

Application: 25-05-009
(U 39 M)
Exhibit No.: (PG&E-15)
Date: March 31, 2026
Witness(es): Various

PACIFIC GAS AND ELECTRIC COMPANY

2027 GENERAL RATE CASE

REBUTTAL TESTIMONY

EXHIBIT (PG&E-15)

GAS OPERATIONS

APPENDIX A

VOLUME 3 OF 3



PACIFIC GAS AND ELECTRIC COMPANY
APPENDIX A
DATA RESPONSES INCLUDED AS APPENDIX A
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PACIFIC GAS AND ELECTRIC COMPANY
General Rate Case 2027 Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_044-Q003
PG&E File Name:	GRC-2027-PhI_DR_TURN_044-Q003
Request Date:	October 2, 2025
Requester DR No.:	TURN-PG&E-044
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	October 16, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: FOLLOW UP TO TURN-34, Q.2 AND Q.5

QUESTION 003

In WP 5-7, the table labeled “Calculation of Total Average (2027-2030)” includes an amount of \$500,000 per year for “Tool Development.”

- a. Please provide a recorded tool development cost by project for each year, 2020-2024.
- b. Is this amount included in the project totals provided in response to TURN-34, Q.5?
- c. Please explain how the \$500,000 figure was developed for years 2027-2030, providing data to support the annual amount.
- d. Is the tool development an activity that takes place on an annual basis to support all projects or is it an activity that takes place in support of each specific project?

ANSWER 003

- a. During our preparation of this data response, PG&E found an inadvertent error in our forecast. PG&E determined that tool development costs are already included in the historical average for MAT HPR and therefore will remove the separate forecast line item of \$500,000 for Tool Development cost from the forecast in Exhibit (PG&E-3), WP 5-7, lines 25-28. This correction will be included in a future errata submission.
- b. Please see response to subpart a.
- c. Please see response to subpart a.
- d. Tool development is an ongoing process to continually improve the integrity assessment of our gas transmission system and/or reduce the upgrades required for future projects. This continuous development ensures we maintain and advance the technology necessary to access and inspect our pipe system effectively and safely. Tool development would typically benefit integrity assessments on many pipelines, not a single project.

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General Rate Case 2027 Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_034-Q002
PG&E File Name:	GRC-2027-PhI_DR_TURN_034-Q002
Request Date:	August 5, 2025
Requester DR No.:	TURN-PG&E-034
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	August 19, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: PG&E-03, CHAPTER 5 – ILI

QUESTION 002

Regarding the model presented at workpaper Table 5-6, please provide a project by project listing of the recorded traditional ILI projects that PG&E is including in its workpaper for years 2020-2024 and include the following information:

- a. The historical project listing should provide recorded project data set forth in the same columns as shown on the Workpaper Table 5-6 for PG&E's forecasted traditional ILI projects for years 2027-2030 although recorded cost in base year dollars should be substituted for project cost estimate and the run year should be the recorded year inspected.
- b. The historical project listing should also include an additional column indicating the type of ILI examination conducted, i.e., MFL-A only, MFL-A plus MFL-C plus EMAT, MFL-A plus MFL-C without EMAT, or other (please specify configuration).
- c. The historical project listing should also include additional columns listing the project mileage by class.
- d. The forecast project listing shown in Workpaper Table 5-6 should be augmented with additional columns showing the projected ILI examination configurations expected for each forecasted procedure (same as shown in 1.b above) and the associated project mileage by class.
- e. Did PG&E exclude any recorded ILI runs from its total program cost figures shown in workpaper Table 5-6? f. If the answer to Q.2.e is "yes":
 - i. Please provide a complete listing of each of the excluded projects.
 - ii. Please provide the same data for each of the excluded projects that is provided for the historic projects per the response to Q.2.a-c.
 - iii. Please explain why each of the excluded projects was excluded.

ANSWER 002

- a. Please see attachment “*GRC-2027-Phi_DR_TURN_034-Q002Atch01*” for a historical project listing including recorded cost and tool type used.
- b. Please see response to subpart a.
- c. PG&E does not historically track ILI project mileage by class. Instead, mileage is categorized by the consequence area; specifically, high consequence areas (HCA), moderate consequence areas (MCA), and areas with no identified consequence area. To support transparency and facilitate review, PG&E has included Columns U -W in attachment “*GRC-2027-Phi_DR_TURN_034-Q002Atch01*” that detail project mileage across these consequence categories.
- d. PG&E augmented Exhibit (PG&E-3), WP 5-7 to WP 5-8 to include tool type and consequence area; see attachment “*GRC-2027-Phi_DR_TURN_034-Q002Atch02*”. Please note per response to subpart c that consequence area was used for the project listing.
- e. PG&E did not exclude any recorded ILI runs from its total program cost figures shown in Exhibit (PG&E-3), WP 5-6 to WP 5-8 unless the run was on a StanPac line. If the run was on a StanPac line, the costs are recorded under MAT 34A.

Traditional &J Projects 2020-2024																						
RUN ID	PWD ID	Run Year	Route	Start Mile Point	End Mile Point	Estimated Mileage	First Time I.J. or Re-Inspection?	HCA	MCA	Non-CA	MFL-A	MFL-C	EMAT	Hard Spot Tool	Commitment Date	Assessment Completed?	Completion Date	Max Inspection Occupancy Count	Diameter	MCA Total Mileage	HCA Total Mileage	Non-CA Mileage
BB001	1409	2020	300A	0.04	40.38	40.35 First Time Inspection	No	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	6/19/2020	109.0	34	0	0	40
BB003	1405	2020	300A	40.93	103.69	62.76 First Time Inspection	No	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	4/1/2020	59.9	34	0	0	40
BB004	1406	2020	300A	103.75	159.13	55.38 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	5/2/2020	127.8	34 x 36	8	21	27
BB005	1403	2020	400	233.89	294.4	60.51 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	8/19/2020	473.8	36	2	8	49
BB005-1	1405	2020	400	203.4	207.87	4.47 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	6/24/2020	8.0	36	1	0	3
BB075	1408	2020	114	0.03	16.58	7.55 Re-Inspection	Yes	No	Yes	Yes	No	No	No	No	First time run post IJ Upgrade	Yes	8/19/2020	211.8	22 x 24	8	0	0
DD05-1	1404	2020	195-1	0.44	20.45	11.01 First Time Inspection	Yes	No	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	7/23/2020	91.6	20	7	0	4
DD05-2	1405	2020	195-1	20.48	25.29	4.81 First Time Inspection	Yes	No	No	Yes	No	No	No	No	First time run post IJ Upgrade	Yes	7/16/2020	69.9	16	5	0	0
F022	1408	2020	1205-16	0.02	2.07	2.05 First Time Inspection	Yes	Yes	No	Yes	No	No	No	No	First time run post IJ Upgrade	Yes	8/21/2020	166.9	6	1	1	0
M008	1405	2020	1050	7.76	22.45	15.09 Re-Inspection	Yes	No	No	Yes	No	No	No	No	First time run post IJ Upgrade	Yes	11/4/2020	624.9	24 x 30	16	0	0
NR005	1404	2020	2100	19.36	32.09	12.74 Re-Inspection	Yes	No	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	8/1/2020	261.0	24	9	0	5
P008	1404	2020	132	43.09	48.57	5.48 First Time Inspection	Yes	No	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	11/13/2020	1033.3	30 x 36	6	0	0
P008	1401	2020	147	0.03	3.97	3.94 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	12/19/2020	163.8	20 x 24	3	0	0
P008	1408	2020	132	31.93	38.39	6.46 Re-Inspection	Yes	No	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	10/18/2020	267.9	30 x 36	6	0	0
P008	1408	2020	132	31.93	38.39	6.46 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	10/18/2020	See P008	30 x 36	See P008	See P008	See P008
P047	1401	2020	0216	114.91	124.87	9.96 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	9/1/2020	167.9	12	0	0	13
SAC170-2	1402	2020	187	16.64	34.83	17.99 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	9/1/2020	226.0	16	5	1	11
SAC170-2	1403	2020	215	4.49	20.48	11.99 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	9/1/2020	166.8	12	2	1	8
BB022	1406	2020	002	43.47	118	74.53 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	12/1/2020	242.6	26	3	20	52
BB039	1409	2021	021C	0.01	8.4	8.39 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	2/25/2021	124.8	24	0	1	46
BB040	1405	2021	400	0.055	82.23	82.175 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IJ Upgrade	Yes	9/14/2021	56.9	36	1	6	75
BB043	1400	2021	400	149.82	197.85	47.93 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IJ Upgrade	Yes	3/14/2021	6.8	36	1	12	64
BB054	1404	2021	401	233.9	317.85	83.95 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	6/30/2021	181.0	42	9	12	64
BB100	1407	2021	300B	161.02	203.07	42.05 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IJ Upgrade	Yes	10/8/2021	48.9	34 x 36	4	15	25
BB115	1404	2021	300A	299.01	353.82	54.81 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	11/10/2021	88.4	52 x 34	1	14	40
BB116	1407	2021	300A	388.54	438.88	50.34 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	8/9/2021	185.7	34 x 36	5	3	1
BB118	1407	2021	300A	450.85	490.63	39.78 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	7/19/2021	1037.9	34 x 36	27	9	16
BB118	1407	2021	300A	490.66	602.23	111.57 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	7/19/2021	See BB118	34 x 36	See BB118	See BB118	See BB118
BB040	1407	2021	400	82.38	142.08	59.7 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	8/19/2021	35.3	36	2	2	36
BB003	1407	2021	137	0.01	50.7	50.69 Re-Inspection	Yes	No	No	Yes	No	No	No	No	First time run post IJ Upgrade	Yes	8/1/2021	23.5	30 x 34	7	0	0
BB040	1411	2021	300	0	42.83	42.83 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	8/1/2021	413.2	36	10	0	0
BB040	1411	2021	300	0	0.01	0.01 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	8/1/2021	See BB040	36	See BB040	See BB040	See BB040
BB042	1402	2021	300A	180.33	203.02	22.69 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	3/15/2021	56.8	34 x 36	1	2	24
DD00-2	1405	2021	191-1	21.48	25.29	3.81 Re-Inspection	Yes	No	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	8/19/2021	See DD00-2	16	See DD00-2	See DD00-2	See DD00-2
BB001-1	1407	2021	890	187.29	176.1	8.81 Re-Inspection	Yes	No	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	9/27/2021	287.8	26	9	0	0
DD00-2	1408	2021	890	175.25	186.4	22.15 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	8/26/2021	125.3	20 x 24	16	1	1
M003	1404	2021	150	0.01	17.63	17.62 Re-Inspection	Yes	No	No	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	5/6/2021	991.6	30 x 34	18	0	0
M008	1407	2021	177A	37.84	89.77	51.93 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	1/14/2021	23.9	12	2	1	43
P002	1405	2021	101	0.01	11.85	11.82 Re-Inspection	Yes	No	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	12/1/2021	317.3	30 x 36	11	0	3
P005	1400	2021	132	0	31.93	31.93 Partial Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	12/16/2021	787.1	24 x 30	19	2	0
P007	1408	2021	130A	0.07	1.49	1.42 First Time Inspection	Yes	No	No	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	8/1/2021	360.5	24	1	0	0
S008	1402	2021	0102	64.54	85.34	20.80 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IJ Upgrade	Yes	7/19/2021	266.6	16	7	4	28
S008	1406	2021	0210	16.65	31.81	15.16 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IJ Upgrade	Yes	2/16/2021	334.1	18 x 20	11	0	15
SAC003	1400	2021	210B	1.37	25.69	24.32 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IJ Upgrade	Yes	2/1/2022	185.4	16 x 20	11	0	15
SAC104-1	1404	2021	108	0.04	11.7	11.66 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IJ Upgrade	Yes	9/26/2021	143.5	24	1	2	3
SAC104-2	1405	2021	108	11.7	25.4	13.7 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	7/2/2021	784.4	24	23	2	1
ST045	1405	2021	015C-04	0.01	7.45	7.44 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	6/29/2021	1409.2	12 x 16	10	3	0
ST045	1405	2021	015C-04	7.45	16.12	8.67 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	6/29/2021	See ST045	12 x 16	See ST045	See ST045	See ST045
ST045	1405	2021	015C-04	16.12	16.55	0.43 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	6/29/2021	1409.2	12 x 16	10	3	0
BB013	1404	2022	300B	440.78	460.49	19.71 Re-Inspection	No	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post IJ Upgrade	Yes	8/19/2021	195.5	34 x 36	3	4	50
BB034	1408	2022	308	28.98	34.07	5.09 Re-Inspection	Yes	No	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	8/19/2021	172.0	36	5	0	0
BB035	1408	2022	401	145.10	197.81	48.62 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	3/1/2022	81.7	30 x 42	1	1	40
BB055	1401	2022	401	317.96	426.05	110.09 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	11/2/2022	273.7	36	15	42	53
BB055	1401	2022	401	84.37	146.15	61.78 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	8/29/2021	74.8	42	6	0	0
CC047	1402	2022	3010	0	24.68	24.68 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	No	First time run post IJ Upgrade	Yes	3/1/2022	171.7	24 x 30	9	2	14
EB002	1402	2022	193	17.89	27.88	10.19 First Time Inspection	Yes	No	No	Yes	No	No	No	No	First time run post IJ Upgrade	Yes	10/29/2022	264.9	24	30	11	0
EB109																						
EB007	1409	2022	021H	0	1.52	1.52 Partial Re-Inspection	Yes	No	No	Yes	No	No	No	No	First time run post IJ Upgrade	Yes	8/28/2022	See EB109	24	See EB109	See EB109	See EB109
EB007																						

EB199	1-519	2022	109B	0	11.81	11.81 Partial Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2021	Yes	8/28/2022	See EB199	24	See EB199	See EB199	See EB199	See EB199
F003	1-655	2022	111A	20.32	27.58	7.26 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	9/21/2022	69.9	16	4	0	3	
F003	1-648	2022	118C	43.38	50.30	6.92 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	3/29/2022	99.7	12 x 16	1	0	0	
F003	1-648	2022	X23263	0	0.0006	0.0006 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	3/29/2022	See F003	12 x 16	See F003	See F003	See F003	
F003	1-648	2022	1200-21	0	0.1	0.1 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	3/29/2022	See F003	12 x 16	See F003	See F003	See F003	
F003	1-648	2022	1200-16	2.99	4.6	2.61 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	3/29/2022	See F003	12 x 16	See F003	See F003	See F003	
F003	1-648	2022	1200-17	0	2.6	2.6 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	3/29/2022	See F003	12 x 16	See F003	See F003	See F003	
F003	1-643	2022	1200-21	0	10.07	10.07 First Time Inspection	Yes	Yes	No	Yes	No	No	No	First time run post IU Upgrade	Yes	9/19/2022	121.4	6	1	0	8	
F030	1-643	2022	STUBA0696	0	0.0099	0.0099 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	9/19/2022	See F030	6	See F030	See F030	See F030	
F003	1-647	2022	138	43.43	49.43	6 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	4/8/2022	43.6	12 x 16	6	0	0	
F003	1-633	2022	101	11.85	33.88	21.83 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2022	Yes	12/17/2022	1418.6	20 x 24	23	0	0	
PH6-1	1-654	2022	109	0.01	23.3	23.29 Partial Re-Inspection	Yes	Yes	No	Yes	No	No	No	6/19/2022	Yes	6/22/2022	1017.3	24 x 30	26	0	0	
PH6-1	1-654	2022	X231461	0	0.0009	0.0009 Partial Re-Inspection	Yes	Yes	No	Yes	No	No	No	6/19/2022	Yes	6/22/2022	See PH6-1	24 x 30	See PH6-1	See PH6-1	See PH6-1	
PH6-1	1-654	2022	132	24.33	31.33	7.0 Partial Re-Inspection	Yes	Yes	No	Yes	No	No	No	6/19/2022	Yes	6/22/2022	See PH6-1	24 x 30	See PH6-1	See PH6-1	See PH6-1	
SAC080	1-645	2022	0617-08	11.01	13	1.9 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	6/1/2022	398.4	16 x 20	7	0	0	
SAC080	1-645	2022	0617-14	0	0.04	0.04 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	6/1/2022	See SAC080	12	See SAC080	See SAC080	See SAC080	
SAC112	1-646	2022	118A	3.69	11.61	7.92 Re-Inspection	Yes	Yes	No	Yes	No	No	No	12/31/2023	Yes	9/20/2022	368.9	16 x 20	7	0	0	
SAC112	1-646	2022	118A-3	0	0.66	0.66 Re-Inspection	Yes	No	No	Yes	Yes	Yes	Yes	12/31/2023	Yes	9/20/2022	See SAC112	16 x 20	See SAC112	See SAC112	See SAC112	
SAC112	1-646	2022	118A	11.71	16.46	4.75 Re-Inspection	Yes	No	No	Yes	Yes	Yes	Yes	12/31/2023	Yes	9/20/2022	See SAC112	16 x 20	See SAC112	See SAC112	See SAC112	
Y0019-2	1-708	2022	118B	26.36	30.6	4.22 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	9/9/2022	284.6	12 x 16	5	0	14	
Y0019-2	1-708	2022	118A	42.4	53.88	11.48 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	9/9/2022	See Y0019-2	12 x 16	See Y0019-2	See Y0019-2	See Y0019-2	
Y0019-2	1-708	2022	118B	33.17	38.39	5.22 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	9/9/2022	See Y0019-2	12 x 16	See Y0019-2	See Y0019-2	See Y0019-2	
Y0019-2	1-708	2022	118A	59.36	53.72	3.36 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IU Upgrade	Yes	9/9/2022	See Y0019-2	12 x 16	See Y0019-2	See Y0019-2	See Y0019-2	
Y0019-2	1-708	2022	116C	0	6.26	6.26 First Time Inspection	Yes	Yes	No	Yes	No	No	No	First time run post IU Upgrade	Yes	9/9/2022	See Y0019-2	12 x 16	See Y0019-2	See Y0019-2	See Y0019-2	
BB038	1-649	2023	131	24.89	46.34	21.45 Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2023	Yes	8/9/2023	126.0	24	1	0	12	
BB042	1-617	2023	400	142.6	149.92	7.32 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	First time run post IU Upgrade	Yes	8/27/2023	14.1	36	2	1	3	
BB048	1-706	2023	801	0.06	82.22	82.17 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	First time run post IU Upgrade	Yes	10/26/2023	54.4	36 x 42	1	0	73	
BB101	1-691	2023	308	203.11	266.59	53.48 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/31/2024	Yes	3/19/2023	71.1	34 x 36	7	13	35	
BB103	1-618	2023	308B	299.62	303.82	34.2 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2023	Yes	1/16/2023	22.0	24	1	0	0	
D1005	1-737	2023	5P5	0	3.67	3.67 Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2024	Yes	2/17/2023	320.0	24	9	0	0	
D1005	1-737	2023	76468	0	0.0006	0.0006 Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2024	Yes	2/17/2023	See D1005	24	See D1005	See D1005	See D1005	
D1005	1-737	2023	191	3.86	6.46	6 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2024	Yes	2/17/2023	See D1005	24	See D1005	See D1005	See D1005	
PH02	1-738	2023	138	36.58	43.42	6.84 Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2024	Yes	10/12/2023	46.8	24	1	2	1	
H4V19	1-733	2023	177A	84.83	161.44	76.61 Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2024	Yes	10/10/2023	33.2	12	0	0	73	
NO05	1-745	2023	621C	0.02	8.86	8.86 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8/10/2023	Yes	1/26/2023	616.3	16	8	0	0	
M08-2	1-656	2023	2426-05	0.15	4.69	4.74 First Time Inspection	Yes	No	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	7/11/2023	395.5	16	5	0	0	
M08-2	1-656	2023	2426-06	4.89	5.95	1.06 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IU Upgrade	Yes	7/26/2023	249.1	12	4	1	0	
M08-2	1-656	2023	2426-11	0	3.57	3.57 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	7/26/2023	See M08-2	12	See M08-2	See M08-2	See M08-2	
M08-2	1-656	2023	2426-11	0	3.57	3.57 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	7/26/2023	See M08-2	12	See M08-2	See M08-2	See M08-2	
PH75-2	1-747	2023	109	37.17	43.48	6.31 First Time Inspection	Yes	No	No	Yes	No	No	No	First time run post IU Upgrade	Yes	8/11/2023	706.3	24 x 30	8	0	0	
S009	1-666	2023	621E	19.49	127.36	124.87 Partial Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2023	Yes	6/9/2023	35.9	12 x 16	1	0	12	
S009	1-666	2023	621C	18.74	21.67	3.13 Partial Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2023	Yes	6/9/2023	293.0	12 x 16	18	0	0	
S009	1-666	2023	STUB11110	0	0.0041	0.0041 Partial Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2023	Yes	6/9/2023	See S009	12 x 16	See S009	See S009	See S009	
S009	1-666	2023	621C	35.05	49.12	14.07 Partial Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2023	Yes	6/9/2023	See S009	12 x 16	See S009	See S009	See S009	
S009	1-666	2023	621D-1	0	1.688	1.688 Partial Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2023	Yes	6/9/2023	See S009	12 x 16	See S009	See S009	See S009	
S009	1-666	2023	621C	50.1435	53.12	2.9765 Partial Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2023	Yes	6/9/2023	See S009	12 x 16	See S009	See S009	See S009	
S009	1-666	2023	STUB11221	0	0.0063	0.0063 Partial Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2023	Yes	6/9/2023	See S009	12 x 16	See S009	See S009	See S009	
SAC002	1-736	2023	210A	1.39	19.47	18.08 Re-Inspection	Yes	No	Yes	Yes	No	No	No	12/31/2024	Yes	6/11/2023	119.4	32 x 36	10	0	0	
SAC113-1	1-749	2023	220	7.74	22.28	14.54 First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	First time run post IU Upgrade	Yes	4/1/2023	291.4	10	2	0	12	
SAC117	1-744	2023	119C	0.02	6.44	6.42 Re-Inspection	Yes	No	Yes	Yes	No	No	No	12/31/2024	Yes	4/27/2023	620.5	16	7	0	0	
SAC154-2	1-797	2023	467	25.944	26.662	0.718 Partial Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2024	Yes	9/28/2023	682.8	24 x 30	2	0	0	
SAC154-2	1-797	2023	1918-02	0.01	1.7656	1.7706 Partial Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	12/31/2024	Yes	9/28/2023	See SAC154-2	24 x 30	See SAC154-2	See SAC154-2	See SAC154-2	
SAC303A	1-740	2023	220	22.28	31.44	9.36 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	12/12/2023	168.1	6	4	1	5	
Y0019-1	1-792	2023	100	136.46	161.14	11.68 Re-Inspection	Yes	No	Yes	Yes	No	No	No	12/31/2024	Yes	10/6/2023	684.6	20 x 24	12	0	0	
BB015	1-760	2024	308B	0	26.37	26.37 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	8/28/2023	268.0	12 x 16	12	0	0	
BB041	1-613	2024	480	163.54	160.82	37.28 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/31/2026	Yes	3/29/2024	75.5	34 x 36	8	14	36	
BB114	1-739	2024	300A	256.22	269	47.78 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/31/2025	Yes	3/19/2024	61.4	36	1	36	0	
BB117	1-733	2024	300A	354.12	391.5	36.38 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12/31/2025	Yes	9/6/2024	25.9	34 x 36	1	37	0	
D1047	1-736	2024	191	0	3.86	3.86 Re-Inspection	Yes	No	Yes	No	Yes	No	No	12/31/2024	Yes	3/12/2024	570.5	30 x 34	6	0	0	
PH31	1-752	2024	1208-06	0	5	5 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IU Upgrade	Yes	10/2/2024	26.7	6	0	0	5	
PH32	1-741	2024	1208-06	0	5.72	5.72 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IU Upgrade	Yes	8/11/2024	55.3	6	0	0	5	
NO05	1-745	2024	1426	0.02	8.86	8.86 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9/24/2025	Yes	1/17/2024	See NO05	10	See NO05	See NO05	See NO05	
NO04-2	1-733	2024	177A	20.69	37.79	6.89 First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post IU Upgrade	Yes	2/24/2024	30.2	12	0	0	0	
PH75-1	1-746	2024	109	30.77	37.16	6.39 First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post IU Upgrade	Yes	5/15/2024	148.1	24 x 30	6	1	0	
S08	1-804	2024	93.44	114.89	21.35 Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	No	12/31/2024	Yes	2/23/2024	290.5	12	6	2	13	
PH90	1-																					

RUN ID Projects 2020-2024																						
RUN ID	PWD ID	Run Year	Route	Start Mile Point	End Mile Point	Estimated Mileage	First Time I/L or Re-Inspection?	HCA	MCA	Non-CA	MFL-A	MFL-C	EMAT	Hard Spot Tool	Commitment Date	Assessment Completed?	Completion Date	Max Inspection Occupancy Count	Diameter	MCA Total Mileage	HCA Total Mileage	Non-CA Mileage
BB001	L429	2020	300A	0.04	40.38	40.35	First Time Inspection	No	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	8/19/2020	109.0	34	0	0	40
BB003	L465	2020	300A	40.93	103.69	62.76	First Time Inspection	No	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	4/7/2020	59.9	34	0	0	40
BB004	L486	2020	300A	103.75	159.13	55.38	First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	5/2/2020	127.8	34	36	8	21
BB045	L513	2020	400	233.89	284.4	50.51	First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	8/12/2020	473.8	36	2	8	49
BB045-1	L515	2020	400	269.4	287.87	18.47	First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post LU Upgrade	Yes	8/24/2020	8.0	36	1	0	3
BB075	L528	2020	114	0.03	16.58	16.55	Re-Inspection	No	Yes	Yes	No	No	No	No	First time run post LU Upgrade	Yes	8/19/2020	211.8	22	34	8	0
DD06-1	L524	2020	195-1	0.44	20.45	11.01	First Time Inspection	Yes	No	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	7/23/2020	91.6	20	7	0	4
DD06-2	L535	2020	195-1	20.48	25.29	4.81	First Time Inspection	Yes	No	No	Yes	No	No	No	First time run post LU Upgrade	Yes	7/16/2020	697.9	16	5	0	0
F022	L518	2020	1203-16	0.02	2.07	2.05	First Time Inspection	Yes	Yes	No	Yes	No	No	No	First time run post LU Upgrade	Yes	8/27/2020	166.9	6	1	1	0
M006	L476	2020	1059	7.76	22.45	15.09	Re-Inspection	Yes	No	No	Yes	No	Yes	No	First time run post LU Upgrade	Yes	11/4/2020	624.9	24	30	16	0
NR006	L454	2020	2100	19.36	32.09	12.74	Re-Inspection	Yes	No	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	8/17/2020	261.0	24	9	0	5
P008	L514	2020	132	43.03	48.57	6.48	First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	11/13/2020	1033.3	30	36	6	0
P008	L431	2020	147	0.03	3.97	3.94	Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post LU Upgrade	Yes	12/19/2020	163.8	20	34	3	0
P008	L528	2020	132	31.93	38.39	6.46	Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	10/18/2020	267.9	30	36	6	0
P008	L438	2020	132	31.93	38.39	6.46	Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	10/18/2020	See P008	30	36	See P008	See P008
P047	L481	2020	0216	114.91	124.87	9.96	First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	9/1/2020	167.9	8	4	2	4
SAC170-2	L481	2020	161	16.48	16.48	0.00	First Time Inspection	No	No	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	9/1/2020	167.9	12	0	0	13
SAC170-2	L482	2020	161	16.64	34.83	17.99	First Time Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post LU Upgrade	Yes	3/7/2020	228.0	16	5	1	11
SAC170-2	L483	2020	215	4.49	20.48	11.59	Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	5/14/2020	166.8	12	2	1	8
BB022	L406	2021	002	43.47	118	74.53	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	12/1/2020	242.6	26	3	20	52
BB039	L509	2021	021C	0.01	8.4	8.39	Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	2/25/2021	124.8	24	0	1	46
BB040	L405	2021	400	0.055	82.23	82.175	First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	9/14/2021	50.9	36	1	6	75
BB043	L400	2021	400	149.82	197.85	47.93	First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	3/12/2021	6.8	36	1	12	64
BB054	L464	2021	401	233.9	317.85	83.95	First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	First time run post LU Upgrade	Yes	6/30/2021	181.0	42	9	12	64
BB103	L407	2021	300B	161.02	203.07	42.05	First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	10/8/2021	48.9	34	36	4	25
BB116	L404	2021	300A	299.01	353.82	54.81	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	First time run post LU Upgrade	Yes	11/10/2021	88.4	52	34	1	14
BB118	L407	2021	300A	368.54	426.88	57.29	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	8/9/2021	185.7	34	36	5	18
BB118	L407	2021	300A	459.85	490.63	30.78	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	7/19/2021	1037.9	34	36	27	9
BB118	L407	2021	300A	0	0.006	0.006	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	First time run post LU Upgrade	Yes	7/19/2021	See BB118	34	36	See BB118	See BB118
BB118	L407	2021	300A	490.66	602.23	111.57	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	First time run post LU Upgrade	Yes	7/19/2021	See BB118	34	36	See BB118	See BB118
BB040	L467	2021	400	82.38	142.08	59.7	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	8/19/2021	36.3	36	2	2	36
BB003	L427	2021	137	0.01	42.83	42.82	Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	12/1/2021	23.5	30	3	0	0
BB040	L411	2021	300	0	42.83	42.83	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	8/1/2021	413.2	36	18	0	2
BB040	L411	2021	BT11128	0.01	0.01	0.01	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	8/1/2021	See BB040	36	See BB040	See BB040	See BB040
BB042	L402	2021	300A	180.33	203.00	22.67	First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	3/15/2021	56.8	34	36	0	24
DD04-2	L435	2021	194-1	21.48	25.29	4.81	Re-Inspection	Yes	No	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	8/12/2021	See DD04-2	16	See DD04-2	See DD04-2	See DD04-2
BB041-1	L467	2021	890	187.29	176.1	8.81	Re-Inspection	Yes	No	Yes	Yes	Yes	Yes	Yes	First time run post LU Upgrade	Yes	9/27/2021	287.8	26	9	0	0
DD04-2	L436	2021	890	176.25	186.4	22.35	Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	8/26/2021	129.3	20	24	16	1
BB041-2	L467	2021	890	176.25	186.4	22.35	Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	9/27/2021	287.8	26	9	0	0
M023	L457	2021	177A	37.84	89.77	51.93	First Time Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	1/14/2021	23.9	12	2	1	49
P002	L505	2021	101	0.01	11.85	11.82	Re-Inspection	Yes	No	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	12/1/2021	317.3	30	36	11	0
P005	L500	2021	132	0	31.93	31.93	Partial Re-Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	12/16/2021	787.1	24	30	19	0
P007	L586	2021	130A	0.07	1.49	1.42	First Time Inspection	Yes	No	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	8/1/2021	360.5	24	1	0	0
S088	L502	2021	0102	64.54	85.34	20.80	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	7/19/2021	266.6	16	8	0	28
S088	L576	2021	0210	16.65	31.81	15.16	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	2/16/2021	334.1	18	8	0	5
SAC003	L560	2021	210B	1.37	25.69	24.32	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	6/12/2021	186.4	18	20	11	0
SAC104-1	L454	2021	188	0.04	11.7	11.66	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	5/26/2021	143.5	24	1	2	3
SAC104-2	L405	2021	188	0.04	37.1	25.4	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	7/27/2021	784.4	24	23	2	1
ST045	L415	2021	015C-04	0.01	7.45	7.44	First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	6/29/2021	1409.2	12	16	10	3
ST045	L415	2021	7221-10	7.45	16.12	8.67	First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	6/29/2021	See ST045	12	16	See ST045	See ST045
V001-1	L414	2021	015C-07	0.02	16.55	16.53	First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	6/29/2021	790.0	15	7	4	0
BB013	L480	2022	300B	0.48	40.49	40.01	First Time Inspection	No	Yes	Yes	Yes	Yes	Yes	Yes	First time run post LU Upgrade	Yes	8/12/2022	1.0	34	0	0	40
BB013	L480	2022	300B	368.78	440.78	72.00	Re-Inspection	Yes	Yes	Yes	Yes	Yes	Yes	No	First time run post LU Upgrade	Yes	7/15/2022	136.5	34	36	3	4
BB014	L418	2022	114	28.98	34.07	5.09	Re-Inspection	Yes	No	Yes	Yes	Yes	No	No	First time run post LU Upgrade	Yes	8/12/2022	172.0	36	5	0	0
BB014	L418	2022	401	145.10	197.81	48.62	First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	3/7/2022	8.7	30	42	1	40
BB055	L461	2022	401	317.96	426.05	110.09	Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post LU Upgrade	Yes	11/2/2022	273.7	36	15	42	53
BB055	L461	2022	401	84.37	146.15	61.78	Re-Inspection	Yes	Yes	Yes	Yes	Yes	No	No	First time run post LU Upgrade	Yes	8/29/2022	74.8	42	6	4	0
CC047	L442	2022	301G	0	24.68	24.68	First Time Inspection	Yes	Yes	Yes	Yes	No	No	No	First time run post LU Upgrade	Yes	3/12/2022	171.7	24	30	9	14
EB002	L442	2022	193	17.89	27.88	10.19	First Time Inspection	Yes	No	No	Yes	No	No	No	First time run post LU Upgrade	Yes	10/29/2022	264.9	24	30	11	0
EB199	L419	2022	021H	0	1.52	1.52	Partial Re-Inspection	Yes	No	No	Yes	No	No	No	First time run post LU Upgrade	Yes	8/28/2022	See EB199	24	See EB199	See EB199	See EB199
EB007																						

HPB	84015200	I-638	DFM 2408-05 MP 0.15 - 4.89 TRAD ILI	\$	53.47	\$	99,636.31	\$	538,385.71	\$	2,619,090.56	\$	71,880.60	\$	3,329,046.65						
HPB	84015204	I-642	I-642 L-301G MP 0-24.68 TRAD ILI	\$	53.47	\$	169,893.44	\$	3,284,425.10	\$	34,679.56	\$	138.16	\$	3,489,189.73						
HPB	84015205	I-643	DFM 1209-01 & DFDS3615 TRAD ILI	\$	53.47	\$	221,431.87	\$	2,000,185.98	\$	51,479.86	\$	1,165.81	\$	2,274,316.99						
HPB	84015206	I-644	DFM 7206-01 MP 0-3.36 TRAD ILI	\$	53.47	\$	34,294.20	\$	30,553.35	\$	53,537.90	\$	1,615,020.83	\$	1,733,459.75						
HPB	84015207	I-645	I-645 DFM 0617-06 & DFM 0617-14 TRAD ILI	\$	53.47	\$	50,431.72	\$	1,518,722.99	\$	(3,150.29)	\$	378.73	\$	1,566,436.62						
HPB	84015208	I-646	I-646 L-119A ILI MP 9.68-16.46 REINSPECT	\$	53.47	\$	23,599.87	\$	2,049,636.21	\$	35,626.66	\$	(6,895.63)	\$	2,102,020.58						
HPB	84015209	I-647	L-138 ILI MP 43.43-49.43 REINSPECTION	\$	53.47	\$	101,061.86	\$	1,069,296.77	\$	13,407.39	\$	1,071.19	\$	1,184,890.68						
HPB	84015210	I-648	DFM 1202 & L-138C TRADITIONAL ILI	\$	53.47	\$	272,506.18	\$	2,364,497.39	\$	48,463.01	\$	1,229.95	\$	2,686,750.00						
HPB	84015211	I-649	L-131 ILI MP 24.89-46.34 REINSPECTION	\$	53.47	\$	112,724.43	\$	110,411.94	\$	2,070,701.36	\$	87,814.38	\$	2,381,705.58						
HPB	84015212	I-650	I-650 L-300B MP 393.78-450.78 ILI REINSP	\$	53.47	\$	80,771.61	\$	3,818,211.02	\$	26,817.21	\$	1,834.70	\$	3,927,688.01						
HPB	84015213	I-651	L-401 MP 317.96-428.05 ILI REINSPECTION	\$	53.47	\$	170,737.83	\$	4,279,179.59	\$	(64,575.67)	\$	2,003.82	\$	4,387,399.04						
HPB	84015502	I-666	L-021C/D/E MP 18.74 - 53.12 TRAD ILI	\$	77.15	\$	22,530.21	\$	588,805.06	\$	2,000,237.46	\$	23,590.97	\$	2,635,240.85						
HPB	84016121	I-675	L-191-1 MP 20.46 - 25.29 REINSPECT PIPE			\$	2,003,755.62	\$	41,958.85	\$	2,961.64	\$	160.51	\$	2,048,836.62						
HPB	84016200	I-521B	L-300B MP299.02-MP353.82 TRAD ILI			\$	87,844.82	\$	1,002,561.41	\$	1,948,120.45	\$	1,020,244.20	\$	4,058,770.88						
HPB	84017541	I-691	L-300B MP 203.11 - 256.59 TRAD ILI			\$	22,534.00	\$	436,475.36	\$	3,466,297.14	\$	11,781.14	\$	3,937,087.64						
HPB	84018120	I-708	I-708 L-118A L-118B L-118G TRAD ILI REIN			\$	97,516.45	\$	3,636,746.80	\$	26,268.25	\$	1,410.78	\$	3,761,942.28						
HPB	84018160	I-707	L-118B MP 0.00-26.24 TRAD ILI			\$	36,614.26	\$	104,970.52	\$	5,750,297.08	\$	298,042.54	\$	6,189,924.40						
HPB	84019860	I-732	I-732 DFM 0617-03, 06, 08 & 07 MP 0.00-1					\$	70,014.01	\$	93,339.19	\$	1,769,374.98	\$	1,932,728.18						
HPB	84019861	I-733	I-733 L-177A MP 88.83-163.04 ILI RI					\$	251,582.48	\$	2,127,966.22	\$	446,174.65	\$	2,825,723.35						
HPB	84019862	I-734	L-021E MP 53.12-64.35 ILI RI					\$	11,689.51	\$	195,331.08	\$	1,873,857.05	\$	2,080,877.64						
HPB	84019863	I-735	L-210A MP 1.39-19.47 ILI RI					\$	83,803.86	\$	1,599,139.82	\$	(18,122.82)	\$	1,664,820.86						
HPB	84019864	I-736	L-191/SP5 MP 0.00-3.86 ILI RI					\$	5,032.70	\$	186,308.42	\$	1,281,638.43	\$	1,472,979.55						
HPB	84019865	I-737	SP5/191 MP 0.00-3.87 ILI RI					\$	259,503.12	\$	1,347,992.84	\$	3,719.78	\$	1,611,215.74						
HPB	84019866	I-738	L-138 MP 38.58-43.42 ILI RI					\$	41,411.48	\$	872,791.71	\$	116,863.69	\$	1,031,066.88						
HPB	84019867	I-739	L-300A MP 256.22-299.00 ILI RI					\$	22,362.81	\$	25,742.48	\$	2,892,836.65	\$	2,940,941.94						
HPB	84019868	I-740	I-740 L-220 MP 22.16-31.64 TRAD ILI					\$	22,601.43	\$	2,168,288.15	\$	179,819.06	\$	2,370,708.64						
HPB	84019869	I-741	L-1209-06 MP 0.00-5.72 TRAD ILI					\$	13,489.64	\$	50,980.47	\$	1,119,873.37	\$	1,184,343.48						
HPB	84019870	I-742	L-100 MP 138.46-150.14 RE-INSPECTION					\$	64,101.69	\$	1,845,847.49	\$	77,772.73	\$	1,987,721.91						
HPB	84019872	I-744	I-744 L-119C MP 0.02-6.64 ILI RI					\$	155,519.00	\$	2,062,914.41	\$	50,606.93	\$	2,269,040.34						
HPB	84019873	I-745	L-142S MP 0.02-8.98 ILI RI					\$	72,460.51	\$	2,416,065.25	\$	347,688.51	\$	2,836,214.27						
HPB	84019874	I-746	L-109 MP 30.77-37.16 TRAD ILI					\$	18,861.45	\$	91,328.17	\$	2,166,667.25	\$	2,276,856.87						
HPB	84019875	I-747	L-109 MP 37.17-43.48 TRAD ILI					\$	35,251.32	\$	2,693,581.45	\$	(274,988.22)	\$	2,453,844.55						
HPB	84019877	I-749	L-220 MP 7.74-22.28 TRAD ILI					\$	174,793.72	\$	1,960,901.05	\$	36,971.20	\$	2,172,665.97						
HPB	84019879	I-751	L-021E MP 124.90-137.38 ILI					\$	112,661.23	\$	4,152,959.23	\$	121,272.49	\$	4,386,892.95						
HPB	84019880	I-752	1209-05 MP 0.00-5.00 TRAD ILI					\$	104,482.47	\$	121,487.53	\$	1,320,360.08	\$	1,546,330.08						
HPB	84019881	I-753	L-177A MP 29.09-37.78 TRAD ILI					\$	54,985.76	\$	740,508.05	\$	2,365,180.10	\$	3,160,673.91						
HPB	84021105	I-767	L-123 MP0.01-14-04 TRAD ILI					\$	20,445.51	\$	143,999.12	\$	2,385,109.12	\$	2,549,553.75						
HPB	84022273	I-796	L-407 MP 0.00-25.27 ILI							\$	115,708.93	\$	1,116,451.61	\$	1,232,160.54						
HPB	84022274	I-797	L-407/1518-02 MP 25.94-26.66 ILI							\$	1,738,806.28	\$	(64,016.27)	\$	1,674,790.01						
HPB	84022276	I-799	L-119A/L-172C MP 0.00-9.68 ILI							\$	31,501.63	\$	2,314,693.99	\$	2,346,195.62						
HPB	84022277	I-800	DFM 0617-06 MP 13.01-20.05 ILI							\$	67,593.99	\$	2,405,294.68	\$	2,472,888.67						
HPB	84022301	I-792	L-300B MP 103.52-160.82 ILI							\$	366,581.28	\$	4,516,917.88	\$	4,883,499.16						
HPB	84022302	I-793	L-300A MP 354.12-393.50 ILI							\$	86,700.61	\$	3,520,034.83	\$	3,606,735.44						
HPB	84022304	I-795	L-406 MP 0.00 - 13.81 ILI							\$	456,488.66	\$	635,399.25	\$	1,091,887.91						
HPB	84022321	I-804	L-021E MP 93.54-114.89 ILI							\$	981,686.72	\$	3,905,383.63	\$	4,887,070.35						
HPB	84024608	I-850	L-124A MP 0.00-26.03 TRADITIONAL ILI RI									\$	2,057,380.99	\$	2,057,380.99						
HPB	84024730	I-866	L-142S MP 0.02-8.98 ILI REINSPECTION									\$	904,609.91	\$	904,609.91						
Total						\$	394,763.65	\$	2,372,781.30	\$	52,169,701.96	\$	81,684,344.90	\$	62,979,997.38	\$	55,591,480.40	\$	46,769,837.84	\$	301,962,907.43

(PG&E-15)

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	CalAdvocates_027-Q006
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_027-Q006
Request Date:	July 17, 2025
Requester DR No.:	PubAdv-PG&E-027-SWC
Requesting Party:	Public Advocates Office
Requester:	Sophie Chia
Date Sent:	July 31, 2025
PG&E Witness(es):	Christopher Warner – Gas Engineering

SUBJECT: ASSET FAMILY - TRANSMISSION PIPE

Please provide the following:

QUESTION 006

Referring to Workpapers to Exhibit PG&E-3, Chapter 5, pages WP 5-7 to WP 5-8, Workpaper Table 5-6, please answer the following questions:

- a. Referring to Workpaper Table 5-6, line 40, Run ID BB001, Run Year 2027, Earliest Compliance Due 7/3/2034. Please explain why this ILI Run will be performed in 2027.
- b. Referring to Workpaper Table 5-6, line 56, Run ID BB025, Run Year 2027, Earliest Compliance Due 12/31/2029. Please explain why this ILI Run will be performed in 2027.
- c. Referring to Workpaper Table 5-6, line 74, Run ID BB039, Run Year 2028, Earliest Compliance Due 8/24/2031. Please explain why this ILI Run will be performed in 2028.
- d. Referring to Workpaper Table 5-6, line 90, Run ID BB013, Run Year 2029, Earliest Compliance Due 12/31/2031. Please explain why this ILI Run will be performed in 2029.
- e. Referring to Workpaper Table 5-6, line 113, Run ID BB003(d), Run Year 2029, Earliest Compliance Due 7/3/2034. Please explain why this ILI Run will be performed in 2029.
- f. Referring to Workpaper Table 5-6, line 121, Run ID BB044, Run Year 2030, Earliest Compliance Due 9/16/2034. Please explain why this ILI Run will be performed in 2030.

ANSWER 006

Of the 110 ILI runs included in our 2027 GRC filing, 7 segments are designated as Moderate Consequence Areas (MCAs) with a longer re-inspection interval of 10 years. Given the critical role our backbone pipelines play in delivering gas across California, the age, the gas pressure, and the threats of those pipelines, generally PG&E proactively inspects backbone lines at least every seven years regardless of if they contain any HCAs. This enhanced inspection frequency supports corrosion growth analysis (CGA), enables timely identification of cracking threats, and informs high-quality asset management planning.

These pipelines operate under higher stress and pressure, making a seven-year inspection cycle a prudent and responsible approach for these pipelines that supply all the gas coming from Canada and Texas. PG&E strategically schedules assessments to balance system risk and reduce hydraulic constraints. As a result, the inspections below on backbone pipelines are being performed ahead of the MCA compliance deadlines.

- a. The BB001 ILI run will be performed in 2027, 7 years after the last inspection in 2020 for this backbone pipeline. The compliance date is relative to the baseline inspection for the MCAs in this run.
- b. Due to hydraulic constraints in 2028 and 2029 and the risk of concurrently assessing the parallel lines L57B and L57C, these lines were scheduled in 2027 and 2028. Since BB039 (L57C) must be re-inspected in 2028 to meet California State Lands Commission's 7-year reassessment requirement, the BB025 (L57B) ILI run was advanced to 2027.
- c. The compliance date for the BB039 ILI Run was based on the re-assessment date for assessing the MCA on this pipeline, however it will be inspected in 2028 due to a California State Lands Commission lease agreement that requires re-assessment every 7 years. The previous inspection was in 2021. Please see the reasoning above on criticality of inspecting backbone lines.
- d. The BB013 ILI run will be performed in 2029, 7 years after the last inspection in 2022 for this backbone pipeline. The compliance date is relative to the baseline inspection for the MCAs in this run.
- e. The BB003 ILI run will be performed in 2029, 9 years after the last inspection in 2020 for this backbone pipeline. Due to hydraulic constraints, an engineering review was performed on the inspection results and threats, and an exception was approved to delay the 7-year inspection to 2029. The compliance date is relative to the baseline inspection for the MCAs in this run.
- f. The BB044 ILI run will be performed in 2030, 6 years after the last inspection in 2024 for this backbone pipeline. The run date was moved into 2030 due to hydraulic system constraints in 2031. The compliance date is relative to the baseline inspection for the MCAs in this run.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
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Data Response

PG&E Data Request No.:	TURN_072-Q002
PG&E File Name:	GRC-2027-PhI_DR_TURN_072-Q002
Request Date:	November 21, 2025
Requester DR No.:	072
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	December 9, 2025
PG&E Witness(es):	Lucy Redmond – Gas Engineering

SUBJECT: EXHIBIT PG&E-3, CHAPTER 6 ASSET FAMILY FACILITIES

QUESTION 002

Asset Family Facilities Capital. Refer to Exhibit PG&E-3, Chapter 6 Table 6-2 on page 6-4.

- a. Provide the amounts authorized by the Commission for each of the years 2020 through 2024.
- b. Do the forecasted amounts shown contain a contingency factor or dollar amount? If so, identify the total amount as well as the supporting calculations showing how the amount was derived for each of the forecasted years.

ANSWER 002

- a. PG&E would like to note that the 2027 GRC Gas Exhibit (PG&E-3), served November 10, 2025, forecasts at the MAT code level, not the MWC level. The one exception to this in Exhibit (PG&E-3), Chapter 6 specifically, is MWC 2K. The Commission also adopted dollars in its GRC decisions (and in the GT&S rate cases previously) at the MAT code level. Because of this, the adopted dollars will be provided at the MAT code level and can be summed to the MWC level, if needed.

Please see below for the 2023 GRC adopted dollars for the capital MAT included in Exhibit (PG&E-3), Ch 6, p. 6-4, Table 6-2 served November 10, 2025.

				(In Thousands of Dollars)				
				2020 GRC (D.20-12-005) or 2019 GT&S (D.19-09-025)			2023 GRC (D. 23.11-069)	
GD/ GT&S	MWC	MAT	MAT Description	2020	2021	2022	2023	2024
GD	2K		Cust HPR Reg Station	58,998	60,425	61,943	0	0

GD	31	31A	31A-LNG/CNG Stations	4,065	4,163	4,268	4,889	4,948
GD	50	50C	Impr Rel/Dep Gas Regulation	40,750	41,735	42,784	49,887	50,488
GD	50	50L	Impr Rel Dep Gas Reg Component	11,977	12,267	12,575	10,669	10,798
GD	50	50N	GD Over Pressure Protection	13,652	13,982	14,334	0	0
GT&S	75	75C	Routine Spend M&C - Capital	16,761	16,072	14,585	18,443	17,850
GT&S	76	763	Perform Simple Station Rblds	6,072	5,476	5,125	7,394	7,156
GT&S	76	764	Perform Complex Station Rblds	31,202	28,138	26,334	47,094	45,580
GT&S	76	765	Perform Transm Terminal Upgrd	6,919	6,512	6,015	10,772	10,426
GT&S	76	766	Becker Sys Upgrade	-	-	-	-	-
GT&S	76	767	Seismic - McDonald Island	-	-	-	-	-
GT&S	76	76F	Emergency Shutdown upgrade	3,606	3,409	3,240	-	-
GT&S	76	76G	GT Over Pressure Protection	-	-	-	0	0
GT&S	76	76N	Routine Spend C&P Capital	37,159	36,232	33,437	58,989	57,710
GT&S	76	76P	GT Elect Upgrd-Hinkley&Topock	3,931	3,654	\$3,415	6,304	6,101
GT&S	76	76Q	Engineering Critical Assmnt 1				-	-
GT&S	76	76R	Compressor Unit Control Repl	3,066	2,899	\$,755	-	-
GT&S	76	76S	Engineering Critical Assmnt 2	280	252	236	9,849	9,532

GT&S	76	76T	Compressor Control Upgrades	1,890	1,787	1,698	12,090	11,839
GT&S	76	76V	Station Strength Tst - Capital	166	215	142	16,745	16,207
GT&S	76	76X	Compressor Replacements	19,266	18,860	18,816	10,488	10,562
GT&S	76	76Y	Compressor Retrofit Projects				-	-
GT&S	76	76Z	Physical Security - Capital	9,386	8,464	7,921	9,655	9,344

Note, a zero (0) above indicates no adopted funding by the Commission. A dash (-) indicates different situations, including:

- No forecast was presented for MAT 766, 76Y and 76Q in the 2019 GT&S or the 2023 GRC.
 - MAT 767 is a new MAT code in the 2027 GRC and wasn't presented in previous rate cases.
 - MAT 76F and 76R were not forecast in the 2023 GRC, station upgrades under these MATs were bundled under MAT 76T.
 - The M&C Station Over Pressure Protection Memorandum Account was adopted for MAT 76G by the Commission in D.19-09-025 meaning nothing was adopted in the MAT code in 2019-2022; however, costs can be charged to the memorandum account.
- b. Of the MATs/programs presented in Exhibit (PG&E-3), Chapter 6, served November 10, 2025, only MAT 76X and MAT 767 include contingency cost in the project-specific forecast. Including contingency in the forecast for MAT 76X and MAT 767 aligns with industry standard practice and reflects the uncertainty inherent in the project maturity at the time the rate case was filed.

The forecast for the projects in MATs 76X and 767 were developed using a cost estimate consistent with the Association for the Advancement of Cost Engineering [AACE] methodologies appropriate to the project's stage of development and anticipated technical construction risk.

For MAT 767 (Seismic Enhancements Program – McDonald Island), contingency costs are included for each of the project scope types (Scope A and Scope B, shown in Exhibit (PG&E-3), WP 6-28, Table 4 and Table 5 served November 10, 2025). A value of \$1,476,229 for Scope A and \$4,292,201 for Scope B of contingency is included based on the expected project cost. As shown in Exhibit (PG&E-3), WP 6-28, Tables 1, 2 and 3 served November 10, 2025, “the forecast was allocated based on the planned staggered phases(...). While each year has a different

forecast amount of work, the forecast presented is an average of the forecast for the four years of the rate case and escalated.”¹

Similarly, for MAT 76X (GT C&P Compressor Replacements), contingency costs are included in the total project estimate shown in Exhibit (PG&E-3), WP 6-27, Table 6 served November 10, 2025. A value of \$25,758,469 of contingency is included based on the expected project cost for Los Medanos. As shown in Exhibit (PG&E-3), WP 6-27, Tables 1 to 5 and Tables 7 and 8, and as explained in the testimony,² expected schedules were developed, both for the Los Medanos and the Topock compressor replacements, and the forecast was allocated based on those schedules. While each year has a different forecast amount of work, the forecast was developed by equally allocating the total amount for 2027-2030 over the four years of the rate case cycle and escalating.

¹ Exhibit (PG&E-3) p. 6-42, lines 23-26, testimony served on November 10, 2025.

² Exhibit (PG&E-3) Ch. 6, Section B.4, testimony served on November 10, 2025.

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Data Response

PG&E Data Request No.:	TURN_123-Q001
PG&E File Name:	GRC-2027-Phi_DR_TURN_123-Q001
Request Date:	January 20, 2026
Requester DR No.:	123
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	February 3, 2026
PG&E Witness(es):	Lucy Redmond – Gas Engineering

SUBJECT: EXHIBIT PG&E-3, CHAPTER 8 GAS OPERATIONS

QUESTION 001

MAT 767 Refer to the response to TURN-PG&E Q72. Provide the contingency amounts by year.

ANSWER 001

As stated in data response GRC-2027-Phi_DR_TURN_072-Q002, MAT 767 (Seismic Enhancements) includes contingency costs that are embedded in the project-specific forecast. Including contingency in the forecast for this MAT code aligns with industry standard practice and reflects the uncertainty inherent in the project maturity at the time PG&E filed its 2027 GRC application. Contingency costs of \$1,476,229 for Scope A and \$4,292,201 for Scope B is included based on the expected project cost.

The forecast for each type of project (Scope A and Scope B¹) were developed using a cost estimate consistent with the Association for the Advancement of Cost Engineering [AACE] methodologies appropriate to the project's stage of development and anticipated technical construction risk.

The Seismic Enhancements Program – McDonald Island Capital (MAT 767) is a new program in the 2027 GRC.² The work proposed in this MAT has never been undertaken before. Because there were no comparable past projects, an initial “Rough Order of Magnitude (ROM) estimate”³ was developed as detailed engineering design has not yet begun.

Project estimators include contingency as an allowance for inherent uncertainty. When design maturity is low, industry guidelines expect estimators to use higher contingency to reflect the larger uncertainty. AACE’s cost estimate classification system shows that

¹ Exhibit (PG&E-3), p.6-41, line 17-34, served on November 10, 2025.

² Exhibit (PG&E-3), p.6-33, line 30 to p.6-34, line 2, served on November 10, 2025.

³ Exhibit (PG&E-3), p.6-41, lines 10-11, served on November 10, 2025.

less-defined projects naturally have broader accuracy ranges and therefore require more contingency.

For MAT 767, itemizing risk and contingency by year is not feasible because the project is forecast by phase and not by year. The level of uncertainty varies across overlapping phases of work, and for the various project scopes. Additionally, as stated in data response GRC-2027-PhI_DR_TURN_072-Q002 and as shown in Exhibit (PG&E-3), WP 6-28, Tables 1, 2 and 3 served November 10, 2025, while the program is projecting various phases of work per year for each of the 5 projects, the forecast presented was calculated by averaging the total forecasted cost, including contingency, for the four years of the rate case (2027-2030) and escalating. For these reasons, the contingency should be interpreted as part of the overall forecast rather than allocated per year.

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PG&E Data Request No.:	TURN_072-Q004
PG&E File Name:	GRC-2027-PhI_DR_TURN_072-Q004
Request Date:	November 21, 2025
Requester DR No.:	072
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	December 9, 2025
PG&E Witness(es):	Lucy Redmond – Gas Engineering

SUBJECT: EXHIBIT PG&E-3, CHAPTER 6 ASSET FAMILY FACILITIES

QUESTION 004

GT Station Reliability Capital (MWC 76). Refer to Exhibit PG&E-3, Chapter 6, page WP 6-45, line 9.

- a. Provide a breakdown by project of the \$53.131 million.
- b. Provide documentation supporting each project cost (quotes, contracts, invoice, bids).

ANSWER 004

- a. The \$53.131 million provided on Exhibit PG&E-3, WP 6-45, line 9 served November 10, 2025 represents the difference (delta) between the forecast amount for 2027 (shown on line 10) and the forecast amount for 2026 (shown on line 7) for the MAT codes included in the chapter under MWC 76 (i.e. MATs 763, 764, 765, 767, 76G, 76N, 76P, 76S, 76T, 76V, 76X and 76Z).

This value is a calculated difference between two forecast values, which include both programmatic and project-specific forecast, aggregated at the MWC level and thus cannot be broken down into a project list. Table 1 below shows the detail of how the \$53.131 million was calculated. Note that the total values for MWC 76 shown in line 13 below (columns '2026 Forecast \$', '2027 Forecast \$' and 'Delta 2026 to 2027 (\$)') match the values shown in Exhibit PG&E-3, WP 6-45 lines 7, line 10 and line 9 (served November 10, 2025), respectively. Table 1 below includes the forecast methodology per MAT.

Table 1: Comparison of 2026 and 2027 GRC Forecast for MWC 76

Line	MAT	MAT Description	2026 Forecast \$	2027 Forecast \$	Delta 2026 to 2027 (\$)	2027 Forecast methodology
1	76S	Engineering Critical Assmnt 2	684,210	2,441,794	1,757,584	Programmatic: 3-year average (2 MATs : 76V + 76S)
2	76G	GT Over Pressure Protection	19,225,000	18,416,679	-808,321	Programmatic: using an internal project estimate

3	763	Perform Simple Station Rblds	13,529,000	10,418,474	-3,110,526	Programmatic: Unit cost estimated from 4 completed projects
4	764	Perform Complex Station Rblds	40,640,703	54,692,915	14,052,212	Programmatic: using an internal project estimate
5	765	Perform Transm Terminal Upgrd	4,349,000	31,081,657	26,732,657	Programmatic: 5-year average of routine work only+ estimate based on historical costs for roof repair Project-based: Brentwood terminal upgrades based on internal project estimate
6	767	Seismic - McDonald Island	0	7,000,464	7,000,464	Project-based: based on internal project estimate and expected schedule
7	76N	Routine Spend C&P Capital	17,266,479	38,356,999	21,090,520	Programmatic: 5-year average (2020-2024)
8	76P	GT Elect Upgrd-Hinkley&Topock	21,706,000	0	21,706,000	No forecast in 2027 GRC
9	76T	Compressor Control Upgrades	12,121,000	8,609,941	-3,511,059	Programmatic: using an internal project estimate
10	76V	Station Strength Tst - Capital	3,424,167	0	-3,424,167	No forecast in 2027 GRC, see MAT 76S
11	76X	Compressor Replacements	33,673,000	40,959,786	7,286,786	Project-based: using an internal project estimate and expected schedule
12	76Z	Physical Security - Capital	6,790,000	14,560,659	7,770,659	Programmatic: unit cost estimated from 15 completed projects
13	n/a	Total MWC 76 (Chapter 6 only)	173,408,559	226,539,370	53,130,811	#N/A

b. See response to sub-part a above.

PACIFIC GAS AND ELECTRIC COMPANY
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Data Response

PG&E Data Request No.:	CalAdvocates_150-Q003
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_150-Q003
Request Date:	September 29, 2025
Requester DR No.:	150
Requesting Party:	Public Advocates Office
Requester:	Chauncey Quam
Date Sent:	October 13, 2025
PG&E Witness(es):	L. Redmond – Gas Engineering

SUBJECT: FACILITIES, EXPENSE AND CAPITAL EXPENDITURES

Please provide the following:

QUESTION 003

Referring to PG&E’s Workpapers Supporting Prepared Testimony Ex. PG&E-03, Chapter 6, Volume 1 of 2, p. WP 6-20 and 6-21, please explain and describe each MAT capital project that includes “2027 GRC” in the project description. Please provide the scope and objective for each of these capital projects, projected timelines and milestones, any regulation requiring the capital projects, and where each project is currently on its projected timeline.

ANSWER 003

PG&E would like to clarify that the “description” column in Exhibit (PG&E-3), WP 6-20 through 6-21, is a Planning Order description and not a project-specific description. While preparing the forecast for each GRC, PG&E creates planning orders to capture the forecast for tracking purposes. These planning orders include the entire forecast for a MAT code from 2026 through 2030, whether the forecast is project-based or programmatic. The forecast is not split at the planning order level based on projects.

The forecast planning order description for the MAT codes in the Gas Exhibit (PG&E-3) all begin with “2027 GRC” followed by the MAT description (e.g. MAT code 765 forecast planning order description is “2027 GRC Terminal Upgrades”). Because these planning orders are not project-specific, there are no related timelines or milestones to provide. Please see PG&E’s prepared testimony for details regarding the scope and objective of our forecast MAT codes.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
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Data Response

PG&E Data Request No.:	CalAdvocates_298-Q002
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_298-Q002
Request Date:	December 5, 2025
Requester DR No.:	PubAdv-PG&E-298-STA
Requesting Party:	Public Advocates Office
Requester:	Stacey Hunte
Date Sent:	December 18, 2025
PG&E Witness(es):	Lucy Redmond – Gas Engineering

SUBJECT: GAS OPERATIONS

QUESTION 002

Referring to Ex. PG&E-3, Ch. 6, workpaper pp. WP 6-20 and 6-21, for the following MAT codes, please provide a list of projects to be completed each year 2025-2030 along with the specific project milestones and timelines. Please also explain if PG&E has begun work on any of these projects and if not, why not.

- MAT 50C
- MAT 50L
- MAT 75C
- MAT 764
- MAT 765
- MAT 767
- MAT 76G
- MAT 76X
- MAT 76Z

ANSWER 002

Although Table 6-20¹ is labeled ‘Recorded CWIP and Forecast Capital Expenditures Details - Projects Over \$3 Million’, it was built to show all the planning orders within MATs that had a subtotal (i.e. sum of recorded for forecast value for 2024 to 2030) above \$3 million, regardless if the forecast was developed at the project level or at the programmatic level.

¹ Exhibit (PG&E-3), Ch. 6, WP 6-20 to WP 6-21, served on November 10, 2025.

I. Programmatic Forecast

The forecast for 2025 to 2030 provided in Exhibit (PG&E-3), Chapter 6 for MATs 50C, 50L, 75C, 764, 76G and 76Z were developed based on a programmatic approach, (e.g. historic average cost and escalation - described in the forecast section of each of these MAT codes) and not based on a specific list of projects with individual estimates. As such, no project timeline and milestones were used for forecasting for these MATs.

II. Project-Based Forecast

The forecast for MATs 767, 765 and 76X were project-based and are described below.

a. MAT 767 : Seismic Enhancements Program – McDonald Island

MAT 767 is a project-based MAT. PG&E's testimony² describes the justification for this work as well as the projects and their phases, which are summarized below.

- McDonald Compressor Platform Seismic Upgrades (Scope B);
- Whisky Slough Seismic Platform Foundation Upgrades (Scope B);
- Turner Cut Seismic Platform Foundation Upgrades (Scope B);
- Whisky Slough Seismic Platform Structural Upgrades (Scope A);
- Turner Cut Seismic Platform Structural Upgrades (Scope A).

Scope A – Structural Reinforcement: detailed engineering design and installation of supplemental structural elements, in order to increase the structural integrity of both the gas processing and well gathering platforms, and to increase the structural linkage between these two adjacent, but structurally independent platforms³.

Scope B – Seismic Foundations Upgrades: detailed engineering design and installation of supplemental structural elements, in order to increase the structural integrity of both the gas processing and well gathering platforms, and to reduce the potential stresses transmitted to gas piping both on and running between the two adjacent platforms⁴.

Each of the five main projects can be performed independently but following a specific sequence of phases. The forecast is to complete each project over multiple years, and over more than one rate case cycle in some instances. The impact on the injection/withdrawal operations of the facilities is expected to be minimal. The work is planned in phases⁵ and is planned to start in 2027, in alignment with the 2027 GRC forecast. There are no projects planned to be completed in 2025 and 2026 for MAT 767. A schedule of milestones and timeline in table format is available in the workpapers⁶ and is copied below.

² Exhibit (PG&E-3), Ch. 6, p. 6-33 to 6-42, served on November 10, 2025.

³ Exhibit (PG&E-3), Ch. 6, p. 6-41, served on November 10, 2025.

⁴ Exhibit (PG&E-3), Ch. 6, p. 6-41, served on November 10, 2025.

⁵ Exhibit (PG&E-3), Ch. 6, p. 6-42, served on November 10, 2025.

⁶ Exhibit (PG&E-3), Ch. 6, WP 6-28, lines 17 to 22, served on November 10, 2025.

Seismic Enhancements Phases	2027	2028	2029	2030	Scope
McDonald Compressor Seismic Upgrades				Engineering to IFC	Scope B
Whisky Slough Seismic Foundation Upgrades		Engineering to IFC	Construction half	Construction half/Closeout half	Scope B
Turner Cut Seismic Foundation Upgrades			Engineering to IFC	Construction half	Scope B
Whisky Slough Seismic Structural Upgrades	Engineering to IFC	Construction on all	Closeout		Scope A
Turner Cut Seismic Structural Upgrades	Engineering to IFC	Construction on half	Construction half/Closeout half	Closeout half	Scope A

This is new work that was not included in a prior GRC application. PG&E has not started to work on this MAT in the 2023 GRC because the results of the evaluations by the external geotechnical and structural experts, which found several structural components that fail to meet the prescribed performance objectives were not available yet: the seismic evaluation and conceptual upgrade report for McDonald Island Compressor Platforms⁷ was published in 2023, and a similar report for Turner Cut and Whiskey Slough Platforms⁸ was published in 2021. Those reports identified the deficiencies⁹ and PG&E does not consider these consequences to be acceptable and therefore proposes to start retrofitting the facility in the 2027 GRC period.

b. MAT 765 : GT M&C Terminal Upgrades

MAT 765 is a combination of programmatic forecasting and project-based MAT. The programmatic part of the MAT, is comprised of the routine terminal upgrades and routine building upgrades, and the project-based includes the Brentwood Terminal rebuild. PG&E's testimony¹⁰ describes the justification for this work as well as the phases for the Brentwood rebuild.

As presented in the testimony, "during 2025 and 2026, PG&E plans to complete two defined tasks, mainly focused on meeting the requirements for the [Certificate of Public Convenience and Necessity (CPCN)] application: (1) complete detailed design engineering package with a Class 3 cost estimate and (2) prepare to submit the CPCN application. Preparing the CPCN will include tasks such as environmental survey, submission for pre-review, addressing CPUC pre-review comments, and official submission. No construction can take place until the CPCN is approved".¹¹

⁷ Forell/Elsesser Engineers, Inc., Seismic Evaluation and Conceptual Upgrade Report, PG&E McDonald Island Compressor Platforms, McDonald Island, CA, F/E Job Number: 18-026.001 (June 13, 2023).

⁸ Forell/Elsesser Engineers, Inc., Seismic Evaluation and Conceptual Upgrade Report, PG&E McDonald Island Turner Cut and Whiskey Slough Platforms, McDonald Island, CA, F/E Job Number: 18-026 (Dec. 13, 2021).

⁹ Exhibit (PG&E-3), Ch. 6, p. 6-37, served on November 10, 2025.

¹⁰ Exhibit (PG&E-3), Ch. 6, p. 6-61 to 6-70, served on November 10, 2025.

¹¹ Exhibit (PG&E-3), Ch. 6, p. 6-63, line 28 to p.6-64 line 2, served on November 10, 2025.

“Due to the complex nature of the facility, PG&E has planned a phased rebuild that will span several years to allow for continued operation of the facility for the duration of construction (...) [using a] phased approach for rebuilding the terminal, with construction scheduled to begin in the 2027 GRC period, subject to CPCN approval.”¹² The “phases are not tied one-to-one with execution years, and the start of phase 1 is dependent on CPCN approval. The construction plan may be modified depending on the results of the CPCN public outreach and review, permitting issues, site conditions, environmental concerns, and/or supply chain issues, etc.”¹³ The phases (milestones) are summarized below and specific details are in the testimony¹⁴. Because of the uncertainty related to the CPCN approval, PG&E is unable at this time to provide a detailed project timeline.

Phase	Activities (details in testimony ¹⁵)
1	Greenfield Site Preparation
2	Greenfield Site Header and SCADA Building
3	Greenfield Site Regulator Runs
4	Existing Station Clearance to Start Removal of Old Assets
5	Installation of Regulator Runs on Existing Yard
6	Site Cleanup and Closeout.

c. MAT 76X : GT C&P Compressor Replacements

MAT 76X is a project-based MAT. PG&E’s testimony¹⁶ describes the justification for this work as well as the two projects that comprises this MAT.

i. Project 1 : Los Medanos K1 Compressor Replacement

As explained in PG&E’s testimony, the Los Medanos project will require “approval of a Certificate of Public Convenience and Necessity (CPCN) before construction can start”¹⁷. While at the time of preparing the forecast presented in the 2027 GRC application, it was expected that the “preparation, review and approval of the CPCN may take many years”¹⁸, PG&E had “expected to file for a CPCN in the 2023 GRC period”¹⁹. The CPCN process was recently introduced and timelines to prepare the documentation and receive approval remain uncertain and have shifted from what was anticipated at time of filing.

In 2025, PG&E worked “to prepare the necessary documentation for CPCN submittal, which includes detailed engineering drawings, construction plans, equipment

¹² Exhibit (PG&E-3), Ch. 6, p. 6-64, lines 3 to 10, served on November 10, 2025.

¹³ Exhibit (PG&E-3), Ch. 6, p. 6-64, lines 3 to 10, served on November 10, 2025.

¹⁴ Exhibit (PG&E-3), Ch. 6, p. 6-65 to 6-67, served on November 10, 2025.

¹⁵ Exhibit (PG&E-3), Ch. 6, p. 6-65 to 6-67, served on November 10, 2025.

¹⁶ Exhibit (PG&E-3), Ch. 6, p. 6-20 to 6-33, served on November 10, 2025.

¹⁷ Exhibit (PG&E-3), Ch. 6, p. 6-23, lines 18 to 19, served on November 10, 2025.

¹⁸ Exhibit (PG&E-3), Ch. 6, p. 6-23, line 25 to 26, served on November 10, 2025.

¹⁹ Exhibit (PG&E-3), Ch. 6, p. 6-23 lines 24 to 25, served on November 10, 2025.

specifications and environmental studies”²⁰ The preliminary engineering phase of the Los Medanos compressor replacement project will continue through Q2 of 2026. Also in 2025, PG&E initiated its permitting strategy, executed environmental consulting contracts, and initiated data-gathering efforts to support the CPCN application and CEQA documentation. Detailed engineering will start in Q3 of 2026 and is expected to continue to mid-2028. PG&E anticipates submitting the CPCN Application in late 2028. Construction is expected to start in 2030 and complete in 2032.

At this time, the schedule remains subject to revision.

ii. Project 2: Topock compressors replacement

As explained in PG&E’s testimony, “the scope of work and timing of the Topock replacement project is (...) dependent on the outcome of federal regulatory activity involving the *Good Neighbor* (GN) requirements of the Clean Air Act²¹ that is outside of PG&E’s control”.²² Since PG&E filed its testimony, a notable change is that the challenge to the Interstate Transport Federal Implementation Plan (ITFIP) in front of the D.C. Circuit is currently held in abeyance, with no anticipated ruling date. In addition, the Environmental Protection Agency (EPA) announced its plans in March 2025 to issue a rulemaking, at an unspecified future date, that would rescind the current ITFIP and adopt a new ITFIP.

With this information in mind, PG&E has not made any changes to the plan proposed in its testimony, due to the regulation uncertainty. “In the case where another compressor would exhibit a greater need of replacement than Topock, that compressor may be prioritized”²³ within this timeframe so that PG&E can continue to manage the aging of the infrastructure fleet on the backbone. The proposed schedule for Topock includes no work in 2025-2026, and the start of engineering in 2027. The proposed high-level schedule also includes a time without construction after engineering to account for the fact that “it is expected that any compressor replacement project will be subject to the GO-177 rule,²⁴ and review and approval of the CPCN is expected to be needed before construction can start, which adds considerable delays to the project”.²⁵ There is no detailed schedule available for this project due to the uncertainty explained above.

Topock Compressor Replacement	2027	2028	2029	2030
Schedule	Detailed Engineering	CPCN Hold 30% Material Pre-Payment	CPCN Hold 30% Material Pre-Payment	Construction Start

²⁰ Exhibit (PG&E-3), Ch. 6, p. 6-23, lines 20 to 23, served on November 10, 2025.

²¹ United States Environmental Protection Agency, Good Neighbor Plan for the 2015 Ozone NAAQS – Compliance for Industrial Sources, available at: <https://www.epa.gov/stationary-sources-air-pollution/good-neighbor-plan-2015-ozone-naaqs-compliance-industrial-sources> (accessed Mar. 7, 2025).

²² Exhibit (PG&E-3), Ch. 6, p. 6-26, lines 10 to 14, served on November 10, 2025.

²³ Exhibit (PG&E-3), Ch. 6, p. 6-27, lines 24 to 31, served on November 10, 2025.

²⁴ Exhibit (PG&E-3), Ch. 1, Section C.1.b, served on November 10, 2025.

²⁵ Exhibit (PG&E-3), Ch. 6, p. 6-27, line 31 to p. 6-28, line 2, served on November 10, 2025.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	CalAdvocates_113-Q001
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_113-Q001
Request Date:	September 4, 2025
Requester DR No.:	PubAdv-PG&E-113-SWC
Requesting Party:	Public Advocates Office
Requester:	Sophie Chia
Date Sent:	September 25, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: ASSET FAMILY – TRANSMISSION PIPE

QUESTION 001

Referring to Exhibit PG&E-3, Chapter 5, page 5-44, Table 5-11, PG&E provides the recorded 2020 to 2024 expense for MAT HPF. Please provide a list of the 2020 to 2024 projects for MAT HPF with the following information:

- a. Project name
- b. Compliance date
- c. Total project mileage
- d. Threats to the pipe
- e. Total recorded project cost split by MAT HPF and other applicable MAT codes.

ANSWER 001

- a. Please see “*GRC-2027-PhI_DR_CalAdvocates_113-Q001Atch01*” for the list of project orders including project name, compliance dates, HPF project mileage, pipe threats, and MAT HPF recorded project costs by year.
- b. Please see response to subpart a.
- c. Please see response to subpart a.
- d. Please see response to subpart a.
- e. The total recorded project costs provided reflect all projects that originated in MAT HPF, along with two high-level journal entry adjustment orders:
 - A debit order for costs from non-HPF originating projects with TIMP scope; and,
 - A credit order for MAT HPF originating projects with non-TIMP scope

This approach was chosen to preserve original project spend and ensure accuracy of total MAT HPF-related costs. Allocations by projects are not included, as they

were performed at a summary level. Additionally, project-level allocation percentages evolved over time due to changes in project engineering maturity and methodology. These changes were reflected through true-up journal entries, further limiting the ability to present consistent project-level cost splits across years.

Starting in 2023, PG&E implemented processes to enhance traceability for project splits through the development of MAT 75U. This MAT allows for the creation of individual project orders based on the composition of drivers and splits within a project's scope. These updates are intended to support more accurate tracking and recording of project splits in the Strength Test program going forward.

