,581,278	$1,916,576	$2,671,599	$2,704,100	$348,356	$357,448	$366,777	$376,057	WP 11-50, Line 10
14		Unit of Measure:	# of Remote Terminal Units Installed (B)	Volume	1	1	1	1	8	8	8	8	WP 11-56, Line 6
15				Total	$1,581,278	$1,916,576	$2,671,599	$2,704,100	$2,786,846	$2,859,582	$2,934,217	$3,008,453	WP 11-37, Line 29
16													
17		Gill Ranch Storage Capital	762	Unit Cost	$840,381	$1,261,993	$1,349,700	$1,500,000	$882,544	$902,931	$923,789	$944,389	WP 11-48, Line 11
18		Unit of Measure:	N/A	Volume	1	1	1	1	1	1	1	1	WP 11-55, Line 5
19				Total	$840,381	$1,261,993	$1,349,700	$1,500,000	$882,544	$902,931	$923,789	$944,389	WP 11-37, Line 28
20													
21		Subtotal - MWC 76 - Gas Transmission Station Reliability			$2,421,659	$3,178,569	$4,021,299	$4,204,100	$3,669,390	$3,762,513	$3,858,006	$3,952,842	
22													
23		Chapter 11 Total			$10,564,352	$13,232,809	$28,279,731	$13,887,375	$12,874,670	$13,208,051	$13,550,073	$13,890,118	
24													

25 **Notes:**
26 (A) All recorded and forecast costs include escalation, and adjustments.
27 (B) PG&E unitized the Gas Transmission SCADA visibility program starting in 2023 for the 2023 General Rate Case to represent regulator stations where a remote terminal unit (RTU) SCADA device would be installed.

Workpaper Table 11-47
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 73A - Gas Transmission Capacity For Load Growth

Line

1 **MAT 73A - Gas Transmission Capacity For Load Growth - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology:** MAT 73A was forecast using a three-year average of 2017, 2018, and 2019 recorded costs plus escalation to 2023, divided by two to account for future risk of capacity load demand.

	Cost Basis for Forecast	**2017 (F)**	**2018 (F)**	**2019 (F)**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**Note**
4	Recorded Expenses	$ 21,117,299	$ 21,273,599	$ 2,963,850								(A)
5	Escalation Rate		3.670%	1.870%	-0.480%	0.910%	2.830%	3.060%	2.610%	2.610%	2.530%	(B)
6	Recorded Adjusted (in 2023 dollars)	$ 23,735,169	$ 23,064,382	$ 3,154,356								(C)
7	Forecast of recorded adjusted three-year average (2017-2019)							$ 16,651,302				(D)
8	Fifty percent forecast reduction due to risk							$ 8,325,651				Line 7 / 2
9	Forecast costs escalated								$ 8,542,951	$ 8,765,922	$ 8,987,700	(E)
10	**Adjusted Forecast**							**$ 8,325,651**	**$ 8,542,951**	**$ 8,765,922**	**$ 8,987,700**	

11 **Notes**
12 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
13 (B) Escalation rates are based on the Gas Transmission capital composite rate.
14 (C) Recorded expenses x future escalation rates to 2023 dollars.
15 (D) 2017 + 2018 + 2019 recorded adjusted expenditures.
16 (E) Previous year + escalation.
17 (F) PG&E excluded recorded costs related to the Line 407 Memorandum Account to forecast for capacity for load growth projects.

Workpaper Table 11-48
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 73B - Gas Transmission Capacity Betterment

Line

1 **MAT 73B - Gas Transmission Capacity Betterment - (Unit of Measure: Non-Unitized)**

2 **Cost Estimating Methodology:** PG&E used the sum of the 2021-2022 adopted/imputed forecast, escalated, divided by four to represent flat costs related to forecast MAT 73B projects over the 2023-2026 GRC period.

3 **Cost Basis for Forecast**	**2017**	**2018**	**2019**	**2020**	**2021 [G]**	**2022 [G]**	**2023**	**2024**	**2025**	**2026**	**Note**
4 Recorded Expenses	$ 8,758	$ 4,415	$ 15,912	$ 5,664							(A)
Forecast Expenses					$ 1,908,285	$ 1,451,756					(B)
5 Escalation Rate	0.000%	3.670%	1.870%	-0.480%	0.910%	2.830%	3.060%	2.610%	2.610%	2.530%	(C)
6 Recorded Adjusted (in 2023 dollars)	$ 9,844	$ 4,787	$ 16,935	$ 6,057	$ 2,022,336	$ 1,496,180					(D)
7 Forecast of recorded adjusted two-year average (2021-2022)							$ 879,629				(E)
8 Forecast costs escalated								$ 902,587	$ 926,145	$ 949,576	(F)
9 **Adjusted Forecast**							**$ 879,629**	**$ 902,587**	**$ 926,145**	**$ 949,576**	Line 8 + 9

10 **Notes**
11 (A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
12 (B) To forecast betterment costs under MAT 73B for the 2023-2026 GRC period, PG&E used the 2021 and 2022 adopted/imputed forecast for MAT 73B as the baseline for the 2023-2026 GRC period. PG&E divided the sum of 2021 and 2022
13 adopted/imputed values by four to represent flat costs expected over the 2023 to 2026 GRC period, escalated. See Exhibit (PG&E-3), Chapter 11, Section D.2.b.i. for further detail on how the forecast for MAT 73B was calculated.
14 (C) Escalation rates are based on the Gas Transmission capital composite rate.
15 (D) Recorded expenses x future escalation rates to 2023 dollars.
16 (E) 2021 + 2022 adopted/imputed forecast divided by 4.
17 (F) Previous year + escalation.
18 (G) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-49
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 762 - Gill Ranch Storage Capital

MAT 762 - Gill Ranch Storage Capital - (Unit of Measure: Non-Unitized)

Cost Estimating Methodology: MAT 762 was forecast using 2019 recorded costs plus escalation to 2023.

Description	Value	Note
2019 Recorded Cost	$ 840,381	(A)
2019 Recorded Units	1	(A)
2019 Average Unit Cost	$ 840,381	Line 4 / 5
Cost Basis for Forecast	$ 840,381	Line 6

	2020	2021 (E)	2022 (E)	2023	2024	2025	2026	Note
Escalation Factor	-0.780%	0.380%	2.610%	2.760%	2.310%	2.310%	2.230%	(B)
Escalation Amount	$ (6,555)	$ 3,169	$ 21,846	$ 23,704	$ 20,387	$ 20,858	$ 20,600	(C)
Forecast Unit Cost	**$ 833,826**	**$ 836,995**	**$ 858,840**	**$ 882,544**	**$ 902,931**	**$ 923,789**	**$ 944,389**	(D)

Notes
(A) See Exhibit (PG&E-3), Chapter 11, WP 11-33.
(B) Escalation rates are based on the Gas Storage capital composite rate.
(C) Previous year unit cost x Escalation Factor.
(D) Previous year unit cost + Escalation amount.
(E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-50
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Cost Forecast Workpapers Supporting Chapter 11 Forecast
MAT 76M - Gas Transmission SCADA Visibility

MAT 76M - Gas Transmission SCADA Visibility - (Unit of Measure: Non-Unitized)

Cost Estimating Methodology: MAT 76M was forecast using two local transmisison SCADA installations projects that had construction start, and end, in 2019 as a baseline for unit costs. Some costs were recorded in 2020 due to project closeout. Previous local transmission SCADA projects were performed over multiple years, and do not accurately reflect the type of RTU installations moving forward for the 2023 GRC.

LT SCADA Installations	2019 Recorded Cost	2020 Recorded Cost	Total Project Cost (2020 Dollars) (A)	Units Performed	Note
LT SCADA Project 1	$ 263,866	$ 49,137	$ 311,736	1	
LT SCADA Project 2	$ 270,905	$ 70,151	$ 339,755	1	
Escalation Rate	0%	-0.480%			(B)

Average Unit Cost - Escalated to 2020 Dollars	$ 325,746 (C)

Cost Basis for Forecast	2021 (E)	2022 (E)	2023	2024	2025	2026	Note
Escalation Rate	0.910%	2.830%	3.060%	2.610%	2.610%	2.530%	(B)
Forecast Unit Cost	**$ 328,710**	**$ 338,013**	**$ 348,356**	**$ 357,448**	**$ 366,777**	**$ 376,057**	**(D)**

Notes
(A) Total Project Cost is calculated by (2019 Recorded Cost * 2020 Escalation Rate) + 2020 Recorded Cost.
(B) Escalation rates are based on the Gas Transmission capital composite rate.
(C) LT SCADA Project 1 Total Project Cost (2020 Dollars) + LT SCADA Project 2 Total Project Cost (2020 Dollars) / 2.
(D) Previous year + escalation.
(E) The 2021 and 2022 forecast presented is for illustrative escalation purposes only and does not necessarily reflect the 2021 or 2022 forecast.

Workpaper Table 11-51
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC 47 - Gas Distribution Capacity

Line

1 **Summary**: MWC 47 - Gas Distribution Capacity forecast to meet base capacity design requirements, growth needs, and to eliminate high-risk manual operations.

2			Recorded		Forecast						Notes
	MAT Code	Unit of Measure	2019	2020	2021	2022	2023	2024	2025	2026	
3	47# - Not Assigned	Non-Unitized	-	-	-	-	-	-	-	-	(A)
4	47B - Install New Gas Distribution Main Pipe	Feet of Main Installed	46,032	45,918	49,054	46,200	46,200	46,200	46,200	46,200	
5	47C - Install New Gas Distribution Regulator Station	Regulator Stations Added	2	3	5	1	3	3	3	3	
6	47D - Install New Distribution Regulator Station Components	Regulator Station Components Added	9	7	10	4	4	4	4	4	
7	47E - Gas Distribution Emergent Work/Betterment	Non-Unitized	-	-	-	-	-	-	-	-	(B)
8	47F - Gas Distribution Other New Capacity	Non-Unitized	-	-	-	-	-	-	-	-	(C)

9 **Notes**
10 (A) PG&E is not forecasting any costs under this MAT in 2023.
11 (B) PG&E is not forecasting any costs under this MAT in 2023.
12 (C) MAT 47F is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT 47F costs on WP 11-42.

Workpaper Table 11-52
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MAT 4AF - Gas Distribution Control Operations Assets - Electronic Pressure Recorders

Summary: MAT 4AF - SCADA equipment installations create centralized visibility for the Gas Distribution Control Center (GDCC). As part of PG&E's SCADA program, PG&E installs Electronic Pressure Recorders (ERXs) on the gas system which transmit pressure and flow data to the GDCC, and alarms when system conditions cross certain operational thresholds.

			Recorded		Forecast					
MAT Code	**Unit of Measure**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
4AF - Electronic Pressure Recorders	ERXs Installed	61	31	29	5	5	5	5	5
4AF - RTU to ERX Conversions	ERXs Installed	-	-	5	5	5	5	5	5
MAT 4AF Total		**61**	**31**	**34**	**10**	**10**	**10**	**10**	**10**

Workpaper Table 11-53
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MAT 4AM - Gas Distribution Control Operations Assets - Remote Terminal Units

Summary: MAT 4AM - SCADA equipment installations create centralized visibility for the Gas Distribution Control Center (GDCC). As part of PG&E's SCADA program, PG&E installs Remote Terminal (RTUs) on the gas system which transmit pressure and flow data to the GDCC, and alarms when system conditions cross certain operational thresholds.

			Recorded		Forecast					
MAT Code	**Unit of Measure**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
4AM - Remote Terminal Units	RTUs Installed	101	95	111	124	97	97	93	10
MAT 4AM Total		**101**	**95**	**111**	**124**	**97**	**97**	**93**	**10**

Notes
(A) Recorded and forecast costs formerly in individual MAT codes (4AA, 4AB, 4AC, 4AE, 4AH, 4AI, 4AJ, 4AK, 4AL, and 4AM) are now summarized into a single MAT (MAT 4AM).

Workpaper Table 11-54
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MWC 73 - Gas Transmission Capacity

Line

1 **Summary**: MWC 73 - Gas Transmission capacity projects include the installation of transmission facilities to meet non-customer-specific demand growth. Examples of capacity projects include
2 constructing new gas pipelines (including parallel lines), increasing regulating station capacity, and adding new regulator stations.

3	MAT Code	Notes
4	73A - Gas Transmission Capacity for Load Growth	MAT 73A is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT 73A costs on WP 11-47.
5	73B - Gas Transmission Capacity Betterment	MAT 73B is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT 73B costs on WP 11-48.

Workpaper Table 11-55
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MAT 762 - Gill Ranch Storage - Capital

Line

1 **Summary**: MAT 762 - PG&E has a 25 percent interest in the Gill Ranch Storage facility it co-owns with SENSA Holdings. Gill Ranch is an underground storage site designed to hold 20 billion
2 cubic feet (Bcf), providing 100 million cubic feet per day (MMcf/d) of withdrawl capacity.

3

4	MAT Code	Notes
5	MAT 762 - Gill Ranch Storage - Capital	MAT 762 is forecast on a non-unitized basis. PG&E describes its method for forecasting MAT 762 costs on WP 11-49.

Workpaper Table 11-56
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Volume Workpapers Supporting Chapter 11 Forecast
MAT 76M - Gas Transmission SCADA Visibility

Summary: MAT 76M - SCADA equipment installations create centralized visibility for the Gas Transmission Control Center (GTCC). The most common SCADA equipment, remote terminal units (RTUs), transmit pressure and flow data to the GTCC, and alarms when system conditions cross certain operational thresholds.

			Recorded		Forecast						
Line	MAT Code	Unit of Measure	2019	2020	2021	2022	2023	2024	2025	2026	Notes
5	MAT 76M - Gas Transmission SCADA Visibility	RTUs Installed	1	1	8	8	8	8	8	8	(A)
6	**MAT 76M Total**		**1**	**1**	**8**	**8**	**8**	**8**	**8**	**8**	

Notes
(A) MAT 76M was non-unitized as a result of the 2019 GT&S decision. PG&E decided to unitize this work starting in 2021 to show the type of work performed.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3), CHAPTER 11, GAS SYSTEM OPERATIONS
PROJECT SUMMARY – GAS DISTRIBUTION NEW CAPACITY

Project Title: Gas Distribution New Capacity
Major Work Categories: MWC 47 and DE (MATs 47B, 47C, 47D, 47F, DEH)
Planning Order Numbers: 5062253, 5262254, 5055349, 5500746, 5500747, 5500748, 5500749, 5500750, 5500751, 5500752, 5500753, 5500754, 5500755, 5500756, 5500757, 5500758, 5500759, 5500760, 5500761, 5500762, 5508859, 5508860, 5508861, 5508862, 5508863, 5508864, 5508865, 5508866, 5508867, 5508869, 5508870, 5508871, 5508872, 5508873, 5508874, 5508875, 5508876, 5508878, 5508879, 5508883, 5508887, 5508888, 5508889, 5508890, 5508891, 5508892, 5508893, 5508895, 5508897, 5508901, 5508902, 5508913, 5508914, 5508916, 5508918, 5508919, 5508921, 5508927, 5508929, 5508972, 5509250, 5542164, 5542165, 5542166, 5542167
Project Start Date: Ongoing
Project Completion Date: Ongoing
Operative Date (only applies to Capital): Operative as installed

Project Description

PG&E installs pipe main, regulators, and other equipment in the gas distribution system to provide adequate capacity in response to gas demand growth or locational shifts in demand due to real estate development. Capacity additions are required for PG&E to meet its obligation to serve under design day, peak-load conditions (APD or CWD). PG&E also performs activities to raise the operating pressure of existing distribution pipeline to meet increased customer load. Activities to uprate the pressure of a pipeline may include regulator station modifications, and upsizing of pipeline components.

Gas System Planning (GSP) engineers forecast demand growth to determine the capacity reinforcements that will enable PG&E to provide continuous service under design day conditions, so the required capacity can be installed before those conditions arise. The process of identifying capacity reinforcements is centered on hydraulic analyses conducted within the network investment plan framework.

The primary drivers for system capacity additions are: (1) new customers within the system, and (2) increased gas usage of existing customers. After years of demand growth, systems may operate close to their maximum capacity, even at temperatures short of design day conditions. In such a constrained system, any incremental gas load may precipitously reduce local pressures and create the immediate risk of uncontrolled outages as design day conditions are approached.

Justification

Capacity additions are required for PG&E to meet its obligation to serve pursuant to Public Utility Code 451, GO58A, and PG&E Gas Rule 15. Capacity standards are listed in PG&E Standard TD-5429S. Under these requirements, the gas distribution system is designed to ensure continuous service under one of two design days, whichever presents the larger load: Cold Winter Day (CWD) – a one in two-year cold weather event, and Abnormal Peak Day (APD) – a one in 90-year event. During a CWD, PG&E must have enough capacity to serve both core and noncore customers. During an APD, PG&E must be able to serve all core customers, with noncore customer use fully curtailed.

Work continues to eliminate high-risk manual operations that are currently in place as a work-around for inadequate capacity. Work also continues to enable all distribution systems to be operated below maximum

allowable operating pressure (MAOP), including over-pressure protection. Capacity for these objectives is embedded in the base number of annual units for capacity work, 46,200 feet. PG&E expects to meet these objectives within the 2023 GRC period.

Without Gas Distribution New Capacity work, PG&E will not be able to meet its obligation to serve, nor will it meet the Abnormal Peak Day Standard listed in TD-5429-S or the design requirements of PG&E Standards H-14 and H-10.

Inadequate capacity could result in a loss of supply due to under-pressurization. The system could run out of gas during peak usage and pilot lights could be extinguished. When pressure is restored, gas might be introduced into the house if the service line lacks a functioning regulator and an appliance lacks a functioning thermocouple. Any ignition source could then cause an explosion harming those within and around the structure. Additionally, there is history that loss of service in cold weather may induce customers to use unsafe heating and cooking sources indoors, such as outdoor grills, leading to fires and asphyxiation. Alternately, loss of heat can lead to hypothermia, especially for individuals with health/mobility issues.

Cost

PG&E describes its unit cost forecasting methodology for MWC 47 and DE in Exhibit (PG&E-3), Chapter 11.

Major Program Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast					
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Expense											
MWC DE			$3,933	$2,950	$2,569	$8,150	$2,262	$2,338			
Expense Total			$3,933	$2,950	$2,569	$8,150	$2,262	$2,338			
Capital											
MWC 47	$39,756	$28,712	$26,095	$36,610	$35,394	$39,071	$34,364	$40,607	$41,696	$42,786	$43,904
Capital Total	$39,756	$28,712	$26,095	$36,610	$35,394	$39,071	$34,364	$40,607	$41,696	$42,786	$43,904

Benefits

Another benefit is to reduce the risk associated with high risk manual operations. A high-risk manual operation involves manipulating regulators or valves just prior to or during a cold weather event to maintain adequate flow and pressure during the event. Through error or mechanical problems, these high-risk manual operations can result in accidental over-pressurization or a loss of supply due to under-pressurization. Using high-risk manual operations as a substitute for capacity is not a best practice. PG&E continues to pursue its goal of phasing out high-risk winter manual operations by installing the appropriate pipeline capacity under the Gas Distribution Capacity program (MWC 47).

Alternatives Considered

The alternative within the realm of capacity deployment is pace. PG&E continually assesses the needs of the system to determine the appropriate pace of capacity installation. Slower implementation may increase the need to implement interim manual operations.

Workpaper Table 11-57
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Capital Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 47	MWC 4A	Detailed Description/Explanation
1	**2016**	**68,890**	**39,756**	**29,134**	
2			(11,044)		Decrease in the amount of gas distribution capacity work needed to maintain design day capacity standards compared to prior years.
3				(4,573)	Decrease in the amount of gas distribution SCADA devices installed compared to prior years.
4	**2017**	**53,273**	**28,712**	**24,561**	
5			(2,616)		Decrease in the amount of gas distribution capacity work needed to maintain design day capacity standards compared to prior years.
6				(168)	Decrease in the amount of gas distribution SCADA devices installed compared to prior years.
7	**2018**	**50,488**	**26,095**	**24,393**	
8			10,515		Increase in gas distribution main replacement and regulator station rebuilds and replacements compared to prior years.
9				3,414	Increase in the amount of gas distribution SCADA devices installed compared to prior years.
10	**2019**	**64,417**	**36,610**	**27,807**	
11			(1,216)		Decrease in the amount of gas distribution capacity work needed to maintain design day capacity standards compared to prior years.
12				7	Immaterial change in cost.
13	**2020**	**63,208**	**35,394**	**27,815**	

Note: Total amounts and amounts for each MWC are obtained from WP 11-37 by summing the relevant lines for each MWC.

Workpaper Table 11-58
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Capital Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 47	MWC 4A	Variance Greater Than $1M?	Variance %	Variance Greater Than or Equal to 5%	Variance Greater Than or Equal to 10%	Variance Required Y/N	Detailed Description/Explanation
1	**2020**	**63,208**	**35,394**	**27,815**						
2			3,677		Yes	10%	Yes	Yes	Yes	Increase due to forecast escalation and the replacement/rebuild of additional regulator stations compared to prior years.
3				(907)	No	-3%	No	No	No	Immaterial change in cost.
4	**2021**	**65,979**	**39,071**	**26,908**						
5			(4,707)		Yes	-12%	Yes	Yes	Yes	Decrease in the amount of distribution capacity projects necessary to operate the system.
6				1,814	Yes	7%	Yes	No	No	Immaterial change in cost.
7	**2022**	**63,086**	**34,364**	**28,722**						
8			6,242		Yes	18%	Yes	Yes	Yes	Increase due to forecast escalation and the replacement/rebuild of additional regulator stations compared to prior years.
9				(5,452)	Yes	-19%	Yes	Yes	Yes	Decrease in the amount of distribution SCADA remote terminal units to be installed compared to prior years.
10	**2023**	**63,876**	**40,607**	**23,270**						
11			1,089		Yes	3%	No	No	No	Immaterial change in cost.
12				624	No	3%	No	No	No	Immaterial change in cost.
13	**2024**	**65,589**	**41,696**	**23,893**						
14			1,090		Yes	3%	No	No	No	Immaterial change in cost.
15				(365)	No	-2%	No	No	No	Immaterial change in cost.
16	**2025**	**66,314**	**42,786**	**23,529**						
17			1,118		Yes	3%	No	No	No	Immaterial change in cost.
18				(20,427)	Yes	-87%	Yes	Yes	Yes	Decrease in the amount of distribution SCADA remote terminal units to be installed compared to prior years as the program comes to an end.
19	**2026**	**47,006**	**43,904**	**3,102**						

Note: Total amounts and amounts for each MWC are obtained from WP 11-37 by summing the relevant lines for each MWC.

Workpaper Table 11-59
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Capital Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 73	MWC 76	Detailed Description/Explanation
1	**2016**	**79,634**	**78,923**	**711**	
2			29,072		Increase in project related costs of the Line 407 Installation project
3				163	Increase in the volume of transmission SCADA remote terminal units installed
4	**2017**	**108,869**	**107,995**	**874**	
5			(83,059)		Decrease due to the project closeout of the Line 407 installation project.
6				618	Increase in the volume of transmission SCADA remote terminal units installed
7	**2018**	**26,427**	**24,936**	**1,492**	
8			(16,793)		Decrease due to lower transmission capacity work necessary to meet design day capacity standards.
9				930	Increase in the volume of transmission SCADA remote terminal units installed
10	**2019**	**10,564**	**8,143**	**2,422**	
11			1,912		Increase due to transmission related capacity work identified.
12				757	Increase in the volume of transmission SCADA remote terminal units installed
13	**2020**	**13,233**	**10,054**	**3,179**	

Note: Total amounts and amounts for each MWC are obtained from WP 11-37 by summing the relevant lines for each MWC.

Workpaper Table 11-60
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit 3, Chapter 11, Gas System Operations
Capital Walk by Major Work Category - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 73	MWC 76	Detailed Description/Explanation
1	**2020**	**13,233**	**10,054**	**3,179**	
2			14,204		Increase in gas transmission new capacity load growth projects.
3				843	Increase in Gill Ranch Storage capital expenditures and SCADA remote terminal unit (RTU) installations
4	**2021**	**28,280**	**24,258**	**4,021**	
5			(14,575)		Decrease in gas transmission new capacity load growth projects required.
6				183	Immaterial change in cost.
7	**2022**	**13,887**	**9,683**	**4,204**	
8			(478)		Immaterial change in cost.
9				(535)	Decrease in the amount of SCADA RTUs that are forecast to be installed compared to prior years.
10	**2023**	**12,875**	**9,205**	**3,669**	
11			240		Immaterial change in cost.
12				93	Immaterial change in cost.
13	**2024**	**13,208**	**9,446**	**3,763**	
14			247		Immaterial change in cost.
15				95	Immaterial change in cost.
16	**2025**	**13,550**	**9,692**	**3,858**	
17			245		Immaterial change in cost.
18				95	Immaterial change in cost.
19	**2026**	**13,890**	**9,937**	**3,953**	

Note: Total amounts and amounts for each MWC are obtained from WP 11-37 by summing the relevant lines for each MWC.

Pages WP 11-63 to 11-65 have been withdrawn

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Deferred Work Analysis

The Gas Distribution deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work;

Check 2a: *The work is measured by units of work.*

Check 2b: PG&E expects to perform fewer of such units during the 2020-2022 period.

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

Line								Check 2					Units Comparison			Dollar Comparison		
1																		
2	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 1	*Check 2a*	*Check 2b*	Check 3	Deferred Work	Explanation	2020 Rec. Adj. + 2021 to 2022 Forecast	2020 to 2022 Imputed	Difference	2020 Rec. Adj. + 2021 to 2022 Forecast (A)	2020 to 2022 Imputed	Difference
3	11	Capital	47	47C	Gas Capacity, Regulator Station	# of reg station	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	12	18	(6)	$ 12,067,593	$ 22,777,035	$ (10,709,442)
4	11	Capital	47	47F	Gas Capacity, Other Enhancements	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 57,369	$ 880,366	$ (822,998)
5	11	Capital	47	47D	Gas Capacity, Replace Regulator Station Component	# of Reg station components	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	21	30	(9)	$ 1,353,223	$ 1,483,715	$ (130,492)
6	11	Capital	47	47B	Gas Capacity, Mains	feet of main	Y	Y	Y	N	N	No deferred work - Work is demand-driven.	141,172	147,291	(6,119)	$ 95,350,568	$ 94,424,415	$ 926,153
7	11	Capital	4A	4A#	SCADA Support	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - MAT 4A# funds work related to integrating SCADA into the Gas Distribution Control Center. No capital work has materialized for this activity during the 2020-2022 GRC period. PG&E is not forecasting expenditures for MAT 4A# in the 2023 GRC.	-	-	-	$ (7,089)	$ 1,516,195	$ (1,523,284)
8	11	Capital	4A	4AF	Install ERX Pressure Monitoring Device	# of Electronic pressure recorders	Y	Y	N	N	N	No deferred work - PG&E expects to install more ERXs compared to imputed due to system need.	70	57	13	$ 2,592,483	$ 1,709,325	$ 883,158
9	11	Capital	4A	4AM	Reg Stat Mntr Dual No Flow Type 3	# of remote terminal units	Y	Y	Y	Y	Y	Yes deferred work - See discussion in Exhibit (PG&E-3), Chapter 11.	330	366	(36)	$ 80,858,974	$ 87,274,501	$ (6,415,526)
10	11	Expense	DE	DEH	Distribution Capacity Uprates	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	$ 12,980,201	$ -	$ 12,980,201
11	11	Expense	FG	FGB	Operate Distribution Mains and Services	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 2,887,779	$ 3,224,668	$ (336,888)
12	11	Expense	FG	FGC	Operate Distribution Regulator General	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and demand-driven.	-	-	-	$ 585,997	$ 751,812	$ (165,814)
13	11	Expense	FG	FG#	Operate Gas Distribution System, Other	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	$ (541)	$ -	$ (541)
14	11	Expense	FG	FGA	Gas Distribution Control Center	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - This MAT is staffing related.	-	-	-	$ 24,343,498	$ 23,551,420	$ 792,077
15	11	Expense	GG	GGA	Gas System Planning - GSO	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - This MAT is staffing related.	-	-	-	$ 19,055,396	$ 14,284,988	$ 4,770,408
16	11	Expense	GG	GG#	Gas Engineering, Other	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - This MAT is staffing related.	-	-	-	$ 5,977,486	$ 4,895,241	$ 1,082,245
17															**Expense Total**	$ 65,829,817	$ 46,708,129	$ 19,121,688
18															**Capital Total**	$ 192,273,121	$ 210,065,552	$ (17,792,431)

19 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023
20 GRC forecast process.

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 11
Deferred Work Analysis

The Gas Transmissiondeferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks listed below.

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work;

Check 2a: *The work is measured by units of work.*

Check 2b: *PG&E expects to perform fewer of such units during the 2019-2022 period.*

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

Line								Check 2					Units Comparison			Dollar Comparison		
1																		
2	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 1	*Check 2a*	*Check 2b*	Check 3	Deferred Work	Explanation	2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast	2019 to 2022 Imputed	Difference	2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast (A)	2019 to 2022 Imputed	Difference
3	11	Capital	73	73B	Capacity Betterment	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - This MAT is non-unitized and demand driven.	-	-	-	$ 3,381,625	$ 6,235,096	$ (2,853,471)
4	11	Capital	73	73A	Capacity for Load Growth	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - This MAT is non-unitized and demand driven.	-	-	-	$ 48,757,016	$ 36,762,173	$ 11,994,843
5	11	Capital	76	76M	GT SCADA Visibility	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 8,873,553	$ 12,043,819	$ (3,170,266)
6	11	Capital	76	762	Gill Ranch Capital	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 4,952,074	$ 5,567,333	$ (615,259)
7	11	Expense	AH	AH4	Gill Ranch Operations & Maintenance	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 11,900,835	$ 11,195,058	$ 705,778
8	11	Expense	CM	CMA	GT&S Operations	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - This MAT is staffing related.	-	-	-	$ 58,616,742	$ 70,008,383	$ (11,391,641)
9	11	Expense	CM	CMB	Electric Power for Gas Compressors	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 107,738,884	$ 88,671,537	$ 19,067,347
10	11	Expense	CX	CXA	GT&S Marketing, Sales & Strategy	Non-Unitized	N	N	N/A	N/A	N	No deferred work - This MAT is staffing related.	-	-	-	$ 21,614,076	$ 23,058,965	$ (1,444,889)
11	11	Expense	JT	JTM	GT Capacity Uprates	Miles	Y	Y	N	N	N	No deferred work - PG&E completed 12.1 miles of capacty uprates in 2020, exceeding the imputed units.	12.57	8.00	4.6	$ 5,554,635	$ 25,674,221	$ (20,119,586)
12															**Expense Total**	$ 205,425,172	$ 218,608,163	$ (13,182,992)
13															**Capital Total**	$ 65,964,268	$ 60,608,421	$ 5,355,847

14 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further
15 information about the 2023 GRC forecast process.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony _____ **Workpapers** ____X____ **SOQ** _____

Exhibit Number: ____3____ **Chapter Number:** ____11____

Chapter Title: **Gas System Operations**

Witness Name: **Daniel Menegus**

Page No.	Line No.	Item	As Filed	As Corrected
WP 11-1	Table 11-1	1. Updated forecast to reflect post-filing errata	1. Replaced in its entirety	1. See replaced Table 11-1
WP 11-2	Table 11-2	2. Updated forecast to reflect post-filing errata	2. Replaced in its entirety	2. See replaced Table 11-2
WP 11-3	Table 11-3	3. Updated forecast to reflect post-filing errata	3. Replaced in its entirety	3. See replaced Table 11-3
WP 11-4	Table 11-4	4. Updated forecast to reflect post-filing errata	4. Replaced in its entirety	4. See replaced Table 11-4
WP 11-32	Table 11-32, Line 3	5. Correction of typos made in sentence structure.	5. Increase in gas system planning engineering staff to plan system operations for the increased number of safety clearance work performed. Also driven by increased electricity costs necessary for to operate PG&E's gas compressor stations.	5. Increase in gas system planning engineering staff to plan system operations for the increased number of safety clearance work performed. Also driven by increased electricity costs necessary to operate PG&E's gas compressor stations.