(PG&E-15)

GRC-2027-PH_Dr_CalAbilities_113-0001Acho1

Exhibit	Chapter	H	MHC	H	MAT	Order	Project Name	2020	2021	2022	2023	2024	Commitment Driver	HPP Mileage	Compliance Date	Pipe Threat(s)
1	3.05A	HP	HPF	HPF	HPF	0117171	Hydrostatic Testing - Non-TMP (2400)	\$ 11,250,169	\$ 11,445,103	\$ 11,641,921	\$ 1,400,810	\$ 22,536	N/A	N/A	N/A	N/A - A credit planning order for Journal entry costs from non-HPP originating projects with TSPF scope
2	3.05A	HP	HPF	HPF	HPF	0118716	Hydrostatic Testing - HPP Non-TMP (C=60)	\$ (111)	\$ (3,554,021)	\$ (1,001,240)	\$ (20,303)	\$ (138,902)	N/A	N/A	N/A	N/A - A credit planning order for Journal entry costs for MAT HPP originating projects with non-TSPF scope
3	3.05A	HP	HPF	HPF	HPF	0121673	L-2004 HP 41.4 - 0.24 TEST 1-005	\$ 3,965					Regulatory Compliance	1.45	12/31/2015	External corrosion (EC), Fatigue threat
3	3.05A	HP	HPF	HPF	HPF	04002400	L-215 HP 4.89-8.52 TEST 1-1264	\$ 1,788	\$ 67	\$ 335			Regulatory Compliance	3.63	12/30/2016	External corrosion (EC), Internal corrosion (IC), Stress corrosion cracking (SCC)
3	3.05A	HP	HPF	HPF	HPF	04002401	L-215 HP 14.56-21.7 TEST 1-1267	\$ 2,844					Regulatory Compliance	2.54	12/30/2017	HCA - Weak, previous rupture on L-215, External corrosion (EC), Internal corrosion (IC), Stress corrosion cracking (SCC)
3	3.05A	HP	HPF	HPF	HPF	04002403	L-1384 L-1268 HP 4.66 - 6.26 TEST	\$ 3,965					Regulatory Compliance	1.72	3/29/2018	External corrosion (EC), Internal corrosion (IC), Selective Seam Weld Corrosion (SSWC)
3	3.05A	HP	HPF	HPF	HPF	04005080	T-1418 DRG4588 0 - 0.24 STRENGTH TEST	\$ 35,726					Regulatory Compliance	0.23	12/31/2019	External corrosion (EC), Internal corrosion (IC), Axial stress corrosion cracking (SCC)
3	3.05A	HP	HPF	HPF	HPF	04005090	T-1453 L-1306 HP 66.346 - 105.72 STRENGTH TEST	\$ 77,771	\$ (795)				Regulatory Compliance	1.51	12/31/2019	External corrosion (EC), Internal corrosion (IC), Axial stress corrosion cracking (SCC)
3	3.05A	HP	HPF	HPF	HPF	04005092	T-1438 L-1124 HP 70.58-76.14 STRENGTH TEST	\$ 220,687	\$ 66,302	\$ (343)	\$ 121		Regulatory Compliance	4.89	12/31/2019	External corrosion (EC), Internal corrosion (IC), Axial stress corrosion cracking (SCC)
3	3.05A	HP	HPF	HPF	HPF	04005094	T-1433 HP 61.11-61 HP 0.00 - 0.00 TEST	\$ 1,445					Regulatory Compliance	0.59	12/31/2018	External corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04007041	T-1437 L-132 TEST HP 19.70-23.16	\$ 4,768					Regulatory Compliance	3.46	12/31/2018	External Corrosion (EC), Subpart 1 Not Met, Leak History
3	3.05A	HP	HPF	HPF	HPF	04007042	T-1438 L-132 TEST HP 26.25-31.95	\$ 4,411					Regulatory Compliance	2.90	12/31/2018	External Corrosion (EC), Internal Corrosion (IC), Subpart 1 Not Met, Leak History
3	3.05A	HP	HPF	HPF	HPF	04007071	T-1501 L-130 HP 185.16-181.57 TEST	\$ 2,085,316	\$ 7,796				Regulatory Compliance	0.72	6/29/2020	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04010922	T-1507 L-403 HP 185.66-186.9 TEST	\$ 2,322,819	\$ 16,978				Regulatory Compliance	1.24	9/25/2020	Stress Corrosion Cracking (SCC) AXIAL, STRONG
3	3.05A	HP	HPF	HPF	HPF	04011002	L-0574 HP MP 0.00 - 0.40 TEST	\$ 3,710,419	\$ 51,260	\$ (51,066)	\$ 38,718	\$ (875)	Regulatory Compliance	0.39	12/31/2020	SCC-AXIAL, STRONG, External Corrosion (EC), Time-Dependent Threat Internal Corrosion (IC)
3	3.05A	HP	HPF	HPF	HPF	04011003	*CANC*L-0714-1613 HP 0.0027 - 0.134 TEST	\$ 2,458					Cancelled	Cancelled	Cancelled	External corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04013550	L-1312 HP 40.00 - 48.00 TEST	\$ 10,379	\$ 189,042	\$ 15,036			Regulatory Compliance	0.05	10/30/2022	External corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04013903	L-132 HP MP 42.15-62.50 TEST	\$ 63,850	\$ 7,044,618	\$ 5,184,017	\$ 185,129	\$ 26,966	Regulatory Compliance	5.29	12/31/2021	DM - HCA - Not Test, IR - HCA - Overpressure, Stub, External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04013904	*CANC*L-132 HP 47.11-48.44 TEST	\$ 150					Cancelled	Cancelled	Cancelled	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04013901	DRP 2215-01 HP 2.07 - 11.70 TEST	\$ 52,180	\$ 1,950,197	\$ 593,918	\$ (451,562)	\$ 157,127	Regulatory Compliance	0.13	12/31/2021	External corrosion (EC), Internal corrosion (IC), HCA - Weak (Manufacturing Seam), HCA - Not Tested
3	3.05A	HP	HPF	HPF	HPF	04014202	*CANC*L-3028 HP 41.16 - 414.4 TEST	\$ 64,727					Cancelled	Cancelled	Cancelled	Cancelled
3	3.05A	HP	HPF	HPF	HPF	04015121	DRG4714 HP 0.0001 - 0.80 TEST	\$ 31,538	\$ 1,749,575	\$ (173,930)	\$ 3,674	\$ 92	Regulatory Compliance	0.46	12/31/2021	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04015122	L-132 HP 18.39 - 38.43 STRENGTH TEST	\$ 23,825	\$ 1,936,321	\$ 99,355	\$ 81,217	\$ 693	Regulatory Compliance	0.07	12/31/2021	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04015123	*CANC*DRG4548 HP 0.1 - 0.03 TEST	\$ 20,998	\$ 46,895				Cancelled	Cancelled	Cancelled	Cancelled
3	3.05A	HP	HPF	HPF	HPF	04015124	*CANC*DRG4549 HP 0.006 - 0.03 TEST	\$ 21,646	\$ 80,681				Cancelled	Cancelled	Cancelled	Cancelled
3	3.05A	HP	HPF	HPF	HPF	04015125	GCUST8183 HP 0.0008 - 0.0774 TEST	\$ 16,902	\$ 2,024,896	\$ (97,046)	\$ 69,439	\$ 216	Regulatory Compliance	0.08	12/31/2021	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04015141	DRG4547 HP 0.01 - 0.03 TEST	\$ 29,159	\$ 2,954,741	\$ 467,351	\$ 45,121	\$ 244	Regulatory Compliance	0.56	12/31/2021	External Corrosion (EC), Axial near-neutral stress crack (NN) Axial SCC
3	3.05A	HP	HPF	HPF	HPF	04015142	DRG4713 HP 0.00 - 0.02 STRENGTH TEST	\$ 13,636	\$ 787,130	\$ 14,199	\$ 1,719	\$ 17,159	Regulatory Compliance	0.02	12/31/2021	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04015143	GCUST8184 HP 0.001 - 0.009 TEST	\$ 21,308	\$ 2,104,088	\$ (161,518)	\$ 3,101	\$ (893)	Regulatory Compliance	0.13	12/31/2021	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04015144	GCUST8181 HP 0.00 - 1.40 STRENGTH TEST	\$ 15,933	\$ 2,494,322	\$ (109,566)	\$ 22,594		Regulatory Compliance	1.42	12/31/2021	External Corrosion (EC), Internal Corrosion (IC), HCA - Not Tested
3	3.05A	HP	HPF	HPF	HPF	04015145	DRP 0910-01 HP 0.03 - 0.15 TEST	\$ 1,862	\$ 931,971	\$ 10,011	\$ 118	\$ 112	Regulatory Compliance	0.01	12/31/2021	External Corrosion (EC), Internal Corrosion (IC)
3	3.05A	HP	HPF	HPF	HPF	04015130	*CANC*DRG4539 HP 0.1 TEST	\$ 1,844	\$ 34,617				Cancelled	Cancelled	Cancelled	Cancelled
3	3.05A	HP	HPF	HPF	HPF	04015131	L-109 HP 28.87 - 29.20 TEST	\$ 17,773	\$ 316,239	\$ 211,783	\$ 9,964,032	\$ 142,450	Regulatory Compliance	0.39	12/31/2023	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04016050	L-109 HP 30.109 - 13.805 STRENGTH TEST	\$ 123,634	\$ 333,482	\$ 14,051,130	\$ 667,355		Regulatory Compliance	3.89	12/31/2023	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04016050	*CANC*L-131 HP 38.66-41.43 TEST	\$ 86,337	\$ 144,162	\$ 59,881	\$ 139,040		Cancelled	Cancelled	Cancelled	Cancelled
3	3.05A	HP	HPF	HPF	HPF	04016070	*CANC*L-131 HP 38.66 - 38.13 TEST	\$ 79,105	\$ 81,007	\$ 21,507	\$ 4,567		Cancelled	Cancelled	Cancelled	Cancelled
3	3.05A	HP	HPF	HPF	HPF	04017080	*CANC*DRP 2008-01 HP 0.3005 - 0.29 TEST	\$ 4,215	\$ 1,861				Cancelled	Cancelled	Cancelled	Cancelled
3	3.05A	HP	HPF	HPF	HPF	04017127	*CANC*L-109 HP 70.00 - 14.50 TEST	\$ 29,308	\$ 1,241				Cancelled	Cancelled	Cancelled	Cancelled
3	3.05A	HP	HPF	HPF	HPF	04017445	DRP 0910-01 HP 0.00 - 0.20 TEST 24"	\$ 113,897	\$ 46,939	\$ 5,581	\$ 134		Regulatory Compliance	0.20	12/31/2021	External corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04017620	GCUST8186 HP 0.00 - 0.02 STRENGTH TEST	\$ 207	\$ 2,881,682	\$ 7,988	\$ (18,364)		Regulatory Compliance	0.02	10/12/2022	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04021144	L-1114 MP 1.34 - 4.60 STRENGTH TEST	\$ 1,718,001	\$ 710,842	\$ 8,922			Regulatory Compliance	3.75	12/5/2023	Selective Seam Weld Corrosion (SSWC)
3	3.05A	HP	HPF	HPF	HPF	04021402	L-1185 HP 13.4 - 27.27 TEST	\$ 33,763	\$ 3,228,957	\$ (186,323)			Regulatory Compliance	4.15	2/23/2024	External Corrosion (EC)
3	3.05A	HP	HPF	HPF	HPF	04022486	L-3012 HP 1.96 - 1.93 TEST	\$ 1,429,791	\$ 234,422				Regulatory Compliance	1.88	12/31/2023	External Corrosion (EC), Subpart 1 Not Met
3	3.05A	HP	HPF	HPF	HPF	04022488	DRP 0614-05 HP 0.480 TEST	\$ 835,720	\$ 79,055	Regulatory Compliance	0.07	12/31/2023	Selective Seam Weld Corrosion (SSWC), Subpart 1 Not Met, Over Pressure Event			
3	3.05A	HP	HPF	HPF	HPF	04022501	DRP 0126-01 HP 0.00 - 1.84 TEST	\$ 2,675,541	\$ 123,095	Regulatory Compliance	1.96	12/31/2023	External Corrosion (EC), Internal Corrosion (IC), HCA - Subpart 1 Not Met			
3	3.05A	HP	HPF	HPF	HPF	04022502	L-0574 HP MP 0.40 - 0.70 TEST	\$ 3,456,108	\$ 104,907	Regulatory Compliance	0.07	12/31/2022	External Corrosion (EC)			
3	3.05A	HP	HPF	HPF	HPF	04022505	L-0210 HP 24.04-25.8 30.87-30.93 TEST	\$ 182,940	\$ 2,146,765	Regulatory Compliance	0.13	12/31/2024	NN-SCC, External corrosion (EC)			
3	3.05A	HP	HPF	HPF	HPF	04022563	L-1244 HP 1.89 - 1.97 TEST	\$ 21,190	\$ (1,776)	Regulatory Compliance	3.10	12/31/2024	NN-SCC, External corrosion (EC), Selective Seam Weld Corrosion (SSWC), RADP Reformation (CPR 192.624)			
3	3.05A	HP	HPF	HPF	HPF	04022664	DRP0810-01 HP 0.2029 - 0.80 TEST	\$ 448	\$ 242	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04022665	*CANC*L-0215 HP 10.34 - 10.48 TEST	\$ 3,931	\$ 4,644	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04022667	*CANC*L-0215 HP 10.34 - 10.48 TEST	\$ 14,791	\$ 9,111	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04022668	*CANC*L-109 HP 48.24-53.71 TEST	\$ 1,701		Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04022669	*CANC*DRP 0614-08 HP 0.7-2.02 TEST	\$ 134	\$ 4	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04022670	L-1314 HP 0.0001 - 1.402 TEST	\$ 28,541					Regulatory Compliance	1.46	12/31/2024	External Corrosion (EC), Internal Corrosion (IC), Selective Seam Weld Corrosion (SSWC), RADP Reformation (CPR 192.624)
3	3.05A	HP	HPF	HPF	HPF	04022671	*CANC*L-109 HP 45.48-47.17 TEST	\$ 399,018	\$ 254,715	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04022672	DRP 0114-01 HP 0.1 - 1.46 TEST	\$ 53,821	\$ 3,938,741	Regulatory Compliance	0.45	12/31/2024	NN-SCC, External corrosion (EC), Internal corrosion (IC)			
3	3.05A	HP	HPF	HPF	HPF	04022673	GCUST8189 HP 0.385-0.521 TEST	\$ 26,711	\$ 1,632,850	Regulatory Compliance	0.14	12/31/2024	External corrosion (EC), Internal corrosion (IC)			
3	3.05A	HP	HPF	HPF	HPF	04022674	L-0216 HP 0.00 - 1.72 TEST	\$ 126,361	\$ 2,786,892	Regulatory Compliance	2.50	12/31/2024	External Corrosion (EC), Internal corrosion (IC)			
3	3.05A	HP	HPF	HPF	HPF	04022678	*CANC*GCUST8190 MP 0.0-0.0055 TEST	\$ 43,651	\$ 29,279	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04022704	DRP0405-01 HP 0.0-0.10 TEST	\$ 645,650	\$ 1,915,410	Regulatory Compliance	0.21	9/22/2024	External Corrosion (EC)			
3	3.05A	HP	HPF	HPF	HPF	04022802	*CANC*L-131 HP 41.40 - 42.70 TEST	\$ 197,351	\$ 124,052	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04023140	*CANC*GCUST8192 HP 0.00-0.0056 TEST	\$ 1,534		Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04023186	L-0216 HP 0.00 - 1.50 TEST	\$ 12,230	\$ 84,541	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04023350	DRP 0614-01 HP 13.81 TEST EXPENSE	\$ 4,574	\$ 157,448	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04023551	*CANC*DRP 0614-01 HP 0.00-0.0056 TEST	\$ 29	\$ 44,777	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04023551	*CANC*DRP 0614-01 HP 0.00-0.0056 TEST	\$ 12,585		Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04023561	DRP 0614-01 HP 7.48 - 7.72 TEST	\$ 35,351	\$ 2,177,951	Regulatory Compliance	0.06	12/31/2024	External corrosion (EC), Selective Seam Weld Corrosion (SSWC)-Moderate			
3	3.05A	HP	HPF	HPF	HPF	04023776	DRP 0614-01 HP 0.00-0.0056 TEST	\$ 1,171	\$ 114,108	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04023777	*CANC*DRP 0120-01 MP 0.004 - 0.1179 TEST	\$ 34	\$ 1,132	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04024100	L-0434 HP 0.00 - 0.10 TEST	\$ 80	\$ 34,134	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	
3	3.05A	HP	HPF	HPF	HPF	04024150	T-1674 L-177A HP 28.36-32.92 TEST	\$ 68,882					Regulatory Compliance	0.18	12/31/2025	External corrosion (EC), Internal corrosion (IC), Selective Seam Weld Corrosion (SSWC)-Moderate
3																

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	CalAdvocates_113-Q002
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_113-Q002
Request Date:	September 4, 2025
Requester DR No.:	PubAdv-PG&E-113-SWC
Requesting Party:	Public Advocates Office
Requester:	Sophie Chia
Date Sent:	September 18, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: ASSET FAMILY – TRANSMISSION PIPE

QUESTION 002

Referring to Exhibit PG&E-3, Chapter 5, pages 5-46 to 5-47, PG&E states,

“The forecast for MAT HPF was determined by applying the Hydrostatic Test Forecast Calculator to the project list described above and then escalating the costs to 2027 dollars. The 2027 forecast is higher than the 2024 recorded cost. The increase in 2027 is driven by a higher volume of time dependent threats, previously tested/unstable threats, and interactive threats coming due in 2027-2030. In addition, the transmission definition initiative impacted work that was originally planned for 2024 to be pushed to future years to allow for reclassification of the asset.”

- a. For the 2027 forecast for MAT HPF, please explain in detail if the Hydrostatic Test Forecast Calculator is the same Hydrostatic Test Forecast Calculator used in the 2023 GRC. If not, please explain the difference between the forecast methods used for the 2023 GRC forecast and the 2027 GRC forecast for MAT HPF.
- b. Please provide the list of projects originally planned for 2024 that is impacted by the transmission definitive initiative and pushed to future years to allow for reclassification of the asset with the (1) project name, (2) compliance date, (3) mileage, and (4) threats to the pipe.

ANSWER 002

- a) The 2023 GRC Strength Test cost model was developed using data from 123 projects completed between 2015 and 2019. Built with linear regression, it required five input variables: Test Count, Diameter, Miles, Dummy_Contractor, and Class Location, and includes five terms in its formula: Log(Test Count), Diameter, Dummy_Contractor, Diameter x Dummy_Contractor, and Log(Miles) x Class_Location.

The 2027 GRC Strength Test cost model draws on a larger dataset of 199 projects completed between January 2015 and April 2024. It uses the same five input variables as the 2023 GRC cost model, but the best-fit formula now contains only four terms: $\text{Log}(\text{Test Count}) \times \text{Diameter}$, Dummy_Contractor , $\text{Log}(\text{Miles}) \times \text{Class_Location}$, and $\text{Log}(\text{Miles})$.

With more historical data and a refined logic structure, the 2027 GRC cost model improves predictive accuracy, achieving a 13% lower out-of-sample root mean square error (RMSE) and 10% lower out-of-sample mean absolute error (MAE) compared to the 2023 model.

- b) Please refer to GRC-2027-Phi_DR_CalAdvocates_113-Q002Atch01 for a list of projects originally planned to be executed in 2024 that were impacted by the Transmission Definition Initiative and rescheduled to future years to allow for reclassification of the asset. MAT JTC projects were excluded from this analysis as these projects are shareholder funded. Programs like MAT 75P and 75N, which are capital upgrades needed to facilitate the assessment, were included but do not have compliance dates since they are tied to a main assessment project under the In-Line Inspection (ILI) or Strength Test programs. Thus, PG&E marked these as not applicable (N/A) for the requested compliance dates.

PACIFIC GAS AND ELECTRIC COMPANY
General Rate Case 2027 Phase I
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Data Response

PG&E Data Request No.:	TURN_045-Q002
PG&E File Name:	GRC-2027-PhI_DR_TURN_045-Q002Supp01
Request Date:	October 2, 2025
Requester DR No.:	45
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	October 16, 2025 (Original) October 23, 2025 (Supplemental)
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: PG&E-03, CHAPTER 5—ILI UPGRADES

QUESTION 002

With respect to Workpaper Table 5-54:

- a. The table starting on line 31 refers to cost calculator (WP-71), which has a total amount estimated for the projects during years 2027-2030 of \$365,470,398.91. Please reconcile this figure to the total unitized figure of \$403,804,712 and explain the basis for the difference in the figures.
- b. Please provide a list of each non-unitized project that was completed during the period 2020-2024 providing:
 - i. The total recorded costs for the project,
 - ii. The year the project was completed,
 - iii. A detailed description of the work that was completed, and
 - iv. A detailed explanation of why the work was required.

ANSWER 002

- a. Exhibit (PG&E-3), Workpaper Table 5-55 presents ILI upgrade cost estimates derived from PG&E's forecast calculator. The total cost estimate of \$403,804,712 shown in Exhibit (PG&E-3), Workpaper Table 5-54 reflects a combination of these forecast calculator driven estimates and those based on detailed 30-60% design job estimates, each calculated individually for the proposed upgrades.
- b. Please see below:
 - i. Please see GRC-2027-PhI_DR_TURN_045-Q002Atch01 for the total recorded costs for the non-unitized work from 2020 to 2024. During our preparation of this data response, PG&E found an inadvertent error in our workpaper. PG&E will update Exhibit (PG&E-3), Workpaper Table 5-54,

lines 11 and 17, to align the non-unitized historical average with this DR response. This correction will be included in a future errata submission.

- ii. Please see GRC-2027-Phi_DR_TURN_045-Q002Atch01 for the year the project was completed.
- iii. PG&E will provide a detailed description of the work that was completed in a supplemental response. This request to provide detailed descriptions of the work that was completed and a detailed explanation of why the work was required necessitates manual validations at the project level, which takes significant time and effort.
- iv. Please see response to subpart b.iii above.

ANSWER 002 SUPPLEMENTAL 01

- b.
 - iii. Please see “*GRC-2027-Phi_DR_TURN_045-Q002Supp01Atch01.xlsx*” for a detailed description of the work completed for each non-unitized project completed in 2020-2024.

98C	ILI Upgrades	5774739	74011081	I-360	2019	L-215/215-1 MP 8.52 ILI LAUNCHER/RECEIVE	\$	377,864.33	\$	111,863.51	\$	442.26		assessment of L-215	meet 2020 compliance date.			
														Remove two elbows and 22' of 12" pipe and install 22' of 12" pipe and two 3R elbows, remove two elbows and 13' of 12" pipe and install 13' of 12" pipe and two 3R elbows, remove two elbows and 12' of 12" pipe and install 12' of 12" pipe and				
98C	ILI Upgrades	5778907	74016609	I-360B	2019	I-360B L-215 MP 8.52-20.04 ILI UPGRADE	\$	297,556.15	\$	14,205.88				5' of 12" pipe and 12" ANSI Valve ,remove one elbow and 10' of 12" pipe and install 10' of 12" pipe and one 3R elbow, remove two elbows and 13' of 12" pipe and install 13' of 12" pipe and two 3R elbows	Upgrades were required to make L-215 piggable in order to run the inspection.			
98C	ILI Upgrades	5782379	74021461	I-485	2019	L-307B MP 16.97 ARBIOS RECEIVER	\$	224,837.56	\$	69,170.25	\$	324.00	\$	93.08	\$	3,359.79	Station. Upgrades to split line to be able to inspect with a single-diameter 8" and shorter 6"x8" tool. Remove and replace 6" fittings with all 3R elbows.	Upgrading the line in order to split the tool run into two single diameter runs in 2019.
98C	ILI Upgrades	5782886	74022042	I-501	2020	L-119C NSUGH GROUNDING ILI UPGRADE	\$	540,008.89	\$	59,736.66	\$	14,322.79	\$	595.69			Installed grounding grid for the ILI Launcher and Receiver, installed 1600' - 4/0 BCW buried 18" deep, installed 19 - 5/8" x 8' copper clad ground rods, installed 12 - non-conductive sleeves for bollards, installed 98' - non-conductive fence, installed 2 - Polarization Cell Replacement (PCR)	The ILI Launcher and Receiver was installed at the NSUGH station was built without a grounding grid. To be able to meet Institute of Electrical and Electronics Engineering to-ground (SLG) fault conditions.
98C	ILI Upgrades	5783011	74022508	I-504A	2020	I-504A L-401 ILI UPRGR LAUNCHER BURNEY	\$	1,807,328.82	\$	152,307.12		\$	1,022.07				Barrel conversion, installed permanent launcher, installed foundation blocks.	from Burney to Gerber. The installation of a launcher were required to run a traditional single diameter ILI tool.
98C	ILI Upgrades	5783012	74022509	I-504B	2019	L-401 ILI UPRGR RECEIVER GERBER	\$	163,341.02	\$	43,164.94	\$	(8,489.74)					receiver; installed 16" full port ball valve.	diameter ILI tool.
98C	ILI Upgrades	5784978	74025580	I-549	2020	L-108 MP11.67 RIPON-MODESTO LNCHR/RVCR	\$	6,679,874.04	\$	1,562,612.54	\$	289,566.60	\$	16,144.64			Installed permanent launcher and receiver for Line 108	inspect L-108.
98C	ILI Upgrades	5798583	74026380	I-047I	2021	I-047I DFM 0617-07 MP 1.11 FENCE INSTALL	\$	50,657.71	\$	833,887.08	\$	80,107.81	\$	12,239.13	\$	127.16	temporary fencing, completed grading, and installed fence grounding.	Provided site security and compliance with grounding study recommendations.
98C	ILI Upgrades	5785639	74026421	I-234D	2023	I-234D L-021C MP 35.05 LAUNCHER	\$	2,041.32	\$	1,183.69	\$	6,869.11	\$	1,250,373.23	\$	33,861.00	35.05-53.11.	the challenges of using the switching station.
98C	ILI Upgrades	5785660	74026560	I-563	2019	L-177A MP 88.83 HARRISION GULCH LAUNCHER	\$	247,132.20	\$	38,273.00	\$	369.78	\$	1,578.13			project I-287. I-563 is a cost holder order number.	required.
98C	ILI Upgrades	5785923	74026766	I-566	2020	L-131 MP 50.70 IRVINGTON ILI UPGRADE	\$	1,099,464.35	\$	27,317.48	\$	65,693.25	\$	175.48	\$	(14,457.92)	foundation blocks, install kicker line.	overall costs for subsequent ILI runs.
98C	ILI Upgrades	5785924	74026767	I-567	2020	L-153 MP0 IRVINGTON ILI UPGRADE LAUNCHER	\$	963,064.91	\$	47,019.26	\$	51,909.46	\$	175.48	\$	(13,532.53)	foundation blocks, install kicker line.	overall costs for subsequent ILI runs.
98C	ILI Upgrades	5785925	74026768	I-568	2020	L-057C MP6.40 PALM TRACT STN ILI UPRG REC	\$	965,125.45	\$	(32,235.58)	\$	132,534.60	\$	32,723.69			Barrel conversion to install permanent receiver, install foundation blocks.	barrels to reduce the cost and impact of code mandated ILI inspection runs.
98C	ILI Upgrades	5785919	74026841	I-570	2020	L-303 MP 0 ANTIOCH ILI UPGRADE LAUNCHER	\$	1,168,239.59	\$	40,772.56	\$	(82,618.24)	\$	(2,020.58)	\$	1,103.19	foundation blocks, install kicker line.	overall costs for subsequent ILI runs.
98C	ILI Upgrades	5785920	74026842	I-571	2020	L-303 MP 42.83 IRVINGTON ILI UPGRADE REC	\$	797,349.39	\$	42,121.84	\$	55,491.30	\$	(6,935.73)	\$	(11,292.47)	Barrel conversion to install permanent receiver, install foundation blocks.	barrels to reduce the cost and impact of code mandated ILI inspection runs.
98C	ILI Upgrades	5785921	74026843	I-572	2020	L-114 MP 9.03 ANTIOCH ILI UPRGR LAUNCHER	\$	1,129,887.84	\$	27,361.54	\$	(5,204.47)	\$	4,409.38	\$	916.34	foundation blocks, install kicker line.	overall costs for subsequent ILI runs.
98C	ILI Upgrades	5785922	74026844	I-573	2020	L-114 MP 16.58 BRENTWOOD ILI UPGRADE REC	\$	1,069,306.50	\$	111,716.89	\$	(4,593.81)	\$	(2,198.14)	\$	1,043.49	Barrel conversion to install permanent receiver, install foundation blocks.	barrels to reduce the cost and impact of code mandated ILI inspection runs.
98C	ILI Upgrades	5788548	74030400	I-594A	2020	L 400 MP 0.00 BURNEY CS ILI LAUNCHER CON	\$	778,910.98	\$	484,213.02		\$	175.48				foundation blocks, install kicker line.	overall costs for subsequent ILI runs.
98C	ILI Upgrades	5789060	74031220	I-594B	2021	L-400 MP 142.61 INSTALL ILI RECEIVER	\$	70,241.11	\$	1,579,333.89	\$	204,418.32	\$	77,063.84			Barrel conversion to install permanent receiver, install foundation blocks.	barrels to reduce the cost and impact of code mandated ILI inspection runs.

													Scope included: install 23' of 12" steel pipe, install 7' of 6" steel pipe, remove 78' of 12" steel pipe, remove 4' of 6" steel pipe, install 12' of 24" steel pipe, remove 25' of 24" steel pipe, retire 39' of 24" steel pipe, remove 2' of 12" steel pipe, retire 1' of 12" steel pipe.	
98C	ILI Upgrades	5791385	74034363	I-360D	2021	L-215 MP 8.52 ILI UPGRADE TIE-INS	\$ 72,405.93	\$ 662,617.25	\$ 78,487.56	\$ (1,114.08)	\$ 3,023.25	Enabled EMAT tool inspection and improved pigability. Based on FEA Analysis of the pig run conducted at speed of 15 MPH, there is a risk of the tool causing stress on a segment of the pipeline and this additional external pipe support will help mitigate the stress within the pipeline during the tool inspection.		
98C	ILI Upgrades	5793158	74036420	I-637	2021	L-021H MP 0.2 INSTALL TEMP PIPE	\$ 127,890.14	\$ 711,465.28	\$ 25,912.24	\$ 1,495.01		In order to mitigate the stress on the pipeline 021H, three new temporary supports were installed to provide support the pipeline during the pig run.		
98C	ILI Upgrades	5794488	74037502	I-671	2021	L-300A MP 344.42 - 344.65 ILI UPGRADE	\$ 12,651.40	\$ 1,598,084.19	\$ 171,333.34	\$ 7,810.92	\$ 565.43	Scope included: remove the two (2) existing 32" bends and install 3R bend, install three (3) sniff holes for gas monitoring while performing the bend replacements, grade and gravel cross-compressor laydown, CNG set up for clearance	Replace two manufactured 32" bends on L-300A at MP 344.40 and 344.65 to allow a 34" MFL-C to safely navigate through during tool inspection.	
98C	ILI Upgrades	5794960	74037765	I-672	2022	L-407 MP 25.27 BASELINE RD PLS RECVR	\$ 47.26	\$ 171,284.59	\$ 506,222.88	\$ (102,491.44)	\$ (2,547.18)	Barrel conversion to install permanent receiver	Excavate 13 locations to replace fitting alignments and quality of welds for elbows and tees installed on L-021C from 2007 to 2008.	Converting into a permanent receiver removes the need and cost to rent barrels and additionally saves on labor to setup and breakdown the barrels. There is a risk of not having sufficient rental/owned equipment to support multiple inline inspection projects.
98C	ILI Upgrades	5795389	74038521	I-234C	2023	L-021C MP 36.15 - 51.67 ILI UPGRADE	\$ 171,098.86	\$ 13,157,524.75	\$ 7,446,176.26	\$ 235,422.24		Install a launcher and receiver	Enabled successful pigging following prior inspection failure.	
98C	ILI Upgrades	5796405	74039690	I-679	2023	L-407 L-406 LAUNCHER RECIEVER YOLO JUNCT	\$ 500,040.62	\$ 289,076.63	\$ 7,293,536.21	\$ 189,793.05		Barrel conversion to install permanent launcher	Yolo Junction requires a receiver and launcher to split runs per Gas System Plannings request during the Level 2 Hydraulic analysis.	
98C	ILI Upgrades	5797258	74041026	I-683	2023	CAPAY MTR STN L-406 MP 0 LAUNCHER CONVER	\$ 127,803.78	\$ 197,604.93	\$ 2,477,421.52	\$ 270,354.19		Barrel conversion to install permanent launcher	To allow L-406 to be made piggable with a permanent launcher barrel.	
98C	ILI Upgrades	5797913	74042284	I-699	2025	CORDELA STN ILI UPGR LAUNCH BAR CONV	\$ 53.85	\$ 1,341.27	\$ 397.84	\$ 269,157.95		Barrel conversion to install a permanent launcher barrel, install bridge valve and equalizing line, install kicker line, replace gauge tap	The installation of the bridge valves and equalizing line is necessary to make this ILI launcher consistent with PG&E's design guidelines for an ILI launcher and allows the ensuing inline inspection project to perform the pigging operations without having to perform work arounds.	
98C	ILI Upgrades	5798673	74043405	I-712	2022	L-118B MP 0.00 - 26.24 ILI UPGRADE	\$ 22,599.66	\$ 2,685,101.35	\$ (34,176.97)	\$ 3,202.79		Cut out section of pipe and install crossite from L-118A to feed a LVC. Install additional crossite from L-118A to feed a LVC.	Addressed stoppages encountered during prior inspection of Line 118B.	
98C	ILI Upgrades	5799167	74044205	I-719	2024	L-021E MP 117-117.3 ILI UPGRADES	\$ 394.70	\$ 699.90	\$ 97,936.97	\$ 3,180,575.03		Replace 174' of existing 8.625" pipe on L-021E attached to the underside of the bridge crossing.	Resolved speed excursions during MFL-A inspection and prepared for MFL-C tool.	
98C	ILI Upgrades	5799374	74044600	I-721	2022	L-153 MP 17.63 FAIRWAY LAUNCHER BRL CONV	\$ 252.89	\$ 1,408,714.92	\$ 128,696.03	\$ (29,300.29)		Barrel conversion to install a permanent launcher	Converting into a permanent launcher removes the need and cost to rent barrels and additionally saves on labor to setup and breakdown the barrels. There is a risk of not having sufficient rental/owned equipment to support multiple inline inspection projects.	
98C	ILI Upgrades	5799872	74045403	I-728	2022	L-302E MP 0.02 HERSHEY JUNC BARREL CONV	\$ 1,302,822.70	\$ 25,014.91	\$ 5,713.34			Barrel conversion	Converting into a permanent launcher removes the need and cost to rent barrels and additionally saves on labor to setup and breakdown the barrels. There is a risk of not having sufficient rental/owned equipment to support multiple inline inspection projects.	
98C	ILI Upgrades	5799903	74045461	I-729	2022	L-172A MP 40.07 LAUNCHER BARREL CONVERSI	\$ 1,051,622.05	\$ (4,639.63)	\$ 7,332.93			Barrel conversion	Converting into a permanent launcher removes the need and cost to rent barrels and additionally saves on labor to setup and breakdown the barrels. There is a risk of not having sufficient rental/owned equipment to support multiple inline inspection projects.	
98C	ILI Upgrades	5805562	74054160	I-813	2024	L-173 MP 8.48 & MP 12.93 ILI UPGRADE	\$ 86,070.28	\$ 3,060,415.87				Scope included replacing reducer, replace 83' of 8" pipe, replace 3' 6" of 6", replace 6" Elbow, replace 6'-4" of 6" and installed 4 PCF.	Addressed stoppages and speed excursions during prior inspection.	
98C	ILI Upgrades	5810102	74059961	I-873	2024	L-1425 MP 1.29-4.3 ILI UPGRADES	\$ 3,076,465.27					Scope included install (6) 10" 3R Elbows, install 15' of 10" Pipe, remove (6) of 16" LH Elbows, install (2) 4" Blowdown Valves, install 75'-2"-2" of 4" Pipe, install 4" Blowdown stack. The project's scope encompasses sections of L-118B, replace 6 elbows.	During an In Line Inspection the tool experienced stoppage and incomplete inspection. These upgrades were required in order to reinspect L-1425.	
98C	ILI Upgrades	5810088	74060001	I-874	2027	L-118B MP 0.52-11.90 ILI UPGRADE	\$ 57.65					Scope: install 200' of 8" Pipe and (9) 8" Elbows, Remove 16'-2" of 8" Pipe, install 2 concrete caps and (10) pipe support/hangers, Install (1) 2" Valve, 65' of 2" pipe, and 3/4" gauge taps (rebuild 2" tap). Slurry fill, cap, and abandon 330' of 8" pipe in place.	Mitigated speed excursions identified during previous pigging runs.	
98C	ILI Upgrades	5810840	74060990	I-880	2025	L-021E MP 115.9 HENSLEY CREEK ILI UPGRAD	\$ 1,601,919.37					Scope: clean & retire (in-place) the existing on run of 12" (~360') pipeline below Petakuma river, Slurry filling of 12" pipeline below the river (~360'), Clean and Removal of existing north and south valve lots (4 Ea. 12" Valves, 4 Ea. 4" Valves, 2 Ea. 2" Valves). Clean and Retire (in-place) the existing " Drip Line (~3000') , Install new buried valves (2 Ea. 12" Valves and 2 Ea. 6" 80 Valves). Install new 12" (~40') pipe, install new 6" (~80') pipe, install new (2 Barred Tees, install new (2) Reducers	Replace all 8" sections of L-021E to make the line piggable for the next MFL-C inspection. There are a number of SCC-Axial and SSWC threats identified along this section of L-021E that need to be met.	
98C	ILI Upgrades	5788578	74001643	R-708	2023	L-021G MP2.46-2.66 REPL 1003'OF 12"	\$ 456,298.86	\$ 440,432.17	\$ 566,686.57	\$ 8,803,991.83	\$ 1,641,353.40			Upgrade was required to make L-021G piggable by replacing the dual 12" pipelines crossing under the Petakuma River to a single 16" pipeline via horizontal directional drilling (HDD).

**PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response**

PG&E Data Request No.:	TURN_102-Q001
PG&E File Name:	GRC-2027-Phi_DR_TURN_102-Q001
Request Date:	January 6, 2026
Requester DR No.:	102
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	January 21, 2026
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: JANUARY 21, 2026 (ACCOUNTING FOR MLK JR. DAY) SUBJECT: PG&E-3 - FOLLOW UP TO DR TURN-PG&E-76, TURN-PG&E-34; GAS GATHERING, VALVES, STANPAC

QUESTION 001

In response to TURN-PG&E-76, Q.1, Attachment 003, PG&E provides a breakdown of DSL operating pressures into five pressure ranges.

- a. Please provide a new version of the workbook that PG&E provided in response to TURN-61, Q.6, Attachment 1 that includes an additional column showing the operating pressure for each DSL line listed.
- b. Please indicate on the new table provided in response to Question 1(a) which lines correspond to the criterion “MAOP Flags for replacements on DSL assets operating above 60 psig and/or involves replacements on DSL,” referred to in footnote (b) of Workpaper Table 5-16 Errata.
- c. Please provide the state or federal regulatory basis for the MAOP flags referred to in the previous question.
- d. Please indicate on the new table provided in response to Question 1(a) which lines correspond to the criterion “A feature has an MAOP-D flag if the MAOP-D is less than the current MAOP of Subsystem (MAOP-S). The MAOP-D flag can be caused by design specifications from traceable, verifiable, and complete (TVC) or non-TVC records,” referred to in footnote (c) of Workpaper Table 5-16 Errata.
- e. Please explain the state or federal regulatory basis for the MAOP-D flags referred to in the previous question.
- f. Please indicate on the new table provided in response to Question 1(a) which lines would be forecasted to be subject to NT-ILI assessments and Direct Assessments as shown in WP-Table 5-23, lines 22 through 28.

- g. Please explain in detail how the MAOP DSL flags described in Line 27 of WP-Table 5-23 differ from “MAOP Flags for replacements on DSL assets operating above 60 psig and/or involves replacements on DSL,” referred to in footnote (b) of Workpaper Table 5-16 Errata.

ANSWER 001

- a. Please see “*GRC-2027-Phl_DR_TURN_102-Q001Atch01.xlsx*” that includes an additional column (column J) showing the operating pressure for each Distribution Supply Line (DSL) line listed. During our preparation of the attachment, PG&E found it had inadvertently included pipelines that were reclassified as Distribution and are not DSL. These outliers were not included in “*GRC-2027-Phl_DR_TURN_102-Q001Atch01.xlsx*”. These outliers totaled 7.5 miles of the 713.8 miles shown in Exhibit (PG&E-3), WP Table 5-91, served November 10, 2025, and the removal of these outliers does not change the forecast. Although these segments were historically categorized as transmission, they are currently operating at or below 60 psig and would not be managed as a DSL asset. All work included in the forecast will only be performed on pipelines classified as DSL, consistent with the criteria outlined by the CPUC in Decision D.23-12-003. In a future errata submission and/or at hearings, PG&E will issue a corrected version of Exhibit (PG&E-3), WP Table 5-91, to make it more clear that the list includes both DSL and distribution assets that were previously Transmission.
- b. PG&E cannot identify on the “*GRC-2027-Phl_DR_TURN_102-Q001Atch01.xlsx*” table, which specific lines will be subject to MAOP Flags for replacements on DSL assets between 2027–2030 because the exact scope has not yet been identified. PG&E determines the specific DSL lines to assess and the timing of work based on internal procedures and compliance/regulatory commitments outlined in subpart c below. PG&E will also consider factors such as risk, operational concerns, engineering feasibility, and costs to help determine the best timing and location of this work.

Distribution Supply Line (DSL) is a new classification that was not included in prior rate cases; therefore, the 2027 GRC is the first time PG&E has forecasted work associated with DSL MAOP flags on DSL assets operating above 60 psig, as referenced in footnotes (b) and (c) of Exhibit (PG&E-3), Workpaper Table 5-16, served November 10, 2025. For background on the definition change that introduced DSL, see Exhibit (PG&E-3), Ch. 1, Section C.1.a.

The forecasted MAOP-T and MAOP-D scopes relate to the implementation of Non-TIMP Replacement in Lieu of Strength Testing. These scopes of work require replacing or pressure testing untested, underrated or invalidly tested pipe components or non-line pipe components, (e.g., elbows, flanges, HPR sets, meters, odorizers, PCFs, regulators, taps, tees, unions, and valves). Replacement is used when pressure testing is not feasible or is more costly.

- c. PG&E’s internal procedures require the mitigation of pipelines, including DSL, when design, test or other records are inadequate. PG&E’s MAOP validation procedure

was written to align with CPUC Decision / CA Law (D.11-06-017 and CPUC Code Section 958 issued in 2011 and 2012), 49 CFR § 192.619, and PHMSA advisories (ADB-11-01 & ADB-12-06 published in 2011 and 2012) directing operators to utilize Traceable, Verifiable, and Complete (TVC) records to calculate MAOP and to implement a test/replacement plan for all transmission pipe with inadequate TVC records.

Although these DSL lines are no longer classified as transmission per CFR 49, PG&E intends to maintain the existing TVC level MAOP requirements for these DSL assets. MAOP flags, including DSL MAOP flags and non-pipe MAOP-D flags, typically arise from missing or invalid strength test records or design inconsistencies. Remediation actions for MAOP flags may include pressure reductions, replacements, new strength tests, retirement, or field verification, depending on the nature of the flag.

- d. PG&E interprets this question as relating to non-pipe since footnote C in Exhibit (PG&E-3), WP 5-27 is attributed to non-pipe. Please see response to subpart b regarding selection/timing of work on DSL routes which applies to both pipe and non-pipe. Historically, non-pipe MAOP-D mitigation efforts were executed through multiple transmission programs and asset families, making it difficult to isolate the portion of work strictly related to non-pipe MAOP-D flags. Going forward, the validation and mitigation of non-pipe features with MAOP-D flags will be prioritized at a pace that aligns with PG&E's risk reduction goals for non-pipe MAOP issues.

Non-pipe MAOP-D flags consist of non-line pipe components (e.g., elbows, flanges, HPR sets, meters, odorizers, PCFs, regulators, taps, tees, unions, and valves). Using Pipeline Feature List (PFL) data in GT-GIS and engineering judgement, PG&E estimates approximately 58 non-pipe MAOP-D flags for the 2027-2030 period will require mitigation via replacement. Replacement is the most cost effective option for the non-pipe assets that are dispersed and have limited co-location with other MAOP-D assets.

- e. Please see response to subpart c.
- f. PG&E cannot identify on the “*GRC-2027-PhI_DR_TURN_102-Q001Atch01.xlsx*” table, which specific lines will be subject to NT-ILI or Direct Assessment in 2027–2030 because the selections have not yet been identified. However, please see the table below for assessments performed on DSL routes in 2024 and 2025.

Type of Assessment	Route	Year Assessment Was Done
ECDA	0630-01	2024
ECDA	DREG4436	2024
NT-ILI	101	2024
ECDA	1519-01	2025
ECDA	8807-01	2025
NT-ILI	101	2025

- g. The DSL MAOP-flag remediation for MAT JTB in Exhibit (PG&E-3), Workpaper Table 5-23, line 27, served November 10, 2025, may include a broader set of activities (e.g., strength tests, component installation, repairs, etc.). Depending on the nature of the flag, this remediation work can be outside the normal replacement scope of MAT JT6. In contrast, the DSL MAOP-flag work in for MAT JT6 Exhibit (PG&E-3), Workpaper Table 5-16, served November 10, 2025, footnote (b) is replacement work only.

PACIFIC GAS AND ELECTRIC COMPANY
General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	CalAdvocates_071-Q001
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_071-Q001
Request Date:	August 5, 2025
Requester DR No.:	PubAdv-PG&E-071-SWC
Requesting Party:	Public Advocates Office
Requester:	Sophie Chia
Date Sent:	August 19, 2025
PG&E Witness(es):	Christopher Warner – Gas Engineering

SUBJECT: ASSET FAMILY - TRANSMISSION PIPE

QUESTION 001

Referring to Exhibit PG&E-3, Chapter 5, page 5-46, lines 2 to 12, PG&E states, “Work for the Non-TIMP Replacement in Lieu of Strength Testing (MAT JT6) is implemented when expense replacement is a more cost-effective option than compliance required strength testing under MAT 75U. The forecast for MAT JT6 was determined by applying the pipe replacement cost model to the project list described above and then escalating the costs to 2027 dollars. The 2027 forecast is higher than the 2024 recorded cost. The forecast is higher because a low volume of work materialized in 2024. Additionally, PG&E is forecasting work in 2027 for MAOP flags on DSL routes and non-pipe MAOP design flags that is leading to a higher forecast.”

- a. Please explain in detail why there was a low volume of work in 2024 for MAT JT6.
- b. Also, referring to PG&E’s response to GRC 2027-PhI_DR_Cal Advocates_016-Q16- 001Rev01Atch01, please explain in detail why the work in 2024 for MAT JT6 forecasted in the 2023 GRC of \$39.932 million and authorized in the 2023 GRC Decision of \$11.284 million did not materialize in 2024.
- c. Please explain in detail whether PG&E used the same pipe replacement cost model in the 2023 GRC forecast for Non-TIMP replacement in lieu of strength testing (MAT JT6). If not, please explain how the 2027 GRC forecast pipe replacement cost model is different and more appropriate than the pipe replacement cost model used to forecast MAT JT6 in the 2023 GRC.
- d. Please explain in detail when PG&E first implemented that work for the Non-TIMP Replacement in Lieu of Strength Testing (MAT JT6) when expense replacement is a more cost-effective option than compliance required strength testing under MAT 75U.
- e. Is PG&E’s 2027 GRC the first time that PG&E is forecasting work for MAOP flags on DSL routes and non-pipe MAOP design flags under MAT JT6? If not, please explain in detail which GRC(s) that PG&E forecasted work for MAOP flags on DSL routes and non-pipe MAOP design flags in MAT JT6.

- f. Please explain in detail which MWC and MAT Code recorded costs and number of Flags for MAOP flags on DSL routes for years 2020 to 2024. Please provide the MWC, MAT Codes, the 2020 to 2024 recorded costs, the 2020 to 2024 recorded Flags and the references in PG&E's testimony and workpapers for the 2020 to 2024 recorded costs and Flags.
- g. Please explain in detail which MWC and MAT Code recorded costs and number of Flags for non-pipe MAOP design flags for years 2020 to 2024. Please provide the MWC, MAT Codes, the 2020 to 2024 recorded costs, the 2020 to 2024 recorded Flags and the references in PG&E's testimony and workpapers for the 2020 to 2024 recorded costs and Flags.
- h. Please explain in detail how the forecasted costs for MAOP flags on DSL routes and non-pipe MAOP design flags that PG&E forecasted in MAT JT6 for its 2027 GRC relate to the implementation of Non-TIMP Replacement in Lieu of Strength Testing.
- i. Please explain in detail how the forecasted 2027 expense for the Non-TIMP Replacement in Lieu of Strength Testing under MAT JT6 affects the forecasted 2027 to 2030 capital costs under MAT 75U and/or any other MWC/MAT Codes. Please provide a copy of supporting analysis.

ANSWER 001

- a. Program costs in 2024 were below the 2023 GRC adopted dollars because a greater number of work scopes exceeded the current 50-foot threshold for capitalization. Under applicable accounting guidelines, these longer segments qualified as capital scopes rather than expense scopes, resulting in a lower overall expense spend for MAT JT6.
- b. Please see response to subpart a.
- c. PG&E employed a refreshed cost model for the 2027 GRC forecast, leveraging an expanded historical dataset encompassing projects from 2015 through 2024 for MAT JT6. To improve model accuracy, additional Geographic Information System (GIS) attributes were integrated, enabling more precise identification of cost drivers such as pipe diameter, location, and total replacement length. The model underwent cross-validation to ensure predictive accuracy and reliability across various project types.
- d. PG&E implements this strategy where feasible and considers cost as it determines the appropriate assessment method for the required scope or threat. The initial implementation of this strategy occurred in the 2019 Gas Transmission and Storage rate case. See A.17-11-009, Exhibit (PG&E-1), p. 5-45, lines 17-34 for a description of the strategy.
- e. DSL classification is a newly established category of pipe and was not included in prior rate cases. In prior rate cases, these pipelines were considered gas transmission. As a result, this is the first time PG&E has explicitly requested funding to address work scopes falling under this new classification. See Exhibit

(PG&E 3), Section C.1.a for more information on the gas transmission definition change which included this new classification.

Historically, non-pipe MAOP of design flag (MAOP-D) replacement in lieu of strength test has been opportunistic or bundled with sections of pipe that have been replaced. Non-pipe MAOP-D flags consist of non-line pipe components such as elbows, flanges, HPR sets, meters, odorizers, PCFs, regulators, taps, tees, unions, and valves. This is the first time PG&E has requested funding to address non-pipe MAOP-D flags and is proposing to accelerate work on non-pipe components by implementing replacements that are not bundled with line pipe projects.

- f. Please see response to subpart e above. These costs have not previously been included in PG&E's rate case.
- g. Historically, non-pipe MAOP-Design (MAOP-D) replacements have not been charged to MAT JT6. During the recorded cost period from 2020 to 2024, replacement mitigation work for non-pipe MAOP-D flags was captured opportunistically and bundled across various MATs, depending on the location of the flagged features. These efforts were executed through multiple transmission programs and asset families, making it difficult to isolate the portion of work due to non-pipe MAOP-D flags.

Because of this opportunistic and bundled approach, the validation and mitigation of non-pipe features with MAOP-D flags were not prioritized at a pace that aligned with PG&E's risk reduction goals for non-pipe MAOP issues. Between 2020 and 2024, the MATs that opportunistically addressed non-pipe MAOP-D flags included MAT 2KC (MWC 2K), MAT 50C (MWC 50), MAT 75O (MWC 75), MAT 75R (MWC 75), and MAT JTD (MWC JT).

- h. The forecasted costs for MAOP-D flags on DSL routes and non-pipe that PG&E forecasted in the 2027 GRC for MAT JT6 relate to the implementation of Non-TIMP Replacement in Lieu of Strength Testing because these scopes of work require replacing untested and/or underrated pipe components or pipe components with invalid tests or pressure testing the pipe or non-pipe. This work, driven by Non-TIMP untested (MAOP-T) and underrated (MAOP-D) flags, is performed if pressure testing is more expensive or not feasible.
- i. PG&E interprets this question to be referring to Non-TIMP Replacement in Lieu of Strength Testing capital MAT 75R rather than MAT 75U as stated.

The forecasted expense under MAT JT6 has an impact on MAT 75R as any scopes of work greater than 1 foot would move from expense MAT JT6 to capital MAT 75R as part of the capitalization policy change from 50 feet to 1 foot minimum. Please see Exhibit (PG&E-10), Chapter 7, Section I for more information on this capital accounting practice. This change resulted in \$16 million of projects forecast for replacements in-lieu of strength testing moving from expense MAT JT6 to capital MAT 75R for the 2027-2030 period. Please see Exhibit (PG&E-3), WP Table 5-18 for a list of projects under MAT 75R that are greater than 1 foot.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	SierraClub_002-Q002
PG&E File Name:	GRC-2027-PhI_DR_SierraClub_002-Q002
Request Date:	June 27, 2025
Requester DR No.:	Sierra Club-PG&E-02
Requesting Party:	Sierra Club
Requester:	Matt Vespa
Date Sent:	July 16, 2025
PG&E Witness(es):	Daven Phelan – Gas Engineering

QUESTION 002

PG&E response to Data Request Sierra Club-PG&E-01, Q.5(b) identifies the number of services replaced from 2022-2024 by customer class through MAT 14A, 14D and 50A. For each of these categories, please also provide the number of services that connect to a single customer meter, the number that connect to 2-5 meters, and the number that connect to more than 5 meters. (Sierra Club seeks a response similar to what PG&E provided in response to Q.4(a)).

ANSWER 002

For each category in SierraClub_001-Q005(b), please find appended to the original table the number of services that connect a single meter, the number of services that connect 2-5 meters, and the number of services that connect more than 5 meters:

Program	Year	Total Services Replaced ^(a)	Core Residential Meters	Core Commercial Meters	Industrial Meters	Noncore Meters	Single meter Services ^(b)	2-5 meter Services ^(b)	>5 meter Services ^(b)
GPRP (MAT 14A)	2022 - 2024	6,106	8,299	679	2	1	5,170	1,013	118
Plastic Pipe Replacement (MAT 14D)	2022 - 2024	35,827	44,383	1,392	2	1	32,282	3,802	422
Reliability Pipe Replacement (MAT 50A)	2022 - 2024	2,563	3,931	159	0	0	1,951	477	78
(a) Excludes counts where a service was unable to be correlated with the meter class data. (b) Total services replaced varies slightly as data availability for count of meters per service varies from meter class data.									

PG&E was unable to correlate all services with a customer meter classification for the voluminous number of services that were replaced in the 2022 - 2024 timeframe. Approximately 1,001, 3,948, and 926 services from MAT 14A, MAT 14D, and MAT 50A, respectively, were unable to correlate with meter class data.

California Public Utilities Commission Docket No. A.25-05-009

**Application of Pacific Gas and Electric Company for Authority, Among Other Things, to
Increase Rates and Charges to Electric and Gas Service Effective on January 1, 2027**

Sierra Club Response to Data Request PG&E-Sierra Club-02

To: Hannah Keller, on behalf of PG&E, GRC@pge.com

From: Matthew Vespa, Earthjustice, on behalf of Sierra Club
Sara Gersen, Earthjustice, on behalf of Sierra Club
Rebecca Barker, Earthjustice, on behalf of Sierra Club

Date Request Sent: February 20, 2026

Response Due: March 6, 2026

QUESTION 1

Please provide all data analysis or other evidence that supports the claim on Exhibit SC-01, p. 24, line 25 that the need for capital expenditures “is declining at increasing speed”.

RESPONSE TO QUESTION 1

Sierra Club objects to this request on the grounds that it is unduly burdensome, pursuant to CPUC Rule 10.1.

Notwithstanding this objection, Sierra Club has already provided all analysis, calculations, references, and documents used in support of Sierra Club’s opening testimony and workpapers either by reference in footnotes within the testimony and workpapers itself or in the attachments to Data Request PG&E-Sierra Club-01. As Sierra Club explained in the paragraph following the above-referenced sentence, this statement is supported by PG&E’s own data,¹ as well as the adoption of the 2025 Title 24 Building Code.²

QUESTION 2

Regarding the 2022 Building Code referenced on Exhibit SC-01, p. 31, line 21, please provide:

¹ Sierra Club Testimony at 24:22–25:5.

² Sierra Club Testimony at 25:5–9.

- a. Any data or analysis Sierra Club has regarding the impact of the 2022 Building Code update on the demand for natural gas and/or new customer connections (transmission level (MAT 26A) and distribution level (MWC 29)) in PG&E's service territory over the 2027-2030 period.
- b. By MWC or MAT, the volume reduction forecast by year 2027-2030.
- c. Any specific analysis relating to the betterment forecast reduction.
- d. By MWC or MAT, forecast for the percent of betterment decrease by year for 2027-2030.

RESPONSE TO QUESTION 2

Sierra Club objects to this request on the grounds that it is unduly burdensome, pursuant to CPUC Rule 10.1.

Notwithstanding this objection, Sierra Club has already provided all analysis, calculations, references, and documents used in support of Sierra Club's opening testimony and workpapers either by reference in footnotes within the testimony and workpapers itself or in the attachments to Data Request PG&E-Sierra Club-01. Additionally, Sierra Club notes that PG&E's publicly reported data on line extension allowances indicate high rates of all-electric new construction in 2023, when the 2022 Building Code update went into effect, and beyond.³

QUESTION 3

Please state whether Sierra Club developed any independent, forward-looking forecasts of gas distribution capacity needs or capital expenditures for MAT 47B (Gas Distribution Capacity, Mains) for the 2027–2030 GRC period. If so, please identify and produce that forward-looking forecast.

RESPONSE TO QUESTION 3

No. Sierra Club analyzed and critiqued PG&E's forecasting for capacity needs and capital expenditures, since it is PG&E's burden to adequately support its requests for ratepayer funds.⁴

³ See, e.g., CPUC, *Building Decarbonization*, <https://www.cpuc.ca.gov/about-cpuc/divisions/energy-division/building-decarbonization> (noting that PG&E's July 2024 Advice Letter submission pursuant to D.23-12-037 reflected that in 2023, 72.45% of residential new construction line extension requests were for all-electric buildings, and 91.07% of non-residential new construction line extension requests were for all-electric buildings.).

⁴ Sierra Club Testimony at 22:6–15, 26:13–22.

QUESTION 4

Please identify and produce all analyses, modeling, or system level evaluations Sierra Club relied upon to conclude that PG&E will not need MAT 47B (Gas Distribution Capacity, Mains) capital investments over the 2027-2030 period.

RESPONSE TO QUESTION 4

Sierra Club objects to this request because it misstates Sierra Club's testimony.

As stated in testimony, Sierra Club's position is not that PG&E will not need to make any MAT 47B investments over the 2027–2030 period, but that “the historical average upon which [PG&E's MAT 47B, 47C, and 37D costs] are based cannot reasonably form a basis for a 2027–2030 forecast in light of California's advances in building decarbonization policy.”⁵ Sierra Club recommended the Commission adopt the same approach it took in SoCalGas and SDG&E's most recent GRC for these costs, which was to adopt a forecast of zero and direct the utility to base any future requests on planned work.⁶ This position does not presuppose that no planned work could exist between 2027–2030.

Notwithstanding that objection, Sierra Club has already provided all analysis, calculations, references, and documents used in support of Sierra Club's opening testimony and workpapers either by reference in footnotes within the testimony and workpapers itself or in the attachments to Data Request PG&E-Sierra Club-01.

QUESTION 5

Please identify and produce any analysis Sierra Club performed regarding the potential safety, reliability, or operational impacts of adopting a zero forecast for MAT 47B (Gas Distribution Capacity, Mains) and therefore performing no MAT 47B work over the 2027-2030 GRC period, including impacts on service pressure, peak-day performance, or compliance with CPUC reliability standards.

RESPONSE TO QUESTION 5

Sierra Club objects to this request on the grounds that it is unduly burdensome pursuant to CPUC Rule 10.1, argumentative, and misrepresents Sierra Club's testimony.

⁵ Sierra Club Testimony at 22:6–19.

⁶ Sierra Club Testimony at 22:10–12 (citing D.24-12-074 at 956, 959–960).

As explained in response to Question 4, Sierra Club's position is that PG&E's reliance on historical data without any adjustments for advances in policy that are likely to impact the amount of capital expenditures needed in this category is insufficient to meet its burden of proof to the Commission. As noted in Sierra Club's testimony, the Commission adopted a forecast of zero for this category in SoCalGas and SDG&E's most recent rate case after finding that the utilities had failed to meet their evidentiary burden by relying solely on historical data without accounting for the impacts of policy changes.⁷

Notwithstanding that objection, Sierra Club did not perform any independent analysis of safety, reliability, or operational impacts of adopting a zero forecast for MAT 47B.

QUESTION 6

To the extent that Sierra Club is forecasting a reduced need for new gas capacity as a result of state policy and initiatives promoting electrification, has Sierra Club forecasted a corresponding increase in the need for new electric capacity upgrades? If not, why not? If yes, please provide all such analysis and supporting documentation.

RESPONSE TO QUESTION 6

Sierra Club objects to this request on the grounds that it is unduly burdensome and not reasonably calculated to lead to the discovery of admissible evidence.

Notwithstanding this objection, Sierra Club has not performed its own forecasting of electric capacity needs as a result of state policy and initiatives promoting electrification. Sierra Club does not believe it needs to independently undertake an electric capacity analysis to question the reasonableness of PG&E's gas system investments. Sierra Club also notes PG&E's Electric Distribution Testimony factors in electrification in making capital requests. (*See, e.g.,* Exh. PG&E-04 at 2-4).

⁷ Sierra Club Testimony at 22:10–12 (citing D.24-12-074 at 956, 959–960).



(PG&E-15)

*Public Advocates Office
California Public Utilities Commission*

505 Van Ness Avenue
San Francisco, CA 94102

<http://publicadvocates.cpuc.ca.gov>

**ADVOCATES OFFICE
DATA RESPONSE
Pacific Gas & Electric Company Test Year 2027 General Rate Case
A.25-05-009**

Date: February 25, 2026

Origination Date: February 20, 2026

Response Due: **March 6, 2026**

To: Hannah Keller
cc: GRC@pge.com

GRC 2027 Coordinators:
GRCCaseCoordinators@pge.com

From: Dao Phan, Project Coordinator
Public Advocates Office
505 Van Ness Avenue, Room 4104
San Francisco, CA 94102 dao.phan@cpuc.ca.gov

Data Request No: GRC-2023-PhI_DR_PGE_CalAdvocates018

GENERAL OBJECTIONS

Cal Advocates objects to each data request to the extent that it mischaracterizes Cal Advocates' opening testimony.

Cal Advocates objects to each data request to the extent that it is overly broad, unduly burdensome, or not reasonably calculated to lead to the discovery of admissible evidence.

Cal Advocates objects to each instruction and data request as overly broad and unduly burdensome to the extent that it seeks documents or information that PG&E will possess when it receives Cal Advocates' opening testimony. Responding to such requests would be oppressive, unduly burdensome, and unnecessarily expensive, and the burden of responding to such requests is substantially the same or less for PG&E as for Cal Advocates. All such documents and information will not be produced.

Cal Advocates objects to each instruction and data request to the extent that it seeks



information or documents protected from disclosure by the attorney-client privilege, attorney work product doctrine, or any other applicable privilege.

PG&E Question 1:

Please clarify what you mean by “RD&D-type pilot-scale” activities in Exhibit CA-12, p. 13, line 1 as it pertains to PG&E’s Gas Transmission Capacity Program (MAT 73A).

Public Advocates Office Response to Question 1:

“RD&D-type pilot-scale” refers to limited-scope or exploratory activities that resemble research or demonstration efforts rather than full-scale transmission capacity expansion projects.

As used in CA-12 for MAT 73A, the term reflects that PG&E did not provide project-level documentation showing defined transmission backbone expansion projects with established scope, cost, and in-service dates for TY 2027. The record did not demonstrate system-wide capacity construction at the level requested.

Response prepared by B. Benitez

PG&E Question 2:

Please describe the calculations behind the \$0.850 million TY 2027 forecast recommendation on Exhibit CA-12, p. 13, line 20.

Public Advocates Office Response to Question 2:

The \$0.850 million TY 2027 recommendation for MAT 73A is based on PG&E’s recent recorded adjusted capital expenditures (2022–2024) reflected in CA-12.

Recorded spending during this period was substantially below PG&E’s TY 2027 forecast, and PG&E did not provide evidence of new executable transmission expansion projects beginning in TY 2027 that would justify a material increase. Cal Advocates therefore normalized the forecast to reflect demonstrated historical execution levels.

Response prepared by B. Benitez

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	CalAdvocates_030-Q013
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_030-Q013
Request Date:	July 18, 2025
Requester DR No.:	PubAdv-PG&E-030-LJL
Requesting Party:	Public Advocates Office
Requester:	Lindsay Loethen
Date Sent:	August 1, 2025
PG&E Witness(es):	Daven Phelan – Gas Engineering

SUBJECT: CHAPTER 4, GAS DISTRIBUTION CAPITAL EXPENDITURES

Referring to PG&E-3, Workpapers for Reliability Main Replacement Program, p. 4-29, MAT 50A, please provide the following information for questions 9-16.

QUESTION 013

Has PG&E identified an increase in the level of risks associated with the Reliability Main Replacement Program compared to previous years? If yes, please provide a copy of all supporting workpapers used in determining PG&E's claim.

ANSWER 013

Yes, PG&E has identified an increase in the level of risks associated with the Reliability Main Replacement Program compared to previous years. The work in this program is proactive replacement based on observations of conditions that could eventually lead to a failure. An analysis of the projects initiated based on observations¹ indicated an increase in unit forecast was needed to accommodate newly-identified jobs. Reference GRC-2027-PhI_DR_CalAdvocates_030-Q009Atch01 for a copy of the analysis performed.

¹ See Exhibit PG&E-3, Chapter 4, p. 4-36 line 19 to p. 4-37 line 15 for description of observed conditions and factors driving replacement under this program.

GRC-2027-PhI_DR_CalAdvocates_030-Q009Rev01Atch01

MAT 50A Pending Jobs					
Budget Scenario	Sum of PrimaryUnits (ft.)	Sum of PrimaryUnits (mi.)	GRC 2024 - 2026 Forecast ^(a)	Pending Remaining (ft.)	Pending Remaining (mi.)
2024	123055	23.3	65082	57973	11.0
2025	215239	40.8	67446	147793	28.0
2026	164833	31.2	64981	99852	18.9
2027	2440	0.5		2440	0.5
2028	2915	0.6		2915	0.6
2029	150	0.0		150	0.0
Grand Total	508632	96.3			58.9

^(a) Reference 2027 GRC, Exhibit (PG&E-3), Chapter 4, WP 4-29, line 9.

MAT 50A Created Annually (excludes cancelled jobs)		
Creation Year	Sum of PrimaryUnits (ft.)	Sum of PrimaryUnits (mi.)
2022	71890	13.6
2023	88960	16.8
Average	80425	15.2

GRC Forecast Proposed		
Remaining End of GRC 2023 divided by 4 (2027-2030)	Average Annual Order Creation 2022/2023	Total Forecast per Year (2027-2030)
14.7	15.2	30.0

**PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Request**

To:	The Utility Reform Network
Recipient Name:	Jalal Awan
Request Date:	February 20, 2026
PG&E Data Request No.:	PGE_TURN014
PG&E File Name:	GRC-2027-PhI_DR_PGE_TURN014
Due Date:	March 6, 2026
PG&E Witness(es):	Daven Phelan – Gas Engineering
Response Date:	March 5, 2026

Please provide electronic responses to the following questions. Hard copy responses are unnecessary. The responses should be sent as e-mail attachments to the recipients below. If the files are too large to email, please contact the Discovery Manager below to upload the documents into a folder on the Electronic Secure File Transfer (ESFT) and notify the recipient below.

GRC 2027 Discovery Manager:
Hannah Keller
at GRC@pge.com

GRC Case Coordinators
at GRCCaseCoordinators@pge.com

SUBJECT: PIPE REPLACEMENT

EXHIBIT: (TURN-03) GAS DISTRIBUTION MAINS AND SERVICES – PIPELINE REPLACEMENT PROGRAMS

- 1. Describe all experience and expertise witness Jawal (sic) Awan has relevant to gas pipeline integrity management and gas pipeline operations.**

Q01 Response:

My overall qualifications are set forth in TURN-3, p.1, lines 4–25 (Section I.A, “Summary of Witness Qualifications”) and Attachment 1 (p.1,2).

In this proceeding, specifically related to “gas pipeline integrity management”, my testimony/critique is limited to quantitative risk analysis of PG&E’s own DIMP/RiskFinder documentation, assumptions, and outputs. My testimony focuses on:

- Issues with PG&E’s justifications for its pipeline replacement programs (TURN-3, Section III)
- Evaluation of PG&E’s RiskFinder/DIMP model inputs, weighting assumptions (TURN-3, Section IV)

- Assessment of Likelihood of Failure and Consequence of Failure modeling choices (TURN-3, pp. 17–21)
- Identification that PG&E’s 2027 GRC forecast was not derived from DIMP outputs (TURN-3, p.21, lines 9–17)
- Development of risk-aligned mileage and unit-cost recommendations using PG&E’s own data (TURN-3, Section V). Notwithstanding the critiques described above, for Recommendation 1 (mileage-related), I do not alter PG&E’s underlying DIMP/RiskFinder assumptions or inputs, but rely directly on PG&E’s model outputs to propose a more risk-aligned pace.

I have both academic training and work experience related to risk analyses and statistical methods that are relevant to the quantitative analysis of gas pipeline integrity management as conducted using PG&E’s DIMP/RiskFinder model, including:

- Ph.D. in Policy Analysis (RAND Graduate School) with formal training and examinations in *Empirical Analysis I–III (probability, statistics, regression, econometrics)*, *Decision Analysis*, *Operations Research*, *Machine Learning*, *Cost–Benefit and Cost-Effectiveness Analysis*, and *Policy Analysis and Modeling of Complex Problems*. My academic work focused on quantitative modeling of complex systems, risk estimation, and structured policy evaluation under uncertainty.
- Work conducting review of PG&E’s quantitative risk framework as presented in its 2024 RAMP Application (A.)24-05-008, including but not limited to risk assessment methodology, valuation of safety/reliability attributes, and mitigation cost-effectiveness evaluation. TURN was largely aligned with the Safety Policy Division (SPD) evaluation report (Nov. 8, 2024) on PG&E’s RAMP application.
- As an Assistant Policy Researcher at the RAND Corporation (2017-2023) and Summer Fellow at the International Institute for Applied Systems Analysis (IIASA) in Vienna (Summer 2023), I authored and/or co-authored peer-reviewed research for federal agencies such as U.S. Department of Homeland Security (DHS), the Centers for Disease Control and Prevention (CDC) and the National Cooperative Highway Research Program (NCHRP) applying probabilistic threat modeling, risk assessment, scenario analysis, and mitigation tradeoff evaluation to critical infrastructure risks. This work - published in outlets including *Journal of Critical Infrastructure Policy*, *Disaster Medicine and Public Health Preparedness*, and *Nature (Scientific Reports)* - required structured risk quantification and benefit–cost reasoning directly analogous to gas distribution integrity modeling and capital prioritization analysis. My Google profile with citation to referenced work can be accessed here:
https://scholar.google.com/citations?user=0A3_DZUAAAAJ&hl=en
- While I do not have direct experience in gas pipeline operations, I previously served for five years as an electrical projects and maintenance engineer at Engro Fertilizers’ (formerly Exxon Mobil) 1.3 million ton-per-year combined-cycle gas-based ammonia-urea facility, often referred to as the world’s largest single-train ammonia urea complex. My responsibilities included plant operations, preventive and corrective maintenance planning, and risk-informed safety investments in critical electrical and control systems in accordance with NFPA and IEEE standards. (see here:
https://ureaknowhow.com/pdflib/630_2012%20Idrees%20Engro%20N&S%20Commissioning%20and%20Early%20Operating%20Experience%20of%20the%20World's%20Largest%20Single-Train%20Urea%20Complex.pdf)

In TURN-3, I do not present any opinions related to pipeline mechanical characteristics, metallurgy or independent pipe-condition related engineering conclusions. My recommendations are squarely based on the DIMP/RiskFinder outputs. Specifically, for **Recommendation 1 (mileage)**, I critique PG&E’s approach but do **not** change PG&E’s underlying modeling data or assumptions; I use the outputs to

propose a more risk-aligned pace. For **Recommendation 2 (unit costs)**, I adjust PG&E's unit-cost assumptions using PG&E's own gas distribution mains cost data provided in R.24-09-012.

2. **If witness Awan relied upon any other experts in forming his opinions and preparing his testimony concerning PG&E's gas distribution pipeline replacement programs, identify all such individuals and their relevant experience and/or expertise in gas pipeline integrity management and/or gas pipeline operations.**

Q02 Response:

I did not retain or independently rely on any other gas pipeline engineering expert in preparing my testimony.

As described in TURN-3, p.2, lines 5–10, TURN previously retained Mr. John Sugar, an expert economist, who evaluated PG&E risk reports and internal leak data in a prior proceeding.

As described in TURN-3, p.2, lines 15–18, TURN previously retained Mr. Rod Walker, a veteran gas distribution engineer, who evaluated internal SoCalGas data, national data, and PHMSA bulletins concerning pipeline integrity and replacement.

I state in my testimony:

“In this case, I closely analyzed the same type of internal data that were considered by Mr. Sugar and Mr. Walker.” (TURN-3, p.2–3, lines 23–24) and “...reached similar conclusions as TURN's prior experts” (TURN-3, p.3, lines 1–2). I did not rely on those other expert analyses or conclusions, but simply note that based on my own risk analyses I reached similar conclusions.

3. **Please provide all workpapers and calculations for TURN's Recommendation 2, as described on page 6 of Exhibit TURN-03.**

Q03 Response:

Please see TURN-03, WPs submitted (served on February 23, 2026), specifically WP_TURN-3_Fig1_Table1_Table4.xlsx for Recommendations 1 and 2.

4. **Referring to Exhibit TURN-03, Section III.A, does TURN's witness Awan believe that limiting pipe replacement programs based on installation year and leak rates would comply with 49 CFR 192, subpart P? If so, explain how PG&E could comply with subpart P if it ignored other risk factors that might render pipe that does not meet those criteria riskier than pipe that does?**

Q04 Response:

Limiting pipe replacement programs solely “based on installation year and leak rates” would likely not comply with 49 CFR 192, Subpart P, **if** other relevant risk factors are ignored. This statement in my testimony was meant to highlight that PG&E’s own proposal is inconsistent with the law **because** it appears to rely on a strict “installation year” cutoff as the basis for its pre-1985 plastic pipeline replacement plan.¹ To eliminate any confusion, I will amend my testimony to delete the phrase “both the law and” at line 19 on page 7. I do want to clarify, however, that relying on “installation year and leak rates” might not always “result in non-compliance,” if, for example, no other relevant risk information or data were available.

As noted in PG&E’s own testimony stating: 49 CFR 192, Subpart P requires utilities to “identify threats, evaluate and rank risk through the evaluation of the likelihood and consequence of failure of each threat, and then require(s) the identification and implementation of measures to address risk.” (PG&E-3, p. 4-27, lines 13-17). Subpart P does not mandate replacement based on any single variable. It requires operators to: “...consider reasonably available information to identify existing and potential threats... (§192.1007(b))”.²

My contention is that PG&E’s own proposal is inconsistent with the law to the extent it appears to rely on a strict installation-year cutoff rather than a risk analysis that considers all relevant factors. While PG&E conducts such a risk analysis (i.e. the DIMP/RiskFinder analysis), it has not demonstrated that its proposed pipeline replacement pace is derived from the risk-ranking results of that analysis.³

My recommendation is that replacement be aligned with risk as demonstrated by PG&E’s DIMP/RiskFinder outputs, which I assume are developed in compliance with 49 CFR Part 192, Subpart P and other applicable regulations. I do not recommend ignoring any risk factors, rather I recommend that PG&E use its full, actual risk model results to prioritize pipeline replacements for the 2027-2030 GRC period and beyond.

5. Does TURN witness Awan agree that as pipeline assets age the risk associated with those assets increases? If not, please explain.

Q05 Response:

I do not disagree that there is a relationship between pipeline age and risk of failure, but the relationship is not necessarily linear, and may not hold for each and every unit increase in asset age.

¹ Refer to PG&E’s 2024 Gas Safety Plan, p.38, Table 7 here: https://www.pge.com/assets/pge/docs/about/pge-systems/PDF_GasPipelineSafetyOIR_Report_PGE_20240315.pdf where PG&E’s internal overall objective/goal is intended to “achieve a removal rate of pre-1985 pipe that limits asset age to 100 years by 2030”. TURN assumes that, absent evidence linking the 139 miles/year pace to quantified risk results, the replacement level appears driven by this age-based target rather than a demonstrated risk-based prioritization.

² Refer here for 49 CFR subpart P: <https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-D/part-192/subpart-P>

³ On the contrary, when asked whether the 2027 GRC pipeline replacement forecast is informed by DIMP outputs, PG&E responded: “No, these outputs did not directly inform the forecasts for MATs 14A, 14D, and 50A.” (GRC-2027-PhI_DR_TURN_062-Q004, Answer b). PG&E further confirmed that “none of the 3,545 jobs identified for mitigation analysis are included in the 2027 GRC forecast.” (GRC-2027-PhI_DR_TURN_062-Q004, Answer c.i).

I have not evaluated or quantitatively established a linear relationship between asset age and risk, nor have I tested whether any apparent relationship (e.g., as reflected in Table 5 which shows leakage rates/mile increasing generally with pipeline installation year) is statistically significant. Even if correlation were observed, correlation alone would not establish causation.

As discussed in TURN-3, Section IV, risk under PG&E's DIMP/RiskFinder framework is a function of Likelihood of Failure (LoF) $\times$ Consequence of Failure (CoF), each of which depends on multiple variables, including but not limited to, operational threats, excavation damage, corrosion, material factors, pressure, geography etc. (TURN-3, Section IV.A-C.)

My testimony does not assume that age alone determines risk, but I do not disagree that it is an important contributing factor to overall risk.

- 6. Does TURN witness AEAN have a target asset age that PG&E should endeavor to not exceed for the following asset types: (1) steel pipe; (2) plastic pipe; (3) Aldyl-A plastic pipe; (4) pre-1985 vintage Aldyl-A plastic pipe? If so, please provide the target age and explain the basis for your opinion.**

Q06 Response:

The response is “No” for all four categories of pipe.

I do not propose or endorse a single “target” asset age for steel, plastic, Aldyl-A, or any other pipeline type. My testimony does not establish an age cap as a proxy for risk.

To the contrary, I critique PG&E's predetermined age-based objective to: “achieve a removal rate of pre-1985 pipe that limits asset age to 100 years by 2030.” (TURN-3, p.11, lines 8–9; citing footnote 16 i.e. 2024 Gas Safety Plan, Table 7.)

My position is that replacement decisions should be aligned with risk as demonstrated by PG&E's DIMP/RiskFinder outputs, not based on a predetermined maximum asset age threshold.

- 7. Does TURN have a target Cost Benefit Ratio (CBR) for PG&E gas pipe replacement below which TURN does not believe PG&E should replace pipe? If yes:**
- a. Please provide that target CBR and explain the basis for TURN's opinion.**
 - b. Has TURN estimated when, were PG&E to cease pipeline replacement until the CBR reached the target level, when, as the assets age without replacement, that target level will most likely start to be reached? If so, please provide the estimate and any supporting analysis and calculations.**
 - c. Has TURN estimated, under the scenario described in subpart b, if PG&E were to halt pipeline replacement until the CBR reached the target level, the pace of replacement that would likely then be required to maintain the safety of the system, as measured by the CBR? If so, provide your estimate and supporting analysis.**

Q07 Response:

7. a.

No.

TURN does not propose a specific target Cost-Benefit Ratio (CBR) below which PG&E should categorically cease pipe replacement. As discussed in TURN-3, Section III.C (“The Cost-Effectiveness Problem”), my testimony notes that PG&E’s reported CBRs are extremely low, but does not establish a numerical cutoff threshold.

b. See 7.a above.

c. See 7.a above.

8. Does TURN witness Awan’s analysis of the 1976-1984 plastic cohort indicate it is risk-free and/or has a homogenous risk profile? If your answer is no:

a. Does TURN witness Awan agree there could be locations within the 1976-1984 plastic cohort where pipe replacement is prudent?

b. Does TURN witness Awan agree that there could be segments within the 1976-1984 plastic cohort that pose a higher risk than segments within the 1967-1971 plastic cohort?

Q08 Response:

No. My analysis does not indicate that the 1976–1984 plastic cohort (or any other discrete pipeline cohort) is “risk-free” and/or has a homogeneous risk profile.

8a. Yes. On a case-by-case basis, there could be locations within the 1976–1984 cohort where replacement is prudent. These locations would be identified based on their higher relative risk scores from the DIMP/RiskFinder output(s).

8b. Yes. There could be segments within the 1976–1984 cohort that pose higher risk than segments within the 1967–1971 cohort. These locations would be identified based on their higher relative risk scores from the DIMP/RiskFinder output(s).

As noted in **TURN Recommendation 3 (TURN-3, p.7, lines 2–6)**, I recommend that PG&E provide a DIMP-informed, segment-level replacement plan with sub-decade vintage analysis and geographic risk disaggregation in its 2031 GRC. That recommendation is intended to require production of granular risk data to identify higher-risk segments within the 1976-1984 (or any other sub-decade) pipeline vintage cohort; had such data been provided here, it could have more definitively addressed Questions 8a and 8b.

9. Exhibit TURN-03, Section V.3, states that “steel mains are consistently riskier than plastic on a per-mile basis” and, based in part on this statement, supports PG&E’s forecast of replacing 25 miles per year of steel pipe, but recommends reducing PG&E’s proposed pace of plastic

pipe replacement from 139 miles per year to 85 miles per year. In light of TURN's conclusion that the steel pipe poses a higher risk:

- a. Why did TURN recommend reducing the pace of replacing plastic pipe but not increasing the pace of replacing steel pipe?**
- b. Why calibrate plastic pipe replacement to the forecast steel pipe replacement rate (TURN-03, page 26), rather than calibrate the steel replacement rate to the plastic replacement rate? Or to another rate altogether?**

Q09 Response:

PG&E's provided DIMP/RiskFinder output data show that compared to pre-1941 steel (RoF: 4.68/mile), pre-1985 plastic (RoF: 2.87/mile) is roughly 1.6× lower risk. (TURN-3, p.25)

9a. Because pre-'41 steel is demonstrably riskier per mile compared to any other age-based cohorts in PG&E's provided pipeline vintage data, TURN treats the PG&E proposed 25 miles per year of steel replacement as the baseline for risk-proportional diligence – and assumes that PG&E is responsibly mitigating the risk posed by higher-risk steel (TURN-3, p.26, lines 3-4). Recommendation 1, therefore, reduces pre-'85 plastic to 85 miles per year (from PG&E's 139 miles per year) to maintain proportionality with pre-'41 steel's higher per-mile risk. A prudent approach is to calibrate to the higher-risk category, not the lower-risk one as that may inflate the replacement pace for *both* plastic and steel.

9b. Steel is used as the benchmark because, based on the RiskFinder data provided by PG&E, it exhibits the higher demonstrated per-mile risk. However, the available data are not sufficiently granular to evaluate all sub-cohort or location-specific risk differentials. Accordingly, TURN's proposed mileage calibration relies on the best available evidence in PG&E's own risk model outputs, recognizing that refinement would depend on more detailed risk-segment data.



(PG&E-15)

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**PUBLIC ADVOCATES OFFICE
DATA RESPONSE
Pacific Gas & Electric Company Test Year 2027 General Rate Case
A.25-05-009**

Date: March 12, 2026

Origination Date: February 27, 2026

Response Due: **March 13, 2026**

To: Hannah Keller
cc: GRC@pge.com

GRC 2027 Coordinators:
GRCCaseCoordinators@pge.com

From: Dao Phan, Project Coordinator
Public Advocates Office
505 Van Ness Avenue, Room 4104
San Francisco, CA 94102 dao.phan@cpuc.ca.gov

Data Request No: GRC-2023-PhI_DR_PGE_CalAdvocates044

GENERAL OBJECTIONS

Cal Advocates objects to each data request to the extent that it mischaracterizes Cal Advocates' opening testimony.

Cal Advocates objects to each data request to the extent that it is overly broad, unduly burdensome, or not reasonably calculated to lead to the discovery of admissible evidence.

Cal Advocates objects to each instruction and data request as overly broad and unduly burdensome to the extent that it seeks documents or information that PG&E will possess when it receives Cal Advocates' opening testimony. Responding to such requests would be oppressive, unduly burdensome, and unnecessarily expensive, and the burden of responding to such requests is substantially the same or less for PG&E as for Cal Advocates. All such documents and information will not be produced.

Cal Advocates objects to each instruction and data request to the extent that it seeks information or documents protected from disclosure by the attorney-client privilege, attorney



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(PG&E-15)

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work product doctrine, or any other applicable privilege.

PG&E Question 1:

Is it your understanding that over the 2023-2025 period, PG&E failed to perform any gas distribution leak survey work funded in the 2023 GRC? If your answer is yes:

- a. State all facts supporting your understanding.
- b. Identify all documents supporting your understanding.

Public Advocates Office Response to Question 1:

Cal Advocates objects to this data request on the grounds that it is overbroad, unduly burdensome, oppressive, lacks sufficient information, and calls for information already in the public domain or available to PG&E.

Subject to and without waiving the foregoing objections, please refer to Cal Advocates' testimony Ex. CA-09, p. 28, where Cal Advocates states "PG&E's authorized work was not performed as proposed in the 2023 GRC. The authorized units for this program are 3,828 repairs in 2023-2026 rate case period. PG&E recorded approximately 1,704 repairs below target for MAT FIG."

PG&E Question 2:

Is it your understanding that, over the 2023-2025 period, PG&E failed to repair any identified leaks on gas distribution main in accordance with regulatory requirements? If your answer is yes:

- a. How many Grade 1 leaks do you contend PG&E identified on gas distribution main yet failed to repair? If your answer is anything other than zero, please explain the basis for your answer and identify all supporting documentation.
- b. How many Grade 2 leaks do you contend PG&E identified on gas distribution main yet failed to repair within 15 months? If your answer is anything other than zero, please explain the basis for your answer and identify all supporting documentation.
- c. Do you contend that PG&E, over the 2023-2025 period, has failed to repair Grade 3 leaks in compliance with its gas Leak Abatement Compliance Plan? If so, explain the basis for your opinion and identify all supporting documents.

Public Advocates Office Response to Question 2:

Cal Advocates objects to this data request on the grounds that it is overbroad, unduly burdensome, oppressive, lacks sufficient information, and calls for information already in the public domain or available to PG&E.



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Subject to and without waiving the foregoing objections, please see response to Question 1 above.

PG&E Question 3:

Referring to page 32, lines 8-9 of your testimony, please explain the basis for your opinion that “PG&E created for itself ‘more complex jobs.’” How did PG&E create more complex jobs?

Public Advocates Office Response to Question 3:

Cal Advocates objects to this data request on the grounds that it is unduly burdensome, oppressive, lacks sufficient information, and calls for information already in the public domain or available to PG&E.

Subject to and without waiving the foregoing objections, please refer to Ex. PG&E-03, Ch. 8, p. 8-181, PG&E states “PG&E forecasts to mitigate approximately 241,336 meter set leak repairs between 2023 and 2026, which is below the authorized amount by approximately 78,664 units. This is attributed primarily to more **complex jobs** resulting in an increase unit cost and overall spending exceeding authorized funding. These deferred units, while important to repair, are non-hazardous by definition and do not impact delivery of service.” (Emphasis added).

PG&E Question 4:

Identify all facts supporting your answer to Question 3.

Public Advocates Office Response to Question 4:

Cal Advocates objects to this data request on the grounds that it is unduly burdensome, oppressive, lacks sufficient information, and calls for information already in the public domain or available to PG&E.

Subject to and without waiving the foregoing objections, please see response to Question 3 above.

PG&E Question 5:

Identify all documents supporting your answer to Question 3.

Public Advocates Office Response to Question 5:

Cal Advocates objects to this data request on the grounds that it is unduly burdensome, oppressive, lacks sufficient information, and calls for information already in the public domain or available to PG&E.



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(PG&E-15)

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Subject to and without waiving the foregoing objections, please see response to Question 3 above.

PG&E Question 6:

Provide an example of a job that PG&E made more complex.

Public Advocates Office Response to Question 6:

Cal Advocates objects to this data request on the grounds that it is unduly burdensome, oppressive, lacks sufficient information, and calls for information already in the public domain or available to PG&E.

Subject to and without waiving the foregoing objections, please see response to Question 3 above.

PG&E Question 7:

Regarding your statement on page 32, lines 16-17: “PG&E could have avoided the incrementally higher repair costs had repairs been performed when they were scheduled”:

- a. Explain what you mean by “when they were scheduled”; that is, what “schedule” are you referring to?
- b. Is it your opinion that the nature of the work required to repair a meter set leak changes over time? If so, please explain the basis for your answer and provide any supporting documentation.

Public Advocates Office Response to Question 7:

Cal Advocates objects to this data request on the grounds that it is unduly burdensome, oppressive, lacks sufficient information, and calls for information already in the public domain or available to PG&E.

Subject to and without waiving the foregoing objections,

- a. Referring to page 32, lines 8-15, Cal Advocates states “PG&E has created for itself “more complex jobs resulting in an increase unit cost” because it did not complete the remaining meter set leak repairs in a timely manner. These projects had “deferred units [that] while important to repair, are non-hazardous by definition and do not impact delivery of service,” meaning that they were less of a priority for PG&E. Had PG&E not deferred meter set leak repair projects authorized in the 2023 GRC, PG&E could have completed these important meter set leak repair projects earlier and would have the time and opportunity to undertake these repairs in a normal manner.”
- b. Please see response to 7a above.

Responses prepared by Lindsay Loethen

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	CalAdvocates_129-Q001
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_129-Q001
Request Date:	September 15, 2025
Requester DR No.:	PubAdv-PG&E-129-BBE
Requesting Party:	Public Advocates Office
Requester:	Bibi Benitez
Date Sent:	[Date]
PG&E Witness(es):	Lucy Redmond, Ryan Weber – Gas Engineering

SUBJECT: GAS SYSTEM OPERATIONS & NATURAL GAS STORAGE STRATEGY

QUESTION 001

The following questions relate to PG&E's capital expenditure costs shown in Workpaper Table 9-19 (Gas System Operations & NGSS, Capital Expenditures by Major Work Category). The Public Advocates Office seeks clarification regarding significant decreases or increases in recorded spending for the years 2020–2024.

- a. Line 1, Please explain the sharp decline in capital expenditures for MWC 47B between 2020 (\$31M) and 2024 (\$7.7M). What drivers account for the reduced activity, and why does the forecast increase in the forecast years?
- b. Line 2, Provide documentation on why Reg Station capital (MWC 47C) fell so steeply after 2021. For example, were projects deferred, canceled, or completed ahead of schedule?
- c. Line 3, Please justify the reduction in replacement regulator station expenditures after 2022.
- d. Line 8, Explain the negative or credit entry for 2022 in MWC 4AF. For example, was this a reclassification, accounting adjustment, or refund?
- e. Line 11, Provide justification for the >70% reduction in spending between 2021 and 2024. For example, were compliance requirements relaxed, was the program scaled back, etc.?
- f. Line 13, Please explain why spending on Capacity for Load Growth peaked in 2022 then dropped by ~85% by 2024. What assumptions changed?
- g. Line 14, Provide project-level detail for the spike in 2022 for Capacity Betterment expenditures. Please also explain why the spending dropped to zero in 2024.
- h. Line 15, Please explain the volatility in Gill Ranch Capital spending between 2020 and 2024. For example, what are the cost drivers and how do they create volatility?

ANSWER 001

- a. The decline in capital expenditures for the Gas Distribution Capacity, Mains program (MAT 47B) from 2022 to 2024 was primarily due to reallocating funds as part of a broader strategy to address higher risk areas as described in Exhibit (PG&E-3), Chapter 2, Section D. This reprioritization process reduced the ability to complete capacity capital work in MAT 47B. As a temporary measure, Manual Operations, sometimes including the injection of CNG or LNG into the system, were used as an alternative to main installation for meeting increased demand; however, this approach is not sustainable long-term. The MAT 47B forecast in 2027-2030 reflects PG&E's intent to resume capital investments to reduce reliance on Manual Operations and meet design day criteria, ensuring service obligations are met. PG&E has identified required capital projects to meet anticipated capacity needs, and the forecast accounts for both historical spending averages and expected future demands. For further details on spending and unit installation for 2023 through 2026 for MAT 47B, please refer to Exhibit (PG&E-3), p. 9-86.
- b. The decline in spending for the Gas Distribution Capacity, Regulator Stations program (MAT 47C) after 2021 is primarily due to a combination of deferred and canceled projects, as well as challenges related to permitting and implementation. Several projects were postponed, and at least one was canceled. A project originally scheduled for 2023 was canceled because it was deemed no longer necessary. Another project planned for 2024 incurred minimal Regulator Station Installation costs due to its limited scope. For further details on spending and unit installation for 2023 through 2026 for MAT 47C, please refer to Exhibit (PG&E-3), p. 9-87 through 9-88.
- c. Projects in the Gas Distribution Capacity, Replace Regulator Station Component program, (MAT 47D) involve replacing components within a regulator station, and fluctuations in project complexity and requirements drive changes in annual expenditures. The cost of replacement regulator station component units varies depending on the complexity and scope of each project. While the average unit cost in 2020-2024 is approximately \$120,000, actual unit cost ranged from ~\$16,000 to ~\$590,000 per unit in 2020-2024. For example, in 2022, one project was completed at a unit cost of \$589,000; this unit cost reflected unique requirements including the installation of a 10" fire-valve, and was not representative of standard costs, thereby elevating the total spend for that year.
- d. The credit entry in 2022 in the Gas Distribution (GD) Electronic Pressure Recording Devices program (MAT 4AF) is primarily due to an accounting adjustment made before the establishment of the correct standing order for the Gas Distribution Over Pressure Protection program (MAT 50N). Initially, some MAT 50N-related work was charged to standing orders in both MATs 4AF and 4AM. Once the appropriate standing order for MAT 50N was created, the associated costs were reclassified and reallocated to the correct job codes to ensure accurate financial reporting. This adjustment resulted in a credit entry in 2022 for MAT 4AF, reflecting the transfer of costs out of the incorrect standing order and into the correct one. Since the correct standing orders have now been established, this issue should not arise in the future for these programs.

- e. The reduction in spending for the Gas Distribution Remote Terminal Units program (MAT 4AM) between 2021 and 2024 is primarily due the lower number of units installed. See table below for 2020-2024 recorded units and dollars in MAT 4AM.

	2020 Recorded	2021 Recorded	2022 Recorded	2023 Recorded	2024 Recorded
4AM Units	95	111	79	27	35
4AM Dollars	\$ 26,153,177	\$ 28,835,252	\$ 27,161,225	\$ 11,310,846	\$7,381,394

- f. Spending on Gas Transmission Pipeline Capacity for Load Growth program (MAT 73A) peaked in 2022 mainly because of a large Pipeline Capacity project, which also drove up costs in 2023. Transmission capacity projects are planned based on system needs and can vary widely in scope and cost, so year-over-year fluctuations are normal. The reduced spend by 2024 reflects the completion of that major project and no similar large projects being required in 2024.
- g. The Gas Transmission Capacity Betterment, (MAT 73B) funded three projects between 2020 and 2024. The increased spend in 2022 was driven by the El Dorado Hills and Grass Valley LNG injection sites. Both involved ILI upgrade work requiring the installation of an LNG Injection site, and PG&E purchased these parcels to leverage the sites for both future In-Line inspections (ILI) and future capacity and reliability needs. The third project was a traditional betterment project involving upsizing pipe from 6" to 8" diameter during planned safety replacement work. After these projects were completed, no betterment projects were planned for 2024. Transmission capacity betterment projects are planned based on system needs and can vary widely in scope and cost, so year-over-year fluctuations are normal. See table below for Gas Transmission Capacity Betterment, (MAT 73B) project spend from 2020 to 2024.

MAT 73B - Project Type	2020 Recorded	2021 Recorded	2022 Recorded	2023 Recorded	2024 Recorded
ILI Upgrade Land Acquisition - El Dorado Hills	\$ -	\$ 49,124	\$ 1,801,603	\$ 146,052	\$ -
ILI Upgrade Land Acquisition - Grass Valley	\$ -	\$ -	\$ 2,410,338	\$ 657	\$ -
ILI Upgrade - Calistoga, upsize 6" diameter to 8"	\$ 5,664	\$ 1,928	\$ 1,703	\$ 2,545,083	\$ -

- h. Gill Ranch capital (MAT 762) recorded spend between 2020-2024 had variability based on the type and number of projects that were executed each year; this included a combination of facility work as well as well integrity work to meet CalGEM regulations. Well integrity work was completed in years 2020, 2021, 2022, and 2024. However, well integrity work was not completed in 2023 due to a delay in CalGEM issuing permits to Gill Ranch to execute the well work. Because of this permitting delay, the work that had been initially planned to be

executed in 2023 was executed in 2024. As an example of variability in facility projects incremental to the wells, in 2020, Gill Ranch had a Programmable Logic Controller (PLC) upgrade project whereas in 2021, Gill Ranch completed a compressor overhaul.

PG&E would like to note that the 2027 GRC forecast for MAT 762 is based on consultation with Gill Ranch Storage (majority owner and operator) to determine future operating costs and was not based on historical recorded cost.

**PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response**

PG&E Data Request No.:	CalAdvocates_156-Q001
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_156-Q001
Request Date:	October 3, 2025
Requester DR No.:	156
Requesting Party:	Public Advocates Office
Requester:	Bibi Benitez
Date Sent:	October 16, 2025
PG&E Witness(es):	Ryan Weber – Gas Engineering

SUBJECT: GAS SYSTEM OPERATIONS & NATURAL GAS STORAGE STRATEGY

QUESTION 001

Referring to Exhibit (PG&E-3), Chapter 9, Table 9-2, “Summary of Capital”:

- a. Please explain the year-to-year changes from 2020 through 2027.
- b. Please identify whether the changes are driven by one-time projects, ongoing activities, or other factors.

ANSWER 001

- a. PG&E provides an explanation of the year-to-year changes at the MWC level in our historical and forecast walk workpapers. As required by the Commission, PG&E provides a variance explanation if the difference between two years is larger than the established thresholds. See Exhibit (PG&E-3), WP 9-15 through 9-18 for expense and WP 9-33 through 9-36 for capital.

In addition to the historical and forecast walk workpapers, PG&E also provides an explanation of the forecast methodology for every MAT code with a 2027 forecast in the “Forecast” sections of testimony. The “Forecast” section also includes a comparison to 2024 recorded (i.e. the base year) to the 2027 forecast and an explanation if there is a significant variance between the two. For example, in the Forecast section for MAT 47B on Exhibit (PG&E-3), p. 9-15, PG&E explains:

“The 2027 dollar forecast increase as compared to 2024 is driven by an abnormally low recorded cost in MAT 47B in 2024. In 2024, the lower recorded costs in the Gas Distribution Capacity, Mains program was a result of completing relatively low-cost units as well as PG&E reallocating funds from MAT 47B to higher priority work in other programs. PG&E expects future capacity requirements and costs to be more in line with 2022-2023 spending.”

To further help explain any changes specifically related to one-time costs or abnormal conditions within a recorded year, if a MAT code has a historical average forecast methodology, PG&E generally provides an explanation why any years are included or excluded in the average. This could include situations where a 3- or 5-year average is used but includes a year or years with spending significantly above or below the average and why that year should be included in the forecast. For example, in the Forecast section for MAT 47C, PG&E explains the reason for using a 4-year historical average due to certain years having abnormally low spend. See Exhibit (PG&E-3), p. 9-15:

“The four-year method was chosen as the most appropriate in this case to obtain a more complete view of the complexity and cost of projects that are required by this program. The costs vary from year to year, in large part because the capital projects span many years, and the costs are not spread equally over each phase. The costs in 2023 and 2024 were abnormally lower than the other years, due to types of units installed, and fewer active construction phases, which is where most of the costs are incurred.”

- b. See response to subpart a. PG&E provided specific examples of year-to-year changes from 2020 – 2024 driving spend in the response to GRC-2027-Phi_DR_CalAdvocates_129-Q001. These responses included explanations of variations in recorded costs between 2020 - 2024 for MATs 47B, 47C, 47D, 4AF, 4AM, 73A, 73B, and 762.

**PACIFIC GAS AND ELECTRIC COMPANY
General Rate Case 2027 Phase I
Application 25-05-009
Data Response**

PG&E Data Request No.:	TURN_033-Q005
PG&E File Name:	GRC-2027-PhI_DR_TURN_033-Q005Supp01
Request Date:	August 5, 2025
Requester DR No.:	TURN-PG&E-033
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	August 19, 2025 (Original) September 11, 2025 (Supplemental)
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: PG&E-03, CHAPTER 5 – VARIOUS

QUESTION 005

Regarding workpaper Table 5-23, which states at footnote (c) that

“These are new categories of work to occur annually during 2027-2030 GRC period. The new DSL work categories include DSL Corrosion, DSL Integrity Assessments, and DSL MAOP flags that are not included in the 5-year historical average due to the new work being performed in 2024.”

- a. What is new about the work included in these categories, specifically is the type of work new or the application of this type of work to the DSL lines? Please cite to specific state or federal gas integrity management regulations in demonstrating what is newly required.
- b. How does the corrosion assessment required in category DSL integrity assessments and other work, differ from the corrosion assessment required for other types of transmission pipelines on PG&E's system?
- c. If PG&E has previously provided the same type of integrity assessments on different portions of PG&E's transmission system (non-DSL), please provide project by project listing of any of these assessments that has occurred within the timeframe 2020-2024.
- d. Please provide a project by project listing of the completed projects that PG&E has relied upon in deriving the figures at cells C22:C26, describing the assessment activities that were pursued for each project and including the categories of project name, region of line location, line designation, test mileage, pipeline diameter, class location, contractor used, year of test completion, recorded project cost, and threats addressed/reason for test.

ANSWER 005

- a. As outlined in Exhibit (PG&E 3), p. 1-6 to p.1-8, PG&E's Transmission Definition initiative led to the reclassification of over 710 miles of pipeline operating below 20% SMYS to Distribution Supply Line (DSL). This introduced a new application of this type of work to the newly designated DSL. Please see breakdowns of the three buckets below that, while not required by Code, represent a best practice for asset management and supports PG&E's commitment to safety and reliability.
- **DSL Corrosion:** the proposed DSL corrosion work introduces a proactive engineering approach to assess external corrosion risks on high-pressure DSL that are no longer subject to 49 CFR § 192 Subpart O inspections. This initiative includes the deployment of machine learning models to estimate corrosion damage and rates, as well as the installation of Electrical Resistance (ER) probes in areas with elevated external corrosion risk. These measures aim to enhance visibility into pipeline integrity where traditional transmission-level assessments are no longer mandated.
 - **DSL Integrity Management (IM):** DSL IM is newly proposed work designed to address threat assessments, direct assessment (DA) activities, preventative and mitigative measures, and NT-ILI evaluations for DSL pipelines. This risk-based work is essential for maintaining pipeline safety and comply with DIMP regulations under 49 CFR § 192 Subpart P § 192.1007(d) which state that operators are required to identify threats, rank risks, and implement mitigation strategies. PG&E's approach ensures that risk-driven evaluations are performed to enhance the integrity and safe operations of these pipelines that operate between 100 and 1,040 psig but classified as Distribution. PG&E is forecasting to spend \$40.1 million in expense during the 2027 GRC period (2027-2030) to perform evaluations on selected, risk prioritized segments. This forecast for the 713.8 miles of DSL equates to approximately \$56,234 per mile. As a comparison, PG&E is forecasting \$1,100 million in expense to comply with the Subpart O Transmission required assessments on segments due in 2027-2030. The Subpart O required spend for the 5,654 miles of Gas Transmission pipeline equates to \$193,495/mile. The risk-informed assessments and mitigations on these DSL lines, is a cost-effective strategy to manage their risks.
 - **DSL MAOP:** MAOP flags are identified through engineering reviews of GIS data. These flags typically arise from missing or invalid strength test records or design inconsistencies that do not support the recorded MAOP. Remediation actions may include pressure reductions, replacements, or new strength tests, depending on the nature of the flag. PG&E's internal procedures and 49 CFR § 192.619 require that pipelines, including DSL, operate at or below the lowest validated MAOP based on design, test, or other criteria. PG&E's MAOP validation procedure was written to conform with CPUC Decision/ CA Law (D-11-06-017 & CPUC Code Section 958 issued in 2011&2012) and PHMSA advisories (ADB-11-01 & ADB-12-06 published in 2011&2012) directing operators to utilize Traceable, Verifiable, and Complete

- (TVC) records to calculate MAOP and to implement a test/replacement plan for all transmission pipe. Although these DSL lines are no longer classified as transmission, PG&E intends to maintain the existing TVC level MAOP requirements for these assets.
- b. This proposed work in this program represents an additional engineering evaluation of DSL which is not currently conducted on pipelines subject to 49 CFR § 192 Subpart O, as those lines undergo more comprehensive integrity assessments every seven years. The intent is to introduce a new approach for evaluating the integrity of DSL pipelines that will not receive 49 CFR § 192 Subpart O inspections. This differs from existing practices by incorporating supplementary data to better approximate the risk on these newly classified high-pressure distribution lines.
 - c. The proposed corrosion DSL work was not conducted in 2020-2024. While PG&E has implemented certain components such as ER probe usage and coupon removal/replacement, the full scope of the proposal, including machine-based data modeling, has not been executed.
 - d. PG&E is still gathering this information and will provide a supplemental response.

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- d. PG&E does not have a project-by-project listing of the completed projects because DSL work was not conducted between 2020 to 2024 and is new work to be performed. Following the California Public Utilities Commission's (CPUC) Decision (D.23-12-003) which approved PG&E's revised transmission pipeline definition, PG&E introduced a new asset classification known as Distribution Supply Line (DSL). This classification applies to pipeline segments that meet specific criteria, such as operating above 60 psig but with a hoop stress below 20% of the specified minimum yield strength (SMYS). This definition change reflects PG&E's alignment with updated federal definitions under 49 CFR §192.3. Given the uncertainty of this new classification and the absence of Subpart O integrity assessment requirements, PG&E applied engineering judgment to estimate the integrity management (IM) needs for DSL pipelines. To ensure a robust and risk-informed approach while remaining cost-conscious, PG&E proposed a forecast of \$10 million annually for DSL work in the 2027 General Rate Case (GRC). This \$10 million forecast includes all DSL work including DSL Integrity Assessments and Other Work, DSL Corrosion and DSL MAOP flags. The remainder of the response to subpart d focuses on DSL Integrity Assessments and Other Work and DSL Corrosion which is the work included in cells C22:C26.

This estimate reflects PG&E's commitment to maintaining pipeline safety through threat assessments, direct assessments (DA), preventative and mitigative measures, and Non-traditional In-line Inspections (NT-ILI) evaluations, all in alignment with Subpart P of 49 CFR §192. The work targets segments operating

between 100 and 1,040 psig but below 20% SMYS, which are not covered under Subpart O.

As explained in response to subpart a, PG&E is forecasting \$40.1 million in total expense in MAT JTB during the 2027 GRC rate case cycle (2027-2030) to evaluate 713.8 miles of DSL, equating to \$56,000 per mile. In contrast, PG&E expects to spend \$1.1 billion to comply with Subpart O assessments for 5,654 miles of Gas Transmission pipeline, or \$193,500 per mile. This comparison underscores the cost-effectiveness of PG&E's risk-informed strategy for DSL assets.

The lower per-mile cost for DSL IM reflects both the reduced regulatory burden and the risk-based mitigation approach PG&E has adopted. This includes leveraging historical corrosion data, installing ER probes, and conducting coupon assessments to inform future corrosion models. PG&E's methodology ensures that integrity risks are managed prudently without imposing undue costs on ratepayers.

DSL Integrity Assessments and Other Work:

PG&E estimates DSL Direct Assessment expenses considered similar DA activities used for External Corrosion Direct Assessment (ECDA) or 100% Direct Examination (DE) between 2020 to 2024. The estimate took a conservative cost estimate of ECDA indirect inspection and digs¹ taking into account 100% DE averages.²

PG&E estimated two NT-ILI assessments per year for DSL pipe, totaling 1 mile annually. Using the unit cost from WP Table 5-7, PG&E calculated the cost at \$2.04 million per mile or \$1.02 million per NT-ILI project. However, during our preparation of this data response, PG&E found an inadvertent error in our workpaper. PG&E will correct Exhibit (PG&E-3), WP Table 5-23 to reflect \$1.02 million per NT-ILI project instead of \$1.05 million per project in a future errata submission and/or at hearings.

To account for the other expected integrity management work, PG&E allocated \$2.4 million to this work category which is the difference between the existing budget categories and the overall \$10 million target. This funding supports activities such as Direct Examination and Repair (DE&R), which may be necessary if NT-ILI assessments identify anomalies on DSL pipelines. It also includes other Preventive and Mitigative (P&M) measures, such as accelerated leak surveys, designed to proactively evaluate the integrity of DSL pipe.

DSL Corrosion:

DSL corrosion includes the three following activities:

Development of Machine Learning³: PG&E forecasts a total of \$450,000 over 2027 General Rate Case period (2027-2030) to support the development of machine learning tools for corrosion risk modeling on DSL. PG&E anticipates completing one third of the DSL mileage annually, resulting in a \$150,000 per year forecast for

¹ See Exhibit (PG&E-3), Workpaper Table 5-9 and Exhibit (PG&E-3), WP 5-16 to WP 5-18.

² See Exhibit (PG&E-3), Workpaper Table 5-12 and Exhibit (PG&E-3), WP 5-22 to WP 5-23

³ See Exhibit (PG&E-3), WP 5-37, line 23 (Forecast \$150,000.00)

corrosion modeling activities. Roughly 713.8 miles of pipeline operation under 20% SMYS were reclassified to DSL, so PG&E is forecasting to complete 238 miles/year.

The total of \$450,000 over the 2027 GRC period includes:

- \$400,000 allocated for model development, based on vendor proposals.
- \$50,000 for Corrosion Engineering review, representing 382 hours at a rate of \$131/hour.

Installation of Electrical Resistance (ER) probes⁴: To enhance corrosion monitoring, PG&E plans to install 10 ER probes per year, with a unit cost of \$70,000. This cost is benchmarked against the historical average cost of test station installations from 2020 to 2023 (\$69,000), as both ER probes and test stations share similar installation scopes and utilize the same construction teams.

Replacement of Coupon Test Stations⁵: Additionally, PG&E forecasts the replacement of 10 coupon test stations (CTS) annually, with a unit cost of \$12,500. This estimate includes:

- \$10,000 in material costs.
- \$2,500 in labor costs, based on 22.5 hours of PG&E Corrosion Mechanic time at \$131/hour.

These investments support PG&E's proactive corrosion control strategy for DSL assets, which aligns with best practices and PG&E's commitment to pipeline safety and reliability.

⁴ See Exhibit (PG&E-3), WP 5-37, line 22 (Forecast \$700,000)

⁵ See Exhibit (PG&E-3), WP 5-37, line 23 (Forecast \$125,000)



California
**Department of
Conservation**
Geologic Energy Management Division

Gavin Newsom, Governor
Jennifer Lucchesi, Director

5/22/2025

TRANSMITTED VIA ELECTRONIC MAIL



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Oakland CA 94612
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SUBJECT: MECHANICAL INTEGRITY TESTING SCHEDULE – PACIFIC GAS AND ELECTRIC COMPANY (PG&E)

Mr. Wong,

The California Geologic Energy Management Division (CalGEM) has reviewed PG&E's proposed mechanical integrity testing (MIT) schedule submitted on January 20, 2023. As discussed below, CalGEM denies PG&E's request to conduct its second round of casing wall thickness (CWT) inspections beyond a seven-year interval for the applicable wells. Otherwise, CalGEM approves PG&E's proposed schedule for CWT inspections. CalGEM also approves PG&E's request to conduct pressure testing at intervals of no less than every five years and the order of wells to be tested. (See attached PG&E MIT Due Dates table.)

Background:

In September 2022, CalGEM began communicating with PG&E regarding creating a second-round testing schedule that improved upon PG&E's previous schedule. In early 2023, PG&E submitted a proposed second-round testing schedule and supporting data, and CalGEM corresponded and met with PG&E to evaluate and understand its proposal. Additionally, CalGEM has met with the California Public Utilities Commission and California Energy Commission to validate deliverability concerns raised by PG&E over the frequency of testing intervals.

CalGEM appreciates PG&E's engagement in developing a well-specific MIT schedule for the McDonald Island and Los Medanos fields that is in accordance with California Code of Regulations, title 14 (CCR), section 1726.6.

Regulatory Basis for Mechanical Integrity Testing

Pursuant to CCR section 1726.6, subdivision (a)(2) and (3), operators of underground gas storage (UGS) wells must conduct CWT inspections and pressure testing on their wells.

CWT inspections are to be performed every 24 months or at an alternative frequency approved by CalGEM based on a demonstration of the well's corrosion rate. (Cal. Code Regs., tit. 14, § 1726.6, subd. (a)(2).) The regulations contemplate that approval of an alternative frequency would be based on at least two rounds of inspections, performed at 24-month intervals, with the first round completed by October 1, 2020.

Pressure testing of the production casing is to be performed every 24 months if CalGEM has not approved a well-specific minimum pressure testing frequency as part of an operator's Risk Management Plan. (Cal. Code Regs., tit. 14, § 1726.6, subd. (a)(3).)

Background on PG&E's Testing Schedules

On June 15, 2021, CalGEM approved PG&E's first-round testing schedule, with both CWT inspections and well pressure tests targeted for completion in 2024. Due to permitting delays, PG&E was granted an extension for specific wells into 2025. To date, PG&E has adhered to its approved testing plan and is anticipated to complete the testing and inspections as approved.

On January 20, 2023, CalGEM received PG&E's proposed second-round testing schedule, and on May 23, 2023, PG&E provided additional information to CalGEM to support its proposal. Appendix A1 of this proposal lists the wells and the planned year of completion and envisions eight or more years to perform inspections in most cases.

CalGEM's Evaluation of PG&E's Proposed Second-Round Testing Schedule

CalGEM has thoroughly reviewed and evaluated PG&E's proposed second-round testing schedule and supporting data. CalGEM's review focused extensively on well safety and confirmed the following:

1. The results of CWT inspections received to date do not indicate extensive casing wall loss.
 - a. Current casing burst strengths exceed the 115% maximum allowable operating pressure required per regulation,
 - b. The least estimated remaining life exceeds seven years.
2. Where metal loss indicated a potential integrity concern, PG&E worked with CalGEM's Northern District to perform well work to address the issue.
3. The wells have had passing pressure tests.
4. The wells have completed noise and temperature logs in the past year.

Based on this information, CalGEM agrees with PG&E's proposal regarding the order of wells to be tested, ensuring that the wells with the highest risk will be re-tested first. However, CalGEM does not agree with the proposed intervals between CWT inspections. Rather, CalGEM is approving a schedule with a maximum of seven years between inspections as it ensures the protection of public health, safety, and the environment and the understanding of PG&E's gas storage fields and operations because obtaining additional data as soon as practicable allows for the establishment of corrosion growth rates. In addition, to avoid disruptions to deliverability, a maximum seven-year testing interval is the shortest interval that PG&E has indicated it could

perform the inspections (see Application of Pacific Gas and Electric Company for Authority, Among Other Things, to Increase Rates and Charges for Electric and Gas Service Effective on January 1, 2023 (U39M); Evidentiary Hearing Application 21-06-021, testimony of Lucy Redmond, Sr. Director Gas Facilities and Storage Engineering).

With respect to PG&E's proposal to conduct pressure testing on a five-year schedule, CalGEM agrees that this interval is appropriate as it is supported by other safety precautions including annular pressure monitoring, temperature and noise logging, and daily leak detection inspections.

The attached table (PG&E MIT Due Dates) includes well-specific due dates to complete CWT testing and pressure testing consistent with CalGEM's evaluation, summarized as follows:

- CWT inspections are to be performed no later than seven years after the previous inspection. Shorter intervals may be required where test results indicate that a more frequent inspection interval is necessary or as otherwise proposed by PG&E. CalGEM continues to evaluate CWT test results statewide, from wells with two or more data points, to consider whether longer intervals are appropriate; and;
- Pressure testing is to be performed on a five-year schedule as requested by PG&E.

Approved Second-Round Testing Schedule

CalGEM, therefore, requires PG&E to perform second-round testing pursuant to the schedule in the attached PG&E MIT Due Dates table subject to the following conditions:

Conditions of approval

1. PG&E shall adhere to the schedule for CWT inspections and pressure testing on a well-by-well basis. (See attached PG&E MIT Due Dates table.)
2. Within 30 days of completing the first-round testing, expected to be completed by the end of 2025 for each remaining well, PG&E must provide:
 - a. The test results for each well; and
 - b. An evaluation of those results and a recommended due date not to exceed seven years from the initial test based on the results of that inspection.
3. For each well, PG&E must conduct annular pressure testing every five years, consistent with its requested interval, which is reflected in the attached PG&E MIT Due Dates table.
4. Continued compliance with other requirements, including:
 - a) Each well must be equipped with real-time annular monitoring equipment.
 - i. PG&E must submit tubing-casing annulus alarm set points for each well and information supporting the determination of that alarm set point, including annular fluid, the initial pressure when the packer

- was set, and operational configuration information in accordance with CCR section 1726.7, subdivision (d)(2).
- ii. PG&E must submit pressures above their established alarm set points.
 - b) PG&E must complete daily leak detection inspections consistent with California Air Resources Board regulations.
 - c) All wells must have temperature and noise logs conducted at least annually consistent with CCR section 1726.6, subdivision (a)(1).

Flexibility in Compliance Schedule to Address Reliability Requirements from the California Public Utilities Commission to Meet Californians' Energy Needs

If by March 1st of any given year, PG&E anticipates compliance with the testing requirements would likely cause PG&E to be out of compliance with reliability requirements mandated by the CPUC because of unusually low hydroelectric availability, higher than average winter demand that has significantly depleted storage inventory, unanticipated pipeline or well maintenance, or another data supported reason, PG&E may notify the CPUC and CalGEM and request an adjustment to the testing schedule in that year. Any request for an extension must include specific logistical and engineering constraints with detailed explanations substantiated with quantitative data. CalGEM may also consider a request to adjust the testing schedule in the event of an emergency or unanticipated extreme event that occurs after March 1.

Upon receipt of an extension request, CalGEM will consult with CPUC regarding PG&E's stated reliability concerns and the Deputy Executive Director over the CPUC's Energy Division shall notify the State Oil and Gas Supervisor, in writing, of their verification of the changed conditions leading to PG&E's request, and CalGEM may modify the testing deadlines. PG&E will diligently and proactively adhere to the CalGEM-approved schedule (attached), testing wells early as scheduling allows, and will only delay testing once approved by CalGEM. Failure to adhere to the approved schedule may result in corrective action up to and including, but not limited to, civil penalties for each day a well is out of compliance with its assigned due date.

Conclusion

This approval is subject to revision in its entirety or on a well-by-well basis by CalGEM, based on any data or other information that suggests that the testing frequency should be modified to protect public health and safety, property, the environment, and natural resources.

CalGEM continues to evaluate CWT test results statewide, from wells with two or more data points, to consider whether longer intervals are appropriate. CalGEM also continues to work with the California Energy Commission and the California Public Utilities Commission to stay informed regarding reliability concerns. Should a change in the approved schedule be warranted by additional data, confirmed by the CPUC, indicating potential reliability impacts, including the potential need to utilize reserve

capacity under the current schedule, then CalGEM may consider such changes. PG&E must continue to test based on the attached schedule, and only deviate if CalGEM issues a revised schedule.

Please contact Jeanette Hand (Jeanette.Hand@conservation.ca.gov) if you have any questions.

Sincerely,



Emily Reader
Programs Manager, Subsurface Storage and Injection Projects

Attachments:

PG&E MIT Due Dates

CC:

Leuwam Tesfai, CPUC, Deputy Executive Director for Energy and Climate Policy
Candace Morey, CPUC, Interim Director of Distributed Energy Resources, Natural Gas & Retail Rates;
David Erne, CEC, Deputy Director of Resource Planning, Reliability & Emergency
Lucy Redmond, PG&E

PG&E MIT DUE DATES					
Well name	Well API	Last CWT	Last SAPT ¹⁾	SAPT Scheduled Test Due Date	Scheduled 2nd round CWT + SAPT due date
McDonald Island					
WS-7W	0407720193	3/23/2019			3/23/2026
LMac-1	0407720609	5/9/2021			12/31/2026
TC-7S	0407720206	5/27/2019			5/27/2026
WS-3W	0407720213	6/5/2021			12/31/2026
WS-14E	0407720257	6/6/2019			6/6/2026
TC-12S	0407720248	6/13/2019			6/13/2026
WS-6E	0407720185	6/27/2019			6/27/2026
WS-11E	0407720253	7/7/2019			7/7/2026
ZUCK-1	0407700091	8/13/2019			8/13/2026
WS-8E	0407720188	10/4/2019			10/4/2026
ROB-1	0407720524	11/25/2019			11/25/2026
WS-11W	0407720265	3/12/2020			3/12/2027
TC-2N	0407720199	3/28/2022			12/31/2027
WS-1AE	0407720536	4/2/2020			4/2/2027
TC-13N	0407720234	4/15/2022			12/31/2027
TC-12N	0407720230	4/17/2020			4/17/2027
WS-16W	0407720231	4/19/2020			4/19/2027
WS-4E	0407720178	5/3/2020			5/3/2027
WS-5E	0407720179	5/17/2020			5/17/2027
WS-12E	0407720255	5/23/2020			5/23/2027
MCD-11	0407700086	5/31/2020			5/31/2027
ZUCK-H	0407720010	6/14/2020			6/14/2027
WS-13E	0407720256	6/26/2020			6/26/2027
WS-7E	0407720187	7/18/2020			7/18/2027
WS-9E	0407720189	7/27/2020			7/27/2027
TC-10S	0407720251	8/3/2020			8/3/2027
MCD-12	0407700087	8/25/2020			8/25/2027
MCD-10	0407700085	10/1/2020			10/1/2027
TC-11N	0407720229	3/10/2021			3/10/2028
WS-4W	0407720214	4/9/2021			4/9/2028
TC-4S	0407720203	5/26/2021			5/26/2028
MCD-13	0407700088	6/2/2021			6/2/2028
TC-3S	0407720216	6/11/2021			6/11/2028
WS-2W	0407720212	6/19/2021			6/19/2028
WS-9W	0407720195	7/6/2021			7/6/2028

Well name	Well API	Last CWT	Last SAPT ¹⁾	SAPT Scheduled Test Due Date	Scheduled 2nd round CWT + SAPT due date
TC-8S	0407720533	7/21/2021			7/21/2028
TC-11S	0407720250	8/8/2021			8/8/2028
MCD-9	0407700084	11/3/2021			11/3/2028
WS-18W	0407720465	3/23/2022			3/23/2029
TC-5S	0407720204	4/7/2022			4/7/2029
TC-5N	0407720207	4/24/2022			4/24/2029
TC-6N	0407720208	5/11/2022			5/11/2029
TC-15N	0407720239	5/26/2022			5/26/2029
TC-17N	0407720548	6/9/2022			6/9/2029
TC-16N	0407720240	6/11/2022			6/11/2029
MCD-5A	0407720552	7/28/2022			7/28/2029
TC-3N	0407720201	3/10/2023			3/10/2030
TC-4N	0407720202	3/24/2023			3/24/2030
WS-15W	0407720233	3/28/2023			3/28/2030
TC-7N	0407720225	4/30/2023	6/26/2024	6/26/2029	4/30/2030
TC-8N	0407720226	5/24/2023			5/24/2030
WS-10W	0407720534	6/8/2023			6/8/2030
TC-9S	0407720252	6/24/2023	7/6/2023	7/6/2028	6/24/2030
TC-13S	0407720247	8/29/2023	9/28/2023	9/28/2028	8/29/2030
MCD-4	0407700080	9/3/2023	9/14/2023	9/14/2028	9/3/2030
MCD-6	0407700082	9/28/2023	10/1/2023	10/1/2028	9/28/2030
TC-14S	0407720244	10/9/2023	10/18/2023	10/18/2028	10/9/2030
WS-1E	0407720168	12/8/2023			12/8/2030
MCD-7	0407700083	12/25/2023	12/30/2023	12/30/2028	12/25/2030
WS-17W	0407720166	5/7/2024	5/14/2024	5/14/2029	5/7/2031
TC-15S	0407720245	5/12/2024	5/17/2024	5/17/2029	5/12/2031
WS-20W	0407720535	6/23/2024	7/1/2024	7/1/2029	6/23/2031
WS-13W	0407720241	7/24/2024	7/24/2024	7/24/2029	7/24/2031
WS-5W	0407720211	7/26/2024	3/29/2023	3/29/2028	7/26/2031
WS-6W	0407720192	8/2/2024	8/7/2024	8/7/2029	8/2/2031
WS-12W	0407720264	8/9/2024	8/31/2024	8/31/2029	8/9/2031
WS-8W	0407720194	8/16/2024	9/1/2024	9/1/2029	8/16/2031
TC-2S	0407720219	8/25/2024	6/24/2023	6/24/2028	8/25/2031
WS-1E	0407720168	12/8/2023	1/23/2025	1/23/2030	12/8/2031
TC-1AN	0407720742	1/5/2024	1/13/2024	1/13/2029	1/5/2031
TC-1BN	0407720741	2/18/2024	2/27/2024	2/27/2029	2/18/2031
Lil Mac-2	0407720743	7/8/2024	7/14/2024	7/14/2029	7/8/2031

Well name	Well API	Last CWT	Last SAPT ¹⁾	SAPT Scheduled Test Due Date	Scheduled 2nd round CWT + SAPT due date
WS-2E	0407720169	3/23/2025	3/23/2025	3/23/2030	3/23/2032
WS-3E	0407720173	3/31/2025	3/31/2025	3/31/2030	3/31/2032
TC-17S	0407720258	4/13/2025	4/13/2025	4/13/2030	4/13/2032
The McDonald Island Wells below have not been incorporated into the schedule based on first round test results or ongoing well work					
WS-19W	0407720467	6/12/2024			
WS-1W	0407720215	7/4/2024			
WS-1AW	0407720544	2025			
TC-10N	0407720228	2025			
TC-1AS	0407720551	2025			
TC-1S	0407720218	2025			
TC-16S	0407720243	2025			
Los Medanos					
LM-17D	0401320136	7/11/2021			12/31/2026
LM-15C	0401320121	9/21/2019			9/21/2026
LM-11C	0401320128	8/1/2020			8/1/2027
LM-20D	0401320297	8/11/2020			8/11/2027
LM-16D	0401320133	6/20/2021			6/20/2028
LM-10C	0401320131	6/29/2021			6/29/2028
LM-19D	0401320295	5/21/2022			5/21/2029
LM-3A	0401320115	6/25/2022			6/25/2029
LM-6B	0401320140	7/21/2022			7/21/2029
LM-7C	0401320130	8/15/2022			8/15/2029
LM-14C	0401320298	6/13/2023	6/20/2023	6/20/2028	6/13/2030
LM-21D	0401320308	8/1/2023	8/10/2023	8/10/2028	8/1/2030
LM-9C	0401320123	11/19/2023	11/26/2036	11/26/2028	11/19/2030
LM-13C	0401320299	8/13/2024	8/17/2024	8/17/2029	8/13/2031
LM-5B	0401320144	8/27/2024	9/4/2024	9/4/2029	8/27/2031
GINO-3	0401300135	9/12/2024	9/16/2024	9/16/2029	9/12/2031
The Los Medanos wells below have not been incorporated into the schedule based on first round test results or ongoing well work					
LM-12C	0401320307	2025			
LM-2A	0401320138	2025			
¹ The Last SAPT Column is only populated where the date of the previous SAPT is greater than five years from the date of the next CWT and SAPT. Based on current WellSTAR records and may be updated based on 2025 testing.					

Plan_Dt	Core	Indus	UEG	Baja	California Production	Redwood	Total PGE Storage Withdrawal	Total ISP Withdrawal	Withdrawal Reserve Capacity Used	Pipe_wd	Pipeline Balancing Capacity Available
4/5/2020	1112	667	463	646	30	1817	358	135	3	300	300
4/6/2020	1280	698	509	668	29	1819	393	258	2	300	300
6/10/2020	408	700	813	504	31	1866	230	0	29	300	300
6/21/2020	382	644	520	461	29	1778	214	24	27	300	300
8/15/2020	398	965	1169	598	33	1973	200	421	2	300	300
10/5/2020	423	821	882	590	29	1983	279	117	5	300	300
1/25/2021	1800	711	738	594	28	1860	443	622	9	300	300
1/26/2021	1919	729	727	582	28	1925	413	919	17	300	300
6/29/2021	385	821	989	649	28	1856	360	196	11	300	300
7/9/2021	409	916	1251	603	28	1792	330	462	20	300	300
7/12/2021	450	849	1168	498	30	1841	407	238	7	300	300
7/19/2021	409	933	1122	498	28	1824	388	335	1	300	300
8/24/2021	427	939	759	651	26	2031	204	198	3	300	300
11/18/2021	938	770	809	232	27	1569	420	339	8	300	300
12/6/2021	1290	792	928	596	27	1837	384	425	60	300	300
12/20/2021	1761	812	958	602	26	1610	562	1243	27	300	300
12/21/2021	1649	849	899	677	28	1385	555	1448	54	300	300
12/27/2021	1708	782	863	762	28	1388	596	1108	99	300	300
1/9/2022	1369	712	610	660	27	1475	393	732	33	300	300
1/24/2022	1320	734	666	646	27	1850	286	298	8	300	300
2/1/2022	1525	758	585	537	27	1651	353	820	32	300	300
2/22/2022	1628	751	792	576	27	1687	553	797	3	300	300
2/23/2022	1741	820	878	496	27	1576	415	1448	24	300	300
4/11/2022	936	662	527	595	27	1838	362	203	12	300	300
6/21/2022	356	642	972	591	24	1642	300	1	8	300	300
7/11/2022	384	640	940	558	25	1851	437	122	12	300	300
8/24/2022	383	815	994	555	27	1491	452	331	3	300	300
10/9/2022	428	719	877	499	25	1995	221	11	3	300	300
11/20/2022	1244	636	719	392	27	1610	296	870	12	300	300
11/29/2022	1481	721	838	546	26	1641	276	774	2	300	300
12/18/2022	1780	622	853	392	26	1691	207	1462	16	300	300
12/19/2022	1914	701	1032	443	26	1682	282	1485	79	300	300
1/2/2023	1788	609	984	573	26	1622	438	789	52	300	300
1/31/2023	1698	712	1017	386	26	1525	723	1141	104	300	300
3/29/2023	1519	735	599	624	27	2020	233	224	15	300	300
4/18/2023	895	668	461	553	27	2097	233	0	2	300	300
7/26/2023	487	801	1190	452	15	2050	346	121	36	300	300
8/24/2023	357	891	909	698	16	1891	325	78	53	300	300
11/21/2023	994	721	877	708	18	1595	303	403	1	300	300
11/25/2023	1150	707	721	751	19	1536	399	285	91	300	300
11/26/2023	1283	708	843	761	19	1487	396	488	95	300	300
11/27/2023	1328	695	943	725	19	1529	285	798	7	300	300
12/10/2023	1363	697	944	764	19	1912	283	355	11	300	300
12/11/2023	1232	740	1114	698	19	1877	284	513	9	300	300
12/17/2023	1115	685	1049	697	18	1715	301	434	5	300	300
1/12/2024	1533	756	1237	682	19	1099	451	1489	109	300	300
2/7/2024	1577	786	817	586	20	1803	311	730	2	300	300
6/24/2024	391	693	1066	392	7	1506	187	229	5	300	300
7/8/2024	350	724	1135	443	23	1878	339	143	51	300	300
7/9/2024	374	717	1162	398	23	1908	289	204	1	300	300
1/12/2025	1196	668	682	124	21	1308	304	1005	4	300	300
1/13/2025	1366	743	729	124	22	1297	346	1228	46	300	300
1/15/2025	1331	756	847	249	21	1442	303	1191	3	300	300
1/26/2025	1433	731	842	190	21	1536	356	1207	56	300	300
1/27/2025	1473	759	923	192	21	1545	326	1388	26	300	300
2/11/2025	1485	726	848	448	22	1701	375	609	73	300	300
2/18/2025	997	706	784	173	21	1336	464	785	9	300	300
8/22/2025	341	927	1198	483	20	1638	299	784	17	300	300
9/2/2025	362	911	1259	679	19	1561	306	422	12	300	300

Storage Withdrawal Impact Notes	Storage Outage Impact Total w/ baseline outages (mmscf/d)	Redwood Notes	Redwood Outage Impact (mmscf/d)
Well Outages for integrity management assessment.	-286	N/A	N/A
Well Outages for integrity management assessment.	-285	N/A	N/A
Well Outages for integrity management assessment, Whiskey Slough maintenance (-286 mmcsf/d).	-519	L-400 In-Line Inspection	-360
Well Outages for integrity management assessment, McDonald Island hydrotest (-367 mmcsf/d)	-566	N/A	N/A
Well outages for integrity management assessment, Whiskey Slough Maintenance (-377 mmcsf/d), McDonald Island In-Line Inspection (-110 mmcsf/d)	-674	N/A	N/A
Well outages for integrity management assessment, Whiskey Slough Maintenance (-468 mmcsf/d)	-669	N/A	N/A
Well Outages for integrity management assessment.	-238	N/A	N/A
Well Outages for integrity management assessment.	-181	N/A	N/A
Well outages for integrity management assessment, Turner Cut Station Maintenance (-509 mmcsf/d)	-951	L401 In-Line Inspection, Gerber Station Maintenance, L400 Pressure Reduction	-450
LMS Maintenance (-91 mmcsf/d), Well outages for integrity management assessment, Turner Cut Station Maintenance (-503 mmcsf/d)	-1066	L400 Pressure Reduction	-230
Well outages for integrity management assessment, Turner Cut Station Maintenance (-503 mmcsf/d)	-914	L400 In-Line Inspection Upgrade, L400 Pressure Reduction	-260
Well outages for integrity management assessment, Turner Cut Station Maintenance (-503 mmcsf/d), Antioch Station outage impact (-119 mmcsf/d)	-1046	Burney Station Maintenance, L303 Pipeline Maintenance, L400 Pressure Reduction	-370
Well outages for integrity management assessment, Turner Cut Station Maintenance (-487 mmcsf/d)	-746	N/A	N/A
McDonald Island injection testing (-90 mmcsf/d), Well outages for integrity management assessment	-323	Delevan Station Maintenance	-80
Well Outages for integrity management assessment.	-197	N/A	N/A
Well Outages for integrity management assessment.	-182	N/A	N/A
Well Outages for integrity management assessment.	-163	Burney Station Maintenance	-110
Well Outages for integrity management assessment.	-165	N/A	N/A
Well Outages for integrity management assessment.	-173	L-400 Pipeline Maintenance, L-303 Pipeline Maintenance	-170
Well Outages for integrity management assessment.	-226	L-400 Pipeline Maintenance, L-303 Pipeline Maintenance	-170
Well Outages for integrity management assessment.	-189	L-400 Pipeline Maintenance, L-303 Pipeline Maintenance	-160
Well Outages for integrity management assessment.	-164	L-400 Pipeline Maintenance, L-303 Pipeline Maintenance	-160
Well Outages for integrity management assessment.	-159	L-400 Pipeline Maintenance, L-303 Pipeline Maintenance	-160
Whiskey Slough Maintenance (-340 mmcsf/d), well outages for integrity management assessment	-635	Buckeye Station Maintenance	-250
Turner Cut Maintenance (-226 mmcsf/d), well outages for integrity management assessment	-635	Buckeye Station Maintenance, L-400 Pipeline Maintenance	-570
Turner Cut Maintenance (-465 mmcsf/d), well outages for integrity management assessment	-697	Buckeye Station Maintenance	-170
Turner Cut Maintenance (-235 mmcsf/d), well outages for integrity management assessment	-630	L-401 Pipeline Maintenance, Buckeye Station Maintenance	-670
Turner Cut Maintenance (-203 mmcsf/d), well outages for integrity management assessment	-642	Buckeye Station Maintenance	-230
Well Outages for integrity management assessment.	-271	N/A	N/A
Whiskey Slough Maintenance (-340 mmcsf/d), well outages for integrity management assessment	-277	Delevan Station Maintenance	-120
Well Outages for integrity management assessment.	-231	N/A	N/A
Well Outages for integrity management assessment.	-272	N/A	N/A
Well Outages for integrity management assessment.	-236	N/A	N/A
Well Outages for integrity management assessment.	-230	Delevan Station Maintenance	-130
Turner Cut Maintenance (-64 mmcsf/d), well outages for integrity management assessment	-362	N/A	N/A
Whiskey Slough Maintenance (-326 mmcsf/d)	-556	Delevan Station Maintenance, Gerber Station Maintenance	-120
Well outages for integrity management assessment, Turner Cut Station Maintenance (-353 mmcsf/d)	-679	Bethany Station Maintenance, Delevan Station Maintenance	-140
Well Outages for integrity management assessment.	-517	Bethany Station Maintenance, L-400 Pipeline Maintenance	-290
Well Outages for integrity management assessment.	-488	Tionesta Station Maintenance	-100
Well Outages for integrity management assessment.	-765	N/A	N/A
Well Outages for integrity management assessment.	-765	N/A	N/A
Well Outages for integrity management assessment.	-764	N/A	N/A
Well Outages for integrity management assessment.	-324	N/A	N/A
Well Outages for integrity management assessment.	-312	Bethany Station Maintenance	-10
Well Outages for integrity management assessment.	-292	N/A	N/A
Well Outages for integrity management assessment.	-190	N/A	N/A
Well Outages for integrity management assessment.	-249	N/A	N/A
Turner Cut Maintenance (-367 mmcsf/d), well outages for integrity management assessment	-680	Indian Springs Station Maintenance, Buckeye Station Maintenance, Bethany Station Maintenance	-217
McDonald Island Hydrotest (-90 mmcsf/d), well outages for integrity management assessment	-407	Indian Springs Station Maintenance, Buckeye Station Maintenance	-132
McDonald Island Hydrotest (-90 mmcsf/d), well outages for integrity management assessment	-407	Indian Springs Station Maintenance, Buckeye Station Maintenance	-213
Well Outages for integrity management assessment.	-172	Indian Springs Station Maintenance	-70
Well Outages for integrity management assessment.	-151	Indian Springs Station Maintenance	-70
Well Outages for integrity management assessment.	-151	Indian Springs Station Maintenance, Burney Station Maintenance	-210
Well Outages for integrity management assessment.	-168	Indian Springs Station Maintenance	-70
Well Outages for integrity management assessment.	-165	Indian Springs Station Maintenance	-70
Well Outages for integrity management assessment.	-228	Indian Springs Station Maintenance, Tionesta Station Maintenance	-320
Well Outages for integrity management assessment.	-203	Indian Springs Station Maintenance	-70
Whiskey Slough Maintenance (-310 mmcsf/d), Turner Cut Maintenance (-21 mmcsf/d), Well outages for integrity management assessment	-720	Temperature discount	-30
Whiskey Slough Maintenance (-340 mmcsf/d), Well outages for integrity management assessment	-688	Burney Station Maintenance	-57

Baja Notes	Topock Capacity Impact (mmscf/d)	Hinkley Capacity Impacts (mmscf/d)	Kettleman Capacity Impact (mmscf/d)
L300A In-Line Inspection Upgrades	0	-314	-314
L300A In-Line Inspection	0	-329	-329
L300A In-Line Inspection, L300B Pipeline Maintenance	0	-205	-205
Topock Station Maintenance, L300A Pipeline Maintenance	0	-524	-555
Topock Station Maintenance, L300A Pipeline Maintenance	-504	-435	-435
Topock Station Maintenance, L300A Pipeline Maintenance	-390	-390	-390
Topock Station Maintenance, L300A Pipeline Maintenance	-390	-339	-339
Topock Station Maintenance, L300A Pipeline Maintenance	-390	-339	-339
L300A Pipeline Maintenance	0	-325	-325
L300A Pipeline Maintenance	0	-325	-325
L300A Pipeline Maintenance	0	-469	-469
L300A Pipeline Maintenance	0	-469	-469
L300B Pipeline Maintenance, L300A Pipeline Maintenance, L300A Pressure Reduction, L303 Maintenance	0	-325	-554
Hinkley Station Maintenance, L300A Pipeline Maintenance	-546	-546	-495
L300A Pipeline Maintenance, L-300B Pipeline Maintenance	-10	-264	-123
L300A Pipeline Maintenance	-10	-10	-145
L300A Pipeline Maintenance	-10	-10	-145
L300A Pipeline Maintenance	-10	-10	-145
L300A Pipeline Maintenance, Topock Station Maintenance	-295	-10	-145
N/A	N/A	N/A	N/A
L300A Pipeline Maintenance, Kettleman Station Maintenance, Topock Station Maintenance	-295	-162	-225
L300A Pipeline Maintenance, Kettleman Station Maintenance	-155	-295	-295
L300A Pipeline Maintenance, Kettleman Station Maintenance	-155	-295	-295
L300A Pipeline Maintenance	-30	-260	-345
L300A Pipeline Maintenance, L300B Pipeline Maintenance	-30	-260	-425
L300A Pipeline Maintenance, L300B Pipeline Maintenance	-30	-260	-599
L300A Pipeline Maintenance, L300B Pipeline Maintenance, Hinkley Station Unplanned Maintenance	-30	-376	-275
L300A Pipeline Maintenance, L300B Pipeline Maintenance, Hinkley Station Maintenance	-30	-315	-599
L300A Pipeline Maintenance, L300B Pipeline Maintenance, Hinkley Station Unplanned Maintenance	-30	-260	-260
L300A Pipeline Maintenance, L300B Pipeline Maintenance	-30	-260	-260
L300A Pipeline Maintenance, L300B Pipeline Maintenance	0	-157	-157
L300A Pipeline Maintenance, L300B Pipeline Maintenance	0	-157	-157
N/A	N/A	N/A	N/A
L300A Pipeline Maintenance, L300B Pipeline Maintenance	0	-157	-157
L300A Pipeline Maintenance, L300B Pipeline Maintenance, Hinkley Station Maintenance	0	-376	-187
L300A Pipeline Maintenance, L300B Pipeline Maintenance, Kettleman Station Maintenance	0	-187	-594
L300A Pipeline Maintenance, L300B Pipeline Maintenance	0	-187	-500
L300A Pipeline Maintenance, L300B Pipeline Maintenance	0	-187	-475
Hinkley Station Maintenance , Topock Station Maintenance	-174	-55	-325
Hinkley Station Maintenance , Topock Station Maintenance	-174	-55	-325
Hinkley Station Maintenance , Topock Station Maintenance	-174	-55	-325
Hinkley Station Maintenance , Topock Station Maintenance	-174	-55	-325
Hinkley Station Maintenance, Topock Station Maintenance	-5	-25	-25
Hinkley Station Maintenance, Topock Station Maintenance	-5	-25	-25
Hinkley Station Maintenance, Topock Station Maintenance	-5	-25	-25
Hinkley Station Maintenance, Topock Station Maintenance	-5	-25	-25
Hinkley Station Maintenance, Topock Station Maintenance, Kettleman Station Maintenance	-5	-155	-105
Hinkley Station Maintenance, L300B Pipeline Maintenance, L300A Pipeline Maintenance	0	-435	-475
L300A Pipeline Maintenance, Kettleman Station Maintenance	0	-376	-594
L300A Pipeline Maintenance, Kettleman Station Maintenance	0	-376	-594
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
Hinkley Station Maintenance	0	-75	0
Hinkley Station Maintenance	0	-75	0
Hinkley Station Maintenance, Kettleman Station Maintenance, Unplanned L300A Pipeline Maintenance	0	-495	-145
Hinkley Station Maintenance, L300A Pipeline Maintenance	0	-495	-115
Hinkley Station Maintenance, Kettleman Station Maintenance, L300A Pipeline Maintenance	0	-475	-425
Hinkley Station Maintenance, Kettleman Station Maintenance, L300A Pipeline Maintenance	0	-265	-425

PG&E Wells With Two or More Casing Wall Thickness Inspections (11/20/2025)

(PG&E-15)

Count	Field	Well	API	Casing	PG&E Proposed Revised Reinspection Year	CalGEM Reinspection (Per 5.22.2025 Letter)	Casing Wall Thickness (CWT) Inspection Log Type	Date of 1st CWT Inspection	1st CWT Inspection Result (% Metal Loss Observed)	Date of 2nd CWT Inspection	2nd CWT Inspection Result (% Metal Loss Observed)	Maximum Metal Loss from 2nd CWT Inspection (% Metal Loss Observed)	Depth of Metal Loss (ft)	Cause of Metal Loss	Growth Type	Change Between Inspections	Years Between Inspections	Remaining Life As Of Today (year)	PG&E's Revised Reinspection Interval
1	Los Medanos	LM 5-B	04-013-20144-00	7.000	2031	8/27/2031	MVRT, HRVRT	5/15/2013	21%	8/28/2024	31%	31%	31	Corrosion	Time dependent	0.89%	11	35	7
2	Los Medanos	LM 12-C	04-013-20307-01	7.000	2037	N/A	HRVRT	5/15/2016	21%	6/9/2025	22%	23%	247	Mechanical	Intervention Based	0.11%	9	75	12
3	Los Medanos	LM 2-A	04-013-20138-00	7.000	2037	N/A	HRVRT	6/12/2016	20%	6/21/2025	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	9	75	12
4	Los Medanos	LM 11-C	04-013-20308-00	7.000	2033	8/12/2030	HRVRT	6/12/2015	21%	8/12/2023	21%	36%	273	Mechanical	Intervention Based	0.00%	8	73	10
5	Los Medanos	GINO 3-F	04-013-00135-00	7.000	2037	9/12/2031	HRVRT	8/31/2017	39%	9/12/2024	44%	44%	3,760	Mechanical	Intervention Based	0.71%	7	26	13
6	Los Medanos	LM 11-C	04-013-20128-01	7.000	2033	8/1/2027	HRVRT	6/10/2015	20%	8/1/2020	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	5	70	13
7	Los Medanos	LM 20-D	04-013-20297-01	7.000	2036	8/1/2027	HRVRT	8/1/2020	38%	7/24/2024	30%	30%	270	Mechanical	Intervention Based	-2.02%	4	74	12
8	Los Medanos	LM 13-C	04-013-20299-00	7.000	2031	8/1/2031	HRVRT	7/2/2023	32%	8/13/2024	36%	36%	3,909	Mechanical	Intervention Based	3.58%	1	6	7
9	Los Medanos	LM 3-A	04-013-20115-01	7.000	2032	6/25/2029	HRVRT	6/25/2022	20%	7/2/2025	28%	28%	3,885	Mechanical	Intervention Based	2.65%	3	13	7
10	McDonald Island	WS 3-E	04-077-20173-00	5.500	2032	3/31/2032	HRVRT	11/28/2017	20%	3/31/2025	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	7	74	7
11	McDonald Island	WS 1-W	04-077-20215-00	7.000	2032	N/A	HRVRT	10/3/2015	41%	7/4/2024	44%	44%	5,620	Mechanical	Intervention Based	0.34%	9	23	8
12	McDonald Island	TC 10-A	04-077-20228-00	7.000	2032	N/A	HRVRT	8/14/2017	20%	11/13/2025	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	8	75	7
13	McDonald Island	WS 2-E	04-077-20169-00	7.000	2032	3/23/2032	HRVRT	10/24/2017	20%	3/23/2025	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	7	74	7
14	McDonald Island	TC 4-N	04-077-20202-00	7.000	2035	3/24/2030	HRVRT	8/9/2016	20%	3/24/2023	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	7	72	12
15	McDonald Island	TC 3-N	04-077-20201-00	7.000	2035	3/10/2030	HRVRT	9/11/2016	20%	3/10/2023	25%	25%	117	Mechanical	Intervention Based	0.77%	6	33	12
16	McDonald Island	WS 12-W	04-077-20264-00	7.000	2036	8/9/2031	HRVRT	8/1/2018	20%	8/9/2024	23%	23%	492	Mechanical	Intervention Based	0.50%	6	75	12
17	McDonald Island	TC 7-N	04-077-20225-00	7.000	2030	4/30/2030	HRVRT	9/22/2017	26%	4/30/2023	27%	27%	2,494	Mechanical	Intervention Based	0.18%	6	75	7
18	McDonald Island	TC 5-S	04-077-20204-00	7.000	2034	4/7/2029	HRVRT	10/8/2016	20%	4/7/2022	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	5	71	12
19	McDonald Island	TC 2-S	04-077-20219-00	7.000	2032	8/25/2031	HRVRT	4/16/2019	20%	8/25/2024	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	5	74	8
20	McDonald Island	WS 5-W	04-077-20211-00	7.000	2032	7/26/2031	HRVRT	5/15/2021	20%	7/26/2024	23%	23%	2,130	Mechanical	Intervention Based	0.94%	3	50	8
21	McDonald Island	TC 13-S	04-077-20247-01	8.625	2030	8/29/2030	HRVRT	10/14/2014	20%	8/29/2023	23%	23%	2,462	Mechanical	Intervention Based	0.34%	9	75	7
22	McDonald Island	TC 8-N	04-077-20226-00	8.625	2030	5/24/2030	HRVRT	8/5/2014	20%	5/24/2023	20%	32%	N/A	Metal loss not observed	Intervention Based	0.00%	9	72	7
23	McDonald Island	TC 9-S	04-077-20252-00	8.625	2030	6/24/2030	HRVRT	9/14/2014	20%	6/24/2023	27%	27%	876	Mechanical	Intervention Based	0.80%	9	31	7
24	McDonald Island	TC 1A-S	04-077-20551-00	8.625	2037	N/A	HRVRT	11/7/2016	20%	6/4/2025	20%	20%	4,964	Mechanical	Intervention Based	0.00%	9	74	12
25	McDonald Island	TC 14-S	04-077-20444-00	8.625	2033	10/9/2030	HRVRT	7/16/2015	20%	10/9/2023	22%	31%	741	Mechanical	Intervention Based	0.24%	8	75	10
26	McDonald Island	TC 17-A	04-077-20546-00	8.625	2034	6/9/2029	HRVRT	8/22/2014	20%	6/22/2022	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	8	72	12
27	McDonald Island	TC 1-S	04-077-20218-00	8.625	2037	N/A	HRVRT	4/10/2018	20%	8/16/2025	24%	31%	857	Mechanical	Intervention Based	0.56%	7	40	12
28	McDonald Island	TC 16-S	04-077-20243-01	8.625	2037	N/A	HRVRT	4/21/2018	35%	4/30/2025	36%	36%	3,442	Mechanical	Intervention Based	0.14%	7	75	12
29	McDonald Island	TC 17-S	04-077-20258-00	8.625	2037	4/13/2032	HRVRT	5/4/2018	26%	4/13/2025	29%	34%	786	Mechanical	Intervention Based	0.43%	7	44	12
30	McDonald Island	TC 8-S	04-077-20533-00	8.625	2033	7/21/2028	HRVRT	9/4/2014	20%	7/21/2021	20%	20%	5,090	Mechanical	Intervention Based	0.00%	7	71	12
31	McDonald Island	WS 8-W	04-077-20194-00	8.625	2036	8/16/2031	HRVRT	6/9/2018	26%	8/16/2024	27%	35%	291	Mechanical	Intervention Based	0.16%	6	75	12
32	McDonald Island	WS 6-W	04-077-20192-00	8.625	2036	8/2/2031	HRVRT	6/26/2018	25%	8/2/2024	32%	32%	295	Mechanical	Intervention Based	1.15%	6	17	12
33	McDonald Island	WS 20-W	04-077-20355-01	8.625	2036	6/23/2031	HRVRT	9/22/2018	20%	6/23/2024	24%	36%	3,596	Mechanical	Intervention Based	0.69%	6	24	12
34	McDonald Island	WS 17-W	04-077-20166-00	8.625	2031	5/7/2031	HRVRT	8/7/2018	35%	5/1/2024	32%	45%	284	Mechanical	Intervention Based	-0.52%	6	75	7
35	McDonald Island	MCD-9	04-077-00084-00	8.625	2033	11/3/2028	HRVRT	10/25/2016	20%	12/19/2021	20%	20%	N/A	Metal loss not observed	Intervention Based	0.00%	5	71	12
36	McDonald Island	TC 2-N	04-077-20199-00	8.625	2029	12/31/2027	HRVRT	5/27/2018	22%	3/28/2022	20%	21%	4,405	Mechanical	Intervention Based	-0.52%	4	71	7
37	McDonald Island	TC 12-S	04-077-20248-00	8.625	2031	6/13/2026	HRVRT	9/28/2014	26%	6/13/2019	26%	26%	3,601	Mechanical	Intervention Based	0.00%	5	69	12
38	McDonald Island	TC 3-S	04-077-20216-00	8.625	2031	6/11/2028	HRVRT	6/11/2021	20%	9/6/2024	27%	33%	3,451	Mechanical	Intervention Based	2.16%	3	8	7
39	McDonald Island	TC 5-N	04-077-20207-00	8.625	2037	4/24/2029	HRVRT	4/24/2022	21%	5/25/2025	21%	21%	1,438	Mechanical	Intervention Based	0.00%	3	74	12
40	McDonald Island	WS 1A-W	04-077-20544-00	8.625	2037	N/A	HRVRT	6/4/2018	22%	6/30/2025	20%	20%	3,911	Mechanical	Intervention Based	-0.28%	7	75	12

PG&E has provided the table above of all the wells with two or more direct casing wall thickness inspections comparing the well's most recent casing wall thickness log to the previous log. The metal loss comparison are of features located within the same interval observed on both the first and second inspection. Note in some instances, the highest metal loss reported in the second casing wall thickness inspection was not used to calculate change rate because it wasn't observed on the first casing wall thickness inspection. PG&E has largely observed mechanically induced metal loss which is not expected to result in a time dependent reduction in casing wall thickness. If all joints were reported as class 1 (less than 20% metal loss) in the casing wall thickness inspection then its result was assumed to be 20 %. For wells that aren't identified as time dependent metal loss, PG&E does not believe there is a time dependent change but rather a change that results from repeated well intervention activities. By way of demonstration, PG&E has calculated the change in metal loss between inspections to show CalGEM that even if such results were misinterpreted to attempt to suggest a time dependent reduction to remaining life exists, that the reinspection intervals proposed by PG&E are sufficiently short enough not to exceed this inferred remaining life. Much of the change in the observed metal loss is related to a change in the processing algorithm. The rate of change is subject to the accuracy of the latest tool, algorithm, or technology. Therefore, increases or decreases have been empirically observed within the inspection results. This is especially the case for wells which had a very limited time elapsed between inspections, such as Los Medanos 13-C and Turner Cut 3-S.

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Final Report

Review of the Gas Storage Well Casing Reinspection Plan

Prepared for:
PG & E

Purpose:
Review the PG & E Reinspection
Plan



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1 Executive Summary

PG&E requested Blade to review their casing reinspection strategy, program, procedures, and results. PG&E completed baseline inspections of wells in both of its fields, McDonald Island and Los Medanos, by 2023; all wells were converted to tubing-and-packer completions by 2025.

The elements of the PG&E reinspection plan include the following:

- Decisions are first guided by whether the casing can withstand 115% MAOP, and then whether the log data exceeds stress curves.
- New casing and casing with features not related to corrosion have inspections set for 12 to 15 years.
- For casing with new features in an inspection, the inspection automatically reverts to 5 to 8 years.
- Otherwise, multiple inspection runs are to be used to estimate the apparent growth rate and determine when the wall loss will reach 115% MAOP for the casing.

There is a flowchart and a document that dictate casing logging and data assessments. PG&E's current approach is conservative.

The tubing, packer, and tailpipe represent the primary barrier, while the production casing serves as the secondary barrier. Baseline inspection of the casing is essential and confirms casing integrity. However, the constant removal (every 24 months) of a properly functioning primary barrier (tubing and packer) risks compromising the well integrity to inspect the secondary barrier. The value of the casing inspection should balance this risk. To assess this, Blade attempted to estimate the corrosion rates.

Blade estimated possible corrosion on the ID. Assuming that the storage gas leaks into the tubing-casing annulus and is replenished, the casing ID corrosion rate would range from 0.34 to 1.2 mpy, depending on the depth and field conditions. If the tubing-casing annulus gas is not replenished, the maximum wall loss would be 0.0025 in. However, the casing OD corrosion is more complex. There are two possibilities: aquifer corrosion and microbiologically induced corrosion. The aquifer corrosion driven by oxygen and CO₂, for a specific assumed water chemistry, ranges from 1.5 to 2.3 mpy. This will need to be updated for a typical Northern California water chemistry.

Re-inspection aims to identify any increases in wall loss due to corrosion, confirm ongoing time-dependent wall loss, or affirm that there is no active wall loss. Too frequent inspections will be misleading, especially if they show no additional wall loss. This will occur due to the inherent uncertainties, errors, and tolerances associated with magnetic logging technology. Using the ID corrosion rates and an assumed $\pm 10\%$ uncertainty in wall thickness for a 20% flaw depth, it would take 25 years to grow to 31%. Prior tool runs may exhibit no wall loss increases and could be misleading. It is essential to space the inspections to observe any increased wall loss. Blade proposes an alternative process for PG&E to consider and, if appropriate, integrate. The approach uses ID corrosion and OD corrosion separately to establish inspection frequencies based on an understanding of the possible corrosion mechanisms.

Overly frequent inspections can be damaging because entering the well poses a risk of mechanical damage during rig-based inspection operations. Instead of casing wall thickness inspection tools, PG&E can use through-tubing inspection to assess whether there are significant changes in the nature of corrosion; if there are, casing thickness inspections should be conducted at key, appropriately spaced frequencies.

Corrosion mitigation to prevent wall loss is essential, and PG&E is using measures such as CP for external corrosion and inhibited packer fluids. Furthermore, PG&E monitors all annulus spaces to ensure there is no significant corrosion or fluid movement across casing strings. Such active mitigation, combined with

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annulus monitoring, should assist in corrosion management. Casing inspections should be spaced appropriately based on the operating corrosion mechanism.

Frequent removal of the tubing—the primary barrier—to inspect the casing (secondary barrier) increases the risk of Lack of Well Control during the workover, additional wall loss due to intervention activities (drill bits, scrapers, etc.), and safety risks during the workover. Since every live well with tubing must be killed before any operation, there is always a safety risk to personnel. This should be balanced with the possible value of casing inspection. In Blade's opinion, given the risks articulated and the tolerances of the logging technologies, inspection every 24 months to 12 to 15 years is overly frequent.

Suppose the only risk is internal corrosion, which has been quantified here and is insignificant (less than 1.2 mpy when exposed to injection gas). In that case, it (insignificant corrosion rate) can be used to establish the casing inspection frequency with a single inspection.

If the logging indicates external corrosion, the mechanism should be understood, and if it is due to oxygen or other corrodents and there is CP mitigation, an inspection frequency of 12 to 15 years should be considered. If, for any reason, it is established that MIC is the external corrosion mechanism, a second inspection run over 5 years should be conducted to characterize the corrosion rate. Overall, the corrosion risks are low. If necessary, through-tubing inspection can be utilized to monitor the casing.

PG&E's current approach is conservative, and the frequent casing inspections increase casing integrity (intervention-related deformation) and safety (LOWC) risks.

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2 Background & Introduction

PG&E operates an extensive underground storage facility with a total capacity of approximately 100 BCF. The storage is in depleted fields, comprising McDonald Island, Los Medanos, and Pleasant Creek. The objective of underground gas storage (UGS) is to access, as needed, an extensive underground gas reservoir. As the demand fluctuates based on weather and other seasonal needs, there is immediate access to hydrocarbon gas.

McDonald Island is the largest of three UGS fields, a gas reservoir that was depleted in 1958 and subsequently developed as a gas storage field in the 1970s. There is a total of 77 injection/withdrawal wells, and an additional 8 observation wells. The average well depth is 5,200 feet, with a bottom-hole pressure (BHP) of 2,365 psi. There are four different sectors in this field: Turner Cut, with 16 wells on the north side and 18 wells on the south side; Whiskey Slough, with 21 wells on the West side and 15 wells on the east side.

The Los Medanos field was depleted in 1973 and converted into a gas storage field in 1981. There is a total of 17 injection/withdrawal wells, and an additional 2 observation wells. The average well depth is approximately 4,100 feet, with a BHP of 1,774 psi. There are four different pads: A (2 wells), B(3 wells), C (8 wells), and D (6 wells).

Pleasant Creek is the smallest field, comprising 6 injection/withdrawal wells, with an average well depth of 2,800 feet. This field, however, is not relevant to the report and will not be addressed.

In 2017 and 2018, PG&E converted all the wells from single-barrier to double-barrier construction. Generally, the wells consist of three strings of pipe, surface casing, production casing, and tubing. The current configuration of the wells is shown in Figure 1, called a tubing-packer completion.

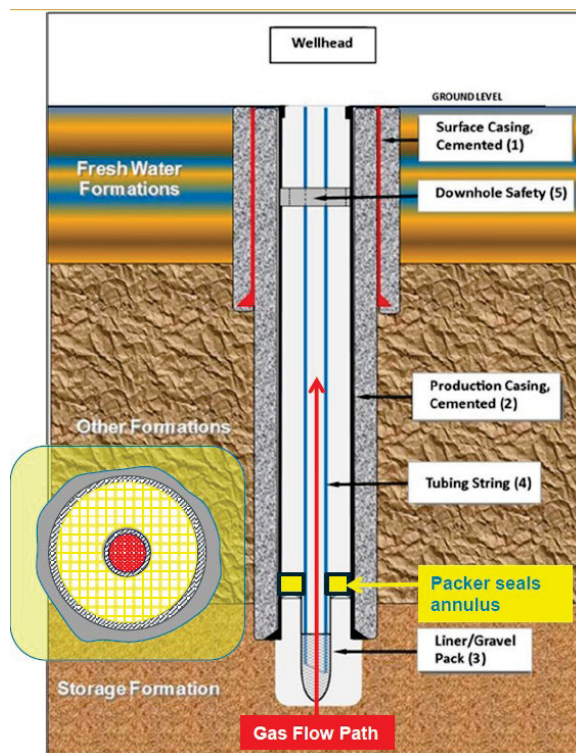


Figure 1: Current configuration of a typical UGS well.