WP 11-32	Table 11-32, Line 7	6. Correction of typos made in sentence structure.	6. Increase in gas system planning engineering staff to plan system operations for the greatly increased number of safety clearance work performed on the gas distribution system and increased electricity costs for to operate PG&E's gas compressor stations.	6. Increase in gas system planning engineering staff to plan system operations for the greatly increased number of safety clearance work performed on the gas transmission system and increased electricity costs to operate PG&E's gas compressor stations.
WP 11-48	Table 11-48, Line 2	7. Revision of workpaper cost estimating methodology explanation to align with testimony.	7. Cost Estimating Methodology: MAT 73B was forecast using a two-year average of 2021 and 2022 forecast costs plus escalation to 2023.	7. Cost Estimating Methodology: PG&E used the sum of the 2021-2022 adopted/imputed forecast, escalated, divided by four to represent flat costs related to forecast MAT 73B projects over the 2023-2026 GRC period.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 12, GAS TECHNOLOGY

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PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 12, GAS TECHNOLOGY

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(CONTINUED)

Table 12-1
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12
Gas Technology
Expenses by Major Work Category
(Thousands of Nominal Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	JV	Maintain IT Apps & Infra	23,799	24,795	25,850	12,399	14,584	15,204	17,211	15,578	
2	KE	GT PL Safety Enhance Plan-Exp	4,301								
3	**Total**		**28,100**	**24,795**	**25,850**	**12,399**	**14,584**	**15,204**	**17,211**	**15,578**	WP 12-5 Line 18

Notes: (A) Line 3, 2022 and 2023 Forecast vary from the values listed in Testimony due to errata. These amounts align to the Results of Operations (RO) model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 12-2
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12
Gas Technology
Expenses by Major Work Category
(Thousands of Base Year Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	JV	Maintain IT Apps & Infra	25,496	25,758	25,943	12,248	14,584	15,056	16,574	14,567
2	KE	GT PL Safety Enhance Plan-Exp	4,541							
3	**Total**		**30,037**	**25,758**	**25,943**	**12,248**	**14,584**	**15,056**	**16,574**	**14,567**

Table 12-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12
Gas Technology
Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	JV	JV8	ISvcs: Data Center (non-LAN)	(45)								
2		JVA	ISvcs: Wrkplce End User SW Ste	20,474	23,877	21,477	9,689	11,233	12,104	15,211	13,578	
3		JVT	ASvcs: Applications Support	2,563	918	4,372	2,711	3,351				
4		JV#	Information Technology Other	807					3,100	2,000	2,000	
5	**JV Total**			**23,799**	**24,795**	**25,850**	**12,399**	**14,584**	**15,204**	**17,211**	**15,578**	
6	KE	KE5	PSEP	4,301								
7	**KE Total**			4,301								
8	**Total**			**28,100**	**24,795**	**25,850**	**12,399**	**14,584**	**15,204**	**17,211**	**15,578**	

Notes: (A) Line 8, 2022 and 2023 Forecast vary from the values listed in Testimony due to errata. These amounts align to the Results of Operations (RO) model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 12-4
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12
Gas Technology
Expenses by MAT Code
(Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	JV	JV8	ISvcs: Data Center (non-LAN)	(48)							
2		JVA	ISvcs: Wrkplce End User SW Ste	21,858	24,794	21,564	9,554	11,233	11,982	14,645	12,694
3		JVT	ASvcs: Applications Support	2,775	964	4,379	2,694	3,351			
4		JV#	Information Technology Other	910					3,074	1,928	1,873
5	**JV Total**			**25,496**	**25,758**	**25,943**	**12,248**	**14,584**	**15,056**	**16,574**	**14,567**
6	KE	KE5	PSEP	4,541							
7	**KE Total**			**4,541**							
8	**Total**			**30,037**	**25,758**	**25,943**	**12,248**	**14,584**	**15,056**	**16,574**	**14,567**

Workpaper Table 12-5
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 12, Gas Technology
Summary of Expenses

Gas Distribution Expense

Line No.	Description	MWC	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference
1	Asset Management and Risk Analysis	JV	13,449,354	13,847,517	10,626,801	5,432,245	5,825,008	11,451,470	13,375,976	11,957,939	WP 12-19
2	Event Management	JV	1,240,783	568,685	40,272	288,218	797,213	138,000	225,000	225,000	WP 12-27
3	Field Work Management	JV	3,191,241	3,228,325	2,746,288	2,038,859	2,304,641	138,000	225,000	225,000	WP 12-30
4	System Operation and Control	JV	491,165	225,112	787,798	1,003,780	1,177,419	110,400	180,000	180,000	WP 12-36
5	Energy Management	JV	72,809	-	-	-	95,991	-	-	-	
6	Enterprise Resource Management	JV	49,399	35,600	-	-	-	-	-	-	
7	Customer Service	JV	-	305,447	91,172	-	-	-	-	-	
8	**Total Distribution Expenses**		**18,494,751**	**18,210,685**	**14,292,332**	**8,763,101**	**10,200,272**	**11,837,870**	**14,005,976**	**12,587,939**	

Gas Transmission Expense

Line No.	Description	MWC	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference
9	Asset Management and Risk Analysis	JV	3,952,842	4,736,039	10,295,623	2,534,795	2,950,611	3,108,143	2,784,794	2,569,838	WP 12-19
10	Event Management	JV	45,848	-	-	10,296	88,153	92,000	150,000	150,000	WP 12-27
11	Field Work Management	JV	966,786	17,979	-	-	435,614	92,000	150,000	150,000	WP 12-30
12	System Operation and Control	JV	267,908	611,617	767,919	888,593	909,551	73,600	120,000	120,000	WP 12-36
13	Energy Management	JV	4,538	97,486	-	171,068	-	-	-	-	
14	Enterprise Resource Management	JV	64,916	1,121,462	493,821	-	-	-	-	-	
15	Safety, Governance, Regulatory, and Compliance	JV	1,096	-	-	31,585	-	-	-	-	
16	Safety, Governance, Regulatory, and Compliance	KE	4,273,159	-	-	-	-	-	-	-	
17	**Total Transmission Expenses**		**9,577,091**	**6,584,584**	**11,557,362**	**3,636,337**	**4,383,929**	**3,365,743**	**3,204,794**	**2,989,838**	

Total Expense

Line No.	Description	MWC	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast
18	**Total Expenses**	All	**28,071,842**	**24,795,268**	**25,849,694**	**12,399,438**	**14,584,202**	**15,203,613**	**17,210,770**	**15,577,777**

Workpaper Table 12-6
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 12, Gas Technology
Expense Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC JV	Detailed Description/Explanation
1	**2016**	**18,495**	**18,495**	
2			(284)	N/A
3	**2017**	**18,211**	**18,211**	
4			(3,918)	Expense includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Increase due to an increase for NPAEs which added $1.5M to the actuals as well as an increase for the AMBBS Recovery Program - $3.7M.
5	**2018**	**14,292**	**14,292**	
6			(5,529)	Expense includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to decreases in multiple projects. Includes the iGPS project by $1.2M, the AMBBS Recovery Program by $2.4M, and three other projects totaling $2.4M (NPAEs, PAR Flags, and PS&D).
7	**2019**	**8,763**	**8,763**	
8			1,437	Expense includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Increase due to increases in the actuals for Mobile Pronto Forms ($586k) and CC&B syncing and Address Cleanup ($956k) totaling $1.5M.
9	**2020**	**10,200**	**10,200**	

Note: Total amounts and amounts for each MWC are obtained from WP 12-5 by summing the relevant lines for each MWC.

Workpaper Table 12-7
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 12, Gas Technology
Expense Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC JV	Detailed Description/Explanation
1	**2020**	**10,200**	**10,200**	
2			1,638	Expense includes a change in the portfolio of Gas Tech and Gas IT projects year over year. Increase due to development of Alignment of Asset to LiDAR project, increasing investment in Customer meter address cleanup effort as well as increasing investment in Mobile As-Builts digitization effort for distribution pipeline.
3	**2021**	**11,838**	**11,838**	
4			2,168	Expense includes a change in the portfolio of Gas Tech and Gas IT projects year over year. Increase due to further investment in development and deployment Mobile As-Builts for distribution pipeline, development of workflow automation to modernize the corrosion process as well as adding investment in improving Gas Distribution GIS data quality and syncing up with the SCADA data repository.
5	**2022**	**14,006**	**14,006**	
6			(1,418)	Expense includes a change in the portfolio of IT projects year over year.
7	**2023**	**12,588**	**12,588**	

Note: Total amounts and amounts for each MWC are obtained from WP 12-5 by summing the relevant lines for each MWC.

Workpaper Table 12-8
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 12, Gas Technology
Expense Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC JV	MWC KE	Detailed Description/Explanation
1	**2016**	**9,577**	**5,304**	**4,273**	
2			1,281		Expense includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Increase due to the addition of the AMBBS Recovery Program which added $3M to the actuals.
3				(4,273)	Expense includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to the end of the Mariner Program.
4	**2017**	**6,585**	**6,585**	**0**	
5			4,973		Expense includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Increase due to an increase for NPAEs which added $1.5M to the actuals as well as an increase for the AMBBS Recovery Program which increased the actuals by $3.7M.
6				0	N/A
7	**2018**	**11,557**	**11,557**	**0**	
8			(7,921)		Expense includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a decrease of several projects. AMBBS Recovery Program reduced the actuals by $5.5M; NPAEs by $1.1M, and Project Governance & Controls and PS&D projects by $1.1M.
9				0	N/A
10	**2019**	**3,636**	**3,636**	**0**	
11			748		Immaterial change in cost.
12				0	N/A
13	**2020**	**4,384**	**4,384**	**0**	

Note: Total amounts and amounts for each MWC are obtained from WP 12-5 by summing the relevant lines for each MWC.

Workpaper Table 12-9
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 12, Gas Technology
Expense Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC JV	MWC KE	Detailed Description/Explanation
1	**2020**	**4,384**	**4,384**	**0**	
2			(1,018)		Expense includes a change in the portfolio of Gas Tech and Gas IT projects year over year. Decrease due to spreading Gas Pipeline Operations and Maintenance project to multiple years, reducing Next Generation GIS Migration Proof of Concept spending as well as consolidation of SCADA infrastructure project.
3				0	N/A
4	**2021**	**3,366**	**3,366**	**0**	
5			(161)		Immaterial change in cost.
6				0	N/A
7	**2022**	**3,205**	**3,205**	**0**	
8			(215)		Immaterial change in cost.
9				0	N/A
10	**2023**	**2,990**	**2,990**	**0**	

Note: Total amounts and amounts for each MWC are obtained from WP 12-5 by summing the relevant lines for each MWC.

Table 12-10
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 12
Gas Technology
Capital Expenditures by Major Work Category
(Thousands of Nominal Dollars)

			Capital Expenditures											
No.	MWC	MWC Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	2F	Build IT Apps & Infra	49,030	24,831	15,690	8,774	19,773	27,801	22,556	22,999	23,454	23,921	24,401	
2		**Grand Total**	**49,030**	**24,831**	**15,690**	**8,774**	**19,773**	**27,801**	**22,556**	**22,999**	**23,454**	**23,921**	**24,401**	WP 12-14 Line 18

Table 12-11
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 12
Gas Technology
Forecast Capital Expenditures Summary
(Thousands of Nominal Dollars)

		Capital Expenditures							
Line No.	Description	2020 CWIP	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	Projects > $3 Million*	6,562	27,801	22,556	22,999	23,454	23,921	24,401	
2	Other Work	23,223	-	-	-	-	-	-	
3	**Total**	**29,786**	**27,801**	**22,556**	**22,999**	**23,454**	**23,921**	**24,401**	WP 12-14, Line 18
4	* Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.								

Table 12-12
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 12
Gas Technology
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over $3 Million*
(Thousands of Nominal Dollars)

					CWIP	Capital Expenditures						
Line No.	Planning Order	Description	MWC	Operative Date	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Subtotal
	MWC - 2F	**Build IT Apps & Infra**										
1	5515290	FORECAST ONLY - 2FA - GT	2F		-	8,638	-	-	-	-	-	8,638
2	5515319	FORECAST ONLY - 2FA - GD ONLY	2F		-	7,223	-	-	-	-	-	7,223
3	5524284	Gas SCADA Network Improvements(Trans Cap	2F		6,562	-	-	-	-	-	-	6,562
4	5793163	Field Work Management_GO (C)	2F	Dec-2020	-	1,791	900	900	900	900	900	6,291
5	5793164	Event Management_GO (C)	2F	Dec-2020	-	1,791	900	900	900	900	900	6,291
6	5793169	Asset Mgt & Risk Analysis_GO_R (C)	2F	Dec-2020	-	2,149	1,080	1,080	1,080	1,080	1,080	7,549
7	5793172	System Operation & Ctrl_GO_R (C)	2F	Dec-2020	-	1,433	720	720	720	720	720	5,033
8	5793259	Field Work Management_GO (C)	2F		-	1,194	600	600	600	600	600	4,194
9	5793260	Event Management_GO (C)	2F		-	1,194	600	600	600	600	600	4,194
10	5793265	Asset Mgt & Risk Analysis_GO_R (C)	2F		-	1,433	720	720	720	720	720	5,033
11	5793268	System Operation & Ctrl_GO_R (C)	2F		-	955	480	480	480	480	480	3,355
12	5793313	2023 GRC GD Technology	2F		-	-	1,706	1,751	1,798	1,846	1,896	8,997
13	5793314	2023 GRC GT Technology	2F		-	-	1,721	1,767	1,814	1,863	1,912	9,077
14	5794507	2023 GRC Asset Mgt&Risk Analysis_GD (C)	2F		-	-	5,713	5,866	6,023	6,184	6,349	30,134
15	5794523	2023 GRC Asset Mgt&Risk Analysis_GT (C)	2F		-	-	7,417	7,615	7,819	8,028	8,243	39,123
16	**Total**				**6,562**	**27,801**	**22,556**	**22,999**	**23,454**	**23,921**	**24,401**	**151,694**
17		**Grand Total**			**6,562**	**27,801**	**22,556**	**22,999**	**23,454**	**23,921**	**24,401**	**151,694**

18 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Table 12-13
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 12
Gas Technology
Recorded and Forecast Capital Expenditures Details - Other Work*
(Thousands of Nominal Dollars)

			Capital Expenditures										
Line No.	MWC	MWC Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast
1	2F	Build IT Apps & Infra	49,030	24,349	12,223	7,709	18,226	-	-	-	-	-	-
2	**Grand Total**		**49,030**	**24,349**	**12,223**	**7,709**	**18,226**	**-**	**-**	**-**	**-**	**-**	**-**

3 * Excludes projects greater than $3M

Workpaper Table 12-14
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 12, Gas Technology
Summary of Capital Expenditures

Gas Distribution Capital Expenditures

Line No.	Description	MWC	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	Reference
1	Asset Management and Risk Analysis	2F	2,933,311	862,103	782,177	903,959	2,619,334	9,372,292	8,498,344	8,696,917	8,900,804	9,110,150	9,325,099	36,032,970	WP 12-19
2	Event Management	2F	1,148,719	(311)	-	199,927	696,967	1,791,000	900,000	900,000	900,000	900,000	900,000	3,600,000	WP 12-27
3	Field Work Management	2F	9,830,804	3,824,611	950,729	34,237	4,750,483	1,791,000	900,000	900,000	900,000	900,000	900,000	3,600,000	WP 12-30
4	System Operation and Control	2F	13,236,745	5,796,224	4,391,089	2,462,978	3,945,865	1,432,800	720,000	720,000	720,000	720,000	720,000	2,880,000	WP 12-36
5	Energy Management	2F	-	-	-	-	482,126	-	-	-	-	-	-	-	
6	Safety, Governance, Regulatory, and Compliance	2F	143,718	770,389	413,380	101,525	-	-	-	-	-	-	-	-	
7	Enterprise Resource Management	2F	1,201,973	-	696,558	236,860	10,213	-	-	-	-	-	-	-	
8	Customer Service	2F	-	715	11	-	-	-	-	-	-	-	-	-	
9	**Total Distribution Capital Expenditures**		**28,495,269**	**11,253,730**	**7,233,945**	**3,939,486**	**12,504,989**	**14,387,092**	**11,018,344**	**11,216,917**	**11,420,804**	**11,630,150**	**11,845,099**	**46,112,970**	

Gas Transmission Capital

Line No.	Description	MWC	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	Reference
10	Asset Management and Risk Analysis	2F	8,412,842	3,516,867	814,604	1,232,998	930,515	10,070,300	9,857,500	10,102,090	10,353,228	10,611,088	10,875,851	41,942,258	WP 12-19
11	Event Management	2F	85,411	-	-	93,337	672,773	1,194,000	600,000	600,000	600,000	600,000	600,000	2,400,000	WP 12-27
12	Field Work Management	2F	1,144,344	1,740,833	29,023	-	1,955,714	1,194,000	600,000	600,000	600,000	600,000	600,000	2,400,000	WP 12-30
13	System Operation and Control	2F	10,329,133	5,882,079	6,327,233	3,372,602	3,703,093	955,200	480,000	480,000	480,000	480,000	480,000	1,920,000	WP 12-36
15	Energy Management	2F	-	1,387,491	5,492	-	-	-	-	-	-	-	-	-	
14	Safety, Governance, Regulatory, and Compliance	2F	-	18,367	646,777	4,239	-	-	-	-	-	-	-	-	
16	Enterprise Resource Management	2F	563,268	1,031,647	632,474	131,412	5,674	-	-	-	-	-	-	-	
17	**Total Transmission Capital Expenditures**		**20,534,998**	**13,577,285**	**8,455,604**	**4,834,589**	**7,267,769**	**13,413,500**	**11,537,500**	**11,782,090**	**12,033,228**	**12,291,088**	**12,555,851**	**48,662,258**	

Total Capital Expenditure

Line No.	Description	MWC	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026
18	**Total Capital Expenditures**	All	**49,030,267**	**24,831,015**	**15,689,549**	**8,774,074**	**19,772,758**	**27,800,592**	**22,555,844**	**22,999,007**	**23,454,033**	**23,921,238**	**24,400,950**	**94,775,228**

Workpaper Table 12-15
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 12, Gas Technology
Capital Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC 2F	Detailed Description/Explanation
1	**2016**	**28,495**	**28,495**	
2			(17,242)	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to multiple projects with high actuals. Gas Radios - $5.7M, Picarro purchase - $3.3M, Video Wall - $2.7M, Locate & Mark - $2.3M, GEOMart - $1.6M, GD GIS Phase II - $1.3M, and TAMI - $1.1M.
3	**2017**	**11,254**	**11,254**	
4			(4,020)	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a few projects with high actuals. Picarro purchase - $2.3M, EM tool - $1.4M, and GDCC Enhancements - $632k.
5	**2018**	**7,234**	**7,234**	
6			(3,294)	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a few projects with high actuals. Gas Radios - $1.2M, EM Tool - $1.6M, and Heavy Bid to SAP - $920k.
7	**2019**	**3,939**	**3,939**	
8			8,566	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Increase due to multiple projects with high actuals. Inspect and Engage 2.0 - $2.7M, LocusView - $1.4M, ABB Service Suite Upgrade iOS - $1.1M, Materials Traceability - $1.1M, along with several under a million; CONSTRUCT GD RELEASE 2.0 - $647k, GPOM - $674k, GD GIS Upgrade - $639k, and Transaction Sys Framewrk Upgrd - $482k.
9	**2020**	**12,505**	**12,505**	

Note: Total amounts and amounts for each MWC are obtained from WP 12-14 by summing the relevant lines for each MWC.

Workpaper Table 12-16
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 12, Gas Technology
Capital Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC 2F	Detailed Description/Explanation
1	**2020**	**12,505**	**12,505**	
2			1,882	Capital includes a change in the portfolio of Gas Tech and Gas IT projects year over year. Increase due to Major 3G to 4G Upgrades in Remote Measurement Device Infrastructure, Major building an Operator Training Simulator Platform for the Gas Operations Center as well as investment in CPUC 3-Year Leak Survey
3	**2021**	**14,387**	**14,387**	
4			(3,369)	Capital includes a change in the portfolio of Gas Tech and Gas IT projects year over year.
5	**2022**	**11,018**	**11,018**	
6			199	Immaterial change in cost.
7	**2023**	**11,217**	**11,217**	
8			204	Immaterial change in cost.
9	**2024**	**11,421**	**11,421**	
10			209	Immaterial change in cost.
11	**2025**	**11,630**	**11,630**	
12			215	Immaterial change in cost.
13	**2026**	**11,845**	**11,845**	

Note: Total amounts and amounts for each MWC are obtained from WP 12-14 by summing the relevant lines for each MWC.

Workpaper Table 12-17
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 12, Gas Technology
Capital Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC 2F	Detailed Description/Explanation
1	**2016**	**20,535**	**20,535**	
2			(6,958)	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a few projects with lower actuals. AMBBS Enhancements - $3.4M, IM Data Loader - $2M, and GEOMart - $1.5M.
3	**2017**	**13,577**	**13,577**	
4			(5,122)	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a few projects with lower actuals. GT GIS Upgrade - $1.9M, Cross Bore Inspection - $1.7M, and Online Pipeline Simulator - $1.6M.
5	**2018**	**8,456**	**8,456**	
6			(3,621)	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to two projects with lower actuals. SCADA Network Improvements - $2.4M and Predictive Health Analytics - $1.2M.
7	**2019**	**4,835**	**4,835**	
8			2,433	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Increase due to two projects with high actuals. GPOM - $2M, SCADA Network Improvements - $482k
9	**2020**	**7,268**	**7,268**	

Note: Total amounts and amounts for each MWC are obtained from WP 12-14 by summing the relevant lines for each MWC.

Workpaper Table 12-18
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 12, Gas Technology
Capital Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Line No.	Year	Amount	MWC 2F	Detailed Description/Explanation
1	**2020**	**7,268**	**7,268**	
2			6,146	Capital includes a change in the portfolio of Gas Tech and Gas IT projects year over year. Increase due to Major 3G to 4G Upgrades in Remote Measurement Device Infrastructure, Major building an Operator Simulator Platform for the Gas Operations Center as well as major field workforce iPAD device lifecyle deployment
3	**2021**	**13,414**	**13,414**	
4			(1,876)	Capital includes a change in the portfolio of Gas Tech and Gas IT projects year over year.
5	**2022**	**11,538**	**11,538**	
6			245	Immaterial change in cost.
7	**2023**	**11,782**	**11,782**	
8			251	Immaterial change in cost.
9	**2024**	**12,033**	**12,033**	
10			258	Immaterial change in cost.
11	**2025**	**12,291**	**12,291**	
12			265	Immaterial change in cost.
13	**2026**	**12,556**	**12,556**	

Note: Total amounts and amounts for each MWC are obtained from WP 12-14 by summing the relevant lines for each MWC.

PACIFIC GAS AND ELECTRIC COMPANY
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12, Gas Technology
Program Summary: Asset Management & Risk Analysis

Value Stream Program: Asset Management & Risk Analysis
Major Work Categories: JV & 2F
Planning Order Numbers: Expense Distribution: 5055000, 5272413, 5055634, 5054910; Expense Transmission: 5055396, 5272429, 5055657, 5054911; Capital Distribution: 5793169, 5794507, 5793313; Capital Transmission: 5793265, 5794523, 5793314;
Project Start Date: 2023
Project Completion Date: 2026
Operative Date: Various

Program Description

The Asset Management and Risk Analysis value stream focuses on technology solutions used to manage the lifecycle of utility assets; to track their location, condition, specifications, and relationships to other assets; and to understand and manage asset-related risks. Gas Technology's main focus on work in the Asset Management and Risk Analysis Management's include:

- Providing visibility of assets through map-based field information and real-time asset situational awareness;
- Optimizing the planning, upkeep, and replacement of assets based on data-driven analytics and risk assessments of asset failure;
- Meeting grid interconnection compliance requirements and customer needs; and
- Working with various stakeholders (e.g., other utilities, telecom companies) to ensure that shared utility assets are accurately designed and appropriately loaded.

The work described in this value stream portfolio summary addresses the targeted needs of Gas Technology. In the next rate cycle, this work will also support the switch to a more regionalized business operations model. Asset Management & Risk Analysis technology investment is also implemented at the enterprise level and this work is described in Exhibit 7, chapter 8. Examples of projects Gas Operations is pursuing in this value stream include:

Project: G-D-0001 Land Base Re-alignment or QC project in Gas Operations

The project will interactively adjust Gas Distribution features in Gas Distribution Geographic Information System (GD GIS) with the goal of gaining proper spatial placement relative to the PG&E Enterprise land base. This land base is updated on an annual basis, and therefore the Gas Distribution features in GD GIS will need to be adjusted on an annual basis.

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Program Summary: Asset Management & Risk Analysis

Justification

Data will be out-of-sync if the land base and gas distribution features in GD GIS are not adjusted on an annual basis.

Benefits

This project provides increased safety through the improved spatial accuracy of Gas Distribution asset data.

Alternatives Considered

Do nothing. This is not a viable option. Without annual updating of the Gas Distribution features in GD GIS, this project will result in gas asset data in GD GIS that does not align with land base data, misrepresenting gas assets on the map for all end users.

Project: G-D-0002 Customer Care & Billing (CC&B) Syncing

Gas Operations employees are required to find and evaluate gas distribution meter information based on geographic location. PG&E stores meter data in the Customer Care & Billing (CC&B) system. PG&E's Gas Distribution Geographic Information System (GD GIS) stores geographic asset information leading up to the meter location but does not include detailed meter data.

There is an effort underway to reconcile locational data between GD GIS and CC&B to improve the accuracy of accessible meter data and to establish a digital join between the two datasets. The purpose of the CC&B Syncing Updates project is to maintain the synchronization between the two systems as meters are added and retired.

Justification

Without synchronization between CC&B meter data and GD GIS service location data, it is difficult to accurately identify which gas customers are within a geographic area or along a specific portion of the gas distribution network. The ability to generate impacted customer lists is an important safety factor for emergency events, for planning and engineering, and for asset maintenance and inspection. This is also important for customer service to prevent visits to the same location multiple times in a short period of time, impacting customers unnecessarily.

Benefits

Benefits of synchronized meter data between CC&B and GD GIS include:

- Ability to quickly identify affected customers in emergency and outage situations based on geographic area or by connectivity to the gas distribution network in GD GIS.
- Provides a single point of access for all data regarding meter location and installation.

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Program Summary: Asset Management & Risk Analysis

- Ability for engineering, integrity management, planning, and field workers to retrieve customer counts and meter data such as meter manufacturer and installation date based on geographic location.
- Improved precision of risk assessment of meter sets and customer-connected equipment.
- Helps to identify unmapped assets, thus increasing public safety by allowing for timely and accurate locating and marking.
- Better understanding of how many meters are associated with each service location to normalize above ground leaks.

Alternatives Considered

Do nothing. This option does not allow for the reporting that is required in emergency situations, nor does it allow for a single point of access for all data pertaining to meter location and installation.

Project: G-T-0002 Data Systems Improvement TIMP

The Transmission Integrity Management Program (TIMP) has the following needs for data systems improvement. These capabilities are under the Stewardship of the Federal Monitors and subject to annual California Public Utilities Commission (CPUC) audits.

1. Extend development of TCAT (database software to store excavation data) system to support TIMP sub-processes including:

    a. Enhancements to H-Form (data form for excavation by inline inspection, direct assessment, and hydrotest projects) workflow
    b. Storing data collected by data therapeutics projects in support of TIMP Risk model
    c. Repair database, metallurgical database, and site evaluation reports in support of TIMP Pipeline Engineers (PLE) team, Maximum Allowable Operating Pressure (MAOP) validation team in Asset Knowledge Management (AKM), and Enterprise Risk Management (ERM).

2. Develop or acquire desktop software to model and predict corrosion including:
    a. External corrosion
    b. Internal corrosion
    c. Selective seam weld corrosion by incorporating data from cathodic protection monitoring
    d. Soil testing
    e. Gas quality testing
    f. Coating inspection
    g. Corrosion coupons. Includes incremental funding for Software Platform for Work Management (SAP) and Gas Transmission Geographic Information System (GT GIS) system enhancements in support of corrosion data. Off the shelf software can fulfill this need.

3. Enhancements to GT GIS and SAP systems to support TIMP Assessment plan cycle including:
    a. Milepoint management
    b. Pipeline change audit tools
    c. High Consequence Area (HCA)/Class support

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Program Summary: Asset Management & Risk Analysis

Justification

1. The TCAT system is a critical database application to store field collected pipeline integrity data (H-Forms), validate data quality, and support repair and mitigation decisions. The TCAT system is currently supported by external software vendor with uncertain contract funding each year, this arrangement jeopardizes the crucial compliance and safety processes supported by TCAT.
2. Data from cathodic protection monitoring, soil testing, gas quality testing, coating inspection, and corrosion coupons are not stored in an analytical system where validation of data quality and identification of potential problem areas can be done system wide. Currently ad hoc corrosion inspection data cannot be housed in either SAP and GT GIS systems and capability to model corrosion on a system level using data analytics do not exist like most pipeline operators.
3. Existing GT GIS and SAP systems are unable to provide critical Management of Change information that CPUC and the Federal Monitors require in order to ensure that TIMP fulfill long-duration (7 to 14-year cycles) compliance obligations on every transmission pipe asset.