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The surface casing isolates the freshwater formations from the wellbore. The production casing is run to the target depth of the reservoir. The production tubing is contained within the casing, and in the current configuration, it serves as the primary path for gas injection or withdrawal. The key distinction of these wells is the presence of a packer, which isolates the production casing above the packer from the storage gas. This design ensures that the tubing-packer is the primary barrier, while the casing serves as the secondary barrier. Under normal operating conditions, the production casing is never exposed to stored gas, which significantly increases the reliability and safety of the production casing.

California Geologic Energy Management Division (CalGem) regulates the storage wells in California. Section 1726.6 Mechanical Integrity Testing has three elements to it:

1. Temperature and Noise log annually.
2. Casing Wall Thickness Inspection using Magnetic or Ultrasonic technologies is performed every 24 months. *The Division may approve a less frequent casing wall thickness inspection schedule for a well if the operator demonstrates that the well's corrosion rate is low enough that biennial inspection is not necessary.*
3. Pressure testing of the annulus between the tubing and casing at least once every 24 months.

PG&E has developed a detailed strategy and program around Item (2), casing wall thickness inspection and re-inspection. The focus of this report is a review of the re-inspection program to identify any enhancements to the approach and strategy.

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3 PG & E Re-Inspection Program

The current approach to well integrity and re-inspection is summarized in documents TD-4875S [1] and TD-4875P-05. The casing wall thickness re-inspection program is governed by Appendix C of TD-4875P-05. The flow chart is shown in Figure 2. The Barlow equation and stress analysis of the production casing guide all the initiation decision-making.

Appendix C, Casing Inspection Survey Decision Tree
Page 1 of 1

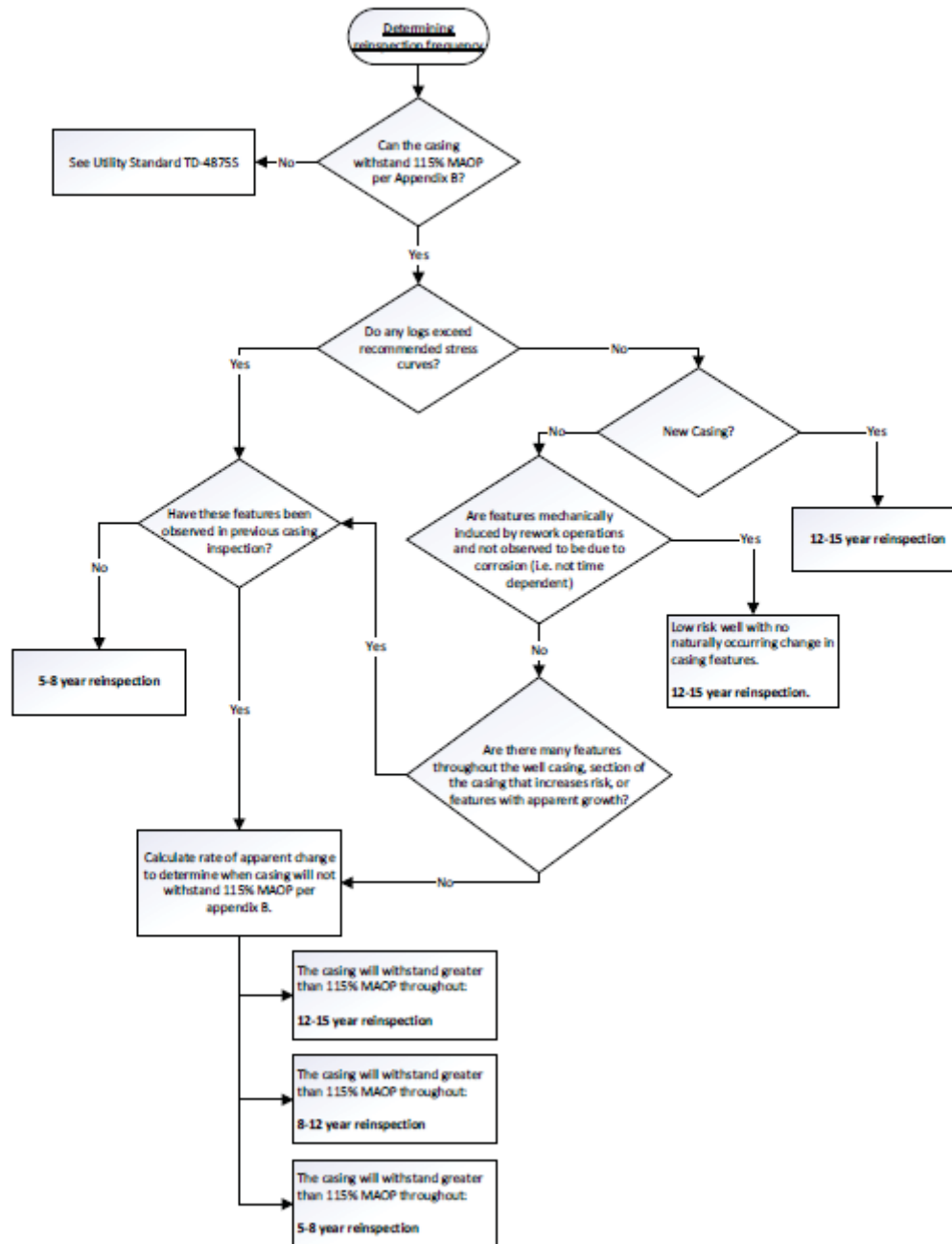


Figure 2: Decision tree for reinspection from Appendix C of TD-4875P-05

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Per the flow chart's logic, if any of the anomalies compromise the stress or pressure limits of the casing, immediate action is required.

Assuming the anomalies do not compromise stress or pressure limits, decisions are made regarding the frequency of reinspection. The key takeaways from the flow charts are as follows:

- Anomalies and features are only considered if they are Class 2 or greater.
- If the casing is new or is an existing casing string with only mechanically induced features, the inspection frequency is set to 12 to 15 years.
- If new features are identified during an inspection, then proceed to reinspection within 5 to 8 years.
- If there are features that do not exhibit apparent growth, estimate an evident change to determine when the casing will withstand 115% MAOP. Reinspection can occur between 5 and 15 years after the initial inspection.

Takeaways from this approach:

- The upper bound on the inspection frequency is 15 years, even for a new inner string production casing or a newly drilled replacement well.
- If there are any new features in a re-inspection, the frequency is 5 to 8 years.
- All other decisions are based on growth rates from multiple inspections.

3.1 Well Integrity

TD-4875S is a document that complements the reinspection plan and addresses risk-based decisions, verifications, and demonstrations of individual well integrity.

Methodologies used by PG&E to mitigate corrosion on the production casing are as follows:

- Annual review of the CP system that protects the surface casing and production casing by reviewing all the available data, including E-Log-i surveys.
- Use of annular packer fluid that includes a corrosion inhibitor and a bactericide.
- Wellbore produced fluids and solids are sampled during the withdrawal season to assess the corrosivity of the product stream.
- Both the A annulus (Tubing x Casing) and B annulus (Casing x Surface Casing) are monitored, and any changes in gas migration are noted and acted on. In wells with an inner casing, an additional annulus is actively monitored. The treatment includes assessing the chemical fingerprint of the gas, isolating the issue, and developing a remediation plan.

3.2 Remediation Options

When a casing is determined not to meet 115% MAOP, per the first decision point in the flowchart shown in Figure 2, a separate process is followed to address early relogging or remediation requirements. This flow chart is in Utility standard, TD-4875S, and is shown below in Figure 4. The solutions include, if possible, backoff and replace the compromised casing, Patch or scab or full liner, cemented liner, or other solutions. This is remediation options for casings with excessive wall loss.

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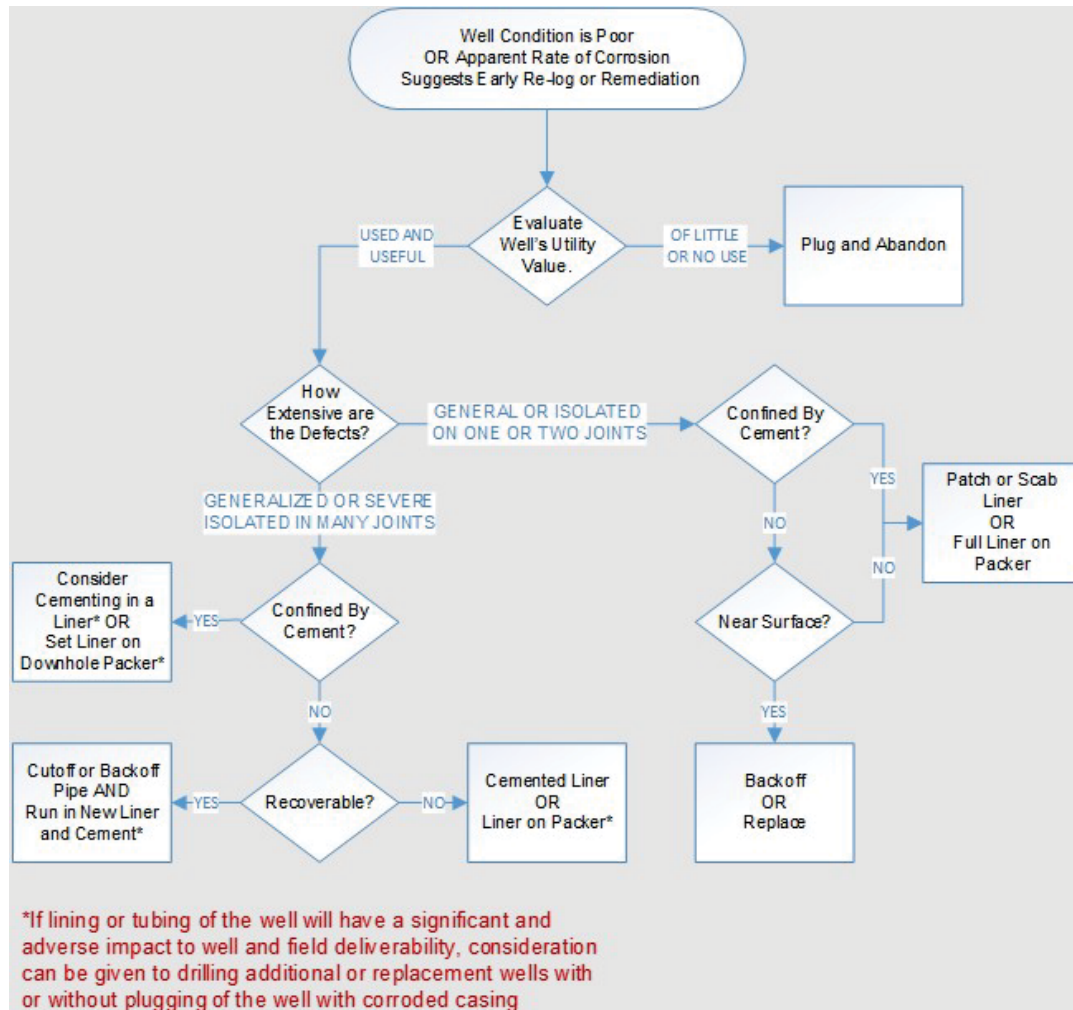


Figure 3: Remediation process for wells with excessive wall loss indications

4 Wall Loss

PG&E uses downhole Magnetic Flux Leakage (MFL) based logging tools to measure wall thickness. MFL technology is widely used for production casing evaluation because it can detect corrosion, wall loss, and localized defects without requiring a liquid couplant. The principle relies on inducing strong magnetization in the casing wall using permanent magnets or electromagnets. When the steel wall is continuous and uniform in thickness, the magnetic flux remains confined primarily within the metal. However, at locations where the wall is thinned or damaged, the magnetic circuit is disrupted, and magnetic field lines "leak" out. Arrays of sensors—typically Hall-effect devices or induction coils—measure the amplitude and shape of this leakage field, which is then mapped circumferentially and axially to identify and locate anomalies.

The Baker Hughes HRVRT (High-Resolution Vertilog Radial Tool) is a leading example of modern MFL-based casing inspection. Unlike early single-channel MFL devices, the HRVRT incorporates a full radial array of flux sensors distributed circumferentially around the tool body. This configuration provides accurate, high-resolution 360° imaging of the casing interior, enabling the detection and precise sizing of localized pitting and small-scale corrosion features.

The logging tools will identify wall loss; however, the nature or source of the wall loss is unknown. Furthermore, all the logging tools have tolerances and thresholds for wall loss. Wall loss can be caused by manufacturing defects, wear, deformation resulting from well operations, or corrosion. Re-inspection aims to identify any changes in wall loss. An increase in wall loss could indicate that corrosion is the operational mechanism; however, no changes (or changes in wall thicknesses that are within the tool tolerance) would suggest that manufacturing or deformation due to operations is the cause. It's essential to note that two consecutive inspection runs should be sufficiently spaced to accurately detect corrosion. If they are spaced too closely, they will not detect any increase in wall loss and will not provide any insight into the corrosion rate.

The need for repeated wall thickness measurements arises from the possibility of increased wall loss due to corrosion, which may occur at either the inner diameter (ID) or the outer diameter (OD) of the production casing. In UGS wells, corrosion is the only time-dependent threat that would require casing wall thickness measurements.

Knowing the corrosion mechanism, especially the corrosidents, conservative estimates of corrosion rates can be quantified and are discussed in this document.

OD corrosion may occur on the production casing, with causes that are location-specific. Above the surface casing shoe, in the annulus between the surface casing and the production casing (the 'B' annulus), corrosion may occur due to the presence of annular fluid. Another possible cause in the 'B' annulus can occur if aquifer water enters the annulus through the surface casing. Below the surface casing shoe, OD corrosion may occur due to exposure to fluids from unknown formations. Predicting corrosion rate or wall loss on the OD of the production casing is challenging, given the uncertainty in these fluids. However, with knowledge of the aquifer chemistry, corrosion rates can be predicted, and often the aquifer may contain oxygen and CO₂. This is discussed later in the section below. However, if the mechanism is microbially induced corrosion, the rates are unpredictable. There are literature estimates of MIC that can be used; these are from laboratory and field experiments. Therefore, in some cases, OD corrosion rate can be estimated; in others, it can only be established through multiple inspections, spaced far enough apart to detect an increase in wall loss or to confirm no detectable increase.

ID corrosion of the production casing, on the other hand, is quantitatively predictable, since the internal environment can be predicted with a degree of certainty. The internal gas composition is available, and

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the packer fluid composition is known as well. The CO₂ concentration is approximately 0.88% with no H₂S; this is the primary corrosive agent.

4.1 Production Casing ID Corrosion

Blade used the commercial software OLI to model corrosion of the production casing ID, resulting from potential CO₂ in the annulus between the production casing and the tubing (known as the 'A' annulus).

OLI Systems software applies an electrolyte thermodynamics framework to accurately simulate complex downhole environments where brines, dissolved gases, and hydrocarbon phases coexist. The process begins with speciation modeling, where the software computes equilibrium distributions of aqueous, gas, solid, and hydrocarbon phases based on wellbore pressure, temperature, and composition. This enables the prediction of key environmental factors, such as pH, redox potential, and the stability of corrosion-relevant species (e.g., CO₂, H₂S, Fe²⁺, carbonate, and sulfide solids).

For corrosion assessment, OLI employs electrochemical kinetic models built on mixed-potential theory. The software estimates the anodic dissolution rate of carbon steel and the competing cathodic reactions (e.g., hydrogen evolution, oxygen reduction, CO₂/H₂S reduction pathways). By coupling thermodynamic speciation with rate expressions for charge-transfer processes, OLI provides quantitative predictions of general corrosion rates, localized corrosion risk, and the impact of scale or film formation on steel tubulars.

This integrated thermodynamic-electrochemical approach enables scenario testing of how variations in pressure, temperature, water chemistry, or gas composition affect the corrosivity of the downhole environment and, consequently, the carbon steel wall-loss rate.

The injected and withdrawn gas flows through the tubing, and because of the packer completion, the production casing is not typically exposed to the natural gas. The typical gas composition is summarized in Table 1. It is predominantly methane, and the CO₂ concentration crucial to corrosion is 0.88 mole percent.

PG&E provided the safety data sheet for the packer fluid from GEO Drilling fluids. They showed water concentrations ranging from 72% to 98% and sodium chloride concentrations from 2% to 26%. It also has some bactericides (glutaraldehyde) and corrosion inhibitors.

In the presence of the packer fluid, there will be no wall loss or corrosion, as the fluid contains no corrosive agents. Under normal operating conditions, the time-dependent wall loss is negligible or zero in the production casing.

However, if there is a tubing leak —either at a connection or at the packer —that results in gas ingress into the annulus, there is a distinct possibility of wall loss or corrosion.

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Table 1: Typical Gas composition at MacDonald Island Whiskey Slough

Component	Value
H ₂ O	0.0
N ₂	0.422000
CO ₂	0.885200
H ₂ S	0.0
CH ₄	91.8300
C ₂ H ₆	5.72990
C ₃ H ₈	0.871300
i-C ₄ H ₁₀	0.0955000
n-C ₄ H ₁₀	0.116400
i-C ₅ H ₁₂	0.0222000
n-C ₅ H ₁₂	0.0151000
C ₆ H ₁₄	0.0146000

OLI was utilized to estimate this corrosion rate and pH as a function of well depth. The corrosion modeling considered the following:

- Mixed injection gas with packer fluid in a 50/50 mass ratio
- Pressure and temperature to estimate the downhole environment
 - To estimate pressure and temperature profiles during withdrawal and injection, a well from each of the Los Medanos and McDonald Island fields was modeled and analyzed in StrinGnosis. Well data were provided by PG&E, along with the relevant surface pressures and temperatures, the geothermal temperature, and the injection/withdrawal rates.

4.1.1 McDonald Island Corrosion Results

The results for the McDonald Island withdrawal and injection cases are shown in Figure 4 and Figure 5 . The corrosion rate approaches a maximum of 1.2 mpy (mils per year) in the deepest section of the wellbore. In contrast, it is approximately 0.3 mpy in the shallower section for the withdrawal case. For the injection case, the rates range from 0.44 to 0.57 mpy. The pH in both instances was around 6.

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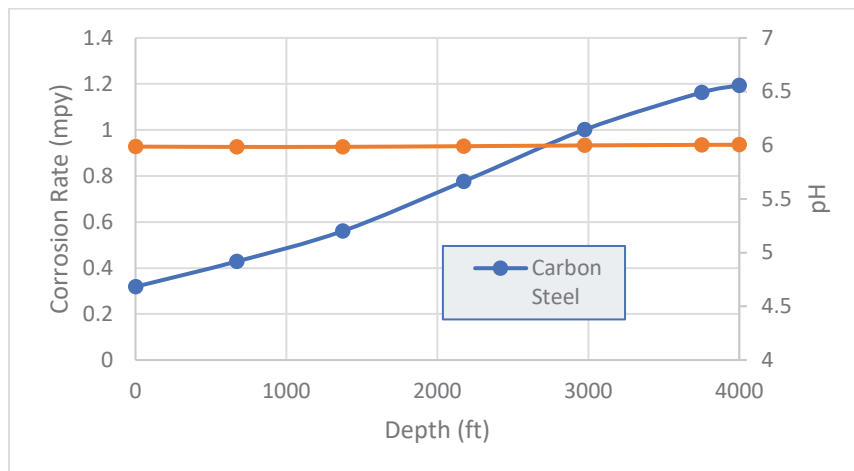


Figure 4: pH and Corrosion rate as a function of depth – McDonald withdrawal

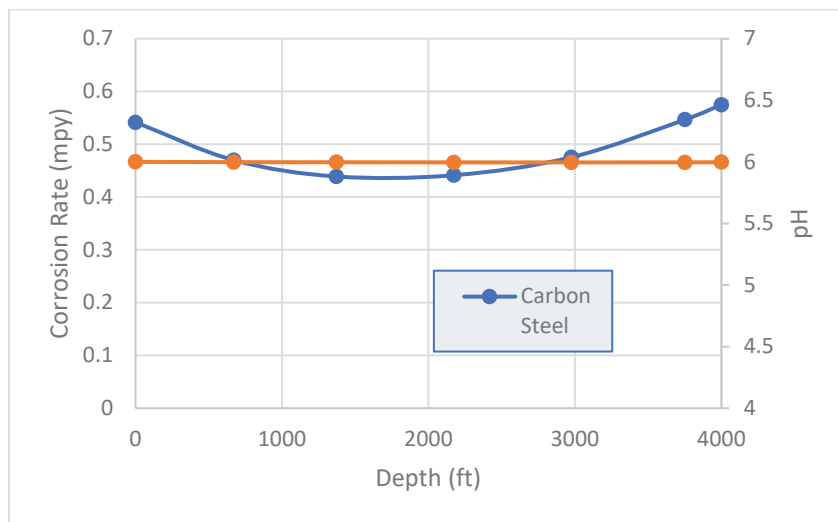


Figure 5: pH and Corrosion rate as a function of depth – McDonald injection

It's important to note that the corrosion rates discussed above assume that there is a constant replenishment of the injection gas in the 'A' annulus. This is a highly conservative scenario assumption.

The more likely scenario is that the gas leaks into the annulus, remains stagnant within it, and is not replenished. Since the gas is trapped in a confined volume, a conservative assumption is made: it is assumed that all the CO₂ will be consumed, and that there is adequate water (packer fluid) for the reaction.

In the following analysis, the gas occupies the annulus between the tubing and production casing strings, containing 0.88% CO₂. During corrosion, it is assumed that the CO₂ is consumed in the corrosion of Fe from the steel. Once all the CO₂ is consumed, as shown in the chemical reaction below, the wall loss will stop.



These assumptions allow us to estimate the maximum quantity of iron lost and, consequently, wall loss.

- The annulus volume was calculated using:
 - Inner Diameter of Casing: 7.825 in.

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- Outer Diameter of Tubing: 4.5 in.
- For the temperature and pressure conditions, the highest density calculated using OLI is 0.11 g/ml
- Reaction Stoichiometry is 1 mol CO₂ to 1 mol Fe. One mole of iron reacts with one mole of CO₂ to form iron carbonate. We assume that excess water is present.
- Based on these assumptions, there is enough CO₂ to oxidize iron (II) carbonate, 0.051 kg of steel tubular.
- Dividing the volume of steel consumed by the affected area, the calculated wall loss would be 0.0025 mils.

This assumed model results in a wall loss of 0.0025 mils per instance of exposure or annulus leak. Note, this only occurs when there is a leak into the A annulus.

4.1.2 Los Medanos Corrosion Results

The results for the Los Medanos withdrawal and Injection cases are shown in Figure 6 and Figure 7. The corrosion rate approaches a maximum of 0.8 mpy (mils per year) in the deepest section of the wellbore. In contrast, it is approximately 0.4 mpy in the shallower section for the withdrawal case. For the injection case, the rates range from 0.44 to 0.57 mpy. The pH in both instances was around 6.

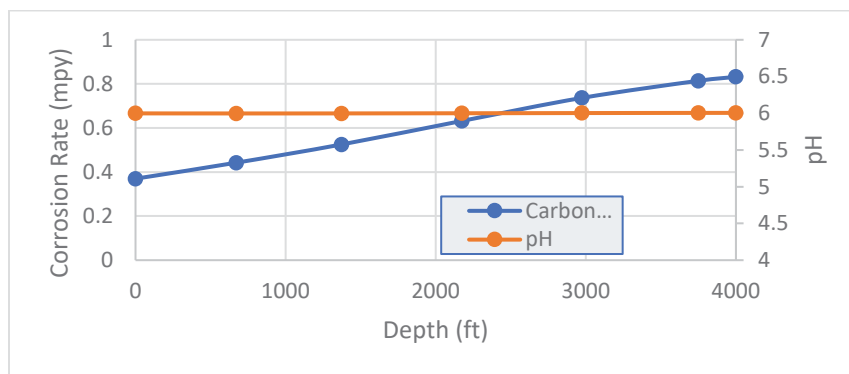


Figure 6: pH and Corrosion rate as a function of depth – Los Medanos withdrawal

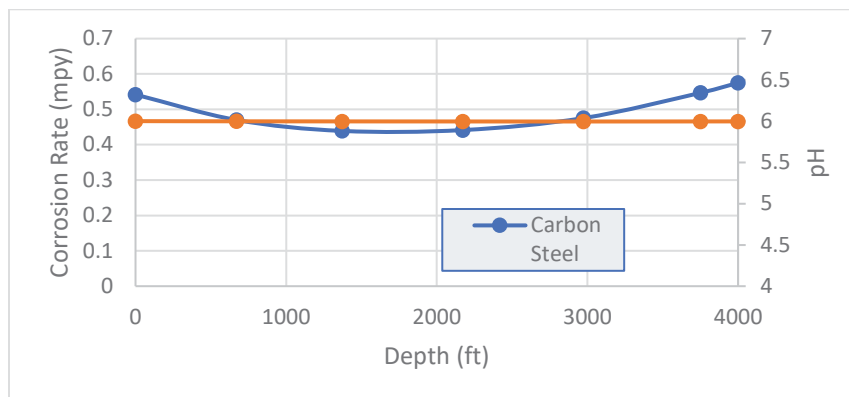


Figure 7: pH and Corrosion rate as a function of depth – Los Medanos injection

As discussed in the previous section, in the case of a leak, the most likely scenario is that the gas is trapped in the 'A' annulus and is not replenished. Since the gas is trapped in a confined volume, a conservative assumption is made here; it is assumed that all the CO₂ will be consumed, and there is believed to be adequate water (packer fluid) for such a reaction.

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In the following analysis, the gas occupies the annulus between the tubing and production casing strings and contains 0.88% CO₂. During corrosion, it is assumed that the CO₂ is consumed in the corrosion of Fe from the steel. Once the CO₂ is fully consumed, as shown in the chemical reaction below, the wall loss will stop.

These assumptions allow us to estimate the maximum quantity of iron lost and, consequently, wall loss.

- The annulus volume was calculated using:
 - Inner Diameter of Casing 6.366 in.
 - Outer Diameter of Tubing 4.5 in
- For the temperature and pressure conditions, the highest density calculated using OLI is 0.11 g/ml
- Reaction Stoichiometry is 1 mol CO₂ to 1 mol Fe. One mole of iron reacts with one mole of CO₂ to form iron carbonate. We assume that excess water is present.
- Based on these assumptions, there is enough CO₂ to oxidize iron (II) carbonate, 0.025 kg of steel tubular.
- Dividing the volume of steel consumed by the affected area, the calculated wall loss would be 0.001 mils.

This assumed model results in a wall loss of 0.001 mils per instance of exposure or leak into the annulus. Noe, this only occurs when there is a leak into the 'A' annulus.

4.2 OD Corrosion

Blade doesn't have details around the aquifer chemistry in Northern California. However, taking some typical aquifer water chemistry consisting of the following:

- 100 ppm Bicarbonate
- 4 mg/L of CO₂ and 2 mg/L of oxygen
- pH of 7.5

Corrosion rate was estimated using OLI for the water chemistry assumed above for a small range of temperatures, as shown below in Figure 8; ranging from 1.4 to 2.3 mpy.

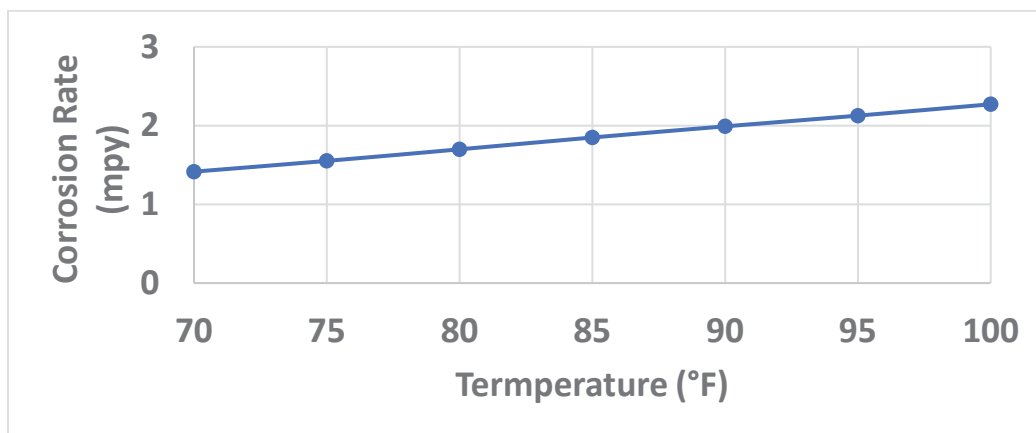


Figure 8: OD Corrosion rate as a function of temperature

(PG&E-15)

It is essential to note that if microbiologically induced corrosion is a potential mechanism, estimating corrosion rates can be challenging. There is literature data indicating rates of around 1.5 mpy; however, the localized corrosion rates can be higher.

4.3 Key Takeaways

- Wall thickness logging tools based on magnetic flux leakage can quantify the ID and OD wall loss anomalies. The frequency should be high enough that any increase in wall loss exceeds the tolerances. A 24-month frequency is too frequent and inadequate for quantifying wall loss; it may even be misleading. For internal corrosion, based on the estimated corrosion rate, the frequency should be around 25 years. For external corrosion, depending on the extent of mitigation and mechanism, it can be anywhere from 5 to 25 years.
- OD corrosion could be caused due to various factors such as 'B' annulus fluid, or 'B' annulus fluid plus fresh water ingress from the surface casing; further, the mechanism could be due to oxygen corrosion or microbiological activity. Oxygen corrosion rates can be predicted, and a typical aquifer corrosion rate with oxygen and CO₂ appears to range from 1.2 to 2.2 mpy. Microbiologically induced corrosion rates are difficult to predict. Other than MIC, the frequency would approach 12 to 25 years. For MIC, a five year frequency can be considered and then extended based on rate estimate, if there is growth.
- ID corrosion rate modeling was conducted for scenarios where the storage gas leaks into the 'A' annulus. Depending on the scenario, the corrosion rate could range from 1.2 mpy to 0.31 mpy. This modeling assumes that the storage gas in the annulus continues to be replenished. A more realistic scenario is that the storage gas is trapped in the annulus. This will not result in ongoing corrosion or wall loss, and the wall loss for each such leak event would be around 0.001 to 0.0025 mils.

(PG&E-15)

5 Load Medanos Field

The Los Medanos gas storage field, situated in the hills northeast of the Naval Weapons Depot near Concord in Contra Costa County, California, plays a crucial role in meeting the demand of major areas in the northern East Bay. Initially discovered in April 1958 and depleted by July 1973, the field was repurposed and became fully operational as a storage facility in 1981.

5.1 Field Summary

The facility operates from the Domingue Formation of the Eocene era, at an approximate depth of 4,100 feet, with an average reservoir thickness of 150 feet. Storage operations rely on cemented casing completions and a mix of injector/withdrawal and observation wells. Field elevations range from near sea level to more than 550 ft. The field sees a maximum storage pressure of 1,600 psi at the wellhead, with a maximum bottom hole storage pressure of 1,774 psi and a MAOP of 1,800 psi. It has a storage capacity of 16 BCF.

The Los Medanos field has 20 wells, spread over four pads: A, B, C, and D. The general field layout is shown in Figure 9, with a well-type breakdown given in Table 2.



Figure 9: Los Medanos Field Layout

(PG&E-15)

Table 2: Los Medanos Well Breakdown

Pad	I/W	P&A	OBS	Total	Total (Non-P&A)
A	2	1	1	4	3
B	2	1	0	3	2
C	6	0	2	8	8
D	5	0	0	5	5
Total	15	2	3	20	18

The wells are similar in design and can be generically described as shown in Table 3. The casing strings were attempted to be fully cemented, but in many cases, the bond quality was deficient, and PG&E adjusted effective TOCs after the fact.

Table 3: Los Medanos Well Configuration

String	OD	Weight	Grade	MD (ft)
Conductor	20			50
Surface	10 ¾	40.5	K55	900
Production	7	23	K55	4000
Liner	4	11.6	L80	4200
Tubing	4 ½ x 3 ½	12.6 x 9.2	L80	3900

5.2 Well Inspection Summary

Baseline casing inspections of all wells were completed in 2023. Tubing and packer conversions were completed in 2025.

A summary of the wells with and without features is shown in Table 4 and is broken down by platform.

Table 4: Los Medanos Wells with Features, by Platform

Platform	Features Identified			
	YES		NO	
	Count	%	Count	%
A	1	25%	3	75%
B	2	67%	1	33%
C	4	50%	4	50%
D	3	60%	2	40%
Totals:	10	50%	10	50%

Fifty percent of the wells in Los Medanos show no indication of Class 2 casing features.

(PG&E-15)

5.2.1 Well Tables

The wells in the Los Medanos field have been broken down into several categories: P&A, No Identified Features (Class 2 or greater), with Identified Features & 1 Inspection, and with Identified Features & 2 Inspections, as shown in Table 5, Table 6, Table 7 and Table 8, respectively. These tables also indicate wells that have had inner casings installed, as well as those with at least one external feature identified. Dates are also provided for tubing and packer conversions.

Table 5: Los Medanos P&A Wells

<u>Well Name</u>	<u>Station or Routing</u>	<u>Feature(s) Identified</u>	<u>External Features</u>	<u>Inner Casing</u>	<u>Reinspection Determination per UGS C-P</u>	<u>Tubing & Packer Conversion</u>	<u>Last MFL Inspection</u>	<u>Next Planned MFL Inspection</u>
LM-1A	Platform A	No			P&A		P&A	P&A
LM-4B	Platform B	Yes			P&A		P&A	P&A

Table 6: Los Medanos Wells with No Identified Features

<u>Well Name</u>	<u>Station or Routing</u>	<u>Feature(s) Identified</u>	<u>External Features</u>	<u>Inner Casing</u>	<u>Reinspection Determination per UGS C-P</u>	<u>Tubing & Packer Conversion</u>	<u>Last MFL Inspection</u>	<u>Next Planned MFL Inspection</u>
LM-2A	Platform A	No			TBD	2025	2016	2025
LM-12C	Platform C	No			TBD	2025	2016	2025
LM-3A	Platform A	No			5-8 year	2022	2022	2027
LM-7C	Platform C	No			5-8 year	2022	2022	2027
LM-6B	Platform B	No			12-15 year	2022	2022	2034
LM-10C	Platform C	No			12-15 year	2021	2021	2033
LM-11C	Platform C	No			12-15 year	2020	2020	2032
LM-16D	Platform D	No			12-15 year	2021	2021	2033
LM-19D	Platform D	No			12-15 year	2022	2022	2034

Table 7: Los Medanos Wells with Features & 1 Inspection

<u>Well Name</u>	<u>Station or Routing</u>	<u>Feature(s) Identified</u>	<u>External Features</u>	<u>Inner Casing</u>	<u>Reinspection Determination per UGS C-P</u>	<u>Tubing & Packer Conversion</u>	<u>Last MFL Inspection</u>	<u>Next Planned MFL Inspection</u>
LM-15C (OBS)	Platform C	Yes			5-8 year	2019	2019	2027
LM-14C	Platform C	Yes			5-8 year	2023	2023	2028
LM-17D	Platform D	Yes	Y		5-8 year	2021	2021	2026
LM-9C	Platform C	Yes	Y		5-8 year	2023	2023	2028

Table 8: Los Medanos Wells with Features & 2 Inspections

<u>Well Name</u>	<u>Station or Routing</u>	<u>Feature(s) Identified</u>	<u>External Features</u>	<u>Inner Casing</u>	<u>Reinspection Determination per UGS C-P</u>	<u>Tubing & Packer Conversion</u>	<u>Last MFL Inspection</u>	<u>Next Planned MFL Inspection</u>
LM-20D	Platform D	Yes			12-15 year	2020	2024	2036
LM-21D	Platform D	Yes			8-12 year	2023	2023	2031
LM-5B	Platform B	Yes	Y		5-8 year	2025	2024	2029
GINO-3 (OBS)	Platform A	Yes	Y		12-15 year	2024	2024	2036
LM-13C	Platform C	Yes	Y		5-8 year	2023	2024	2029

(PG&E-15)

5.3 StrinGnosis Analysis, Minimum Required Wall

The commercial program StrinGnosis® was used to evaluate the minimum wall thickness of the standard 7 in. 23 ppf K55 Production Casing. A typical well configuration was used, based on the casing program previously described in Table 3; the Wellbore Schematic is shown in Figure 10. The well was assumed to be vertical, with a linear geothermal temperature of 60 °F at surface and 119 °F at TD. The packer fluid was conservatively assumed to be 10 ppg (but could be as low as 8.33 ppg).

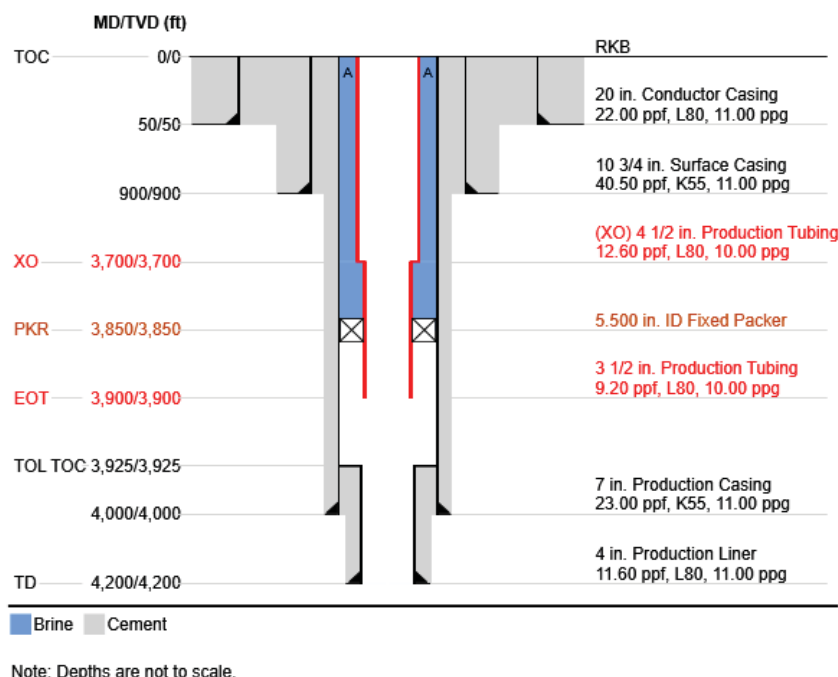


Figure 10: Los Medanos Typical Wellbore Schematic

The design-dictating load on the production casing occurs when a production tubing leak occurs during withdrawal conditions (12 MMcf/D). As a worst-case scenario, the tubing leak is assumed to occur at the surface at the maximum field operating pressure of 1,600 psi. This surface pressure, combined with the hydrostatic 10 ppg of the packer fluid, imparts a burst load on the production casing. At nominal conditions, this results in a minimum burst safety factor of 2.22 and a corresponding 2.31 triaxial safety factor.

Assuming minimum burst and triaxial design factors of 1.1 and 1.25, respectively, a maximum allowable wall loss of the production casing can be estimated. Wall loss can occur due to corrosion, mechanical means, or a combination of both. These results are shown in Figure 11.

(PG&E-15)

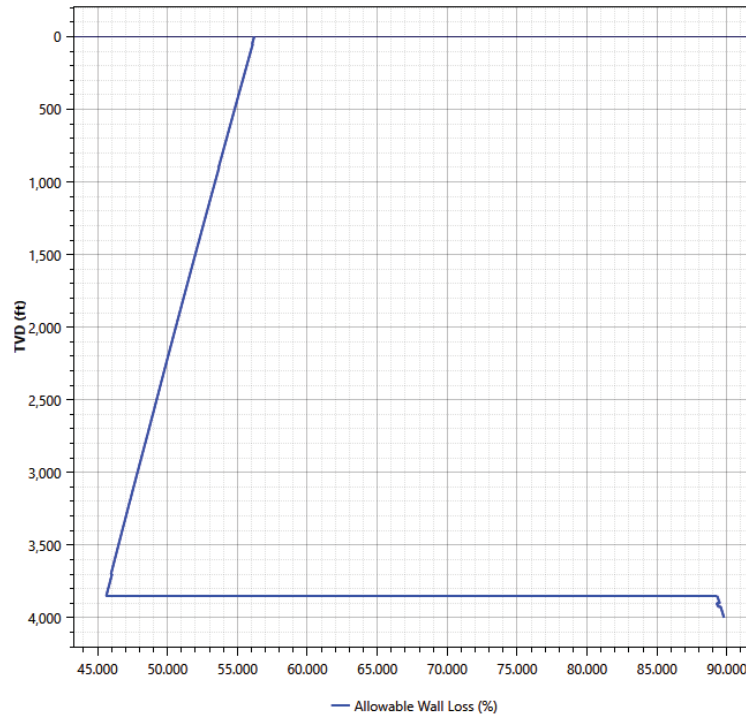


Figure 11: Los Medanos, Allowable Wall Loss on Production Casing (7 in. 23 ppf K55)

As shown, the minimum allowable wall loss occurs at the packer depth, where the combined surface pressure and hydrostatic pressure from the packer fluid are at their greatest. In the case of this “typical” Los Medanos well, with maximum field pressures, the allowable wall loss is shown to be approximately 45% (resulting in 55% remaining body wall). These results are consistent with those provided by PG&E for well LM 17-D, which indicated a maximum allowable wall loss of 45-50% (resulting in 50-55% of the body wall remaining).

For reference, if the packer fluid is 8.33 ppg, the allowable wall loss would be 54% (resulting in 46% of the body wall remaining).

(PG&E-15)

6 McDonald Island Field

The McDonald Island gas storage field, located in San Joaquin County about ten miles west of Stockton in the California Delta, is the largest of PG&E's three underground storage fields and the second largest in the state. It is situated on an island platform roughly 12 ft below sea level, accessed by a bridge. It is capable of meeting approximately 35% of Northern California's winter peak-day gas demand. The field was initially discovered in June 1936, depleted by March 1958, repurposed, and fully developed as a storage facility by 1975.

6.1 Field Summary

The facility operates in the Mokelumne River formation of the Late Cretaceous era, at an approximate depth of 5,200 ft with an average reservoir thickness of 50 ft. Storage operations rely on cemented casing completions and a mix of injector/withdrawal and observation wells. The field experiences fog and peat soil conditions and requires cathodic protection to control corrosion of the surface casing. The field sees a maximum wellhead storage pressure of 2,070 psi, a maximum bottom-hole storage pressure of 2,365 psi, and a facility MAOP of 2,160 psi. McDonald Island maintains a total storage capacity of 82 BCF.

The McDonald Island field has 91 wells, distributed across two main production platforms (each with 34-36 wells) along with peripheral sites. Most of the operating facilities are installed on platforms above sea level or engineered to continue operating under flooded conditions. The general field layout is shown in Figure 12, Figure 13 and Figure 14 with well-type breakdown given in Table 9.

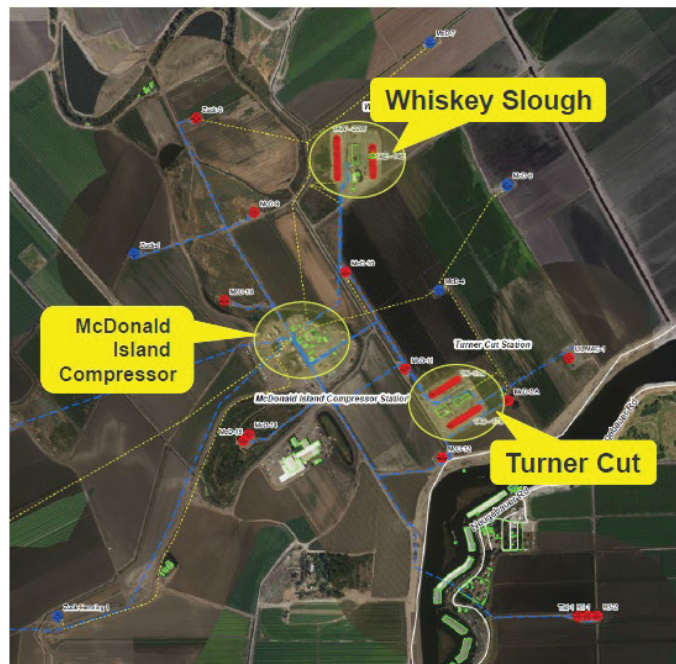


Figure 12: McDonald Island Field Layout

(PG&E-15)



Figure 13: McDonald Island – Turner Cut Station



Figure 14: McDonald Island – Whiskey Slough Station

Table 9: McDonald Island Well Breakdown

Station or Routing	I/W	P&A	OBS	Injection Only	Total	Total (Non-P&A)
Whiskey Slough West	19	1	1	0	21	20
Whiskey Slough East	14	1	0	0	15	14
Turner Cut North	16	2	0	0	18	16
Turner Cut South	16	1	1	0	18	17
Non-platform well-Routing TC	4	0	0	0	4	4
Non-platform well-Routing WS	2	3	0	1	6	3

(PG&E-15)

Station or Routing	I/W	P&A	OBS	Injection Only	Total	Total (Non-P&A)
Non-platform well	1	2	6	0	9	7
Total	72	10	8	1	91	81

The wells are similar in design and can be generically described as shown in Table 10. The casing strings were attempted to be fully cemented, but in many cases, the bond quality was deficient, and PG&E adjusted effective TOCs after the fact.

Table 10: McDonald Island Well Configuration

String	OD (in)	Weight (ppf)	Grade	MD (ft)
Conductor	20			80
Surface	13 3/8	61	K55	800
Production	8 5/8	36	K55	5,500
Liner	5 ½	17	L80	5,700
Tubing	4 ½	12.6	L80	5,400
(Inner String)	7	26	L80	5,400

6.2 Well Inspection Summary

Baseline casing inspections of all wells were completed in 2023. Tubing and packer conversions were completed in 2025.

A summary of the wells with and without features is shown in Table 4 and is broken down by platform.

Table 11: McDonald Island Wells with Features, by Platform

Station	Features Identified			
	YES		NO	
	Count	%	Count	%
Turner Cut South	12	67%	6	33%
Turner Cut North	12	75%	4	25%
Whiskey Slough East	6	40%	9	60%
Whiskey Slough West	17	81%	4	19%
Non-Platform well	8	44%	10	56%
Totals:	55	63%	33	38%

(PG&E-15)

6.2.1 Well Tables

The wells in the McDonald Island field have been broken down into several categories: P&A, No Identified Features (Class 2 or greater), with Identified Features & 1 Inspection, and with Identified Features & 2 Inspections, as shown in Table 12, Table 13, Table 14 and Table 15, respectively. These tables also indicate wells that have had inner casings installed, as well as those with at least one external feature identified. Dates are also provided for tubing and packer conversions. The wells in the Los Medanos field have been broken down into several categories: P&A, No Identified Features (Class 2 or greater), with Identified Features & 1 Inspection, and with Identified Features & 2 Inspections, as shown in Table 5, Table 6, Table 7 and Table 8, respectively. These tables also indicate wells that have had inner casings installed, as well as those with at least one external feature identified. Dates are also provided for tubing and packer conversions.

Table 12: McDonald Island P&A Wells

<u>Well Name</u>	<u>Station or Routing</u>	<u>Feature(s) Identified</u>	<u>External Features</u>	<u>Inner Casing</u>	<u>Reinspection Determination per UGS C-P</u>	<u>Tubing & Packer Conversion</u>	<u>Last MFL Inspection</u>	<u>Next Planned MFL Inspection</u>
MCD-14	Non-Platform well	No			P&A		P&A	P&A
ROB-2	Non-Platform well	No			P&A		P&A	P&A
TC-6S	TurnerCutSouth	No		Y	P&A		P&A	P&A
MCD-15	Non-Platform well	Yes			P&A		P&A	P&A
TC-1N	Turner Cut North	Yes			P&A		P&A	P&A
TC-9N	Turner Cut North	Yes		Y	P&A		P&A	P&A
TILD-1	Non-Platform well	Yes			P&A		P&A	P&A
WS-10E	Whiskey Slough East	Yes			P&A		P&A	P&A
WS-14W	Whiskey Slough West	Yes			P&A		P&A	P&A
WS-1E	Whiskey Slough East	Yes			P&A		P&A	P&A
ZUCK-3	Non-Platform well	Yes			P&A		P&A	P&A

(PG&E-15)

Table 13: McDonald Island Wells with No Identified Features

<u>Well Name</u>	<u>Station or Routing</u>	<u>Feature(s) Identified</u>	<u>External Features</u>	<u>Inner Casing</u>	<u>Reinspection Determination per UGS C-P</u>	<u>Tubing & Packer Conversion</u>	<u>Last MFL Inspection</u>	<u>Next Planned MFL Inspection</u>
TC-1AS	TurnerCutSouth	No			TBD	2024	2017	2025
TC-1S	TurnerCutSouth	No			TBD	2024	2018	2025
TC-17S	TurnerCutSouth	No			TBD	2024	2018	2025
WS-1AW	Whiskey Slough West	No			TBD	2024	2018	2025
LMAC-1	Non-Platform well	No			5-8 year	2021	2021	2026
ROB-1 (OBS)	Non-Platform well	No			12-15 year	2019	2019	2031
TC-7S	TurnerCutSouth	No			12-15 year	2019	2019	2031
WS-6E	Whiskey Slough East	No			12-15 year	2019	2019	2031
WS-11E	Whiskey Slough East	No			12-15 year	2019	2019	2031
ZUCK-H (OBS)	Non-Platform well	No			12-15 year	2020	2020	2032
TC-12N	Turner Cut North	No			12-15 year	2020	2020	2032
WS-1AE	Whiskey Slough East	No			12-15 year	2020	2020	2032
WS-5E	Whiskey Slough East	No			12-15 year	2020	2020	2032
WS-7E	Whiskey Slough East	No			12-15 year	2020	2020	2032
WS-9E	Whiskey Slough East	No			12-15 year	2020	2020	2032
MCD-10	Non-Platform well	No			12-15 year	2020	2020	2032
MCD-11	Non-Platform well	No			12-15 year	2020	2020	2032
MCD-12	Non-Platform well	No			12-15 year	2020	2020	2032
WS-2W	Whiskey Slough West	No			12-15 year	2021	2021	2033
MCD-13	Non-Platform well	No			12-15 year	2021	2021	2033
TC-5N	Turner Cut North	No			12-15 year	2022	2022	2034
TC-17N	Turner Cut North	No			12-15 year	2022	2022	2034
WS-18W	Whiskey Slough West	No			12-15 year	2022	2022	2034
MCD-5A	Non-Platform well	No			12-15 year	2022	2022	2034
WS 1-E RD	Whiskey Slough East	No			12-15 year		2023	2035
TC 1A-N	Turner Cut North	No			12-15 year		2024	2036
TC 1B-N	Turner Cut North	No			12-15 year		2024	2036
LMAC-2	Non-Platform well	No			12-15 year		2024	2036
TC-10N	Turner Cut North	No		Y	TBD	2024	2017	2025
WS-3E	Whiskey Slough East	No		Y	TBD	2024	2017	2025
WS-8E	Whiskey Slough East	No		Y	12-15 year	2019	2019	2031
WS-14E	Whiskey Slough East	No		Y	12-15 year	2019	2019	2031
TC-10S	TurnerCutSouth	No		Y	12-15 year	2020	2020	2032
WS-11W	Whiskey Slough West	No		Y	12-15 year	2020	2020	2032

(PG&E-15)

Table 14: McDonald Island Wells with Features & 1 Inspection

<u>Well Name</u>	<u>Station or Routing</u>	<u>Feature(s) Identified</u>	<u>External Features</u>	<u>Inner Casing</u>	<u>Reinspection Determination per UGS C-P</u>	<u>Tubing & Packer Conversion</u>	<u>Last MFL Inspection</u>	<u>Next Planned MFL Inspection</u>
TC-16S	TurnerCutSouth	Yes			TBD	2024	2018	2025
WS-3W	Whiskey Slough West	Yes			5-8 year	2021	2021	2026
TC-13N	Turner Cut North	Yes			5-8 year	2022	2022	2027
TC-13S	TurnerCutSouth	Yes			5-8 year	2023	2023	2028
TC-8N	Turner Cut North	Yes			5-8 year	2023	2023	2028
WS-15W	Whiskey Slough West	Yes			5-8 year	2023	2023	2028
WS-7W	Whiskey Slough West	Yes			12-15 year	2019	2019	2031
WS-4E	Whiskey Slough East	Yes			12-15 year	2020	2020	2032
WS-13E	Whiskey Slough East	Yes			12-15 year	2020	2020	2032
MCD-9 (Inj)	Non-Platform well	Yes			12-15 year	2021	2021	2033
WS-9W	Whiskey Slough West	Yes			12-15 year	2021	2021	2033
TC-6N	Turner Cut North	Yes			12-15 year	2022	2022	2034
TC-16N	Turner Cut North	Yes			12-15 year	2022	2022	2034
MCD-7 (OBS)	Non-Platform well	Yes			12-15 year	2023	2023	2035
WS-10W	Whiskey Slough West	Yes			12-15 year	2023	2023	2035
WS-20W	Whiskey Slough West	Yes			12-15 year	2024	2024	2036
WS-2E	Whiskey Slough East	Yes		Y	TBD		2017	2025
WS-5W	Whiskey Slough West	Yes		Y	TBD		2024	2025
TC-7N	Turner Cut North	Yes		Y	5-8 year	2023	2023	2029
WS-12E	Whiskey Slough East	Yes		Y	12-15 year	2020	2020	2032
WS-16W	Whiskey Slough West	Yes		Y	12-15 year	2020	2020	2032
TC-11N	Turner Cut North	Yes		Y	12-15 year	2021	2021	2033
TC-4S	TurnerCutSouth	Yes		Y	12-15 year	2021	2021	2033
TC-11S	TurnerCutSouth	Yes		Y	12-15 year	2021	2021	2033
WS-4W	Whiskey Slough West	Yes		Y	12-15 year	2021	2021	2033
TC-15N	Turner Cut North	Yes		Y	12-15 year	2022	2022	2034
TC-5S	TurnerCutSouth	Yes		Y	12-15 year	2022	2022	2034
TC-4N	Turner Cut North	Yes		Y	12-15 year	2023	2023	2035
TC-15S	TurnerCutSouth	Yes		Y	12-15 year	2023	2024	2036
WS-13W	Whiskey Slough West	Yes		Y	12-15 year	2023	2024	2036
MCD-4 (OBS)	Non-Platform well	Yes	Y		12-15 year	2023	2023	2035
MCD-6 (OBS)	Non-Platform well	Yes	Y		12-15 year	2023	2023	2035
ZUCK-1 (OBS)	Non-Platform well	Yes	Y	Y	12-15 year	2019	2019	2031
TC-3N	Turner Cut North	Yes	Y	Y	12-15 year	2023	2023	2035
WS-12W	Whiskey Slough West	Yes	Y	Y	12-15 year	2024	2024	2036

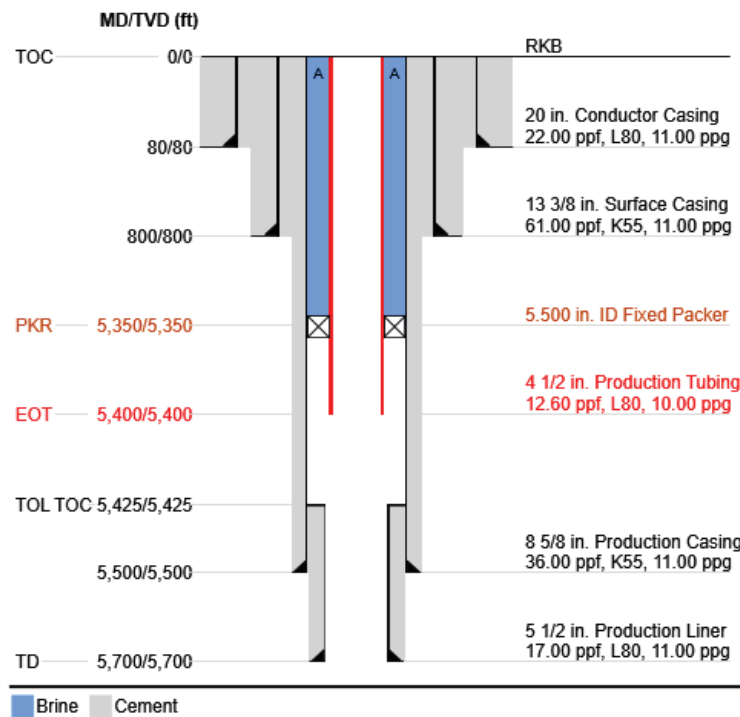
(PG&E-15)

Table 15: McDonald Island Wells with Features & 2 Inspections

Well Name	Station or Routing	Feature(s) Identified	External Features	Inner Casing	Reinspection Determination per UGS C-P	Tubing & Packer Conversion	Last MFL Inspection	Next Planned MFL Inspection
TC-2S	TurnerCutSouth	Yes		Y	TBD	2019	2024	2025
WS-19W	Whiskey Slough West	Yes			TBD	2024	2024	2025
TC-2N	Turner Cut North	Yes			5-8 year	2022	2022	2027
TC-3S	TurnerCutSouth	Yes			5-8 year	2021	2024	2029
WS-17W	Whiskey Slough West	Yes			5-8 year	2024	2024	2029
TC-14S	TurnerCutSouth	Yes			8-12 year	2023	2023	2031
TC-12S	TurnerCutSouth	Yes			12-15 year	2019	2019	2031
TC-8S	TurnerCutSouth	Yes			12-15 year	2021	2021	2033
WS-6W	Whiskey Slough West	Yes			12-15 year	2024	2024	2036
WS-8W	Whiskey Slough West	Yes			12-15 year	2024	2024	2036
TC-9S	TurnerCutSouth	Yes	Y		5-8 year	2023	2023	2028
WS-1W	Whiskey Slough West	Yes	Y	Y	TBD	2024	2024	2025

6.3 StrinGnosis Analysis, Minimum Required Wall

StrinGnosis® was used to evaluate the minimum wall thickness of the standard 8 5/8 in. 36 ppf K55 Production Casing. A typical well configuration was used, based on the casing program previously described in Table 10; the Wellbore Schematic is shown in Figure 15. The well was assumed to be vertical, with a linear geothermal temperature of 60 °F at the surface and 140 °F at TD. The packer fluid was conservatively assumed to be 10 ppg (but could be as low as 8.33 ppg).



Note: Depths are not to scale.

Figure 15: McDonald Island Typical Wellbore Schematic

(PG&E-15)

The design dictating load on the production casing occurs when there is a production tubing leak during withdrawal conditions (15 MMcf/D). As a worst-case scenario, the tubing leak is assumed to occur at surface at the maximum field operating pressure of 2,070 psi. This surface pressure, combined with the hydrostatic 10 ppg of the packer fluid, imparts a burst load on the production casing. At nominal conditions, this results in a minimum burst safety factor of 1.73 and corresponding 1.79 triaxial safety factor.

Assuming minimum burst and triaxial design factors of 1.1 and 1.25 respectively, a maximum allowable wall loss of the production casing can be estimated. Wall loss could occur from corrosion, mechanical means, or a combination of those. These results are shown in Figure 16.

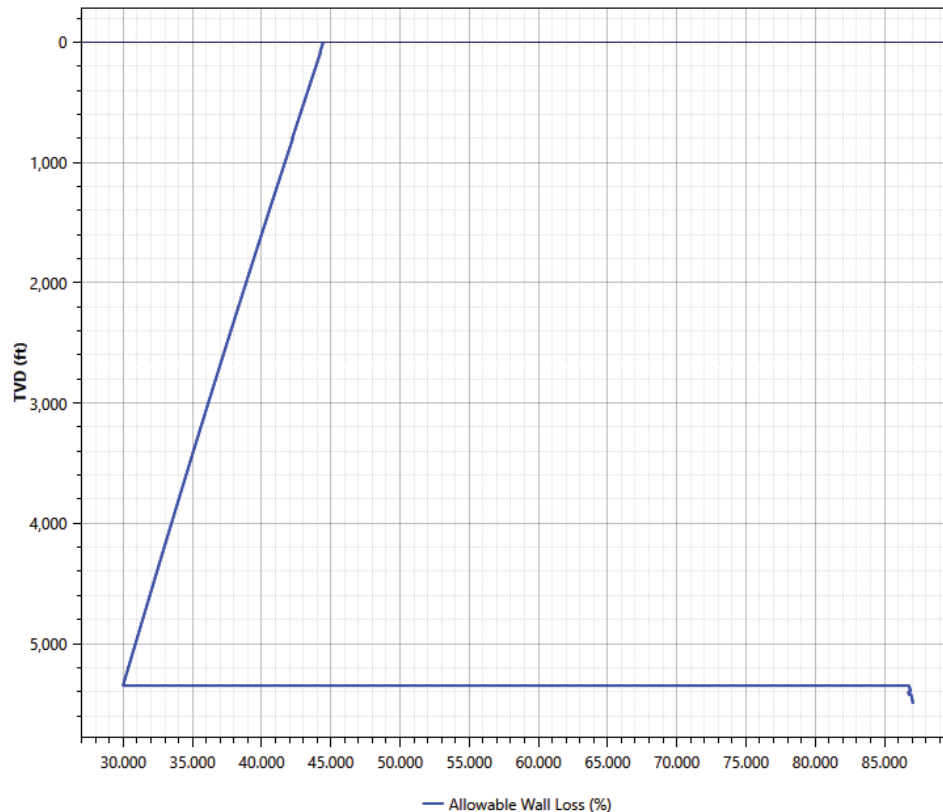


Figure 16: McDonald Island, Allowable Wall Loss on Production Casing (8 5/8 in. 36 ppf K55)

As shown, the minimum allowable wall loss occurs at the packer depth, where the combined surface pressure and hydrostatic from the packer fluid are at their greatest. In the case of this “typical” McDonald Island well, with maximum field pressures, the allowable wall loss is shown to be approximately 30% (resulting in 70% remaining body wall). These results are consistent with those provided by PG&E for wells TC 8-N, WS 17-W and WS 15-W, which generally indicate maximum allowable wall loss of 30-35% (resulting in 65-70% remaining body wall).

For reference, if the packer fluid is 8.33 ppg, the allowable wall loss would be 42% (resulting in 58% remaining body wall).

7 Workover Implications

Per regulatory requirements, PG&E is required to pull tubing in gas storage wells every two years. This approach to managing well integrity, while intended to limit gas release and prevent loss of well control, may increase the likelihood of well control issues.

The use of production packers and tubing as barriers in gas storage wells is a significant step towards improving well integrity and preventing loss of well control (LOWC). However, pulling tubing to inspect the production casing for wall loss and penetrations at short intervals over time will increase PG&E's risk exposure rather than limiting loss-of-well-control (LOWC) events. This section describes the rationale of this standpoint and provides alternatives that will limit PG&E's overall risk profile.

7.1 Barrier Discussion

The basis for these claims lies in pressure control barriers and how barriers are installed, maintained, and switched during operations. The source of the barrier discussion is primarily in two documents: API RP 96 and ISO TS 16530-2. API RP 96 Deepwater Well Design and Construction discusses barriers for deepwater well construction. This document examines the barriers to flow from subsurface formations to the mudline during well construction, testing, and temporary abandonment. However, it does not explicitly address permanent well completions, production, injection, and workover operations. A more comprehensive document for categorizing barriers is the ISO TS 16530-2. This document considers all possible barriers and categorizes them as primary or secondary.

Primary barriers are defined as confirmed isolations near the source of the hydrocarbon resource. A secondary barrier is a confirmed isolation that is either farther from the hydrocarbon resource than the primary barrier or requires action to activate it. The action may be either human or automated, with no human intervention. This is part of regular risk management for energy companies that handle flammable and explosive materials during drilling, completion, workover, and production operations, to limit LOWC events.

In Figure 17, the left hand well sketch is an example of the primary barriers for PG&E production wells. The downhole primary barriers, shown in red, can be broken down into the portion of the tubular below the production packer that penetrates the hydrocarbon-bearing zone and the confirmed cemented annulus (B). The cement and production casing below the packer are the barrier to flow from the reservoir. The production packer and an overbalanced packer fluid comprise the barrier for the tubing annulus (A). For an operating production well, there is no barrier; however, a shut-in production well has a retrievable subsurface safety valve as the barrier (tubing bore).

In Figure 17, the right-hand well sketch illustrates the secondary barriers for PG&E production wells. The secondary barriers are shown in purple and are comprised of the production casing and the tubing hanger on the (B annulus) and the production tree surface safety valve. Depending on the pressure rating and load resistance, the surface casing and wellhead may also serve as a barrier to well flow at the surface.

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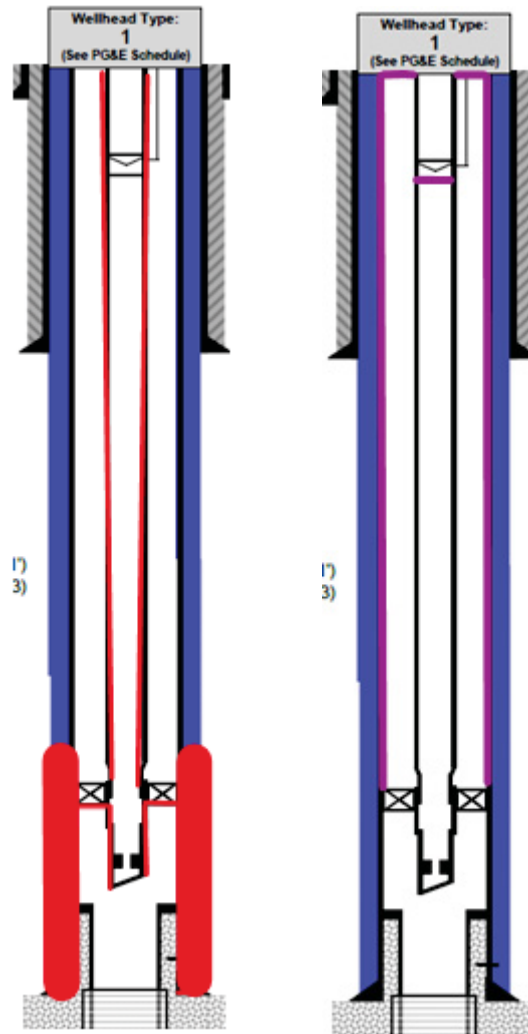


Figure 17: Primary (left in red) and Secondary (right in purple) Barriers in a well

In summary, production tubing serves as the flow conduit for gas storage wells, providing a reliable primary barrier to prevent flow to the environment. Production casing serves as a secondary barrier to prevent well fluids from flowing into the environment. By design, the production casing is minimally exposed to hydrocarbons, cyclic pressure loads, and wall loss due to normal well activities. Production casing is essential for maintaining well integrity and isolating hydrocarbons from the environment.

7.1.1 Production Casing

Having production tubing does not reduce the production casing's exposure to external annular corrosion; however, it does prevent or mitigate internal corrosion. The task of cement in the production casing or 'B' annulus is to mitigate external corrosion. In the case of some wells, the 'B' annulus outside of the production casing is contained by partial cement. However, the leak path to the surface above the surface casing is contained by the casing hanger in the wellhead. The cement sheath and a stable drilling fluid principally manage annular corrosion. However, fluid-bearing formations may increase the corrosion threat to the production casing.

(PG&E-15)

Besides corrosion, formation-induced loads can also threaten the second barrier's integrity and, over time, the primary barrier. Formation-induced loads are principally geological in that compaction, subsidence, and other such formation-induced loading may result in secondary barrier failure, but not in the total loss of well integrity associated with primary barrier failure. If formation-induced loading is a concern, downhole monitoring can improve response time to this threat.

7.1.2 Production Casing Cement

The condition of the production casing cement depends on many factors that should be assessed on a well-by-well basis. These factors are:

1. Cement quality by age of placement.
2. Regulations governing cementing and zonal isolation.
3. Data availability and data quality of the cement placement and monitoring.
4. Cement exposure time to subsurface conditions.
 - a. Debonding - Micro-annuli, stress fractures, and cement voids
 - b. Chemical degradation

Cement integrity greatly influences casing loading and corrosion rates from fluids on the outer casing surface. However, it is essential to understand that the production casing serves as a secondary barrier for well fluid containment. It is vital to overall well integrity, but it is not the primary barrier to flow from the well.

7.1.3 Monitoring Barriers

Well integrity monitoring should focus on primary well barriers. The primary surface barriers are the exposed production tree and master valves. These can be visually monitored, operated, and tested for effectiveness as a barrier. The production packer and tubing can be monitored from the surface without intervention. The tubing and packer can be monitored while the well is operating by measuring pressure in the A annulus. If a well is taken offline, a more direct monitoring of the tubing and connection integrity can be conducted by through tubing logging to assess wall loss over time. Only when an issue with the primary barrier integrity is identified should the well be deactivated and a plan developed for primary barrier replacement and secondary barrier inspection.

For wells that PG&E quantitatively assesses as high risk, additional monitoring measures may be undertaken. These may include the following:

1. Remote monitoring of A and B annulus pressures.
2. Fiber optic distributed acoustic and temperature monitoring.
3. Through-tubing cased hole logging to monitor wall loss.

Fiber-optic monitoring is a significant well intervention and can take two forms. The fiber optic may be placed during a scheduled tubing replacement operation, where it is inserted into the tubing. The second option is placement of the production casing during a scheduled well-relining, where the newly installed production casing features fiber optic capabilities (See Figure 18).

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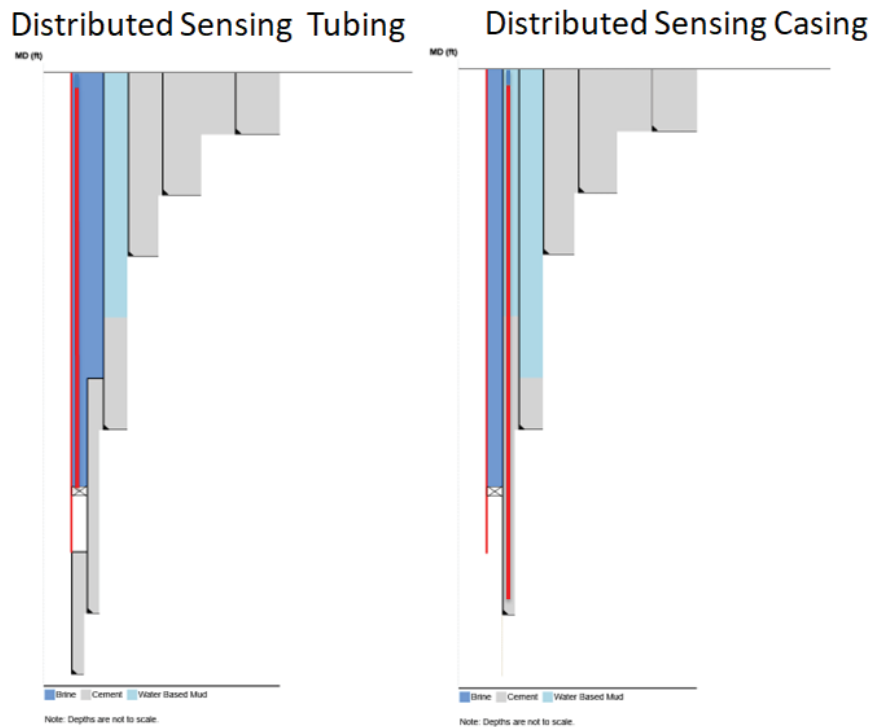


Figure 18: Fiber Optic tubing and casing monitoring

Fiber-optic well monitoring provides long-term monitoring of casing and tubing for integrity issues, eliminating the need for additional intervention. Through-tubing cased-hole logging is a distance measurement inspection of a secondary barrier in the well. It may offer some indication of long-term degradation of the secondary barrier. However, it must be kept in mind that production casing is a secondary barrier that can be monitored by other means that do not require intervention.

7.2 Risk Assessment

The current method required by the state of California involves retrieving the primary barrier from the well to assess the secondary barrier of the gas storage well every two years. This procedure may result in unnecessary well interventions that do not improve the well's overall integrity but instead increase the company's overall risk profile.

The risk can increase due to the following:

1. Through tubing wireline intervention and LOWC.
2. Well intervention with workover rig on the well and placement and removal of well barriers.
3. LOWC's include additional men and equipment on a well operation and well site compared to an unmanned well site.
4. Service and design age considering hazard rate vs. service time resulting in premature failure.

7.2.1 Frequency of LOWC Events

There is significant documented evidence of an increase in incidents of LOWC with intervention operations compared to operating without LOWC. Wireline interventions tracked separately in the Sintef report indicate well releases without loss of well control. Workover operations indicate LOWCs to expect an

(PG&E-15)

additional 12.5% over production wells in operation. There is a higher potential for injuries and fatalities because of increased personnel on location as well as damaged and lost equipment. The only category where the production well risk is higher is the probability of a larger spill with a blowout and surface flow. See Table 16.

Table 16: SINTEF US GoM Frequencies OCS 2000-2015

Main Category	Number of LOWCs to Expect			
	Workover 16,900 wells in service	Completion 400 wells in service	Production 16,900 wells in service	Wireline 16,900 wells in service
Blowout surface flow	1.954	0.088	1.737	0.000
Blowout (underground flow)	0	0	0	0
Diverted well release	0	0.088	0.000	0.000
Well release	2.605	0.088	0.868	0.651
Sum	4.559	0.264	2.605	0.651

7.2.2 Men and Equipment on Location

A typical well in operation on land is unmanned. An unplanned release on an unmanned location impacts the environment but does not result in injury and fatality. However, when a fully functioning primary barrier is pulled from a well, there are many steps, equipment, and personnel on location to perform these activities. If a LOWC event occurs, there is a significantly higher risk of escalation from a release, ignition of hydrocarbons, fatalities, and damages. The severity is dependent upon personnel response, and the company risk profile is much higher for these operations.

7.2.3 Service and design Age

Repeated removal of the tubing, connection, and tubing seal assembly exposes the system to leak paths and possible failures. The packer seal assembly may be redressed for each application; however, the repeated application exposes the system to possible retrieval and installation damages. This is an important factor to consider in the decision-making process of repeated casing inspections. **We are removing a properly functioning primary barrier (tubing), which risks compromising the well integrity to inspect the secondary barrier.**

This concept, as shown in Figure 19, breaks down the startup time, use life, and wear out of a service tool. This example can be applied to production seals, tubing, connections, and tubing hangers. Premature failures refer to the short life of an item that fails early due to the issues listed in the orange column. This is the concern for pulling the fully functional primary barrier to inspect the secondary barrier.

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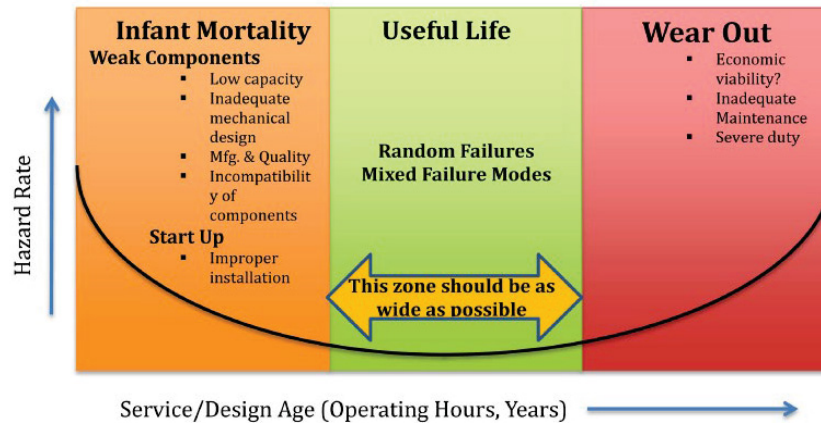


Figure 19: Example of Bathtub Curve, Hazard rate vs. service time

7.3 Key Takeaways

- Production tubing, packer seal assembly, and tail pipe are the primary barriers, and a perfectly operational primary system is removed to inspect the production casing, a secondary barrier. This increases well integrity risks. The casing inspection should be balanced against the primary barrier risk.
- LOWC events are higher during a well workover when compared to production. There is an increased safety risk with repeated workovers. SINTEF data demonstrates this.

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8 Re-Inspection Observations and Suggestions

Blade reviewed the current processes and the well-integrity data book to provide an opinion on the current approach to establishing reinspection frequencies. Suggestions will be provided later in this section.

PG&E has already installed an inner casing string in wells with excessive wall-loss anomalies and has also performed plug-and-abandonment (P&A) on a number of wells. The focus of our assessment is on the operational wells.

Overall, the PG&E re-inspection program is quite conservative. The current upper limit for inspection frequency is 12 to 15 years, which Blade believes is too frequent in certain scenarios. Additionally, Blade believes that inspection frequency of less than 12 to 15 years should consider two factors: corrosion rate estimates from logging and the HRVRT tool's tolerances and uncertainties. One needs to ensure that the increase in wall loss exceeds the tolerances, errors, and uncertainties associated with the chosen inspection frequency. Otherwise, the frequency may be so small that the tool may not detect the increase in wall loss, as it will be obscured by the tool's sizing uncertainties and tolerances.

The only time-dependent wall-loss phenomenon in an underground gas storage well is corrosion, either on the ID or the OD of the casing. The only other cause for wall loss would be well interventions for logging purposes; consequently, logging interventions should be minimized.

8.1 ID Corrosion

ID corrosion was discussed in Section 4 on Wall loss. A scenario in which the storage gas leaks into the 'A' annulus and is continuously replenished was evaluated and found to yield a corrosion rate of 0.34-1.2 mpy. This is a highly conservative estimate, but it still represents a small corrosion rate. For casing ID corrosion to occur, it is necessary to assume a storage gas leak into the annulus. If there is no gas replenishment, the wall loss (not rate) will be in the range of 0.0025 mils. Each event will result in a worst-case wall loss of around 0.0025 mils. If the gas is replenished, the highest corrosion rate is estimated at 1.2 mpy.

The tolerances for HRVRT are unclear; however, let us assume it is +/- 10% of the wall thickness. This assumption is based on previous work with this technology. In this case, a 20% anomaly in the first inspection would correspond to a 10% to 30% range in corrosion depth. A corrosion rate of 1.2 mpy —the highest estimated for ID corrosion —would not be detected in either a 5-year or a 15-year re-inspection. In fact, a 20% anomaly would not exceed the tolerance until 25 years later (at 31.1%).

For any scenario where the anomaly is Class 1, even a 25-year inspection will barely register an increase in wall loss.

8.2 OD Corrosion

OD corrosion can occur in two different places:

- a. Above the surface casing shoe due to the B annulus fluid. This corrosion here will be self-limiting if the fluid is trapped in the annulus. However, if aquifer water infiltrates through the surface casing, it can result in corrosion rates. If it contains oxygen and carbon dioxide, this is predictable; however, if it involves microbial corrosion, it becomes unpredictable.
- b. Below the surface casing shoe, the corrosion is suppressed, depending on the depth, by the cathodic protection.

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8.3 Implications for Reinspection

Blade recommends that PG&E treat ID features differently from OD features, especially given a reasonably accurate estimate of the corrosion rate for ID features.