Benefits

1. Enhanced safety through improved data quality and data utilization in Gas Transmission pipeline integrity management, prevent threats to pipeline from being missed by mitigation and remediation programs, reduce risk of catastrophic pipeline ruptures like San Bruno.

2. Meet regulatory expectations from CPUC and Federal Monitors on improvement of data sources critical to risk assessment. Avoid unfavorable regulatory findings, loss of PG&E's reputation, and/or imposition of costly remedies by regulators.

3. Avoid future cost of hiring consultants to perform in-depth data analysis on a case by case basis.

Alternatives Considered

No investment. TIMP is obligated to make overly conservative decisions on pipeline assessment, repair, and mitigation when good data is not available or not accessible. This leads to unnecessary assessment projects, excavations, repairs, and asset replacement costing millions of dollars.

Hiring consultants to perform work that TIMP can't perform due to lacking data system capability - this will not meet timelines required by code to repair or mitigate safety threats to transmission pipelines; it will not be possible to hire enough consultants due to the thousands of miles of pipe requiring data collection and analysis; and it will pose huge risk to PG&E's code compliance and can result in unfavorable regulatory findings.

Project: G-TD-0008 Device Purchases – Gas Operations

As Gas Operations moves to adhere to better compliance and documentation practices, the capability of iPads, the increased ease of use and functionality of apps, and the need for employees to work in the field, has led to greater adoption resulting in higher demands of iPads year over year as different groups

transition to using them. The greatest influx has been from digitalization efforts and a move from ruggedized laptops to iPads. This is a lifecycle project which will repeat every few years to stay current.

Justification

Information Technology's new policy requires Lines of Business (LOB's) to fund the replacement of the device due to item being broken, lost, or stolen. Therefore, Gas Operations will be required to purchase more iPads in 2021 and beyond. This also includes keeping reserve iPads on hand as the deployment of newly purchased iPads can be delayed.

Benefits

Ensures mobile field work forces are equipped with adequate iPad devices and tools to perform jobs effectively and efficiently. Most importantly, digitization across the board will reduce human errors and keep all records accurate, as well as keeping the field work force equipped with adequate iPad devices.

Alternatives Considered

Do nothing. This is not a viable option. Mobile field workforces use of mobile devices is increasing, therefore requiring they be equipped with the appropriate tools to perform jobs effectively and efficiently. More importantly, digitization across Gas Operations will reduce human errors and ensures accuracy of records.

Project: G-TD-0009 GD/GT-GIS Data Improvement in Gas Operations

The purpose of the Gas Distribution and Gas Transmission - Geographic Information System (GIS) Data Improvement project is to enhance the Gas Distribution and Transmission Geographic Information System (GIS) databases through the addition and improvement of gas asset data. The data enhancements will enable future GIS functionality and data reporting requirements.

Justification

To improve the quality of Gas Distribution and Gas Transmission data for office and field-based employees.

Benefits

Ongoing GIS data enhancements will provide access to accurate, integrated and, readily available asset information for asset management, field operations, and system planning leading to improved analytics and decision making.

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Alternatives Considered

Do nothing. This is not a viable option. GIS data provides critical asset data to PG&E Construction, Maintenance, and Operations. As PG&E business evolves, data sets or newly added data sets need to be incorporated to ensure GIS data is accurate.

Project: G-TD-0010 GD GT GIS Upgrade

The purpose of the project is to add enhanced functionality to the Gas Distribution Geographic Information System (GD GIS) and the Gas Transmission Geographic Information System (GT GIS) through deployment of software upgrades. Enhancements will provide increased access to integrated, readily available asset information for asset management, field operations, and system planning, leading to improved analytics and decision making. In addition, enhancements and upgrades are required for improved safety, compliance, and efficiency for cathodic protection, emergency response, integrity management, engineering and design, mapping, and gas planning. Ongoing GIS data enhancements Examples of beneficial updates include:

- Deactivated Gas Main data conversion
- Transmission Line Definition Revision Initiative (TLDRI).
- Completed Deactivated Mains data conversion from legacy maps to GD GIS
- Resolved Deactivated Main and Service features that had conflicts between Deactivated Line Type and Material
- Pipes installed prior to 1965 with conflicting material and install dates were reviewed and updated
- Added missing Hydraulically Independent System (HIS) models to GD GIS.

Justification

Gas GIS upgrades will provide future technology tools needed for asset management, system integrity, system planning, and emergency response.

Benefits

The primary benefits of GIS upgrades are increased safety achieved through the improved accessibility to gas asset data and the ability to meet future compliance reporting requirements.

Alternatives Considered

Do nothing. This option introduces the risk of not being able to accurately respond to future compliance reporting requirements and does not address the opportunity to increase safety through the improved access to gas asset data.

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Program Summary: Asset Management & Risk Analysis

Project: Next Gen GIS Foundational Migration - Gas Operations

There is an IT initiative at PG&E to replace the current GIS technology with a next generation GIS platform. With the migration to the next generation of GIS, there are business related activities that need to be addressed to ensure a smooth transition for end users which is the purpose of this project. These activities include performing data migrations from the legacy gas distribution and transmission systems to the next generation system as well as performing a quality assurance check on the data. Secondly, change management is also a vital part of any transition as it guides how we prepare, equip and support individuals to successfully adopt change for organizational success. Finally, training for end users is needed so they become accustomed with the software as well as updates to established processes.

Justification

Data from the legacy gas distribution and transmission GIS systems need to be migrated to the next generation platform that PG&E IT is implementing. This project will allow PG&E business teams to identify and communicate changes associated with the migration to the next generation of GIS technology to end users as well as provide needed training.

Benefits

This project will provide the following benefits:

- Integrated view of assets across LOB's (GD, GT, ED, ET, etc.).
- More detailed asset network modeling (ex. stations) results in enhanced integration with other systems.
- Trace analytics - currently GT GIS has no connectivity and trace capabilities. UN will allow tracing from transmission assets to the distribution meter.
- Diagrams - automated schematic network diagram generation from the GIS.
- 3-D mapping and visualizations aligning with internal R&D efforts which include creating and utilizing underground models with visually accurate above ground spatial representation.
- Increased integration between gas asset GIS data and external agency geospatial data (ex. CalFire burn areas, earthquake fault zones, flood data). This is especially beneficial in emergency response.
- Cost savings from needing to manage different systems with significantly different data models.
- Integrated views for all lines of businesses. Users currently have to change between different applications.
- The Utility Network provides automated creation of assets visualizations via diagrams for analysis.
- More detailed asset network modeling results in enhanced integration with other systems.
- Integrated drone flight planning and the creation of 3D digital walkthroughs to assess vulnerabilities.
- Ability to view all assets from different LOB’s in one system for unified planning or bundling of work for field operations.

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Program Summary: Asset Management & Risk Analysis

- Can utilize subnetworks, like CP, to provide an operational view of the network with dynamic analysis and trace capabilities.
- Can model assets at a high level of detail such as regulator stations including all the internal components digitally.
- Containment functionality will allow a better representation of asset features within stations. This provides real world modeling of linear features that can be traced within stations.
- A feature called diagrams explains the network structure and how it operates in a simplified view. This capability replaces paper single line operating schematics with a digital version keeping the network up to date.
- Integrated dashboarding to quickly visualize statistics on assets to improve asset management strategies.

Alternatives Considered

Do nothing. This alternative introduces operational risk since GIS is a mission critical system that impacts many downstream users across many different lines of business which include integrity management, reporting and field-based personnel. The company will also be restricted from achieving digital transformation targets while aligning different lines of business on to a single platform.

Costs

PG&E used the IT Project/Program Estimating Tool (PET) to document estimate assumptions and generate labor and non-labor cost forecasts for these projects. To calculate labor costs, the PET captures labor hours by activity and resource type, multiplies that by standard labor rates, and adds in standard overhead factors. To calculate non-labor costs, the PET captures contract costs by type (such as software licenses or third-party services), material costs by unit quantity and unit price, and standard overheads such as materials burden and AFUDC. Other factors, such as escalation and capital/expense ratios, are calculated based on standard rates and accounting guidance. See Exhibit (PG&E-7), Chapter 8 for additional information regarding the PET. PG&E can provide the specific PET output produced for these projects upon request.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast							
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total	Workpaper Reference
EXPENSE													
MWC JV Distribution	13,449	13,848	10,627	5,432	5,825	11,451	13,376	11,958	-	-	-	85,966	WP 12-5 Line 1
MWC JV Transmission	3,953	4,736	10,296	2,535	2,951	3,108	2,785	2,570	-	-	-	32,934	WP 12-5 Line 9
												-	
Expense Total	**17,402**	**18,584**	**20,923**	**7,967**	**8,776**	**14,559**	**16,161**	**14,528**	**-**	**-**	**-**	**118,900**	
CAPITAL													
MWC 2F Distribution	2,933	862	782	904	2,619	9,372	8,498	8,697	8,901	9,110	9,325	62,003	WP 12-14 Line 1
MWC 2F Transmission	8,413	3,517	815	1,233	931	10,070	9,858	10,102	10,353	10,611	10,876	76,779	WP 12-14 Line 10
Capital Total	**11,346**	**4,379**	**1,597**	**2,137**	**3,550**	**19,442**	**18,356**	**18,799**	**19,254**	**19,721**	**20,201**	**138,782**	
TOTAL COST	**17,402**	**18,584**	**20,923**	**7,967**	**12,326**	**34,001**	**34,517**	**33,327**	**19,254**	**19,721**	**20,201**	**257,682**	

PACIFIC GAS AND ELECTRIC COMPANY
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12, Gas Technology
Program Summary: Event Management

Value Stream Program: Event Management
Major Work Categories: JV, 2F
Planning Order Numbers: Expense Distribution: 5054995; Expense Transmission 5055391; Capital Distribution: 5793164; Capital Transmission 5793260;
Project Start Date: 2023
Project Completion Date: 2026
Operative Date (only applies to Capital): Various

Program Description

The Event Management value stream focuses on the technology solutions used to coordinate planned events (such as maintenance outages) and to manage the Company's response to emergencies, utility asset failures, service disruptions, and other unplanned system-wide or localized events.

The work described in this value stream portfolio summary addresses the targeted needs of Gas Technology. In the next rate cycle, this work will also support the switch to a more regionalized business operations model. Examples of projects Gas Operations is pursuing in this value stream include:

Project: G-D-0004 Mobile Solutions

Gas Operations mobile Form solutions is to use a mobile workflow management app solution enabling remote workers to collect data on a mobile device, access company data in the field, and automatically share the results with back-office systems, cloud services, and people. A mobile form solution workflow automation app makes it possible to track, analyze, and continuously improve processes with form automation solutions.

Gas Operations uses a low code, no code application to simply digitize our current paper forms into an electronic format. Field personnel as well as engineering, receive work onto a mobile device to receive work, document work and complete work in a timely manner.

The workstream processes that are currently using mobile solutions include but are not limited to Corrosion, Maintenance & Construction, Gas Pipeline Operations and Maintenance (GPOM), Construction, and Engineering.

Mobile solutions are managed within Gas Operations and follows a quick delivery approach to our field users, to help meet compliance deadlines that may be bestowed upon various organizations on an ad hoc basis.

Mobile form solutions is a continuous long-term project to support annual license fees and new form professional development cost.

PACIFIC GAS AND ELECTRIC COMPANY
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Exhibit (PG&E-3), Chapter 12, Gas Technology
Program Summary: Event Management

Justification

Maintaining our interim mobile form application solution through Gas Operations enables PG&E to digitize forms used in the field and eliminate printed manual forms. It cuts down travel time, expense as well as manual input errors.

Benefits

- Enhanced safety and compliance through the digitization of our records within Gas Operations.
- Enable complete records for maintenance and reliability for the business to report out more timely and accurate statuses of work planned, work completion, etc.
- Eliminates printed manual forms.
- Reduces travel time.
- Reduces manual input errors.

Alternatives Considered

There are no alternatives.

Project: G-TD-0002 Survey Solutions

Deploy a digital version of the survey form that is accessible and editable on a mobile device. This form will be used to replace hard copy forms used by Gas Organization in the field.

Justification

The Survey solutions project is part of field operations automation to improve operational efficiency and productivity. The byproduct is to reduce errors caused by entering manual operations and reduce the amount of Notice of Violations (NoVs).

Benefits

The productivity of the field work force can be improved at a factor of 15-20% for each case. When field operations are entered via smart form, there is a reduction in errors and inaccurate data, thus maintaining the integrity of the dataset.

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Program Summary: Event Management

Alternatives Considered

Do nothing. PG&E will continue using hard copy forms to manually enter data in the field; risking inaccuracy of data and costly data corrections to ensure quality.

Costs

PG&E used the IT Project/Program Estimating Tool (PET) to document estimate assumptions and generate labor and non-labor cost forecasts for these projects. To calculate labor costs, the PET captures labor hours by activity and resource type, multiplies that by standard labor rates, and adds in standard overhead factors. To calculate non-labor costs, the PET captures contract costs by type (such as software licenses or third-party services), material costs by unit quantity and unit price, and standard overheads such as materials burden and AFUDC. Other factors, such as escalation and capital/expense ratios, are calculated based on standard rates and accounting guidance. See Exhibit (PG&E-7), Chapter 8 for additional information regarding the PET. PG&E can provide the specific PET output produced for these projects upon request.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast							
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total	Workpaper Reference
EXPENSE													
MWC JV Distribution	1,241	569	40	288	797	138	225	225	-	-	-	3,523	WP 12-5 Line 2
MWC JV Transmission	46	-	-	10	88	92	150	150	-	-	-	536	WP 12-5 Line 10
Expense Total	**1,287**	**569**	**40**	**298**	**885**	**230**	**375**	**375**	**-**	**-**	**-**	**4,059**	
CAPITAL													
MWC 2F Distribution	1,149	-	-	200	697	1,791	900	900	900	900	900	8,337	WP 12-14 Line 2
MWC 2F Transmission	85	-	-	93	673	1,194	600	600	600	600	600	5,045	WP 12-14 Line 11
Capital Total	**1,234**	**-**	**-**	**293**	**1,370**	**2,985**	**1,500**	**1,500**	**1,500**	**1,500**	**1,500**	**13,382**	
TOTAL COST	**1,287**	**569**	**40**	**298**	**2,255**	**3,215**	**1,875**	**1,875**	**1,500**	**1,500**	**1,500**	**17,441**	

PACIFIC GAS AND ELECTRIC COMPANY
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12, Gas Technology
Program Summary: Field Work Management

Value Stream Program: Field Work Management
Major Work Categories: JV, 2F
Planning Order Numbers: Expense Distribution: 5054994; Expense Transmission 5055390; Capital Distribution: 5793163; Capital Transmission 5793259;
Project Start Date: 2023
Project Completion Date: 2026
Operative Date (only applies to Capital): Various

Program Description

The Field Work Management value stream focuses on technology solutions used to plan and execute field work safely and efficiently, to document performed work completely and accurately, and to manage the flow of information between field crews and the back-office. Field Work Management encompasses service planning, customer-requested work initiation, design, cost estimation, construction management, and project completion and invoicing activities. A key strategic goal of the Field Work Management value stream is the digitization of all forms to streamline and integrate processes, increase transparency and consistency, and reduce errors. Gas Technology's main focus on work in the Field Work Management's IT value stream can be summarized as:

- Work Planning, Engineering & Design: Improve planning and scheduling capabilities through the unification and standardization of tools;
- Work Execution: Facilitate more effective and efficient work delivery through increased integration and digitization of tools and processes, enabling improved compliance adherence, simplified field operations, and risk reduction; and
- Emergency Preparedness & Response: Respond to all emergencies safely, quickly, and transparently to meet the needs of the communities by leveraging technology and communication infrastructure.

The work described in this value stream portfolio summary addresses the targeted needs of Gas Technology. In the next rate cycle, this work will also support the switch to a more regionalized business operations model. Field Work Management technology investment is also implemented at the enterprise level and this work is described in Exhibit 7, chapter 8. Examples of projects Gas Operations is pursuing in this value stream include:

PACIFIC GAS AND ELECTRIC COMPANY
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Exhibit (PG&E-3), Chapter 12, Gas Technology
Program Summary: Field Work Management

Project: G-TD-0004 Low-No Code Development and POC's

This project facilitates process improvements within Gas around the collection of data in the field and how we process that data back in the office. This project will bring in outside support for the creation of electronic surveys and work management tools.

Justification

We can neither afford, nor is it advisable, to pursue custom solutions for data gathering in the field. We have numerous processes which are paper based and others that rely on mobile solutions. Both will be early targets for a process analysis/improvement effort followed by low/no code development. This will help PG&E to better control our risk, apply validation logic and expand access to data in a cost-effective manner.

Benefits

- Improved data quality
- Reduction in tech burden
- Cost savings
- Improved access to data
- Time savings

Alternatives Considered

- Expand use of existing custom solutions and continue to fund enhancements to them as needed.
- Allow the business to roll back to using paper if/when their custom solutions break, and PG&E can't afford to fix them.

Neither of these options are suitable nor advisable. The only time PG&E should rely on a custom solution is when a cost-effective COTS (commercial off-the-shelf) option is unavailable, and data trapped on paper isn't readily accessible for reporting purposes.

Project: G-TD-0005 Middleware Solution for Esri and SAP

To implement software that acts as a bridge between Environmental Systems Research Institute (ESRI) and Software Platform for Work Management (SAP) to reduce long term cost in using customized SAP interface.

Justification

The degree of customization present inhibits continuous improvement and introduces error into our processes which require manual intervention to identify. Complex logic needs to be removed out of SAP and used only for data storage, leveraging the tools in the field to perform any necessary input. This

project would provide the funding needed to implement a software solution that would help move data back and forth between the field and SAP.

Benefits

- Reduce risk
- Eliminate data loss
- Improve data accuracy and quality
- Save time
- Save money

Alternatives Considered

Do nothing. SAP would continue to be our system of record and eventually PG&E will be using paper to run our business, resulting in added cost and delays, as PG&E won't have the time nor money to make the necessary changes to SAP to keep our digital processes going.

Project: G-TD-0006 Corrosion Automation Refresh - Workflow Optimization

The scope of this project is to fix current digital workflows that are broken and not optimized for Geographic Information System (GIS) or new mobile technologies integrated with software platform for work management at PG&E (SAP).

Justification

Digital solutions are failing, and processes are being rolled back to paper. Without investment, this process will grow in risk and cost to maintain.

Benefits

- **Reduced risk to public**:
    - The work being done by this team is directly connected to public safety. This is bigger than self-reports and (Notice of Violations) NOVs, one failed pipeline due to an improperly maintained CPA (Cathodic Protection Area) could directly result in an explosion with loss of life. Our current reality is that PG&E is applying people to look for errors in our digital process because PG&E knows the system is error prone and missed reads are commonplace. Constant monitoring by PG&E employees & contractors to find errors is not sufficient given where the rest of the world is at in terms of technology.

- **Cost savings**:
    - The SAP portion of Corrosion's workflow is not meeting the needs of the business. Most of our requests for funds are tied to fixing SAP. PG&E estimates that it spends a couple hundred thousand dollars each year on small fixes for SAP but that isn't fixing everything, only the small problems. Further, each of these small fixes has the potential to break other processes because the logic involved is overly complicated. By greatly streamlining the SAP logic and pushing it downstream to the mobile collection technology, it will create a

cheaper way for the business to maintain their forms and allow them to implement process improvements more quickly with less fear of breakage.

- Each month the business, support, and IT team members (25 people) meet to discuss a list of the top 10 technology issues facing the Corrosion team and assign action items. This human time could be redirected to solving other problems if the underlying technology is fixed.

- The investment of time looking for errors is a necessary step today, but it adds no value in and of itself. This time could be freed for other tasks if a reliable process were in place.

- **Time savings**:
  - There are a multitude of workarounds currently filling the role of functional digital processes because those processes aren't providing reliable results and the data being collected isn't in a comprehensible format - Portable Document Formats (PDF) vs. GIS). Additional contractors are used to run reports, look for missed issues and potential risks. This means PG&E is slower to act on issues.

- **Improved data quality**:
  - The current process involves a broken digital process and humans looking for errors. From a data quality perspective, this is risky. Furthermore, employees have been forced to use PDF's and then attach them to SAP. The problem with this is that PG&E has all of the data (liability) and no easy way to test if it is reasonable (corrosion listed on plastic).

- **Improved access to data**:
  - Data contained in PDF's aren't searchable nor reportable barring major manual efforts for audits. Further, there are teams like Risk which need access to this data and currently have no way to natively ingest this into their models.

Alternatives Considered

Do nothing. This option would not be advisable for safety reasons.

Project: G-TD-0007 GPOM Digital Catalyst Initiative

Gas Pipeline Operations and Maintenance (GPOM) maintains pipeline and pressure control assets along 20,000 miles of backbone and local transmission pipeline as well as distribution assets. These include valves, pressure regulating stations, compressor stations, storage facilities and various ancillary equipment.

In 2015 PG&E migrated GPOM assets into a standardized SAP, asset knowledge management system via a project called Asset Management Backbone and Stations (AMBBS). This system evolved over time due to limitations and complex business requirements. While it is effective at maintaining an asset registry, maintenance items, maintenance plans, work orders and operations the system is labor intensive, inflexible and provides no capability for integrated work schedules with other lines of business, an important feature for effective long-term management. GPOM has cross functional work plans with various departments in PG&E which caused some issues with visibility of follow on work and work in support of regular maintenance activities.

PACIFIC GAS AND ELECTRIC COMPANY
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12, Gas Technology
Program Summary: Field Work Management

GPOM uses an extensive, standards and procedures system for recordation of preventative and corrective maintenance which is largely paper based where-as personnel fill in work completion checklists and forms and file them for traceability and reference needs. While the paper system is workable it is not flexible and does not provide timely and effective reference for equipment analyses and system health without labor intensive data consolidation. While AMBBS can provide completion evidence it is not capable of providing the full extent of the work completion electronically. (i.e., the paper record checklist)

The AMBBS work management system provides no viable capability for the creation of electronic data capture of field checklists and data exchange between various stakeholders and other Lines of Business.

In year 2023, this will be the third year of this multi-year initiative to create a fully digital workflow and documentation for this organization. In 2021, PG&E is moving to an enterprise suite of schedule and dispatch software as well as mobile applications for effective field capture of inspection and maintenance data with associated reporting.

GPOM needs this scheduling tool set to effectively manage day to day workflows and provide visibility of cross functional workstreams that effect GPOM's workload like emerging work, project work on GPOM facilities, construction, and communications. The ability to effectively schedule and dispatch work with full visibility will help create and maintain a safe and reliable gas delivery system and position GPOM for ongoing success.

GPOM needs an effective way to convert from a paper-based records system to a flexible electronic records system. GPOM uses over 50 different paper forms to capture work completions for over 100,000 inspections per year generating mounds of physical records that require management and archiving. With today's software technologies PG&E will transition to an electronic register and gain system effectiveness by streamlining data capture and reporting. This project will position GPOM for success by establishing improved processes for work completion and data collection.

In 2023, the GPOM organization will have a year and a half of technology implementation to identify issues and look for opportunities for continuous improvement. Those improvements in conjunction with the completion of the digitization of all remaining workflows and paper records and associated reporting will take this project to completion.

Justification

Establishing a solid foundational schedule and dispatch program along with digital workflow for work management, improves visibility to inform decision making and gain effectiveness. Establishing field mobile platform for effective work completion, streamlines work and provides complete electronic access to valuable facility data for various stakeholders. The system provides visibility across GPOM and will lead to significant efficiency gains by bundling and being able to reduce potential outage impacts to the customers.

Benefits

By implementing the suite of applications to support a digital workflow, GPOM would achieve holistic work scheduling and management for preventative and corrective maintenance. The system will position PG&E to integrate other gas work types affecting GPOM workflows and provide visibility into work bundling opportunities to reduce risk, provide for safer operation, and efficiency gains. With the implementation of

an effective field mobile work solution GPOM can achieve risk reduction by streamlining records generation and reporting and provide a robust data set to inform decision making.

Alternatives Considered

Stop the initiative before completion: If this digital initiative is not completed, it will leave the organization in a hybrid digital and paper mode that will impact the ability to efficiently and effectively prove the completion of compliance work against our gas distribution transmission assets.

Costs

PG&E used the IT Project/Program Estimating Tool (PET) to document estimate assumptions and generate labor and non-labor cost forecasts for these projects. To calculate labor costs, the PET captures labor hours by activity and resource type, multiplies that by standard labor rates, and adds in standard overhead factors. To calculate non-labor costs, the PET captures contract costs by type (such as software licenses or third-party services), material costs by unit quantity and unit price, and standard overheads such as materials burden and AFUDC. Other factors, such as escalation and capital/expense ratios, are calculated based on standard rates and accounting guidance. See Exhibit (PG&E-7), Chapter 8 for additional information regarding the PET. PG&E can provide the specific PET output produced for these projects upon request.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast							
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total	Workpaper Reference
EXPENSE													
MWC JV Distribution	3,191	3,228	2,746	2,039	2,305	138	225	225	-	-	-	14,097	WP 12-5 Line 3
MWC JV Transmission	967	18	-	-	436	92	150	150	-	-	-	1,813	WP 12-5 Line 11
Expense Total	**4,158**	**3,246**	**2,746**	**2,039**	**2,741**	**230**	**375**	**375**	**-**	**-**	**-**	**15,910**	
CAPITAL													
MWC 2F Distribution	9,831	3,825	951	34	4,750	1,791	900	900	900	900	900	25,682	WP 12-14 Line 3
MWC 2F Transmission	1,144	1,741	29	-	1,956	1,194	600	600	600	600	600	9,064	WP 12-14 Line 12
Capital Total	**10,975**	**5,566**	**980**	**34**	**6,706**	**2,985**	**1,500**	**1,500**	**1,500**	**1,500**	**1,500**	**34,746**	
TOTAL COST	**4,158**	**3,246**	**2,746**	**2,039**	**9,447**	**3,215**	**1,875**	**1,875**	**1,500**	**1,500**	**1,500**	**50,656**	

PACIFIC GAS AND ELECTRIC COMPANY
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12, Gas Technology
Program Summary: System Operation and Control

Value Stream Program: System Operation and Control
Major Work Categories: JV, 2F
Planning Order Numbers: Expense Distribution: 5055003; Expense Transmission: 5055399; Capital Distribution 5793172; Capital Transmission 5793268;
Project Start Date: 2023
Project Completion Date: 2026
Operative Date (only applies to Capital): Various

Program Description

The System Operation and Control value stream focuses on the technology solutions that directly enable the monitoring, operation, and control of PG&E's gas, electric, and generation systems, including the edge networks that connect monitoring, automation, and other field devices to PG&E's core data networks.

The work described in this value stream portfolio summary addresses the targeted needs of Gas Technology. In the next rate cycle, this work will also support the switch to a more regionalized business operations model. System Operation and Control technology investment is also implemented at the enterprise level and this work is described in Exhibit 7, chapter 8. Examples of projects Gas Operations is pursuing in this value stream include:

Project: G-T-0003 Cyber Protect Field Devices LVC Gas Measurement in Gas Operations

Existing field devices communicate with Gas Operations via an obsoleted 3G and unsecured public network. Due to security risk and the required compliance with PG&E's Cyber Infrastructure Protection (CIP), the communication protocol for these sites will be converted to 4G Private network over the secured Operation Data Network (ODN)/Gas Data Network (GDN) loop for large volume gas customers. Total converted sites involved is 150.

Justification

To avoid the possibility of going through the 3G network to gain access to Gas Operations' Supervisory Control and Data Acquisition (SCADA) systems via the field devices. The safety consequences associated with such events may be catastrophic. The mitigation was to fund this project to reduce the possibility of data breach, unauthorized access to other connected systems, exposure of customer confidential information, etc., by eliminating 3G modems and replacing them with 4G modems to upgrade the connected infrastructure.

Benefits

To meet PG&E's North American Electric Reliability Corporation Cyber Infrastructure Protection (NERC CIP) protocol to protect the confidential customer & marketing data.

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Program Summary: System Operation and Control

Alternatives Considered

Do nothing. This is not a viable option. In Gas Operations, Large Volume Customer's (LVC) gas usage is measured using specific measurement devices such as custody transfer ultrasonic flow meters, gas chromatographs, sampling systems, and flow computers. Approximately 60%-70% of the total gas volume throughput in PG&E's backbone systems are measured and billed using these measurements, data collection and communication systems. Until 2018, the entire large volume gas measurement sites were communicating over the unsupported and unsecured 3G network on the Utility Data Network (UDN).

This was identified as a potential risk. The project objective/scope is to eliminate the 3G modems and replace them with 4G modems and upgrade the connected infrastructure.

Project: G-TD-0001 SCADA Infrastructure in Gas Operations

Supervisory Control and Data Acquisition (SCADA) Infrastructure addresses network resiliency requirements in SCADA by deploying appropriate infrastructure (e.g., adding alternate network paths to key transmission assets, deploying satellite terminals for key sites, improving Wide Area Network (WAN) resiliency, upgrading terminal server and radio sites for mountaintop sites, and reconfiguring Local Area Network (LAN) and remote servers).

Justification

The SCADA Infrastructure Project is a continuous enhancement program designed to keep the SCADA Infrastructure current. Network devices will be upgraded periodically based on manufacturer suggested lifecycle.

Benefits

The SCADA Infrastructure enables continuous improvement in SCADA technology reliability and resiliency to aid in any possible future failures and eliminate single source of failure risks on critical infrastructure.

Alternatives Considered

Do nothing. This is not a viable option. To not upgrade PG&E's SCADA infrastructure continuously, the hardware will become obsolete (normally 3-5 years). PG&E uses a rotational strategy to upgrade/replace obsolete equipment, servers, devices at region by region basis. Obsolete infrastructure could prove catastrophic as it will fail to monitor our gas pipeline effectively.

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Program Summary: System Operation and Control

Project: G-TD-0003 GOC Enhancements in Gas Operations

The Gas Operations Control (GOC) Enhancements project is a process of changing software tools to follow process changes, new and changed data sources, data presentation changes, getting a small task off of spreadsheets or paper, and improving software tool workflows to close gaps and be more efficient.

Justification

This Project is a GOC long-term lifecycle enhancement effort and is needed every year to make required GOC enhancements to data, process, and tools.

Benefits

GOC enhancements allow PG&E to adapt to software, process, data, and workflow changes. This benefits areas of compliance, risk management and work efficiency.

Alternatives Considered

Do nothing. Software tools need to be adjusted periodically to adapt to corresponding supporting process changes.

Project Title: G-TD-0012 Gas SCADA Upgrade

Supervisory Control and Data Acquisition (SCADA) Server infrastructure is a core part of the overall monitoring and control capability of the Gas Operations Control Center. Maintaining a system that is current is critical for PG&E's ability to monitor, prevent, and respond to gas events including measurement and control performance, overpressure/under pressure of pipelines, dig-ins, clearance activities, inventory and supply management, etc.

Gas SCADA Upgrade addresses the need for periodic life-cycling of the underlying SCADA system to maintain resiliency, avoid End of Life (EOL) performance concerns, and maintain compliance with cybersecurity standards.

Justification

Gas SCADA software needs to be upgraded to function with the current supported operating system. The Windows OS has a limited lifespan and needs to be upgraded to reduce vulnerability risks from adversaries trying to compromise our Operational Technology. Other dependencies with Operating System Upgrades would include SCADA hardware and software since there are close dependencies with the lifespan of equipment.

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Program Summary: System Operation and Control

Benefits

New supported hardware and software with up-to-date OS, eliminating the vulnerability risk to older hardware and software that is at risk of not being supported, resulting in security vulnerabilities.

Gas SCADA Upgrades keep the software and hardware current while positioning the Gas Control Center (GCC) for future growth and expansion. Regular upgrades ensure a proactive maintenance approach and will avoid any negative impacts of system degradation due to age.

Alternatives Considered

Do nothing. Presents unacceptable risk to Windows OS, hardware, and software that needs to be upgraded to maintain overall monitoring and control capability of the Gas Operations Control Center.

Project Title: G-TD-0013 Operator Training Simulator Upgrade

The Operator Training Simulator Upgrade project is to build a simulator of the Gas Transmission & Distribution Supervisory Control and Data Acquisition (SCADA) systems to be used during operator apprenticeships, lessons learned, and hypothetical drills. 49CFR192.631 (h) Control Room Management requires pipeline operators to establish a controller training program, designed such that each controller is equipped to carry out their roles and responsibilities during normal, abnormal, and emergency operating conditions. The training program must include use of a “computerized simulator or non-computerized method” in its delivery. PG&E currently provides for this need via slide-based (e.g. Microsoft PowerPoint) electronic training modules as well as tabletop exercises. Leading control rooms in the industry have begun to integrate simulators into their training programs to replicate real-life scenarios with real-time interaction.

This project will implement an Operator Training Simulator that integrates with PG&E's Gas Supervisory Control and Data Acquisition (SCADA) System to provide a flight simulator type training environment that will be used by Gas Control to train and qualify operators during operator apprenticeships, share lessons learned, and perform hypothetical drills.

Justification

The Operator Training Simulator will improve training methods by providing comprehensive interaction with GOC technology tools and introducing simulated operating scenarios. This both meets existing Control Room Management obligations and enables a more robust training program.

Benefits

Improving skills in these areas is critical to the control room’s recognition and response to events as well as implementing proactive measures to avoid events, leading to lower operating risk for the public and

employees. Implementation of simulation-style training allows for many more operating scenarios to be developed for training exposure and more rapid training development.

Alternatives Considered

Do nothing. Continued use of the static electronic modules and tabletop theoretical exercises, which provides foundational training, but no system interaction, is not the current and most effective way to train and qualify operators.

Project: G-T-0004 ECTS MAOP Data in Records Management System

Electronic gas As-Built records have been migrated to PG&E's enterprise wide central records management system from the legacy Enterprise Compliance Tracking System (ECTS). These As-Built records had been scanned and loaded into ECTS during a project that made documents required to validate Maximum Allowable Operating Pressure (MAOP) of gas mains on the gas network available electronically. The records management system also contains documents that were scanned during a project that made historical gas distribution As-Built records available electronically. In addition, the records management system contains more recent electronic As-Built records scanned by PG&E's mapping personnel.

From a record-keeping perspective, Gas Transmission & Distribution As-Built records are considered as the most critical in Gas Operations and are classified as Vital-Emergency Operation Plan Records. This Project also support retaining these records in a Tier1 system adhering to the Mission Critical Process 'P04-Safely Respond to Unplanned Events'.

The purpose of this project is to review the electronic documents migrated from ECTS for completeness and searchability within the records management system; and to eliminate duplicate and irrelevant records for Gas Operations systems, processes, and users.

Justification

The risk of not having concise, complete, accurate, and easily searchable records in a document management system introduces operational risk when trying to construct, operate, and maintain a utility system safely and prudently. Not only will the results of this project be beneficial to PG&E personnel on a daily operations level, but it will greatly assist planning in the event of an emergency response situation where time may be limited, and accuracy of data is paramount.

Benefits

The benefits of the project are to ensure that accurate and complete electronic records are easily accessible to employees and to rectify any discrepancies and duplicative documents. Users will have confidence knowing they are referencing the latest iteration of As-Built data for planning, reporting and decision making on assets. In addition, having Transmission & Distribution As-Builts in a tier 1 system will

facilitate PG&E's ability to meet the traceable, verifiable, and complete requirements specified by Pipeline and Hazardous Materials Safety Administration (PHMSA) (ADB 12-06).

Alternatives Considered

Do nothing. This would result in uncertainty when determining which As-Built records migrated from ECTS are accurate, complete, and searchable within the records management system.

Costs

PG&E used the IT Project/Program Estimating Tool (PET) to document estimate assumptions and generate labor and non-labor cost forecasts for these projects. To calculate labor costs, the PET captures labor hours by activity and resource type, multiplies that by standard labor rates, and adds in standard overhead factors. To calculate non-labor costs, the PET captures contract costs by type (such as software licenses or third-party services), material costs by unit quantity and unit price, and standard overheads such as materials burden and AFUDC. Other factors, such as escalation and capital/expense ratios, are calculated based on standard rates and accounting guidance. See Exhibit (PG&E-7), Chapter 8 for additional information regarding the PET. PG&E can provide the specific PET output produced for these projects upon request.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast							
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total	Workpaper Reference
EXPENSE													
MWC JV Distribution	491	225	788	1,004	1,177	110	180	180	-	-	-	4,155	WP 12-5 Line 4
MWC JV Transmission	268	612	768	889	910	74	120	120	-	-	-	3,761	WP 12-5 Line 12
Expense Total	**759**	**837**	**1,556**	**1,893**	**2,087**	**184**	**300**	**300**	**-**	**-**	**-**	**7,916**	
CAPITAL													
MWC 2F Distribution	13,237	5,796	4,391	2,463	3,946	1,433	720	720	720	720	720	34,866	WP 12-14 Line 4
MWC 2F Transmission	10,329	5,882	6,327	3,373	3,703	955	480	480	480	480	480	32,969	WP 12-14 Line 13
Capital Total	**23,566**	**11,678**	**10,718**	**5,836**	**7,649**	**2,388**	**1,200**	**1,200**	**1,200**	**1,200**	**1,200**	**67,835**	
TOTAL COST	**24,325**	**12,515**	**12,274**	**7,729**	**9,736**	**2,572**	**1,500**	**1,500**	**1,200**	**1,200**	**1,200**	**75,751**	

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12
Deferred Work Analysis Summary

The Gas Distribution deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work

Check 2a: *The work is measured by units of work.*

Check 2b: PG&E expects to perform fewer of such units during the 2020-2022 period.

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

								Check 2					Units Comparison			Dollar Comparison		
Line	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 1	*Check 2a*	*Check 2b*	Check 3	Deferred Work	Explanation	2020 Rec. Adj. + 2021 to 2022 Forecast	2020 to 2022 Imputed	Difference	2020 Rec. Adj. + 2021 to 2022 Forecast (A) (B)	2020 to 2022 Imputed	Difference
1	12	Capital	2F	2FA-GD	Svcs: Development	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 37,910,425	$ 34,765,105	$ 3,145,320
2	12	Expense	JV	JV#-GD	Maintain IT Apps & Infrastructure, Other	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	$ 3,060,000	$ -	$ 3,060,000
3	12	Expense	JV	JVT-GD	Asvcs: Applications Support	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	$ 1,934,232	$ -	$ 1,934,232
4	12	Expense	JV	JVA-GD	Technology	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 31,049,886	$ 38,491,588	$ (7,441,702)
5															**Expense Total**	$ 36,044,118	$ 38,491,588	$ (2,447,470)
6															**Capital Total**	$ 37,910,425	$ 34,765,105	$ 3,145,320
7																		

8 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 12
Deferred Work Analysis Summary

The Gas Transmission deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks listed below

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work

Check 2a: *The work is measured by units of work.*

Check 2b: *PG&E expects to perform fewer of such units during the 2019-2022 period.*

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

								Check 2					Units Comparison			Dollar Comparison		
Line	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 1	*Check 2a*	*Check 2b*	Check 3	Deferred Work	Explanation	2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast	2019 to 2022 Imputed	Difference	2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast (A) (B)	2019 to 2022 Imputed	Difference
1	12	Capital	2F	2FA-GT	Svcs: Development	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 37,053,357	$ 91,107,780	$ (54,054,422)
2	12	Expense	JV	JVA-GT	Technology	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 10,267,880	$ 55,291,509	$ (45,023,628)
3	12	Expense	JV	JVT	ASvcs: Maintain/Support	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 2,282,923	$ 8,525,602	$ (6,242,679)
4	12	Expense	JV	JV#-GT	Maintain IT Apps & Infrastru	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 2,040,000	$ 3,768,444	$ (1,728,444)
5															**Expense Total**	$ 14,590,803	$ 67,585,555	$ (52,994,752)
6															**Capital Total**	$ 37,053,357	$ 91,107,780	$ (54,054,422)
7																		

8 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony _____ Workpapers _____X_____ SOQ _____

Exhibit Number: ___3_____ Chapter Number: ____12____

Chapter Title: Gas Technology

Witness Name: Darrell Feldman

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
WP 12-1	Workpaper Table 12-1	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 12-1
WP 12-2	Workpaper Table 12-2	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 12-2
WP 12-3	Workpaper Table 12-3	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 12-3
WP 12-4	Workpaper Table 12-4	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 12-4
WP 12-17	Workpaper Table 12-17, Line 2	Correction to Detailed Description/Explanation	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a few projects with high actuals. AMBBS Enhancements - $3.4M, IM Data Loader - $2M, and GEOMart - $1.5M.	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a few projects with lower actuals. AMBBS Enhancements - $3.4M, IM Data Loader - $2M, and GEOMart - $1.5M.

Page No.	Line No.	Item	As Filed	As Corrected
WP 12-17	Workpaper Table 12-17, Line 4	Correction to Detailed Description/Explanation	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a few projects with high actuals. GT GIS Upgrade - $1.9M, Cross Bore Inspection - $1.7M, and Online Pipeline Simulator - $1.6M.	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to a few projects with lower actuals. GT GIS Upgrade - $1.9M, Cross Bore Inspection - $1.7M, and Online Pipeline Simulator - $1.6M.
WP 12-17	Workpaper Table 12-17, Line 6	Correction to Detailed Description/Explanation	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to two projects with high actuals. SCADA Network Improvements - $2.4M and Predictive Health Analytics - $1.2M.	Capital includes a change in the portfolio of Gas Tech & Gas IT projects year over year. Decrease due to two projects with lower actuals. SCADA Network Improvements - $2.4M and Predictive Health Analytics - $1.2M.

PACIFIC GAS AND ELECTRIC COMPANY
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EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 13, OTHER GAS OPERATIONS SUPPORT

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PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE
EXHIBIT (PG&E-3) GAS OPERATIONS

WORKPAPERS SUPPORTING
CHAPTER 13, OTHER GAS OPERATIONS SUPPORT

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Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 13
Other Gas Operations Support
Expenses by Major Work Category
(Thousands of Nominal Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	34	Maint Gas Trans-Subsid	2,246	3,575	1,378	1,442	1,159	3,923	4,432	3,129	
2	AB	Misc Expense	29,076	114,252	36,745	22,882	27,743	(69,799)	34,484	35,630	
3	AK	Manage Environmental Oper	2,966	2,546	2,805	2,707	2,965	2,280	2,336	3,071	
4	AY	Habitat and Species Protection	2								
5	CR	Mnge Waste Disp & Transp	446	461	525	792	538	535	546	676	
6	DN	Develop & Provide Trainng	10,139	8,279	10,411	4,400	1,667	2,098	2,145	4,406	
7	GF	Gas Trans & Dist Sys Mapping	12,234	11,852	11,011	6,316	7,965	8,523	8,623	9,770	
8	GZ	R&D Non-Balancing Account	3,303	3,327	3,596	3,602	5,339	6,572	6,770	11,500	
9	LX	Catastrophic Events						1,500	2,859	2,912	
10	OM	Operational Management	20,319	16,549	12,502	19,574	21,133	20,388	19,421	21,710	
11	OS	Operational Support	26,442	23,884	33,823	25,708	27,733	33,913	33,317	37,243	
12	Total		107,173	184,725	112,796	87,423	96,242	9,933	114,933	130,047	WP 13-5, Line 28

Notes: (A) Line 12, 2023 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 13-2
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 13
Other Gas Operations Support
Expenses by Major Work Category
(Thousands of Base Year Dollars)

Line No.	MWC	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	34	Maint Gas Trans-Subsid	2,376	3,696	1,372	1,417	1,159	3,915	4,309	2,957
2	AB	Misc Expense	31,335	119,634	37,261	22,977	27,743	(69,330)	33,234	33,340
3	AK	Manage Environmental Oper	3,198	2,685	2,856	2,709	2,965	2,251	2,241	2,856
4	AY	Habitat and Species Protection	2							
5	CR	Mnge Waste Disp & Transp	472	476	523	779	538	533	531	638
6	DN	Develop & Provide Trainng	10,739	8,566	10,399	4,338	1,667	2,080	2,068	4,121
7	GF	Gas Trans & Dist Sys Mapping	13,370	12,659	11,437	6,458	7,965	8,328	8,157	8,953
8	GZ	R&D Non-Balancing Account	3,556	3,513	3,677	3,602	5,339	6,492	6,495	10,706
9	LX	Catastrophic Events						1,472	2,720	2,683
10	OM	Operational Management	22,357	17,921	12,913	20,096	21,133	19,896	18,325	19,811
11	OS	Operational Support	29,337	25,927	35,536	26,309	27,733	33,047	31,414	33,957
12	**Total**		**116,742**	**195,077**	**115,974**	**88,685**	**96,242**	**8,684**	**109,494**	**120,022**

Table 13-3
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 13

Expenses by MAT Code
(Thousands of Nominal Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference (A)
1	34	34A	Stan-Pac Expense	2,246	3,575	1,378	1,442	1,159	3,923	4,432	3,129	WP 13-5, Line 13
2	**34 Total**			**2,246**	**3,575**	**1,378**	**1,442**	**1,159**	**3,923**	**4,432**	**3,129**	
3	AB	AB1	Support	(6,200)	(2,021)	177	(867)	(533)	(98,524)			WP 13-5, Line 15
4		AB7	Safety, Qual, & Contract Mgmt			2,180	2,060	1,835	1,200	1,200	1,240	WP 13-5, Line 2, Line 16
5		#	Not assigned	35,276	116,272	34,388	21,689	26,441	27,525	33,284	34,390	
6	**AB Total**			**29,076**	**114,252**	**36,745**	**22,882**	**27,743**	**(69,799)**	**34,484**	**35,630**	
7	AK	AKA	Haz Waste Mgmt	2,966	2,546	2,805	2,707	2,965	2,280	2,336	3,071	WP 13-5, Line 17
8	**AK Total**			**2,966**	**2,546**	**2,805**	**2,707**	**2,965**	**2,280**	**2,336**	**3,071**	
9	AY	AYA	CGT-Env, HCP-Hab&Cultural Prot	2								WP 13-5, Line 18
10	**AY Total**			**2**								
11	CR	CRA	Hazard Waste Disp & Transp	446	461	525	792	538	535	546	676	WP 13-5, Line 19
12	**CR Total**			**446**	**461**	**525**	**792**	**538**	**535**	**546**	**676**	
13	DN	DN1	Training Development	7,755	5,899	5,530	83	30				WP 13-5, Line 4, Line 20
14		DN2	Gas Qualifications	2,384	2,381	4,881	4,317	1,636	2,098	2,145	4,406	WP 13-5, Line 5, Line 21
15		#	Not assigned									WP 13-5, Line 3
16	**DN Total**			**10,139**	**8,279**	**10,411**	**4,400**	**1,667**	**2,098**	**2,145**	**4,406**	
17	GF	GFO	Mapping Support-Distribution	4,391	3,948	3,910	3,090	3,394	4,400	4,401	4,203	WP 13-5, Line 7
18		GFP	Mapping Support-Transmission	7,602	7,904	7,102	3,225	4,571	4,123	4,221	5,567	WP 13-5, Line 23
19		#	Not assigned	240								WP 13-5, Line 6, Line 22
20	**GF Total**			**12,234**	**11,852**	**11,011**	**6,316**	**7,965**	**8,523**	**8,623**	**9,770**	
21	GZ	GZA	Gas R&D and Deployment	3,303	3,327	3,596	3,602	5,339	6,572	6,770	11,500	WP 13-5, Line 8
22	**GZ Total**			**3,303**	**3,327**	**3,596**	**3,602**	**5,339**	**6,572**	**6,770**	**11,500**	
23	LX	LXA	GD Restore & Rebuild Expense						1,500	2,859	2,912	WP 13-5, Line 9
24	**LX Total**								**1,500**	**2,859**	**2,912**	
25	OM	#	Not assigned	20,319	16,549	12,502	19,574	21,133	20,388	19,421	21,710	WP 13-5, Line 10, Line 25
26	**OM Total**			**20,319**	**16,549**	**12,502**	**19,574**	**21,133**	**20,388**	**19,421**	**21,710**	
27	OS	#	Not assigned	26,442	23,884	33,823	25,708	27,733	33,913	33,317	37,243	WP 13-5, Line 11, Line 26
28	**OS Total**			**26,442**	**23,884**	**33,823**	**25,708**	**27,733**	**33,913**	**33,317**	**37,243**	
29	**Total**			**107,173**	**184,725**	**112,796**	**87,423**	**96,242**	**9,933**	**114,933**	**130,047**	WP 13-5, Line 28

Notes: (A) Line 31, 2023 Forecast values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

Table 13-4
Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 13
Other Gas Operations Support
Expenses by MAT Code
(Thousands of Base Year Dollars)

Line No.	MWC	MAT Code	Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
1	34	34A	Stan-Pac Expense	2,376	3,696	1,372	1,417	1,159	3,915	4,309	2,957
2	**34 Total**			**2,376**	**3,696**	**1,372**	**1,417**	**1,159**	**3,915**	**4,309**	**2,957**
3	AB	AB1	Support	(6,560)	(2,083)	226	(842)	(533)	(97,800)		
4		AB7	Safety, Qual, & Contract Mgmt			2,175	2,025	1,835	1,190	1,157	1,161
5		#	Not assigned	37,894	121,717	34,860	21,794	26,441	27,280	32,077	32,179
6	**AB Total**			**31,335**	**119,634**	**37,261**	**22,977**	**27,743**	**(69,330)**	**33,234**	**33,340**
7	AK	AKA	Haz Waste Mgmt	3,198	2,685	2,856	2,709	2,965	2,251	2,241	2,856
8	**AK Total**			**3,198**	**2,685**	**2,856**	**2,709**	**2,965**	**2,251**	**2,241**	**2,856**
9	AY	AYA	CGT-Env, HCP-Hab&Cultural Prot	2							
10	**AY Total**			**2**							
11	CR	CRA	Hazard Waste Disp & Transp	472	476	523	779	538	533	531	638
12	**CR Total**			**472**	**476**	**523**	**779**	**538**	**533**	**531**	**638**
13	DN	DN1	Training Development	8,211	6,102	5,518	81	30			
14		DN2	Gas Qualifications	2,529	2,464	4,882	4,256	1,636	2,080	2,068	4,121
15		#	Not assigned								
16	**DN Total**			**10,739**	**8,566**	**10,399**	**4,338**	**1,667**	**2,080**	**2,068**	**4,121**
17	GF	GFO	Mapping Support-Distribution	4,951	4,341	4,139	3,163	3,394	4,276	4,134	3,815
18		GFP	Mapping Support-Transmission	8,147	8,318	7,298	3,294	4,571	4,052	4,022	5,139
19		#	Not assigned	271							
20	**GF Total**			**13,370**	**12,659**	**11,437**	**6,458**	**7,965**	**8,328**	**8,157**	**8,953**
21	GZ	GZA	Gas R&D and Deployment	3,556	3,513	3,677	3,602	5,339	6,492	6,495	10,706
22	**GZ Total**			**3,556**	**3,513**	**3,677**	**3,602**	**5,339**	**6,492**	**6,495**	**10,706**
23	LX	LXA	GD Restore & Rebuild Expense						1,472	2,720	2,683
24	**LX Total**								**1,472**	**2,720**	**2,683**
25	OM	#	Not assigned	22,357	17,921	12,913	20,096	21,133	19,896	18,325	19,811
26	**OM Total**			**22,357**	**17,921**	**12,913**	**20,096**	**21,133**	**19,896**	**18,325**	**19,811**
27	OS	#	Not assigned	29,337	25,927	35,536	26,309	27,733	33,047	31,414	33,957
28	**OS Total**			**29,337**	**25,927**	**35,536**	**26,309**	**27,733**	**33,047**	**31,414**	**33,957**
29	**Total**			**116,742**	**195,077**	**115,974**	**88,685**	**96,242**	**8,684**	**109,494**	**120,022**

Workpaper Table 13-5 Revised
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Other Gas Operations Support
Summary of Expenses

Gas Distribution Expense

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference	Notes
1	Gas General Support	AB	AB#	18,627,039	44,419,071	15,785,042	4,833,797	19,429,846	13,318,507	15,838,314	16,367,717	WP 13-13, line 2	
2	Gas Safety Quality Contract	AB	AB7	-	-	1,000,607	791,139	825,459	480,000	480,000	496,119	WP 13-13, line 4	
3	Training Other	DN	DN#	-	-	-	89	-	-	-	-		1
4	Training Development	DN	DN1	1,570,221	2,513,483	2,332,399	9,231	464	-	-	-		2
5	Gas Qualifications	DN	DN2	1,555,835	1,345,104	2,735,508	2,608,640	882,715	1,085,990	1,110,915	2,546,396	WP 13-9, line 2	
6	Mapping Other	GF	GF#	215,491	-	-	-	-	-	-	-		3
7	Gas Mapping Support - Distribution	GF	GFO	4,391,328	3,948,056	3,909,647	3,090,218	3,393,922	4,399,801	4,401,275	4,202,624	WP 13-12, line 2	
8	Gas R&D	GZ	GZA	2,115,732	1,665,118	2,062,612	1,756,546	3,289,641	3,487,699	3,592,331	5,850,000	WP 13-10, line 2	
9	D Restore & Rebuild Expense	LX	LXA	-	-	-	-	-	1,500,000	2,859,304	2,911,535	WP 13-15, line 2	
10	Gas Overhead Allocations	OM	OM#	13,671,449	11,627,912	4,673,143	13,225,572	14,362,965	10,296,342	11,793,224	13,183,022	WP 13-14, line 2	
11	Gas Overhead Allocations	OS	OS#	16,145,788	16,552,791	28,440,476	15,458,020	26,631,180	27,211,890	24,144,837	26,990,239	WP 13-14, line 3	
12	**Total Expenses**			**58,292,882**	**82,071,536**	**60,939,434**	**41,773,251**	**68,816,191**	**61,780,229**	**64,220,200**	**72,547,651**		

Notes
(1) DN# is recorded only for prior cost adjustments to DN2. No forecast moving forward.
(2) DN1 is used for Gas Training Development which has moved to the PG&E Academy Chapter and is not forecasted in the Gas Exhibit Chapter 13
(3) GF# is standard cost variance for MWC GF and is now tracked within MAT AB#

Gas Transmission Expense

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Reference	Notes
13	Gas StanPac	34	34A	2,245,939	3,575,321	1,377,846	1,441,802	1,159,020	3,923,324	4,432,408	3,129,065	WP 13-8, line 2	
14	Gas General Support	AB	AB#	16,648,513	71,853,232	18,603,196	16,855,684	7,011,290	14,206,485	17,446,060	18,022,419	WP 13-13, line 3	
15	Support	AB	AB1	(6,200,000)	(2,020,682)	177,341	(867,017)	(532,818)	(98,523,979)	-	-		4
16	Gas Safety Quality Contract	AB	AB7	-	-	1,179,195	1,268,507	1,009,502	720,000	720,000	744,178	WP 13-13, line 5	
17	Hazardous Material Management	AK	AKA	2,966,405	2,545,720	2,805,463	2,706,729	2,965,400	2,279,887	2,336,102	3,070,728	WP 13-6, line 2	
18	CGT-Env, HCP-Hab&Cultural Prot	AY	AYA	1,606	-	-	-	-	-	-	-		5
19	Hazardous Material Disposal & Transportation	CR	CRA	445,867	460,518	525,183	792,314	538,314	534,567	546,060	675,608	WP 13-7, line 2	
20	Training Development	DN	DN1	6,185,040	3,385,284	3,197,466	73,607	29,756	-	-	-		6
21	Gas Qualifications	DN	DN2	827,757	1,035,476	2,145,549	1,708,522	753,737	1,012,112	1,033,874	1,859,743	WP 13-9, line 3	
22	Mapping Other	GF	GF#	24,648	-	-	-	-	-	-	-		7
23	Gas Mapping Support - Transmission	GF	GFP	7,602,427	7,903,827	7,101,518	3,225,494	4,571,418	4,123,292	4,221,369	5,567,007	WP 13-12, line 3	
24	Gas R&D	GZ	GZA	1,187,267	1,662,367	1,532,917	1,845,808	2,049,307	3,084,727	3,177,268	5,650,000	WP 13-10, line 3	
25	Gas Overhead Allocations	OM	OM#	6,647,271	4,921,102	7,829,132	6,348,215	6,770,223	10,091,255	7,628,109	8,527,060	WP 13-14, line 4	
26	Gas Overhead Allocations	OS	OS#	10,296,276	7,331,034	5,382,316	10,249,801	1,101,784	6,700,989	9,171,708	10,252,568	WP 13-14, line 5	
27	**Total Expenses**			**48,879,014**	**102,653,200**	**51,857,121**	**45,649,466**	**27,426,932**	**(51,847,341)**	**50,712,958**	**57,498,378**		

Notes
(4) AB1 Recorded Emergent Cost Only - Cost allocated to Project Orders. No forecast moving forward.
(5) AYA is used for Environmental Habitat and Cultural Protection which has transferred to PG&E Shared Services and is not forecasted for Gas Exhibit Chapter 13.
(6) DN1 is used for Gas Training Development which has moved to the PG&E Academy Chapter and is not forecasted in the Gas Exhibit Chapter 13
(7) GF# is standard cost variance for MWC GF and is now tracked within MAT AB#

Total Expense

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast
28	**Total Expenses**	All	All	**107,171,897**	**184,724,735**	**112,796,555**	**87,422,717**	**96,243,123**	**9,932,888**	**114,933,159**	**130,046,029**

Workpaper Table 13-6
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC AK - Transmission Hazardous Waste Management

Program Description:

Expense - PG&E's management of hazardous materials specifically for Gas Transmission projects.

Line	MWC	Transmission/ Distribution % Split	2017 Recorded Adjusted	2018 Recorded Adjusted (c)	2019 Recorded Adjusted (c)	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference
1	**MWC AK Total**		**$ 2,545,720**	**$ 2,805,463**	**$ 2,706,729**	**$ 2,965,400**	**$ 2,279,887**	**$ 2,336,102**	**$ 3,070,728**	
2	MAT AKA - Hazardous Waste Management - Transmission	100%(b)	$ 2,545,720	$ 2,805,463	$ 2,706,729	$ 2,965,400	$ 2,279,887	$ 2,336,102	$ 3,070,728	(a)
3										

4 Notes:

5 (a) Expense 3-year average (2017-2019)

6 (b) Gas Transmission Only

7 (c) 2018 and 2019 recorded costs reflected in this workpaper may vary from the Results of the Operations (RO) model provided with PG&E's 2023 GRC Filing due to timing differences.

Workpaper Table 13-7
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC CR - Transmission Hazardous Waste Disposal and Transportation

Program Description:

Expense - PG&E's management of disposing hazardous waste specifically for Gas Transmission projects.

Line	MWC	Expense - Transmission/Distribution % Split	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference
1	**MWC CR Total**		**$ 460,518**	**$ 525,183**	**$ 792,314**	**$ 538,314**	**$ 534,567**	**$ 546,060**	**$ 675,608**	
2	MAT CRA - GT Hazardous Waste Disposal Transportation - Transmission	100%[(b)]	$ 460,518	$ 525,183	$ 792,314	$ 538,314	$ 534,567	$ 546,060	$ 675,608	[(a)]

3 Notes:

4 (a) Expense 3-year average (2017-2019)

5 (b) Gas Transmission Only

Workpaper Table 13-8 Revised
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
Gas Transmission MWC 34 - Gas StanPac

Program Description:

Expense - Gas StanPac is 54.6 miles of transmission pipeline that is an integral part of PG&E transmission system. It is 6/7 owned by PG&E and 1/7 owned by Chevron pipeline.

Line	MWC	Transmission/Distribution % Split	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference
1	**MWC 34 Total**		**$ 1,377,846**	**$ 1,441,802**	**$ 1,159,020**	**$ 3,923,324**	**$ 4,432,408**	**$ 3,129,065**	
2	MAT 34A - Expense	100%	$ 1,377,846	$ 1,441,802	$ 1,159,020	$ 3,923,324	$ 4,432,408	$ 3,129,065	(a)
3									
4	Notes:								
5	(a) Expense 3-year average (2018-2020) MAT 34A excluding non-recurring activity plus additional dollars, which represents known project-specific scope related to the Traditional ILI, Strength Test and Internal Corrosion Direct Assessment programs reflected in PG&E Exhibit 3, Chapter 5.								
6	(b) 2023 Forecast value varies from the value listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.								
7	(c) Gas Transmission only								

Line		2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2023 Forecast	
8	MAT 34A - Capital Excluding Non-Recurring	$ 1,405,646	$ 1,410,798	$ 648,198	$ 1,294,966	2018-2020 Average escalated to relevant year

Line		Total Project Estimate	2023 Forecast	
9	Specific Project Adders			6/7th of 4-year average estimate escalated to 2023, net of unrecoverable amounts if applicable
	Pipe Replacement in Lieu of TIMP Strength Test Program (MATs HPM / 34A)			
10	SP3 Repl 0.001MI (Proj Num 8401)	$ 470,577	$ 110,101	WP 5-32, Line 663; WP 5-37, Lines 7-13
11	SP3 Repl 0.000MI (Proj Num 8404)	$ 470,577	$ 110,101	WP 5-32, Line 664; WP 5-37, Lines 7-13
12	SP3 Repl 0.001MI (Proj Num 8405)	$ 470,577	$ 110,101	WP 5-32, Line 665; WP 5-37, Lines 7-13
13	SP3 Repl 0.002MI (Proj Num 8399)	$ 470,577	$ 110,101	WP 5-32, Line 662; WP 5-37, Lines 7-13
	Traditional ILI Runs (MATs HPB / 34A)			
14	SP4Y Trad ILI Run MP 1.3-7.50	$ 1,100,300	$ 257,447	WP 5-11, Line 128; WP 5-10, Lines 8-10, 13, 16-17
	Internal Corrosion Direct Assessment Digs (MATs HPO / 34A)			
15	IC23-SP3-191	$ 1,142,013	$ 1,068,784	WP 5-21, Line 52; WP 5-20, Lines 11 and 30-33
	Internal Corrosion Direct Assessment Engineering (MATs HPJ / 34A)			
16	IC23-SP3-191	$ 72,088	$ 67,466	WP 5-21, Line 52; WP 5-20, Lines 8 and 19-22
17	**Total Forecast**		**$ 3,129,065**	

Workpaper Table 13-9
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC - DN Gas Qualifications

Program Description:

Expense - MWC DN are the activities related to the administration of Gas Distribution and Gas Transmission qualification programs that assess the competency of employees performing covered tasks.