ID corrosion is more predictable since the storage gas is involved, along with an aqueous environment. As discussed earlier, the corrosion rates are significantly lower in tubing-packer completion. The maximum corrosion rate one would experience if the gas is replenished in the annulus (i.e., vented) would range from 0.34 to 1.2 mpy. If the gas is not vented, the wall loss will not exceed 0.0025 mils. The frequency should be appropriately established based on these assumptions, unless the logging data indicates rates higher than estimated.

If the well exhibits OD corrosion rather than manufacturing anomalies, the inspection frequency should be determined based on additional data regarding the surface casing, CP, and the location of the anomaly. If the anomaly is located above the surface casing shoe, either below or above the TOC would be important. If the corrosion mechanism is unclear, the inspection frequency can be 5 to 8 years. If the anomaly is located below the shoe and in a section where the cement is in good condition, or if the cement is poor but the CP reaches the location, then the inspection frequency can be extended to 12 to 15 years or beyond. Consequently, Blade would suggest that PG&E deal with OD wall loss or corrosion differently from ID wall loss or corrosion. Wells with only ID wall loss could have significantly longer re-inspection frequency, which is clearly justified by the estimated rates of wall loss. To ensure that other OD mechanisms aren't active, annulus monitoring, surface casing condition monitoring, and perhaps through tubing inspection to ensure that surface and production casing don't exhibit new corrosion. It is essential to utilize annulus monitoring and surface casing condition monitoring to reduce the need for casing thickness inspections.

8.4 Proposed Approach

Blade would like PG&E to consider the approach described below. The frequency of casing inspection should be determined by the time-dependent wall-loss mechanism: corrosion. Furthermore, the corrosion mechanism on the casing ID will differ from that on the casing OD, as previously discussed. Not articulated in the flow chart, but tool threshold, tolerances, and sizing accuracy should be accounted for when using corrosion rates to establish reinspection frequency.

The flowchart in Figure 20 demonstrates the approach Blade would suggest PG&E consider. The key elements are as follows:

- If the casing is new, the only operable corrosion mechanism would be the ID storage gas, and a corrosion rate of 1.2 mpy is appropriately conservative. These casings would need around 25 years before they need an inspection.
- If the features are identified to be corrosion-related and not deformation, and they are external, then the path is different. If they are above the casing shoe and the TOC, then a frequency of 5-8 years may be necessary. Above the casing shoe, but below the TOC, the OD shouldn't exhibit active corrosion, allowing ID corrosion rates to be used. If the anomaly is below the casing shoe, then, depending on the reach of the CP and cement, a corrosion rate of 1.2 mpy can be utilized. It's essential to identify the corrosion mechanism and, if quantifiable, use that estimate to determine the inspection frequency.
- If the features are on the ID then use 1.2 mpy or 0.0025 mils for each ingress of storage gas into the A annulus.

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- If there are multiple inspections, then the higher rate should be used.

Re-inspection Frequency Rationale

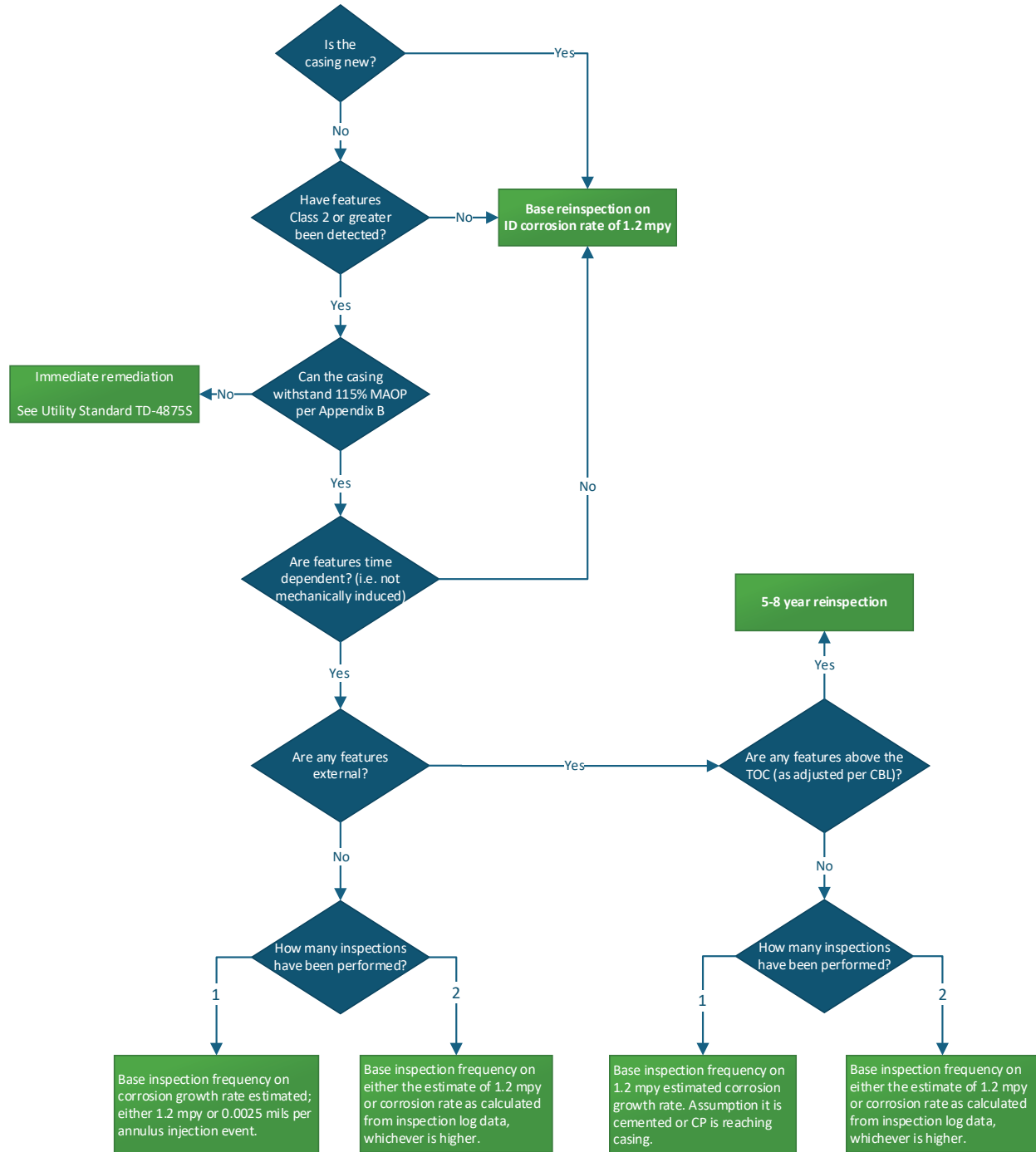


Figure 20: Proposed Flowchart for establishing re-inspection frequency

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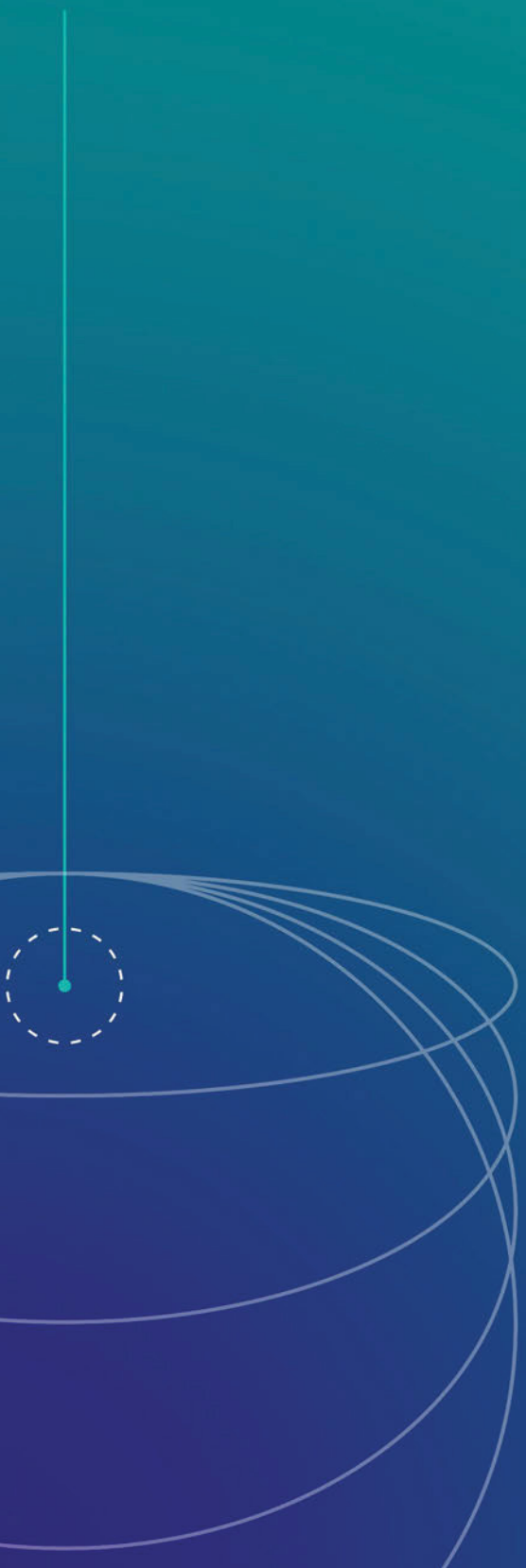
9 References

- [1] *TD-4875S, R 0b, Well Integrity.pdf*, Jan 15, 2025.
- [2] *2023 0523 PGE Cover Letter 2nd Reinspection Plan Approval Request_Final.pdf*, May 23, 2023.
- [3] *PG&E Reinspection Plan 01202023.pdf*, May 23, 2023.
- [4] *Reinspection Plan Supporting Justification (5.23.2023)_Part1.pdf*, May 23, 2023.
- [5] *Reinspection Plan Supporting Justification (5.23.2023)_Part2.pdf*, May 23, 2023.
- [6] *Reinspection Plan Supporting Justification (5.23.2023)_Part3.pdf*, May 23, 2023.
- [7] *Reinspection Plan Supporting Justification (5.23.2023)_Part4.pdf*, May 23, 2023.
- [8] *Reinspection Plan Supporting Justification (5.23.2023)_Part5.pdf*, May 23, 2023.
- [9] *CalGEM Data Request - Revised Testing Schedule and Required Data (1.19.2024).pdf*, Jan 19, 2024.
- [10] *GP-1100 Strategic Asset Management Plan.pdf*, July 18, 2024.
- [11] *GP-1108 Underground Gas Storage Asset Management Plan.pdf*, Dec 19, 2024.
- [12] *GP-1109 Gas Data Asset Management Plan.pdf*, Oct 1, 2024.
- [13] *GPF - GEO Packer Fluid - GEO - SDS.pdf*, July 20, 2016.
- [14] *PG&E Gas Composition.xlsx*.
- [15] *Email: Re_ Utility Standard_ TD-4875S*, Aug 11, 2025.
- [16] *TD-4875P-05, R 1, Casing Inspection Logging and Data Assessments.pdf*, Aug 21, 2024.
- [17] *Well Integrity Databook_EOY2024.pdf*.
- [18] *CalGEM_PHMSA_AUDIT_INTRO_11-8-2021.pdf*, Nov 8, 2021.
- [19] *Email: Review of PG&E Risk Calculations*, Aug 22, 2025.
- [20] *TD -4876P-03.pdf*, May 17, 2023.
- [21] *040772020800_TC 6N_Gyro_8.625-in_20220511.xlsm*, May 11, 2022.
- [22] *040132029800_NoiseTemp_LM_14-C_2024-11-23.LAS*, Nov 23, 2024.
- [23] *040772020800_NoiseTemp_TC_6-N_2024-11-11.LAS*, Nov 11, 2024.
- [24] *LM-14C GYRO MS.xlsm*, June 12, 2023.
- [25] *MDI and LM flow Data (Blade-Energy).xlsx*.
- [26] *TD-4876P-05, R 0, Wellhead Annuli Pressure Collection.pdf*, May 17, 2023.

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**Review and Analysis of
PG&E's Reinspection Plan
Schedule for Mechanical
Integrity Testing of
Underground Gas Storage
Wells**

December 2, 2025
(PG&E-15)

Review and Analysis of PG&E's Reinspection Plan Schedule for Mechanical Integrity Testing of Underground Gas Storage Wells

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December 2, 2025

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Acronyms and Abbreviations

API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
CalGEM	California Geologic Energy Management
CBL	cement bond log
14 CCR	California Code of Regulations, Title 14
CFR	Code of Federal Regulations
DHSV	downhole safety valves
°F	degrees Fahrenheit
ft	feet
GPS	Global Positioning System
HRVRT	High-resolution Vertilog
ID	inside diameter
IMP	Integrity Management Plan
in	inch
I/W	injection/withdrawal
MAOP	maximum allowable operating pressure
MIPT	Mechanical integrity pressure test
MIYP	minimum internal yield pressure
MLF	magnetic flu leakage
OD	outside diameter
PG&E	Pacific Gas & Electric Company
psi	pounds per square inch
QRA	quantitative risk analysis
RAMP	Risk Assessment and Mitigation Phase
RMP	Risk Management Program
SCADA	Supervisory Control and Data Acquisition
SCG	Southern California Gas Company
SDGE	San Diego Gas & Electric Company
SIMP	Storage Integrity Management Program
SSSV	subsurface safety valve
TOC	top of cement
UNGSF	Underground natural gas storage facility

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Executive Summary

The objective of this work was to perform an independent review of PG&E's *Well Reinspection Plan Methodology and Relevant Factors Informing the Approach*, dated January 20, 2023 (**"January 2023 Reinspection Plan"**). In response to a letter from CalGEM dated April 11, 2023, requesting explanation and additional data, PG&E resubmitted the plan in a report titled, *Well Reinspection Plan Methodology and Relevant Factors Informing the Approach*, dated May 23, 2023 (**"May 2023 Reinspection Plan"**). Based upon progress implementing the 2023 Reinspection Plan, PG&E submitted to CalGEM a revised reinspection plan in a report titled *CalGEM Data Request – Revised Testing Schedule and Required Data*, dated January 19, 2024 (**"2024 Reinspection Plan"**).

These **"Reinspection Plans"** describe procedures for the time between integrity assessments of the injection and withdrawal ("I/W") wells at PG&E's Northern California underground natural gas storage facilities ("UNGSF"): McDonald Island, Los Medanos, and Pleasant Creek. The foundation of PG&E's well integrity management program was documented in the report, *Underground Storage Risk and Integrity Management Plan, Revision 5*, dated March 29, 2019 (**"UNGSF Integrity Plan"**).

Exponent performed an independent review of both PG&E's UNGSF Integrity Plan and the Reinspection Plans for the reasonableness of their technical approaches and foundations, and, where sufficient detail was available, compared the Plans to other such plans by UNGSF facility operators in the United States and internationally.

California Code of Regulations Title 14, ("14 CCR") Section 1726.6(a)(2) requires that, "A casing wall thickness inspection to estimate internal and external corrosion, employing such methods as magnetic flux or ultrasonic technologies, shall be performed at least once every 24 months to determine if there are possible issues with casing integrity." A 24-month wall thickness reinspection interval may be too frequent for new wells or wells with sufficiently low corrosion rates. Such a short interval may also impact the natural gas storage volumes and the supply to commercial and residential customers. CalGEM, however, also states that, "The Division may approve a less frequent casing wall thickness inspection schedule for a well if the operator demonstrates that the well's corrosion rate is low enough that biennial inspection is not necessary."

Based on our review of the documents and data, it is our conclusion that PG&E's reinspection plans for their UNGSFs are based on sound technical quantitative risk analysis ("QRA") methods and verified with a database of well inspection results. PG&E's reinspection intervals were developed through risk ranking of all UNGSF wells (i.e., age and construction of wells); analysis of the results of high-resolution magnetic flux leakage ("MFL") wall thickness measurement logs to estimate corrosion rates and mechanical damage of production casing; risk assessment of workover procedures to inspect, test and perform well intervention; and impacts of

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well construction and integrity reinspection on storage capacity and gas deliverability to residential and commercial customers.

PG&E's risk-based wall thickness reinspection intervals are based on estimated corrosion rates or the depth of mechanical damage and the minimum internal yield pressure ("MIYP") to meet 115% of the well's MAOP. The corrosion rate is used to estimate how long the casing can meet the 115% MAOP, which is used to assess the remaining life of the production casing. Based on PGE's risk-based assessment method, the rate of apparent change of wall thickness is calculated to determine when casing will *not* withstand 115% MAOP. PG&E has defined three reinspection intervals, each interval defined as how long the casing will withstand greater than 115% MAOP throughout with the apparent corrosion rate:

- **12 – 15 years reinspection interval**
- **8 – 12 years reinspection interval**
- **5 – 8 years reinspection interval**

If it is determined that the production casing will *not* meet the 115% MAOP or that the apparent corrosion rate predicts a remaining life of *less* than 5 – 8 years, then additional tests and evaluation are required to determine if the production casing can be repaired or if a new inner string of casing should be installed.

PG&E's wall thickness reinspection log intervals are based on QRA methods similar to those published in January 2025 in a peer reviewed paper in Society of Petroleum Engineers ("SPE") Journal. In addition, we understand that CalGEM has approved, on a well-by-well basis, wall inspection reinspection intervals of seven years for Southern California Gas Company ("SoCalGas") and San Diego Gas & Electric (SDG&E).

This work was performed under PG&E requisition number PR1386362, issued April 7, 2025 titled *Exponent, Inc. Casing Integrity Program Review*.

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Findings and Conclusions

PG&E's 2024 Revised Reinspection Plan is robust and comprehensive. PG&E's methodology is based on the balance between risks and benefits, incorporating analysis of well construction and integrity, personnel safety, as well as storage volume of natural gas and dependable gas deliverability to its customers.

PG&E's UNGSF Well Integrity Management Program

The principal foundations of the plan are (1) the construction of the gas storage well to meet regulatory and best industry standards and (2) the condition of the production casing, which may be considered the principal barrier between the stored natural gas and the environment outside of the gas storage wellbore. The condition of the production casing is assessed by periodic well inspections, which include:

1. Annual wellbore temperature and noise logs.
2. Periodic production casing wall thickness inspection logs.
 - a. Direct production casing wall thickness logging after removing the tubing and packer (i.e., single string logging).
 - b. Through-tubing wall thickness logging (i.e., multiple string logging).
3. Mechanical integrity pressure tests ("MIPT") of the tubing and the tubing-to-production annulus.
4. Continuous monitoring of wellhead pressures using a Supervisory Control and Data Acquisition ("SCADA") systems.
5. Daily leak detection (methane) measurements.

Inspection items 1 and 2 require taking a well out of operation for a short period of time, mobilizing a wireline or workover rig on the well, and performing the logging or other tests. Inspections items 1 and 2 are referred to as "well intervention" operations, since they require access to the wellbore. It is well known that well intervention present risks to personnel safety and wellbore integrity.¹ Inspection item 3, an MIPT, may require a short cessation of operations, but involves increased tubing or annulus pressure and stress on the wellbore casing and tubing strings, which represents a risk to the safety of personnel and potentially to the environment. Inspection items 4 and 5 do not require well intervention and do not necessarily result in impacts to well operation, unless the monitoring detects an anomaly or leak.

¹ Stephens, M., Koduro, S., Vani, J., Paxman, T., and Wright, C., Final Report: Risk Assessment and Treatment of Wells, C-FER Technologies, prepared for Pipeline and Hazard Materials Safety Administration (PHMSA), September 2020.

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It is PG&E's practice to run temperature and noise logs annually as part of its gas storage inventory verification program. Measured wellbore temperatures and pressures are used to compute the volume of gas stored in the reservoir. Noise log data is used to determine if there are possible gas leaks in the tubing or casing, or fluid flow outside of the wellbore.

PG&E established a baseline of the condition of their UNGSF wells by the end of 2019. PG&E performed a program of well integrity logging and testing of each of their UNGSF wells to establish a baseline condition of each well, in particular the production casing. The program included temperature-noise logs to assess if there was a possible leak in the tubing or casing. Wall thickness logs were run to assess the wall thickness of the production casing, using direct logging of the production casing and through-tubing multiple string wall thickness logging. Cement bond logs ("CBLs") to determine the top of cement ("TOC") and the quality of the cement outside the production casing. MIPTs were performed on each UNGSF well. If the logging and MIPTs showed production casing did not exhibit mechanical or pressure integrity, PG&E took one of the following options for a given well:

1. Installed a new production casing string with a smaller diameter than the older production casing string, with cement in the annulus between the casing strings.
2. Repaired the production casing string.
3. Plugged and abandoned the well.

Installing a new smaller diameter production casing string reduced the rate at which gas could be injected and withdrawn from the well, which impacted deliverability of stored gas to residential and commercial customers. In addition, the Aliso Canyon blowout resulted in new regulations for construction of UNGSF wells, which included the required injection and withdrawal of storage gas through a tubing string sealed at the end with a packer, which in turn reduced the injection and withdrawal volumetric flow rate of gas, compared to injection and withdrawal through the production casing or the production-casing annulus.

PG&E includes in their risk and integrity management plans the impact of periodic interruptions for well integrity assessments. The interruptions impact the deliverability of natural gas to its residential and commercial customers.

1. **PG&E's 103 active I/W UNGSF wells have at least two barriers (primary and secondary), as required by § 1726.5(b)(1)(A) and (B) – Well Construction Requirements**
 - a. All wells have at least one cemented production casing string.
 - b. Many wells have a new second cemented production casing string, which was installed inside of an older production casing string that exhibited indications of excessive mechanical damage or corrosion, based on MFL inspection data.
 - c. All wells have a production tubing string and packers.
 - d. Most wells have surface controlled downhole safety valves ("DHSVs").

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2. PG&E’s wall thickness reinspection intervals are based on risk ranking of the wells, apparent corrosion rate, mechanical damage to casing, and MIYP calculated based on measured wall thickness.

- a. PG&E’s risk-based wall thickness reinspection intervals are based on estimated corrosion rates or the depth of mechanical damage and the minimum internal yield pressure (“MIYP”) to meet 115% of the well’s MAOP. The corrosion rate is used to estimate how long the casing can meet the 115% MAOP, which is used to assess the remaining life of the production casing. Based on PGE’s risk-based assessment method, the rate of apparent change of wall thickness is calculated to determine when casing will *not* withstand 115% MAOP. PG&E has defined three reinspection intervals, each interval defined as how long the casing will withstand greater than 115% MAOP throughout with the apparent corrosion rate:

12 – 15 years reinspection interval

8 – 12 years reinspection interval

5 – 8 years reinspection interval

- b. If it is determined that the production casing will *not* meet the 115% MAOP or that the apparent corrosion rate predicts a remaining life of *less* than 5 – 8 years, then additional tests and evaluation are required to determine if the production casing can be repaired or if a new inner string of casing should be installed.
 - c. **Figure 1** is a decision tree developed by PG&E for determining the appropriate reinspection interval.
- 3. PG&E has performed quantitative risk analysis (“QRA”) to optimize the frequency of MFL tool well thickness logging. The optimum logging frequency from this analysis is between 7 and 21 years.**
- a. The results of PG&E’s QRA are plotted in **Figure 2**.² The y-axis is the change in risk score of PG&E’s 103 UNGSF well as a function of the inspection frequency in years (i.e., the number of years between inspections).
 - b. The red line is the change in aggregated incurred and escalated risks. The risk of a loss of well containment is low if the logging frequency is small, such as for example every 2 years (or 24 months). The risk increases monotonically as the time between inspections increases, as expected. That is, if the corrosion rate is high and the time between wall thickness logs is excessively long, corrosion through the casing wall may take place before a wall thickness inspection takes place, which could lead to a loss of gas containment. On the other hand, every time a production casing MFL log is run in the well, a workover rig must be mobilized on the well, the well must be killed with high-density brine, the tubing and packer must be pulled, the logs are run, and then tubing and packer run back in, wellhead operations are performed to land the tubing and packer, the rig is demobilized, and the well is brought back into production or injection. Each

² PG&E Reinspection Plan May 23, 2023, Figure 4.

operation on the well carries a risk to on-site rig and service company personnel and to the environment.

- c. The green curve is the change in aggregated benefit (or risk reduction) of time between MFL tool wall thickness logs. Short time between logs has a low benefit for low and moderate corrosion rates, because of the time and expense of workover rigs, risk to service personnel, and gas storage service interruptions. At some field- or well-dependent inspection frequency, there is a point of diminishing returns, which in PG&E's UNGSF fields is about 15 years.
 - d. As can be seen in **Figure 2**, for PGE's UNGSFs and well construction designs, the benefits are greater than the risks for well logging interval between approximately 7 and 21 years. For intervals shorter than 7 years, the frequent well interventions bring a greater risk to loss of containment and danger to field personnel than benefit. For intervals greater than 21 years the risk of corrosion growth and containment loss is greater than the benefit of fewer well interventions.
4. **PG&E has calculated a predicted failure rate (loss of containment event) per workover for their 103 USG wells. That predicted failure rate is consistent with industry data and estimates a loss of containment event approximately once every 50 years for 103 wells.**
- a. PG&E has estimated that the baseline failure rate per workover or logging operation of its 103 UNGSF wells is 0.018.³ The failure rate is defined as:

$$\text{Failure Rate} = \frac{\text{Number of loss of containment incidents}}{(\text{Number of wells})(\text{Years of operation})}$$

A failure rate of 0.018 for 103 wells indicates approximately 1 failure in 50 years of PG&E's well workover operations.

- b. Stephens *et al.* estimated a workover failure rate of 0.019 based on UNGSF industry data, which is almost identical to PG&E's estimate.^{4 5} This work was performed to address the risks in the UNGSF industry after the Aliso Canyon blowout. Thus, PG&E's failure rate is consistent with the UNGSF industry.
- c. A comparison of PG&E's failure probability estimate to that of the industry estimate is shown in **Figure 3**. There is industry consensus that well interventions for inspection operations increases the risk of failures. That is, any time a well is entered for a workover, there is an increased risk of loss of containment, environment impact, and on-site personnel injuries.

³ PG&E Reinspection Plan May 23, 2023, pp. 9-10, Figure 5 and Figure 6.

⁴ Stephens, M., Koduro, S., Vani, J., Paxman, T., and Wright, C., Final Report: Risk Assessment and Treatment of Wells, C-FER Technologies, prepared for Pipeline and Hazard Materials Safety Administration (PHMSA), September 2020.

⁵ Stephens, M., Webinar –Part 2 An Overview of Demonstration Analysis Results, contained in Risk Assessment and Treatment of Wells PHMSA Project DTPH56-17-RA-00002, November 17, 2020.

5. **As discussed above, well intervention for UNGSF well workovers carry adverse risks, but the risks can be managed and minimized by optimization of the well intervention schedule. PG&E has shown that, through QRA and analysis of MFL tool wall thickness measurements on its UNGSF wells, that risks can be reduced by optimally scheduling well interventions and logging frequency.**
- a. **Figure 4** demonstrates the impact of MFL tool logging frequency for PG&E's 103 UNGSF wells.⁶ The number of days of well intervention is referred to as the "Elevated Risk Exposure." The time period of the analysis is 2025 – 2040, or 16 years. The analysis considers the number of wells that are being logged, the number of wells adjacent to the wells being logged,⁷ and the number of wells that remain in I/W service during logging and inspection operations.
 - b. The orange bars are the elevated risk days for a well inspection frequency of **2 years (24 months)**. The total number of days spent on logging and workovers is 18,464 days for MFL tool log workovers.
 - c. The blue bars are elevated risk exposure for a frequency of **7 years**. The total number of risk exposure days is 6,244.
 - d. The green bars are for PG&E's Reinspection Plan using the Risk Based MFL tool inspection frequency, which incorporates the apparent growth rate of corrosion and mechanical damage. The total number of risk exposure days is 3,457.
 - e. When considering the risks associated with the number of days spent performing well workover, there is significantly lower risk by considering the age of the wells, the construction of the wells, and the measured corrosion rate of the wells.
6. **PG&E's proposed reinspection frequency intervals for wall thickness logs are reasonable and consistent with other UNGSF operators who have performed a detailed Risk Assessment of their UNGSF wells.**
- a. The wall thickness log frequency interval is based on PG&E's Casing Inspection Survey Frequency Decision Tree, which is included in PG&E's Casing Inspection Logging and Data Assessments, Utility Procedure: TD-4875P-05 of Effective November 1, 2024 (see **Figure 1**).⁸
 - b. The Decision Tree first determines if the casing can withstand 115% MAOP. If the casing cannot withstand 115% MAOP, the well is set for possible remediation following a separate remediation decision tree.
 - c. Wall thickness logs are then examined to determine if there any locations in the casing at which the wall thickness loss indicates that casing stresses exceed the recommended stress

⁶ PG&E Reinspection Plan May 23, 2023, Figures 1, 2, and 3 combined.

⁷ For the purposes of safety, PG&E shuts in wells that are adjacent to wells that are being logged.

⁸ Casing Inspection Logging and Data Assessments, Appendix C, Utility Procedure: TD-4875P-05 Publication Date: 08/21/2024 Effective Date: 11/01/2024 Rev: 1, p. 11.

curves. The Decision Tree provides a process for determining a reinspection interval given the age of the casing, previous casing inspections, and the number of features that may increase the risk of apparent growth.

- d. The step-by-step process for determining I/W well integrity is based on the MFL wall thickness log data and is summarized as follows. The reinspection interval is determined by considering the calculated MIYP (i.e., burst strength) of the casing using the wall thickness indicated from the wall thickness log. Depending on the magnitude of the measured wall thickness loss, the casing may still be able to meet the requirement that it can safely withstand 115% of the MAOP. That is, the MIYP after wall thickness loss may still be significantly greater than the MAOP, thus providing an adequately large safety factor for well pressure integrity. The Decision Tree process for determining the reinspection interval is shown in **Figure 1**.
- e. First, compute the casing MIYP (i.e., burst strength) using the Barlow equation from API TR-5C3⁹ and the wall thickness as measured by the wall thickness log. If the casing MIYP does not meet 115% of the MAOP, then further analysis of the casing required, possibly for repair of the casing, installation of a new inner string, or P&A of the well. If the MIYP (i.e., casing stress¹⁰) as computed with the measured wall thickness loss is sufficient to meet the required 115% of the MAOP the API TR-5C3 MIYP with the nominal wall thickness, then the reinspection interval is based on the rate of apparent change in wall thickness that is determined by evaluating the change in percent metal loss over time. An estimate for the years remaining on a well is then determined using the rate of apparent wall thickness change, the percent metal loss, and the MIYP of the casing with the reduced wall thickness. The estimate for years remaining with an adequate MIYP (i.e., internal pressure burst resistance for fitness for I/W well service) dictates the required reinspection interval for an I/W well. The decision conditions for the required reinspection intervals are:
 - i. **5 - 8 years** reinspection interval
 1. If the wall thickness loss from the log is new and the number or nature of the loss indications is different, compared to the previous log.
 2. Calculate the apparent corrosion rate using the difference in the indicated wall thickness loss between the new and previous logs. If the calculated MIYP based on the predicted corrosion rate is less than 115% MAOP in 5 – 8 years, then the reinspection must be within 5 to 8 years.
 - ii. **8 - 12 years** reinspection interval:
 1. Calculate the apparent corrosion rate using the difference in the indicated wall thickness loss between the new and previous logs. If the calculated MIYP based

⁹ American Petroleum Institute, API Technical Report 5C3, Calculating Performance Properties of Pipe Used as Casing or Tubing, Seventh Edition, June 2018, Addendum 1, October 2019, Annex A.

¹⁰ PG&E refers to this stress states as “recommended stress curve.”

on the predicted corrosion rate is less than 115% MAOP in 8 – 12 years, then the reinspection must be within 8 – 12 years.

iii. **12 - 15 years** reinspection interval:

1. No logs indicate wall thickness loss that would result in a calculated MIYP that is less than the API TR-5C3 nominal MIYP. This is normally the case for new casing.
2. Wall thickness loss features from the most recent log are observed to be mechanically induced by workover operations and are not due to time-dependent corrosion. Time dependence would be indicated by increased wall thickness loss from the previous log to the new log.
3. Calculate the apparent corrosion rate using the difference in the indicated wall thickness loss between the new and previous logs. If the calculated MIYP based on the predicted corrosion rate is less than 115% MAOP in 12 – 15 years, then the reinspection must be within 12 – 15 years.

7. The basis for PG&E's wall thickness logging frequency intervals is based on reasonable analysis of corrosion rates and risk assessment.

- a. PG&E's estimates for the apparent growth of corrosion-induced wall thickness loss of production casing includes this following uncertainty ranges for MFL tools, such as Baker Hughes's HRVRT:
 - i. $\pm 10 - 15\%$ of actual metal loss for isolated pitting or mechanical damage
 - ii. $\pm 15 - 20\%$ of actual metal loss for general corrosion or mechanical damage of a large area of the casing inner or outer surface
- b. These uncertainly ranges are consistent with those reported in publications by Baker Hughes on analysis of magnetic flux wall thickness pigging tools for pipelines.^{11 12 13}
- c. PG&E uses a classification system for the character and orientation of wall thickness loss features as measured using an MFL tool. The graphical system characterizes the wall thickness feature as circumferential groove, axial groove, localized pitting, pitting, and general from measurements of the of the width, length, and depth of the MFL tool measurement. This system is routinely used in pipeline and wellbore tubular (i.e., casing) inspections using MFL tools, such as the Baker Hughes HRVRT tool.¹⁴

¹¹ Scott, B. and Famie, S., Maximizing Accuracy of MFL Pipeline Inspections, Piping Products & Services Associations, 2019. Available at <https://ppsa-online.com/papers/19-Aberdeen/2019-05-BakerHughes-paper.pdf>

¹² Scott, B. and Famie, S., Maximizing Accuracy of MFL Pipeline Inspections, Pipeline Technology Journal, Issue 3, 2020, pp. 8 - 12. Available at <https://ppsa-online.com/papers/19-Aberdeen/2019-05-BakerHughes-paper.pdf>

¹³ Yeung, P, Sporns, R, Clouston, S, Coleman, GA, Miller, S, & Mieila, C. "Maximizing MFL ILI Sizing Confidence and Accuracy Using High-Resolution Field Measurement Data." Proceedings of the 2012 9th International Pipeline Conference. Volume 2: Pipeline Integrity Management. Calgary, Alberta, Canada. September 24–28, 2012. pp. 217-227. ASME. <https://doi.org/10.1115/IPC2012-90528>

¹⁴ Pipeline Operators Forum (POF), Specifications and requirements for in-line inspection of pipelines, Standard Practice POF 100, November 2021. Figure 2.2. Available at

- d. PG&E uses a range for the margin of error in MFL wall thickness loss measurements:
 - i. $\pm 10\%$ - 15% isolated pits or damage
 - ii. $\pm 15\%$ - 20% general corrosion
 - e. The ranges of error used by PG&E are conservative and consistent with published at by Baker Hughes, “The sizing accuracy was $\pm 20\%$ or $\pm 15\%$ WT depending on the defect type [circa before the 1990s]. ... Today [circa 2019] the minimum detection and sizing level is from 4% and $\pm 8\%$ of local wall thickness, compared to 30% and $\pm 15\%$ from 20 years earlier.”¹⁵ Thus, PG&E’s uses conservative ranges of error to account for the use of earlier MFL wall thickness tools, such as Vertilog. Modern MFL tools, such as HRVRT, are more accurate.¹⁶
 - f. PG&E’s “Well by Well Integrity Inspection Summary” data tables include a column labeled, “Detection Limit and Reporting Threshold for MFL.” For all of PG&E’s UNGSF wells which have a baseline, the detection limit and reporting threshold is $< 20\%$, which is the Class 1 depth category. The depth of a corrosion pit or mechanical damage detectable by an MFL tool is dependent upon the accuracy of the tool. The detectable depth is referred to as the “threshold depth.” Based on the ranges of accuracy of MFL tools discussed above, the likely threshold depth may range from approximately 4% to 20% , depending on the tool.
- 8. PG&E’s MFL Tool Data Interpretations of API Specification 5CT¹⁷ Wall Thickness accurately addresses Wall Thickness Tolerances and Permissible Defect Depths**
- a. API Spec 5CT §8.11.2 – Wall Thickness, specifies a 12.5% tolerance on casing and tubing pipe body wall thickness. This tolerance specification means, for example, that for API 8-5/8-in OD, 36 ppf (pounds per foot) casing with a nominal wall thickness of 0.400-inm the thickness can be as small as 0.350-in. This casing OD and wall thickness was used in the construction of many of PGE’s UNGSF wells. The 12.5% wall thickness tolerance means that the wall thickness could be uniformly 12.5% smaller than nominal and would still meet wall thickness specification. To account for this tolerance, the API assumes a wall thickness of 0.875 of the nominal thickness in the Barlow formula to calculate the internal yield pressure of API casing and tubing.¹⁸
 - b. API Spec 5CT §8.13.1 – Pipe and Accessory Made from Pipe, addresses defects in the pipe body and includes a specification for the maximum permissible depth of an

<https://pipelineoperators.org/media/2225?signature=17154e22a8af66d6429819a9503f5f4c11a3ec646ba5ed870ae94bbe70fc2f94>

¹⁵ Scott, B. and Famie, S., Maximizing Accuracy of MFL Pipeline Inspections, Piping Products & Services Associations, 2019. Available at <https://ppsa-online.com/papers/19-Aberdeen/2019-05-BakerHughes-paper.pdf>

¹⁶ Child, T., Baker Hughes, PHMSA – Casing and Cementing Integrity, PHMSA Pipeline R&D Forum, Cleveland, OH, November 16-17, 2016, Slide 21. Available at <https://primis.phmsa.dot.gov/rd/mtgs/111616/Terry%20Child.pdf>

¹⁷ American Petroleum Institute, API Specification 5CT, Casing or Tubing, Tenth Edition, June 2018, §8.11.2.

¹⁸ American Petroleum Institute, API Technical Report 5C3, Calculating Performance Properties of Pipe Used as Casing or Tubing, Seventh Edition, June 2018, Addendum 1, October 2019, Annex A.

imperfection or defect in tubing and casing as, “linear imperfection on the outside or inside surface, of any orientation, with a depth greater than those tabulated in Table C.30 or Table E.30, ...” Table E.30 specifies, “The depth as % of Specified Wall Thickness,” which is 12.5% for the grades of steel used by PG&E for the production casing in their UNGSF wells.

9. PG&E has established a reasonable baseline of MFL tool data for all UNGSF Wells

- a. All of PG&E’s active UNGSF I/W wells had direct HRVRT (not through-tubing) tool runs through the production casing.
- b. The HRVRT tool runs date from May 15, 2013 (LM-5B) through March 28, 2023 (WS-15W).

10. The technical basis of PG&E’s wall thickness (corrosion loss) rate analysis is reasonable and conservative.

- a. PG&E calculates a corrosion rate by considering the wall thickness loss measured by an MFL tool at two different times. If an early wall thickness measurement, WT_n , was measured in year Y_n , and a later wall thickness measurement, WT_p , was measured at Y_p , then the maximum and minimum corrosion rates (or rates of change of wall thickness) are:
 - i. Rate of Apparent Change (corrosion rate)¹⁹

$$\frac{[(WT_p) - (WT_n)]}{(Y_p - Y_n)}$$

- b. As a conservative measure, PG&E may include an MFL tool range of error, $\pm 15\%$, in the corrosion rate. Interpretations of metal loss from MFL measurements are best within $\pm 10\text{--}15\%$ of actual metal loss but could be close to $\pm 15\text{--}20\%$ for general corrosion.

11. PG&E’s MFL inspection frequency intervals are based on reasonable technical analysis and risk assessment.

- a. PGE’s MFL tool inspection frequency intervals are based on an assessment of the Apparent Rate of Change of wall thickness (i.e., decrease in wall thickness or growth of corrosion depth) due to corrosion or to mechanical damage, as indicated in MFL tool data. In particular, PG&E examined HRVRT logs for all of their active UNGSF wells.
- b. For their inspection frequency interval decision process, PG&E classified the Apparent Rate of Change as aggressive, moderate, or low. PG&E also included the MFL tool measured wall thickness in the decision process.

¹⁹ PG&E Utility Procedure: TD-4875P-05, Casing Inspection Logging and Data Assessments, Publication Date: 08/21/2024 Effective Date: 11/01/2024 Rev: 1, p. 10.

- c. Based on their analysis, PG&E's decision tree has four well intervention and MFL tool inspection frequency classifications, ranging from immediate well intervention and repair to 12 – 15 years between MFL tool inspections, as described above in item 6.

12. PG&E's well thickness log inspection intervals are consistent with CCR § 1726.6(a)(2) when the corrosion rate is aggressive and for specific well conditions.

- a. CCR 1726.6(a)(2) requires, "A casing **wall thickness inspection** to estimate internal and external corrosion, employing such methods as **magnetic flux** or ultrasonic technologies, shall be performed **at least once every 24 months** to determine if there are possible issues with casing integrity. Logging shall include a repeat section of no less than 200 feet, preferably across intervals where anomalies are present. The results shall be **compared against prior results** and any other available data to determine the corrosion rate. If the casing wall thickness inspection indicates that within the next **24 months** thinning of the casing will diminish the casing's ability to contain 115 percent of the well's maximum allowable operating pressure utilizing Barlow's equation or another, similarly effective method, then **the well shall be remediated** and shall not be used for injection or withdrawal without subsequent approval from the Division. **The Division may approve a less frequent casing wall thickness inspection schedule for a well if the operator demonstrates that the well's corrosion rate is low enough that biennial inspection is not necessary.**" [Emphasis added]
- b. As described below, PGE's Reinspection Plan provides for MFL tool inspections at intervals of less than or equal to 24 months, if the apparent rate of growth of corrosion or mechanical damage is judged to be aggressive or if the depth of the corrosion or damage is. In addition, the wells may require consideration for immediate remediation.
- c. PG&E has established baseline MFL tool log data for all of its UNGSF wells. The majority of PG&E's UNGSF wells have low apparent corrosion growth rates and would meet the conditions for the "less frequent casing wall thickness inspection" of 2 years, as permitted under CCR 1726.6(a)(2).

13. PG&E uses the apparent corrosion rate measure from MFL wall thickness inspection tools as one of the fundamental and important parameters for the wall thickness logging inspection frequency. The following are examples showing how apparent corrosion growth is used in PG&E's decision analysis.

- a. PG&E included three example calculations in the Reinspection Plan May 23, 2023 Appendix A3: Applied Methodology Calculation Examples. The examples were for UNGSF wells Turner Cut 2-S (TC-2S), Los Medanos 15-C (LM-15C), and Turner Cut 1-N (TC-15N). We provide two additional sample to illustrate interpretation and calculation of corrosion rates.
- b. The sources of the data used as input for these examples were:
 - i. PG&E's Reinspection Plan May 23, 2023 Appendix A1 PG&E's Well Reinspection Plan (McDonald Island and Los Medanos)

- ii. PG&E's Reinspection Plan May 23, 2023 Appendix B Well Specific Integrity Detail
 - iii. PG&E's Reinspection Plan May 23, 2023 Appendix C Well Integrity Data Book
 - iv. PG&E's Reinspection Plan May 23, 2023 Appendix C Well Integrity Data Book
 - v. PG&E's Revised Reinspection Plan January 19, 2025 PG&E Reinspection Plan
 - vi. PG&E's Revised Reinspection Plan January 19, 2025 Exhibit B – Well Availability Comparison & Forecasted Withdrawal Capacity
 - vii. PG&E's Revised Reinspection Plan January 19, 2025 PG&E's Well Reinspection Summary
 - viii. PG&E Well Integrity Data Book 2024 Well Reinspection Summary
- c. Los Medanos 5-B (LM-5B)
- i. LM-5B was spudded on March 1, 1979 and initially completed on April 3, 1979. The well was completed with 7-in, 23 ppf, K-55 production casing, which has a nominal wall thickness of 0.317-in.
 - ii. A Micro-Vertilog ("MVRT") MFL wall thickness inspection log was run on May 15, 2013, which PG&E notes as the Baseline MFL wall thickness inspection log. The maximum depth of wall thickness loss was reported as 40% at 3,947-ft, which is a Class 2 depth range. The wall thickness loss was noted as General corrosion on the inner diameter. General ID corrosion was quantified over most of the casing string, ranging in the low to high 20% range, or Class 2.
 - iii. The maximum apparent corrosion rate is calculated using the basis as 0% of the new casing at the spud year of 1979, and the maximum wall thickness loss of 40% in 2013. The apparent corrosion rate is 1.18% per year without including the MFL tool accuracy of 15% and 2.06% per year with the tool accuracy included. The apparent corrosion rate is classified as Moderate in PG&E's decision tree flow chart.
 - iv. PG&E's MFL tool frequency interval decision tree leads to the classification "Class 2 and/or 3 with Moderate Apparent Growth, OR General Class 3 with Growth Undefined."
 - v. The classification leads to a frequency interval of 5 – 8 years because of the General Class 3 nature of the wall thickness loss.
- d. Turner Cut 11-N (TC-11N)
- i. TC-11N was spudded on March 18, 1974 and initially completed on April 1, 1974. The well was initially completed with 8-5/8-in, 36 ppf, K-55 production casing, which has a nominal wall thickness of 0.400-in.

- ii. 7-in, 26 ppf, K-55 production casing, which has a nominal wall thickness of 0.362-in., was run inside of the 8-5/8-in production casing on March 19, 2021.
- iii. An HRVRT MFL wall thickness inspection log was run through the 8-5/8-in production casing on June 4, 2013, which PG&E notes as the Baseline MFL wall thickness inspection log. The maximum depth of wall thickness loss was reported as 30% at 1,372-ft, which is a Class 2 depth range. The wall thickness loss was noted as Axial on the inner diameter. Such a wall thickness loss indication would likely be due to localized mechanical damage.
- iv. The maximum apparent corrosion rate is calculated using the basis as 0% wall thickness loss for the new production casing at the spud year of 1974, and the 30% maximum measured wall thickness loss of 30% in 2013. The apparent corrosion rate is 0.97% per year without including the MFL tool accuracy of 15% and 1.74% per year with the tool accuracy included. This level of apparent wall thickness loss with isolated Class 2 depth would lead to a wall thickness reinspection frequency of 8 – 12 years.
- v. TC-11N was re-inspected in March 22, 2021 using an HRVRT log, which reaffirmed the wall thickness loss of 30% at 1,372-ft in the 8-5/8-in production. PG&E characterized the wall loss as follows, “The well was inspected with a MFL in 2013 and 2021 where an axial feature was identified at the maximum dogleg severity.”
- vi. PG&E elected to run and cement an inner string of 7-in, 26 ppf, L-80 production casing, which has a nominal wall thickness of 0.362-in.
- vii. An HRVRT wall thickness log was run through the new 7-in production casing in 2021, which exhibited no wall thickness loss. Therefore, PG&E’s reinspection frequency is 12 – 15 years, with next MFL log scheduled for inspection in 2033.

14. PG&E has developed wall thickness inspection frequency schedules to ensure that a sufficient number of wells can remain active to meet storage gas injection and withdrawal cycles and volumes to satisfy residential and commercial gas demand. These procedures appear to be reasonable to Exponent.

- a. PG&E installed new, smaller diameter production casing in many wells, and nearly all wells have tubing strings and a packer, which decreases gas injection and withdrawal rates, compared to annulus flow and casing flow.
- b. PG&E’s Reinspection Plans were developed to schedule wall thickness inspections according to the risk-based inspection frequency intervals so that there are wells available to meet gas flow injection and withdrawal needs. PG&E has provided detailed flow rate calculations that are sufficient to show that deliverability is satisfied.
- c. In addition, PG&E has developed “cross compression” methods to assist in meeting injection and withdrawal demands and allow continued cleanup of wells that have been

worked over. Cross compression is a method of routing gas from some wells to other wells to increase volumetric flow rate and pressure.

15. Because of the lower flowrates discussed in the previous section, PG&E has a schedule to drill at least 4 new UNGSF I/W wells.

- a. Four new McDonald Island wells were drilled and completed in 2023. Three new wells were planned for Los Medanos in 2024, and an additional five new wells are planned for McDonald Island in 2025.
- b. The new wells are designed to meet CFR and CCR regulations for UNGSF facilities and wells.

16. PG&E's January 19, 2024 Revised Testing Schedule is reasonable and based on technical data.

- a. PG&E notified CalGEM of a revised testing schedule and the technical basis for it on January 19, 2024.
- b. The basis of the revised testing schedule is:
 - i. There were wells listed in the May 23, 2023 reinspection schedule that were: (1) not worked over, (2) did not pass standard annular pressure tests, and (3) did not pass sand production inspection results.
 - ii. Work on these wells were shifted as shown in the revised 2024 reinspection plan, where appropriate.
- c. Well integrity logging procedures were not revised or modified for this revised inspection plan.
- d. PG&E's primary reason for the revised plan is to maintain well integrity and to ensure that there are sufficient I/W wells to meet storage and production demands. Wells with reinspection frequencies of 5 – 8 years were shifted from 2023 and 2024 work to 2026 work to meet a 7-year inspection frequency.
- e. PG&E performed system reliability analysis by modeling well flow rates to ensure that the available wells will meet gas demand.
- f. PG&E included the effects of cross compression in their system reliability flow simulations.

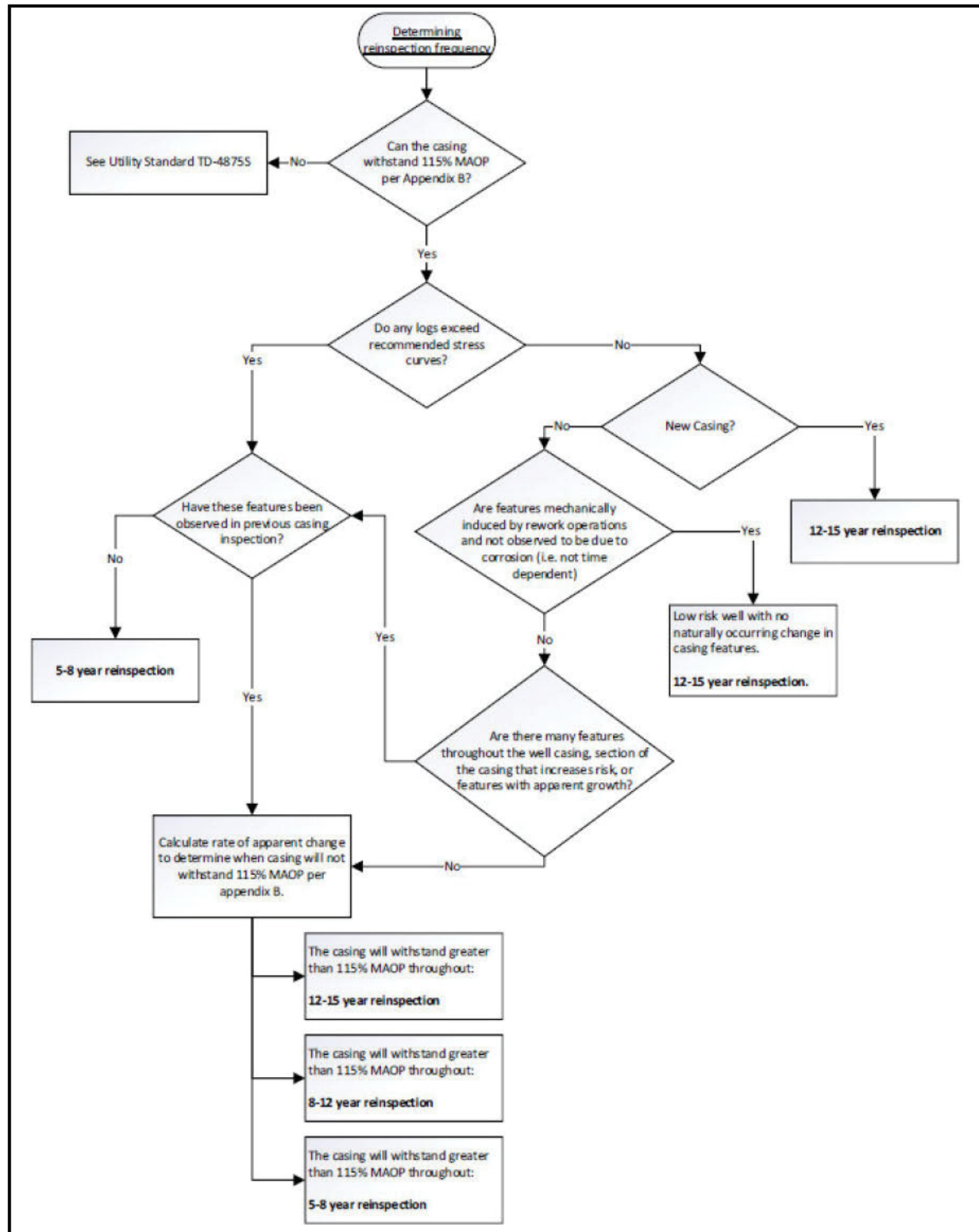


Figure 1. PG&E Casing Inspection Survey Decision Tree.

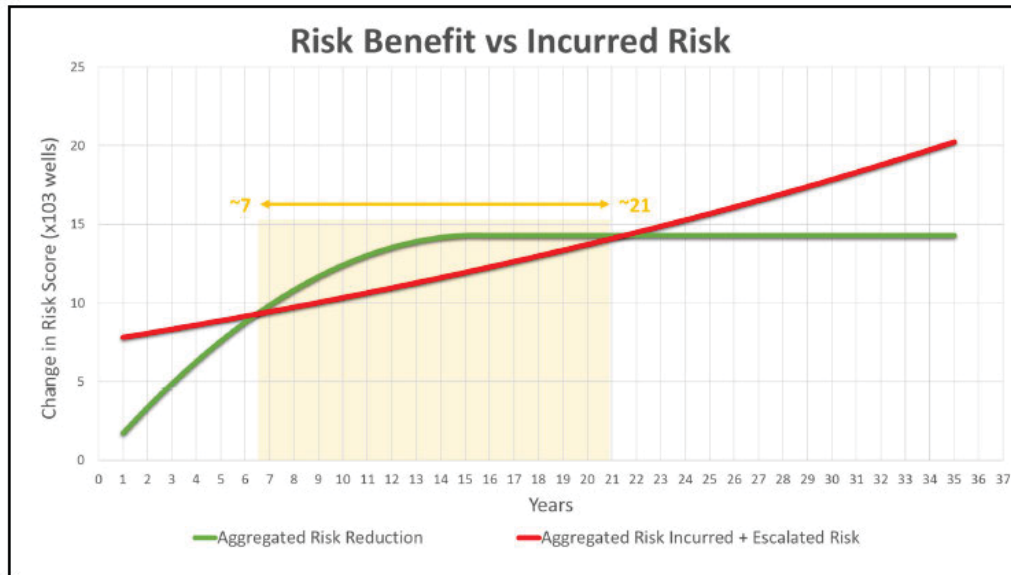


Figure 2. PG&E reinspection Plan: Risk Benefits and Incurred Risk.

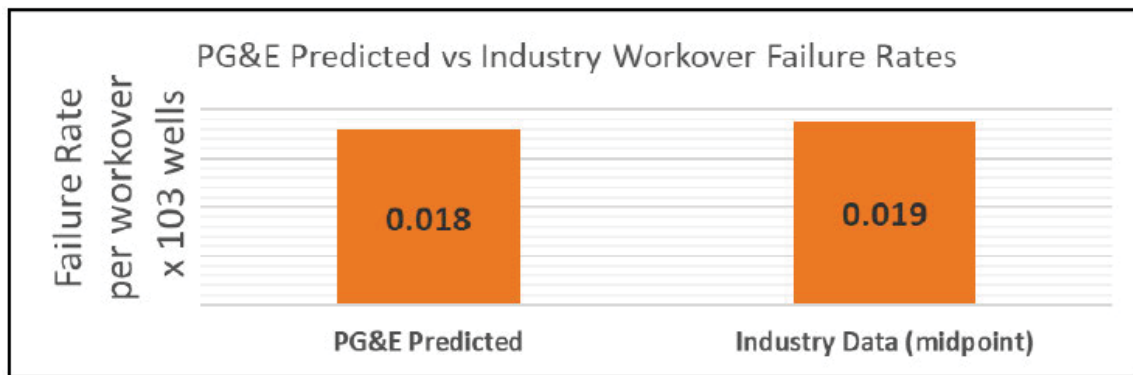


Figure 3. Failure Rate per Workover for PG&E's 103 UNGSF wells and Industry Failure Rate.

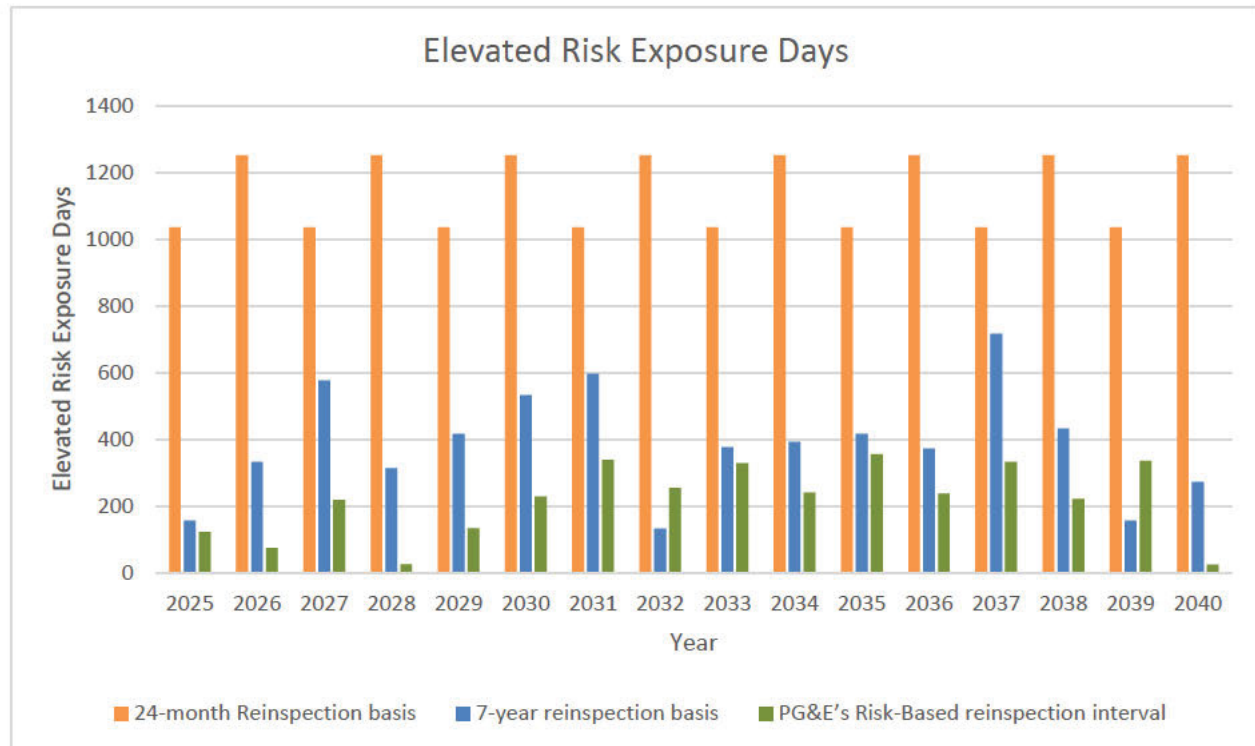


Figure 4. PG&E's elevated risk exposure days given reinspection intervals of 24 months, 7 years, and following a risk-based methodology.

Suggestions for improvements

1. PG&E's may consider using alternative logging tools

- a. For certain applications, it may be practical and efficient for PG&E to casing inspection tools based on high resolution acoustic imaging technology and through-tubing multi-string technologies. These tools are generally more expensive than HRVRT logs and multi-arm caliper logs, and since they are newer technologies, may also be less available. They have, however, certain advantages over more traditional logging tools.
- b. These tools may be best utilized to inspect for external casing corrosion or damage near the surface, which Exponent has found to be a cause of leaks in older gas storage wells, and older oil and gas production wells.
- c. **DarkVision logging tool**
 - i. DarkVision is a commercial logging tool based on acoustic imaging of the inner surface of the tubing or casing.²⁰ The tool utilizes multiple acoustic wave

²⁰ <https://darkvisiontech.com/technology/>

transmitters and receivers to map the surface the pipe.^{21 22 23} Exponent has evaluated tubing and casing inspections using this tool for the matters related to oriented perforations and seam welds in casing and tubing. The tool produces high resolution images and literature shows that results are accurate. A recent paper presented in 2022 has demonstrated that the tool can be used to measure the thickness of the pipe.²⁴

d. Through tubing multi-string logs

i. TGT Oilfield Services

1. TGT Oilfield Service developed spectral noise through-tubing logging tools to inspect the diameters and wall thicknesses of multiple concentric casing strings and flow of liquids and gas behind casing or outside of the wellbore.
2. Multi Tube Integrity (“MTI”) logs are acoustic tools which uses spectral decomposition analysis.^{25 26}
3. TGT also markets an electromagnetic scanning tool referred to as magnetic imaging defectoscope (“MID”) tool, or MID-2 and MID-3 tools.^{27 28}

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- ²¹ Rassenfoss, Stephen. "Getting Your Perforations in a Line Can Mean More-Productive Fracturing." *J Pet Technol* 73 (2021): 18–21. doi: <https://doi.org/10.2118/0721-0018-JPT>
- ²² Plaxton, Bill , Pehlke, Trent , Baxter, Dennis , Crockett, Matt , and Trent Kaiser. "SAGD Production Casing Failure Diagnosis and Repair." Paper presented at the SPE Thermal Well Integrity and Design Symposium, Banff, Alberta, Canada, November 2018. doi: <https://doi.org/10.2118/193362-MS>
- ²³ Pehlke, Trent, Simpson, Greer, Maxwell, Tamara, Bourgeois, Charles, Stibbs, Joshua, and Thomas Littleford. "On Track for Refrac: Targeting Under-Stimulated Stages and Assessing Casing Integrity Defects with High-Resolution Acoustic Imaging." Paper presented at the SPE Hydraulic Fracturing Technology Conference and Exhibition, The Woodlands, Texas, USA, February 2024. doi: <https://doi.org/10.2118/217768-MS>
- ²⁴ Simpson, Greer, Littleford, Tom, and Anthony Battistel. "High-Resolution Acoustic Imaging for Submillimetric Casing Thickness Quantification and Advanced Effective-Area-Based Burst Pressure Analyses." Paper presented at the SPE Annual Technical Conference and Exhibition, Houston, Texas, USA, October 2022. doi: <https://doi.org/10.2118/210010-MS>
- ²⁵ Aslanyan, A. and Davydov, D., 2012. Spectral Noise Logging SNL-5 Technical, September. Available at <https://tgtiagnostics.com/wp-content/uploads/2019/10/SNL-5-White-Paper.pdf> .
- ²⁶ Maxwell-Amgbaduba, S., Ogbonna, D., Obakhena, F., Okereke, O., Green, I., Volkov, M., and Oyanu, . "De-Risking Thermal Induced Sustained Annulus Pressure to Safeguard Optimal Production." Paper presented at the SPE Nigeria Annual International Conference and Exhibition, Lagos, Nigeria, August 2021. doi: <https://doi.org/10.2118/208255-MS>
- ²⁷ Aslanyan, A., Aslanyan, I., Arbuzov, A., Zagidullin, B., Al-Rahawi, T. A., Prosvirkin, S., Al-Ajmi, M. F., Awad, M. O., Sharma, S. S., and M. Das. "Time-Domain Magnetic Defectoscopy for Tubing and Casing Corrosion Detection." Paper presented at the SPE International Oilfield Corrosion Conference and Exhibition, Aberdeen, Scotland, May 2014. doi: <https://doi.org/10.2118/169601-MS>
- ²⁸ Ansari, Arsalan A., Libdi, Ziad , Khan, Naeem , Aslanyan, Arthur , Aslanyan, Irina , Volkov, Maxim , Arbuzov, Andrey , Achkeev, Andrey , Shnaib, Fathi , and Ruslan Makhyanov. "Triple-Barrier Thickness Scanning Using Through-Tubing Pulse-Magnetic Logging Tool." Paper presented at the SPE Russian Petroleum Technology Conference, Moscow, Russia, October 2015. doi: <https://doi.org/10.2118/176655-MS>

4. TGT has also developed a spectral tool reported to detect flow behind or in between casing strings, which they market as the “Chorus” tool.^{29 30}
5. Exponent has examined log data from both MTI and Chorus logs for analysis of gas storage wells. These tools give reasonable results consistent with the locations of high-resolution temperature and noise logs.

e. Weatherford Geophone Array Production (“GAP”) log

- i. The GAPS tools uses acoustic (seismic) wave analysis to detect the movement of flow outside of or in between casing strings.³¹ Based on correlations they have developed, the report to be able to discriminate the type of fluid, gas or liquid, which is flowing, the direction of flow.
- ii. Exponent has experience interpreting the results of this logging tool to investigate cross flow in a gas production well. The results are consistent with high resolution noise and temperature logs, and the flow discrimination is useful.

2. Calculation of Failure Rate

- i. Provide details on the calculation of the Failure Rate per workover x 103 wells, which is in Figure 5 of the May 23, 2023 Report.
- ii. The failure rate is given as 0.018 and agrees with industry data.
- iii. The source of the failure rate would likely help CalGEM to appreciate the validity of the estimated failure rate.

3. Corrosion Rate

- a. TC Energy used a probabilistic approach to estimate corrosion rates. This is probably not necessary since PG&E is using actual measurements from HRVRT logs. Performing a probabilistic approach, however, may be useful in estimate the maximum wall thickness frequency (i.e., 12 years or more).

4. Burst Rating (MIYP)

- a. PG&E may want to consider using a defect-based or fracture mechanics approach for burst resistance. The API TR 5C3 Barlow equation is conservative and is likely not accurate for mechanical damage, which appears the source of wall thickness loss

²⁹ Sedrati, Khaled, Almulhim, Bassam K., and Tolulope M. Hassan. "Cross-Flow Behind the Casing Examination Using Spectral Noise and High Precision Temperature Tool in Partially Cemented Long String Gas Wells." Paper presented at the GOTECH, Dubai City, UAE, April 2025. doi: <https://doi.org/10.2118/224600-MS>

³⁰ Evdokimov, S., Kadura, M., Ben Boudiaf, M., Sikander, S., Ezwai, J., Zitouni, M., Ezarrug, N., Abosart, A., Elyaseer, M., and M. Hander. "Diagnosing Well Integrity in Oilfield with Corrosive Aquifer with Pulse Electromagnetic and Chorus Acoustic Technologies." Paper presented at the ADIPEC, Abu Dhabi, UAE, November 2024. doi: <https://doi.org/10.2118/222318-MS>

³¹ [https://www.weatherford.com/documents/real-result/formation-evaluation/wireline-services/gaps-identifies-gas-source-to-diagnose-crossflow-from-nearby-well,-saving-\\$150,000/](https://www.weatherford.com/documents/real-result/formation-evaluation/wireline-services/gaps-identifies-gas-source-to-diagnose-crossflow-from-nearby-well,-saving-$150,000/)

detections in many of PG&E's directionally drilled wells. Exponent has assisted PG&E to develop analysis for pipeline risk integrity (TIMP applications).

5. 49 CFR § 192(d)(3) 7-year reassessment from baseline

- a. PG&E may consider stressing that the 7-year interval agrees with PG&E's Risk Benefit vs Incurred Risk plot of Figure 4 of the May 23, 2025 Reinspection Plan. There is also literature which supports the 7-year interval for pipelines.

6. Technical Publication

- a. PG&E may consider publishing their methodology as a technical paper in AGA or SPE conferences or journals. This may aid in CalGEM's understanding of the methods and enable them to compare it to other risk-based methods.

Background

Aliso Canyon Blowout

On October 23, 2015, a natural gas leak occurred on October 23, 2015 at the SS-25 well pad of the Aliso Canyon underground natural gas storage facility (“UNGSF”) operated by Southern California Gas Company (“SoCalGas”) near Los Angeles, California. The gas leaked through a corroded hole at the external surface of the production casing, and shortly thereafter a circumferential fracture occurred in the production casing at approximately 892 ft below the wellhead. The leak breached the wellbore envelope, and a blowout occurred to the surface, which made conventional well killing operations difficult. The blowout persisted for 111 days until a relief (intervention) well was drilled and intersected the SS-25 on February 11, 2016. At that time the well blowout was killed. The well was plugged on February 18, 2016.^{32 33}

New Rules, Regulations, and Industry Practices

As a result of the blowout, new federal and state regulations were introduced in 2016, 2017, and 2018, which included:

- U.S. Department of Transportation (“DOT”) Pipeline and Hazardous Materials Safety Administration’s (“PHMSA”) Underground Storage regulations, 49 Code of Federal Regulations (“CFR”) §§ 191 and 192. These regulations adopt American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation, among other things.
- The California Geologic Energy Management (“CalGEM”) Division³⁴ established 14 California Code of Regulations (CCR) §1726 California Underground Gas Storage regulations effective October 1, 2018, which includes among other things, requirements for operators to submit project-specific Risk Management Plans, Emergency Response Plans, project data requirements, a Records Management Program, well construction requirements, mechanical integrity testing requirements, and monitoring and reporting requirements.

The Federal regulation 49 CFR §§ 191 and 192 and State regulation CCR §1726 in general require comprehensive risk assessments of all phases of UNGSF assets and operations. Well integrity is a specific focus of the regulations, which is also a focus of API RP 1171.

Monitoring the wall thickness of the production casing and tubing for indications of corrosion and mechanical damage is specific requirement of the regulations and AP RP 1171, which is

³² [2015 Aliso Canyon Gas Leak After Action/Corrective Action Report](#)

³³ Blade Energy Partners. 2019. SS-25 RCA Supplementary Report: SS-25 Casing Failure Analysis. Available at <https://www.socalgas.com/sites/default/files/SoCalGas-154.pdf>

³⁴ Formerly Division of Oil, Gas, and Geothermal Resources (“DOGGR”)

incorporated by reference into CFR § 192. While CCR §1726 does not explicitly incorporate by reference API RP 1171, it requires risk-based management plans for UNGSF assets and operations, and production casing and tubing wall thickness monitoring.

Based on our review of documents provided by PG&E, publicly available documents addressing UNGSF operations, and technical literature, Exponent finds that PG&E is compliant with regulations and recommended practices of 49 CFR § 192, CCR § 1726, and API RP 1171. The requirements for wall thickness monitoring in 49 CFR § 192, CCR § 1726, and API 1171 are summarized in the next section.

Wall Thickness and Corrosion Monitoring Requirements

The requirements for wall thickness monitoring in 49 CFR Parts 192 and 192, CCR §1726, and API 1171 are summarized in this section. While the requirement of wall thickness monitoring is fundamental to maintaining the pressure integrity of UNGSF wells, corrosion rate and the appearance of mechanical damage after well intervention for workovers requires repeated wall thickness measurements. Repeated monitoring requires the determination of the time between wall thickness measurements.

API Recommended Practice 1171

The first edition of API RP 1171 was published in September 2015, shortly before the Aliso Canyon blowout. Subsequent to the blowout, API RP 1171 was revised and the second edition was published in November 2022, with an errata section added in September 2023.

With regard to Risk Management Programs, API RP 1171 includes § 8 Risk Management for Gas Storage Operations, which includes [Emphasis in bold added]:

§ 8.6.2 Frequency

The operator shall define the interval of review and identify any new threats or hazards.

The **interval** should be of sufficient length that the quantity of new data and information that is brought into the analysis is meaningful and that any developing trends have sufficient data to be identifiable.

The operator shall define a review **frequency** for the P&M measures, not to exceed three years.

The frequency or interval refers to reviewing the RMP but not specifically wall thickness inspection frequency or interval.

Section 6 of API RP 1171, Functional Integrity in the Design and Construction of Natural Gas Storage Wells, include [Emphasis in bold added]:

§ 6.10.2 Casing Inspection Logging

The operator should perform **baseline** casing inspection logging on new production casing.

§ 6.10.3 Well Conversion to Storage Service

When converting to storage service, the condition of accessible tubulars and cement shall be evaluated to determine capabilities of containing formation pressures and providing zonal isolation of the storage reservoir. Wellhead assembly equipment shall be rated to or above the maximum anticipated surface pressure.

Based on the documentation we have reviewed PG&E has completed initial wall thicknesses MFL to compile a baseline of all of its UNGSF wells.

API RP 1171 Section 9 Integrity Demonstration, Verification, and Monitoring Practices includes the following [Emphasis in bold added]:

§ 9.3.1 Well Integrity Evaluation

The operator shall evaluate the mechanical integrity of each well, including each third-party well, where possible, that penetrates the storage reservoir and buffer zone, or areas influenced by storage operations. The evaluation depends upon a variety of factors, including but not limited to, available data, well type, ownership, and status.

Data for evaluation of active third-party wells shall be requested from third-party operator and should be requested from public sources. Public sources can include state and historical preservation office databases. Evaluation of third-party wells follows the **frequency** as determined using the risk assessment.

Active well mechanical integrity evaluations shall include **initial** and **subsequent evaluations** at a **frequency determined using the risk assessment and the information derived from the initial evaluation**.

§ 9.3.2 Well Integrity Monitoring

The operator shall verify the integrity of the production casing by pressure testing or **corrosion logging** at a **frequency determined by the risk analysis**. When the latter is used, then the operator shall evaluate areas of apparent metal loss and the impact on the allowable operating pressure.

API RP 1171 does provide specific guidance on the frequency of logging or time interval between logs and rather leave it to the operator to establish a frequency based on risk analysis.

Based on our review of PG&E's Reinspection Plans, we find that PG&E complies with API RP 1171 § 9.3.2, and that they have established corrosion logging frequencies for its UNGSF wells based on a technically sound risk analysis and a comprehensive examination of date of all of their UNGSF wells.

Code of Federal Regulations Part 191 and Part 192

49 CFR Part 191 – Pipeline Incident and Annual Reporting

Part 191 sets forth the federal reporting requirements for natural gas pipeline systems, including UNGSF wells.³⁵ It requires operators to promptly notify authorities of any significant pipeline or storage incident and to file detailed incident reports describing what happened. Operators must also submit annual reports summarizing key data, such as gas volumes stored, operating pressures, well counts, and maintenance activities, to give regulators oversight of their system's integrity. Additionally, Part 191 mandates safety-related condition reports if an operator discovers conditions that could jeopardize the safe operation of a pipeline or storage well.³⁶ By extending these reporting rules to UNGSFs, Part 191 ensures transparency and early warning of potential issues in gas storage fields.

PG&E's 2019 Asset Management Plan and Reinspection Plans comply with these regulations.

49 CFR Part 192 – Natural Gas Pipeline Safety Standards

Part 192 contains the comprehensive safety standards for natural gas pipelines, covering all phases from design and construction to operation, maintenance, and integrity management.³⁷ These are the minimum federal safety requirements pipeline operators and UNGSFs must follow to prevent leaks, ruptures, and other hazards. In the context of UNGSF wells, Part 192 was expanded after the 2015 Aliso Canyon incident to directly regulate these facilities as part of the pipeline system.³⁸ Operators of UNGSFs are required to meet rigorous well integrity and risk management practices drawn from industry standards. PHMSA has incorporated API RP 1170 for solution mined salt caverns and API RP 1171 for depleted hydrocarbon reservoirs as enforceable criteria.³⁹ This means companies must design, operate, and monitor UNGSF wells according to proven engineering guidelines. Part 192 also requires storage operators to establish written procedures for operations, maintenance, and emergency preparedness at their underground facilities, and to implement an ongoing integrity management program to ensure wells remain safe over time. In summary, pipeline transportation and UNGSF safety rules are intended to maintain the structural integrity of wells and pipelines and protect the public and environment from the dangers of uncontrolled gas releases.

³⁵ [eCFR :: 49 CFR Part 191 -- Transportation of Natural and Other Gas by Pipeline: Annual, Incident, and Other Reporting](#)

³⁶ [GAO-20-167, NATURAL GAS STORAGE: Actions Needed to Assess Inspection Workload and Progress toward Safety Outcomes](#)

³⁷ [eCFR :: 49 CFR Part 192 -- Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards](#)

³⁸ [Underground Natural Gas Storage | PHMSA](#)

³⁹ [Underground Natural Gas Storage | PHMSA](#)

Part 192 directs operators to API RP 1171 as follows [Emphasis in bold added]:

§ 192.12 (d)(2) *Integrity management baseline risk assessment intervals*. No later than **March 13, 2024**, each UNGSF operator must complete the **baseline risk assessments** of all reservoirs and caverns, and at least 40% of the baseline risk assessments for each of its **UNGSF wells** (including wellhead assemblies), beginning with the highest-risk wells, as identified by the risk analysis process. No later than March 13, 2027, an operator must complete baseline risk assessments on all its wells (including wellhead assemblies). Operators may use prior risk assessments for a well as a baseline (or part of the baseline) risk assessment in implementing its initial integrity management program, so long as the prior assessments meet the requirements of **API RP 1171** (incorporated by reference, see § 192.7), section 8, and continue to be relevant and valid for the current operating and environmental conditions. When evaluating prior risk-assessment results, operators must account for the growth and effects of indicated defects since the time the assessment was performed.

§ 192.12 (d)(3) *Integrity management re-assessment intervals*. The operator must determine the appropriate interval for risk assessments under **API RP 1171** (incorporated by reference, see § 192.7), subsection 8.7.1, and this paragraph (d) for each reservoir, cavern, and well, using the results from earlier assessments and updated risk analyses. The re-assessment interval for each reservoir, cavern, and well must not exceed **seven years** from the date of the **baseline assessment** for each reservoir, cavern, and well.

In summary, baseline wall thickness measurements must be completed by March 23, 2024. PG&E met this deadline for all McDonald Island and Los Medanos UNGSF wells prior to the required date. PG&E has used QRA methods to develop reinspection (*i.e.*, reassessment) plans. The plans optimize the Likelihood of Risk Event (“LoRE”) and Consequence of a Risk Event (“CoRE”). As discussed in this report, PG&E’s analysis is reasonable and based on technically sound QRA practices. For new wells, wells with newly installed inner production casing strings, and wells demonstrated to have a low corrosion rate, the MFL well inspection interval is greater than seven years.

CCR Title 14, Division 2, Section 1726

Article 5 § 1726 – 1726.10 addresses Requirements for Underground Gas Storage. More specifically, § 1726.6 addresses Mechanical Integrity Testing of UNGSF wells, including those in depleted hydrocarbon reservoirs. The requirements for mechanical integrity testing of UNGSF wells are as follows [Emphasis in bold added]:

(a) The operator shall, at a minimum, conduct the following mechanical integrity testing on each gas storage well and every other well that penetrates the gas storage reservoir of the operator’s underground gas storage project, with the exception of wells that have been plugged and abandoned in accordance with Public Resources Code section 3208:

(1) A **temperature and noise log** shall be conducted at least **annually** to ensure integrity. Logging shall include a repeat section of no less than 200 feet, preferably across intervals where anomalies are present. If an anomaly is identified that indicates a possible loss of or threat to the mechanical integrity of the well, then the operator shall immediately report the anomaly to the appropriate district office. If the operator is unable to explain any anomaly, then the well shall not be used for injection or withdrawal without subsequent approval from the Division.