Line	MAT	Transmission/Distribution % Split	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference
1	**MAT DN2 Total**		**$ 2,380,581**	**$ 4,881,057**	**$ 4,317,162**	**$ 1,636,453**	**$ 2,098,102**	**$ 2,144,789**	**$ 4,406,139**	
2	MAT DN2 - Distribution	58%	$ 1,345,104	$ 2,735,508	$ 2,608,640	$ 882,715	$ 1,085,990	$ 1,110,915	$ 2,546,396	Line 1 * 58%
3	MAT DN2 - Transmission	42%	$ 1,035,476	$ 2,145,549	$ 1,708,522	$ 753,737	$ 1,012,112	$ 1,033,874	$ 1,859,743	Line 1 * 42%
4										
5	Notes:									
6	(a)Expense 3-year average (2017-2019)									
7	(b) For information regarding the Gas Training Program, see Exhibit (PG&E-8), Ch. 6, Section B.3.									

Workpaper Table 13-10
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC - GZ Gas R&D Deployment

Program Description:

Expense - This program detects, develops, tests and introduces new methods and technologies in Gas Operations to improve gas safety, reliability and efficiency.

Line	MWC	Transmission/Distribution % Split	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference
1	**MWC GZ Total**		**$ 3,595,529**	**$ 3,602,354**	**$ 5,338,948**	**$ 6,572,426**	**$ 6,769,599**	**$ 11,500,000**	
2	MAT GZA - Distribution	51%	**$ 2,062,612**	**$ 1,756,546**	**$ 3,289,641**	**$ 3,487,699**	**$ 3,592,331**	**$ 5,850,000**	Line 1 * 51%
3	MAT GZA - Transmission	49%	$ 1,532,917	$ 1,845,808	$ 2,049,307	$ 3,084,727	$ 3,177,268	$ 5,650,000	Line 1 * 49%
4									

5	Category		2018 recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	Methodology
6	Contributions to Collaborations and Consortiums	NYSEARCH	$ 574,129	$ 672,715	$ 627,382	$ 700,000	$ 700,000	$ 710,000	*PG&E has increased its contribution to NYSEARCH to bring it to about $700k for the 2020-2022 GRC period with successful results. We plan to keep the funding at this level or higher moving forward with an increased emphasis on decarbonization.*
7		OTD	$ 726,256	$ 630,587	$ 750,000	$ 750,000	$ 750,000	$ 750,000	*The contribution to OTD is expected to stay flat for the next GRC period. The main focus areas will stay methane emission abatement, dig-in prevention, mobile as-built and material properties with a new emphasis on hydrogen.*
8		PRCI	$ 256,980	$ 305,233	$ 249,344	$ 400,000	$ 450,000	$ 500,000	*PG&E forecasts its contribution to PRCI to increase with the development of a new field dedicated to emerging fuels. PRCI focus is on transmission pipelines, compressor stations and underground storage facilities.*
9		NGI	$ 250,000	$ -	$ 75,000	$ 75,000	$ 175,000	$ 475,000	*The contribution to the Natural Gas Initiative at Stanford University will grow to include additional research on impact of hydrogen on natural gas infrastructure and carbon capture sequestration and utilization.*
10		UTD	$ -	$ -	$ 350,000	$ 350,000	$ 350,000	$ 350,000	*PG&E has joined UTD (Utilization Technologies Development) in 2020 to explore the impact of renewable natural gas and hydrogen on its customers applications. The contribution is expected to stay stable over the next GRC period.*
11		Others	$ 444,393	$ 659,413	$ 1,777,248	$ 2,451,477	$ 2,163,527	$ 5,862,829	*PG&E forecasts to continue to grow its R&D efforts beyond the traditional industry consortia. This investment includes support to deployment of new technologies within its operations to ensure that their benefits are rapidly captured. It will also include broader collaborations to accelerate and optimize the sourcing of innovation especially in the context of decarbonization.*

Workpaper Table 13-10
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC - GZ Gas R&D Deployment

12	Team Costs	$ 1,343,771	$ 1,334,406	$ 1,509,973	$ 1,845,523	$ 2,181,072	$ 2,852,171	*The R&D and Innovation team will grow as it extends its project portfolio towards low -carbon no-carbon solutions, diversifies its collaborations and accelerates the transition of new technologies into the business. Its workforce will grow from 9 FTE in 2020 to 17 FTE in 2023.*
13	Reducing Methane Emissions [(a)]	$ 1,091,213	$ 1,515,490	$ -	$ -	$ -	$ -	*The R&D activity related to methane emission abatement has been transferred into the regular GRC budget in 2020. It will continue to be a main topic of research, technology development and deployment through the next GRC periods in order to reach methane abatement goals of 20% in 2025 and towards 40% by 2030 compared to 2015 emissions.*
14	Therapeutics	$ 1,738,171	$ 3,085,121	$ 1,234,942	$ 1,066,431	$ -	$ -	*The therapeutics program will be completed in 2021 with three important innovations for leak detection, mobile as-built data collection and traceability and dig-in prevention of bored pipelines. Such deployment and industrialization efforts will continue on other topics, integrated in the R&D and Innovation's project portfolio.*
15	**Total R&D and Innovation**	**$ 6,424,913**	**$ 8,202,965**	**$ 6,573,889**	**$ 7,638,431**	**$ 6,769,599**	**$ 11,500,000**	

16
17 Notes:

18 (a) Expense amounts for 2018 and 2019 related to the Leak Abatement Best Practices required by D.17-06-015 will be recovered through a balancing account established in that proceeding. Starting in 2020, these costs will be recorded in MWC GZ (Research and Development) and cost recovery will be through the GRC.

19
20

Workpaper Table 13-11
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC - GF Mapping Support

Program Description:

Expense - The Gas Mapping Support Program maintain gas distribution (GFO) and gas transmission (GFP) asset information in our systems of record, that are not directly charged to an order.

Line	MWC	Transmission/ Distribution % Split	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference
1	**MWC GF Total**		**$ 11,851,884**	**$ 11,011,165**	**$ 6,315,712**	**$ 7,965,340**	**$ 8,523,093**	**$ 8,622,644**	**$ 9,769,631**	(c)
2	MAT GFO - Distribution	43%	$ 3,948,056	$ 3,909,647	$ 3,090,218	$ 3,393,922	$ 4,399,801	$ 4,401,275	$ 4,202,624	(a)
3	MAT GFP - Transmission	57%	$ 7,903,827	$ 7,101,518	$ 3,225,494	$ 4,571,418	$ 4,123,292	$ 4,221,369	$ 5,567,007	(b)
4										
5	Notes:									
6	(a) Expense 3-year average (2017-2019) MAT GFO									
7	(b) Expense 3-year average (2018-2020) MAT GFP									
8	(c) Line 1: MWC GF MAT code setup allows Distribution and Transmission allocation for the Mapping Support Program.									

Workpaper Table 13-12
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC - AB Other General Support

Program Description:

Expense - General support expenses for Gas Operations.

Line	MWC	Transmission/Distribution % Split	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference	Notes	Notes
1	**MWC AB Total**		**$ 116,272,302**	**$ 36,568,040**	**$ 23,749,127**	**$ 28,276,097**	**$ 28,724,996**	**$ 34,484,375**	**$ 35,630,433**	(a)		
2	MAT AB# Distribution Total	43%	$ 18,556,104	$ 15,785,042	$ 4,833,797	$ 19,429,846	$ 13,318,507	$ 15,838,314	$ 16,367,717			
3	MAT AB# Transmission Total	57%	$ 16,879,301	$ 18,603,196	$ 16,855,684	$ 7,011,290	$ 14,206,489	$ 17,446,060	$ 18,022,419			
4	MAT AB# Misc Contracts McKinsey		$ 80,836,897	$ -	$ -	$ -	$ -	$ -	$ -			
5												
6	**MAT AB# Subtotal**		**$ 116,272,302**	**$ 34,388,238**	**$ 21,689,481**	**$ 26,441,136**	**$ 27,524,996**	**$ 33,284,375**	**$ 34,390,136**			
7	MAT AB7 Distribution Total	40%	$ -	$ 1,000,607	$ 791,139	$ 825,459	$ 480,000	$ 480,000	$ 496,119	(b)		
8	MAT AB7 Transmission Total	60%	$ -	$ 1,179,195	$ 1,268,507	$ 1,009,502	$ 720,000	$ 720,000	$ 744,178	(b)		
9	**MAT AB7 Subtotal**		**$ -**	**$ 2,179,802**	**$ 2,059,646**	**$ 1,834,961**	**$ 1,200,000**	**$ 1,200,000**	**$ 1,240,297**			

Line	MAT		2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	
10	**MWC AB - Distribution Total**		$ 18,556,104	$ 15,785,042	$ 4,833,797	$ 19,429,846	$ 13,318,507	$ 15,838,314	$ 16,367,717	
11	MAT AB# Other Support - Type B		$ 7,128,526	$ 7,508,900	$ 7,657,562	$ 5,738,114	$ 4,212,308	$ 4,914,037	$ 5,071,947	(c)
12	MAT AB# Other Support - CEMA		$ -	$ -	$ -	$ -	$ 2,685,000	$ 2,780,000	$ 2,878,000	
13	MAT AB# Misc. Contracts (excluding McKinsey)		$ 11,427,578	$ 8,276,142	$ (2,823,765)	$ 13,691,732	$ 6,421,199	$ 8,144,278	$ 8,417,770	

Line	MAT		2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	
14	**MWC AB - Transmission Total**		$ 16,879,301	$ 18,603,196	$ 16,855,684	$ 7,011,290	$ 14,206,489	$ 17,446,060	$ 18,022,419	
15	MAT AB# Other Support - Type B		$ 3,541,904	$ 3,733,644	$ 4,867,204	$ 3,713,684	$ 5,627,692	$ 6,565,210	$ 6,776,181	(c)
16	MAT AB# Misc. Contracts (excluding McKinsey)		$ 13,337,397	$ 14,869,552	$ 11,988,480	$ 3,297,606	$ 8,578,797	$ 10,880,850	$ 11,246,238	

Line	MAT		2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast
17	**MWC AB - Misc Contracts Total**		$ 105,601,872	$ 23,145,694	$ 9,164,715	$ 16,989,338	$ 14,999,997	$ 19,025,128	$ 19,664,008
18	MAT AB# Misc Contracts (excluding McKinsey) Total		$ 24,764,975	$ 23,145,694	$ 9,164,715	$ 16,989,338	$ 14,999,997	$ 19,025,128	$ 19,664,008
19	MAT AB# Misc Contracts McKinsey		$ 80,836,897	$ -	$ -	$ -	$ -	$ -	$ -

20 Notes:

21 (a) Expense 3-year average (2017-2019) MAT AB# (excluding McKinsey)
22 (b) Expense 2021 Forecast MAT AB7: The forecast was based on the 2021 forecast which used 2020 actuals with a reduction in the number of contractors, and standard escalation was applied. This is a non-unitized MAT.
23 (c) MAT AB# Other Support - Type B Allocation - refer to line 25 to 26 in this workpaper for calculation of Type B allocation
24

		FTE			Capital vs Expense Split			2021 Without OH per FTE			Overhead Percentages			2021 Fully Loaded Total per FTE		
25	CC Type	Previous Plan (Aug 2020)	Current HC (as of 01/2021)	Approved headcount CAP	Capital	Expense	Non Earnings	Capital	Expense	Non Earnings	Total	Capital	Expense	Non Earnings	Capital	Expense	Non Earnings	Total
26	B	45	45	45	-	1	-	-	129,389	-	129,389	-	2	-	-	218,667	-	218,667

Workpaper Table 13-13
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC - OM/OS Gas Overhead Allocation

Program Description:

The overhead expense costs of Gas Operations employees that supervise, support, or manage employees who charge their time to specific orders.

Line	MWC	Transmission/Distribution % Split	2022 Forecast	2023 Forecast	Reference
1	**OM/OS Total**		**52,737,878**	**58,952,889**	
2	OM-D	22%	11,793,224	13,183,022	
3	OS-D	46%	24,144,837	26,990,239	
4	OM-T	14%	7,628,109	8,527,060	
5	OS-T	17%	9,171,708	10,252,568	

Line	MAT	FTE	2021	2022	2023
6	**Total OM/OS Fcst**		**51,153,423**	**97,156,949**	**58,952,889**
7	Escalation		2.39%	3.10%	3.21%
8	Type D	277	13,778,411	14,205,191	15,710,997
9	Type G	877	37,375,013	38,532,687	42,617,303
10	**Subtotal**		**51,153,423**	**52,737,878**	**58,328,299**
11	Officer Compensation (Starting in 2023)			$ 44,419,071	$ 624,590
12					
13					
14	Notes:				
15	(a) Breakdown of cost per Type D and Type G described in lines 16 to 20 of this workpaper.				

		FTE			Capital vs Expense Split			2021 Without OH per FTE				Overhead Percentages			2021 Fully Loaded Total per FTE			
17	CC Type	Previous Plan (Aug 2020)	Current HC (as of 01/2021)	Approved headcount CAP	Capital	Expense	Non Earn	Capital	Expense	Non Earnings	Total	Capital	Expense	Non Earnings	Capital	Expense	Non Earnings	Total
18	D	297	264	277	62%	31%	7%	$ 58,981	$ 29,433	$ 6,325	$ 94,739	2.5	169%	1.78	$ 147,452	$ 49,742	$ 11,259	$ 208,453
19	G	883	820	877	62%	31%	7%	$ 50,533	$ 25,217	$ 5,419	$ 81,169	2.5	1.69	1.78	$ 126,332	$ 42,617	$ 9,647	$ 178,595
20	**Total**	**1,180**	**1,084**	**1,154**														

Workpaper Table 13-14
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
Gas Operations MWC LX

Program Description:

Expense - PG&E's Butte Rebuilt Program cost.

Line	MWC	Transmission/ Distribution % Split	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Reference
1	**MWC LX Total**		**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,500,000**	**$ 2,859,304**	**$ 2,911,535**	
2	MAT LXA - Distribution Expense	100%[(b)]					$ 1,500,000	$ 2,859,304	$ 2,911,535	[(a)]
3										
4	Notes:									
5	(a) For further information regarding the Butte Rebuilt program, please see Exhibit (PG&E-4), Chapter 23.									
6	(b) Gas Distribution Only									

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations/Gas Ops Other Support
Program Summary

Project Title: Gas Operator Qualification (OQ) Program
Major Work Categories: MWC DN (MAT DN2)
Planning Order Numbers: 5055627, 5055640
Project Start Date: N/A
Project Completion Date: N/A
Operative Date (only applies to Capital): N/A

Project Description

The Operator Qualification program is responsible for all OQ associated need by the Gas Operations field employees, this ensures that Gas Operations workforce remains compliant, competent, safe and qualified.

Drivers for the Operator Qualification program include:

- OQ profiling
- OQ test scheduling
- Test materials, props, and tools
- OQ test/evaluation
- Learning Management System

The portfolio of Operator Qualification program consists of a combination of internal and external procured content like materials, props, tools and services. PG&E optimizes the ratio of internal vs.external procurement of content based on availability, quality, adherence to industry standards and cost to maximize the efficiency of program spend.

The scope of the program is developed and driven in alignment to Gas Operation's business need. Strong and unified governance models leads to OQ success which includes budgeting and prioritization processes for the creation of the Operator Qualification program. The OQ profiling governance process creates accountability, transparency and oversight for Gas Operations by aligning with Risk Register and Corrective Action Program.

Justification

The development of the Operator Qualification program is critical to driving the skils, ability and knowledge in the Gas Operations workforce and ensuring operational risks are mitigated.

Operator Qualification program is a mandated requirement which adheres with the Department of Transportation's (DOT) 49 CFR 192 and California Public Utilities Commission's (CPUC) GO 112 regulations. The program's priorities are set through the OQ profiling governance process, ensuring accountability, transparency and oversight in conjunction with the supporting guidance documents and qualifications based on alignment with Gas Operations Risk Register.

The program is a continuation from the prior rate case, the difference from the previous filing is that OQ Profiling for employees was implemented in late 2018. OQ Profiling defines the Operation Qualification requirements for each workgroup and the benefit is that each job classification for each workgroup will have more qualified workforce to perform all construction tasks.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations/Gas Ops Other Support
Program Summary

If the Operator Qualification program is not created or does not keep pace with regulatory and technological changes, it will become outdated, as would the skills, ability and knowledge of the Gas Operations workforce. This in turn, would compromise PG&E's ability to safely and reliably operate its natural gas systems as well as lead to a decrease in work effectiveness.

Partner Order	Description	Order Number	Description
3024317	Qualifications Contracted Services	8171021	Evaluation Delivery - Contracted - GD
		8173528	Evaluation Delivery - Contracted - GT
3024318	Qualifications Props	8171019	Props - GD
		8173529	Props - GT
3028257	IT Special Projects	8171022	IT -- Special Projects GD
		8189940	IT -- Special Projects GT
3028337	Qualifications Trailer/Modular	8198386	Trailer/Modular - GD
		8198387	Trailer/Modular - GT

Cost

The Operator Qualification program forecasting methodology is described below:

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast				
	2016	2017	2018	2019	2020	2021	2022	2023	Total	Workpaper Reference
EXPENSE										
5035452 - Distribution	$1,556	$1,345	$2,736	$2,609	$883	$1,086	$1,110	$2,281	$13,606	WP 13-5, line 5.
5035453 - Transmission	$828	$1,035	$2,146	$1,709	$754	$1,012	$1,035	$4,406	$12,925	WP 13-5, line 21.
									-	
Expense Total	$2,384	$2,380	$4,882	1,709	$1,637	$2,098	$2,145	$6,687	$26,531	
Total Program Cost	2,384	2,380	4,882	1,709	1,637	2,098	2,145	6,687	26,531	

Additional Cost Information:
The focus and means for Operator Qualification program changes are based on operational needs and considers the resources available. The costs are based on the resources needed, purchasing of materials, props & tools and contracting professional services to support program needs.

Benefits

- The program will provide Gas Operation employees the Operator Qualification needed to safely operate PG&E's natural gas systems.
- The program will lead to increased workforce competencies and qualifications.
- The program will have PG&E meet and adhere to the state and federal regulations.

Alternatives Considered

N/A – Operator Qualification is a state and federal requirement.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Research & Development Deployment
Project Summary

Project Title: R&D and Deployment
Major Work Categories: GZ (MAT: GZA)
Planning Order Numbers: 5055612, 5055623
Project Start Date: N/A
Project Completion Date: N/A
Operative Date (only applies to Capital): N/A

Project Description

The purpose of the R&D and Deployment Program is to detect, develop, test, and introduce new methods and technologies in PG&E's Gas Operations to improve gas safety, reliability, and efficiency. To optimally perform at the lowest possible cost, R&D and Deployment often operates in collaboration with other utilities and pipeline operators through national and international R&D leading consortia, such as Pipeline Research Council International (PRCI), NYSEARCH, as well as Utilization Technology Development (UTD) and Operations Technology Development (OTD) group of the Gas Technology Institute, or through ad-hoc, co-funded initiatives called Joint Industry Projects (JIP). R&D and Deployment also actively seeks cooperation with the Pipeline and Hazardous Materials Safety Administration, the California Energy Commission Public Interest Energy Research Program, the Department of Energy and other organizations.

Justification

The R&D and Deployment team has defined seven priorities that address the major threats for each Asset Family as identified in Gas Operations' Risk Register, and that support their mitigation measures: (1) extending the safe operational lifetime of our pipelines; (2) understanding the condition of PG&E's assets; (3) developing proactive, as opposed to reactive, operations; (4) re inventing leak management; (5) eliminating dig ins; (6) improving construction methods; and (7) decarbonizing the gas system. While these priorities help guide R&D and Deployment, efforts undertaken on a year-to-year basis vary based on risks to the Company's gas organization and collective needs of the collaborations and consortia to which PG&E contributes.

Cost

PG&E used 2019 historical actuals with standard escalation as our estimation method. Adders in forecast are for decarbonization including hydrogen, renewable natural gas and carbon capture utilization.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast				
	2016	2017	2018	2019	2020	2021	2022	2023	Total	Workpaper Reference
Expense Total - GD	$2,116	$1,665	$2,063	$1,757	$3,290	$3,488	$3,592	$5,850	$23,820	WP 13-5, line 8.
Expense Total - GT	$1,187	$1,662	$1,533	$1,846	$2,049	$3,085	$3,177	$5,650	$20,190	WP 13-5, line 24.
TOTAL PROJECT COST	$3,303	$3,327	$3,596	$3,602	$5,339	$6,572	$6,770	$11,500	$44,009	

PACIFIC GAS AND ELECTRIC COMPANY
Gas Research & Development Deployment
Project Summary

Additional Cost Information:

Given the acceleration of the transition towards a zero carbon California economy by 2045 set by Executive Order B 55 18, we believe that innovation and new technologies are critical to enable and progressively deliver low to zero carbon emerging fuels such as Renewable Natural Gas, Bio methane and Hydrogen through PG&E's gas infrastructure. In addition, PG&E as a dual energy utility, is uniquely positioned to explore, develop and demonstrate new solutions integrated with the electric system to provide Californians safe, reliable, affordable and clean energy.

In this context, we propose to expand and strengthen the R&D and Innovation program with a new focus on zero carbon energy and increased investment in safety and integrity breakthrough improvements.

PG&E has published its decarbonization R&D and Innovation road map on its web site and has regularly updated it for progress and new priority topics.

Alternatives Considered / Benefits

No alternatives considered. Since its inception in 2012, the R&D and Innovation program has completed 404 projects and deployed 89 new solutions as of December 31st, 2020 including the robotic in line inspection tool (Explorer) developed through NYSEARCH to inspect sections of pipelines that are not accessible to traditional PIGs, the Mobile As Built application designed through OTD that electronically capture in real time material characteristics and geometry of new Distribution assets, and the Super Emitter Program that contributed to reduce methane emissions of the Distribution system by more than 20 percent at minimal cost.

The success of PG&E's R&D and Innovation program has been recognized by the John B, Mc Gowan Senior Research Award of the American Gas Association in 2018.

R&D and Innovation

Explorer: A line of autonomous robots to inspect un-piggable pipelines

At the end of 2020, only 36% of PG&E's transmission pipelines could be inspected with smart pigs pushed by the flow of gas. Low radius bends, valves and other restrictions, change of diameters as well as low pressure and flow impeded the use of smart pigs in the remaining 64%. PGE's plan is to reduce this number to 31% by 2029. But adapting existing lines to enable pigging is costly, disruptive and sometimes unpractical. For the un-piggable portions, PG&E uses "Non-traditional" techniques that consist in pulling inspection tools or inserting robots. The most advanced technology - the untethered Explorer robots - can be inserted in active pipelines through a Pressure Control Fitting, to autonomously navigate, collect inspection data independently of the flow of gas, and be retrieved without disrupting in any way the service to our customers.

Explorer is the result of an on-going R&D effort of North American utilities including PG&E federated through NYSEARCH a research consortium of the gas industry. Initiated in 2005 with the support of PHMSA, it led to the first commercial deployment at PG&E in February 2014. As a leader of the program, we were also the first operator to demonstrate the largest diameter (30-36 inch) inspection in a life pipeline in May 2013, the embarked hardness testing tool in August 2019, the in-line self-charging function in November 2019, and the bend inspection tool in January 2020.

EXPLORER

Total cost of the program: $33.2M

PG&E funding: $3.9M

Leverage ratio: 8.4

Other funders:

- NYSEARCH: $15.4 M
- PHMSA: $6.5M
- Invodane: $5.5M
- OTD: $1.9M

Royalties based on revenues generated by the tool: $72k (cumulated up to 2019)

A presentation at the International Pipeline Conference by PG&E in 2016 was an opportunity to show case the execution of a series of complex inspections of line 132 along SFO airport and highway 101. It was estimated that savings brought by the technology for these projects alone were greater than $30M while maximizing safety[1].

Today, 65 ILI projects at PG&E, representing 28 miles of inspection, have leveraged the Explorer technology produced through the R&D and Innovation program. Other gas operators around the world also use Explorer to inspect un-piggable sections of their system improving the overall safety of the industry.

Current status:

- Six robot sizes for pipe diameters from 6" to 36"
- Metal loss characterization with longitudinal Magnetic Leak Flux sensing,
- Dent characterization with stereoscopic laser imaging,

[1] [redacted] "CASING & INSERTED PIPE INSPECTION PROGRAM ON THE SAN FRANCISCO PENINSULA USING ROBOTIC ILI -p.7" IPC 2016, Calgary, September 26-30, 2016

- Visual inspection to identify special features
- Bends inspection (6”, 20”-24”, 30-36”)
- Hardness testing (20”-24”)
- Recharging through a PCF

Current focus of development is on:

- Crack detection, especially along seam welds,
- Automation to improve performance and reduce cost, plus high resolution pipeline mapping
- Range extension through self-charging and improved telecommunication

Example of inspection in SF Bay Area [IPC2016-64586]

Explorer launcher at Ceres, CA in March 2019

Explorer 30-36 during demonstration at PG&E in May 2013

R&D and Innovation

Automated data collection from the field to GIS for distribution mains and services

Accurate and current records of the characteristics and location of underground natural gas assets are critical for safe and reliable operation of the natural gas transportation and delivery system. They also help reduce the risk of pipeline damage from excavation.

In 2014, R&D and Innovation intiated with OTD the integration of two emerging solutions: the standard marking of plastic assets under ASTM F2897 and high accuracy GNSS (Global Navigation Satellite System) localization tools to enable in the field material traceability and geometry data collection as well as real-time automated recording in GIS.

It culminated in 2020 in the deployment of the new Mobile As-Built solution to the Distribution General Construction crews. PG&E is leading the industry along with ATMOS, Dominion Energy, Duke Energy and NICOR towards an end to end paperless as-built documentation process. Integration with design engineering and estimating has also been initiated in 2021 and extension to Transmission assets is planned for 2023.

Along the way, R&D and Innovation also collaborated with the California Energy Commission in 2017 to pilot the application on 10 new contruction projects led by the Maintenance and Construction teams. Results were instrumental in improving the technology and refining the workflows in the field and in the backend with the mapping team before GIS integration.

MOBILE AS-BUILT

Industry R&D: $3.3M

PG&E share: $275k

Leverage ratio: 12.0

Deployment costs:

Hardware: $2.9M

Software: $1.3M

GIS Integration: $1.9M

Status at the end of February 2021:

Field users: 69

Mapping users: 24

QC users: 15

Miles of main and services: 56 and 34, respectively

Completed/In-Progress Projects: 705

Number of fittings: 28,342

Guidance and feedback were also offered to suppliers in order to assure that bar code marking was easily readable in all situations and on all assets in strict application of the national standard ASTM F2897. The use of a standard developed through previous industry wide R&D efforts is a key driver of efficiency since suppliers now provide the marking at no cost for PG&E.

PG&E's leadership has been recognized through multiple publications and conference presentations:

- Distribution Material Traceability - Article in the Pipeline & Gas Journal - October 2017
- Paperless as-builting with tracking and traceability focusing on PG&E's experience - Presentation at AGA Operation Conference - June 2018
- PG&E's Mobile As-Built (MAB) initiative and systematic approach of redefining our century-old as-built process under the Piping Materials track - Presentation at AGA Operation Conference - May 2019

- PG&E's Gas Distribution Mobile As-Built (MAB) initiative - Presentation at the GTI GIS Week - October 2019
- Distribution Mobile As-Built (MAB) program including the workflow for integration into Esri GIS - Presentaion at 2019 ESRI GeoConX Conference - October 2019
- PG&E's paperless capture of gas distribution as-builts utilizing GIS, GPS and barcode scanning - Presentaion at 2020 DISTRIBUTECH International Conference - January 2020

Current R&D efforts:

- Marking of steel pipelines and components
- Collection of pressure testing and fusion data collection
- Adaptation to urban canyon
- Assistance to navigate back to assets based on geographic coordinates
- Three-dimensional representation for complex construction sites
- Adaptation to maintenance activities
- Integration with the Locate and Mark process
- Application to horizontal drilling asset construction
- Assistance to accurate GNSS coordinate collection

Pictures:

Figures 1 &2: Field User Utilizing MAB Application on Mobile Device

Figure 3: MAB data digested into GD GIS

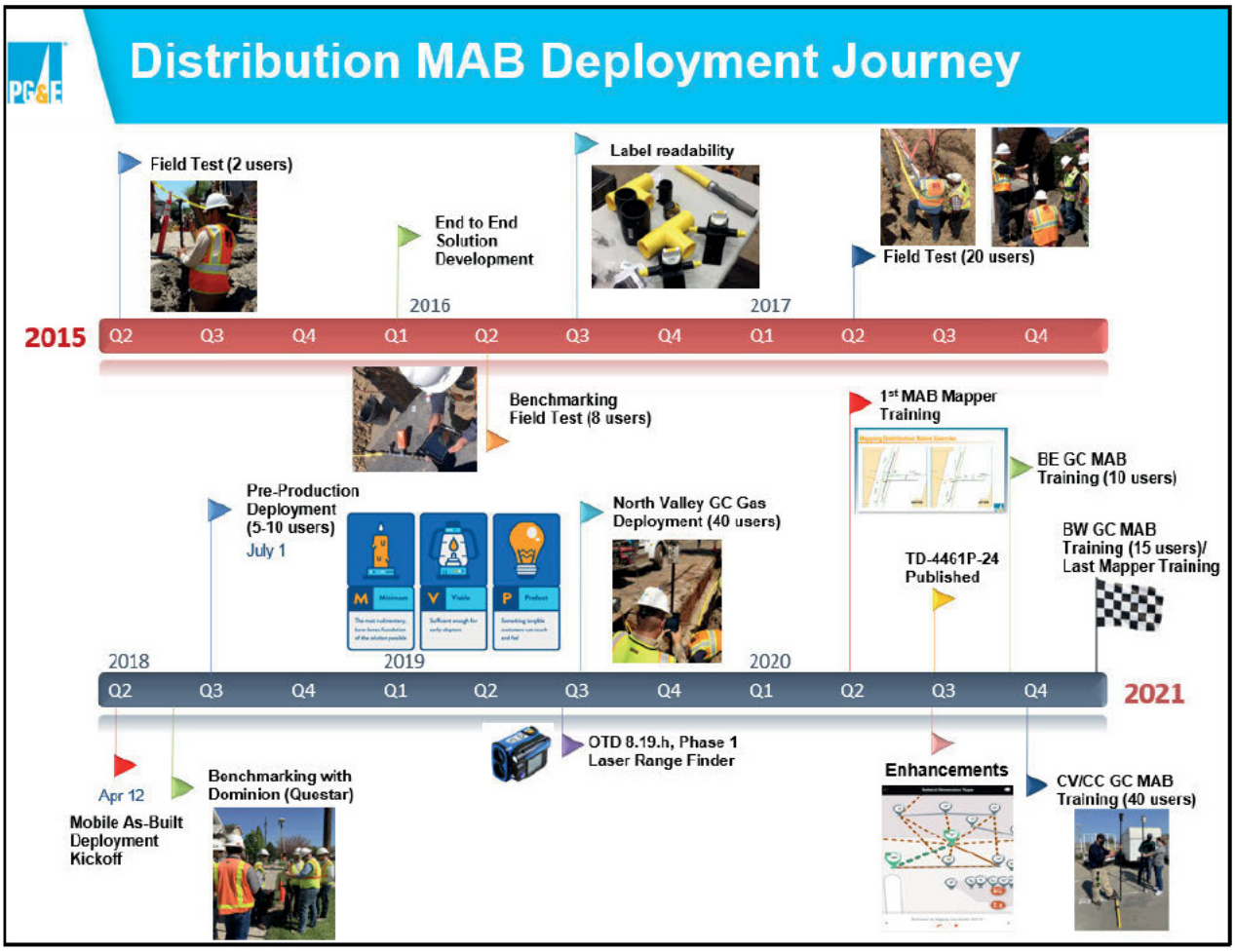
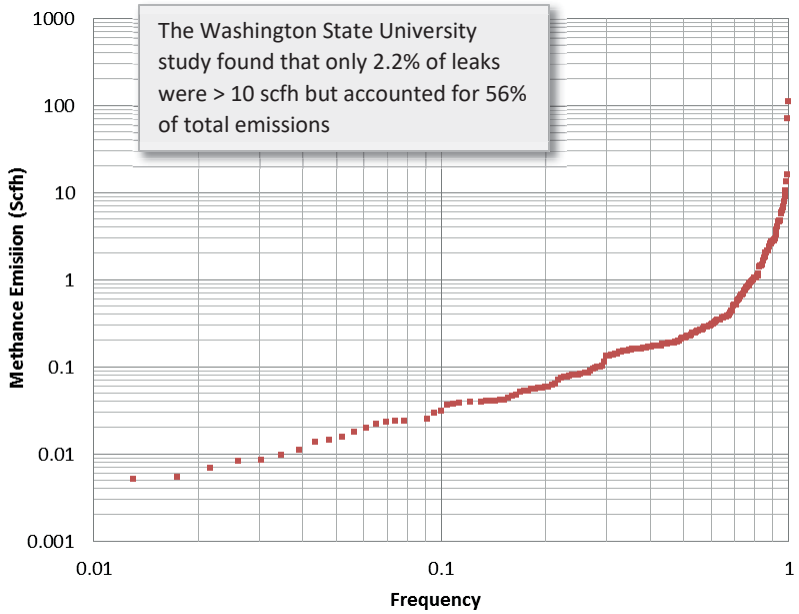


Figure 4: MAB Timeline from R&D to Production Deployment

R&D and Innovation

The Super-Emitter Program reduces methane emissions of the distribution network at a lower cost

Leaks on distribution pipelines represent about 25% of our methane emissions as reported under SB1371. Measurements performed by Washington State University across the country in 2014 showed that only a small number (2.2%) of larger leaks, typically greater than 10 scfh, contribute to most of these emissions (56%).



Distribution of leaks observed by Washington State University on Distribution pipelines

SUPER EMITTER PROGRAM COSTS AND BENEFITS

R&D costs: $535k

- PG&E share: $62k
- leverage ratio: 8.7
- Other funders
  - NYSEARCH: $329k
  - PHMSA: $145k

Implementation costs (per year):

- Additional survey costs: $1.1M

Benefits (per year):

- 2018: 128 SE repairs equate to 1,402 regular leak repairs for savings of $9.6M
- 2019: 125 SE repairs equate to 1,370 regular leak repairs for savings of $9.3M

Following up on this observation R&D and Innovation started in 2016 to explore how the Picarro system could be used to accelerate the detection, quantification and then repair of the largest leaks of PG&E's distribution system. A project was also launched with NYSEARCH co-funded by other utilities and PHMSA to characterize the uncertainty of vehicle-based leak quantification tools such as Picarro's technology. The results confirmed that, even if their accuracy was limited, vehicle-based tools could be used to rapidly survey our whole distribution system, identify larger leaks and prioritize their repair.

In parallel, a calculation method was developed to correctly represent the uncertainties of the measurement and ensure that the reported emissions were valid.

The method was presented to CPUC and CARB early 2018 and accepted for implementation. It has also been regularly featured in industry conferences such as AGA Operation Conference in 2020 and at the EPA Gas Star meeting in 2019, EUCI and PRCI. The program was filed as a Best Management Practice of the EPA's Methane Challenge in 2020.

The first year of application in 2018 when the territory not covered by compliance survey was driven with Picarro cars, led to the identification of 220 super emitters and a reduction of emission by 15% for about 128 additional repairs. The second year in 2019, the reduction of emission reached 23% by the combination of a larger coverage and the effect of accelerating the survey: the territory being surveyed for large leaks every year, less time was left for these leaks to form and grow.

The program is about 20 times more cost effective to reduce methane emissions than the systematic repair of all found leaks. In addition, the early detection of large leaks with the annual survey of the territory, made possible with the Picarro mobile system, substantially reduces the number of large leaks open in our system at any point of time, further reducing emissions and improving safety.

Finally, the data collected through the Super Emitter survey is merged with compliance survey results to better inform the schedule of subsequent surveys since the number of new leaks can be predicted trough analytics.

Current R&D efforts:

- Improve quantification algorithms to improve the performance of Super Emitter surveys
- Develop a Risk informed leak survey schedule to prioritize compliance surveys based on the probability to find leaks
- Improve resource scheduling based on predictive leak probability modelling
- Expand the program to smaller leaks
- Extend the method to other assets such as M&R stations, Compressor stations and Storage facilities.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations Mapping Support
Program Summary

Project Title: Mapping Support
Major Work Categories: MWC GF (MATs: GFO and GFP)
Planning Order Numbers: 5055712, 5055714
Project Start Date: N/A
Project Completion Date: N/A
Operative Date (only applies to Capital): N/A

Project Description

Gas Transmission and Distribution Mapping are critical to ensure accurate, complete and accessible asset data for our systems of record, PHMSA Advisory compliance, and associated CPUC decisions. Our system consists of approximately 6,438 miles of transmission pipeline, 43,509 miles of distribution main and nearly 3.6 million gas services. These pipelines provide natural gas to the Company's 4.6 million residential, commercial and industrial customers. Data from these pipes are used throughout Gas Operations to assess risk, ensure proper operation of gas facilities, design and engineer projects, determine MAOP, plan and execute maintenance and construction, perform leak survey, and perform locate and mark.

MWC GF also funds the following tasks:

- Processing of delineation requests for external customers, developers and agencies,
- External data requests including inspections and audits,
- Completing Requests for Work and Asset Registry updates enabling updates to maintenance plans,
- Data discrepancy corrections,
- Updating of operating maps and diagrams used for preventative maintenance and emergency response activities.

Justification

GFO & GFP

PG&E is required to provide customers, communities, utilities and governmental agencies an accurate account
of installed facilities. Likewise PG&E is required to install, maintain, operate and eventually retire gas transmission and distribution facilities in a safe and reliable manner. Accurately and timely updates to maps and records are a critical part of this effort. PG&E uses electronic maps and database management systems to store and access information to effectively provide internal support for locate and mark, leak survey, preventative maintenance, engineering and design, integrity assessment activities and in calculating franchise taxes paid to local governments.

GFP-Sprecific Regulatory Requirements

Per PHMSA Advisory ADB 12-06 and associated CPUC decisions, each owner or operator of a gas transmission pipeline and associated facilities is required to verify that the feature attributes are traceable, verifiable, and complete. In addition, per PHMSA Mega Rule 192.67 (Records: Material Properties), 192.205 (Records: Pipeline Components), 192.607 (Material Property Verification) and 192.624 (MAOP Reconfirmation), PG&E must gather and retain traceable, verifiable, and complete (TVC) material test reports (MTR), Certificates of Compliance (CoC), or other records documenting the physical characteristics, manufacturing standards and pressure ratings for gas transmission pipelines and associated components. The Gas Asset Knowledge Management organization tracks essential asset information in managed systems of record (i.e. GIS, SAP, Documentum, etc.), including: diameter, yield strength, ultimate tensile strength, wall thickness, seam type, chemical composition, size, material type, location, configuration, and other critical information in accordance with these regulatory requirements.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations Mapping Support
Program Summary

The Pipeline Open Data Standard (PODS) database, also maintained in the gas transmission GIS, is the official compilation of critical information and calculations for many safety decisions related to Maximum Allowable Operating Pressure (MAOP). Maintaining these systems of record ultimately contributes to the safe and reliable delivery of natural gas to PG&E's customers and to the safety of employees and third parties performing work in the community.

Cost

The table below displays cost information for planning orders in each MAT with major and regular costs in previous recorded years.

GFO:

Forecasted costs (2021-2026) are allocated using a three-year average based on historical proportion of annual spend. The three-year averages are 2017-2019 (standard methodology) to align with the three-year averages used to derive the 2023 total forecast.
Total forecast for 2021 and 2022 is based on current imputed values. 2023 total forecasts are based on three-year averages of historical spend escalated to 2023 dollars while successive forecast years are escalated to current year dollars based on the previous year's forecast.

GFP:

Forecasted costs (2021-2026) are allocated using a three-year average based historical proportion of annual spend. The three-year averages are 2018-2020 for GFP to align with the three-year averages used to calculate our 2023 total forecasts. GFP does not use the standard methodology of averaging 2017-2019 costs to derive the 2023 forecast because that results in higher costs than anticipated for GFP. Total forecast for 2021 and 2022 is based on current imputed values. 2023 total forecasts are based on three-year averages of historical spend escalated to 2023 dollars while successive forecast years are escalated to current year dollars based on the previous year's forecast. GFP 2023 forecast uses three-year averages of 2018-2020.

Major Project Spending Estimates
(Thousands of Dollars; Nominal for Recorded Costs and Real for Forecasted Costs)

	Recorded					Forecast			
	2016	2017	2018	2019	2020	2021	2022	2023	Workpaper Reference
MAT GFO	$ 4,391	$ 3,948	$ 3,910	$ 3,090	$ 3,394	$ 4,400	$ 4,401	$ 4,203	
Total	**$ 4,391**	**$ 3,948**	**$ 3,910**	**$ 3,090**	**$ 3,394**	**$ 4,400**	**$ 4,401**	**$ 4,203**	WP 13-5, Line 7
MAT - GFP	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	
5245453 - DD&QA - PFL	$ 5,418	$ 6,120	$ 4,822	$ 1,855	$ 1,083	$ 2,050	$ 2,099	$ 2,768	
5045463 - GT Scanning & Attributing Contracts	$ -	$ -	$ -	$ 93	$ 133	$ 80	$ 82	$ 108	
5245376 - Gas Transmission Mapping	$ 1,718	$ 1,462	$ 2,034	$ 1,235	$ 1,730	$ 1,441	$ 1,475	$ 1,946	
5031954 - PFL Contracts	$ 466	$ 322	$ 244	$ 43	$ 1,615	$ 552	$ 565	$ 745	
Total	**$ 7,602**	**$ 7,904**	**$ 7,100**	**$ 3,226**	**$ 4,561**	**$ 4,123**	**$ 4,221**	**$ 5,567**	WP 13-5, Line 23

Alternatives Consider / Benefits

No alternatives considered. Mapping support focuses on confirming that all maps and records of the gas transmission and distribution systems are accurate and reliable, reducing the risk of dig-ins, over pressure events and other similar events.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations/Gas Other Support
Program Summary

Project Title: Other Gas Operations Support (MAT AB#)
Major Work Categories: MWC's AB; MAT AB#
Planning Order Numbers: 5058173, 5056001, 5055629, 5055350, 5056002, 5055650, 5055353, 5056002
Project Start Date: N/A
Project Completion Date: N/A
Operative Date (only applies to Capital): N/A

Project Description

The costs incurred for supporting both the Gas Transmission and Distribution Operations teams is recorded to MAT code AB#. Support programs aligned to MAT AB# include the Engineer Rotation Development Program (ERDP), Gas Consulting Contracts, Gas Data Management and customer incentives related to the Gas Asset Strategy's Alternative Energy Program, among others.

Justification

The programs covered in MAT AB# provide general support to the Gas Operations organization to strategically solve problems and plan. For example, the ERDP focuses on providing enhanced learning opportunities and rigorous training to create a pipeline of entry-level engineers needed to support Gas Operations in the future. Additionally, the Gas Consulting Contracts enable the Gas Operations organization to provide specialized resources to support emerging projects and provide a wide range of emergent analyses.

Cost

A 3 year (2017-2019) historical annual average of costs for Gas Other General Support was used to produce the final escalated portion of the forecast.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast				
	2016	2017	2018	2019	2020	2021	2022	2023	Total	Workpaper Reference
Expense Total - GD	$18,627	$44,419	$15,785	$4,834	$19,430	$13,557	$18,113	$18,717	$153,482	WP 13-5, line 1.
Expense Total - GT	$16,649	$71,853	$18,603	$16,856	$7,011	$13,968	$13,308	$13,749	$171,997	WP 13-5, line 14.
TOTAL PROJECT COST	$35,276	$116,272	$34,388	$21,689	$26,441	$27,525	$31,421	$32,466	$325,478	

Alternatives Considered / Benefits

No alternatives considered. The projects and programs recorded to MWC AB allow PG&E address emerging issues in Gas Distribution and Gas Transmission by working with specialty programs that manage, monitor and improve quality of our gas operations work.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations/Gas Other Support – Data Management
Program Summary

Project Title: Gas Data Management
Major Work Categories: AB#
Planning Order Numbers: 5056001, 5056002
Project Start Date: N/A
Project Completion Date: N/A

Project Description

The Gas Data Management plan is program within MAT AB#. In alignment with the Enterprise, Gas Operations will establish and implement a foundational data management program. It will focus on data architecture and its maintenance, data governance, and data quality to drive the effective use of data in risk mitigation for Gas Operations.
The Gas Operations Data Management Program will execute new policies, standards, and procedures, including:

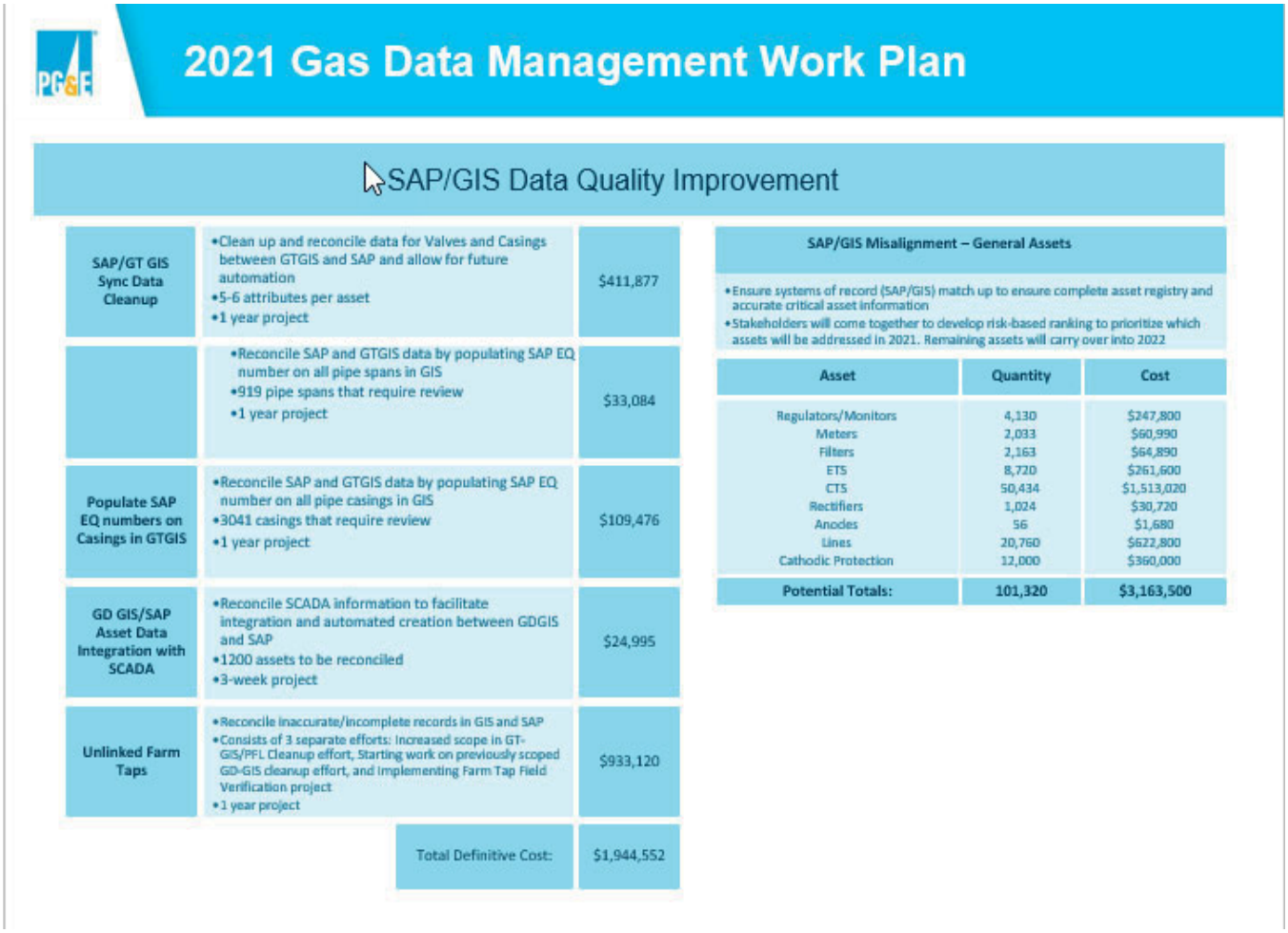
- Implementation and maintenance of a data asset register
- Implementation of a data analytics platform (such as Palantir Foundry) within Gas Operations that integrates asset-related information from disparate sources such as SAP, GIS, and CC&B, enabling a data-driven approach to risk mitigation
- Completion of data quality improvement projects that have been prioritized based on a risk assessment framework

Justification

PG&E's data environment has evolved over time with the development and deployment of large, built-for-purpose data source systems (e.g., SAP, GIS). PG&E has integrated data between individual systems on a case-by-case basis through data interfaces or by manually combining data outside the base systems. This has led to inconsistent data across systems, a lack of data owners, no consistent metadata and no centrally integrated environment to facilitate effective development of analytics.
To improve decision making, the Gas Operations Data Management Program will enable effective use of data in asset and risk management. The program will set a foundation for data use and provide the ability to access, integrate, and analyze data across disparate systems.

The program will provide a necessary, practical data integration approach that utilizes data pipelines from source data systems (SAP, GIS, and CC&B) into an integrated data platform, such as Palantir Foundry. This approach, combined with the completion of essential data improvement projects within the program, will enable access to timely, trusted, and consistent information, that can be leveraged for advanced data analytics, thereby enabling the ability to make more effective, data-driven decisions.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations/Gas Other Support – Data Management
Program Summary



2021 Gas Data Management Work Plan

SAP/GIS Data Quality Improvement

SAP/GT GIS Sync Data Cleanup	•Clean up and reconcile data for Valves and Casings between GTGIS and SAP and allow for future automation •5-6 attributes per asset •1 year project	$411,877
	•Reconcile SAP and GTGIS data by populating SAP EQ number on all pipe spans in GIS •919 pipe spans that require review •1 year project	$33,084
Populate SAP EQ numbers on Casings in GTGIS	•Reconcile SAP and GTGIS data by populating SAP EQ number on all pipe casings in GIS •3041 casings that require review •1 year project	$109,476
GD GIS/SAP Asset Data Integration with SCADA	•Reconcile SCADA information to facilitate integration and automated creation between GDGIS and SAP •1200 assets to be reconciled •3-week project	$24,995
Unlinked Farm Taps	•Reconcile inaccurate/incomplete records in GIS and SAP •Consists of 3 separate efforts: Increased scope in GT-GIS/PFL Cleanup effort, Starting work on previously scoped GD-GIS cleanup effort, and Implementing Farm Tap Field Verification project •1 year project	$933,120
	Total Definitive Cost:	$1,944,552

SAP/GIS Misalignment – General Assets

- Ensure systems of record (SAP/GIS) match up to ensure complete asset registry and accurate critical asset information
- Stakeholders will come together to develop risk-based ranking to prioritize which assets will be addressed in 2021. Remaining assets will carry over into 2022

Asset	Quantity	Cost
Regulators/Monitors	4,130	$247,800
Meters	2,033	$60,990
Filters	2,163	$64,890
ETS	8,720	$261,600
CTS	50,434	$1,513,020
Rectifiers	1,024	$30,720
Anodes	56	$1,680
Lines	20,760	$622,800
Cathodic Protection	12,000	$360,000
Potential Totals:	**101,320**	**$3,163,500**

The Gas Data Management program requests dollars that support the Data Management program. This is a new program. Expense drivers are estimates from similar data improvement work completed for PG&E's gas distribution and transmission Geographic Information Systems (GIS). Data Management Data Quality work is not limited to GIS systems as it may include SAP and CC&B or other systems (e.g., Documentum). Data Management is forecast to spend $3.0 million in 2021 and 2022 and $3.1 million in 2023.

Cost

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast			
	2016	2017	2018	2019	2020	2021	2022	2023	Total
EXPENSE									
MAT AB# (5056001 & 5056002)	N/A	N/A	N/A	N/A	N/A	$3,000	$3,000	$3,101	$9,101
									-
Capital Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**$3,000**	**$3,000**	**$3,101**	**$9,101**

Benefits

Having reliable, trusted data reduces the following:

- Risk
- Compliance violations
- Organizational inefficiencies
- Customer dissatisfaction

Alternatives Considered

Do nothing – not a viable option. Lack of effective data management has been identified as a major concern for the utility and Gas Operations. The Gas Operations Data Management program will implement PG&E's new enterprise-wide policy and standards to ensure effective data governance, data curation, and data sharing. The program will also complete necessary data projects to ensure the accuracy and completeness of critical datasets.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations/ Operations Management & Operational Support
Program Summary

Project Title: Operations Management (OM) and Operational Support (OS)
Major Work Categories: OM, OS; (MAT: OM#; OMS#)
Planning Order Numbers: 5055630, 5057378, 5055651, 5057377
Project Start Date: N/A
Project Completion Date: N/A
Operative Date (only applies to Capital): N/A

Project Description

Operational Management (OM) and Operational Support (OS) reflect the costs associated with personnel that
supervise, manage and/or support the Gas Distribution employees that perform work charged to orders.

Justification

OM# and OS# cover the overhead costs of gas employees that supervise, support, or manage employees who charge their time to specific orders. These employees' primarily manage and support the work forecasted in the entire Gas Portfolio. PG&E tracks the expense portion of OM and support costs in MAT OM# and OS#. OM and OS costs are allocated between expense and capital, and between Gas Distribution and Gas Transmission.

Costs for work are allocated to different cost buckets within PG&E's cost model. The capital and expense direct labor costs are described and accounted for in the programs within other chapters of the Gas Exhibit. The expense portion of the OM and OS costs are accounted for in MATs OM# and OS#. The costs are assigned based on the Provider Cost Center (PCC) to which an employee is assigned. Costs for employees assigned to an OM PCC are captured in MAT OM#. Costs for employees assigned to an OS PCC are captured in MAT OS#.

Cost

PG&E developed the 2023 forecasts for Operational Management and Support costs captured in MAT's OM# and OS# using the combined gross dollars for OM and OS employees and the total headcount for OM and OS employees.

To develop the forecast:

1) PG&E determined an average cost-plus escalation per OM/OS employee. This was based on the PCCs designated as OM or OS then layering on the 2021 headcount cap with known added increases.

2) PG&E then split this new gross OM/OS dollar amount, and allocated 62% to capital and 38% percent to expense. This split is based on historical spend (2016-2019) for all Gas Ops Capital and Expense work.

3) The resulting expense portion of OM/OS (38%) was then split between Transmission and Distribution using the 2016 - 2019 OM/OS actuals. This split resulted in 32% of the expense dollars being allocated to Transmission and 68% being allocated to Distribution.

PACIFIC GAS AND ELECTRIC COMPANY
Gas Operations/ Operations Management & Operational Support
Program Summary

The Final step was to ensure this expense portion split between T&D, matched historical spend for OM and OS. This resulted in the following: 32% of expense in Transmission; 15% of which is OM and 17% is OS, and 68% of expense in Distribution; 22% of which is OM and 46% is OS.

Major Project Spending Estimates
(Thousands of Nominal Dollars)

	Recorded					Forecast			
	2016	2017	2018	2019	2020	2021	2022	2023	Workpaper Reference
OM# Expense Total - GD	$13,671	$11,628	$4,673	$13,226	$14,363	$10,296	$11,793	$13,183	WP 13-5, line 10.
OM# Expense Total - GT	$6,647	$4,921	$7,829	$6,348	$6,770	$10,091	$7,628	$8,527	WP 13-5, line 25.
EXPENSE									
OS# Expense Total - GD	$16,146	$16,553	$28,440	$15,458	$26,631	$27,212	$24,145	$26,990	WP 13-5, line 11.
OS# Expense Total - GT	$10,296	$7,331	$5,382	$10,250	$1,102	$6,701	$9,172	$10,253	WP 13-5, line 26.
TOTAL PROJECT COST	$46,761	$40,433	$46,325	$45,282	$48,866	$54,300	$52,738	$58,953	

Additional Cost Information:
The OM/OS forecast is based on potential increases in employee headcount, and capital/expense and transmission/distribution split percentages.

Benefits

The costs covered in OM and OS allow for work throughout the gas organization to be completed quickly and effectively with a high degree of thoroughness, and are critical to supporting the Gas Transmission and Distribution organization's role in the larger company.

Alternatives Considered

PG&E continually monitors and evaluates its OM/OS staffing plans to so that the right number of OM/OS employees are available to manage and support Gas Distribution operations.

Workpaper Table 13-15
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 13, Other Gas Operations Support
Expense Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC AB	MWC DN	MWC GF	MWC LX	MWC OM	MWC OS	MWC GZ	Detailed Description/Explanation
1	**2016**	**58,293**	**18,627**	**3,126**	**4,607**	**0**	**13,671**	**16,146**	**2,116**	
2			25,792							Increase due to the McKinsey Contract
3				733						Immaterial variance
4					(659)					in 2016, GD Mapping led an effort to recover Leak Inspection records system-wide and coordinated the scanning and shipping to off-site storage as part of this effort. This was charged to our GF budget.
5						0				N/A
6							(2,044)			The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
7								407		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
8									(451)	Delays in some projects that led to shift of payments from 2017 to 2018
9	**2017**	**82,072**	**44,419**	**3,859**	**3,948**	**0**	**11,628**	**16,553**	**1,665**	
10			(27,633)							MWC AB reduction due to realignment of orders between MAT codes.
11				1,209						OQ Profiling application went live. Increase in OQ Requirement/testing.
12					(38)					Immaterial variance
13						0				N/A
14							(6,955)			The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
15								11,888		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
16									397	Delays in some projects that led to shift of payments from 2017 to 2018
17	**2018**	**60,939**	**16,786**	**5,068**	**3,910**	**0**	**4,673**	**28,440**	**2,063**	
18			(11,161)							MWC AB reduction due to realignment of orders between MAT codes.
19				(2,450)						Decrease due to reduced additional evaluator headcount.
20					(819)					Regionalization for GD Mapping started in 2018 which resulted in a reduction in headcount and less expense work.
21						0				N/A
22							8,552			The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
23								(12,982)		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
24									(306)	Delays in some projects that led to shift of payments from 2019 to 2020
25	**2019**	**41,773**	**5,625**	**2,618**	**3,090**	**0**	**13,226**	**15,458**	**1,757**	
26			14,630							MWC AB increase due to realignment of orders between MAT codes.
27				(1,735)						Decrease due to reduced additional evaluator headcount
28					304					Increase due to research and completion of outstanding field verification Map Correction CAPs.
29						0				N/A
30							1,137			The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
31								11,173		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
32									1,533	Transfer of Methane Emission Abatement expenditures from Balancing Account under OIR-15-01-008 back to R&D budget.
33	**2020**	**68,816**	**20,255**	**883**	**3,394**	**0**	**14,363**	**26,631**	**3,290**	

Note: Total amounts and amounts for each MWC are obtained from WP 13-5 by summing the relevant lines for each MWC.

Workpaper Table 13-16
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 13, Other Gas Operations Support
Expense Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC AB	MWC DN	MWC GF	MWC GZ	MWC LX	MWC OM	MWC OS	Detailed Description/Explanation
	2020	**68,816**	**20,255**	**883**	**3,394**	**3,290**	**0**	**14,363**	**26,631**	
			(6,457)							MWC AB reduction due to realignment of orders between MAT codes.
				203						Immaterial variance
					1,006					MCFV CAP Project was expense work completed in 2020.
						198				Increase of activity on decarbonization of the gas system including RNG and Hydrogen
							1,500			Increase due to Butte Rebuild costs.
								(4,067)		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
									581	Immaterial variance
	2021	**61,780**	**13,799**	**1,086**	**4,400**	**3,488**	**1,500**	**10,296**	**27,212**	
			2,520							MWC AB reduction due to realignment of orders between MAT codes.
				25						Immaterial variance
					1					Immaterial variance
						105				Immaterial variance
							1,359			Increase due to Butte Rebuild costs.
								1,497		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
									(3,067)	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
	2022	**64,220**	**16,318**	**1,111**	**4,401**	**3,592**	**2,859**	**11,793**	**24,145**	
			546							Immaterial variance
				1,435						Increased OQ Qualification expense and licensing fees
					(199)					Immaterial variance
						2,258				Increase of activity on operation cost reduction and decarbonization of the gas system including Carbon Capture Utilization and Sequestration
							52			Immaterial variance
								1,390		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
									2,845	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
	2023	**72,548**	**16,864**	**2,546**	**4,203**	**5,850**	**2,912**	**13,183**	**26,990**	

Note: Total amounts and amounts for each MWC are obtained from WP 13-5 by summing the relevant lines for each MWC.