(2) A **casing wall thickness inspection** to estimate internal and external corrosion, employing such methods as **magnetic flux or ultrasonic technologies**, shall be performed at least once every **24 months** to determine if there are possible issues with casing integrity. Logging shall include a repeat section of no less than 200 feet, preferably across intervals where anomalies are present. The results shall be compared against prior results and any other available data to determine the corrosion rate. If the casing wall thickness inspection indicates that within the next 24 months thinning of the casing will diminish the casing's ability to contain 115 percent of the well's maximum allowable operating pressure utilizing Barlow's equation or another, similarly effective method, then the well shall be remediated and shall not be used for injection or withdrawal without subsequent approval from the Division. **The Division may approve a less frequent casing wall thickness inspection schedule for a well if the operator demonstrates that the well's corrosion rate is low enough that biennial inspection is not necessary.**

PG&E has been performing temperature and noise logs in all UNGSF wells annually as part of their inventory verification program. Thus, they are compliant with § 1726(a)(1).

PG&E has completed baseline MFL tool wall thickness inspections for all of its UNGSF wells using Baker Hughes Vertilog, MicroVertilog, and HRVRT tool. The majority of wells were logged with HRVRT tools, which are more accurate.⁴⁰

PG&E has performed QRA to determine a reasonable and technically sound reinspection interval to compare wall thicknesses as a function of time and to (1) determine indications of mechanical damage and (2) to estimate corrosion rates with reasonable accuracy. The interval between MFL tool wall thickness logs is a function of:

- Well construction
- Well age (spud date)
- Production casing age (initial completion date)
- Top of cement outside production casing

⁴⁰ Child, T., Baker Hughes, PHMSA Pipeline R&D Forum, Cleveland, OH, November 16-17, 2016. Available at <https://primis.phmsa.dot.gov/rd/mtgs/111616/Terry%20Child.pdf>

- If an inner string (new production casing) was installed
- Change in completion equipment
- Workover schedule
- Injection and withdrawal schedule
- Time since last wall thickness measurement log
- Estimated corrosion rate
- Evidence of mechanical damage associated with measured wall thickness
- Risks during workovers and well intervention

As described in this report, PG&E's well inspection intervals are as follows:

- 5-8 Year Interval: Class 2 and/or 3 with Aggressive Apparent Growth, OR general Class 3 with Growth Undefined
- 8-12 Year Interval: Class 2 and/or 3 with Moderate Apparent Growth, OR isolated Class 3 with Growth Undefined
- 12-15 Year Interval: Class 1, 2, or 3 with No Apparent Growth, OR Class 1 or 2 with Growth Undefined

Moreover, PG&E performed a formal QRA showing that the optimum time to perform a wall thickness inspection, including the risks of well workover intervention and injection/withdrawal volumes was 7 to 21 years.

Based on our analysis and review of the documents, Exponent finds that PG&E's wall thickness reinspection intervals are reasonable and based upon sound technical analysis.

Overview of PG&E's Underground Storage Facilities

PG&E's underground natural gas storage facilities help to maintain a reliable source of energy for California and provide a cushion for seasonal variations in supply and demand.⁴¹ PG&E's Gas Storage Asset Family consists of three main underground storage fields: McDonald Island, Los Medanos, and Pleasant Creek.⁴² McDonald Island is the largest gas storage field owned by PG&E, consisting of 82 total wells with a capacity of 137 billion cubic feet. Los Medanos, PG&E's second largest gas storage facility consists of 18 wells and a maximum capacity of 29 billion cubic feet. Pleasant Creek is the smallest storage facility owned exclusively by PG&E and has a total of 6 wells with a maximum capacity of 7.3 billion cubic feet. PG&E has executed a purchase and sale agreement for the sale of the Pleasant Creek Gas Storage Field as a result of the California Public Utilities Commission (CPUC) Decision D-19-09-025 in PG&E's 2019 gas transmission and storage rate case.⁴³ The sale is pending approval from CPUC. PG&E also owns a 25% interest in the Gill Ranch storage facility, which operated by an independent party. The UNGSF wells at the Gill Ranch facility are not subject to the reinspection plan. The plan, however, does direct PG&E to continue to work with Gill Ranch Storage, Ltd. to operate, assess, and maintain the assets. A map of the field locations of the PG&E storage wells can be seen in Figure 5.⁴⁴

At each field there are several assets that are governed by one or more regulatory body. PG&E's The three storage fields operated by PG&E consist of 106 storage wells,⁴⁵ 16.6 miles of transmission pipe, and three compression and processing facilities in their fields. The 106 UNGSF include injection/withdrawal and observations wells and does not include wells that are plugged and abandoned.⁴⁶ Regulations related to the safety, construction, operations, and maintenance of surface equipment and pipeline operated in California are under the jurisdiction of the CPUC. The UNGSF wells owned and operated by PG&E are mainly under the jurisdiction of PHMSA and CalGEM, while there are other agencies that may have regulatory authority.

At this time, PG&E has completed its baseline casing inspections for 100% of its wells in preparation of establishing a set reinspection plan. PG&E has also made progress converting all wells to tubing and packer with 91% of wells converted in 2024 and a plan for 100% of wells to be converted by the end of 2025.⁴⁷

⁴¹ PG&E, Underground Gas Storage Asset Management Plan, GP-1108, Revision 11, December 19, 2024, p. 7.

⁴² *Id.*, p. 10.

⁴³ *Id.*, p. 14.

⁴⁴ *Id.*, p. 11.

⁴⁵ *Id.*, p. 10. Note: 106 UGS wells is listed in PG&E GP-1108 as of December 18, 2024. The number of active PG&E UGS wells varies as wells are plugged & abandoned, new wells drilled, and other wells are taken out of service because they did not pass integrity tests or for other reasons.

⁴⁶ *Id.*, p. 10.

⁴⁷ *Id.*, p. 15.

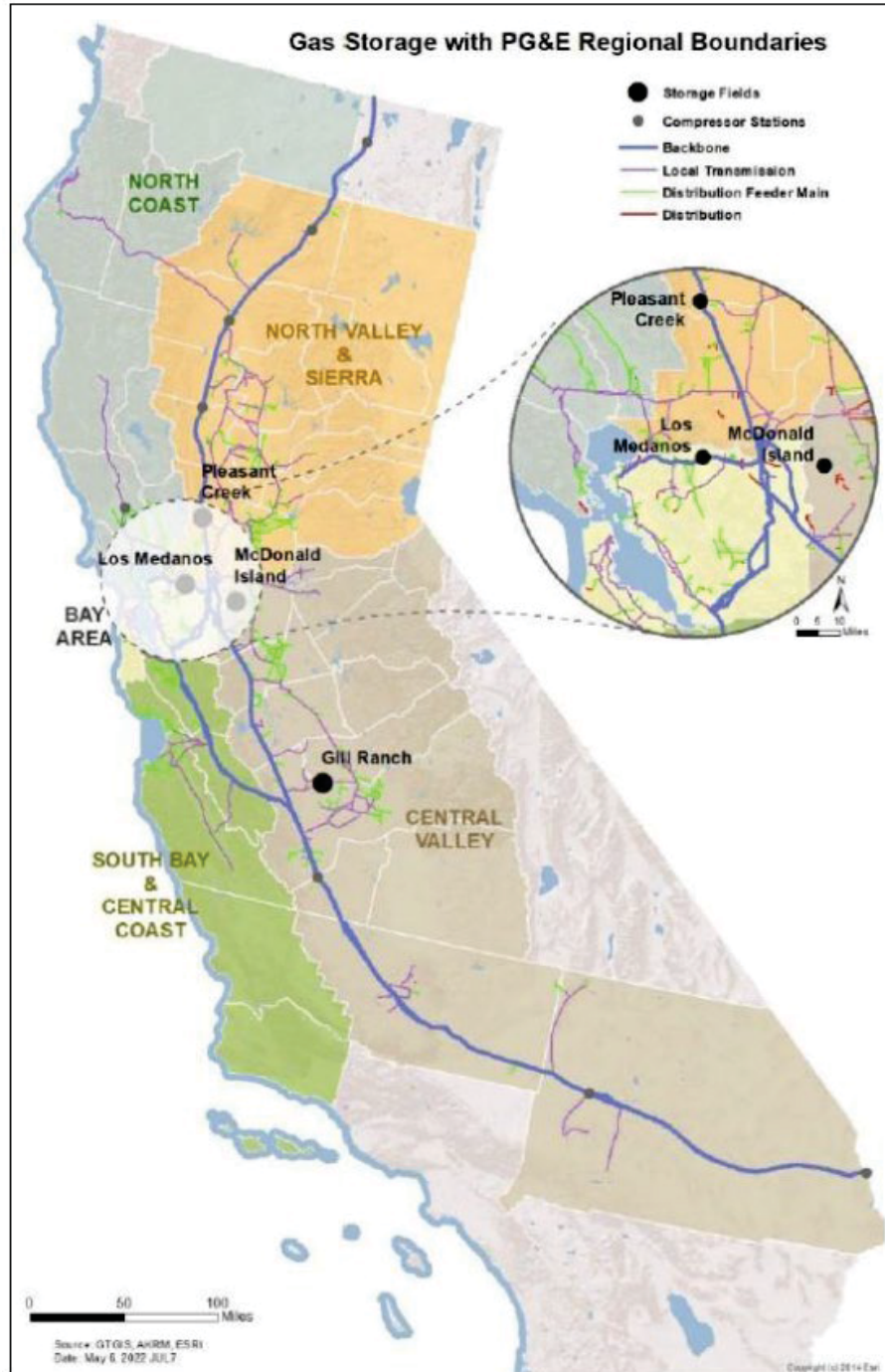


Figure 5. Map of PG&E Gas Storage Facilities.

PG&E UNGSF Facilities

Summary of PG&E Storage Field Characteristics

PG&E provided a summary of its storage fields and the wells that they are comprised of in its Underground Gas Storage Asset Management Plan. Table 1 details key components of the summary from PG&E for its three main storage fields and the Gill Ranch field that it partially owns.⁴⁸

Table 1. PG&E Storage Field Statistical Summary as of 12/19/2024.

Asset Category	Description of Statistic	McDonald Island	Los Medanos	Pleasant Creek	Gill Ranch
General Information	Operator	PG&E	PG&E	PG&E	Gill Ranch
	County	San Joaquin	Contra Costa	Yolo	Madera/Fresno
	Discovery Date	1936	1958	1948	1942/1957
	Year Placed in Storage Service	1975	1973	1960	2010
Well Types	Number of injection (INJ) / withdrawal (WD) Wells	72	15	6	10
	Number of SWD Wells	0	0	0	1
	Number of Observation Wells	8	3	0	8
	Number of tubing and casing (TC) Wells	11	3	6	N/A
	Number of TP Wells	61	12	0	N/A
	Number of P&A Wells	11	2	1	4
Field Pressure and Inventory	Maximum Field Pressure (psig)	2,070	1,600	1,250	3,250
	Facility MAOP (psig)	2,160	1,800	1,300	3,150
	Cushion Gas (BCF)	99.5	17.4	5.1	3.5
	Working Gas (BCF)	37.1	11.8	2.3	20
	Total Maximum Inventory (BCF)	136.6	29.1	7.3	23.5

McDonald Island

The McDonald Island Storage field is located on a man-made island in Sacramento-San Joaquin River Delta, see Figure 6⁴⁹ shown below. The field was discovered in 1936 and the first well, the Weyl-Zuckerman 1, has a spud date of 7/9/1936. The field was first used for storage in 1975. As of today, there are 92 total wells in the McDonald Island Gas Storage field with the latest, Lil

⁴⁸ *Id.*, p. 19.

⁴⁹ Figures 5, 6, and 7 from CalGEM's WellSTAR Well Finder Database last accessed June 2025.

Mac 2, having a spud date of 3/6/2024. Table 2 lists the API number, spud date, wells status, data of P&A of wells at the facility.⁵⁰ There are a total of 80 active wells and 12 wells that have been plugged and abandoned. Of the 80 active wells, 74 are withdrawal/injection wells and 6 are observation wells.

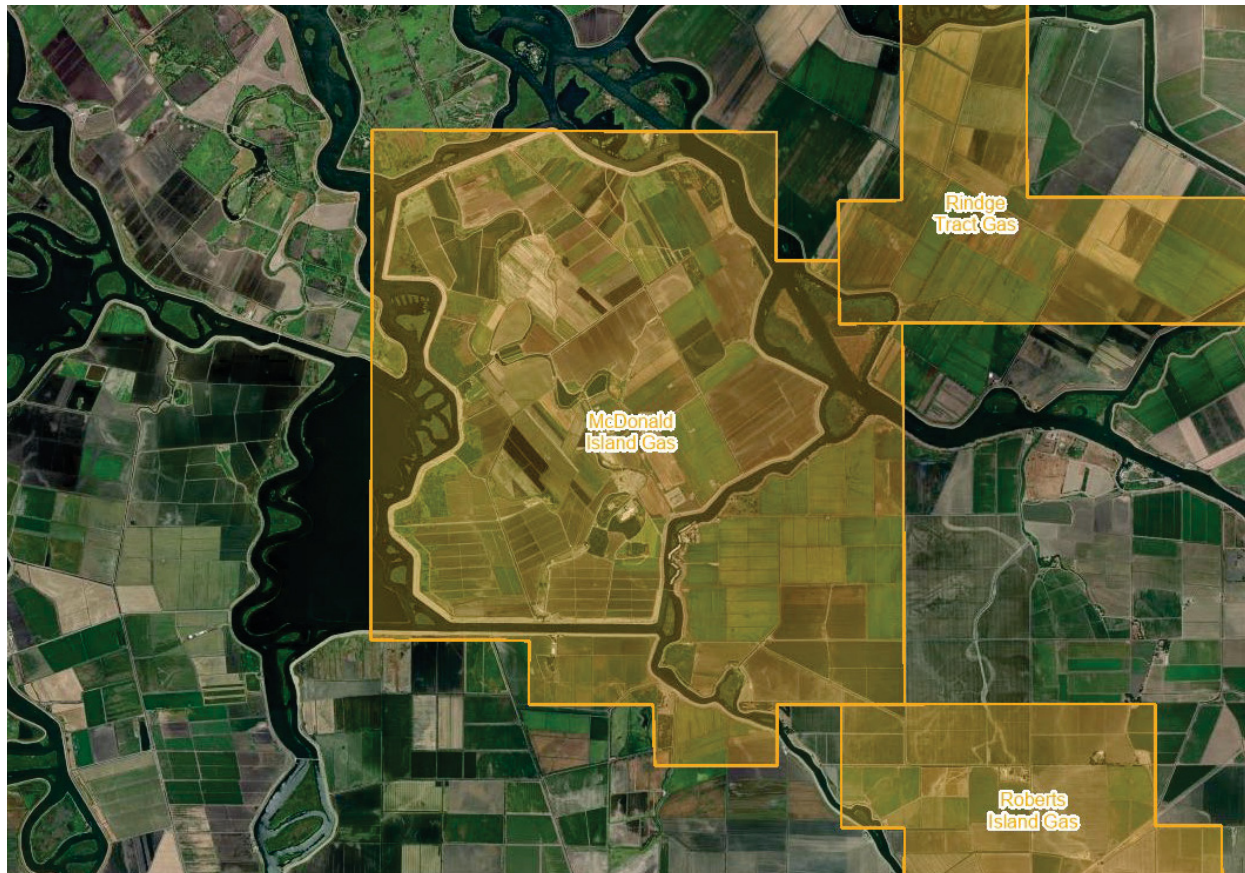


Figure 6. Map of McDonald Island Gas storage field from CalGEM's WellSTAR Well Finder Database.

Table 2. McDonald Island Storage Field Wells

Well Name and Number	API Number	Spud Date	Type of Well	Plugged and Abandoned Date
Lil Mac 1	07720609	7/18/1999	Withdrawal/Injection	
Lil Mac 2	07720743	3/6/2024	Withdrawal/Injection	
McDonald Island Farms 4	07700080	10/23/1949	Observation	
McDonald Island Farms 5A	07720552	8/17/1991	Withdrawal/Injection	

⁵⁰ Tables 1, 2, and 3 are based on data provided by PG&E to Exponent in file, _API Numbers_.xlsx, dated June 13, 2025.

Well Name and Number	API Number	Spud Date	Type of Well	Plugged and Abandoned Date
McDonald Island Farms 6	07700082	10/19/1949	Observation	
McDonald Island Farms 7	07700083	11/12/1949	Observation	
McDonald Island Farms 9	07700084	8/11/1960	Withdrawal/Injection	
McDonald Island Farms 10	07700085	8/27/1960	Withdrawal/Injection	
McDonald Island Farms 11	07700086	9/13/1960	Withdrawal/Injection	
McDonald Island Farms 12	07700087	9/28/1960	Withdrawal/Injection	
McDonald Island Farms 13	07700088	10/16/1960	Withdrawal/Injection	
McDonald 14	07720441	8/23/1984	Withdrawal/Injection	3/15/2024
McDonald Island Farms 15	07720444	10/10/1984	Withdrawal/Injection	3/15/2024
Roberts Island 1	07720524	10/12/1989	Observation	
Roberts Island 2	07720523	10/31/1989		10/1/2020
Tilden Community 1	07700090	1/22/1937		11/18/2019
Turner Cut 1 AS	07720551	7/27/1991	Withdrawal/Injection	
Turner Cut 1 AN	07720742	11/30/2023	Withdrawal/Injection	
Turner Cut 1 BN	07720741	1/18/2024	Withdrawal/Injection	
Turner Cut 1-N	07720196	5/23/1973	Withdrawal/Injection	10/10/2023
Turner Cut 1-S	07720218	11/21/1973	Withdrawal/Injection	
Turner Cut 2-N	07720199	6/9/1973	Withdrawal/Injection	
Turner Cut 2-S	07720219	10/31/1973	Withdrawal/Injection	
Turner Cut 3-N	07720201	7/3/1973	Withdrawal/Injection	
Turner Cut 3-S	07720216	10/9/1973	Withdrawal/Injection	
Turner Cut 4-N	07720202	7-19-1973	Withdrawal/Injection	
Turner Cut 4-S	07720203	9/21/1973	Withdrawal/Injection	
Turner Cut 5-N	07720207	8-1-1973	Withdrawal/Injection	
Turner Cut 5-S	07720204	8/25/1973	Withdrawal/Injection	
Turner Cut 6-N	07720208	8/29/1973	Withdrawal/Injection	
Turner Cut 6-S	07720205	7/31/1973		12/6/2022
Turner Cut 7-N	07720225	12/12/1973	Withdrawal/Injection	
Turner Cut 7-S	07720206	7/10/1973	Withdrawal/Injection	
Turner Cut 8-N	07720226	1/19/1974	Withdrawal/Injection	

Well Name and Number	API Number	Spud Date	Type of Well	Plugged and Abandoned Date
Turner Cut 8-S	07720533	3/15/1990	Withdrawal/Injection	
Turner Cut 9-N	07720227	2/7/1974	Withdrawal/Injection	4/18/2024
Turner Cut 9-S	07720252	11/22/1974	Withdrawal/Injection	
Turner Cut 10-N	07720228	3/1/1974	Withdrawal/Injection	
Turner Cut 10-S	07720251	4/2/1974	Withdrawal/Injection	
Turner Cut 11-N	07720229	3/18/1974	Withdrawal/Injection	
Turner Cut 11-S	07720250	9/18/1974	Withdrawal/Injection	
Turner Cut 12-N	07720230	4/2/1974	Withdrawal/Injection	
Turner Cut 12-S	07720248	10/16/1974	Withdrawal/Injection	
Turner Cut 13-N	07720234	4/18/1974	Withdrawal/Injection	
Turner Cut 13-S	07720247	9/20/1974	Withdrawal/Injection	
Turner Cut 14-N	07720235	5/13/1974		2/4/1982
Turner Cut 14-S	07720244	9/9/1974	Withdrawal/Injection	
Turner Cut 15-N	07720239	7/12/1974	Withdrawal/Injection	
Turner Cut 15-S	07720245	8/28/1974	Withdrawal/Injection	
Turner Cut 16-N	07720240	7/30/1974	Withdrawal/Injection	
Turner Cut 16-S	07720243	8/10/1974	Withdrawal/Injection	
Turner Cut 17-N	07720548	7/5/1991	Withdrawal/Injection	
Turner Cut 17-S	07720258	4/3/1975	Withdrawal/Injection	
Weyl-Zuckerman 1	07700091	7/9/1936	Observation	
Weyl-Zuckerman 3	07700093	10/29/1949		10/28/2019
Whisky Slough 1A-E	07720536	5/6/1990	Withdrawal/Injection	
Whisky Slough 1A-W	07720544	6/12/1991	Withdrawal/Injection	
Whisky Slough 1-E	07720168	10/3/1972	Withdrawal/Injection	12/9/2021
Whisky Slough 1-W	07720215	3/16/1974	Withdrawal/Injection	
Whisky Slough 2-E	07720169	10/27/1972	Withdrawal/Injection	
Whisky Slough 2-W	07720212	12/5/1973	Withdrawal/Injection	
Whisky Slough 3-E	07720173	11/21/1972	Withdrawal/Injection	
Whisky Slough 3-W	07720213	11/16/1973	Withdrawal/Injection	
Whisky Slough 4-E	07720178	12/5/1972	Withdrawal/Injection	

Well Name and Number	API Number	Spud Date	Type of Well	Plugged and Abandoned Date
Whisky Slough 4-W	07720214	10/26/1973	Withdrawal/Injection	
Whisky Slough 5-E	07720179	1/6/1973	Withdrawal/Injection	
Whisky Slough 5-W	07720211	9/18/1974	Withdrawal/Injection	
Whisky Slough 6-E	07720185	2/7/1973	Withdrawal/Injection	
Whisky Slough 6-W	07720192	6/19/1973	Withdrawal/Injection	
Whisky Slough 7-E	07720187	3/2/1973	Withdrawal/Injection	
Whisky Slough 7-W	07720193	5/30/1973	Withdrawal/Injection	
Whisky Slough 8-E	07720188	3/20/1973	Withdrawal/Injection	
Whisky Slough 8-W	07720194	5/8/1973	Withdrawal/Injection	
Whisky Slough 9-E	07720189	4/9/1973	Withdrawal/Injection	
Whisky Slough 9-W	07720195	4/18/1973	Withdrawal/Injection	
Whisky Slough 10-E	07720190	4/26/1973	Observation	7/16/2022
Whisky Slough 10-W	07720534	4/3/1990	Withdrawal/Injection	
Whisky Slough 11-E	07720253	12/7/1974	Withdrawal/Injection	
Whisky Slough 11-W	07720265	7/21/1975	Withdrawal/Injection	
Whisky Slough 12-E	07720255	1/14/1975	Withdrawal/Injection	
Whisky Slough 12-W	07720264	6/30/1975	Withdrawal/Injection	
Whisky Slough 13-E	07720256	1/27/1975	Withdrawal/Injection	
Whisky Slough 13-W	07720241	6/12/1975	Withdrawal/Injection	
Whisky Slough 14-E	07720257	2/8/1975	Withdrawal/Injection	
Whisky Slough 14-W	07720238	5/6/1974	Observation	8/11/2023
Whisky Slough 15-W	07720233	4/22/1974	Withdrawal/Injection	
Whisky Slough 16-W	07720231	4/2/1974	Withdrawal/Injection	
Whisky Slough 17-W	07720166	9/7/1972	Withdrawal/Injection	
Whisky Slough 18-W	07720465	6/27/1985	Withdrawal/Injection	
Whisky Slough 19-W	07720467	7/29/1985	Withdrawal/Injection	
Whisky Slough 20-W	07720535	4/19/1990	Withdrawal/Injection	
Zuckerman-Henning 1	07720010	6/16/1967	Observation	

Los Medanos

PG&E lists 21 I/W wells and 1 observation well (Ginochio 3-7) at Los Medanos, see Table 3 below. Of the 21 I/W wells, 4 are listed as P&A'd and 1 as an observation well. Thus, Los Medanos has 16 I/W currently in operation. The oldest well is the observation well, Ginochio 3-7 and the oldest I/W 2 well currently operating is Los Medanos 3-A, which is 48 years old.



Figure 7. Map of Los Medanos Gas storage field from CalGEM's WellSTAR Well Finder Database.

Table 3. Los Medanos Storage Field Wells

Well Name and Number	API Number	Spud Date	Type of Well	Plugged and Abandoned Date
Ginochio 3-7	04-013-00135-00	12/7/1961	Observation	

Well Name and Number	API Number	Spud Date	Type of Well	Plugged and Abandoned Date
Los Medanos 1-A	04-013-20373-00	11/25/2007		9/22/2020
Los Medanos 2-A	04-013-20138-00	11/14/1978	Withdrawal/Injection	
Los Medanos 3-A	04-013-20115-01	10/17/1977	Withdrawal/Injection	
Los Medanos 4-B	04-013-20093-00	7/17/1973		10/31/2019
Los Medanos 5-B	04-013-20144-00	3/1/1979	Withdrawal/Injection	
Los Medanos 6-B	04-013-20140-01	12/20/1978	Withdrawal/Injection	
Los Medanos 7-C	04-013-20130-02	5/25/1978	Withdrawal/Injection	
Los Medanos 8-C	04-013-20145-01	4/4/1979		11/28/2017
Los Medanos 9-C	04-013-20123-00	2/7/1978	Withdrawal/Injection	
Los Medanos 10-C	04-013-20131-01	7/21/1978	Withdrawal/Injection	
Los Medanos 11-C	04-013-20128-01	3/17/1978	Withdrawal/Injection	
Los Medanos 12-C	04-013-20307-01	4/15/1991	Withdrawal/Injection	
Los Medanos 13-C	04-013-20299-00	7/7/1990	Withdrawal/Injection	
Los Medanos 14-C	04-013-20298-00	6/19/1990	Withdrawal/Injection	
Los Medanos 15-C	04-013-20121-00	12/12/1977	Observation	
Los Medanos 16-D	04-013-20133-00	9/30/1978	Withdrawal/Injection	
Los Medanos 17-D	04-013-20136-00	1/31/1979	Withdrawal/Injection	
Los Medanos 18-D	04-013-20135-00	10/23/1978		12/8/2017
Los Medanos 19-D	04-013-20295-00	5/23/1990	Withdrawal/Injection	
Los Medanos 20-D	04-013-20297-01	6/5/1990	Withdrawal/Injection	
Los Medanos 21-D	04-013-20308-00	5/6/1991	Withdrawal/Injection	

Pleasant Creek

Figure 7 shows the location of the Pleasant Creek UNGSF. Table 4 is a summary of Pleasant Creek UNGSF well information. The wells at the Pleasant Creek storage facility are currently pending sale and are not included in future years of the PG&E reinspection plans. The storage field currently contains six withdrawal/injection wells and one well that has been plugged and abandoned. According to PG&E documents, these wells are not currently operational because of the pending sale. There are no current plans to reinspect or rework the wells at the Pleasant Creek storage facility.

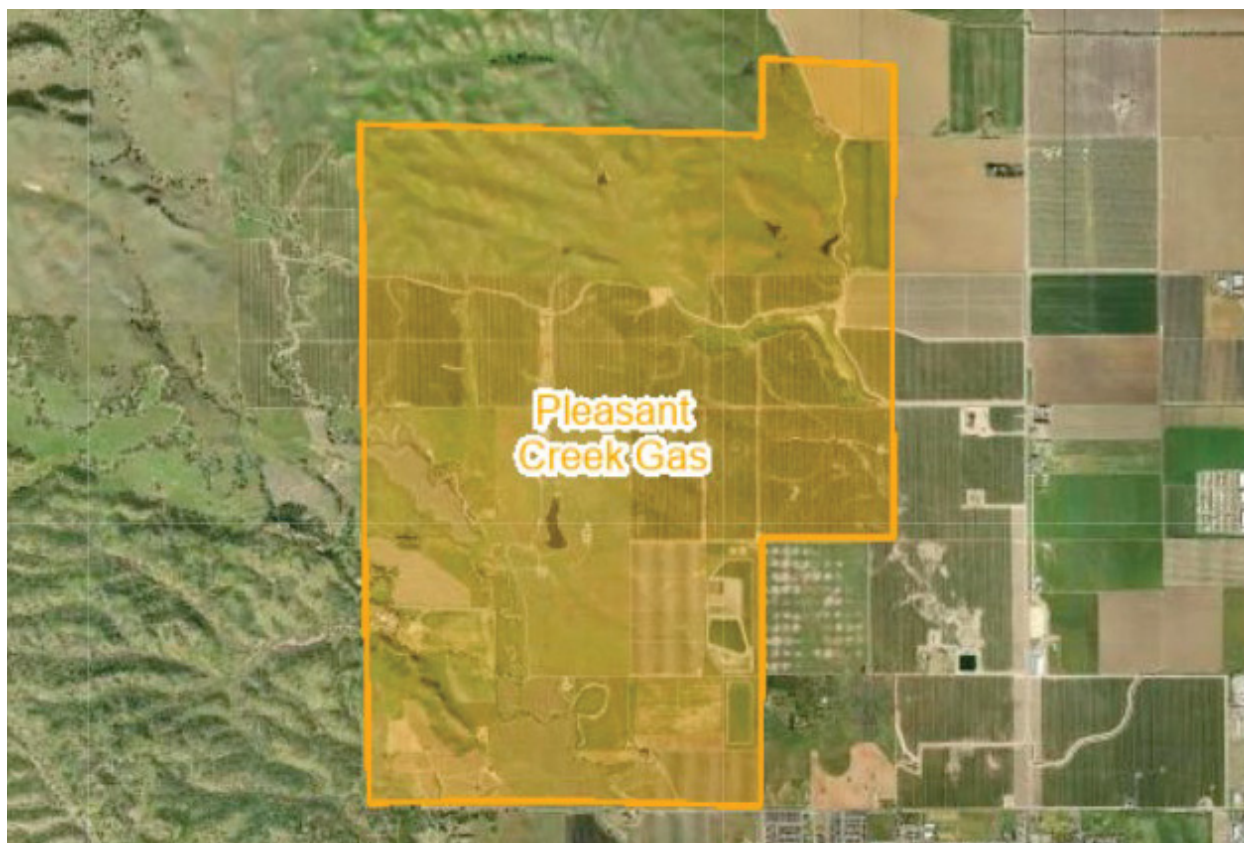


Figure 8. Map of Pleasant Creek Gas storage field from CalGEM's WellSTAR Well Finder Database.

Table 4. Pleasant Creek Storage Field Wells

Well Name and Number	API Number	Spud Date	Type of Well	Plugged and Abandoned Date
Pleasant Creek Unit 3 1	04-113-00063-00	11/27/1948	Withdrawal/Injection	
Pleasant Creek Unit 3 2	04-113-20192-01	9/4/1973	Withdrawal/Injection	
Pleasant Creek Unit 3 3	04-113-20193-00	9/22/1973	Withdrawal/Injection	
Pleasant Creek Unit 3 4	04-113-20194-00	10/15/1973	Withdrawal/Injection	
Pleasant Creek Unit 3 5	04-113-21279-01	4/20/2012	Withdrawal/Injection	
Pleasant Creek Unit 4 1	04-113-00064-00	6/12/1949		8/2/2019
Pleasant Creek Unit 4 2	04-113-20195-00	10/4/1973	Withdrawal/Injection	

Gill Ranch

PG&E owns a 25% interest in the wells in the Gill Ranch storage facility. These wells are not subject to the reinspection plans. The field is operated by Gill Ranch LTD. While the

reinspection plan does not directly impact the wells at the Gill Ranch Storage Facility, PG&E works closely with Gill Ranch Ltd to ensure the well integrity requirements are met.

New UNGSF Wells for McDonald Island and Los Medanos

In July 2018 CalGEM finalized regulations for underground natural gas storage fields in the California area. One regulation focused on well construction and the requirement to eliminate a single point of failure in a well by including a primary and secondary well barrier in the design of the well. CalGEM strongly recommended that the tubing and packer design be used to accomplish this. Other new regulations that were finalized in July 2018 covered the following areas:

- Field-specific risk management plans
- Mechanical integrity testing designed to detect anomalies
- Requirements for real-time data gathering system, including alarms to alert operators of pressure changes that indicate potential emissions
- Protocols for decommissioning a storage project

Prior to the new regulations, PG&E's original well construction design allowed for gas flow through both tubing and casing annulus, shown in the left side of Figure 9.. The tubing and packer design recommended by PG&E only allows for gas flow through the inner tubing, shown on the right side of Figure 9.. Because PG&E must retrofit their UNGSF wells with tubing and packer design, the volumetric rate at which gas can be injected and withdrawn is reduced, compared to the original construction, in which gas could flow through the tubing and casing annulus. Because of the reduced deliverability afforded by the cross-sectional area of the smaller diameter inner tubing, PG&E has drilled and proposed to drill additional new UNGSF wells in 2025 to compensate for the reduced deliverability.

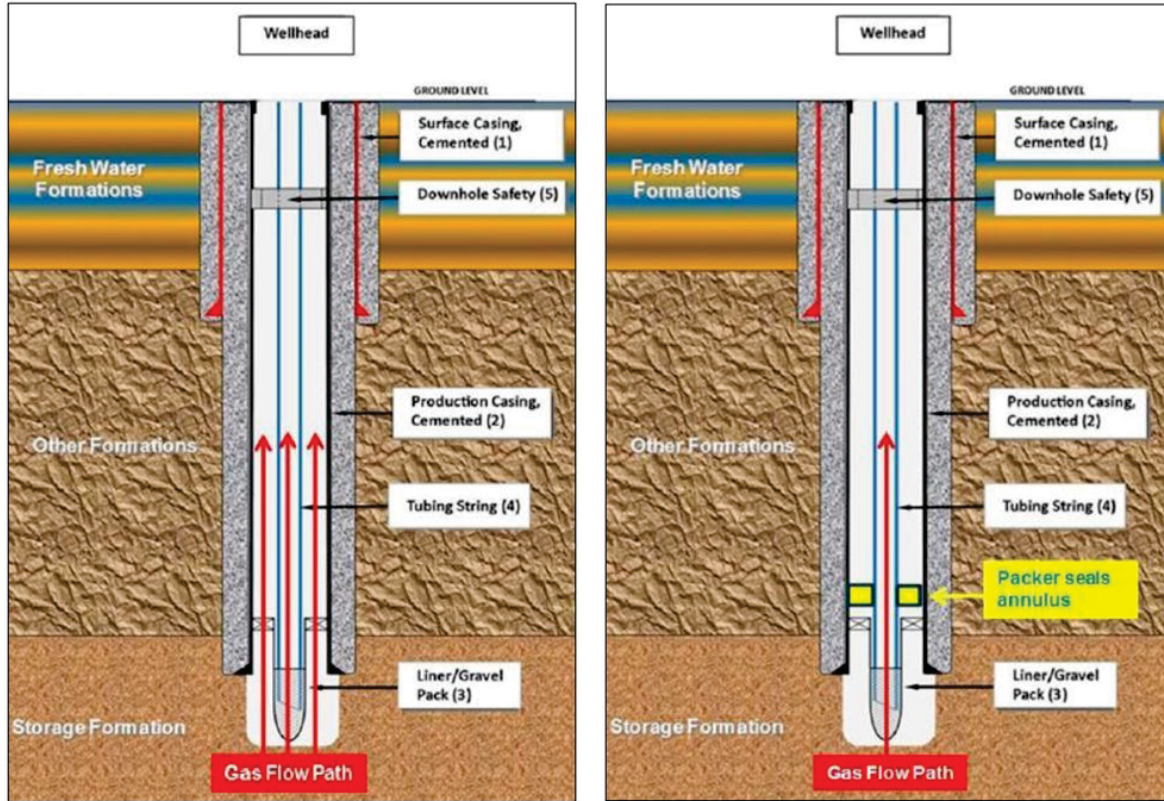


Figure 9. Well construction with tubing and casing flow (left) and with tubing and packer flow (right).⁵¹

⁵¹ PG&E, Underground Gas Storage Asset Management Plan, GP-1108, Revision 11, December 19, 2024, pp. 53 and 54/.

PG&E's UNGSF Asset Management Plans

Overview of PG&E Risk Integrity and Management Plans

In this section, we summarize PG&E's UNGSF 2019 UNGSF risk management plan and its reinspection plans.

Underground Storage Risk and Integrity Management Plan – March 29, 2019

PG&E's Underground Storage Risk and Integrity Management Plan ("2019 IMP") was developed to provide guidance to PG&E personnel involved in all aspects of UNGSF operations. We have reviewed PG&E's 2019 IMP and have found it to be in compliance with PHMSA regulations 49 CFR Parts 191 and 192. As described previously, 49 CFR Parts 191 and 192 incorporate by reference, API RP 1171.

PG&E Reinspection Plan Supporting Justification – January 20, 2023

As previously described in this report, CalGEM promulgated § 1726.6(a)(2), which required wall thickness measurements at "24-month intervals to determine if there are possible issues with [production] casing integrity." CalGEM provides in § 1726.6(a)(2), however, that, "The Division may approve **a less frequent casing wall thickness inspection schedule** for a well if the operator demonstrates that the well's corrosion rate is low enough that biennial inspection is not necessary." [Emphasis in bold added]

PG&E proposed an alternative reinspection interval that is determined based on the condition of production casing strings derived from baseline direct casing inspection results.⁵² Reinspection intervals would be scheduled in one of the following categories:

- **5-8 year Reinspection Interval:** Class 2 and/or 3 metal loss with aggressive apparent growth, or general class 3 with growth undefined
- **8-12 year Reinspection Interval:** Class 2 and/or 3 metal loss with apparent growth, or isolated class 3 with grown undefined
- **12-15 year Reinspection Interval:** Class 1, 2, or 3 with No apparent growth, or Class 1 or 2 with Growth Undefined.

⁵² "Direct" means an MFL run directly inside of the production casing, rather than a "multi-string" log run inside the production tubing which can detect wall thickness loss in strings outside of the production tubing.

The casing condition is determined by the amount of metal loss observed from the direct casing MFL tool results. The wall thickness loss is based on a classification by Baker Hughes from the development and calibration of their Vertilog MFL tools:⁵³

- Class 1 is 0-20% metal loss
- Class 2 is 20-40% metal loss
- Class 3 is 30-60% metal loss
- Class 4 is 60% to 100% metal loss

Wall thickness loss, which may be referred to as corrosion rate, is defined as the change of condition of the well over time as determined by evaluating the baseline condition of the well.

The recommendation from PG&E of moving from a set prescribed reinspection interval (i.e., 24 months) to risk-based intervals, was motivated by the negative impact that frequent logging and inspections can have on the health of a well. Frequent logging can be invasive and have unintended consequences, such as mechanical damage due to for example milling operations during a workover. Therefore, by limiting wall thickness reinspection to be performed only when it is necessary, safe, and based on well observations, the life of the well can be extended and the storage facilities can be operated in a safe manner. Well entry activities such as well logging, pressure testing, and working over a well results in an elevated risk for a loss of containment event (“LoCE”) due to the reliance on temporary barriers. According to PG&E documents, the “[l]oss of containment risk correlates statistically to the frequency that well intervention-based inspections are being performed.”⁵⁴ This is partly due to the increased number of elevated risk exposure days that occur with more frequent well interventions during workovers. PG&E estimated the number of elevated risk exposure days that would be expected for the 24-month reinspection interval required by CalGEM, a 7-year reinspection interval, and a risk-based reinspection interval in which wells are reinspected between 5 – 15 years based on well characteristics and the growth of corrosive features or mechanical damage. The number of elevated exposure days for each program is shown in Figure 10.. An increased number of elevated risk exposure days results in a higher risk to personnel that are performing the reinspections. Although PG&E has safeguards in place to protect personnel when performing tasks on a well, there is more risk involved when they are more frequently performing inspections.

Significant resources are required to properly perform the required well interventions during workovers on PG&E’s UNGSF wells on a 24-month interval. This includes “drilling and workover rigs, rig crews, BOP equipment, pressure pumping units, wireline trucks, logging tool availability, drilling mud, the market conditions, the availability of OCTG, and the availability of

⁵³ Haire, John N., and Jearald D. Heflin. "Vertilog - A Down-Hole Casing Inspection Service." Paper presented at the SPE California Regional Meeting, Bakersfield, California, April 1977. doi: <https://doi.org/10.2118/6513-MS>

⁵⁴ Page 4 of PG&E Reinspection Plan 01202023.pdf

competent well site management.”⁵⁵ According to PG&E, these resources and the skilled workers required to conduct the work are insufficient given a 24-month reinspection interval.

While performing baseline inspections in their injection and observation wells, PG&E observed physically induced mechanical damage within the well casings. The damage was observed in deviated portions of wells and where repetitive passes with drilling equipment occurred. Given these observations PG&E have concluded that there is a greater opportunity for damage to the integrity of the well given more frequent well inspections and operations. Pressure testing also puts additional strain on wells as they require testing at pressures higher than the typical operating pressure or maximum allowable pressure of injection or withdrawal operations. More frequent pressure testing can shorten the lifespan of a well as certain elements are subjected to additional stresses due to the cyclic loading of pressure testing. If the damage induced from drilling equipment and pressure tests continues, wells may need to be recemented if possible. If a well can not be recemented due to insufficient space in the inner tubing in the well, the well may need to be plugged and abandoned. In these cases, to keep up with demand, new wells will need to be drilled. This presents another set of challenges as there is limited available space to drill new wells.

To reduce the risks of damage induced during workovers or well intervention, lower the number of exposure days, increase worker safety, and maximize the lifespan of a well, PG&E developed a quantitative risk-based methodology to estimate the optimal reinspection interval for its wells. The objective of the risk-based interval model is to maximize the benefits of reinspections, while minimizing the potential negative impacts of performing reinspections. Risk scores were determined from evaluating the annual frequency of significant loss of containment events (LoCE) and the consequence of risk event (“CoRE”). Using these metrics, PG&E developed a projection of the risk profile of a well after a single inspection. As shown in Figure 10, the risk profile shows an optimal range of between 7-21 years, in which the benefits of reinspection are greater than the incurred risk. Reinspecting a well outside of these intervals could add more risk to the wells than benefit.

In an effort to determine well failure frequencies PG&E predicted a baseline failure rate and compared their estimates to industry assessments of estimates for the number of loss of containment (LOC) events per year. PG&E found a baseline failure rate 0.018 LOC events per year for their 103 wells. This was comparable to the 0.019 failure rate per workover for 103 wells found from a research project conducted for PHMSA. According to analysis, the predicted failure rate nearly doubles to a failure rate of 0.035 per year for all 103 years during well workovers. This number is only further increased when reinspections become more frequent. Figure 10 shows how different inspection intervals change the risk score for the PG&E’s 103 wells with a steadily increasing risk shown for a 2-year reinspection interval. Increasing the well intervention or workover interval results in reduced overall risk.

⁵⁵ PG&E Reinspection Plan Supporting Justification, May 23, 2023, § 1.3, p. 6.

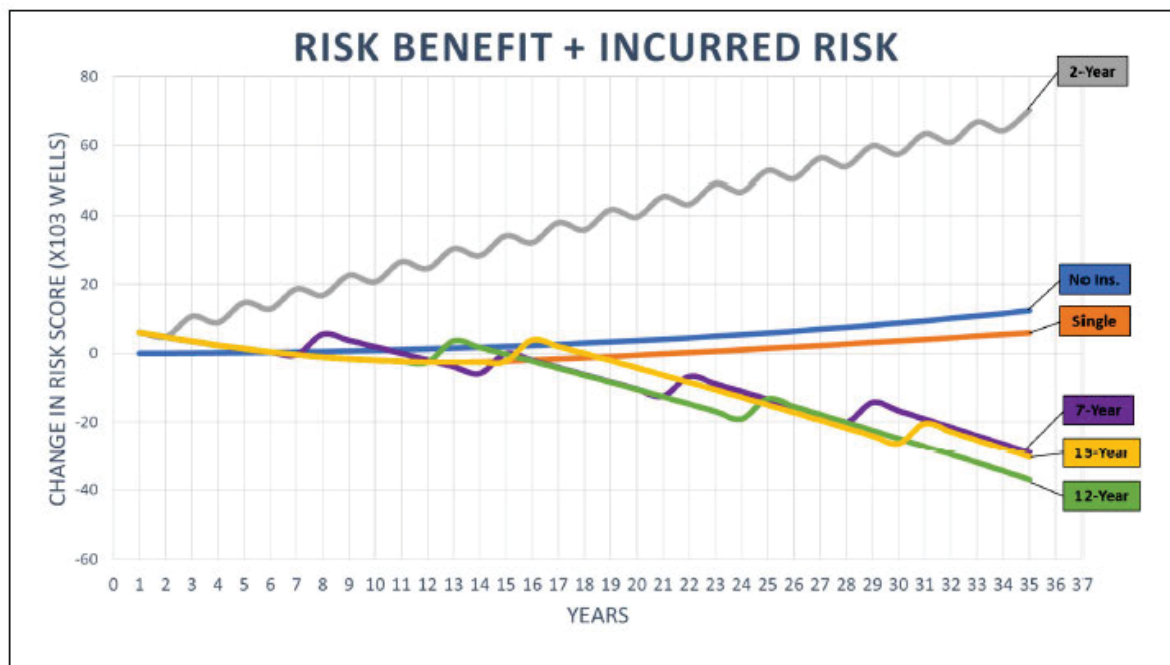


Figure 10. Risk benefit analysis for varying intervals of reinspection.

PG&E evaluated the impacts to system reliability and resource availability during peak and off-peak seasons. Frequent inspections result in more wells being unavailable for operation. This includes both injection and withdrawal operations. System reliability depends on the number of wells that are available and in service for injection and withdrawal. The number of wells required to be out of service to maintain a 24-month inspection interval would make it difficult to meet storage requirements. A lack of sufficient storage may impact energy reliability and lead to price volatility.

Many of the wells at the McDonald Island and Los Medanos facilities are in close proximity to each other. To maintain safe operations during rig workovers and some wireline operations, wells next to the one being worked over are shut in. This results in wells taken out of service at a times of high demand and with the results of lower storage availability.

PG&E has a 40% reduction in the ability to meet storage capacity as a result of the conversion of UNGSF wells to tubing and packer production and smaller diameter inner production casing strings to maintain two barriers.⁵⁶ The conversion to tubing and packer wells have reduced the volumetric rate of injection and withdrawal of their UNGSF wells, leading to the reduced storage capacity and ability to provide gas to commercial and residential customers. To mitigate this, PG&E has drilled new wells and plans to drill additional wells to meet the capacity and deliverability demands.

⁵⁶ *Id.*, § 4.0, p. 18.

The frequency of reinspections not only impacts gas availability, but also the costs incurred by commercial and residential ratepayers.⁵⁷ PG&E has estimated costs for varying wall thickness reinspection intervals, the cumulative costs can be seen in Figure 11.. More frequent reinspections result in associated greater costs.

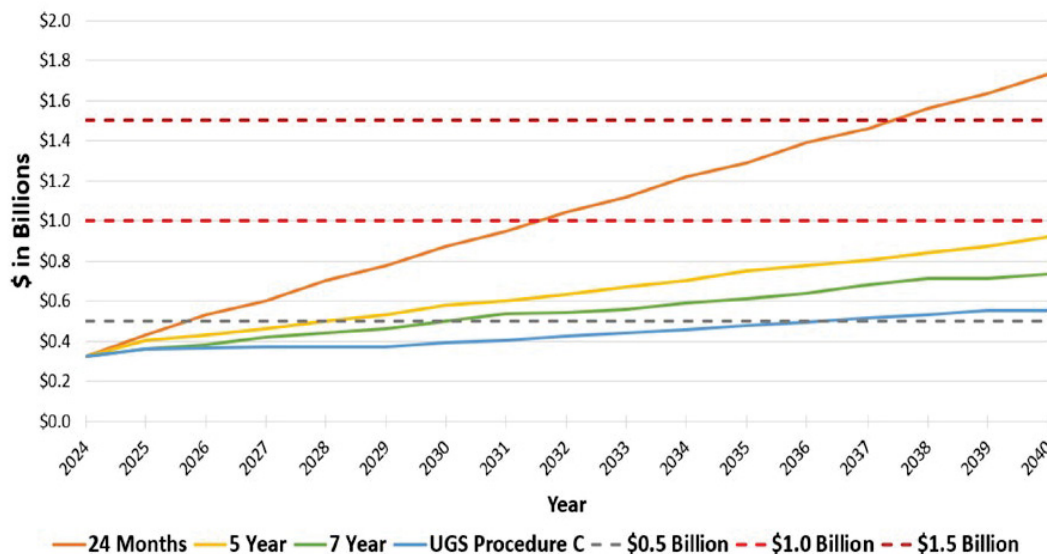


Figure 11. Cumulative cost comparison for various USG well wall thickness reinspection intervals.

Letter from CalGEM to PG&E – April 11, 2023

CalGEM transmitted a letter to PG&E dated April 11, 2023 regarding, “Proposed Mechanical Integrity Testing Schedule, January 20, 2023” (2023 PG&E Reinspection Plan). In summary, CalGEM expressed concerns about the 2023 PG&E Reinspection Plan as follows:

- The frequency of production casing wall thickness logs; that is, the time duration between wall thickness logs, or the “inspection interval.”
- The frequency of inspection of wells with up to 60% wall thickness loss, as measured by wall thickness logs.
- The potential risks associated with inspection intervals for each well, rather than focusing on the date of the initiation of the second-round casing inspection program.
- The attribution of wall thickness loss due to mechanical damage only with no attribution to corrosion.

⁵⁷ *Id.*, § 2.2, p. 15.

- PG&E reportedly established the baseline wall thickness of its UNGSF wells as of March 28, 2023.⁵⁸ CalGEM believes that PG&E's estimated corrosion rates in its UNGSF wells were based on a comparison of the measured wall thickness obtained in the most recent log data to the API Spec 5CT nominal wall thickness. CalGEM was concerned that the API Spec 5CT -12.5% wall thickness tolerance⁵⁹ affects the accuracy of the corrosion rate calculation.
- CalGEM expressed concern that PG&E's proposed reinspection plan "significantly extended" the wall thickness inspection frequency interval prior to completion of the second round of well thickness logging. CalGEM asserted that basis of PG&E's inspection frequency interval was the risk of possible damage to casing caused by the inspection process itself and the risk to safety of personnel due to well workover intervention.
- CalGEM interprets CCRs as requiring the establishment of a corrosion rates based on two successive casing wall thickness inspection logs at a required inspection frequency interval.
- CalGEM refers to a regulatory 24-month default frequency interval for pressure testing and wall thickness inspections, unless CalGEM approves of a longer frequency interval.
- CalGEM agreed to consider PG&E's proposed six-year interval for the first round of consecutive wall thickness logs, if PG&E could demonstrate safety measures, such as SCADA, leak detection technology, and annual temperature-noise logs would be performed during the interval.

Based on our review of PG&E's documents and UNGSF well data that PG&E has complied with CalGEM's requirements.

PG&E Reinspection Plan Supporting Justification – May 23, 2023

On May 23, 2023, PG&E sent a letter to CalGEM detailing their second request for approval for their proposed reinspection methodology and plan. In their letter, PG&E attempted to clarify several points and address several statements made by CalGEM in their April 11, 2023 letter, which was in response to PG&E's first letter requesting approval for their modified plan. PG&E summarized points from their reinspection plan as described in the previous section of this report. The letter focused on the wall thickness baseline and the reinspection interval, considerations, and risks, UNGSF wells that have been remediated, PG&E's plans for communication, and other clarifying points in response to CalGEM correspondence.

In the letter to CalGEM, PG&E stated that a reinspection interval of 6 years for all of its wells was not "feasible or advisable."⁶⁰ After converting all UNGSF wells to be tubing and packer, the capacity of each well was reduced leading to a reduction of the overall ability of the wells and

⁵⁸ PG&E, January 20, 2023, Reinspection Plan - Supporting Justification, Appendix B: PG&E Well Specific Integrity Detail.

⁵⁹ American Petroleum Institute, API Specification 5CT, Casing or Tubing, Tenth Edition, June 2018, §8.11.2.

⁶⁰ May 23, 2023 Letter from PG&E to CalGEM, p. 1.

storage field to meet storage and deliverability demands. A general wall thickness reinspection interval of six years or fewer would further reduce the capacity and availability of resources as a number of UNGSF wells would be placed out of commission during reinspection. Further details and estimates and the quantitative impact on storage fields during various reinspection intervals were analyzed by PG&E's and documented in the reinspection plan. To compensate for the loss in storage and deliverability while conducting all reinspection tests and converting the remaining wells to be a dual barrier tubing and packer wells, PG&E drilled several new wells. PG&E stated that they support well reinspections and that their reinspection plan considers all risks when operating and reinspecting the wells and storage fields that they operate. PG&E clarified an apparent misunderstanding that reinspection of UNGSF wells which exhibited 60% casing loss in the baseline wall thickness inspection could take as long as 15 years. Such PG&E UNGSF wells with significant metal loss were remediated with a new inner casing string or plugged and abandoned. Those wells that were remediated through the installation of new, high strength production casings and, because of the new casing, would not be reinspected for 12-15 years.

PG&E Revised Testing Schedule and Required – January 19, 2024

In response to CalGEM's request for a revised testing schedule and well data, PG&E prepared and provided a revised reinspection plan on January 19, 2024, outlining their plan and provided reasoning to explain differences from the May 23, 2023 reinspection plan. The revised reinspection plan addressed "incomplete 2023 rework wells, wells that did not pass the required standard annular pressure test (SAPT), and wells removed from service due to sand inspection results."⁶¹ The reinspection schedules for those particular UNGSF wells were revised to be and incorporated into the 2024 planned work.

The rescheduling resulted in wells originally planned for reinspection in 2024 to be rescheduled for 2025, due to potential lack of resources to reinspect all wells and to ensure adequate capacity for the winter season. Additionally, production flow rates for wells that were converted to tubing and packer were updated from prior injection and deliverability estimates. The revised plan included appendices consisting of forecasted withdrawal capacity based on 7-year reinspection intervals and PG&E's risk-based inspection intervals. The revised reinspection plan is presented in tables and includes the years in which the tests and workovers were performed or are scheduled in the future for 2019-2040, including: converting to converting wells to tubing and packer, thru-tubing well thickness logs, noise and temperature logs, post conversion inspections, and reassessment of wells.

⁶¹ PG&E, January 19, 2024, CalGEM Data Request - Revised Testing Schedule and Required Data, p. 3.

Industry Example Wall Thickness Inspection Intervals

We summarize in this section wall thickness inspection intervals from regulations in states other than California, other countries where such regulations are available, and other UNGSF operators where information is publicly available. Wall thickness interval regulations in API RP 1171, 49 CFR Part 192, and Title 14 CCR 1726 were review in an earlier section of this report.

49 CFR § 192.12(d)(2) requires operators establish a baseline risk assessment of all reservoirs by March 13, 2024 and establish a baseline risk assessment of at least 40% of all UNGSF wells by March 13, 2027. Moreover, 49 CFR § 192.12(d)(3) requires re-assessments of reservoirs and wells, “The re-assessment interval for each reservoir, cavern, and **well must not exceed seven years from the date of the baseline assessment** for each reservoir, cavern, and well.”

[Emphasis in bold added.] Regarding the meaning of the terms “reassessment” and “reinspection,” CalGEM stated in a footnote of the transcripts of PG&E’ 2023 General Rate Case Rebuttal, “Note, CalGEM uses the term “inspection” whereas PHMSA uses “assessment.” Reinspections and re-assessments are considered the same within this testimony and the terminology is used interchangeably.”⁶²

While all UNGSF operators within the United States must comply with 49 CFR Part 192, detailed information on reassessment or reinspection programs is not easily accessible within the public domain. We have found two examples of operators whose reinspection intervals are described in detail within the public domain. We summarize them below.

Two examples of detailed reinspection intervals

TC Energy – SPE Journal Publication

TC Energy is an energy company based in Calgary, Alberta, Canada, which operates UNGSFs in Canada.⁶³ TC Energy published the development of a risk-based UNGSF well reinspection logging interval program in January 2025 issue of the SPE Journal in a paper titled, “Determination of Optimal Corrosion Logging Frequencies of Gas Storage Operations.”⁶⁴ Although there are differences between some of the analytical techniques used by PG&E and TC Energy, both risk-based approaches resulted in the identical wall thickness logging reinspection intervals. TC Energy’s intervals are:⁶⁵

⁶² Pacific Gas and Electric Company, 2023 General Rate Case, Rebuttal Testimony, Exhibit (PG&E-17), Gas Operations, Chapters 1-14, Volume 1 of 2, Application 21-0-21, July 11, 2020, at footnote 32, p. 7A-20. Available at <https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2106021/5195/492451251.pdf>

⁶³ <https://www.tcenergy.com/operations/maps/power-and-storage-map/>

⁶⁴ Abaa, K., and H. Tripathi. "Determination of Optimal Corrosion Logging Frequencies for Gas Storage Fields." *SPE J.* 30 (2025): 50–64. doi: <https://doi.org/10.2118/218901-PA>

⁶⁵ *Id.* Figure 2 and Figure 13.

- 12 – 15 years: Class 1 and 2 defect with no corrosion or Class 1 defect with low defect corrosion.
- 8 – 12 years: Class 2 defect with low corrosion, Class 1 defect with moderate corrosion or Class 3 defect with halted corrosion.
- 5 – 8 years: Class 2 defect with moderate corrosion or general Class 3 defect with halted corrosion.
- 3 – 5 years: Class 1 and 2 defect with aggressive corrosion Class 3 defect with low corrosion.
- Immediate remove from service: Class 4 defect depth ($> 60\%$).

TC Energy provided a decision tree to determine the logging frequency of a well, shown below in Figure 12.. TC Energy's flow chart is almost identical to PG&E's casing inspection survey initial May 23, 2023 frequency decision tree.⁶⁶ PG&E has revised the decision tree, as described previously in this report.

PG&E's casing wall thickness log reinspection intervals have been documented as part of GRC proceedings, TC Energy would have had access to PG&E's documentation. The similarity in the reinspection intervals and differences in risk analysis methodologies indicates that the PG&E's risk-based reinspection intervals have a robust basis.

TC Energy's evaluated the metal loss from Vertilog and HRVRT MFL logs on UNGSF wells to determine a method for developing a probabilistic corrosion rate. From the average corrosion rate ("ACR"), TC Energy organized wells into different classes based on the severity of the corrosion rate. Similarly to PG&E, TC Energy calculated both the maximum and minimum corrosion rate for each well by finding the rate of change in metal loss percentage between two MFL logs. To account for measurement errors in the MFL tool, TC Energy used a $\pm 12\%$ error rate in their calculated corrosion rate. PG&E uses a similar formula for the rate of apparent change wall thickness, or corrosion rate. Instead of a 12% measurement error for the MFL logging tool, PG&E uses a $\pm 15\%$ measurement error in their calculations. From the calculated change in wall thickness found from the MFL wall inspection results, both PG&E and TC Energy classify the rates as Low, Moderate, or Aggressive. Table 5 below compares PG&E and TC Energy classifications. PG&E and TC Energy have similar classifications for well thickness loss rate, with PG&E being marginally more conservative, having a cutoff of 1% wall thickness for the Low and Moderate wells, as compared 1.2% wall thickness loss of TC Energy.

⁶⁶ PG&E's Well Reinspection Plan Methodology and Relevant Factors Informing the Approach, May 23, 2023, Appendix A2: TD-4870M Utility Procedure – UGS- C- P, Casing Inspection Survey Frequency Decision Tree.

Table 5. Wall thickness rate of change classifications from PG&E and TC Energy

Corrosivity	Corrosion Rate Change	
	PG&E ⁶⁷	TC Energy
Low	<1% wall thickness	<1.2% wall thickness
Moderate	<1-3% wall thickness	1.2-3% wall thickness
Aggressive	>3% wall thickness	>3% wall thickness

TC Energy computed burst pressure of casing as a function of defect length and depth, based on formulas and criteria in ASME B31G-2012,⁶⁸ and by Kiefner and Vieth.⁶⁹ Corrosion rate and burst strength were then used to compute remaining life estimates of casing for selected diameters, wall thicknesses (i.e., weights), and strengths of interest to TC Energy in their operations. TC Energy computed the remaining life of casing for defect depths corresponding to the Baker Hughes wall loss percentages Class 1 wall loss < 20%, Class 2 wall loss 20% to 40%, and Class 3 wall loss > 40% (based on API 5CT nominal wall thickness), and then applied corrosion rates for each defect depth class. The remaining life of the casing is based on the calculated burst strength with a defect length of 6-in. Alternatively, TC Energy us a Monte-Carlo simulations to estimate the burst strength for statistically varying parameters and assumed a failure probability of 10^{-3} . TC Energy's reinspection interval is based on the half-life remaining theory specified in API 570.⁷⁰

⁶⁷ Note that this was PG&E's classification in the May 23, 2023 Reinspection plan, Utility Procedure: UGS – C – P Publication Date: 12/20/2021 Effective Date: 02/01/2022 Rev: 0. This classification system has been revised in PG&E's Casing Inspection Survey Frequency Decision Tree, Utility Procedure: TD-4875P-05, Publication Date: 08/21/2024 Effective Date: 11/01/2024 Rev: 1.

⁶⁸ ASME. ASME B31G-2012: Manual for Determining the Remaining Strength of Corroded Pipelines, a Supplement to ASME B31 Code for Pressure Piping. Revision of ASME B316-2009).

⁶⁹ Kiefner, J. F. , and Vieth, P. H. , 1989, " A Modified Criterion for Evaluating the Remaining Strength of Corroded Pipe," Pipeline Research Council International, Inc, Battelle Memorial Institute, Houston, TX. Pipe [Project PR 3-805].

⁷⁰ American Petroleum Institute, API 570, Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems, 4th Edition, February 2016.

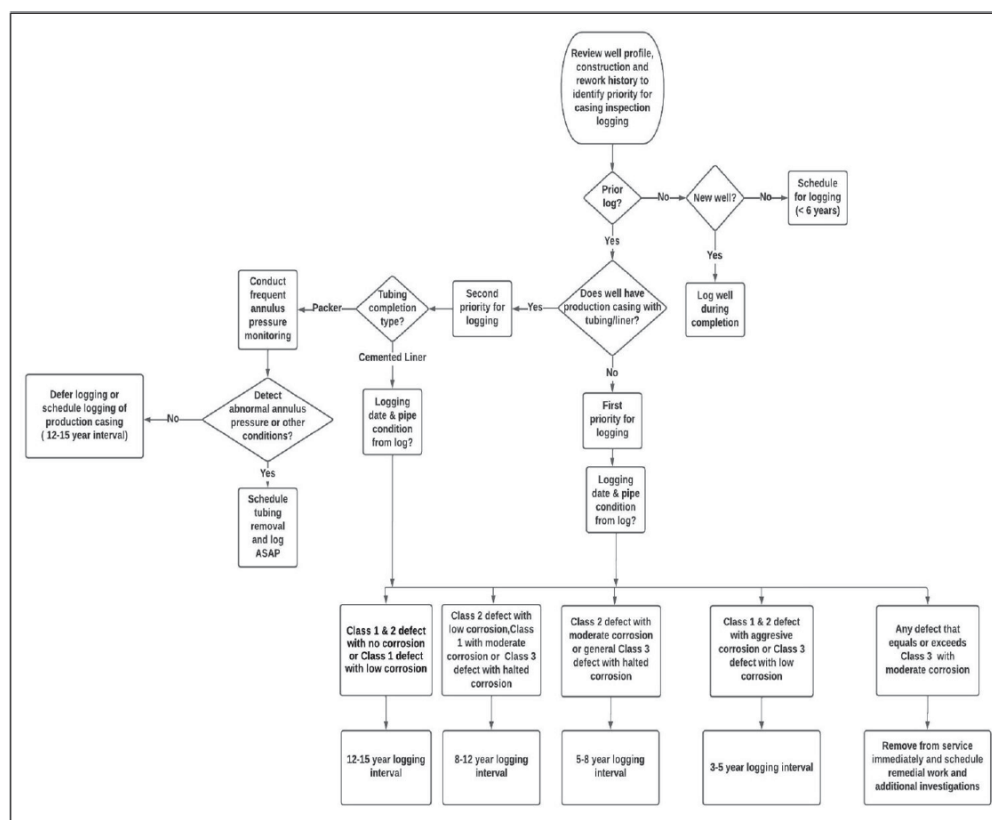


Figure 12. TC Energy casing logging frequency decision flow chart.

Southern California Gas Company (SoCalGas, SCG)

As summarized below, at the present time SoCalGas has an agreement with CalGEM for a seven-year reinspection interval of its UNGSF wells as approved on a well-by-well basis. The analytical details of the development of their risk-based methods are not explicitly disclosed in the publicly available documents and reports we acquired. Based on the documents we have reviewed, their approach is similar to that of PG&E. Both SCG and PG&E used bow-tie risk-assessment models with the following components:

- a systematic hazard identification (HAZID) process based on data provided by various UNGSF operators,
- the development of bow tie risk assessment models with threats and barriers identification, and
- and the development of probabilistic models quantifying the interactions between the barriers and threats.

The model is described in some detail in a manuscript title, “Quantitative Assessment of Failure Probability of Underground Natural Gas Storage Wells Using an Integrated Bow-Tie Bayesian

Network Approach.”⁷¹ PG&E and SoCalGas served as “industry partners” in the development and critical review of the models.⁷²

As a result of the Aliso Canyon incident, SoCalGas was required to take formal actions to verify the mechanical integrity of their UNGSF wells under the supervision of the California Public Utilities Commission (“CPUC”) and the Division of Oil, Gas, and Geothermal Resources⁷³ (“DOGGR”). SoCalGas operates four underground gas storage facilities: Aliso Canyon, La Goleta, Honor Rancho, and Playa del Rey, with a combined working capacity of approximately 119.5 Bcf and 177 active wells.⁷⁴ SoCalGas completed its baseline inspections and initiated reinspections of existing storage wells in 2019 and 2020. In 2022, baseline inspections were conducted for newly drilled replacement wells, and reinspections continued for existing wells.⁷⁵

As of their 2021 General Rate Case report, SoCalGas was in the process of demonstrating that CCR Title 14 § 1726.6 regulations for 24-month reinspection intervals should be increases:

Per existing regulation, SoCalGas is required to perform metal loss inspections on gas storage well casings on a **24-month** recurring frequency. SoCalGas has evaluated an alternate approach that assigns a well-specific inspection interval, determined in accordance with prior inspection results and an engineering evaluation of the casing’s ability to contain pressure. This alternative would likely result in less frequent inspections, which could mitigate risks associated with frequent well interventions stemming from the temporary reconfiguration of well barriers, the potential for incorrect operations during complex well entry activities, and the higher presence of personnel that is required on-site during these activities. While this represents SoCalGas’s preferred approach, approval from CalGEM is required before this alternative can be implemented. SoCalGas continues to discuss this approach with CalGEM.⁷⁶

As of April 2023, SCaGas stated that:

Using the data gathered from these baseline assessments and re-inspections, SoCalGas is supporting risk-based decision making and research to consider and evolve the recommended frequency of well re-inspections. Extension of the well assessment interval

⁷¹ Ayello, Francois, Agarwal, Arun, Sridhar, Narasi, and Vincent Demay. "Quantitative Assessment of Failure Probability of Underground Natural Gas Storage Wells Using an Integrated Bow-Tie Bayesian Network Approach." Paper presented at the AMPP Annual Conference + Expo, San Antonio, Texas, USA, March 2022.

⁷² *Id.*, Acknowledgements.

⁷³ Now CalGEM.

⁷⁴ SoCalGas, 2025 Risk Assessment Mitigation Phase, (Chapter SCG-Risk-4), Underground Gas Storage System, May 15, 2025, at p. 2. Available at <https://www.socalgas.com/sites/default/files/2025-05/SCG-Risk-4%20Underground%20Gas%20Storage.pdf>

⁷⁵ *Id.*, p. 27.

⁷⁶ SoCalGas, Risk Assessment Mitigation Phase (SCG/SDG&E-RAMP-A) Overview and Approach, May 17, 2021, Chapter SCG-Risk-4, Incident Related to the Storage System (Excluding Dig-In), p. CG-4-21. Available at https://www.socalgas.com/sites/default/files/RAMP_All_Chapters.pdf

will mitigate the chance for injury to well-site employees and potential environmental impact associated with well entry risk.⁷⁷

Regulations and research also continue to evolve regarding the recommended frequency of well re-inspections, with CalGEM regulations currently requiring a 24-month inspection frequency on most wells and CalGEM authorizing extensions beyond 24 months on a well-by-well basis.⁷⁸

The status of SoCalGas work with CalGEM to extend the reinspection interval was further explained in June 2023:

The ongoing accumulation of well integrity findings from the surface monitoring and downhole inspections create additional learning opportunities. The findings of the reassessments suggest to SoCalGas that the reassessment inspection period can be lengthened, and the Company has submitted individual requests to CalGEM for such reassessment extensions for forty-six (46) wells at the Aliso Canyon facility. As of the June 9, 2023 WSOC meeting, SoCalGas had received permission from CalGEM to extend the reassessment interval from twenty-four (24) months to 50-60 months on twenty-nine (29) wells, all of which have had new inner strings of casing installed and cemented in place since the initial baseline inspections. CalGEM's decision is pending on an additional eleven (11) wells, while CalGEM has denied extension of reassessment intervals for six (6) wells.⁷⁹

As of June 2024, the status of SoCalGas's UNGSF well reinspection program was as follows:⁸⁰

- Active well count was 60 (I/W) wells, 43 with complete new inner casing/tubing strings since 2016.
- 54 were wells plugged and abandoned since late 2016.
- All wells have had 2nd-round integrity reinspections, which includes casing inspection logs; 40 wells have had 3rd-round reinspections, and 5 wells have had 4th-round reinspections.

Thus, SoCalGas has had extensive experience with its reinspection program and has collected considerable data.

⁷⁷ 2022 Safety Performance Metrics Report of Southern California Gas Company (U 904 G), April 3, 2023, pp. 14-15. Available at <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/reports/r2007013-socialgas-2022-spmr-report040323.pdf>

⁷⁸ *Id.*, p. 49.

⁷⁹ Annual Report Number 4 Work of the Safety Ombudsman July 2022 – June 2023, Report Date: July 31, 2023, at p. 12. Available at <https://safetyombudsman.com/wp-content/uploads/2023/08/Report-Number-Four-Work-of-the-Ombudsman-Final.pdf>

⁸⁰ Nowaczewski, S.F., Annual Report Review, Safety Ombudsman, Virtual Townhall Meeting, October 15, 2024, p. 20. Available at <https://safetyombudsman.com/wp-content/uploads/2024/09/Ombudsman-Virtual-Public-mtg-October-15-2024-Final-Draft-09-16-24.pdf>

As of its 2025 General Rate report, SoCalGas has come to an agreement with CalGEM to extend the reinspection interval to seven years:

SoCalGas's SIMP was initially modeled after the federally mandated distribution and transmission integrity management programs and the requirements of RP 1171. It was designed to provide a forward-looking, methodical, and structured approach, using state-of-the-art inspection technologies and risk management disciplines to address storage reservoir and well integrity risks. SoCalGas performs integrity inspections on gas storage wells to assess the pressure containing capability of the well, detect possible leaks, and identify metal loss features in tubing and casing. These regular inspections enhance safety by reducing the risk of well failure during operations. Types of inspections include pressure testing, noise and temperature surveys, magnetic flux leakage (MFL) inspection, and ultrasonic testing (UT) inspection. Pressure testing and wall thickness inspections (MFL or UT) are currently required for each gas storage well at a two-year recurring frequency unless otherwise approved by CalGEM. Based on detailed analyses of previous well inspections and the potential risks and benefits of testing at two-year intervals, SoCalGas has submitted well specific requests to CalGEM to extend the reassessment intervals beyond the mandated **24-month interval**. In response, CalGEM has granted reassessment interval extensions for up to **seven years**.⁸¹

As discussed earlier, based on detailed analyses of previous well inspections and the potential risks and benefits of testing at two-year intervals, SoCalGas has submitted well-specific requests to CalGEM pursuant to 14 CCR 1726.6(a)(2) to extend the reassessment intervals beyond the mandated 24-month interval. In response, CalGEM has granted reassessment interval extensions for up to **seven years**.⁸² [Emphasis in bold added.]

United States

As discussed earlier in this report, California regulates UNGSFs under Title 14 CCR 1726. Baseline and reinspections are included in § 1726.6(a)(2), which requires a 24-month wall thickness reinspection interval. While operators must comply with 49 CFR Parts 191 and 192, there appear to be few states that have promulgated regulations for well integrity as comprehensive as California.

Figure 13 depicts the working gas capacity of UNGSFs by state.

⁸¹ SoCalGas, 2025 Risk Assessment Mitigation Phase, (Chapter SCG-Risk-4), Underground Gas Storage System, May 15, 2025, at pp. 15-16. Available at <https://www.socalgas.com/sites/default/files/2025-05/SCG-Risk-4%20Underground%20Gas%20Storage.pdf>

⁸² *Id.*, at p. 27.

Design working natural gas capacity by state, November 2024

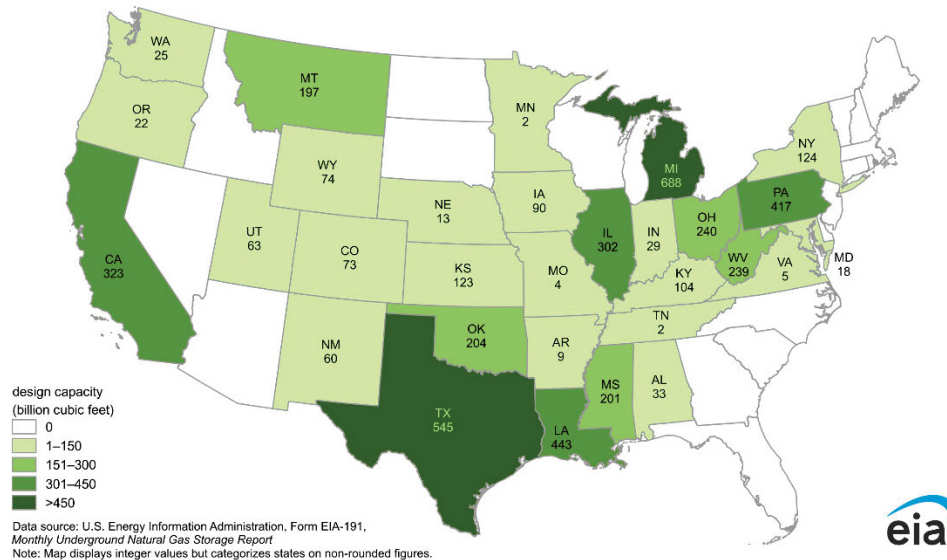


Figure 13. Working gas volumes per states as of November 2024.⁸³

Texas

Individual states may have their own, often more prescriptive, regulations for UNGSF wells. The Railroad Commission of Texas (RRC), for instance, has specific rules for the underground storage of gas. Rule §3.96 ("Underground Storage of Gas in Productive or Depleted Reservoirs") outlines integrity testing requirements.⁸⁴

Initial integrity resting is to be performed before commencing gas injection, operators must pressure test the long string casing. If the well is equipped with tubing set in a packer, the tubing-casing annulus is tested. Wells where injection occurs through casing are tested at the maximum authorized injection pressure, while those injecting through tubing and packer are tested at no less than 500 psig. Subsequent integrity tests are to be performed at each gas storage well must be pressure tested in the same manner as the initial test at least once every five years. This is to determine if there are leaks in the casing, tubing, or packer. The RRC may prescribe a schedule for these tests.

As an alternative to the five-year pressure test, the RRC allows for the monitoring of tubing-casing annulus pressure, with results described in an annual monitoring report, provided there is

⁸³ <https://www.eia.gov/naturalgas/storagecapacity/>

⁸⁴ [https://texreg.sos.state.tx.us/public/readtac\\$ext.TacPage?sl=T&app=9&p_dir=F&p_rloc=157281&p_tloc=19602&p_ploc=9714&pg=3&p_tac=&ti=16&pt=1&ch=3&rl=96](https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=T&app=9&p_dir=F&p_rloc=157281&p_tloc=19602&p_ploc=9714&pg=3&p_tac=&ti=16&pt=1&ch=3&rl=96)

no indication of problems with the well. Exceptions for other viable alternative tests or surveys may also be granted by the commission or its designee.

Michigan

The state of Michigan regulates underground gas storage with guidelines presented in the 25th Edition Michigan Gas Safety Standards Guide.⁸⁵ The guide's section "§192.12 Underground natural gas storage facilities" states that the integrity management program shall consist at a minimum of a framework developed under API RP 1171 section 8, which is discussed in a previous section. Therefore, Michigan regulations call for the use of risk-based integrity management programs.

The regulations state that "*the re-assessment interval for each reservoir, cavern, and well must not exceed seven years from the date of the baseline assessment for each reservoir, cavern, and well.*" There is not specified reinspection interval in the Michigan regulations, although API RP 1171 has guidelines to follow.

Pennsylvania

Pennsylvania regulations established required inspection intervals and integrity tests for operators of underground gas storage wells.⁸⁶

Pennsylvania regulations require operators to perform integrity tests of underground gas storage wells at least every five years as indicated in the Pennsylvania code title 25 § 78.403:⁸⁷

(b) A gas storage reservoir operator shall test the integrity of each gas storage well at least once every 5 years. By June 15, 1995, each gas storage operator shall submit, for Department approval, an integrity testing plan for each gas storage field.

Louisiana

Louisiana regulates gas storage in both solution-mined caverns in salt domes and depleted hydrocarbon reservoirs and aquifers by La. Admin. Code tit. 43, § XIII-512 - Underground Natural Gas Storage Facilities [49 CFR 192.12].⁸⁸ As indicate in the title, § XIII-512 adopted 49

⁸⁵ Guide to the MGSS - 25th Edition.pdf <https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/consumer/nat-gas/MGSS/Guide-to-the-MGSS---25th-Edition.pdf?rev=b3d210541677404b9b112fba762567f0>

⁸⁶ <https://www.law.cornell.edu/regulations/pennsylvania/title-25/part-I/subpart-C/article-I/chapter-78/subchapter-H>

⁸⁷ <https://www.law.cornell.edu/regulations/pennsylvania/25-Pa-Code-SS-78-403>
[https://www.pacodeandbulletin.gov/Display/pacode?file=/secure/pacode/data/025/chapter78/s78.403.html&d=reduce#::~text=\(a\)%20A%20gas%20storage%20reservoir,least%20once%20every%205%20years](https://www.pacodeandbulletin.gov/Display/pacode?file=/secure/pacode/data/025/chapter78/s78.403.html&d=reduce#::~text=(a)%20A%20gas%20storage%20reservoir,least%20once%20every%205%20years)

⁸⁸ Available at <https://www.law.cornell.edu/regulations/louisiana/La-Admin-Code-tit-43-SS-XIII-512>

CFR Parts 191 and 192, which incorporate by reference API RP 1170 and 1171 for salt cavern and depleted reservoir, respectively.

The majority of UNGSF in Louisiana is in solution-mined caverns in salt domes. The gas and liquid hydrocarbon are regulated under the Louisiana Administrative Code, Title 43, Part XIX, §323. Monitoring Requirements, C. Casing Inspection:⁸⁹

1. For existing permitted liquid hydrocarbon storage caverns without a casing inspection or similar log run on the entire length of the innermost cemented casing within **five (5) years** prior to the effective date of these rules, one shall be run within **five (5) years** of the effective date.
2. For existing permitted natural gas storage caverns without a casing inspection or similar log run on the entire length of the innermost cemented casing within ten (10) years prior to the effective date of these rules, one shall be run within **five (5) years** of the effective date.
3. A casing inspection or similar log shall be run on the entire length of the cemented casing in each well at least once every **ten (10) years for hydrocarbon storage caverns** and **fifteen (15) years for natural gas storage caverns**.