Workpaper Table 13-17
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 13, Other Gas Operations Support
Expense Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 34	MWC AB	MWC AK	MWC AY	MWC CR	MWC DN	MWC GF	MWC GZ	MWC OM	MWC OS	Detailed Description/Explanation
1	**2016**	**48,879**	**2,246**	**10,449**	**2,966**	**2**	**446**	**7,013**	**7,627**	**1,187**	**6,647**	**10,296**	
2			1,329										Increase due to fluctuation of work. Work identified based on what has been found the previous year and compliance.
3				59,384									Increase due to the McKinsey Contract
4					(421)								Decrease due to vendor costs not being allocated to Gas LOB Projects, offset by an increase to Land & Environmental Management MWC AK, Exhibit 7.
5						(2)							Immaterial variance
6							15						Immaterial variance
7								(2,592)					Immaterial variance
8									277				Immaterial variance
9										475			Increase of R&D activity on Methane Emission Abatement
10											(1,726)		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
11												(2,965)	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
12	**2017**	**102,653**	**3,575**	**69,833**	**2,546**	**0**	**461**	**4,421**	**7,904**	**1,662**	**4,921**	**7,331**	
13			(2,197)										Decrease due to fluctuation of work. Work identified based on what has been found the previous year and compliance.
14				(49,873)									MWC AB reduction due to realignment of orders between MAT codes.
15					260								Immaterial variance
16						0							N/A
17							65						Increase due to higher Hazardous Waste pick-up activities.
18								922					OQ Profiling application went live. Increase in OQ Requirement/testing was more
19									(802)				Decreased due to closed order cost.
20										(129)			Transfer of Methane Emission Abatement expenditures to Balancing Account under OIR-15-01-008
21											2,908		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
22												(1,949)	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
23	**2018**	**51,857**	**1,378**	**19,960**	**2,805**	**0**	**525**	**5,343**	**7,102**	**1,533**	**7,829**	**5,382**	
24			64										Increase due to fluctuation of work. Work identified based on what has been found the previous year and compliance.
25				(2,703)									MWC AB reduction due to realignment of orders between MAT codes.
26					(99)								Immaterial variance
27						0							N/A
28							267						Increase due to Standard Cost Variance, more vendor costs allocated to Gas LOB Projects, this was partially offset by a decrease to Land & Environmental Management MWC CR, Exhibit 7, Chapter 6.
29								(3,561)					Decrease due to reduced evaluator headcount.
30									(3,876)				Decrease due to closed PFL Backlog and reduced contracts with Novora, EEI and Insight Global.
31										313			Increase of activities related to Renewable Natural Gas
32											(1,481)		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
33												4,867	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
34	**2019**	**45,649**	**1,442**	**17,257**	**2,707**	**0**	**792**	**1,782**	**3,225**	**1,846**	**6,348**	**10,250**	
35			(283)										Decrease due to fluctuation of work. Work identified based on what has been found the previous year and compliance.
36				(9,769)									MWC AB reduction due to realignment of orders between MAT codes.
37					259								Increases in compliance work related to CARB Oil and Gas Rule (COGR) which has added more oversight requirements from contractors and PG&E environmental management staff.
38						0							N/A
39							(254)						Decrease due to Standard Cost Variance, vendor costs not allocated to Gas LOB projects, this was partially offset by an increase to Land & Environmental Management MWC CR, Exhibit 7, chapter 6.
40								(999)					Decrease due to reduced evaluator headcount.
41									1,346				Increase due to Maximum Allowable Operating Pressure (MAOP) Shorts Contract
42										203			Transfer of Methane Emission Abatement expenditures from Balancing Account under OIR-15-01-008 back to R&D budget.
43											422		Immaterial variance
44												(9,148)	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
45	**2020**	**27,427**	**1,159**	**7,488**	**2,965**	**0**	**538**	**783**	**4,571**	**2,049**	**6,770**	**1,102**	

Note: Total amounts and amounts for each MWC are obtained from WP 13-5 by summing the relevant lines for each MWC.

Workpaper Table 13-8 Revised
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 13, Other Gas Operations Support
Expense Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 34	MWC AB	MWC AK	MWC AY	MWC CR	MWC DN	MWC GF	MWC GZ	MWC OM	MWC OS	Detailed Description/Explanation
1	**2020**	**27,427**	**1,159**	**7,488**	**2,965**	**0**	**538**	**783**	**4,571**	**2,049**	**6,770**	**1,102**	
2			2,764										Increase in StanPac work.
3				(91,085)									Negative forecast included in 2020 for expected efficiencies in the gas operations portfolio.
4					(686)								2020 costs exceeded 2019 GTS estimates due to increases in compliance work related to CARB Oil and Gas Rule (COGR) which has added more oversight requirements from contractors and PG&E environmental management staff. 2021 estimate is based on imputed value from the 2019 GT&S case.
5						0							N/A
6							(4)						Immaterial Change. 2021 estimate is based on imputed values within the 2019 GT&S case.
7								229					Escalation
8									(448)				Estimated decrease to closed order work, matching Imputed
9										1,035			Increase of activity on decarbonization of the gas system including RNG and Hydrogen
10											3,321		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
11												5,599	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
12	**2021**	**(51,847)**	**3,923**	**(83,597)**	**2,280**	**0**	**535**	**1,012**	**4,123**	**3,085**	**10,091**	**6,701**	
13			509										Immaterial variance
14				101,764									Negative forecast included in 2021 for expected efficiencies in the gas operations portfolio.
15					56								Immaterial change.
16						0							N/A
17							11						Immaterial change.
18								22					Immaterial change.
19									98				Immaterial variance
20										93			Immaterial variance
21											(2,463)		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
22												2,471	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
23	**2022**	**50,713**	**4,432**	**18,166**	**2,336**	**0**	**546**	**1,034**	**4,221**	**3,177**	**7,628**	**9,172**	
24			(1,303)										Decrease in identified StanPac work
25				601									MWC AB reduction due to realignment of orders between MAT codes.
26					735								Increase is a result in a change of estimating methods. 2022 estimated values from the 2019 GT&S Case; however, the 2023 was estimated by reviewing the recent actual costs plus escalation.
27						0							N/A
28							130						Increase is a result in a change of estimating methods. 2022 estimated values from the 2019 GT&S Case; however, the 2023 was estimated by reviewing the recent actual costs plus escalation.
29								826					Increase OQ Qualification expense and licensing fees
30									1,346				2018 - 2020 average cost with standard Escalation, matching imputed values
31										2,473			Increase of activity on operation cost reduction and decarbonization of the gas system including Carbon Capture Utilization and Sequestration
32											899		The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
33												1,081	The overall cost allocations are based on compositions of the underlying portfolio and a shift in portfolio composition favoring Transmission or Distribution will result in year over variances within OM/OS.
34	**2023**	**57,498**	**3,129**	**18,767**	**3,071**	**0**	**676**	**1,860**	**5,567**	**5,650**	**8,527**	**10,253**	

Note: Total amounts and amounts for each MWC are obtained from WP 13-5 by summing the relevant lines for each MWC.

Table 13-19
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 13
Other Gas Operations Support
Capital Expenditures by Major Work Category
(Thousands of Nominal Dollars)

				Capital Expenditures											
No.	MWC	MAT	MAT Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	5	05A	Tools	5,592	5,101	10,894	9,320	6,674	4,441	4,449	9,194	9,490	9,794	10,106	
2	5	#	Not assigned	-	-	0	-	1	(76,111)	-	-	-	-	-	
3	12	12A	Environmental - Water Qual	(525)	(1,276)	(2,075)	(1,507)	(1,317)	-	-	-	-	-	-	
4	21	#	Not assigned	-	1,891	1,938	-	12,267	2,017	2,051	2,098	2,151	2,200	2,251	
5	3Q	3QA	GD Restore & Rebuild Capital	-	-	-	-	-	32,110	24,187	17,810	15,868	10,515	9,727	
6	44	44A	Stan-Pac Capital	7,854	3,273	1,800	1,186	7,342	5,388	4,934	2,881	2,956	18,528	18,997	
7	78	78A	Office Facilities	39,834	25,087	272	284	(30)	-	-	-	-	-	-	
8			**Grand Total**	**52,754**	**34,076**	**12,830**	**9,283**	**24,937**	**(32,155)**	**35,620**	**31,982**	**30,464**	**41,037**	**41,081**	

Table 13-20
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 13
Other Gas Operations Support
Forecast Capital Expenditures Summary
(Thousands of Nominal Dollars)

		Capital Expenditures							
Line No.	Description	2020 CWIP	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	Projects > $3 Million*	-	37,543	35,620	31,982	30,464	41,037	41,081	
2	Other Work	6,927	(69,698)	-	-	-	-	-	
3	**Total**	**6,927**	**(32,155)**	**35,620**	**31,982**	**30,464**	**41,037**	**41,081**	

4 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Table 13-21
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 13
Other Gas Operations Support
Recorded CWIP and Forecast Capital Expenditures Details - Projects Over $3 Million*
(Thousands of Nominal Dollars)

					CWIP	Capital Expenditures							
Line No.	Planning Order	Description	MWC	Operative Date	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Subtotal	Reference
	MAT - 05A	**Tools**											
1	5510481	G Dist Region M&C Capital Tools	5		-	3,416	-	-	-	-	-	3,416	
2	5542178	2023 GRC GD Tools & Equipment	5		-	-	3,491	6,105	6,302	6,504	6,712	29,114	
3	5542180	2023 GRC GT Tools & Equipment	5		-	-	958	3,089	3,188	3,290	3,394	13,918	
4	**Total**				**-**	**3,416**	**4,449**	**9,194**	**9,490**	**9,794**	**10,106**	**46,448**	
	MAT - 3QA	**GD Restore & Rebuild Capital**											
5	5544474	2023 GRC Camp Fire Rebuild Forecast	3Q		-	32,110	24,187	17,810	15,868	10,515	9,727	110,216	
6	**Total**				**-**	**32,110**	**24,187**	**17,810**	**15,868**	**10,515**	**9,727**	**110,216**	
	MAT - 44A	**Stan-Pac Capital**											
7	5906323	2023 GRC StanPac (44A)	44		-	-	4,934	2,881	2,956	18,528	18,997	48,295	
8	**Total**				**-**	**-**	**4,934**	**2,881**	**2,956**	**18,528**	**18,997**	**48,295**	
	MAT - #	**Not assigned**											
9	5544400	2023 GRC GD CEMA ST Labor Forecast	21		-	2,017	2,051	2,098	2,151	2,200	2,251	12,768	
10	**Total**				**-**	**2,017**	**2,051**	**2,098**	**2,151**	**2,200**	**2,251**	**12,768**	
11		**Grand Total**			**-**	**37,543**	**35,620**	**31,982**	**30,464**	**41,037**	**41,081**	**217,728**	

12 * Planning orders where Construction Work in Progress (CWIP) Balance as of December 31, 2020 plus six years (2021-2026) of forecast.

Table 13-22
Pacific Gas and Electric Company
2023 GRC
Exhibit (PG&E-3), Chapter 13
Other Gas Operations Support
Recorded and Forecast Capital Expenditures Details - Other Work*
(Thousands of Nominal Dollars)

				Capital Expenditures											
Line No.	MWC	MAT	MAT Description	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	5	05A	Tools	2,399	1,952	4,974	1,578	2,145	1,025	-	-	-	-	-	
2	5	#	Not assigned	-	-	0	-	1	(76,111)	-	-	-	-	-	
3	12	12A	Environmental - Water Qual	(525)	(1,276)	(2,075)	(1,507)	(1,317)	-	-	-	-	-	-	
4	21	#	Not assigned	-	1,891	1,938	-	12,267	-	-	-	-	-	-	
5	44	44A	Not assigned	7,854	3,273	1,800	1,186	7,342	5,388	-	-	-	-	-	
6	78	78A	Office Facilities	39,834	25,087	272	284	(30)	-	-	-	-	-	-	
7		**Grand Total**		**49,562**	**30,927**	**6,910**	**1,541**	**20,407**	**(69,698)**	**-**	**-**	**-**	**-**	**-**	

8 * Excludes projects greater than $3M

Workpaper Table 13-23 Revised
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Other Gas Operations Support
Summary of Capital Expenditures

Gas Distribution Capital

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	Reference	Notes
1	Tools and Equipment Other	05	05#	-	-	292	-	716	(76,111,206)	-	-	-	-	-	-		
2	Gas Capital Tools & Equipment	05	05A	5,592,053	5,101,461	10,894,417	9,320,471	6,674,357	4,441,047	3,490,696	6,105,164	6,302,209	6,503,968	6,712,186	**25,623,526**	WP 13-45, line 2.	
3	Environmental - Water Qual	12	12A	(524,922)	(1,276,416)	(2,074,867)	(1,507,338)	(1,352,721)	-	-	-	-	-	-	-		1
4	Miscellaneous Capital Other	21	21#	-	1,890,800	1,937,975	-	15,917,578	2,017,000	2,051,000	2,098,000	2,151,000	2,200,000	2,251,000	**8,700,000**		2
5	GD Restore & Rebuild Capital	3Q	3QA	-	-	-	-	-	32,110,171	24,186,650	17,809,743	15,867,511	10,515,359	9,726,722	**53,919,335**	WP 13-49, line 2	
6	Office Facilities	78	78A	15,223,954	5,690,562	(1,339,058)	320,550	8,289	-	-	-	-	-	-	-		3
7	**Total Capital Expenditures**			**20,291,086**	**11,406,407**	**9,418,760**	**8,133,683**	**21,248,220**	**(37,542,988)**	**29,728,346**	**26,012,907**	**24,320,720**	**19,219,327**	**18,689,908**	**88,242,861**		

Notes
(1) Recorded Only. Cost allocated to Project Orders.
(2) Forecast for CEMA straight time labor. See Exhibit 4 Chapter 6 (Electric Emergency Recovery for details)
(3) Recorded Cost Only. Cost moved to CRESS Shared Services.

Gas Transmission Capital

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Forecast	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026	Reference	Notes
8	Gas Capital Tools & Equipment	05	05A	-	-	-	-	-	-	958,051	3,088,725	3,187,607	3,289,655	3,394,111	**12,960,098**	WP 13-45, line 3	
9	Environmental - Water Qual	12	12A	-	-	-	-	36,053	-	-	-	-	-	-	-		4
10	Miscellaneous Capital Other	21	21#	-	-	-	-	(3,650,915)	-	-	-	-	-	-	-		5
11	Gas StanPac	44	44A	7,853,764	3,272,563	1,799,858	1,186,233	7,342,314	5,387,942	4,934,075	2,880,580	2,955,637	18,527,978	18,996,995	**43,361,190**	WP 13-48, line 2.	
12	Office Facilities	78	78A	24,609,611	19,396,934	1,611,330	(36,512)	(38,518)	-	-	-	-	-	-	-		6
13	**Total Capital Expenditures**			**32,463,375**	**22,669,497**	**3,411,188**	**1,149,721**	**3,688,934**	**5,387,942**	**5,892,126**	**5,969,305**	**6,143,245**	**21,817,633**	**22,391,106**	**56,321,288**		

Notes
(4) Recorded Only. Cost allocated to Project Orders.
(5) Forecast for CEMA straight time labor. See Exhibit 4 Chapter 6 (Electric Emergency Recovery for details)
(6) Recorded Cost Only. Cost moved to CRESS Shared Services.

Total Capital Expenditure

Line No.	Description	MWC	MAT	2016 Recorded	2017 Recorded	2018 Recorded	2019 Recorded	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total 2023-2026
14	**Total Capital Expenditure**	All	All	**52,754,461**	**34,075,904**	**12,829,948**	**9,283,404**	**24,937,154**	**(32,155,046)**	**35,620,472**	**31,982,212**	**30,463,965**	**41,036,960**	**41,081,014**	**144,564,150**

Workpaper Table 13-24
Pacific Gas and Electric Company
2020 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MAT - 05A Gas Capital Tools and Equipment

Program Description:

Capital - This program supports the planning, purchase and deployment of Capital Tools to field personal performing Gas Operations work.

Line	MAT	Transmission/Distribution % Split	2016 Recorded Adjusted	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	**MAT 05A Total**		**$ 5,592,054**	**$ 5,101,460**	**$ 10,894,418**	**$ 9,320,471**	**$ 6,674,357**	**$ 4,441,047**	**$ 4,448,747**	**$ 9,193,889**	**$ 9,489,816**	**$ 9,793,623**	**$ 10,106,297**	(a)
2	MAT 05A - Distribution	66%	$ 3,192,656	$ 3,148,994	$ 5,920,427	$ 7,742,538	$ 4,529,822	$ 3,415,800	$ 3,490,696	$ 6,105,164	$ 6,302,209	$ 6,503,968	$ 6,712,186	
3	MAT 05A - Transmission	34%	$ 2,399,398	$ 1,952,466	$ 4,973,991	$ 1,577,933	$ 2,144,535	$ 1,025,247	$ 958,051	$ 3,088,725	$ 3,187,607	$ 3,289,655	$ 3,394,111	

Notes:

4 (a) Capex 3-year average (2017-2019)

5 (b) Listed below estimated cost per unit for each tool is based on the most recent purchase price.

Workpaper Table 13-24
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC - 05 Gas Capital Tools and Equipment

	Organization	Tool Description	Quantity	Est. Cost Per Unit (1)	2023-2026 Forecast
6	Construction	Airweld AWAC-0809-1000 Axial Steel Pipe Cutter	1	$10,218	$10,218
7	Construction	Airweld AWAC-0809-1000 Axial Steel Pipe Cutter	1	$10,124	$10,124
8	Construction	Airweld AWAC-0809-2000 Extra Long Axial Steel Pipe Cutter	1	$11,186	$11,186
9	Construction	Airweld AWAC-0809-2000 Extra Long Axial Steel Pipe Cutter	1	$11,214	$11,214
10	Construction	Airweld AWAC-0809-2000 Extra Long Axial Steel Pipe Cutter	1	$11,175	$11,175
11	Construction	Airweld AWAC-0809-2000 Extra Long Axial Steel Pipe Cutter	1	$11,162	$11,162
12	Construction	Bomag Compactor	1	$13,964	$13,964
13	Construction	BTI BX10 Breaker	1	$23,143	$23,143
14	Construction	BTI CX8 Breaker	2	$16,330	$32,660
15	Construction	CAT B5S (formerly H55) Breaker	1	$14,053	$14,053
16	Construction	CAT H55 Breaker	1	$14,077	$14,077
17	Construction	Caterpillar CVP16 Plate Compactor	1	$10,463	$10,463
18	Construction	Cleco 75 RNAL-2X-Nutrunner	1	$7,481	$7,481
19	Construction	Connectra SLS-4A (2"-4") Steel Squeezers	2	$13,456	$26,911
20	Construction	Ditch Witch 102-1608 TK Recon4, North America Radio	3	$20,109	$60,327
21	Construction	Ditch Witch 102-2565 Commander 7 with 17T1 Beacon Base Unit , SV, North America	3	$12,677	$38,030
22	Construction	GC M&C TREX COMUNNICATOR TREXLHPKLWS3S	3	$11,611	$34,832
23	Construction	Hankison RDH-450GAC Heatless Desiccant Dryer	1	$53,173	$53,173
24	Construction	Holiday Detector Spy785 Kit Pipe Coating Inspection	2	$6,899	$13,799
25	Construction	Htyorc PTC/HY-115 Peco Tool Kit	1	$52,771	$52,771
26	Construction	Hytorc Hydraulic Pump, Stealth 2 & Stealth 4 kits.	1	$48,235	$48,235
27	Construction	Jerome 431x Mercury Meter	2	$11,528	$23,055
28	Construction	JET J-7020M 10"x16" Miter Band Saw	1	$10,171	$10,171
29	Construction	Landa Pressure Washer MP-455034E	1	$10,194	$10,194
30	Construction	Magliner MHT75CD Motorized Hand Truck Kit	1	$7,080	$7,080
31	Construction	McElroy A430101-P #14 PitBull Machine Package	1	$8,430	$8,430
32	Construction	McElroy TracStar Super 28 Butt Fusion Machine PGEAT812101P	1	$57,222	$57,222
33	Construction	Miller XMT350 Welding Kit	1	$7,055	$7,055
34	Construction	Sensit GLT G2 tc EX/CO/O2 & Tablet for GLT	8	$7,588	$60,703
35	Construction	Swagelok MS-BTB-M-E-FKIT Manual Tube Bender	1	$8,620	$8,620
36	Construction	Torchmate Lincoln CNC Plasma Cutting Table	1	$35,900	$35,900
37	Construction	Trotec Speedy 360 Flexx Engraver	1	$126,649	$126,649
38	Construction	Vivax vLoc ML2 w/10 watt Transmitter	2	$7,599	$15,198
39	Construction	Vivax vLoc3-Pro Pipe and Cable Locator RTK model	17	$16,595	$282,108
40	Construction	Vivax vLoc3-Pro/ 10Tx Pipe and Cable Locator	230	$10,194	$2,344,713
41	Construction	Weld Clamp Lifting Clamp 24"-42"	2	$10,204	$20,408
42	GPOM	ABL82eTrainer	1	$170,633	$170,633
43	GPOM	Dry well Calbration -40c to 155c, Insert A, 110V	1	$9,620	$9,620
44	GPOM	RX3iPLC Trainers	1	$60,449	$60,449
45	GT Field Engineering	Sprague SPG-1400-035-01 Hydrostatic Test Pump	6	$7,294	$43,764
46	Leak Survey	Gazomat Inspectra Laser	2	$17,046	$34,091
47	Leak Survey	Gazoscan Methane Detector	2	$27,724	$55,448
48	Leak Survey	Heath Aquascope 25903768/2921326	1	$6,892	$6,892
49	Leak Survey	Heath DP-IR	1	$15,386	$15,386
50	Leak Survey	Heath DP-IR	4	$15,601	$62,402
51	Leak Survey	Heath DP-IR	1	$18,925	$18,925
52	Leak Survey	Heath DP-IR +	2	$15,574	$31,148
53	Leak Survey	Heath OMD Optical Methane Detector	1	$47,636	$47,636
54	Leak Survey	Heath RMLD-IS	1	$29,346	$29,346
55	Leak Survey	Heath RMLD-IS	4	$29,346	$117,385
56	Leak Survey	Heath RMLD-IS	4	$34,044	$136,175
57	Leak Survey	Inficon IRwin SXG, 580-020 Methane Leak Detector	2	$18,813	$37,625
58	Leak Survey	ThermoScientific TVA-2020-A4E1B1 Toxic Vapor Analyzer (PID/FID)	2	$30,014	$60,028
59	Leak Survey	Vivax vLoc3-Pro Pipe and Cable Locator with GPS-RTX capable receiver with MLA	2	$15,918	$31,836
60	Leak Survey	Vivax vLoc3-Pro/ 10Tx Pipe and Cable Locator	6	$10,102	$60,614
61	LNG/CNG	Meriam MFC5150 H.A.R.T. Communicator	6	$7,835	$47,010
62	Locate & Mark	Vivax vLoc3-Pro/ 10Tx	1	$16,047	$16,047
63	Locate and Mark	Subsite UtiliGuard+	3	$9,441	$28,324
64	Locate and Mark	Vivax 9800 w/10 watt Transmitter	1	$7,028	$7,028
65	Locate and Mark	Vivax vLoc DM2	1	$12,481	$12,481
66	Locate and Mark	Vivax vLoc ML2 w/10 watt Transmitter	2	$7,498	$14,997
67	Locate and Mark	Vivax vLoc ML2 w/10 watt Transmitter	1	$7,524	$7,524
68	Locate and Mark	Vivax vLoc ML2 w/10 watt Transmitter	2	$7,524	$15,049
69	Locate and Mark	Vivax vLoc ML2 w/10 watt Transmitter	6	$7,559	$45,355
70	Locate and Mark	Vivax vLoc ML2 w/10 watt Transmitter	3	$7,590	$22,770
71	Locate and Mark	Vivax vLoc ML2 w/10 watt Transmitter	4	$7,599	$30,395
72	Locate and Mark	Vivax vLoc ML2 w/10 watt Transmitter	4	$7,564	$30,256
73	Locate and Mark	Vivax vLoc ML2 w/S watt Transmitter	3	$6,718	$20,154
74	Locate and Mark	Vivax vLoc3-Pro Pipe and Cable Locator Dual Output Model (internal GPS)	2	$10,507	$21,013
75	Measurement & Control	Emerson Trex Hart Communicator TREXLHPKLWP35	2	$14,208	$28,416
76	Measurement & Control	Meriam ZMGPS7000-Cal Kit	1	$20,250	$20,250
77	NDE	MANTIS 16:64PR UTPA & TFM Portable Instrument	1	$61,877	$61,877
78	NDE	Olympus HST-X04 Hand Scanner for TOFD	3	$6,774	$20,323
79	Plastic	Airweld AWAC-0809-1000 Axial Steel Pipe Cutter	1	$10,188	$10,188
80	Plastic	Airweld Service Assist Tool	1	$21,889	$21,889
81	Plastic	Footage C850-A001 4"-8" Hydraulic Squeezers w/Pump	2	$15,059	$30,118
82	Plastic	Footage C850-A001 4"-8" Hydraulic Squeezers w/Pump	2	$14,990	$29,981
83	Plastic	Footage C850-A001 4"-8" Hydraulic Squeezers w/Pump	2	$14,046	$28,093
84	Plastic	McElroy A430101-P #14 PitBull Machine Package	1	$8,376	$8,376
85	Plastic	McElroy A430101-P #14 PitBull Machine Package	2	$8,357	$16,714
86	Plastic	McElroy A430101-P #14 PitBull Machine Package	1	$8,405	$8,405
87	Plastic	McElroy A430101-P #14 PitBull Machine Package	1	$8,444	$8,444
88	Plastic	McElroy A430101-P #14 PitBull Machine Package	1	$8,468	$8,468
89	Plastic	McElroy A430101-P #14 PitBull Machine Package	1	$8,275	$8,275
90	Plastic	McElroy PG&E A860805-P Rolling 28 Machine Package	1	$28,851	$28,851
91	Plastic	McElroy PG&E A860805-P Rolling 28 Machine Package	1	$29,098	$29,098
92	Plastic	McElroy PG&E A860805-P Rolling 28 Machine Package	1	$0	$0
93	Plastic	McElroy PG&E A860805-P Rolling 28 Machine Package	1	$28,909	$28,909
94	Plastic	McElroy TracStar Super 28 Butt Fusion Machine PGEAT812101P	1	$56,610	$56,610
95	Plastic	McElroy TracStar Super 28 Butt Fusion Machine PGEAT812101P	1	$57,199	$57,199
96	Pressure Control	Mazco Safe-T-Stopper	1	$21,158	$21,158
97	Pressure Control	Mazco Safe-T-Stopper	1	$21,398	$21,398

Workpaper Table 13-24
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
MWC - 05 Gas Capital Tools and Equipment

	Organization	Tool Description	Quantity	Est. Cost Per Unit (1)	2023-2026 Forecast
98	Pressure Control	Mueller .75",1",1.25 Extended Valve Changer Kit	2	$7,339	$14,677
99	Pressure Control	Mueller 4" Shell Cutter Kit	3	$6,814	$20,441
100	Pressure Control	Mueller 6" Shell Cutter Kit	3	$11,143	$33,428
101	Pressure Control	Mueller 8" Shell Cutter Kit	3	$13,088	$39,264
102	Pressure Control	Mueller H-17012 1.5/2" Valve Changer Kit	2	$6,821	$13,642
103	Pressure Control	Mueller H-17055 .75", 1", 1.25" Split PCF E-Series (60psig max)	3	$9,535	$28,605
104	Pressure Control	Mueller H-17055 .75", 1", 1.25" Split PCF E-Series (60psig max)	4	$9,535	$38,141
105	Pressure Control	Mueller H-17056 .75, 1", 1.25" Split PCF EH-Series (1200 psig drilling / 350 psig stopping max)	4	$15,010	$60,042
106	Pressure Control	Mueller H-17155/H-17160 1.5/2" Split PCF D-Series/Unit No.1 (60psig max)	2	$13,128	$26,255
107	Pressure Control	Mueller H-17155/H-17160 1.5/2" Split PCF D-Series/Unit No.1 (60psig max)	1	$13,107	$13,107
108	Pressure Control	Mueller H-17155/H-17160 1.5/2" Split PCF D-Series/Unit No.1 (60psig max)	3	$13,234	$39,701
109	Pressure Control	Mueller H-17155/H-17160 1.5/2" Split PCF D-Series/Unit No.1 (60psig max)	4	$13,173	$52,692
110	Pressure Control	Mueller H-17155/H-17160 1.5/2" Split PCF D-Series/Unit No.1 (60psig max)	12	$13,234	$158,803
111	Pressure Control	Mueller H-17156 & H-17161 1.5",2" Split PCF DH-Series Kit (1200psig max)	2	$18,996	$37,991
112	Pressure Control	Mueller H-17156 and H-17161 1-1/2" and 2" Split PCF Kit DH-Series Equipment (1200/psig drilling/ 350 psig stopping max)	2	$18,996	$37,991
113	Pressure Control	Mueller H-17190 .75", 1", 1.25" M2 E-Series (60psig max)	4	$12,217	$48,868
114	Pressure Control	Mueller H-17190 .75", 1", 1.25" M2 E-Series (60psig max)	5	$12,161	$60,805
115	Pressure Control	Mueller H-17190 .75", 1", 1.25" M2 E-Series (60psig max)	8	$12,217	$97,735
116	Pressure Control	Mueller H-17190 2" M2 D-Series (60psig max)	1	$9,207	$9,207
117	Pressure Control	Mueller H-17190 2" M2 D-Series (60psig max)	8	$9,761	$78,085
118	Pressure Control	Mueller H-17190 2" M2 D-Series/Unit No.1 (60psig max)	2	$12,602	$25,204
119	Pressure Control	Mueller H-17190 2" M2 D-Series/Unit No.1 (60psig max)	4	$12,704	$50,815
120	Pressure Control	Mueller H-17190 2" M2 D-Series/Unit No.1 (60psig max)	4	$12,646	$50,582
121	Pressure Control	Mueller H-17190 2" M2 D-Series/Unit No.1 (60psig max)	10	$12,704	$127,036
122	Pressure Control	Mueller H-17190 3" M2 D-Series (60psig max)	8	$11,340	$90,719
123	Pressure Control	Mueller H-17190 3" M2 D-Series/Unit No.1 (60psig max)	2	$14,237	$28,475
124	Pressure Control	Mueller H-17190 3" M2 D-Series/Unit No.1 (60psig max)	5	$14,352	$71,762
125	Pressure Control	Mueller H-17190 3" M2 D-Series/Unit No.1 (60psig max)	4	$14,287	$57,147
126	Pressure Control	Mueller H-17190 3" M2 D-Series/Unit No.1 (60psig max)	10	$14,352	$143,524
127	Pressure Control	Mueller H-17190 4" M2 D-Series (60psig max)	8	$13,763	$110,107
128	Pressure Control	Mueller H-17190 4" M2 D-Series/Unit No.1 (60psig max)	2	$17,177	$34,353
129	Pressure Control	Mueller H-17190 4" M2 D-Series/Unit No.1 (60psig max)	5	$17,315	$86,577
130	Pressure Control	Mueller H-17190 4" M2 D-Series/Unit No.1 (60psig max)	4	$17,236	$68,944
131	Pressure Control	Mueller H-17190 4" M2 D-Series/Unit No.1 (60psig max)	10	$17,315	$173,154
132	Pressure Control	Mueller H-17490 2" Save-A-Valve D-Series (60 psig max)	2	$9,902	$19,805
133	Pressure Control	Mueller H-17490 2" Save-A-Valve D-Series (60 psig max)	1	$9,857	$9,857
134	Pressure Control	Mueller H-17490 2" Save-A-Valve D-Series (60 psig max)	4	$9,902	$39,610
135	Pressure Control	Mueller H-17491 1", 1.25" Save-A-Valve EH-Series (1200 psig max)	2	$11,026	$22,052
136	Pressure Control	Mueller H-17491 2" Save-A-Valve DH-Series (1200 psig max)	2	$16,259	$32,519
137	Pressure Control	Mueller H-17500 .75", 1", 1.25" Service Tee E-Series (60psig max)	2	$10,200	$20,401
138	Pressure Control	Mueller H-17500 .75", 1", 1.25" Service Tee E-Series (60psig max)	2	$10,184	$20,369
139	Pressure Control	Mueller H-17500 .75", 1", 1.25" Service Tee E-Series (60psig max)	4	$10,283	$41,131
140	Pressure Control	Mueller H-17500 .75", 1", 1.25" Service Tee E-Series (60psig max)	5	$10,236	$51,178
141	Pressure Control	Mueller H-17500 .75", 1", 1.25" Service Tee E-Series (60psig max)	12	$10,283	$123,392
142	Pressure Control	Mueller H-17500 2" Service Tee D-Series (60psig max)	3	$10,472	$31,415
143	Pressure Control	Mueller H-17500 2" Service Tee D-Series (60psig max)	2	$10,424	$20,848
144	Pressure Control	Mueller H-17500 2" Service Tee D-Series (60psig max)	6	$10,472	$62,831
145	Pressure Control	Mueller H-17501 .75, 1", 1.25" Service Tee EH-Series (1200 psig max)	3	$16,070	$48,210
146	Pressure Control	Mueller H-17501 2" Service Tee DH-Series (1200 psig max)	2	$16,829	$33,657
147	Pressure Control	Mueller H-17656 1", 1.25" Valve Tee EH-Series (1200 psig max)	2	$13,802	$27,603
148	Pressure Control	Mueller H-17656 1", 1.25" Valve Tee EH-Series (1200 psig max)	2	$13,802	$27,603
149	Pressure Control	Mueller H-17656 2" Valve Tee DH-Series (1200 psig max)	2	$16,776	$33,553
150	Pressure Control	Mueller H-17656 2" Valve Tee DH-Series (1200 psig max)	2	$16,776	$33,553
151	Pressure Control	Mueller H-604 Power Operator	2	$11,741	$23,482
152	Pressure Control	Mueller H-604 Power Operator	2	$11,723	$23,445
153	Pressure Control	Mueller H-604 Power Operator	1	$11,781	$11,781
154	Pressure Control	Mueller H-607 Hydraulic Operator	1	$7,302	$7,302
155	Pressure Control	Mueller PG&E Special Valve Changer Kit 682905	2	$8,206	$16,411
156	Pressure Control	Mueller PG&E Special Valve Changer Kit 682905	10	$8,586	$85,861
157	Pressure Control	Mueller PG&E Special Valve Changer Kit 682905	8	$8,651	$69,206
158	Pressure Control	Mueller PG&E Special Valve Changer Kit 682905	50	$8,651	$432,537
159	Pressure Control	Mueller Unit No. 3 Kit	2	$109,476	$218,952
160	Qualifications	McElroy PG&E A860805-P Rolling 28 Machine Package	4	$24,602	$98,407
161	Steel/Welding	Connectra SLS-8B Steel Squeezers with Pump	2	$33,100	$66,201
162	Steel/Welding	Do It American Steel Squeezer Cart	1	$10,883	$10,883
163	Steel/Welding	Industrial Degauss IDMAG	2	$46,655	$93,310
164	Steel/Welding	Industrial Degauss IDMAG	2	$47,036	$94,071
165	Steel/Welding	Lincoln 300 w/Wireless Remote Welder	1	$24,613	$24,613
166	Steel/Welding	Lincoln Classic 300MP Welder	1	$25,626	$25,626
167	Steel/Welding	Lincoln Classic K4264-1 300MP Welder	1	$24,377	$24,377
168	Steel/Welding	Lincoln K3202-1 SAE 300 Engine Driven Welder	1	$24,946	$24,946
169	Steel/Welding	Lincoln K4089-2 SAE 300MP Welder	1	$24,331	$24,331
170	Steel/Welding	Lincoln K4264-1 Classic 300MP Engine Driven Welder	1	$22,194	$22,194
171	Steel/Welding	Mueller H-17155/H-17160 1.5/2" Split PCF D-Series/Unit No.1 (60psig max)	2	$13,067	$26,134
172	Steel/Welding	Mueller H-17190 4" M2 D-Series/Unit No.1 (60psig max)	2	$17,097	$34,195
173	Steel/Welding	Thermal Dynamics Cutmaster 152 System	2	$7,267	$14,535
174	T&R	Condec Source 3000 Kit	1	$8,738	$8,738
175	T&R	Condec Source 3000 Kit	2	$6,792	$13,583
176	T&R	Roland EGX-350 Engraving Machine	2	$12,820	$25,640

Workpaper Table 13-25 Revised
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
Gas StanPac Capital

Program Description:

Capital - Gas StanPac is 54.6 miles of transmission pipeline that is an integral part of PG&E transmission system. It is 6/7 owned by PG&E and 1/7 owned by Chevron pipeline.

Line	MWC	Transmission/ Distribution % Split	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	**Gas StanPac Total**		**$ 1,799,858**	**$ 1,186,233**	**$ 7,342,314**	**$ 5,387,942**	**$ 4,934,075**	**$ 2,880,580**	**$ 2,955,637**	**$ 18,527,978**	**$ 18,996,995**	
2	MAT 44A - Capital	100%	$ 1,799,858	$ 1,186,233	$ 7,342,314	$ 5,387,942	$ 4,934,075	$ 2,880,580	$ 2,955,637	$ 18,527,978	$ 18,996,995	(a)
3												
4	Notes:											
5	(a) Capex 3-year average (2018-2020) MAT 44A excluding non-recurring activity plus additional dollars for 2025 and 2026, which represents known project-specific scope related to the Traditional ILI program in the											
6	Transmission Pipe Asset Family.											
7	(b) Gas Transmission only											

		2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	
9	MAT 44A - Capital Excluding Non-Recurring	$ 631,265	$ 493,778	$ 2,084,704	$ 1,146,356	$ 1,176,226	$ 1,206,875	$ 1,237,417	2018-2020 Average escalated to relevant year
10	Specific Project Adders								
11	*Traditional ILI Upgrade Program (MATs 98C / 44A)*								
12	SP4Y Upgrade MP 1.28-7.50				$ -	$ -	$ 15,495,327	$ -	WP 5-98, Lines 16 and 28
13	SP4Z MP 0.87-5.82				$ -	$ -	$ -	$ 15,887,597	WP 5-98, Lines 17 and 29
					$ -	**$ -**	**$ 15,495,327**	**$ 15,887,597**	WP 5S-15, Lines 13-18
14	*Strength Test Program (MATs 75U / 44A)*			**Total Project Estimate**					
15	SP5, DREG17017 Test 2.16MI (Proj Num 6382)			$ 4,901,483	$ 1,019,545	$ 1,046,111	$ 1,073,369	$ 1,100,532	Total Project Estimate from WP 5-30, Line 460
16	SP5 Test 0.426MI (Proj Num 8410)			$ 3,435,830	$ 714,678	$ 733,300	$ 752,407	$ 771,449	Total Project Estimate from WP 5-32, Line 666
				$ -	**$ 1,734,223**	**$ 1,779,411**	**$ 1,825,776**	**$ 1,871,981**	WP 5S-15, Lines 13-18
17	**Total Forecast**				**$ 2,880,580**	**$ 2,955,637**	**$ 18,527,978**	**$ 18,996,995**	

Workpaper Table 13-26
Pacific Gas and Electric Company
2023 General Rate Case
Workpapers Supporting Chapter 13, Gas Other Support
Gas Operations MWC 3Q

Program Description:

Capital - PG&E's Butte Rebuilt Program cost.

Line	MWC	Transmission/Distribution % Split	2017 Recorded Adjusted	2018 Recorded Adjusted	2019 Recorded Adjusted	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Reference
1	**MWC 3Q Total**		**$ -**	**$ -**	**$ -**	**$ -**	**$ 32,110,171**	**$ 24,186,650**	**$ 17,809,743**	**$ 15,867,511**	**$ 10,515,359**	**$ 9,726,722**	
2	MAT 3QA - Butte Rebuilt Distribution	100%[b]					$ 32,110,171	$ 24,186,650	$ 17,809,743	$ 15,867,511	$ 10,515,359	$ 9,726,722	(a)
3													

4 Notes:

5 (a) For further information regarding the Butte Rebuild program, please see Exhibit (PG&E-4), Chapter 23.

6 (b) Gas Distribution Only

Project Title: Capital Tools and Equipment Replacement Program
Major Work Categories: MWC 05 (MAT 05A)
Planning Order Numbers: 5542178, 5542180
Project Start Date: N/A
Project Completion Date: N/A
Operative Date (only applies to Capital): N/A

Project Description

The Gas Capital Tool Program supports the planning, purchase and deployment of capital tools (valued at greater than $5,000) to field personnel performing operations, construction, and maintenance activities on the gas system.

Justification

For Gas, capital expenditures fund appropriate equipment for employees performing field work. Regular expenditures are necessary to replace tools that are damaged, obsolete or have reached its useful life, and to provide specialized tools to perform testing and analysis. The types of tools and equipment that are part of the forecast include, but are not limited to, leak survey equipment, locate and mark equipment, and valve changers.For example, cutting pipe and tapping equipment costs are recorded to MAT 05A. This equipment is used by PG&E when a pipeline is rerouted, relocated, or repaired. Cutting pipe and tapping equipment includes shortstop equipment that is used to safely stop the flow of gas without squeezing the pipe, as well as beveling equipment that is used to safely perform cutting and beveling of pipeline or fitting where liquids or contaminates are suspected.The program introduces new tools to the system as well as replaces obsolete, worn out tools and tools reaching the end of their life cycle.This program is necessary for safety and reliability as it enables employees across the Gas organization perform maintenance activities to ensure components of the gas system are safe and reliable.

Cost

A 3 year (2017-2019) historical annual average of costs for Capital Tools (MAT 05A) was used to produce the final escalated portion of the forecast for 2023.

Major Project Spending Estimates

(Thousands of Nominal Dollars)

	Recorded					Forecast							
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total	Workpaper Reference
EXPENSE													
MAT 05A	$5,592	$5,101	$10,894	$9,320	$6,674	$4,441	$3,491	$6,105	$6,302	$6,504	$6,712	$71,138	WP 13-53, lines 1
												-	
Capital Total	$5,592	$5,101	$10,894	$9,320	$6,674	$4,441	$3,491	$6,105	$6,302	$6,504	$6,712	$71,138	

Additional Cost Information:

The exact mix of tools and equipment purchased each year varies based on the lifespan of current tools andnew items needed to perform work, as tools and equipment are purchased on an as-needed basis. Theforecast is based on tools that may be purchased during the GRC period and is based on tools purchased in 2020.

Alternatives Considered / Benefits

No alternatives considered since having the right tools is fundamental to PG&E employees completing their work effectively.

Workpaper Table 13-27
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 13, Other Gas Operations Support
Capital Historical Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 05	MWC 12	MWC 21	MWC 3Q	MWC 78	Detailed Description/Explanation
1	**2016**	**17,892**	**3,193**	**(525)**	**0**	**0**	**15,224**	
2			(44)					Decrease due to Business Finance prioritization planning.
3				(751)				Recorded Only. Forecast located in multiple projects.
4					1,891			Purchase of Cessna 208 Utility Aircraft (Aviation)
5						0		N/A
6							(9,533)	Recorded Only. Forecast located in CRESS/Shared Services.
7	**2017**	**9,454**	**3,149**	**(1,276)**	**1,891**	**0**	**5,691**	
8			2,771					Increase due to LOB specific tool purchases.
9				(798)				Recorded Only. Forecast located in multiple projects.
10					47			N/A
11						0		N/A
12							(7,030)	Recorded Only. Forecast located in CRESS/Shared Services.
13	**2018**	**4,445**	**5,920**	**(2,075)**	**1,938**	**0**	**(1,339)**	
14			1,822					Decrease due to Business Finance prioritization planning.
15				568				Recorded Only. Forecast located in multiple projects.
16					(1,938)			Movement of Cessna 208 Utility Aircraft Purchase to PG&E Aviation
17						0		N/A
18							1,660	Recorded Only. Forecast located in CRESS/Shared Services.
19	**2019**	**6,556**	**7,743**	**(1,507)**	**0**	**0**	**321**	
20			(3,212)					Decrease due to Business Finance prioritization planning.
21				155				Recorded Only. Forecast located in multiple projects.
22					15,918			Purchase of Picarro Hardware Asset Units (6 Years)
23						0		N/A
24							(312)	Recorded Only. Forecast located in CRESS/Shared Services.
25	**2020**	**19,104**	**4,531**	**(1,353)**	**15,918**	**0**	**8**	

Note: Total amounts and amounts for each MWC are obtained from WP 13-44 by summing the relevant lines for each MWC.

Workpaper Table 13-28
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 13, Other Gas Operations Support
Capital Forecast Walk by MWC - Distribution
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC05	MWC 12	MWC 21	MWC 3Q	MWC 78	Detailed Description/Explanation
1	**2020**	**19,104**	**4,531**	**(1,353)**	**15,918**	**0**	**8**	
2			(1,115)					Negative forecast included in 2020 for expected efficiencies in the gas operations portfolio.
3				1,353				No costs expected for MWC 12.
4					(13,901)			Decreased due to one time purchase of Picarro Hardware Asset Units
5						32,110		Butte Rebuild. Explanation can be found in Electric Ops Testimony.
6							(8)	No costs expected for MWC 78.
7	**2021**	**37,543**	**3,416**	**0**	**2,017**	**32,110**	**0**	
8			75					Negative forecast included in 2021 for expected efficiencies in the gas operations portfolio.
9				0				N/A
10					34			CEMA Labor - Standard Escalation
11						(7,924)		Butte Rebuild. Explanation can be found in Electric Ops Testimony.
12							0	N/A
13	**2022**	**29,728**	**3,491**	**0**	**2,051**	**24,187**	**0**	
14			2,614					Overhead percentage calculations for Capital Tools.
15				0				N/A
16					47			CEMA Labor - Standard Escalation
17						(6,377)		Butte Rebuild. Explanation can be found in Electric Ops Testimony.
18							0	N/A
19	**2023**	**26,013**	**6,105**	**0**	**2,098**	**17,810**	**0**	
20			197					N/A - Standard Escalation
21				0				N/A
22					53			CEMA Labor - Standard Escalation
23						(1,942)		Butte Rebuild. Explanation can be found in Electric Ops Testimony.
24							0	N/A
25	**2024**	**24,321**	**6,302**	**0**	**2,151**	**15,868**	**0**	
26			202					N/A - Standard Escalation
27				0				N/A
28					49			
29						(5,352)		Butte Rebuild. Explanation can be found in Electric Ops Testimony.
30							0	N/A
31	**2025**	**19,219**	**6,504**	**0**	**2,200**	**10,515**	**0**	
32			208					N/A - Standard Escalation
33				0				N/A
34					51			CEMA Labor - Standard Escalation
35						(789)		Butte Rebuild. Explanation can be found in Electric Ops Testimony.
36							0	N/A
37	**2026**	**18,690**	**6,712**	**0**	**2,251**	**9,727**	**0**	

Note: Total amounts and amounts for each MWC are obtained from WP 13-44 by summing the relevant lines for each MWC.

Workpaper Table 13-29
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 13, Other Gas Operations Support
Capital Historical Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 05	MWC 12	MWC 21	MWC 44	MWC 78	Detailed Description/Explanation
1	**2016**	**34,863**	**2,399**	**0**	**0**	**7,854**	**24,610**	
2			(447)					N/A - Combined in Distribution
3				0				N/A
4					0			N/A
5						(4,581)		Decrease due to less stanpac projects.
6							(5,213)	Decrease due to majority of work completion on Gas Training center in 2016
7	**2017**	**24,622**	**1,952**	**0**	**0**	**3,273**	**19,397**	
8			3,022					N/A - Combined in Distribution
9				0				N/A
10					0			N/A
11						(1,473)		Immaterial Variance
12							(17,786)	Decrease due to transfer of MWC 78A out of Gas to Shared Services
13	**2018**	**8,385**	**4,974**	**0**	**0**	**1,800**	**1,611**	
14			(3,396)					N/A - Combined in Distribution
15				0				N/A
16					0			N/A
17						(614)		N/A
18							(1,648)	Decrease due to transfer of MWC 78A out of Gas to Shared Services
19	**2019**	**2,728**	**1,578**	**0**	**0**	**1,186**	**(37)**	
20			567					N/A - Combined in Distribution
21				36				Miscellaneous costs that were recorded here due to timing
22					(3,651)			Accrual of capital cancelled orders for 2020
23						6,156		Increase in stanpac projects
24							(2)	Misc credits
25	**2020**	**5,833**	**2,145**	**36**	**(3,651)**	**7,342**	**(39)**	

Note: Total amounts and amounts for each MWC are obtained from WP 13-44 by summing the relevant lines for each MWC.

Workpaper Table 13-30 Revised
Pacific Gas and Electric Company
2023 General Rate Case
Chapter 13, Other Gas Operations Support
Capital Forecast Walk by MWC - Transmission
(Thousands of Nominal Dollars)

Ln. No.	Year	Amount	MWC 05	MWC 12	MWC 21	MWC 44	MWC 78	Detailed Description/Explanation
1	**2020**	**5,833**	**2,145**	**36**	**(3,651)**	**7,342**	**(39)**	
2			(77,230)					N/A - Combined in Distribution
3				(36)				No costs expected for MWC 12.
4					3,651			Reversal of cancelled order accrual in 2020 (as the actual orders in the respective MATs were cancelled)
5						(1,954)		Decrease due to less stanpac projects.
6							39	No costs expected for MWC 78.
7	**2021**	**(69,698)**	**(75,086)**	**0**	**0**	**5,388**	**0**	
8			76,044					N/A - Combined in Distribution
9				0				N/A
10					0			N/A
11						(454)		Decrease due to less stanpac projects.
12							0	N/A
13	**2022**	**5,892**	**958**	**0**	**0**	**4,934**	**0**	
14			2,131					Overhead percentage calculations for Capital Tools.
15				0				N/A
16					0			N/A
17						(2,053)		Decrease due to less stanpac projects.
18							0	N/A
19	**2023**	**5,969**	**3,089**	**0**	**0**	**2,881**	**0**	
20			99					N/A
21				0				N/A
22					0			N/A
23						75		Immaterial Variance - Escalation
24							0	N/A
25	**2024**	**6,143**	**3,188**	**0**	**0**	**2,956**	**0**	
26			102					N/A
27				0				N/A
28					0			N/A
29						15,572		Increase in stanpac projects
30							0	N/A
31	**2025**	**21,818**	**3,290**	**0**	**0**	**18,528**	**0**	
32			104					N/A
33				0				N/A
34					0			N/A
35						469		Increase in stanpac projects
36							0	N/A
37	**2026**	**22,391**	**3,394**	**0**	**0**	**18,997**	**0**	

Note: Total amounts and amounts for each MWC are obtained from WP 13-44 by summing the relevant lines for each MWC.

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 13
Deferred Work Analysis Summary

The Gas Transmission deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by following the checks listed below.

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work;

Check 2a: *The work is measured by units of work.*

Check 2b: *PG&E expects to perform fewer of such units during the 2019-2022 period.*

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

								Check 2					Units Comparison			Dollar Comparison		
Line	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 1	*Check 2a*	*Check 2b*	Check 3	Deferred Work	Explanation	2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast	2019 to 2022 Imputed	Difference	2019 and 2020 Rec. Adj. + 2021 to 2022 Forecast (A)	2019 to 2022 Imputed	Difference
1	13	Capital	05	05A-GT	Tools	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 5,705,766	$ 4,283,912	$ 1,421,854
2	13	Capital	05	05#-GT	Tools	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ (76,111,206)	-	$ (76,111,206)
3	13	Capital	12	12A	Environmental - Water Qual	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 36,053	$ (26,950,740)	$ 26,986,793
4	13	Capital	21	21#-GT	Misc Capital, Other	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in	-	-	-	$ (3,650,915)	$ -	$ (3,650,915)
5	13	Capital	44	44A	Stan-Pac Capital	Various	Y	Y	N	N	N	No deferred work - All required work was performed for StanPac assets. Imputed units were estimated across multiple workstreams with multiple units of measure; however, the mix of work required to be performed on StanPac assets differed.	1.42	0.95	0.47	$ 18,850,564	$ 21,843,841	$ (2,993,277)
6	13	Capital	78	78A	Office Facilities	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ (75,030)	$ 14,452,321	$ (14,527,351)
7	13	Expense	34	34A	Stan-Pac Expense	Various	Y	Y	Y	N	N	No deferred work - All required work was performed for StanPac assets. Imputed units were estimated across multiple workstreams with multiple units of measure; however, the mix of work required to be performed on StanPac assets differed.	31.28	421.91	(391)	$ 10,956,554	$ 15,521,073	$ (4,564,519)
8	13	Expense	AB	AB#	Misc costs for MWC AB	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 55,519,519	$ 126,773,700	$ (71,254,181)
9	13	Expense	AB	AB1	Support	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ (99,923,814)	$ (89,288,104)	$ (10,635,710)
10	13	Expense	AB	AB7-GT	Safety, Qual, & Contract Mgmt	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 3,718,009	$ -	$ 3,718,009
11	13	Expense	AK	AKA	Haz Waste Mgmt	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 10,288,117	$ 9,010,974	$ 1,277,143
12	13	Expense	CR	CRA	Hazard Waste Disp & Transp	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 2,411,255	$ 2,115,742	$ 295,513
13	13	Expense	DN	DN1-GT	Training Development	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 103,363	$ 7,682,083	$ (7,578,720)
14	13	Expense	DN	DN2-GT	Training: Gas Qualifications	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 4,508,246	$ 4,005,805	$ 502,440
15	13	Expense	GF	GFP	Production Mapping Trans	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 16,141,573	$ 16,303,040	$ (161,467)
16	13	Expense	GZ	GZA-GT	Gas R&D and Deployment	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 10,157,110	$ 12,192,956	$ (2,035,846)
17	13	Expense	OM	OM#-GT	Operational Management cost	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 30,837,802	$ 29,593,782	$ 1,244,020
18	13	Expense	OS	OS#-GT	Operational Support costs	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 27,224,281	$ 73,895,618	$ (46,671,336)
19															**Expense Total**	$ 71,942,015	$ 207,806,669	$ (135,864,653)
20															**Capital Total**	$ (55,244,768)	$ 13,629,334	$ (68,874,102)
21																		

22 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

Pacific Gas and Electric Company
2023 General Rate Case
Exhibit (PG&E-3), Chapter 13
Deferred Work Analysis Summary

The Gas Distribution deferred work analysis follows the principles for determining if work was deferred set forth in PG&E's 2020 GRC Settlement Agreement. Each MAT or MWC in this chapter was checked against those principles by

Check 1: The work was requested and authorized based on representations that it was needed to provide safe and reliable service.

Check 2: PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work;

Check 2a: *The work is measured by units of work.*

Check 2b: PG&E expects to perform fewer of such units during the 2020-2022 period.

Check 3: PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service

Line	2023 GRC Chapter	Type	MWC	MAT CODE	Description	Unit of Measure	Check 1	Check 2		Check 3	Deferred Work	Explanation	Units Comparison			Dollar Comparison		
								Check 2a	*Check 2b*				2020 Rec. Adj. + 2021 to 2022 Forecast	2020 to 2022 Imputed	Difference	2020 Rec. Adj. + 2021 to 2022 Forecast (A)	2020 to 2022 Imputed	Difference
1	13	Capital	05	05A-GD	Tools	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 11,436,318	$ 10,252,575	$ 1,183,743
2	13	Capital	05	05#-GD	Tools and Equipment, Other	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	$ 716	$ -	$ 716
3	13	Capital	12	12A-GD	Environmental - Water Qual	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	$ (1,352,721)	$ -	$ (1,352,721)
4	13	Capital	21	21#-GD	Misc Capital, Other	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	$ 19,985,578	$ -	$ 19,985,578
5	13	Capital	78	78A-GD	Office Facilities	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized and was not forecast in the 2020 GRC.	-	-	-	$ 8,289	$ -	$ 8,289
6	13	Capital	3Q	3QA	CEMA Capital	Non-Unitized	N	N	N/A	N/A	N	No deferred work - This MAT was not forecast in the 2020 GRC.	-	-	-	$ 56,296,821	$ -	$ 56,296,821
7	13	Expense	AB	AB7-GD	Safety, Qual, & Contract Mgmt	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 1,785,459	$ -	$ 1,785,459
8	13	Expense	AB	AB#-GD	Misc Expense, Other	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 48,586,668	$ 52,970,861	$ (4,384,193)
9	13	Expense	DN	DN1-GD	Training Development	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 464	$ 11,450,911	$ (11,450,448)
10	13	Expense	DN	DN2-GD	Training: Gas Qualifications	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 3,079,620	$ 3,259,497	$ (179,877)
11	13	Expense	GF	GFO	Production Mapping	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 12,194,998	$ 13,069,947	$ (874,948)
12	13	Expense	GZ	GZA-GD	Gas R&D and Deployment	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 10,369,671	$ 10,432,352	$ (62,681)
13	13	Expense	LX	LXA	CEMA Expense	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 4,359,304	$ -	$ 4,359,304
14	13	Expense	OM	OM#-GD	Operational Management cost	Non-Unitized	Y	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 36,452,531	$ 52,128,686	$ (15,676,156)
15	13	Expense	OS	OS#-GD	Operational Support costs	Non-Unitized	N	N	N/A	N/A	N	No deferred work - Work is non-unitized.	-	-	-	$ 77,987,907	$ 56,452,457	$ 21,535,449
16															**Expense Total**	$ 194,816,621	$ 199,764,712	$ (4,948,091)
17															**Capital Total**	$ 86,375,002	$ 10,252,575	$ 76,122,427
18																		

19 (A) The forecast presented for 2021 and 2022 are PG&E approved as of March 5, 2021. PG&E's 2021 forecast reflects the approved 2021 budget. PG&E's 2022 forecast has yet to be finalized as the 2022 budget. See Exhibit (PG&E-1), Chapter 2 and Exhibit (PG&E-2), Chapter 3 for further information about the 2023 GRC forecast process.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony: ☐ **Workpapers:** ☒ **SOQ:** ☐

Exhibit Number: 3 **Chapter Number:** 13

Chapter Title: Gas Other Support

Witness Name: Thomas Fiore/Bryon Winget

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
WP 13-1	Workpaper Table 13-1	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 13-1
WP 13-2	Workpaper Table 13-2	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 13-2
WP 13-3	Workpaper Table 13-3	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 13-3
WP 13-4	Workpaper Table 13-4	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 13-4
WP 13-8	Line 8	MAT 34A description	MAT 34A – Capital Excluding Non-Recurring	MAT 34A – Expense Excluding Non-Recurring
WP 13-13	Workpaper Table 13-12	2020 Recorded Adjusted – MAT AB# Misc. Contracts rounding typo	Line 3: 2020 Recorded Adjusted – $4,041,290 Line 4: 2020 Recorded Adjusted – $23,471,136 Line 12: 2020 Recorded Adjusted – $4,041,290 Line 14: 2020 Recorded Adjusted – $327,606	Line 3: 2020 Recorded Adjusted – $7,011,290 Line 4: 2020 Recorded Adjusted – $26,441,136 Line 12: 2020 Recorded Adjusted – $7,011,290 Line 14: 2020 Recorded Adjusted – $3,297,606

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
WP 13-40	Workpaper Table 13-19	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 13-19
WP 13-41	Workpaper Table 13-20	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 13-20
WP 13-42	Workpaper Table 13-21	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 13-21
WP 13-43	Workpaper Table 13-22	Updated forecast to reflect pre-filing errata, post-filing errata and supplemental testimony	Replaced in its entirety	See Replaced Workpaper Table 13-22

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of February 28, 2022				
WP 13-1	Table 13-1	Updated forecast to reflect pre-filling errata, post-filling errata, and supplemental testimony	Replaced in its entirety	See replaced Table 13-1
WP 13-2	Table 13-2	Updated forecast to reflect pre-filling errata, post-filling errata, and supplemental testimony	Replaced in its entirety	See replaced Table 13-2
WP 13-3	Table 13-3	Updated forecast to reflect pre-filling errata, post-filling errata, and supplemental testimony	Replaced in its entirety	See replaced Table 13-3
WP 13-4	Table 13-4	Updated forecast to reflect pre-filling errata, post-filling errata, and supplemental testimony	Replaced in its entirety	See replaced Table 13-4
WP 13-13	Table 13-12	Updated forecast to reflect pre-filing and post-filing errata	Replaced in its entirety	See replaced Table 13-12
WP 13-45	Table 13-24	PG&E corrected MWC 05 Recorded costs and splits for both Transmission and Distribution	Replaced lines 1-3	See replaced lines 1-3