International

Over time countries have moved towards a risk-based approach instead of a specific MIT interval.

Canada

In Canada, underground gas storage (UNGSF) is often regulated at the provincial level, but a key national standard is CSA Z341, “Storage of hydrocarbons in underground formations.” This standard provides minimum requirements for design, operation, maintenance, and abandonment of UNGSF facilities, covering both depleted reservoir storage and salt cavern storage. Provincial regulators typically require operators to comply with CSA Z341.⁹⁰ CSA Z321 includes standards for Reservoir Storage with the following section on casing inspection logs for storage wells:

10.2.4 Casings and Tubing

⁸⁹ Louisiana Title 43, Natural Resources, Part XVII. Office of Conservation—Injection, and Mining, Subpart 3. Statewide Order No. 29-M (Rev. 3), Chapter 3. Hydrocarbon Storage Wells in Salt Dome Cavities. Available at https://www.dnr.louisiana.gov/assets/OC/NOI_29-M_Rev3.pdf

⁹⁰ Canadian Standards Association, CSA Standard Z341 Series-02 Storage of Hydrocarbons in Underground Formations, December 2002.

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The following requirements for casing and tubing shall apply:

- a) For storage and observation wells that have tubingless completions, the innermost casing or cemented liner shall be inspected with a casing inspection log and pressure-tested to 1.1 times the maximum operating pressure measured at the wellhead within the first **5 years** of start-up. Frequency of subsequent casing inspections **shall not exceed 8 years**.

The same requirement holds for gas storage in solution mined salt caverns.

Germany

Germany may use a 6-year reinspection interval, according to an industry well integrity service provider.⁹¹ There are also indication that leak inspection are performed every two years.^{92 93} Much of Germany UNGSFs are solution mined caverns in salt domes.

⁹¹ <https://www.tuev-nord.de/en/company/industry/manufacturer/leak-and-well-integrity-examinations-in-accordance-with-bvot/>

⁹² <https://www.lebensraumwasser.com/zum-schutz-des-grundwassers-bohrloch-tuev-in-niedersachsen/>

⁹³ <https://esb.bra.nrw.de/1-bergverordnungen-gesetze/tiefbohrverordnung-bvot>

References

Documents Provided by PG&E

PG&E, December 19 2024, GP-1108 – Underground Gas Storage Asset Management Plan Gas Plan, Document Number: GP-1108.

PG&E, October 1, 2024, GP-1109 – Gas Data Asset Management Plan Gas Plan, Document Number: GP-1109.

PG&E, July 18, 2024, Gas Plan GP-1100 – Strategic Asset Management Plan Document Number: GP-1100.

PG&E, January 19, 2024, CalGEM Data Request - Revised Testing Schedule and Required Data.

PG&E, January 20, 2023, Reinspection Plan - Supporting Justification.

PG&E, May 22, 2023, Reinspection Plan - PG&E's Well Reinspection Plan Methodology and Relevant Factors Informing the Approach.

PG&E, May 23, 2023, Letter to CalGEM: 2nd Request for Approval of PG&E's Reinspection Methodology & Plan.

PG&E Well Integrity Data Book.

Industry Standards, Specifications, and Recommended Practices

API. RP 1171 Functional integrity of natural gas storage in depleted and aquifer reservoirs, API RP 1171, First Edition: API, September 2015.

API Spec 5CT, Specification for Casing and Tubing, 9th Edition, July 2011, Effective Date 1 January 2012.

American Petroleum Institute, Specification 5B Threading, Gauging, and Inspection of Casing, Tubing, and Line Pipe Threads, 16th Edition, December 2017.

American Petroleum Institute, Recommended Practice on Procedures for Testing Casing and Tubing Connections, 4th Edition, January 2017.

API RP 6A Specification for wellhead and Christmas tree equipment, 20th edition: API, October 2011.

API RP 10A Specification for Cements and Materials for Well Cementing, 24th Edition: API, 2010.

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Regulations

California Code of Regulations (“CCR”), Title 14, Chapter 4, Subchapter 1, Article 5, Requirements for Gas Underground Storage Projects, California Geologic Energy Management Division Statutes and Regulations, available at <https://www.conservation.ca.gov/index/Pages/California-Geologic-Energy-Management-Division-Statutes-and-Regulations.aspx> Last accessed October 24, 2024.

Industry Reports

Ground Water Protection Council and Interstate Oil and Gas Compact Commission, May, 2017, Gas Storage Regulatory Considerations: A Guide for State and Federal Regulatory Agencies.

U.S. Department of Energy. Ensuring Safe and Reliable Underground Natural Gas Storage: Final Report of the Interagency Task Force on Natural Gas Storage Safety: U.S. Department of Energy, October, 2016.

IOGCC, Energy Resource, Technology, and Research Committee. Hydrocarbon storage in mined caverns: A guide for State regulators. 1998.

Natural Gas Supply Association. Storage of Natural Gas. [Online] January 28, 2013. <http://naturalgas.org/naturalgas/storage>.

British Geological Survey. An Appraisal of Underground Gas Storage Technologies and Incidents for the Development of Risk Assessment Methodology, RR : Health and Safety Executive, 2008.

Lord, Anna S. Overview of Geologic Storage of Natural Gas with an Emphasis on Assessing the Feasibility of Storing Hydrogen. : Sandia National Laboratories, SAND200-5878, 2009.

CSA. Storage of hydrocarbons in underground formations, 2341 Series- 14, 138: Canadian Standards Association, August, 2014.

United Nations Economic Commission for Europe. Study on underground gas storage in Europe and Central Asia. Geneva, Switzerland : United Nations, 2013.

Folga, S., et al. U.S. natural gas storage risk-based ranking methodology and results: Argonne National Laboratory Technical Report ANL-16/19, 2016.

The status quo and technical development direction of underground gas storages in China. Ding, G., et al. 2015, Natural Gas Industry B2.

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USDOT, PHMSA [Docket No. PHMSA-2016-0016] . Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Notice; Issuance of Advisory Bulletin (ADB-2016-02). Washington D.C. : U.S. Federal Register, February 2016. pp. 6334-6336.

Literature

Abaa, K., and H. Tripathi. "Determination of Optimal Corrosion Logging Frequencies for Gas Storage Fields." SPE J. 30 (2025): 50–64. doi: <https://doi.org/10.2118/218901-PA>

Haire, J.N. and Heflin, J.D, Dresser Atlas, “Vertilog – A Down-Hole Casing Inspection Service,” SPE 6513, 1977.

Bird, James M. "Interpretation of Temperature Logs in Water- and Gas-injection Wells and Gas-producing wells." Paper presented at the Drilling and Production Practice, New York, New York, January 1954.

Knutson, C.K. and Boardman, C.R., GeoEnergy Corporation, “An Assessment of Non-Destructive Testing of Well Casing, Cement and Cement Bond in High Temperature Wells”, UCRL-15032, 1979.

Adams, G.W. and Moffat, W.D., Atlas Wireline Services, “Full-Signature Multiple Channel Vertilog,” SPE 22101, 1991.

Mato, S.A., Multi-Channel Casing Inspection Instrument, 87-DT-102, 1987.

McWhirter, V.C., CO₂ + H₂O = Corrosion, 32nd Annual Southwestern Petroleum Short Course Association, Inc., April 23-25, 1985, Texas Tech University.

Katahara, K.W., Kyle, D.G., Sieried, R.W., Gard, M.F., Goodwill, William P., Schasteen, T., and S. Petermann.

"Detection Of External Pipe Defects With A Modified Borehole Televiewer." Paper presented at the SPWLA 29th Annual Logging Symposium, San Antonio, Texas, June 1988.

Mato, S.A., Multi-Channel Casing Inspection Instrument, 87-DT-102, 1987.

El Sherbeny, W., et al., “Magnetic Flux Leakage (MFL) Technology Provides the Industry’s Most Precise Pipe.

Integrity Corrosion Evaluation, Accurately Characterizing Casing and Tubing Strength - Technology Overview and Case History,” SPE 175871-MS, 2015.

Nestleroth, J.B., “Circumferential MFL In-Line Inspection for Cracks in Pipelines”, DE-FC26-01NT41159, June 2003.

December 2, 2025

Shi, Y., Zhang, C., Cai, M., and Jia, G., “Theory and Application of Magnetic Flux Leakage Pipeline

Detection”, *Sensors* 2015, 15, 31036-31055, doi:10.3390/s151229845 Available at <https://www.mdpi.com/1424-8220/15/12/29845/pdf>

Nestleroth, J.B., “Implementing Current In-Line Inspection Technologies on Crawler Systems”, DE-FC26-03NT41881, April 2004.

McWhirter, V.C., CO₂ + H₂O = Corrosion, 32nd Annual Southwestern Petroleum Short Course Association, Inc., April 23-25, 1985, Texas Tech University.

Swanson, R.K. and Kilman, M., Development of Improved Methods for Inspecting Gas Storage Well Downhole Casing, Final Report, AGA Research Project PR 15-411, SwRI Project No. 15-7930, January 31, 1986.

Al-Ajmi, M.F., et al., “North Kuwait Down-hole Corrosion Management Challenge and the Use of New Corrosion Detection Tools to Define the Extent of the Problem,” SPE 81442, 2003.

Newman, M.A., “The Importance in Developing a Surveillance Logging Quality Assurance and Quality Control Plan”, SPE 84828, 2003.

Child, T., Baker Hughes, PHMSA Pipeline R&D Forum, Cleveland, OH, November 16-17, 2016. Available at <https://primis.phmsa.dot.gov/rd/mtgs/111616/Terry%20Child.pdf>

Specifications and Requirements for In-Line Inspection of Pipelines, Pipeline Operators Forum, Version 2016.

Available at https://ucarecdn.com/58371ddd-72ea-4cf4-9422-4c9fbfd5cac1/01_2016_Version.pdf

Rushing, J., “Casing Mechanical Integrity Tests Utilizing Wireline Ultrasonic Imaging Logs,” Geothermal Resources Council Transactions, Vol. 25, 2001.

Child, T., Baker Hughes, PHMSA Pipeline R&D Forum, Cleveland, OH, November 16-17, 2016. Available at <https://primis.phmsa.dot.gov/rd/mtgs/111616/Terry%20Child.pdf>

McKinley, R. M. (1994, July). Temperature, Radioactive Tracer, and Noise Logging for Injection Well Integrity. Report No. EPA/600/R-94/124 for Cooperative Agreement No. CR-818926.

McKinley, R. M. (1982, January 1). Production Logging. Society of Petroleum Engineers. doi:10.2118/10035-MS.

December 2, 2025

- Adnyana, G., Sharma, J., Mims, D., Barnes, D., & Behrens, R. (2018, September 24). Temperature Logging Guidelines and Factors that Affect Measurement Accuracy. Society of Petroleum Engineers. doi:10.2118/191539-MS
- Prensky, S. (1992, May 1). Temperature Measurements in Boreholes - An Overview of Engineering and Scientific Applications. Society of Petrophysicists and Well-Log Analysts.
- McKinley, R. M., & Bower, F. M. (1979, November 1). Specialized Applications of Noise Logging. Society of Petroleum Engineers. doi:10.2118/6784-PA.
- McKinley, R. M., Bower, F. M., & Rumble, R. C. (1973, March 1). The Structure and Interpretation of Noise From Flow Behind Cemented Casing. Society of Petroleum Engineers. doi:10.2118/3999-PA.
- McKinley, R. M. (1982, January 1). Production Logging. Society of Petroleum Engineers. doi:10.2118/10035-MS.
- Bird, J. M. (1954, January 1). Interpretation of Temperature Logs in Water- and Gas-injection Wells and Gas-producing wells. American Petroleum Institute.
- Smith, B. A., & Neal, M. R. (1970, January). Evaluation of Gas Storage Well Completions with Well Logs. Society of Petroleum Engineers. doi:10.2118/2965-MS.
- Johns, J. E., Blount, C. G., Dethlefs, J. C., Julian, J. Y., Loveland, M. J., McConnell, M. L., & Schwartz, G. L. (2009, May 1). Applied Ultrasonic Technology in Wellbore-Leak Detection and Case Histories in Alaska North Slope Wells. Society of Petroleum Engineers. doi:10.2118/102815-PA.
- Julian, J. Y., King, G. E., Johns, J. E., Sack, J., & Robertson, D. B. (2007, January 1). Detecting Ultrasmall Leaks with Ultrasonic Leak Detection, Case Histories from the North Slope, Alaska. Society of Petroleum Engineers. doi:10.2118/108906-MS.
- Weekers, E. E. A. J., & Kastelein, H. J. (1984, January 1). Performance Testing of Well Completion Components Under Simulated Downhole Conditions. Society of Petroleum Engineers. doi:10.2118/13066-MS.
- A Practical Approach to the Interpretation of Cement Bond Logs. Bigelow, E.L. July 1985, Journal of Petroleum Technology 37, no. 7, pp. 1285-1294.
- Overview on underground storage of natural gas. Katz, D. L. and Tek, M. R. 1981, Journal of Petroleum Technology 33, pp. 943-951.
- Evans, D. J. A review of underground fuel storage events and putting risk into perspective with other areas of the energy supply chain, In Underground gas storage: Worldwide experiences and

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future development in the UK and Europe. [ed.] D. J. Evans and R. A. Chadwick: Geological Society: London, 2009. pp. 173-216.

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Limitations

At the request of PG&E, Exponent has conducted an analysis of the PG&E's Reinspection Plan schedule for mechanical integrity testing of underground gas storage wells. This work was performed under PG&E requisition number PR1386362, issued April 7, 2025 title Exponent, Inc. Casing Integrity Program Review. Exponent reviewed and analyzed specific components of Reinspection Plan. The scope of services performed during this review may not adequately address the needs of other users of this report, and any reuse of this report or its findings, conclusions, or recommendations presented herein is at the sole risk of the user. The opinions and comments formulated during this assessment are based on observations and information available at the time of the investigation. No guarantee or warranty as to future life or performance of any reviewed condition is expressed or implied. The findings and conclusions presented herein are made to a reasonable degree of engineering certainty. We have made every effort to accurately and completely investigate all areas of concern identified during our investigation. If new data should become available or there are perceived omissions or misstatements in this report regarding any aspect of those conditions, we ask that they be brought to our attention as soon as possible so that we have the opportunity to fully address them.

Amended Casing Wall Thickness Dates from CalGEM Letter Dated 5/22/2025 (12/1/2025)

Count	Well	API	CalGEM Last CWT	CalGEM Next Inspection Date	Corrected Last CWT	Corrected Next CalGEM Inspection Year	Correction Necessary
1	TC 3-S	04-077-20216-00	6/11/2021	6/11/2028	9/6/2024	2031	CalGEM did not incorporate the most recent casing wall thickness inspection completed in 2024.
2	LM 20-D	04-013-20297-01	8/11/2020	8/11/2027	7/24/2024	2031	CalGEM did not incorporate the most recent casing wall thickness inspection completed in 2024.
3	WS 1-E	04-077-20168-01	12/8/2023	12/8/2031	12/8/2023	2030	CalGEM listed the well twice.
4	TC 5-N	04-077-20207-00	4/24/2022	4/24/2029	5/25/2025	2032	Well completed its second casing wall thickness inspection in 2025.
5	LM 3-A	04-013-20115-01	6/25/2022	6/25/2029	7/2/2025	2032	Well completed its second casing wall thickness inspection in 2025.
6	WS 19-W	04-077-20467-01	6/12/2024	-	-	2032	Well is planned to complete its second casing wall thickness inspection in 2025.
7	WS 1-W	04-077-20215-00	7/4/2024	-	-	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a third casing wall thickness inspection is planned for the well in 2025.
8	WS 5-W	04-077-20211-00	7/26/2024	7/26/2031	-	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a third casing wall thickness inspection is planned for the well in 2025.
9	TC 2-S	04-077-20219-00	8/25/2024	8/25/2031	-	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a third casing wall thickness inspection is planned for the well in 2025.
10	TC 10-N	04-077-20228-00	CalGEM did not include first inspection date of 08/15/2017	-	-	2032	Well was not included in CalGEM's list but the well is planned to complete its third casing wall thickness inspection in 2025.
11	WS 1A-W	04-077-20544-00	CalGEM did not include first inspection date of 06/04/2018	-	6/30/2025	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a second casing wall thickness inspection was completed on the well in 2025.
12	TC 1A-S	04-077-20551-00	CalGEM did not include first inspection date of 11/07/2016	-	5/31/2025	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a second casing wall thickness inspection was completed on the well in 2025.
13	TC 1-S	04-077-20218-00	CalGEM did not include first inspection date of 04/10/2018	-	6/16/2025	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a second casing wall thickness inspection was completed on the well in 2025.
14	TC 16-S	04-077-20243-01	CalGEM did not include first inspection date of 04/21/2018	-	4/30/2025	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a second casing wall thickness inspection was completed on the well in 2025.
15	LM 12-C	04-013-20307-01	CalGEM did not include first inspection date of 05/15/2016	-	6/9/2025	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a second casing wall thickness inspection was completed on the well in 2025.
16	LM 2-A	04-013-20138-00	CalGEM did not include first inspection date of 06/12/2016	-	6/21/2025	2032	CalGEM did not incorporate the first inspection date noted in column titled "CalGEM Last CWT" and a second casing wall thickness inspection was completed on the well in 2025.
17	LMAC-1	04-077-20609-01	5/9/2021	12/31/2026	5/9/2021	2028	Well was originally planned on a 5-8 year interval on a Risk Based plan. Under the CalGEM plan, well will follow a 7-year interval.
18	WS 3-W	04-077-20213-00	6/5/2021	12/31/2026	6/5/2021	2028	Well was originally planned on a 5-8 year interval on a Risk Based plan. Under the CalGEM plan, well will follow a 7-year interval.
19	TC 2-N	04-077-20199-00	3/28/2022	12/31/2027	3/28/2022	2029	Well was originally planned on a 5-8 year interval on a Risk Based plan. Under the CalGEM plan, well will follow a 7-year interval.
20	TC 13-N	04-077-20234-00	4/15/2022	12/31/2027	4/15/2022	2029	Well was originally planned on a 5-8 year interval on a Risk Based plan. Under the CalGEM plan, well will follow a 7-year interval.
21	LM 17-D	04-013-20136-00	7/11/2021	12/31/2026	7/11/2021	2028	Well was originally planned on a 5-8 year interval on a Risk Based plan. Under the CalGEM plan, well will follow a 7-year interval.

Amended SAPT Dates from CalGEM Letter Dated 5/22/2025 (12/1/2025)

Count	Well	API	CalGEM Last SAPT	CalGEM Next SAPT Due Date	Corrected Last SAPT	Corrected Next CalGEM SAPT Year	Correction Necessary
1	TC 3-S	04-077-20216-00	-	-	9/14/2024	2029	CalGEM did not incorporate the most recent SAPT completed in 2024.
2	LM 9-C	04-013-20123-00	11/26/2036	11/26/2028	5/21/2025	2030	Typo on CalGEM SAPT date. SAPT was completed in 2025.
3	WS 1-E	04-077-20168-01	1/23/2025	1/23/2030	4/30/2025	2030	Updated SAPT date. SAPT was completed in 2025.
4	LM 14-C	04-013-20298-00	6/20/2023	6/20/2028	5/20/2025	2030	Updated SAPT date. SAPT was completed in 2025.
5	LM 21-D	04-013-20308-00	8/10/2023	8/10/2028	5/22/2025	2030	Updated SAPT date. SAPT was completed in 2025.
6	TC 2-S	04-077-20219-00	6/24/2023	6/24/2028	-	2030	Well is planned to complete rework and SAPT in 2025.
7	WS 1-W	04-077-20215-00	-	-	-	2030	Well is planned to complete rework and SAPT in 2025.
8	WS 19-W	04-077-20467-01	-	-	-	2030	Well is planned to complete rework and SAPT in 2025.
9	TC 10-N	04-077-20228-00	-	-	-	2030	Well is planned to complete rework and SAPT in 2025.
10	WS 1A-W	04-077-20544-00	-	-	7/5/2025	2030	Well was not included in CalGEM's list but the well was reworked in 2025. SAPT was completed during rework.
11	TC 1A-S	04-077-20551-00	-	-	6/8/2025	2030	Well was not included in CalGEM's list but the well was reworked in 2025. SAPT was completed during rework.
12	TC 1-S	04-077-20218-00	-	-	6/24/2025	2030	Well was not included in CalGEM's list but the well was reworked in 2025. SAPT was completed during rework.
13	TC 16-S	04-077-20243-01	-	-	5/6/2025	2030	Well was not included in CalGEM's list but the well was reworked in 2025. SAPT was completed during rework.
14	TC 5-N	04-077-20207-00	-	-	5/27/2025	2030	Well was not included in CalGEM's list but the well was reworked in 2025. SAPT was completed during rework.
15	LM 12-C	04-013-20307-01	-	-	6/14/2025	2032	Well was not included in CalGEM's list but the well was reworked in 2025. SAPT was completed during rework.
16	LM 2-A	04-013-20138-00	-	-	6/24/2025	2032	Well was not included in CalGEM's list but the well was reworked in 2025. SAPT was completed during rework.
17	LM 3-A	04-013-20115-01	-	-	7/8/2025	2032	Well was not included in CalGEM's list but the well was reworked in 2025. SAPT was completed during rework.

In the tables above, PG&E lists the wells which CalGEM included an incorrect date for casing wall thickness inspections and SAPT testing within the May 22, 2025 CalGEM correspondence letter. PG&E has incorporated the corrected dates as well as the corrected year that the inspection would become due under CalGEM's plan. The tables show the most recent date CalGEM has captured and its expected due date, and PG&E's most recent work and updated due date. PG&E provides the due date being due within the calendar year vs the specific date.

December 8, 2025

By Email

Ms. Emily Reader
Programs Manager, Subsurface Storage and Injection Project
Department of Conservation
California Geologic Energy Management Division

Re: **MECHANICAL INTEGRITY TESTING SCHEDULE – PACIFIC GAS AND ELECTRIC COMPANY (PG&E)**

Dear Ms. Reader,

PG&E is writing in response to CalGEM's letters dated May 22, 2025, and November 12, 2025, regarding the approval of PG&E's proposed Mechanical Integrity Testing (MIT) schedule with certain modifications. PG&E respectfully requests that CalGEM reconsider the approved MIT schedule. PG&E recently obtained new information from third-party experts that support adoption of PG&E's proposed alternative frequency for well inspection. We believe this additional information merits further discussion with CalGEM, in consultation with the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC), on whether the adopted testing schedule is reasonable and appropriate to meet our statutory obligations under Cal. Code of Regulations (CCR) Section 1726.6.

A. CASING WALL THICKNESS INSPECTION FREQUENCY

CCR Section 1726.6(a)(2) states that an operator shall at a minimum conduct a Casing Wall Thickness (CWT) inspection at least once every 24 months but that CalGEM "may approve a less frequent casing wall thickness inspection schedule for a well if the operator demonstrates that the well's corrosion rate is low enough that biennial inspection is not necessary."

In the letter dated May 22, 2025, CalGEM approved a schedule with a maximum of seven years between CWT inspections, stating that "it ensures the protection of public health, safety, and the environment" and that "obtaining additional data as soon as practicable allows for the establishment of corrosion rates." CalGEM also states, "to avoid disruptions of deliverability, a maximum seven-year testing interval is the shortest interval that PG&E has indicated it could perform the inspections."¹ Based on new information obtained by PG&E, we respectfully disagree with CalGEM's conclusions.

We appreciate that CalGEM granted PG&E an exception to the prescriptive 24-month inspection schedule in CCR § 1726.6(a)(2) in favor of a prescriptive 7-year schedule. A

¹ As discussed later in this letter, we believe CalGEM mischaracterized PG&E's statements and offer further clarification on this matter.

longer inspection cycle aligns with PG&E's experience and industry research that increasing the frequency of inspections unduly increases risk to personnel, the environment, and the well and reservoir assets. PG&E will comply with CalGEM's directive to execute well inspections on a 7-year interval **for second-round casing wall thickness inspections** while ensuring deliverability for customers is maintained. However, PG&E remains concerned and forecasts that the pursuit of a strict 7-year interval will still be limited by facility constraints and lead to associated deliverability impacts to storage supply.

PG&E understands it is CalGEM's position that two rounds of direct CWT inspection should take place before an alternative frequency can be considered. In the May 22, 2025, letter, CalGEM states "[t]he regulations contemplate that approval of an alternative frequency would be based on at least two rounds of inspections, performed at 24-month intervals, with the first round completed by October 1, 2020." CalGEM's letter claims its review "focused extensively on well safety" but did not explain why two inspections are required for each well nor provides a basis for adopting a 7-year inspection frequency. CCR Section 1726.6 came into law in 2018, and since this time the industry has advanced in its understanding of the comprehensive risks associated with performing CWT inspections. Because of these risks PG&E recommends longer frequency intervals be adopted by CalGEM. PG&E remains steadfast in its commitment to safety and has implemented processes and controls that far exceed industry best practice. Accordingly, CalGEM should adopt PG&E's proposed second-round testing schedule most recently submitted in January 2024. Alternatively, CalGEM should approve PG&E proposed Revised Reinspection Plan, as discussed below.

1. Third Party Expert's External Reviews of PG&E's Reinspection Plan

In a letter dated December 20, 2023, CalGEM stated PG&E's risk-based frequency was not appropriate and substantially longer than acceptable. To address CalGEM's concerns, PG&E engaged independent third-party engineering experts to evaluate the Reinspection Plans and methodology. The results provide ample justification for adopting PG&E's Reinspection Plan, including benchmarks against storage operators and regulations both domestically and around the world.

These two expert firms are Exponent, Inc. (Exponent) and Blade Energy Partners (Blade). Both firms are renowned for their engineering expertise and have performed extensive engineering analysis, failure investigations, and root cause analysis of incidents in the energy industry. Exponent's expertise includes oil and gas well design and well integrity, well production, wellhead equipment, and well control. Exponent experts have been engaged around the world to perform failure investigations and to give expert testimony in numerous court proceedings.

Blade Energy Partners has consulted on many complex investigations regarding the failure of well and well components of gas storage and production wells. Following the Aliso Canyon and Rager Mountain storage well incidents, Blade Energy provided

trusted support to state and federal regulators, including CPUC and CalGEM (formerly DOGGR), Pennsylvania's Department of Environmental Protection, and the Pipeline and Hazardous Material Safety Administration (PHMSA). As CalGEM is aware, the findings from Blade's investigation related to Aliso Canyon contributed to the concepts introduced in CalGEM's final underground gas storage rules and are further expected to be considered in forthcoming revisions to gas storage well policy and regulations under California Senate Bill 463².

PG&E summarizes the results of the reviews provided by Exponent and Blade Energy below and attaches the expert reports for CalGEM's reference.

Exponent's review concluded:

"[T]hat PG&E's reinspection plans for their UNGSFs are based on sound technical quantitative risk analysis ("QRA") methods and verified with a database of well inspection results. PG&E's reinspection intervals were developed through risk ranking of all UNGSF wells (i.e., age and construction of wells); analysis of the results of high-resolution magnetic flux leakage ("MFL") wall thickness measurement logs to estimate corrosion rates and mechanical damage of production casing; risk assessment of workover procedures to inspect, test and perform well intervention; and impacts of well construction and integrity reinspection on storage capacity and gas deliverability to residential and commercial customers" (p.8).

"[W]ell intervention for UNGSF well workovers carry adverse risks, but the risks can be managed and minimized by optimization of the well intervention schedule. PG&E has shown that, through QRA and analysis of MFL tool wall thickness measurements on its UNGSF wells, that risks can be reduced by optimally scheduling well interventions and logging frequency" (p.14).

"PG&E's proposed reinspection frequency intervals for wall thickness logs are reasonable and consistent with other UNGSF operators who have performed a detailed Risk Assessment of their UNGSF wells" (p.14).

"The basis for PG&E's wall thickness logging frequency intervals is based on reasonable analysis of corrosion rates and risk assessment" (p.16).

"PG&E's MFL inspection frequency intervals are based on reasonable technical analysis and risk assessment" (p.18).

² SB 463 stated "The bill would require, in response to the independent root cause analysis of the 2015 well leak at the Aliso Canyon gas storage facility prepared by Blade Energy Partners dated May 16, 2019, and ordered by the supervisor and the Public Utilities Commission, the division, on or before July 1, 2021, to review and, if necessary, revise its natural gas storage well policy and regulations to address the root causes identified." Revision of CalGEM's well policy and regulations, remain outstanding.

Blade's review concluded:

"The tubing, packer, and tailpipe represent the primary barrier, while the production casing serves as the secondary barrier. Baseline inspection of the casing is essential and confirms casing integrity. However, the constant removal (every 24 months) of a properly functioning primary barrier (tubing and packer) risks compromising the well integrity to inspect the secondary barrier. The value of the casing inspection should balance this risk" (p.5).

"Re-inspection aims to identify any increases in wall loss due to corrosion, confirm ongoing time-dependent wall loss, or affirm that there is no active wall loss. Too frequent inspections will be misleading, especially if they show no additional wall loss. This will occur due to the inherent uncertainties, errors, and tolerances associated with magnetic logging technology" (p.5).

"Repeated removal of the tubing, connection, and tubing seal assembly exposes the system to leak paths and possible failures. The packer seal assembly may be redressed for each application; however, the repeated application exposes the system to possible retrieval and installation damages. This is an important factor to consider in the decision-making process of repeated casing inspections. **We are removing a properly functioning primary barrier (tubing), which risks compromising the well integrity to inspect the secondary barrier**" (Emphasis by Blade) (p.36).

"Overly frequent inspections can be damaging because entering the well poses a risk of mechanical damage during rig-based inspection operations" (p.5).

"Overall, the PG&E re-inspection program is quite conservative. The current upper limit for inspection frequency is 12 to 15 years, which Blade believes is too frequent in certain scenarios. Additionally, Blade believes that inspection frequency of less than 12 to 15 years should consider two factors: corrosion rate estimates from logging and the HRVRT tool's tolerances and uncertainties. One needs to ensure that the increase in wall loss exceeds the tolerances, errors, and uncertainties associated with the chosen inspection frequency. Otherwise, the frequency may be so small that the tool may not detect the increase in wall loss, as it will be obscured by the tool's sizing uncertainties and tolerances" (p.38).

"The tolerances for HRVRT are unclear; however, let us assume it is +/- 10% of the wall thickness. This assumption is based on previous work with this technology. In this case, a 20% anomaly in the first inspection would correspond to a 10% to 30% range in corrosion depth. A corrosion rate of 1.2 mpy —the highest estimated, for ID corrosion —would not be detected in either a 5-year or a 15-year re-inspection. In fact, a 20% anomaly would not exceed the tolerance until 25 years later (at 31.1%)" (p.38).

Both Exponent and Blade emphasize that unnecessary intervention without cause increases the risk of compromising well integrity and too frequent inspections will be misleading. In the spirit of maintaining well integrity and ensuring public safety, these factors should not be dismissed.

2. PG&E Proposed Reinspection Plan

Expert opinions support a balanced approach to the frequency of well interventions; accordingly, CalGEM can approve a modified inspection cycle of an appropriate frequency to mitigate risk for second and subsequent casing wall thickness inspections. To achieve this, PG&E requests the following parameters to be considered for adoption:

Ask #1: For wells that have completed two rounds of CWT inspections, reinspection should adhere to PG&E's risk-based frequency (40 wells total)

The frequency for wells that have **already** received a second inspection, PG&E is requesting approval to adhere to a risk-based framework for the third inspection. This modification would be applicable to 40 wells that have already undergone two rounds of casing wall thickness inspections. PG&E reiterates its concern that routinely entering wells, which requires a workover rig to remove the tubing and perform these inspections, does not meaningfully improve safety. Rather, this instead adds undue risk to personnel, the environment, and assets. Increased inspections will also cause unnecessary expenditures, without risk reduction benefit, for PG&E ratepayers at a time when California is prioritizing affordability.

Ask #2: A 7-Year Reinspection frequency should only apply to wells pending a second CWT inspection and for certain wells PG&E requests risk-based extension for second CWT inspections to ensure deliverability

In its May 22, 2025 letter, CalGEM acknowledged there is flexibility to address reliability requirements. PG&E anticipates impacts to meeting its storage supply standard with a 7-year prescriptive inspection frequency, even if CalGEM grants the modification for wells that have already had two rounds of inspections. Therefore, PG&E additionally requests the Division approve modification to the inspection frequency for a select group of wells to ensure deliverability is maintained at the necessary capacities. The wells selected for extension have already been inspected using a full suite of downhole inspection tools, far exceeding the industry's best practice. The selected wells meet the dual barrier construction requirements and were confirmed to have sufficient integrity. Further, all of PG&E's wells continue to receive comprehensive monitoring practices as described in PG&E's Risk & Integrity Monitoring Plan TD-4870M. Enclosed with this letter, Appendix K (Amended Dates from CalGEM Letter), summarizes the wells requested for modifications and the reasons supporting this extension. PG&E believes these requests are consistent with the recommendations provided by Blade and Exponent.

Ask #3: For all wells, subsequent reinspections should be based off PG&E risk-based guidance subject to CalGEM audit.

For all wells, PG&E requests to conduct CWT inspections at a frequency that is in accordance with PG&E's risk-based guidance (TD-4875P-05) (that may be audited by CalGEM/PHMSA) rather than submitting requests for review and approval from CalGEM for each individual well following subsequent inspections. This would also align with how PHMSA manages the well inspection program nationwide. This approach would greatly reduce CalGEM's administrative burden and provide gas storage operators with the ability to more readily forecast expenditures associated with well work over a longer time horizon. In addition to the ongoing administrative burden, shorter inspection frequencies will cause potential rate impacts that would negatively influence PG&E's efforts to prioritize customer affordability while maintaining safe and reliable service.

3. CalGEM Should Align with PHMSA's Approach to Compliance MIT Due Dates in Consideration of Operational Feasibility

The May 22, 2025 letter from CalGEM establishes compliance deadlines using a strict 7-year window to the specific date of a prior inspection, without providing any further operational flexibility. CalGEM states, "Failure to adhere to the approved schedule may result in corrective action up to and include, but not limited to, civil penalties for each day a well is out of compliance with its assigned due date." Given the complexity of performing this type of well work, the variability in scheduling, and the need for operation feasibility, PG&E requests CalGEM reconsider compliance due dates and adopt an approach that aligns with PHMSA. Specifically, PHMSA established guidance in FAQ -41 for pipeline re-assessment compliance due dates as being *due within the calendar year* as opposed to the day. FAQ-41 states:

FAQ-41. Does the requirement that gas pipeline operator establish assessment intervals not to exceed a specified number of years mean calendar years (i.e., pipe assessed in 2004 must be reassessed during 2011) or actual years? [06/09/2004] [Revised 02/22/2016]

Re-assessments must be conducted in accordance with an operator's procedures for determining the appropriate reassessment interval. Prior to the enactment of the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011, the maximum interval was set using actual years from the date of the previous assessment. Effective January 3, 2012, this was modified such that the maximum interval may be set using the specified number of calendar years. For example, a pipe segment assessed on March 23, 2004 with a seven year interval must be re-assessed before December 31, 2011, using at least confirmatory direct assessment. This segment would need to be re-assessed using one of the methods specified in the rule before December 31, 2014, December 31, 2019 or December 31, 2024, depending on its operating stress (see § 192.939). Note that

this change from actual years to calendar years is specific to gas pipeline reassessment interval years and does not alter the actual year interval requirements which appear elsewhere in the code for various inspection and maintenance requirements.

PG&E requires operational flexibility in the specific ordering of wells to be reworked within a rework season to respond to the expected scheduling and resource challenges that can arise. In a June 15, 2021 letter to PG&E, CalGEM structured the inspection compliance to be satisfied for all wells due in a season by October 1st – this allowed for the re-ordering of well inspections within the year that must occur from time to time.

4. Data Submissions-Response to November 12, 2025 Letter

PG&E completed baseline inspections (i.e., first round of testing) in 2023 and all data was submitted in accordance with the necessary timelines. Please see Appendix E (PG&E Well Specific Integrity Detail), Appendix G (PG&E Wells With Two or More Casing Wall Thickness Inspections) & Appendix K (Amended Dates from CalGEM Letter) enclosed with this correspondence for the dates of first inspection. Second inspection data collected by PG&E has additionally been submitted within the required timeframes, and further, Appendix G contains the proposed reinspection frequency for wells with two rounds of CWT inspections.

5. Corrections to May 22, 2025 Letter Regarding CWT Inspections

First, the dates for the last inspection included by CalGEM in the attachment to its May 22, 2025 letter titled “PG&E MIT Due Dates” appear to be outdated and exclude data provided in WellSTAR and in PG&E’s Reinspection plans submitted to CalGEM in May 2023 and January 2024. PG&E has prepared Appendix K (Amended Dates from CalGEM Letter) showing these corrections.

Second, CalGEM erroneously paraphrased PG&E’s statements made during 2023 Rate Case Hearings. In the May 22, 2025 letter, CalGEM states:

“In addition, to avoid disruptions to deliverability, a maximum seven-year testing interval is the shortest interval that PG&E has indicated it could perform the inspections (see Application of Pacific Gas and Electric Company for Authority, Among Other Things, to Increase Rates and Charges for Electric and Gas Service Effective on January 1, 2023 (U39M); Evidentiary Hearing Application 21-06-021, testimony of Lucy Redmond, Sr. Director Gas Facilities and Storage Engineering).”

This statement is incorrect and mischaracterizes the testimony given. As the hearing transcript shows, PG&E indicated that a 7-year timeframe could be managed specifically referring to the initial conversion to meet CalGEM’s two barrier requirement

for well construction and that had been what was contemplated during rulemaking.³ At the time of rate case preparation and hearings, PG&E used a 7-year inspection frequency as the basis of a potential financial forecast as to what reinspection frequency could be expected to be required in light PHMSA's FAQ guidance that was still pending.⁴ No representations were made during hearings on PG&E's deliverability of a 7-year reinspection frequency as hearings were focused on financial forecasting. Moreover, after hearings concluded, PG&E later made several submissions to CalGEM indicating that the potential impacts a 7-year inspection frequency would have on deliverability. PG&E provides the August 17, 2022 Hearing Transcript as Attachment "August 17, 2022 Transcript VOL 6(EXCERPTED)pages 7-100" for CalGEM's reference.

B. PRESSURE TESTING FREQUENCIES

CCR Section 1726.6(a)(3) mandates a minimum pressure testing frequency of at least once every 24 months unless CalGEM approves another minimum frequency.

In its May 22, 2025 letter, CalGEM set due dates for 60 months after the last Standard Annulus Pressure Test (SAPT) pressure testing date (without a rig), regardless of whether a more recent pressure test had been performed with a rig. PG&E requests clarification of CalGEM's process to allow the pressure testing inspection date to reset with any subsequent pressure test (rig-based or SAPT). Thus, any time a successful pressure test is conducted, the next due date will automatically adjust out by 60 months. PG&E has prepared a list of corrections to update CalGEM's list based on the most recent pressure test conducted, as provided in Appendix K (Amended Dates from CalGEM Letter) which identifies the necessary revisions.

Further, to reduce the likelihood of cement degradation, PG&E also requests CalGEM allow for the SAPT, performed in the absence of a rig, to be conducted at a lower test pressure of 500 psig at surface, similar to allowances for other gas storage operators. As a point of illustration, this would equate to approximately 3,000 psig (145% MAOP) at the casing shoe on average for wells at McDonald Island. PG&E previously indicated concern that overly frequent pressure testing can lead to premature degradation of cement sheath and inner string cement sheath, where placed.

Lastly, PG&E requests that CalGEM allow for operational execution and due dates be set with a compliance period of 60 months not to exceed 63 months⁵ similar to condition #1 in the CalGEM letter dated June 15, 2021.

³ August 17, 2022 Transcript VOL 6(EXCERPTED)" page 7-100.

⁴ PHMSA clarified their position on downhole inspection frequency – specifically, PHMSA does not require a prescribed maximum interval for performing downhole integrity inspections – at the PHMSA Safety of Underground Natural Gas Storage Public Meeting May 16-17, 2023 workshop.

⁵ CalGEM previously adopted this approach for annual Noise & Temperature and Thru-tubing surveys that allowed 12 months not to exceed 15 months in its June 15, 2021 (UNDERGROUND GAS STORAGE WELLS TESTING SCHEDULE DETERMINATION).

C. CONCLUSION

For all of the reasons stated above, PG&E urges CalGEM to approve the requested modifications in this letter or reconsider approving PG&E's originally submitted risk-based plan without modification.

We look forward to your feedback and invite CalGEM and California Department of Conservation leadership to meet with PG&E in January to continue the discussion and hopefully resolve these concerns. PG&E respectfully requests CalGEM to prioritize response to items related to scheduling and compliance due dates.

Should you have any questions, please contact me at 925-453-9276.

Sincerely,



Lucy Redmond
Senior Director, Reservoir Engineering
Pacific Gas and Electric Company

Enclosures by email:

Appendix A - System Reliability Risks (Excerpted)
Appendix E - PG&E Well Specific Integrity Detail (Excerpted)
Appendix G - PG&E Wells with Two or More Casing Wall Thickness Inspections (Excerpted)
Appendix H - PG&E Requests Extension Approval of Select Group of Wells to Ensure Withdrawal Needs are Maintained
Appendix I - Blade Energy Partners Report
Appendix J - Exponent Inc Report (Review and Analysis of PG&E's Reinspection Plan Schedule for Mechanical Integrity Testing of Underground Gas Storage Wells)
Appendix K - Amended Dates from CalGEM Letter (Excerpted)
August 17, 2022 Transcript VOL 6 (Excerpted)

Submitted in WellSTAR as Form ID: 766428

CalGEM Data Request – CalGEM Data Request – PG&E Mechanical Integrity Testing Schedule Response (12.08.2025)

Cc:

Doug Ito, Supervisor, CalGEM

Jeanette Hand, CalGEM

Rohit Sharma, CalGEM

Leuwam Tesfai, CPUC, Deputy Executive Director for Energy and Climate Policy

Candace Morey, CPUC, Assistant General Counsel

David Erne, CEC, Deputy Director of Resource Planning, Reliability & Emergency

██████████ PG&E

Saul Gomez, Senior Director, State Agency Relations, PG&E



*Public Advocates Office
California Public Utilities Commission*

(PG&E-15)

505 Van Ness Avenue
San Francisco, CA 94102

<http://publicadvocates.cpuc.ca.gov>

**PUBLIC ADVOCATES OFFICE
DATA RESPONSE
Pacific Gas & Electric Company Test Year 2027 General Rate Case
A.25-05-009**

Date: 5 March 2026

Origination Date: 18 February 2026

Response Due: 6 March 2026

To: Hannah Keller
cc: GRC@pge.com

GRC 2027 Coordinators:
GRCCaseCoordinators@pge.com

From: Dao Phan, Project Coordinator
Public Advocates Office
505 Van Ness Avenue, Room 4104
San Francisco, CA 94102 dao.phan@cpuc.ca.gov

Data Request No: GRC-2023-Phl_DR_PGE_CalAdvocates005

GENERAL OBJECTIONS

Cal Advocates objects to each data request to the extent that it mischaracterizes Cal Advocates' opening testimony.

Cal Advocates objects to each data request to the extent that it is overly broad, unduly burdensome, or not reasonably calculated to lead to the discovery of admissible evidence.

Cal Advocates objects to each instruction and data request as overly broad and unduly burdensome to the extent that it seeks documents or information that PG&E will possess when it receives Cal Advocates' opening testimony. Responding to such requests would be oppressive, unduly burdensome, and unnecessarily expensive, and the burden of responding to such requests is substantially the same or less for PG&E as for Cal Advocates. All such documents and information will not be produced.

Cal Advocates objects to each instruction and data request to the extent that it seeks



*Public Advocates Office
California Public Utilities Commission*

(PG&E-15)

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San Francisco, CA 94102

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information or documents protected from disclosure by the attorney-client privilege, attorney work product doctrine, or any other applicable privilege.

PG&E Question 1:

Please provide the excel version of the Cal Advocates forecasts calculations (with active formulas) for the MATs in PG&E Facilities Chapter (Exhibit (PG&E-3), Chapter 6) (Expense MATs: FHQ, GMC, JT8, JTL, JTW, JTX, JTY, LV2; and Capital MATs : 2K, 31A, 50C, 50L, 50N, 75C, 763, 764, 765, 767, 76G, 76N, 76S, 76T, 76X and 76Z).

Public Advocates Office Response to Question 1:

Please see Cal Advocates' workpapers, A2505009 Public Advocates Office (Hunter) Gas Operations Part 3 of 4 (CA-11-WP), which were provided to PG&E in February 2025.

PG&E Question 2:

Did Cal Advocates apply escalation when developing its forecasts for work in PG&E's Facilities (Exhibit (PG&E-3), Chapter 6) forecasts?

- a. If yes, please provide the escalation factors in the excel spreadsheet requested in Question 1.
- b. If no escalation factors or adjustments were performed:
 - i. Please explain why Cal Advocates did not apply escalation to the 2022-2024 figures used to forecast 2027 expenses.
 - ii. Please explain why Cal Advocates did not apply escalation to the 2025 partial year data it used to forecast 2027 capital expenditures.
 - iii. Does Cal Advocates contend that PG&E will have experienced no wage, material or other cost inflation from 2022 to 2027?
 - iv. Does Cal Advocates contend that PG&E will have experienced no wage, material or other cost inflation from 2023 to 2027?
 - v. Does Cal Advocates contend that PG&E will have experienced no wage, material or other cost inflation from 2024 to 2027?
 - vi. Does Cal Advocates contend that PG&E will have experienced no wage, material or other cost inflation from 2025 to 2027?



c. If no adjustments or escalation were used, please provide an excel file that shows the Cal Advocates recommendation adjusted to reflect escalation to 2027 dollars, including all formulas.

Public Advocates Office Response to Question 2:

It is Cal Advocates' understanding that the RO model applies escalation to costs from the base year through the test year. Cal Advocates did not apply additional escalation to the historical costs and does not have an escalation spreadsheet outside of the RO model.

PG&E Question 3:

In its testimony (CA-11, Report on the Results of Operations for Pacific Gas and Electric Company Test Year 2027 General Rate Case Gas Operations Part 3 of 4, page 10, lines 10 and 11), Cal Advocates states: "PG&E forecasts \$26.321 million for its Facilities operations and maintenance (O&M) expenses for TY 2027. PG&E's forecast for TY 2027 is an increase of \$3.458 10 million, or 15.12%, over its 2024 recorded adjusted O&M expense of \$28.663 million." Please provide the details of the calculations that were performed resulting in these values and a citation to the 2024 recorded adjusted O&M expense used in the calculation.

Public Advocates Office Response to Question 3:

Please see Cal Advocates' workpapers, A2505009 Public Advocates Office (Hunter) Gas Operations Part 3 of 4 (CA-11-WP), which were provided to PG&E in February 2025. The 2024 recorded adjusted O&M expense is from a spreadsheet titled "2024 Recorded with 2020 and 2023-2025 Adopted (Exh. 3-9)" which was provided by PG&E in October of 2025.

PG&E Question 4:

In its testimony (CA-11, Report on the Results of Operations for Pacific Gas and Electric Company Test Year 2027 General Rate Case Gas Operations Part 3 of 4, page 12, line 20 to page 13, line 2), CalAdvocates states : " PG&E's forecast for TY 2027 of \$307.347 million is an increase of \$59.767 million or 14.89% over its 2024 recorded adjusted capital expenditures of \$401.434 million." Please provide the details of the calculations that were performed resulting in these values and a citation to the 2024 recorded adjusted capital expenditures used in the calculation.



Public Advocates Office
California Public Utilities Commission

(PG&E-15)

505 Van Ness Avenue
San Francisco, CA 94102

<http://publicadvocates.cpuc.ca.gov>

Public Advocates Office Response to Question 4:

Please see Cal Advocates' workpapers, A2505009 Public Advocates Office (Hunter) Gas Operations Part 3 of 4 (CA-11-WP), which were provided to PG&E in February 2025. The 2024 recorded adjusted O&M expense is from a spreadsheet titled "2024 Recorded with 2020 and 2023-2025 Adopted (Exh. 3-9)" which was provided by PG&E in October of 2025.

All responses prepared by Stacey Hunter

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Request

To:	The Utility Reform Network
Recipient Name:	John Defever
Request Date:	February 18, 2026
PG&E Data Request No.:	PGE_TURN003
PG&E File Name:	GRC-2027-PhI_DR_PGE_TURN003
Due Date:	March 4, 2026
PG&E Witness(es):	Lucy Redmond – Gas Engineering
Response Date:	March 2, 2026

Please provide electronic responses to the following questions. Hard copy responses are unnecessary. The responses should be sent as e-mail attachments to the recipients below. If the files are too large to email, please contact the Discovery Manager below to upload the documents into a folder on the Electronic Secure File Transfer (ESFT) and notify the recipient below.

GRC 2027 Discovery Manager:
Hannah Keller
at GRC@pge.com

GRC Case Coordinators
at GRCCaseCoordinators@pge.com

SUBJECT: AACE METHODOLOGIES/PROJECT FORECASTS

EXHIBIT: (TURN-17)

1. Please list all professional experience with project planning, project forecast development and AACE methodologies.

Q01 Response:

My relevant experience is reviewing project cost requests in utility rate cases. It should be noted that my adjustments to project costs in this case were not based on project forecasting methodology but instead on ratemaking principles such as failure to sufficiently support the requested cost, prior underspending, and whether costs were known and measurable.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	SierraClub_004-Q013
PG&E File Name:	GRC-2027-PhI_DR_SierraClub_004-Q013
Request Date:	August 22, 2025
Requester DR No.:	004
Requesting Party:	Sierra Club
Requester:	Matt Vespa
Date Sent:	September 5, 2025
PG&E Witness(es):	Lucy Redmond – Gas Engineering

QUESTION 013

Exhibit PG&E-3 at 6-130 and 131 discusses maintenance and operating expenses for CNG stations.

- a. Has PG&E included all forecast maintenance and operating expenses for its CNG stations in its revenue requirement request in this case, or does it intend to recover a portion of those costs from customers through fuel charges at the publicly available stations?
- b. If PG&E has included all forecast CNG station maintenance and operating expenses in its revenue requirement request, please provide its rationale for not collecting any of these costs from the customers who use the stations.
- c. If PG&E plans to recoup some of these costs from customers who use the stations, please i) identify the level of costs PG&E intends to recoup from these customers and ii) explain how PG&E determined the portion of CNG station maintenance and operating expenses it should collect from these customers.

ANSWER 013

- a. PG&E included all forecast maintenance and operating expenses for its CNG stations in its revenue requirement request in this general rate case in MAT GMC.
- b. CNG stations provide services and benefits beyond the natural gas vehicle fuel service to third-party customers. As presented in Exhibit (PG&E-3), Chapter 6, CNG stations also provide gas distribution system service¹ and portable gas supply support.² These services benefit all of PG&E's customer types (residential, industrial, commercial), regardless if they own or operate a CNG vehicle, by allowing continuity of service during distribution meter set work, temporary pipeline outages or pipeline

¹ Exhibit (PG&E-3), p. 6-128, lines 11 to 20.

² Exhibit (PG&E-3), p. 6-129, lines 1 to 17.

capacity shortfalls which otherwise would create disruptive outages and appliance relights.

- c. PG&E does not plan to recoup any costs from customers who use the stations.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	SierraClub_004-Q015
PG&E File Name:	GRC-2027-PhI_DR_SierraClub_004-Q015
Request Date:	August 22, 2025
Requester DR No.:	004
Requesting Party:	Sierra Club
Requester:	Matt Vespa
Date Sent:	September 5, 2025
PG&E Witness(es):	Lucy Redmond – Gas Engineering

QUESTION 015

Exhibit PG&E-3 at 6-131 discusses capital spending on CNG stations.

- a. Has PG&E included all capital spending for its CNG stations in its revenue requirement request in this case, or does it intend to recover a portion of those costs from customers through fuel charges at the publicly available stations?
- b. If PG&E has included all forecast CNG capital spending in its revenue requirement request, please provide its rationale for not collecting any of these costs from the customers who use the stations.
- c. If PG&E plans to recoup some of these costs from customers who use the stations, please i) identify the level of costs PG&E intends to recoup from these customers and ii) explain how PG&E determined the portion of CNG station capital spending it should collect from these customers.

ANSWER 015

- a. PG&E has included all capital spending for its CNG stations in its revenue requirement request in this general rate case in MAT 31A.
- b. Please see response to GRC-2027-PhI_DR_SierraClub_004-Q013, subpart b.
- c. PG&E does not plan to recoup any costs from customers who use the stations.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	SierraClub_004-Q013
PG&E File Name:	GRC-2027-PhI_DR_SierraClub_004-Q013Rev01
Request Date:	August 22, 2025
Requester DR No.:	004
Requesting Party:	Sierra Club
Requester:	Matt Vespa
Date Sent:	September 5, 2025 (Original) March 12, 2026 (Revised)
PG&E Witness(es):	Lucy Redmond – Gas Engineering, Katia Sokoloff- Gas Rates

QUESTION 013

Exhibit PG&E-3 at 6-130 and 131 discusses maintenance and operating expenses for CNG stations.

- a. Has PG&E included all forecast maintenance and operating expenses for its CNG stations in its revenue requirement request in this case, or does it intend to recover a portion of those costs from customers through fuel charges at the publicly available stations?
- b. If PG&E has included all forecast CNG station maintenance and operating expenses in its revenue requirement request, please provide its rationale for not collecting any of these costs from the customers who use the stations.
- c. If PG&E plans to recoup some of these costs from customers who use the stations, please i) identify the level of costs PG&E intends to recoup from these customers and ii) explain how PG&E determined the portion of CNG station maintenance and operating expenses it should collect from these customers.

ANSWER 013 REVISION 01

- a. PG&E included all forecast maintenance and operating expenses for its CNG stations in its revenue requirement request in its 2027 General Rate Case (GRC) application in MAT GMC and PG&E intends to recover a portion of those costs from customers through fuel charges at the publicly available stations. This General Rate Case will establish PG&E's revenue requirement. The California Public Utilities Commission (CPUC) will decide how to allocate collection of that revenue requirement between PG&E's natural gas distribution customers and CNG customers in its decision in PG&E's 2027 Gas Cost Allocation and Rate Design (Gas CARD) proceeding, Application No. 25-11-006.
- b. As stated in response to subpart a, that PG&E's revenue requirement includes all CNG-station related operating costs, does not mean that PG&E will not recover a portion of those costs from CNG customers. The GRC determines the revenue

requirement, not the allocation of that revenue requirement between customer classes. CNG customers pay their share of costs through the transportation charge set forth in the G-NGV2 (G-Natural Gas Vehicle) tariff. The allocation of costs between CNG customers via the G-NGV2 tariff, on the one hand, and customers taking natural gas distribution service, on the other, is established in the Gas CARD proceeding.

- c. PG&E's proposed allocation of costs to CNG customers is set forth in Exhibit (PG&E-4), Chapter 1 of its opening testimony in the Gas CARD proceeding, a copy of which is attached hereto (please see "*GRC-2027-PhI_DR_SierraClub_004-Q015Rev01Atch01.pdf*") along with a copy of Exhibit (PG&E-2), Chapter 8, which describes PG&E's Natural Gas Vehicle Compression Cost Study (please see "*GRC-2027-PhI_DR_SierraClub_004-Q015Rev01Atch02.pdf*").

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	SierraClub_004-Q015
PG&E File Name:	GRC-2027-PhI_DR_SierraClub_004-Q015Rev01
Request Date:	August 22, 2025
Requester DR No.:	004
Requesting Party:	Sierra Club
Requester:	Matt Vespa
Date Sent:	September 5, 2025 (Original) March 12, 2026 (Revision)
PG&E Witness(es):	Lucy Redmond – Gas Engineering, Katia Sokoloff- Gas Rates

QUESTION 015

Exhibit PG&E-3 at 6-131 discusses capital spending on CNG stations.

- a. Has PG&E included all capital spending for its CNG stations in its revenue requirement request in this case, or does it intend to recover a portion of those costs from customers through fuel charges at the publicly available stations?
- b. If PG&E has included all forecast CNG capital spending in its revenue requirement request, please provide its rationale for not collecting any of these costs from the customers who use the stations.
- c. If PG&E plans to recoup some of these costs from customers who use the stations, please i) identify the level of costs PG&E intends to recoup from these customers and ii) explain how PG&E determined the portion of CNG station capital spending it should collect from these customers.

ANSWER 015 REVISED 01

- a. PG&E included all forecast capital spending for its CNG stations in its revenue requirement request in its 2027 General Rate Case application in MAT 31A and PG&E intends to recover a portion of those costs from customers through fuel charges at the publicly available stations. This General Rate Case (GRC) will establish PG&E's revenue requirement. The California Public Utilities Commission will decide how to allocate collection of that revenue requirement between PG&E's natural gas distribution customers and CNG customers in its decision in PG&E's 2027 Gas Cost Allocation and Rate Design (Gas CARD) proceeding, Application No. 25-11-006.
- b. As stated in response to subpart a, that PG&E's revenue requirement includes all CNG station-related capital expenditures, does not mean that PG&E will not recover a portion of those costs from CNG customers. The GRC determines the revenue requirement, not the allocation of that revenue requirement between customer classes. CNG customers pay their share of costs through the transportation charge

set forth in the G-NGV2 (G-Natural Gas Vehicle) tariff. The allocation of costs between CNG customers via the G-NGV2 tariff, on the one hand, and customers taking natural gas distribution service, on the other, is established in the Gas CARD proceeding.

- c. PG&E's proposed allocation of costs to CNG customers is set forth in Exhibit (PG&E-4), Chapter 1 of its opening testimony in the Gas CARD proceeding, a copy of which is attached hereto (please see "*GRC-2027-PhI_DR_SierraClub_004-Q015Rev01Atch01.pdf*") along with a copy of Exhibit (PG&E-2), Chapter 8 which describes PG&E's Natural Gas Vehicle Compression Cost Study (please see "*GRC-2027-PhI_DR_SierraClub_004-Q015Rev01Atch02.pdf*").

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	SierraClub_004-Q017
PG&E File Name:	GRC-2027-PhI_DR_SierraClub_004-Q017
Request Date:	August 22, 2025
Requester DR No.:	004
Requesting Party:	Sierra Club
Requester:	Matt Vespa
Date Sent:	September 5, 2025
PG&E Witness(es):	Lucy Redmond – Gas Engineering

QUESTION 017

Exhibit PG&E-3 at 6-133, Table 6-32 provides recorded adjusted and forecast capital costs for CNG station expenses.

- a. What portion of these expenses are for publicly accessible CNG stations?
- b. Please identify all specific capital projects included in the 2027 forecast, the cost of each of those projects, and whether the project is at a publicly accessible station.
- c. Does PG&E incur roughly the same level of capital spending for each of its CNG stations?

ANSWER 017

- a. Approximately 90% of capital expenditures presented in Exhibit (PG&E-3), p. 6-133, Table 6-32 are for publicly accessible CNG stations.
- b. As stated in PG&E's testimony, the forecast for capital expenditures (MAT 31A) was developed using a "historical 3-year average (2022-2024) and escalated. The costs for two projects (Eureka CNG facility and Redding CNG facility) in 2022-2024 were not included in the forecast. This method is most appropriate because most of the work activity (beside those projects that were removed) is not expected to change." ¹ A bottoms-up approach that would use specific projects was not used for forecasting as the capital program needs are expected to be similar to prior years, excluding the noted Eureka and Redding projects.
- c. No, the level of capital cost varies between stations and includes factors such as station age/equipment obsolescence, demand/growth, and changes/updates to regulatory requirements.

¹ Exhibit (PG&E-3), p. 6-134, lines 4-9.

**PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response**

PG&E Data Request No.:	CalAdvocates_124-Q005
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_124-Q005
Request Date:	September 11, 2025
Requester DR No.:	PubAdv-PG&E-124-SWC
Requesting Party:	Public Advocates Office
Requester:	Sophie Chia
Date Sent:	October 9, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: ASSET FAMILY - TRANSMISSION PIPE – PIPELINE REPAIR (MAT JTB)

QUESTION 005

Referring to Workpapers to Exhibit PG&E-3, page WP 5-37, Table 5-23, please provide the following:

- a. Please provide a copy of the analysis and all support for the \$1,000 per engineering study for DSL Corrosion and the estimated 150 engineering studies per year.
- b. Please provide a copy of the analysis and all support for the \$70,000 per Electrical Resistance (ER) probes and the estimated 10 ER probes per year.
- c. Please explain what “CTS” stands for and a description of the work.
- d. Please provide a copy of the analysis and all support for the \$12,500 per CTS and the estimated 10 CTS per year.
- e. Please provide a copy of the analysis and all support for the \$1.05 million for NT-ILI and the estimated 2 NT-ILI per year.
- f. Please provide a copy of the analysis and all support for the \$343,745 per Direct Assessment projects and the estimated 10 Direct Assessment projects per year.
- g. Please provide a copy of the analysis and all support for the \$2.4 million of estimated other integrity work per year.
- h. Please provide a copy of the analysis and all support for the \$147,857 per DSL MAOP flags and the estimated 7 DSL MAOP flags per year.

ANSWER 005

- a. PG&E forecasts a total of \$450,000 to support the development of machine learning tools for corrosion risk modeling on DSL. PG&E anticipates completing one third of the DSL mileage annually. Roughly 713.8 miles of pipeline operation under 20% SMYS were reclassified to DSL, so PG&E is forecasted to complete 238 miles/year.

The total of \$450,000 includes:

- \$400,000 allocated for model development, based on vendor proposals.
 - \$50,000 for Corrosion Engineering review, representing 382 hours at a rate of \$131/hour.
- b. To enhance corrosion monitoring, PG&E plans to install 10 ER probes per year, with a unit cost of \$70,000. This cost was benchmarked against the historical average cost of test station installations from 2020 to 2023 (\$69,000), as both ER probes and test stations share similar installation scopes and utilize the same construction teams. The 10 ER probes per year is a corrosion engineer's estimate based on their understanding of the system since ER probes on DSL is entirely new work for in the 2027 GRC.
- c. CTS stands for Coupon Test Station. Test stations are permanent monitoring facilities that consist of leads (wires) that are welded to the piping system and extend to an at-grade or above-grade housing. PG&E utilizes test stations to monitor levels of CP on buried piping systems in accordance with 49 CFR Part 192, Subpart I. This work is key to understanding whether the cathodic protection (CP) applied to the gas transmission lines is sufficient to mitigate external corrosion.
- d. PG&E forecasts the replacement of 10 CTS annually, with a unit cost of \$12,500. This estimate includes:
- \$10,000 in material costs.
 - \$2,500 in labor costs, based on 22.5 hours of PG&E Corrosion Mechanic time at \$131/hour.

These investments support PG&E's proactive corrosion control strategy for DSL assets, which aligns with best practices and PG&E's commitment to pipeline safety and reliability. The 10 CTS per year is a corrosion engineer's estimate based on their understanding of the system since CTS on DSL is entirely new work for in the 2027 GRC.

- e. PG&E estimates two NT-ILI assessments per year for DSL pipe, totaling 1 mile annually. Using the unit cost from Exhibit (PG&E-3), Workpaper Table 5-7, PG&E calculated the cost at \$2.04 million per mile or \$1.02 million per NT-ILI project. However, during our preparation of this data response, PG&E found an inadvertent error in our workpaper. PG&E will correct Exhibit (PG&E-3), Workpaper Table 5-23 to reflect \$1.02 million per NT-ILI project instead of \$1.05 million per project in a future errata submission and/or at hearings.
- f. PG&E estimates DSL Direct Assessment (DA) expense cost considered similar DA activities used for External Corrosion Direct Assessment (ECDA) or 100% Direct Examination (DE) between 2020 to 2024. The estimate took a conservative cost estimate of ECDA indirect inspection and digs¹ taking into account 100% DE averages.²
- g. To account for the other expected integrity management work, PG&E estimated \$2.4 million to support activities such as Direct Examination and Repair (DE&R), which may be necessary if NT-ILI assessments identify anomalies on DSL

¹ See Exhibit (PG&E-3), Workpaper Table 5-9 and Exhibit (PG&E-3), WP 5-16 to WP 5-18.

² See Exhibit (PG&E-3), Workpaper Table 5-12 and Exhibit (PG&E-3), WP 5-22 to WP 5-23

pipelines. It also includes other Preventive and Mitigative (P&M) measures, such as accelerated leak surveys for earlier detection of leaks on DSL pipe.

- h. PG&E estimates an average of seven DSL MAOP flags per year for DSL pipe, based on the seven distribution MAOP flag mitigation activities completed in 2023 (as of 6/28/2024). The average cost to mitigate each of these seven distribution MAOP flags was \$147,857, resulting in a total spend of \$1,034,999 for 2023 (rounded to \$1,035,000). PG&E projects that future DSL MAOP flag mitigation costs will be comparable to those incurred for distribution MAOP flags in 2023, since the work involved is similar.



*Public Advocates Office
California Public Utilities Commission*

(PG&E-15)

505 Van Ness Avenue
San Francisco, CA 94102

<http://publicadvocates.cpuc.ca.gov>

**PUBLIC ADVOCATES OFFICE
DATA RESPONSE
Pacific Gas & Electric Company Test Year 2027 General Rate Case
A.25-05-009**

Date: 5 March 2026

Origination Date: 18 February 2026

Response Due: 6 March 2026

To: Hannah Keller
cc: GRC@pge.com

GRC 2027 Coordinators:
GRCCaseCoordinators@pge.com

From: Dao Phan, Project Coordinator
Public Advocates Office
505 Van Ness Avenue, Room 4104
San Francisco, CA 94102 dao.phan@cpuc.ca.gov

Data Request No: GRC-2023-Phl_DR_PGE_CalAdvocates005

GENERAL OBJECTIONS

Cal Advocates objects to each data request to the extent that it mischaracterizes Cal Advocates' opening testimony.

Cal Advocates objects to each data request to the extent that it is overly broad, unduly burdensome, or not reasonably calculated to lead to the discovery of admissible evidence.

Cal Advocates objects to each instruction and data request as overly broad and unduly burdensome to the extent that it seeks documents or information that PG&E will possess when it receives Cal Advocates' opening testimony. Responding to such requests would be oppressive, unduly burdensome, and unnecessarily expensive, and the burden of responding to such requests is substantially the same or less for PG&E as for Cal Advocates. All such documents and information will not be produced.

Cal Advocates objects to each instruction and data request to the extent that it seeks



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information or documents protected from disclosure by the attorney-client privilege, attorney work product doctrine, or any other applicable privilege.

PG&E Question 1:

Please provide the excel version of the Cal Advocates forecasts calculations (with active formulas) for the MATs in PG&E Facilities Chapter (Exhibit (PG&E-3), Chapter 6) (Expense MATs: FHQ, GMC, JT8, JTL, JTW, JTX, JTY, LV2; and Capital MATs : 2K, 31A, 50C, 50L, 50N, 75C, 763, 764, 765, 767, 76G, 76N, 76S, 76T, 76X and 76Z).

Public Advocates Office Response to Question 1:

Please see Cal Advocates' workpapers, A2505009 Public Advocates Office (Hunter) Gas Operations Part 3 of 4 (CA-11-WP), which were provided to PG&E in February 2025.

PG&E Question 2:

Did Cal Advocates apply escalation when developing its forecasts for work in PG&E's Facilities (Exhibit (PG&E-3), Chapter 6) forecasts?

- a. If yes, please provide the escalation factors in the excel spreadsheet requested in Question 1.
- b. If no escalation factors or adjustments were performed:
 - i. Please explain why Cal Advocates did not apply escalation to the 2022-2024 figures used to forecast 2027 expenses.
 - ii. Please explain why Cal Advocates did not apply escalation to the 2025 partial year data it used to forecast 2027 capital expenditures.
 - iii. Does Cal Advocates contend that PG&E will have experienced no wage, material or other cost inflation from 2022 to 2027?
 - iv. Does Cal Advocates contend that PG&E will have experienced no wage, material or other cost inflation from 2023 to 2027?
 - v. Does Cal Advocates contend that PG&E will have experienced no wage, material or other cost inflation from 2024 to 2027?
 - vi. Does Cal Advocates contend that PG&E will have experienced no wage, material or other cost inflation from 2025 to 2027?



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c. If no adjustments or escalation were used, please provide an excel file that shows the Cal Advocates recommendation adjusted to reflect escalation to 2027 dollars, including all formulas.

Public Advocates Office Response to Question 2:

It is Cal Advocates' understanding that the RO model applies escalation to costs from the base year through the test year. Cal Advocates did not apply additional escalation to the historical costs and does not have an escalation spreadsheet outside of the RO model.

PG&E Question 3:

In its testimony (CA-11, Report on the Results of Operations for Pacific Gas and Electric Company Test Year 2027 General Rate Case Gas Operations Part 3 of 4, page 10, lines 10 and 11), Cal Advocates states: "PG&E forecasts \$26.321 million for its Facilities operations and maintenance (O&M) expenses for TY 2027. PG&E's forecast for TY 2027 is an increase of \$3.458 10 million, or 15.12%, over its 2024 recorded adjusted O&M expense of \$28.663 million." Please provide the details of the calculations that were performed resulting in these values and a citation to the 2024 recorded adjusted O&M expense used in the calculation.

Public Advocates Office Response to Question 3:

Please see Cal Advocates' workpapers, A2505009 Public Advocates Office (Hunter) Gas Operations Part 3 of 4 (CA-11-WP), which were provided to PG&E in February 2025. The 2024 recorded adjusted O&M expense is from a spreadsheet titled "2024 Recorded with 2020 and 2023-2025 Adopted (Exh. 3-9)" which was provided by PG&E in October of 2025.

PG&E Question 4:

In its testimony (CA-11, Report on the Results of Operations for Pacific Gas and Electric Company Test Year 2027 General Rate Case Gas Operations Part 3 of 4, page 12, line 20 to page 13, line 2), CalAdvocates states : " PG&E's forecast for TY 2027 of \$307.347 million is an increase of \$59.767 million or 14.89% over its 2024 recorded adjusted capital expenditures of \$401.434 million." Please provide the details of the calculations that were performed resulting in these values and a citation to the 2024 recorded adjusted capital expenditures used in the calculation.



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California Public Utilities Commission*

(PG&E-15)

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Public Advocates Office Response to Question 4:

Please see Cal Advocates' workpapers, A2505009 Public Advocates Office (Hunter) Gas Operations Part 3 of 4 (CA-11-WP), which were provided to PG&E in February 2025. The 2024 recorded adjusted O&M expense is from a spreadsheet titled "2024 Recorded with 2020 and 2023-2025 Adopted (Exh. 3-9)" which was provided by PG&E in October of 2025.

All responses prepared by Stacey Hunter

From: Hand, Jeanette@DOC
To: [Agent for Service of Process](#)
Cc: [Redmond, Lucy](#); [Reader, Emily@DOC](#)
Subject: Additional data required
Date: Wednesday, December 20, 2023 8:48:55 AM
Attachments: [12.20.23 ltr PG&E second-round MIT Data.pdf](#)

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Hello Brian,

Please find the attached letter requiring additional data related to PG&E's proposed second round MIT schedule. Please reach out to me if you have any question about this communication.

Thank you,

Jeanette (McCracken) Hand, P.G.

Underground Gas Storage Program Manager

Senior Oil and Gas Engineer

California Department of Conservation

Geologic Energy Management Division

Cell: 916-212-4890

PG&E MIT DUE DATES					
Well name	Well API	Last CWT	Last SAPT ¹⁾	SAPT Scheduled Test Due Date	Scheduled 2nd round CWT + SAPT due date
McDonald Island					
WS-7W	0407720193	3/23/2019			3/23/2026
LMac-1	0407720609	5/9/2021			12/31/2026
TC-7S	0407720206	5/27/2019			5/27/2026
WS-3W	0407720213	6/5/2021			12/31/2026
WS-14E	0407720257	6/6/2019			6/6/2026
TC-12S	0407720248	6/13/2019			6/13/2026
WS-6E	0407720185	6/27/2019			6/27/2026
WS-11E	0407720253	7/7/2019			7/7/2026
ZUCK-1	0407700091	8/13/2019			8/13/2026
WS-8E	0407720188	10/4/2019			10/4/2026
ROB-1	0407720524	11/25/2019			11/25/2026
WS-11W	0407720265	3/12/2020			3/12/2027
TC-2N	0407720199	3/28/2022			12/31/2027
WS-1AE	0407720536	4/2/2020			4/2/2027
TC-13N	0407720234	4/15/2022			12/31/2027
TC-12N	0407720230	4/17/2020			4/17/2027
WS-16W	0407720231	4/19/2020			4/19/2027
WS-4E	0407720178	5/3/2020			5/3/2027
WS-5E	0407720179	5/17/2020			5/17/2027
WS-12E	0407720255	5/23/2020			5/23/2027
MCD-11	0407700086	5/31/2020			5/31/2027
ZUCK-H	0407720010	6/14/2020			6/14/2027
WS-13E	0407720256	6/26/2020			6/26/2027
WS-7E	0407720187	7/18/2020			7/18/2027
WS-9E	0407720189	7/27/2020			7/27/2027
TC-10S	0407720251	8/3/2020			8/3/2027
MCD-12	0407700087	8/25/2020			8/25/2027
MCD-10	0407700085	10/1/2020			10/1/2027
TC-11N	0407720229	3/10/2021			3/10/2028
WS-4W	0407720214	4/9/2021			4/9/2028
TC-4S	0407720203	5/26/2021			5/26/2028
MCD-13	0407700088	6/2/2021			6/2/2028
TC-3S	0407720216	6/11/2021			6/11/2028
WS-2W	0407720212	6/19/2021			6/19/2028
WS-9W	0407720195	7/6/2021			7/6/2028

Well name	Well API	Last CWT	Last SAPT ¹⁾	SAPT Scheduled Test Due Date	Scheduled 2nd round CWT + SAPT due date
TC-8S	0407720533	7/21/2021			7/21/2028
TC-11S	0407720250	8/8/2021			8/8/2028
MCD-9	0407700084	11/3/2021			11/3/2028
WS-18W	0407720465	3/23/2022			3/23/2029
TC-5S	0407720204	4/7/2022			4/7/2029
TC-5N	0407720207	4/24/2022			4/24/2029
TC-6N	0407720208	5/11/2022			5/11/2029
TC-15N	0407720239	5/26/2022			5/26/2029
TC-17N	0407720548	6/9/2022			6/9/2029
TC-16N	0407720240	6/11/2022			6/11/2029
MCD-5A	0407720552	7/28/2022			7/28/2029
TC-3N	0407720201	3/10/2023			3/10/2030
TC-4N	0407720202	3/24/2023			3/24/2030
WS-15W	0407720233	3/28/2023			3/28/2030
TC-7N	0407720225	4/30/2023	6/26/2024	6/26/2029	4/30/2030
TC-8N	0407720226	5/24/2023			5/24/2030
WS-10W	0407720534	6/8/2023			6/8/2030
TC-9S	0407720252	6/24/2023	7/6/2023	7/6/2028	6/24/2030
TC-13S	0407720247	8/29/2023	9/28/2023	9/28/2028	8/29/2030
MCD-4	0407700080	9/3/2023	9/14/2023	9/14/2028	9/3/2030
MCD-6	0407700082	9/28/2023	10/1/2023	10/1/2028	9/28/2030
TC-14S	0407720244	10/9/2023	10/18/2023	10/18/2028	10/9/2030
WS-1E	0407720168	12/8/2023			12/8/2030
MCD-7	0407700083	12/25/2023	12/30/2023	12/30/2028	12/25/2030
WS-17W	0407720166	5/7/2024	5/14/2024	5/14/2029	5/7/2031
TC-15S	0407720245	5/12/2024	5/17/2024	5/17/2029	5/12/2031
WS-20W	0407720535	6/23/2024	7/1/2024	7/1/2029	6/23/2031
WS-13W	0407720241	7/24/2024	7/24/2024	7/24/2029	7/24/2031
WS-5W	0407720211	7/26/2024	3/29/2023	3/29/2028	7/26/2031
WS-6W	0407720192	8/2/2024	8/7/2024	8/7/2029	8/2/2031
WS-12W	0407720264	8/9/2024	8/31/2024	8/31/2029	8/9/2031
WS-8W	0407720194	8/16/2024	9/1/2024	9/1/2029	8/16/2031
TC-2S	0407720219	8/25/2024	6/24/2023	6/24/2028	8/25/2031
WS-1E	0407720168	12/8/2023	1/23/2025	1/23/2030	12/8/2031
TC-1AN	0407720742	1/5/2024	1/13/2024	1/13/2029	1/5/2031
TC-1BN	0407720741	2/18/2024	2/27/2024	2/27/2029	2/18/2031
Lil Mac-2	0407720743	7/8/2024	7/14/2024	7/14/2029	7/8/2031

Well name	Well API	Last CWT	Last SAPT ¹⁾	SAPT Scheduled Test Due Date	Scheduled 2nd round CWT + SAPT due date
WS-2E	0407720169	3/23/2025	3/23/2025	3/23/2030	3/23/2032
WS-3E	0407720173	3/31/2025	3/31/2025	3/31/2030	3/31/2032
TC-17S	0407720258	4/13/2025	4/13/2025	4/13/2030	4/13/2032
The McDonald Island Wells below have not been incorporated into the schedule based on first round test results or ongoing well work					
WS-19W	0407720467	6/12/2024			
WS-1W	0407720215	7/4/2024			
WS-1AW	0407720544	2025			
TC-10N	0407720228	2025			
TC-1AS	0407720551	2025			
TC-1S	0407720218	2025			
TC-16S	0407720243	2025			
Los Medanos					
LM-17D	0401320136	7/11/2021			12/31/2026
LM-15C	0401320121	9/21/2019			9/21/2026
LM-11C	0401320128	8/1/2020			8/1/2027
LM-20D	0401320297	8/11/2020			8/11/2027
LM-16D	0401320133	6/20/2021			6/20/2028
LM-10C	0401320131	6/29/2021			6/29/2028
LM-19D	0401320295	5/21/2022			5/21/2029
LM-3A	0401320115	6/25/2022			6/25/2029
LM-6B	0401320140	7/21/2022			7/21/2029
LM-7C	0401320130	8/15/2022			8/15/2029
LM-14C	0401320298	6/13/2023	6/20/2023	6/20/2028	6/13/2030
LM-21D	0401320308	8/1/2023	8/10/2023	8/10/2028	8/1/2030
LM-9C	0401320123	11/19/2023	11/26/2036	11/26/2028	11/19/2030
LM-13C	0401320299	8/13/2024	8/17/2024	8/17/2029	8/13/2031
LM-5B	0401320144	8/27/2024	9/4/2024	9/4/2029	8/27/2031
GINO-3	0401300135	9/12/2024	9/16/2024	9/16/2029	9/12/2031
The Los Medanos wells below have not been incorporated into the schedule based on first round test results or ongoing well work					
LM-12C	0401320307	2025			
LM-2A	0401320138	2025			
¹ The Last SAPT Column is only populated where the date of the previous SAPT is greater than five years from the date of the next CWT and SAPT. Based on current WellSTAR records and may be updated based on 2025 testing.					

From: [Redmond, Lucy](#)
To: [Hand, Jeanette](#)
Cc: [Reader, Emily@DOC](#); courtney.smith@conservation.ca.gov; Sharma, Rohit@DOC; [L \[REDACTED\]](#)
Subject: RE: Additional data required
Date: Friday, January 19, 2024 6:44:02 PM
Attachments: [2024 01 19 PGE Revised Plan Submittal Letter.pdf](#)
[2024 01 19 CalGEM Data Request - Revised Testing Schedule and Required Data.pdf](#)

Hello Jeanette,

Please see the attached letter and submission in response to the data request, dated December 20, 2023.

We look forward to further discussions and would be happy to meet in person and walk through the data request submittal in detail given our familiarity with the operation limitations. We also reiterate our request to hear back as soon as possible regarding the proposed shift of work from the 2024 work plan as part of the proposed revisions to PG&E's Revised Implementation Plan.

Should you have any questions, please contact me at 925-453-9276.

Sincerely,

Lucy Redmond

Director, Reservoir Engineering

Pacific Gas and Electric Company

From: Hand, Jeanette@DOC

Sent: Wednesday, December 20, 2023 8:48 AM

To: Agent for Service of Process

Cc: Redmond, Lucy ; Reader, Emily@DOC

Subject: Additional data required

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Hello Brian,

Please find the attached letter requiring additional data related to PG&E's proposed second round MIT schedule. Please reach out to me if you have any question about this communication.

Thank you,

Jeanette (McCracken) Hand, P.G.

Underground Gas Storage Program Manager

Senior Oil and Gas Engineer

California Department of Conservation

Geologic Energy Management Division

Cell: 916-212-4890



Lucy Redmond
 Director, Facilities & Storage Engineering
 Pacific Gas and Electric Company
 6121 Bollinger Canyon Road
 San Ramon, CA 94583

January 19, 2024

By Email

Ms. Jeanette Hand
 Underground Gas Storage Program Manager
 Department of Conservation
 California Geologic Energy Management Division

Re: Revised Testing Schedule & Required Data

Dear Jeanette,

In December of 2020, CalGEM requested that PG&E furnish an accelerated well inspection and conversion plan by January 18, 2021. PG&E provided its Revised Implementation Plan to CalGEM per this request and it was approved on June 15, 2021. PG&E has been executing to this approved plan since that date.

Recently, PG&E and CalGEM leadership met on December 12, 2023 to discuss PG&E's concerns regarding the reliability outlook for next Winter (2024/2025) should the approved accelerated work plan to complete well inspections and conversions continue in 2024 as approved. In the latter part of 2022 through 2023, PG&E has experienced more well attrition than anticipated, including well outage and subsequent decline in capacity resulting from well rework pending supplemental permits that remain outstanding, wells necessitating plug and abandonment, and wells being taken out of service to repair packers, and sanding issues. These outages coupled with the overall reduction in capacity that results from converting existing wells to tubing and packer configuration for the remaining well population would result in insufficient capacity to meet our CPUC required storage deliverability.

Expedited Review and Response from CalGEM Requested for Revised 2024 Plan

Gas storage is a crucial component of the California energy infrastructure. Significant changes to storage capacity may impact energy reliability, cause extreme price volatility, and reduce energy affordability. As such, PG&E has proposed revisions to the plan approved by CalGEM on June 15, 2021 for the years 2024 and 2025. This portion of the plan is requested to be approved by CalGEM as soon as possible so that PG&E can ensure adequate well availability to meet storage demand in the upcoming winter.

The wells that were planned for inspection and conversion to tubing and packer in 2024 had been selected for that year in the Revised Implementation Plan because the wells had been inspected with an MFL prior to 2018 and the inception of CalGEM well inspection requirements. Given the known condition of the wells due to these previous inspections, PG&E had prioritized these wells for conversion and second inspection last for 2024; however, for the same reasons and the current reliability constraints anticipated, PG&E is requesting that 10 of the wells previously planned for 2024 work, shown highlighted in yellow in the table below, be postponed for conversion until 2025. This would allow time for the drilling of new wells in 2024 and retain



the 10 wells in an unconverted state, limiting the reduction to PG&E's withdrawal capability for the 2024-25 winter withdrawal season. The following table details the changes requested to 2024 and shows the carry over wells now planned for completion in 2024 in green shading.

Well Inspection and Rework Planned Wells

2024 Original	2024 Proposed	2025 Proposed
WS-20W	WS-20W	
WS-19W	WS-19W	
WS-17W	WS-17W	
WS-12W	WS-12W	
WS-8W	WS-8W	
WS-6W	WS-6W	
WS-1W	WS-1W	
WS-1AW	WS-1AW	
GINO-3	GINO-3	
WS-3E	 This group of wells that were inspected with MFL prior to CalGEM Regulations shifts conversion to T&P in 2025 	WS-3E
WS-2E		WS-2E
TC-10N		TC-10N
TC-1AS		TC-1AS
TC-1S		TC-1S
TC-17S		TC-17S
TC-16S		TC-16S
LM-2A		LM-2A
LM-5B		LM-5B
LM-12C		LM-12C
This group of wells is carry over into 2024 (pending supplemental permits, failed pressure test)	WS-13W	Supplemental permit pending 218 days
	WS-5W	Sanding Issues; NOI Approved 10/27/2023
	TC-7N	Supplemental permit pending 232 days
	TC-15S	Supplemental permit pending 32 days
	TC-3S	Potential unseated packer with Post-converted pressure test (SAPT)
	TC-2S	Sanding Issues
	LM-20D	Permit pending 107 days; Potential unseated packer with Post-converted pressure test (SAPT)
	LM-13C	Supplemental permit pending 39 days
	MCD-14	P&A in progress
	MCD-15	P&A planned



PG&E appreciates CalGEM's expedited review and response to this requested plan change as soon as possible so that the work execution plan can be managed efficiently.

Data Request Response and Reinspection Plan Approval

In response to CalGEM's letter dated December 20, 2023, PG&E has prepared the attached submittal. When PG&E and CalGEM met in December 2023, CalGEM reiterated their interest in receiving a second inspection for wells in an expedited manner. In no scenario is PG&E able to achieve this in less than 7 years while still maintaining required deliverability for our customers. ***Should CalGEM require a schedule of 7 years or less, it would adversely impact deliverability and could result in core and pipeline balancing being curtailed.*** The attached includes PG&E's Reinspection that forecasts out expected capacity and demand changes. It is important to note that storage demand is expected to increase pending additional 2024 regulatory filings and decisions issued by the CPUC. Increased demand levels of over 1 BCF/d could be experienced as early as the 2024/2025 winter, exceeding the current demand levels of 857 MMCF/d.

Please note, due to the timing of the data request issued in December, staff availability and ongoing operations work, the views requested for Scenario 2 (5-year reinspection cycle) are in development. As previously shown in prior submittals, the 5-year schedule is not feasible to execute and maintain reliability. These additional views will be provided to CalGEM on or before January 31, 2024.

We look forward to further discussions and would be happy to meet in person and walk through the data request submittal in detail given our familiarity with the operation limitations. We also reiterate our request to hear back as soon as possible regarding the proposed shift of work from the 2024 work plan as part of the proposed revisions to PG&E's Revised Implementation Plan.

Should you have any questions, please contact me at 925-453-9276.

Sincerely,

A handwritten signature in cursive script that reads 'Lucy Redmond'.

Lucy Redmond
Director, Reservoir Engineering
Pacific Gas and Electric Company

Cc:

Emily Reader, CalGEM
Courtney Smith, CalGEM
Rohit Sharma, CalGEM
Mark Krausse, CalGEM



Pacific Gas and Electric Company



CalGEM Data Request Revised Testing Schedule and Required Data

1.19.2024



CalGEM Data Request – Revised Testing Schedule and Required Data

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In response to the Division's information request titled "Revised Testing Schedule and Required Data", PG&E has prepared the following documents.

Revised Schedule For PG&E's Second-Round Testing

In accordance with the Division's request, PG&E has prepared a revised schedule for second-round testing in PG&E's Reinspection Plan (the Plan). The Plan accounts for the incomplete 2023 rework wells, wells that did not pass the required standard annular pressure test (SAPT), and wells removed from service due to sand inspection results. These wells have been incorporated into the 2024 work program to ensure adequate capacity is available in the 2024/2025 winter season. It is not feasible to complete the additional wells and the original 2024 work program due to resource constraints and limitations to capacity, which would exceed 30 wells. As such, PG&E is requesting to complete a portion of the 2024 work program¹ in 2025 as referenced in PG&E's Well Risk Evaluation and Construction Standard Implementation Plan. The previous submissions assigned simulated conversion rates to all converted tubing and packer wells because the converted well performance was not determined. The Plan contained within includes the actual flow rates obtained by the wells that underwent flow testing. Provisional flow rates are utilized for wells that have been converted or will be converted. Once the converted wells are flow tested new flow rates will be established based on test results. Additional new drills were added to the Plan: 3 wells at Los Medanos and 5 wells at McDonald Island. A deration factor was assigned for operational considerations that are routinely observed. The factor applied is as follows: McDonald Island (5%), Los Medanos (7%), New Drill Wells (5%) and Gill Ranch (7%). A cross compression efficacy percentage of 50% was applied in the UGS Procedure C scenario and 25% in the 7-year scenario.

PG&E notes that for certain wells the risk-based proposal results in inspection intervals of 5-8 years. In these cases, the next inspection was scheduled 5 years from the date of the last inspection. The 7-Year shows the impact of the 2023 carry-over wells and 2024 work program both getting executed in 2024. Platform outages are typically taken in the summer months to perform required maintenance and compliance activities. In addition, PG&E anticipates other inspection will be needed on PG&E transmission facilities that will affect the storage availability. These items are included in the forecast.

PG&E is also providing the injection graphs for the requested scenarios. It is important to note without adjustments to the 2024 work program injection will be constrained and can adversely affect the ability to inject the requisite storage inventories for the 2024/2025 winter withdrawal.

System Reliability Risk

In response to subsection "System Reliability Risk" PG&E has provided "Scenario 2" termed "missing" by CalGEM. This scenario uses the same sets of well flowrates and other flow assumptions as the other scenarios provided in "Reinspection Plan Supporting Justification".

¹ 2024 work program is based upon PG&E's Revised Implementation Plan (Titled "2021.6.15_Ltr_MIT schedule_PGE") approved June 15, 2021



As discussed in the “Reinspection Plan Supporting Justification” this scenario was not considered a plausible scenario for execution as it results in outcomes that severely threaten the State’s energy reliability.

Well Availability Comparison

In response to subsection “Well Availability Comparison” please find the requested charts for the 5-Year, 7-Year, and UGS Procedure C – Adjusted Work Program updated to include new drills, the use of cross compression, and plugged and abandoned wells in the forecast. The forecast assumes that the plan is executed as proposed, and actual results may vary based on individual well and field performance, market dynamics, schedule variations, permitting delays, etc. PG&E modeled the benefit of cross compression as an increase to forecasted withdrawal capacity that results from a percentage of inspected well capacity. The forecast does not reflect discretely identified units that are undergoing cross compression and therefore such units are not included in this chart.

Please see Exhibit B - Well Availability Comparison & Forecasted Withdrawal Capacity for reference.

Forecasted Withdrawal Capacity

In response to subsection “Forecasted Withdrawal Capacity” please find the requested charts for scenarios 5-Year, 7-Year, and UGS Procedure C – Adjusted Work Program updated to include new drills, the use of cross compression, and plugged and abandoned wells in the forecast. PG&E also updated the well flowrates based on flow testing to date as well as observed trends in well attrition and projected storage service requirements.

Comparison of Actual Data Versus Capacity Model After Conversion to Tubing and Packer for Each Well

In response to subsection “Comparison of Actual Data Versus Capacity Model After Conversion to Tubing and Packer for Each Well” PG&E has provided the individual well data of the modeled values predicting the flow rate after tubing on packer conversion to the actual measured data.

Please see Exhibit C - Comparison of Well Flowrates for reference.

New Drills

In response to subsection “New Drills”, PG&E has provided the well details including the anticipated drill and completion dates. In 2023, CalGEM has issued permits for Little Mac-2, Whiskey Slough 1-E, Turner Cut 1A-N, and Turner Cut 1B-N. PG&E forecasts to drill eight more wells at McDonald Island Storage Field and Los Medanos Storage Field to address the reduced well capacity concerns. The rates assigned to new drills (15 MMscf/D) is an estimate and actual results may vary.

Please see Exhibit D – Information Concerning New Drills for reference.



PG&E Reinspection Plan

Well Name (Abbreviated)	API Number	Planned Year of Review for T&P Conversion	Year of last MFL audit (if T&P Conversion 2019-2020)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Los Medanos																										
2019 Well Assessments & Conversions to T&P																										
LM-10C	0601320121	2019																								
LM-10D	0601320122	2019																								
2020 Well Assessments & Conversions to T&P																										
LM-10E	0601320123	2020																								
LM-10F	0601320124	2020																								
LM-10G	0601320125	2020																								
2021 Well Assessments & Conversions to T&P																										
LM-10H	0601320126	2021																								
LM-10I	0601320127	2021																								
LM-10J	0601320128	2021																								
2022 Well Assessments & Conversions to T&P																										
LM-10K	0601320129	2022																								
LM-10L	0601320130	2022																								
LM-10M	0601320131	2022																								
LM-10N	0601320132	2022																								
LM-10O	0601320133	2022																								
LM-10P	0601320134	2022																								
LM-10Q	0601320135	2022																								
LM-10R	0601320136	2022																								
LM-10S	0601320137	2022																								
LM-10T	0601320138	2022																								
2023 Well Assessments & Conversions to T&P																										
LM-10U	0601320139	2023																								
LM-10V	0601320140	2023																								
LM-10W	0601320141	2023																								
LM-10X	0601320142	2023																								
LM-10Y	0601320143	2023																								
LM-10Z	0601320144	2023																								
LM-10A	0601320145	2023																								
LM-10B	0601320146	2023																								
LM-10C	0601320147	2023																								
LM-10D	0601320148	2023																								
LM-10E	0601320149	2023																								
LM-10F	0601320150	2023																								
LM-10G	0601320151	2023																								
LM-10H	0601320152	2023																								
LM-10I	0601320153	2023																								
LM-10J	0601320154	2023																								
LM-10K	0601320155	2023																								
LM-10L	0601320156	2023																								
LM-10M	0601320157	2023																								
LM-10N	0601320158	2023																								
LM-10O	0601320159	2023																								
LM-10P	0601320160	2023																								
LM-10Q	0601320161	2023																								
LM-10R	0601320162	2023																								
LM-10S	0601320163	2023																								
LM-10T	0601320164	2023																								
LM-10U	0601320165	2023																								
LM-10V	0601320166	2023																								
LM-10W	0601320167	2023																								
LM-10X	0601320168	2023																								
LM-10Y	0601320169	2023																								
LM-10Z	0601320170	2023																								
LM-10A	0601320171	2023																								
LM-10B	0601320172	2023																								
LM-10C	0601320173	2023																								
LM-10D	0601320174	2023																								
LM-10E	0601320175	2023																								
LM-10F	0601320176	2023																								
LM-10G	0601320177	2023																								
LM-10H	0601320178	2023																								
LM-10I	0601320179	2023																								
LM-10J	0601320180	2023																								
LM-10K	0601320181	2023																								
LM-10L	0601320182	2023																								
LM-10M	0601320183	2023																								
LM-10N	0601320184	2023																								
LM-10O	0601320185	2023																								
LM-10P	0601320186	2023																								
LM-10Q	0601320187	2023																								
LM-10R	0601320188	2023																								
LM-10S	0601320189	2023																								
LM-10T	0601320190	2023																								
LM-10U	0601320191	2023																								
LM-10V	0601320192	2023																								
LM-10W	0601320193	2023																								
LM-10X	0601320194	2023																								
LM-10Y	0601320195	2023																								
LM-10Z	0601320196	2023																								
LM-10A	0601320197	2023																								
LM-10B	0601320198	2023																								
LM-10C	0601320199	2023																								
LM-10D	0601320200	2023																								
LM-10E	0601320201	2023																								
LM-10F	0601320202	2023																								
LM-10G	0601320203	2023																								
LM-10H	0601320204	2023																								
LM-10I	0601320205	2023																								
LM-10J	0601320206	2023																								
LM-10K	0601320207	2023																								
LM-10L	0601320208	2023																								
LM-10M	0601320209	2023																								
LM-10N	0601320210																									

Note: Not necessarily the wells that will join the program. Conversion intended. Please see page 2.

Well Name (Abbreviated)	API Number	Present Creek Offshore High T&E Conversion	Year of last MFL, under USIT Inspection (2013-2018)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Plugged Wells 2019-2024																									
LM-40	0401120003	2019	2019	x	x																				
PC-3.1	0411300084	2019		x																					
TLD-1	0407700060	2019		x																					
RAO-5	0407700060	2019		x	x																				
LM-1A	0401120075	2020		x	x	x																			
RGR-2	0407720023	2020		x	x	x																			
WV-1E	0407720100	2021		x	x	x	x	x																	
WV-1AE	0407720100	2022		x	x	x	x	x	x																
TC-8B	0407720020	2022		x	x	x	x	x	x	x															
TC-10A	0407720100	2023		x	x	x	x	x	x	x	x														
TC-9A	0407720027	2023		x	x	x	x	x	x	x	x														
WV-1AB	0407720028	2023		x	x	x	x	x	x	x	x														
MCD-1A	0407720041	2023		x	x	x	x	x	x	x	x														
MCD-1S	0407720044	2023		x	x	x	x	x	x	x	x														
Present Creek IN THE PROCESS OF BEING SOLD																									
PC-3.1	0411300083	N/A		x		x		x		x															
PC-3.2	0411300103	N/A		x	x	x		x		x															
PC-3.3	0411300103	N/A		x	x	x		x		x															
PC-3.4	0411300104	N/A		x	x	x		x		x															
PC-3.5	0411300229	N/A		x	x	x		x		x															
PC-4.2	0411300105	N/A		x	x	x		x		x															
New Wells Drilled at McDonald Island in 2023																									
WV-1C RD	0407720100	2023																							
TC-10A	0407720100	2023																							
TC-10A	0407720100	2023																							
TC-10A	0407720100	2023																							
New Wells Drilled at Los Medanos in 2024																									
LM-7B	-	2024																							
LM-7C	-	2024																							
LM-7D	-	2024																							
Wells Drilled at McDonald Island in 2025																									
WV-1	-	2025																							
WV-2	-	2025																							
WV-3	-	2025																							
WV-4	-	2025																							
WV-5	-	2025																							



Exhibit A – System Reliability Risk

Withdrawal Capacity on a 5-Year Prescriptive Inspection Cycle

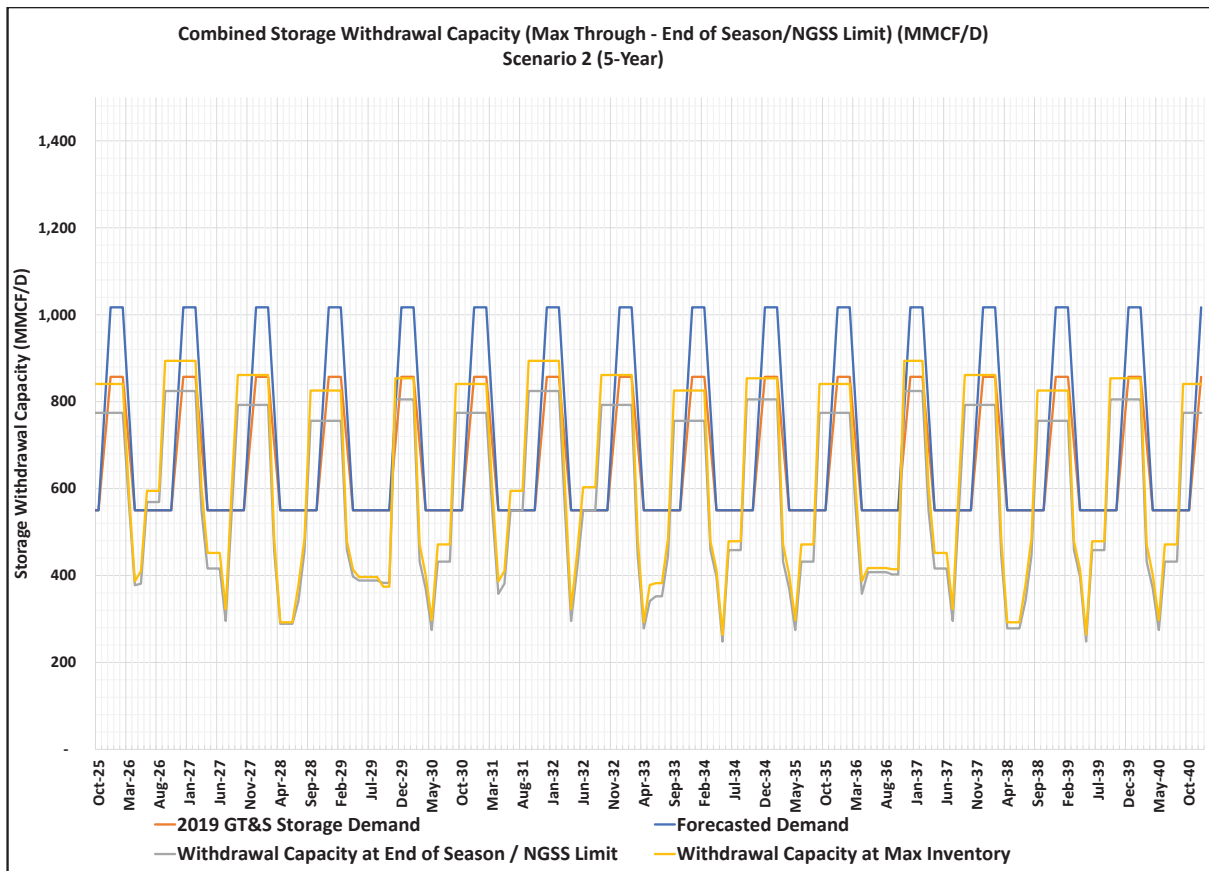
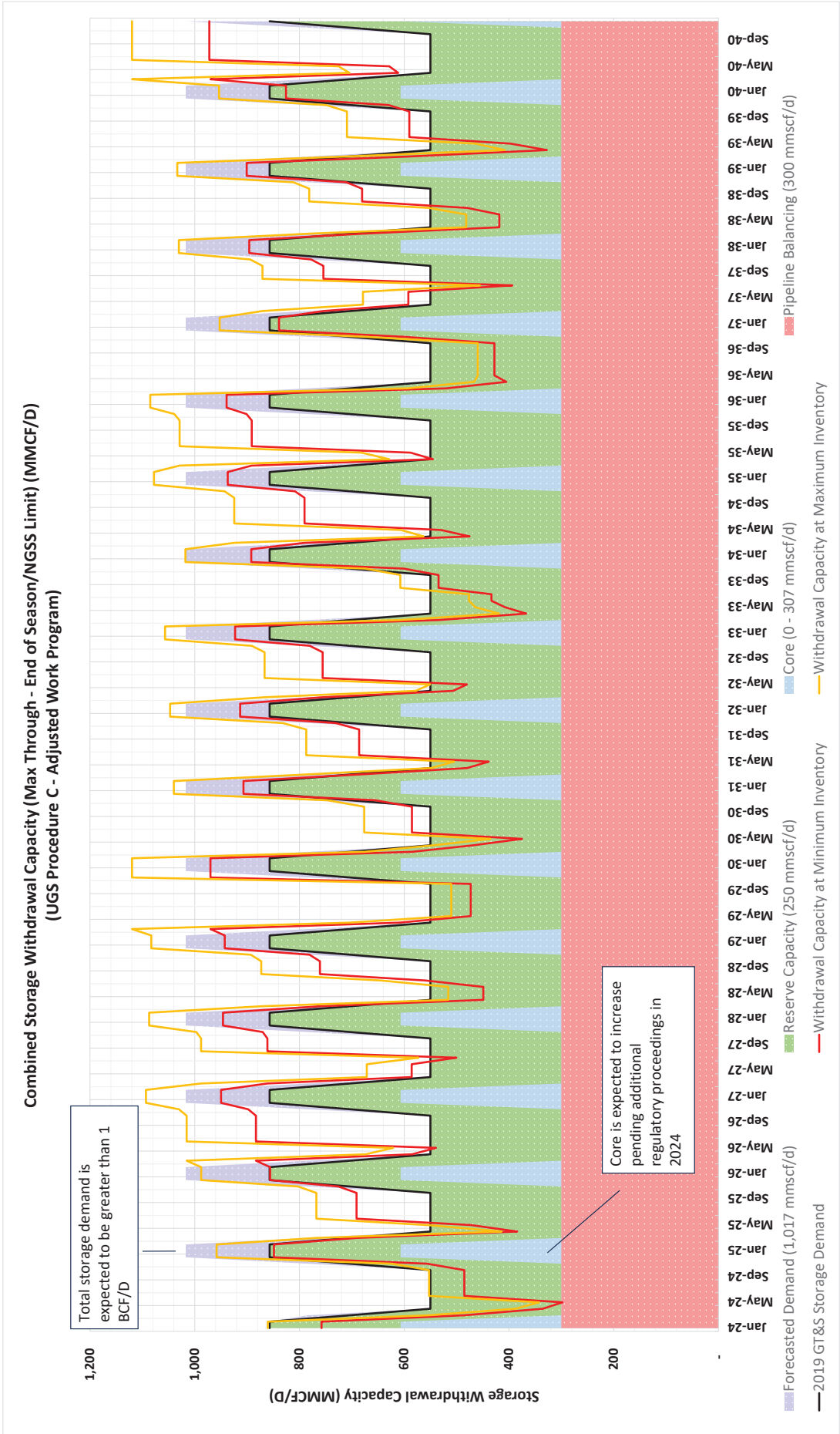


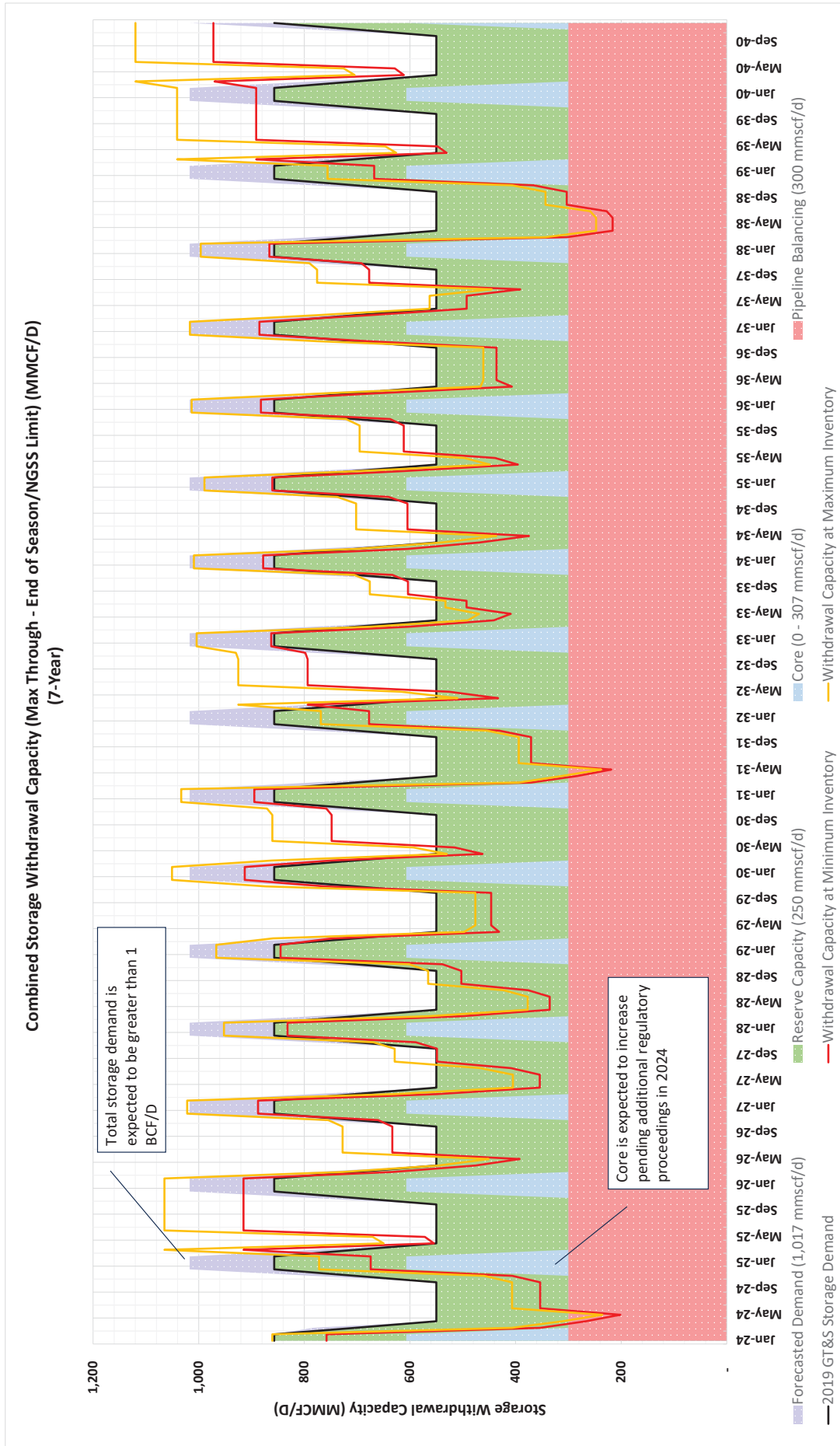


Exhibit B – Well Availability Comparison & Forecasted Withdrawal Capacity

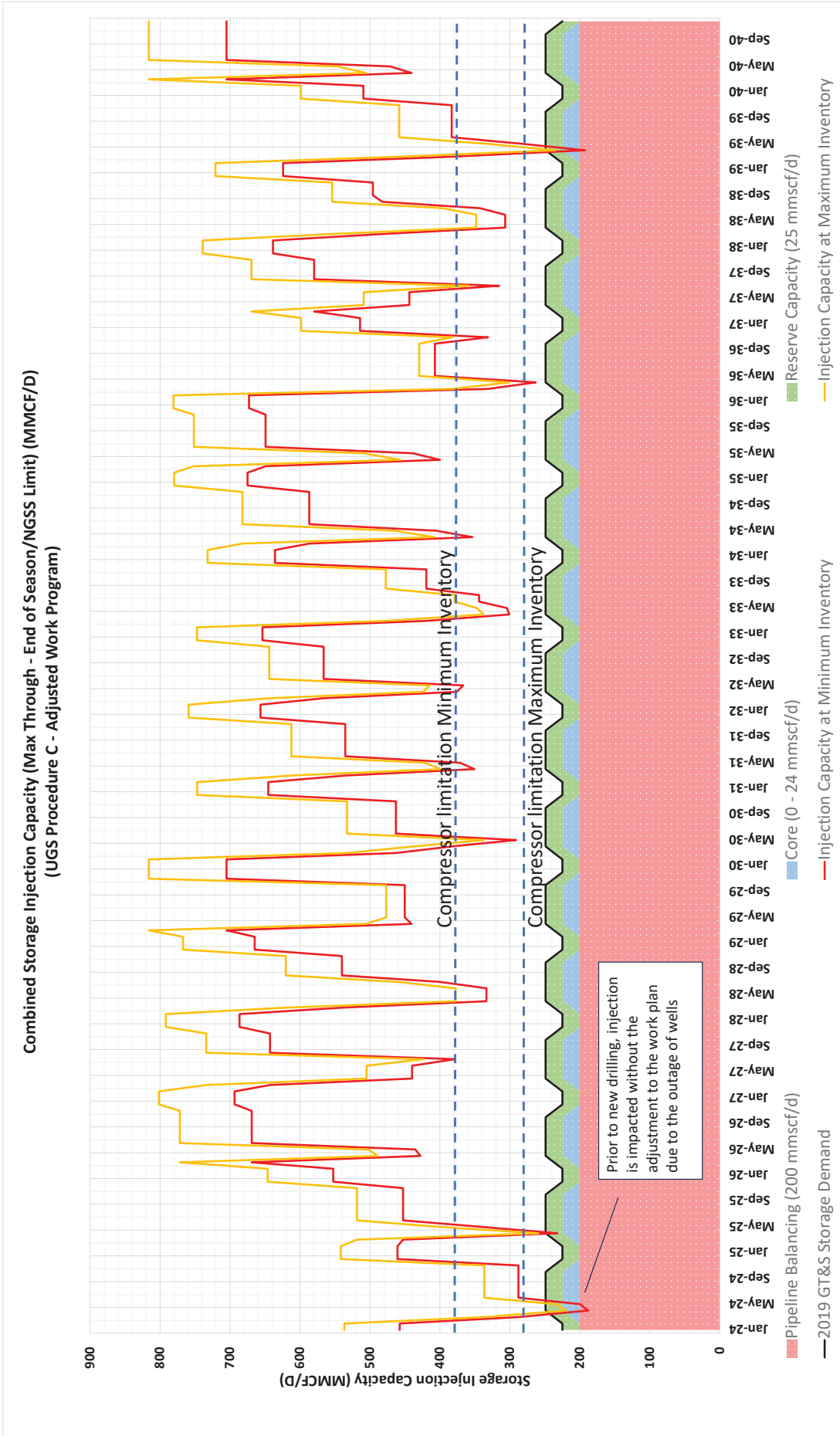
Withdrawal Capacity - UGS Procedure C Adjusted Work Program



Withdrawal Capacity - 7-Year

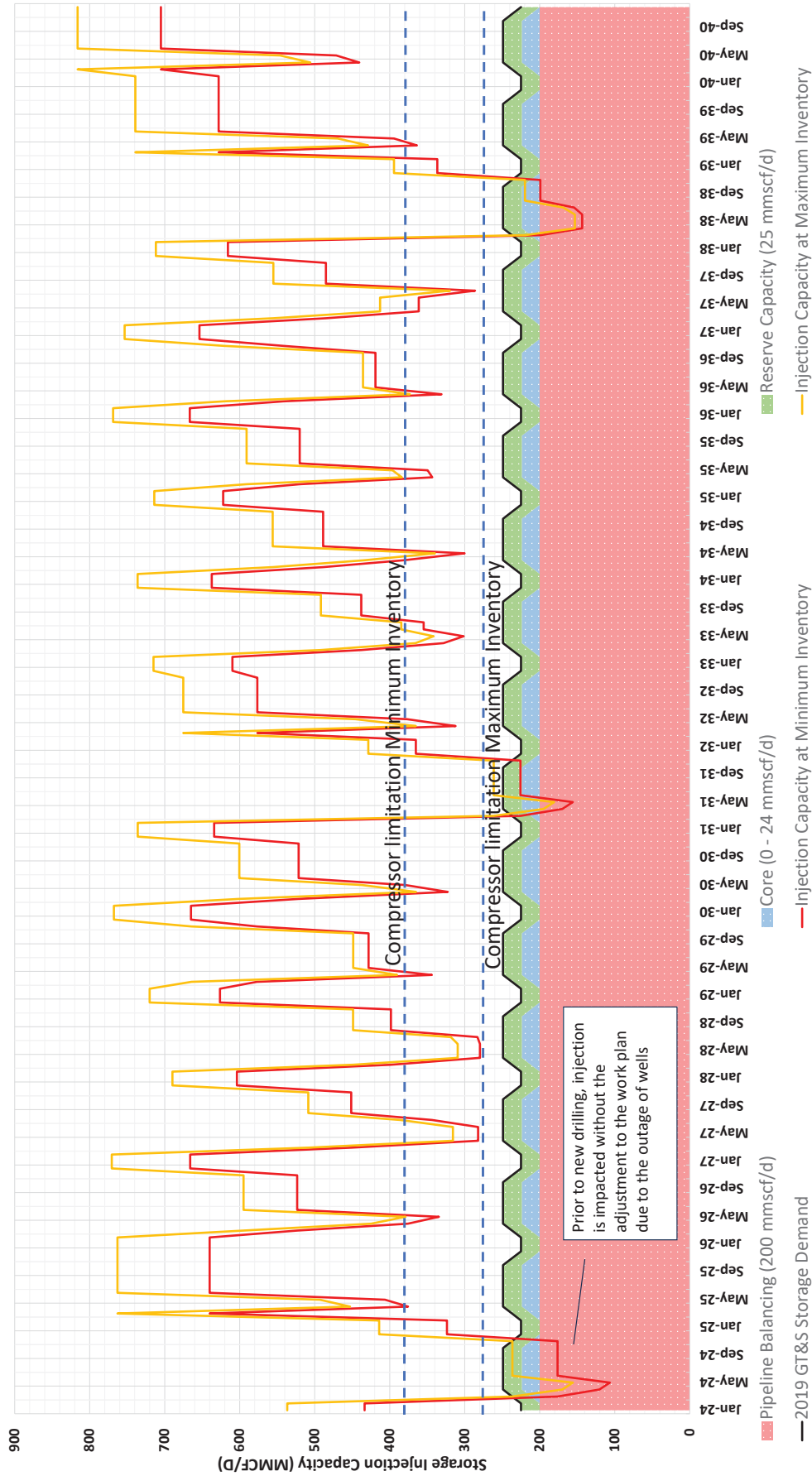


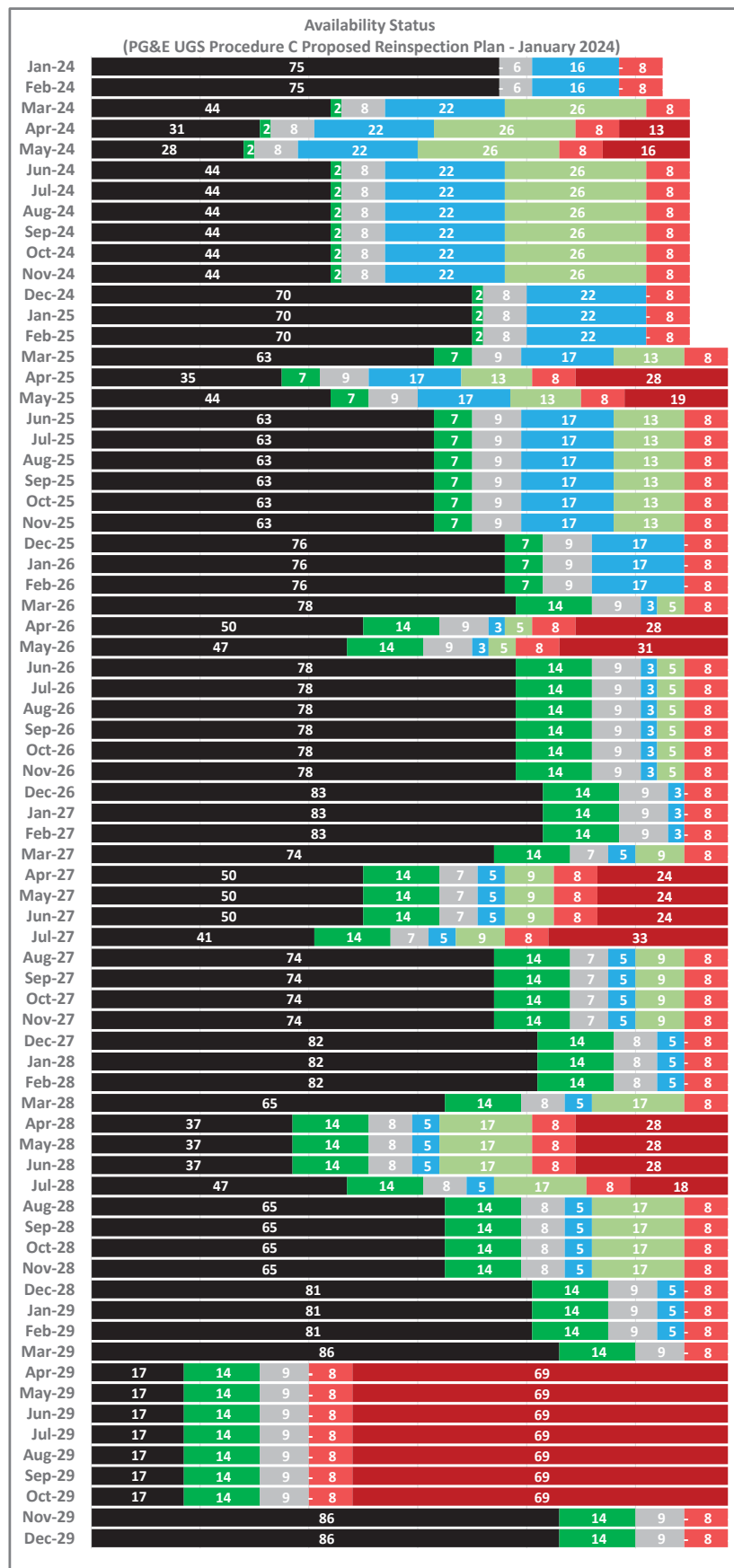
Injection Capacity - UGS Procedure C Adjusted Work Program



Injection Capacity - 7-Year

Combined Storage Injection Capacity (Max Through - End of Season/NGSS Limit) (MMCF/D)
(7-Year)



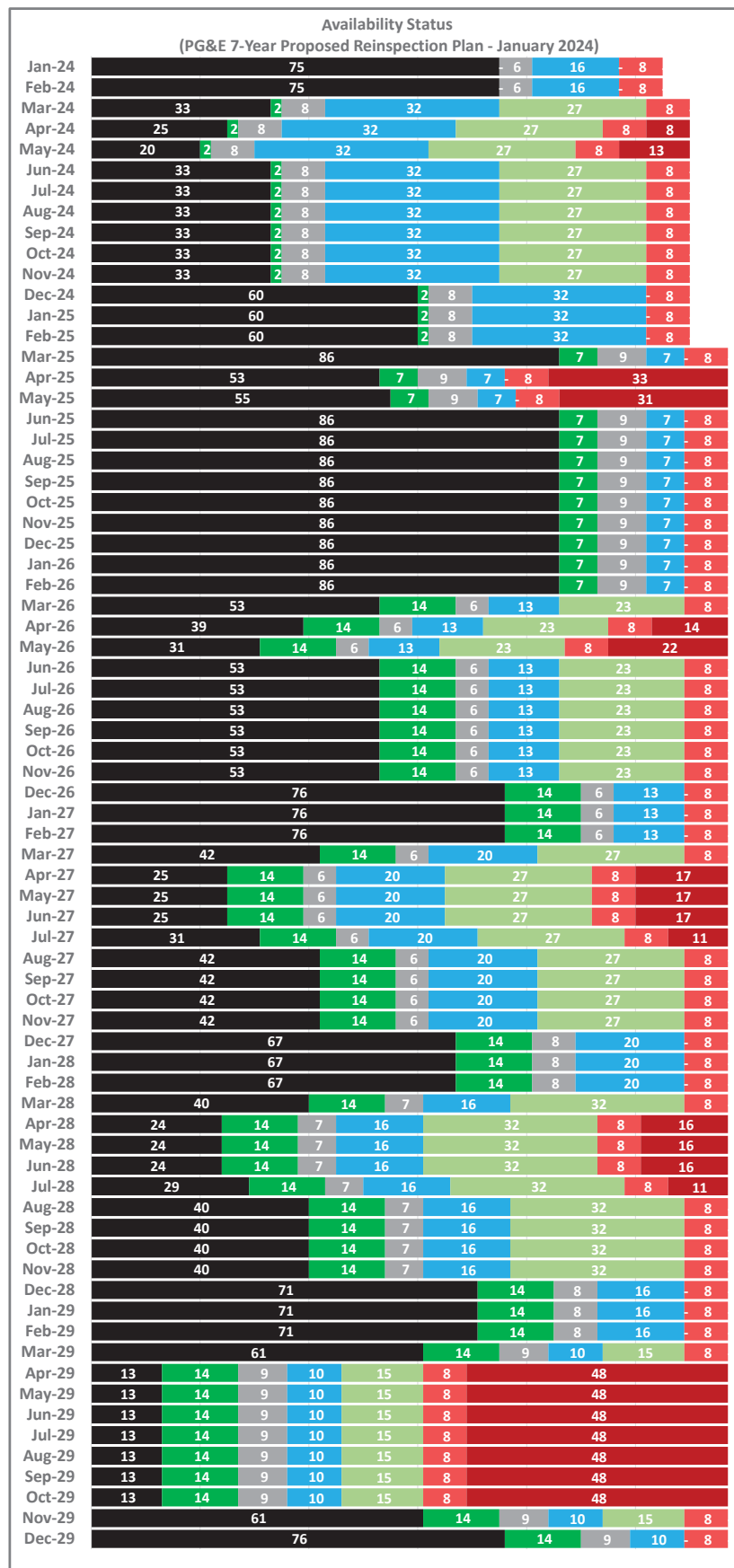


Well Availability Count

UGS Procedure C - Adjusted Work Program

Legend

	Available
	Observation Wells
	Well Inspection
	Adjacent Well Outage
	New Drilling/Inspection
	Pending Abandonment
	Platform



Well Availability Count

7-Year

Legend

	Available
	Observation Wells
	Well Inspection
	Adjacent Well Outage
	New Drilling/Inspection
	Pending Abandonment
	Platform

Minimum Inventory Withdrawal Key

Well Being Reworked with a Rig for Inspection
Adjacent Well Taken Out of Service
Well is Plugged and Abandoned
Well Out of Service (2023 Rework, Sand Insp, SAPT)

Maximum Inventory Withdrawal Key

Well Being Reworked with a Rig for Inspection
Adjacent Well Taken Out of Service
Well is Plugged and Abandoned
Well Out of Service (2023 Rework, Sand Insp, SAPT)

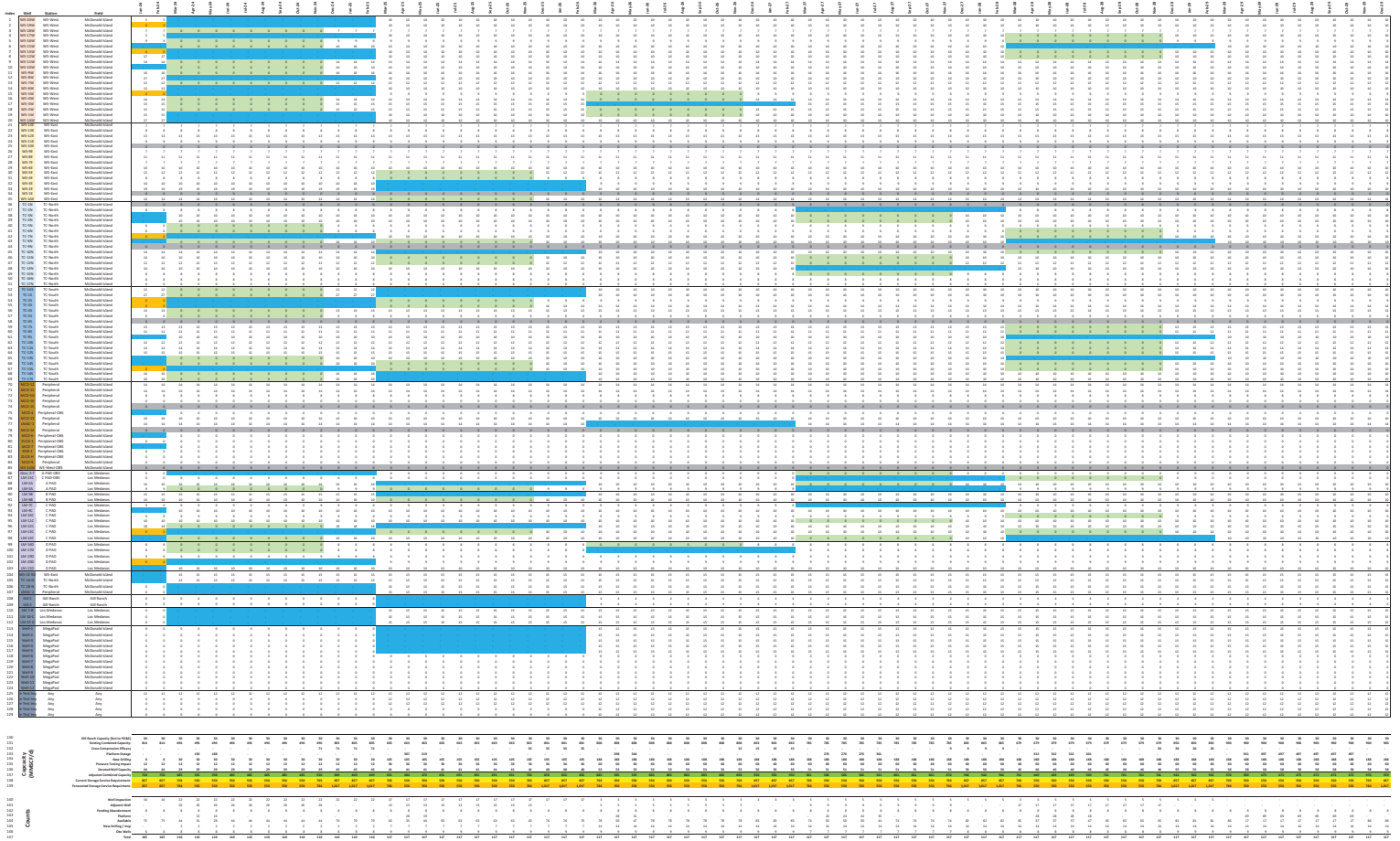
Minimum Inventory Injection Key

Well Being Reworked with a Rig for Inspection
Adjacent Well Taken Out of Service
Well is Plugged and Abandoned
Well Out of Service (2023 Rework, Sand Insp, SAPT)

Maximum Inventory Injection Key

Well Being Reworked with a Rig for Inspection
Adjacent Well Taken Out of Service
Well is Plugged and Abandoned
Well Out of Service (2023 Rework, Sand Insp, SAPT)

Forecasted Withdrawal Capacity at Minimum Inventory (UGS Procedure C - Adjusted Work Program), January 2024



Forecasted Withdrawal Capacity at Minimum Inventory (UGS Procedure C - Adjusted Work Program), January 2024

		Year	2020												2021												2022												2023												2024												2025												2026												2027												2028												2029												2030												2031												2032												2033												2034												2035												2036												2037												2038												2039												2040												2041												2042												2043												2044												2045												2046												2047												2048												2049												2050												2051												2052												2053												2054												2055												2056												2057												2058												2059												2060												2061												2062												2063												2064												2065												2066												2067												2068												2069												2070												2071												2072												2073												2074												2075												2076												2077												2078												2079												2080												2081												2082												2083												2084												2085												2086												2087												2088												2089												2090												2091												2092												2093												2094												2095												2096												2097												2098												2099												2100												2101												2102												2103												2104												2105												2106												2107												2108												2109												2110												2111												2112												2113												2114												2115												2116												2117												2118												2119												2120												2121												2122												2123												2124												2125												2126												2127												2128												2129												2130												2131												2132												2133												2134												2135												2136												2137												2138												2139												2140												2141												2142												2143												2144												2145												2146												2147												2148												2149												2150												2151												2152												2153												2154												2155												2156												2157												2158												2159												2160												2161												2162												2163												2164												2165												2166												2167												2168												2169												2170												2171												2172												2173												2174												2175												2176												2177												2178												2179												2180												2181												2182												2183												2184												2185												2186												2187												2188												2189												2190												2191												2192												2193												2194												2195												2196												2197												2198												2199												2200												2201												2202												2203												2204												2205												2206												2207												2208												2209												2210												2211												2212												2213												2214												2215												2216												2217												2218												2219												2220												2221												2222												2223												2224												2225												2226												2227												2228												2229												2230												2231												2232												2233												2234												2235												2236												2237												2238												2239												2240												2241												2242												2243												2244												2245												2246												2247												2248												2249												2250												2251												2252												2253												2254												2255												2256												2257												2258												2259												2260												2261												2262												2263												2264												2265												2266												2267												2268												2269												2270												2271												2272												2273												2274												2275												2276												2277												2278												2279												2280												2281												2282												2283												2284												2285												2286												2287												2288												2289												2290												2291												2292												2293												2294												2295												2296												2297												2298												2299												2300												2301												2302												2303												2304												2305												2306												2307												2308												2309												2310												2311												2312												2313												2314												2315												2316												2317												2318												2319												2320												2321												2322												2323												2324												2325												2326												2327												2328												2329												2330												2331												2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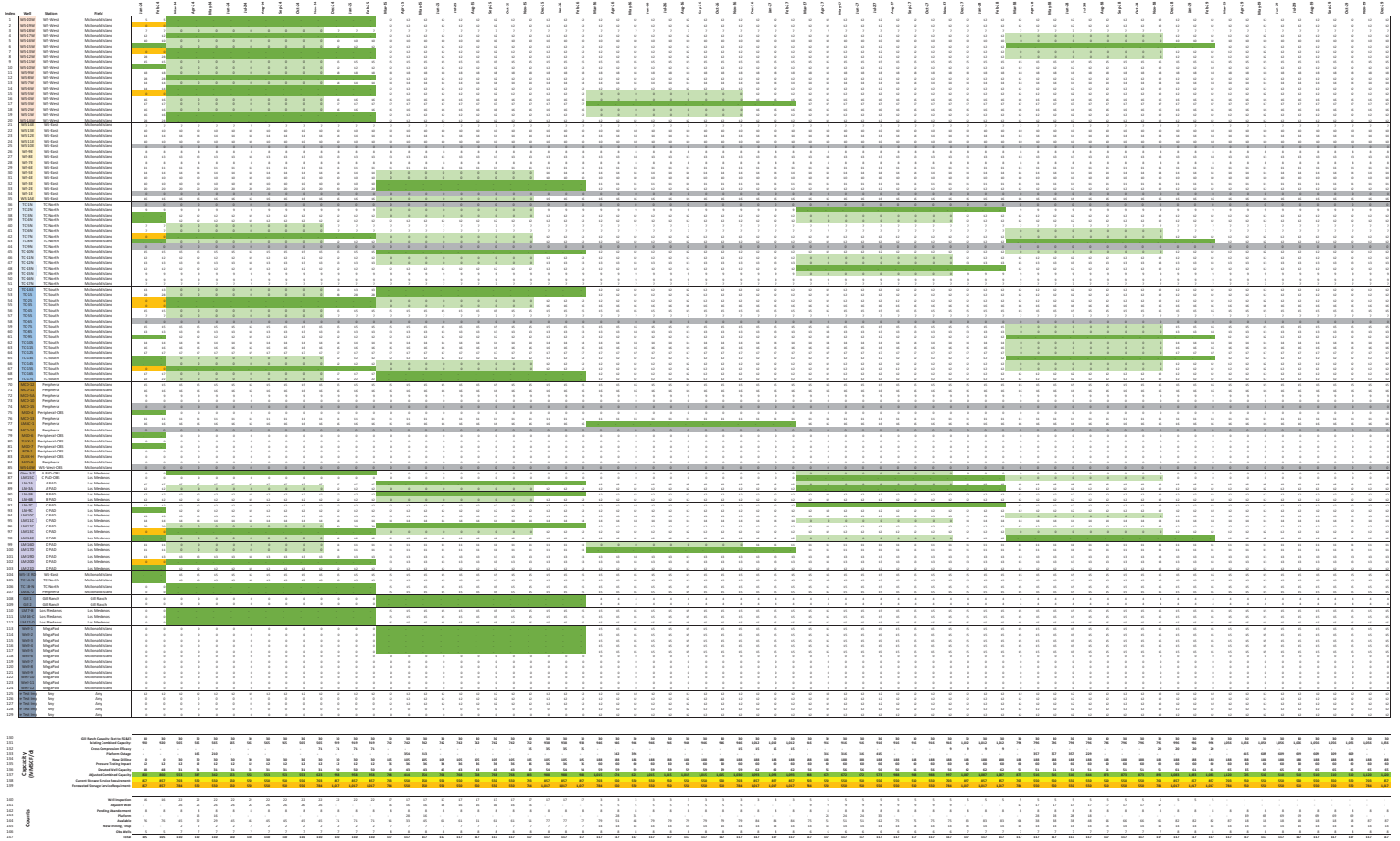
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Forecasted Withdrawal Capacity at Minimum Inventory (7-Year), January 2024

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Forecasted Withdrawal Capacity at Maximum Inventory (UGS Procedure C - Adjusted Work Program), January 2024



Forecasted Withdrawal Capacity at Maximum Inventory (UGS Procedure C - Adjusted Work Program), January 2024

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Forecasted Withdrawal Capacity at Maximum Inventory (UGS Procedure C - Adjusted Work Program), January 2024



Forecasted Withdrawal Capacity at Maximum Inventory (7-Year), January 2024																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
	Country	Region	Plant	Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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Forecasted Withdrawal Capacity at Maximum Inventory (7-Year), January 2024

Date	Station	State	2023												2024												2025												2026												2027														2028																2029																2030																2031																2032																2033																2034																2035																2036																2037																2038																2039																2040																2041																2042																2043																2044																2045																2046																2047																2048																2049																2050																2051																2052																2053																2054																2055																2056																2057																2058																2059																2060																2061																2062																2063																2064																2065																2066																2067																2068																2069																2070																2071																2072																2073																2074																2075																2076																2077																2078																2079																2080																2081																2082																2083																2084																2085																2086																2087																2088																2089																2090																2091																2092																2093																2094																2095																2096																2097																2098																2099																2100																2101																2102																2103																2104																2105																2106																2107																2108																2109																2111		
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(m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity (m3/min)	Capacity 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Forecasted Withdrawal Capacity at Maximum Inventory (7-Year), January 2024

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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Forecasted Injection Capacity at Minimum Inventory (UGS Procedure C - Adjusted Work Program), January 2024

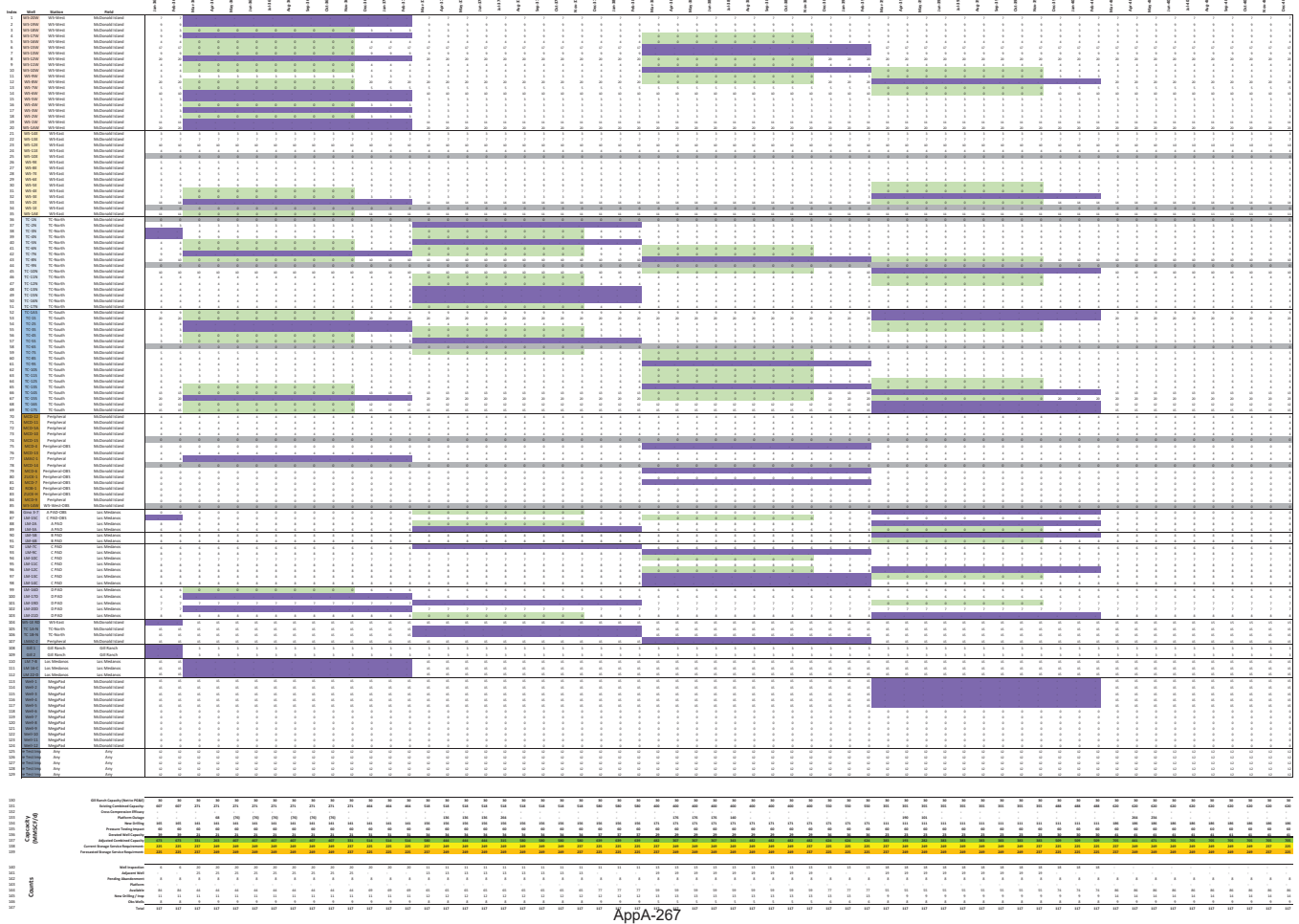


Forecasted Injection Capacity at Minimum Inventory (UGS Procedure C - Adjusted Work Program), January 2024



Forecasted Injection Capacity at Minimum Inventory (UGS Procedure C - Adjusted Work Program), January 2024

(PG&E-15)



Forecasted Injection Capacity at Minimum Inventory (7-Year), January 2024



Forecasted Injection Capacity at Minimum Inventory (7-Year), January 2024

[illegible]

Forecasted Injection Capacity at Minimum Inventory (7-Year), January 2024



Forecasted Injection Capacity at Maximum Inventory (UGS Procedure C - Adjusted Work Program), January 2024



Forecasted Injection Capacity at Maximum Inventory (UGS Procedure C - Adjusted Work Program), January 2024

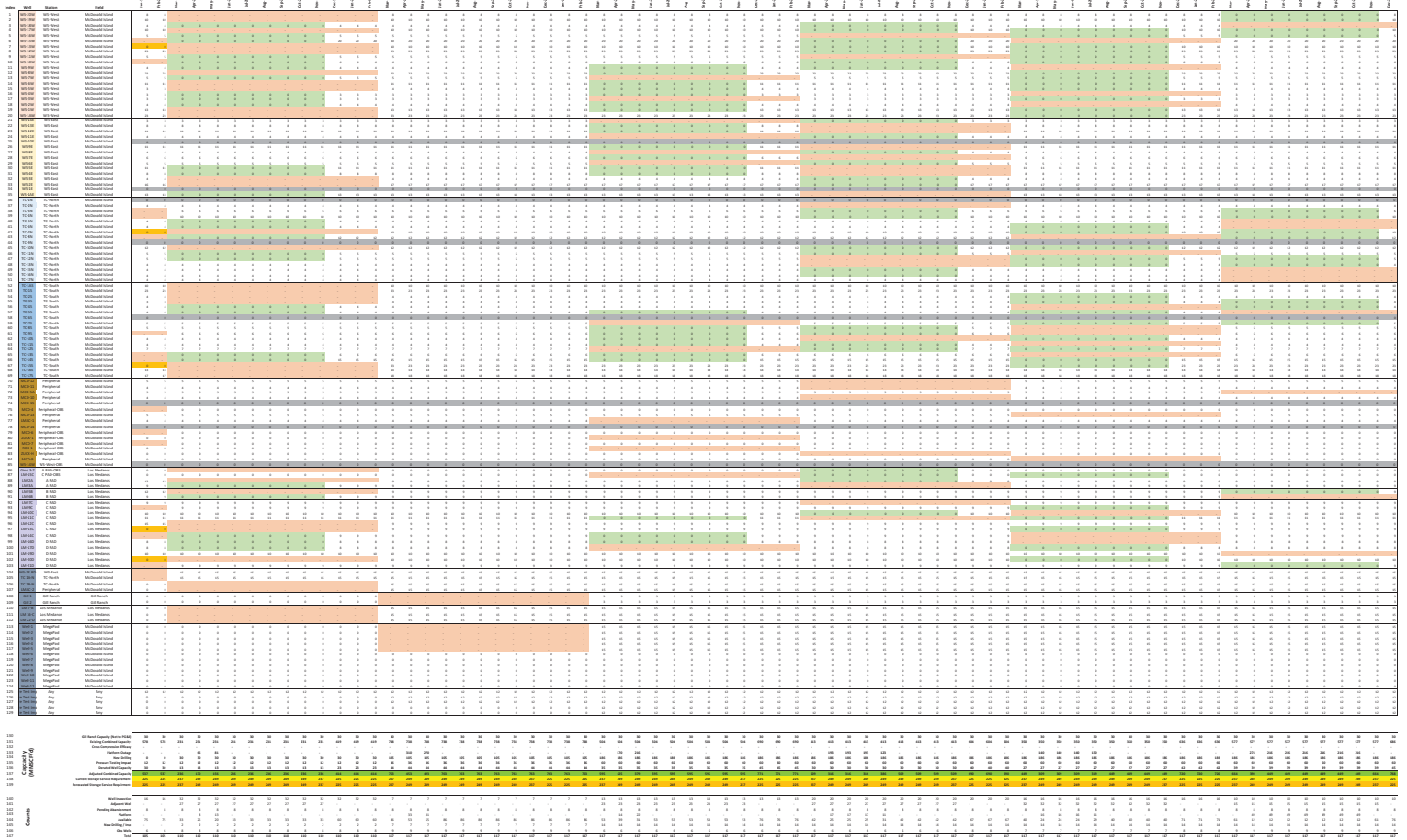
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Forecasted Injection Capacity at Maximum Inventory (UGS Procedure C - Adjusted Work Program), January 2024

(PG&E-15)



Forecasted Injection Capacity at Maximum Inventory (7-Year), January 2024



Forecasted Injection Capacity at Maximum Inventory (7-Year), January 2024

[illegible]

Forecasted Injection Capacity at Maximum Inventory (7-Year), January 2024

[illegible]



Exhibit C – Comparison of Well Flowrates

In response to subsection “Comparison of Actual Data Versus Capacity Model After Conversion to Tubing and Packer for Each Well” PG&E has provided the individual well data of the modeled values predicting the flow rate after tubing on packer conversion to the actual measured data.

Los Medanos Well Flowrate Comparison					
Well	Field	Station/Pad	API	Modeled Withdrawal Rate	2023 Rate Table
GINO 3-7	Los Medanos	A Pad	01300135	0	0
LM 1-A	Los Medanos	A Pad	01320373	0	0
LM 2-A	Los Medanos	A Pad	01320138	10.8	10.0
LM 3-A	Los Medanos	A Pad	01320115	7.5	8.6
LM 4-B	Los Medanos	B Pad	01320093	0	0.0
LM 5-B	Los Medanos	B Pad	01320144	10.3	10.0
LM 6-B	Los Medanos	B Pad	01320140	0	10.0
LM 7-C	Los Medanos	C Pad	01320130	7.5	8.6
LM 9-C	Los Medanos	C Pad	01320123	15	10.0
LM 10-C	Los Medanos	C Pad	01320131	8.1	9.3
LM 11-C	Los Medanos	C Pad	01320128	8.7	10.0
LM 12-C	Los Medanos	C Pad	01320307	12.5	10.0
LM 13-C	Los Medanos	C Pad	01320299	9.4	10.0
LM 14-C	Los Medanos	C Pad	01320298	12.5	10.0
LM 15-C	Los Medanos	C Pad	01320121	0	0.0
LM 16-D	Los Medanos	D Pad	01320133	6.5	7.5
LM 17-D	Los Medanos	D Pad	01320136	6.5	7.5
LM 19-D	Los Medanos	D Pad	01320295	8.1	9.3
LM 20-D	Los Medanos	D Pad	01320297	0	9.3
LM 21-D	Los Medanos	D Pad	01320308	9.4	10.0

McDonald Island Peripheral Well Flowrate Comparison					
Well	Field	Station/Pad	API	Simulated Withdrawal Rate	2023 Rate Table
MCD-4	McDonald Island	Peripheral	07700080	0	0
MCD-6	McDonald Island	Peripheral	07700082	0	0
MCD-7	McDonald Island	Peripheral	07700083	0	0
ROB-1	McDonald Island	Peripheral	07720524	0	0
TILD-1	McDonald Island	Peripheral	07700090	0	0
ZUCK-1	McDonald Island	Peripheral	07700091	0	0
ZUCK-H	McDonald Island	Peripheral	07720010	0	0
LMAC-1	McDonald Island	Peripheral	07720609	8.8	14.3
MCD-5A	McDonald Island	Peripheral	07720552	8.6	7.9
MCD-11	McDonald Island	Peripheral	07700086	7	14.4
MCD-12	McDonald Island	Peripheral	07700087	6.1	13.5
MCD-9	McDonald Island	Peripheral	07700084	0	0
MCD-10	McDonald Island	Peripheral	07700085	7.1	0
MCD-13	McDonald Island	Peripheral	07700088	7.6	9.5
MCD-14	McDonald Island	Peripheral	07720441	9.1	0
MCD-15	McDonald Island	Peripheral	07720444	10.8	0

* Note: Orange is the provisional rate for recently converted and unconverted wells after conversion

Exhibit C - Comparison of Well Flowrates

AppA-278

McDonald Island Turner Cut Station Well Flowrate Comparison					
Well	Field	Station/Pad	API	Simulated Withdrawal Rate	2023 Rate Table
TC 1-N	McDonald Island	Turner Cut North	07720196	10.8	0
TC 2-N	McDonald Island	Turner Cut North	07720199	7.3	7.7
TC 3-N	McDonald Island	Turner Cut North	07720201	9.1	10.0
TC 4-N	McDonald Island	Turner Cut North	07720202	8	10.0
TC 5-N	McDonald Island	Turner Cut North	07720207	9.7	6.4
TC 6-N	McDonald Island	Turner Cut North	07720208	8.2	6.4
TC 7-N	McDonald Island	Turner Cut North	07720225	9.9	10.0
TC 8-N	McDonald Island	Turner Cut North	07720226	9.1	10.0
TC 9-N	McDonald Island	Turner Cut North	07720227	9.9	0
TC 10-N	McDonald Island	Turner Cut North	07720228	12.3	10.0
TC 11-N	McDonald Island	Turner Cut North	07720229	9.4	10.3
TC 12-N	McDonald Island	Turner Cut North	07720230	8.9	11.6
TC 13-N	McDonald Island	Turner Cut North	07720234	10.1	10.2
TC 15-N	McDonald Island	Turner Cut North	07720239	10.5	8.3
TC 16-N	McDonald Island	Turner Cut North	07720240	9.1	7.8
TC 17-N	McDonald Island	Turner Cut North	07720548	8.6	6.4
TC 1A-S	McDonald Island	Turner Cut South	07720551	11.1	10.0
TC 1-S	McDonald Island	Turner Cut South	07720218	10.8	10.0
TC 2-S	McDonald Island	Turner Cut South	07720219	9	10.0
TC 3-S	McDonald Island	Turner Cut South	07720216	10.2	10.0
TC 4-S	McDonald Island	Turner Cut South	07720203	6.8	13.0
TC 5-S	McDonald Island	Turner Cut South	07720204	9	6.3
TC 6-S	McDonald Island	Turner Cut South	07720205	9.2	0
TC 7-S	McDonald Island	Turner Cut South	07720206	8.3	13.1
TC 8-S	McDonald Island	Turner Cut South	07720533	7.6	11.4
TC 9-S	McDonald Island	Turner Cut South	07720252	8.4	10.0
TC 10-S	McDonald Island	Turner Cut South	07720251	9	12.0
TC 11-S	McDonald Island	Turner Cut South	07720250	9.5	14.4
TC 12-S	McDonald Island	Turner Cut South	07720248	10.6	15.4
TC 13-S	McDonald Island	Turner Cut South	07720247	9.1	10.0
TC 14-S	McDonald Island	Turner Cut South	07720244	9.4	10.0
TC 15-S	McDonald Island	Turner Cut South	07720245	10.6	10.0
TC 16-S	McDonald Island	Turner Cut South	07720243	6.4	10.0
TC 17-S	McDonald Island	Turner Cut South	07720258	0	10.0

McDonald Island Whiskey Slough Station Well Flowrate Comparison					
Well	Field	Station/Pad	API	Simulated Withdrawal Rate	2023 Rate Table
WS 1A-E	McDonald Island	Whiskey Slough East	07720536	10.2	14.0
WS 1-E	McDonald Island	Whiskey Slough East	07720168	9.1	15.0
WS 2-E	McDonald Island	Whiskey Slough East	07720169	9.1	10.0
WS 3-E	McDonald Island	Whiskey Slough East	07720173	8.3	9.4
WS 4-E	McDonald Island	Whiskey Slough East	07720178	7.4	8.4
WS 5-E	McDonald Island	Whiskey Slough East	07720179	11.7	12.1
WS 6-E	McDonald Island	Whiskey Slough East	07720185	7.2	10.2
WS 7-E	McDonald Island	Whiskey Slough East	07720187	7.5	7.0
WS 8-E	McDonald Island	Whiskey Slough East	07720188	10	11.4
WS 9-E	McDonald Island	Whiskey Slough East	07720189	11.3	6.7
WS 10-E	McDonald Island	Whiskey Slough East	07720190	0	0.0
WS 11-E	McDonald Island	Whiskey Slough East	07720253	7.8	9.0
WS 12-E	McDonald Island	Whiskey Slough East	07720255	9	12.5
WS 13-E	McDonald Island	Whiskey Slough East	07720256	7.8	8.4
WS 14-E	McDonald Island	Whiskey Slough East	07720257	0	6.5
WS 1A-W	McDonald Island	Whiskey Slough West	07720544	11.1	10.0
WS 1-W	McDonald Island	Whiskey Slough West	07720215	9	10.0
WS 2-W	McDonald Island	Whiskey Slough West	07720212	8.8	14.6
WS 3-W	McDonald Island	Whiskey Slough West	07720213	8.5	15.4
WS 4-W	McDonald Island	Whiskey Slough West	07720214	9.5	13.9
WS 5-W	McDonald Island	Whiskey Slough West	07720211	8.6	10.0
WS 6-W	McDonald Island	Whiskey Slough West	07720192	0	10.0
WS 7-W	McDonald Island	Whiskey Slough West	07720193	9.1	12.3
WS 8-W	McDonald Island	Whiskey Slough West	07720194	11.7	10.0
WS 9-W	McDonald Island	Whiskey Slough West	07720195	8.6	16.1
WS 10-W	McDonald Island	Whiskey Slough West	07720534	8.8	10
WS 11-W	McDonald Island	Whiskey Slough West	07720265	11.1	13.7
WS 12-W	McDonald Island	Whiskey Slough West	07720264	8.9	10.0
WS 13-W	McDonald Island	Whiskey Slough West	07720241	9.2	10.0
WS 14-W	McDonald Island	Whiskey Slough West	07720238	0	0
WS 15-W	McDonald Island	Whiskey Slough West	07720233	9.3	10.0
WS 16-W	McDonald Island	Whiskey Slough West	07720231	8.9	8.8
WS 17-W	McDonald Island	Whiskey Slough West	07720166	8.9	10.0
WS 18-W	McDonald Island	Whiskey Slough West	07720465	8.7	6.6
WS 19-W	McDonald Island	Whiskey Slough West	07720467	9	10.0
WS 20-W	McDonald Island	Whiskey Slough West	07720535	5.8	10.0

* Note: Orange is the provisional rate for recently converted and unconverted wells after conversion

Exhibit C - Comparison of Well Flowrates

AppA-279



Exhibit D – Information Concerning New Drills

In response to subsection “New Drills”, PG&E has provided the well details including the anticipated drill and completion dates. In 2023, CalGEM has issued permits for Little Mac-2, Whiskey Slough 1-E, Turner Cut 1A-N, and Turner Cut 1B-N. PG&E forecasts to drill eight more wells at McDonald Island Storage Field and Los Medanos Storage Field to address the reduced well capacity concerns. The rates assigned to new drills (15 MMscf/D) is an estimate and actual results may vary.

Table 1: New Drills			
PG&E Field	Well Name	Anticipated Drill Year	Est. Completion Year
McDonald Island	Whiskey Slough 1-E	2023	2024
McDonald Island	Turner Cut 1A-N	2023	2024
McDonald Island	Turner Cut 1B-N	2024	2025
McDonald Island	Little Mac-2	2024	2025
Los Medanos	Los Medanos 7-B	2024	2025
Los Medanos	Los Medanos 22-D	2024	2025
Los Medanos	Los Medanos 16-C	2024	2025
McDonald Island	Well-1	2025	2026
McDonald Island	Well-2	2025	2026
McDonald Island	Well-3	2025	2026
McDonald Island	Well-4	2025	2026
McDonald Island	Well-5	2025	2026

Exhibit D - Information Concerning New Drills

From: [Reader, Emily@DOC](#)
To: [Redmond, Lucy](#)
Subject: RE: PG&E - CalGEM Meeting
Date: Wednesday, February 7, 2024 8:01:04 AM

Classification: Public

CAUTION: EXTERNAL SENDER!

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Lets plan for 9:30am. I will give you a call and can add the NOI list to the topics.

From: Redmond, Lucy <LMRI@pge.com>
Sent: Tuesday, February 6, 2024 5:57 PM
To: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>
Subject: RE: PG&E - CalGEM Meeting

Classification: Public

Hi Emily,

I have from 9:30-10:30 open and then 12-1pm. Let me know if those times work for you.

Lucy

From: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>
Sent: Tuesday, February 6, 2024 4:44 PM
To: Redmond, Lucy <LMRI@pge.com>
Subject: RE: PG&E - CalGEM Meeting

Classification: Public

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Hi Lucy-

I thought a call to give you an update on where we are with things might be easiest. Let me know if

you have some free time tomorrow to connect.

Emily

From: Redmond, Lucy <LMRI@pge.com>
Sent: Monday, January 29, 2024 4:04 PM
To: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>
Subject: RE: PG&E - CalGEM Meeting

Classification: Public

Hi Emily,

Circling back to check with you on dates. Let me know.

Thanks,

Lucy

From: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>
Sent: Tuesday, January 23, 2024 9:10 AM
To: Redmond, Lucy <LMRI@pge.com>
Subject: RE: PG&E - CalGEM Meeting

Classification: Public

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Lucy:

I will circle around with our UGS group to identify timing. We communicate with CPUC frequently and plan to include both CEC and CPUC in future conversations on this topic. This is currently one of our top priorities and I will let you know what we are thinking as far as timing goes to get something on the calendar.

Emily

From: Redmond, Lucy <LMRI@pge.com>
Sent: Monday, January 22, 2024 12:30 PM

To: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>

Subject: PG&E - CalGEM Meeting

Classification: Public

Hi Emily,

Hope you had a good weekend. I wanted to follow up to our Friday submittal and see if we can plan to get a meeting on the calendar to discuss any questions the Division has. There are two issues that we provided in our letter, the first being the topic of getting an extension on T&P conversion work planned for this year for 10 of the wells so that we can maintain reliability next winter and the second being the ongoing topic of reinspection frequency. For both of these topics, I think the CPUC would like to participate. Let me know your thoughts and perhaps a brief phone call is best to discuss next steps. We are happy to host a meeting at our San Ramon location, or can come in person to Sacramento.

Thank you,

Lucy
925-453-9276

You can read about PG&E's data privacy practices at PGE.com/privacy.

From: [Redmond, Lucy](#)
To: [Hand, Jeanette](#); [Reader, Emily@DOC](#)
Cc: [courtney.smith@conservation.ca.gov](#); [Sharma, Rohit@DOC](#); [REDACTED]
Subject: RE: Additional data required
Date: Wednesday, January 31, 2024 5:39:02 PM
Attachments: [Well Availability Comparison & Forecasted Withdrawal Capacity - 5-Year.pdf](#)

Hello Jeanette and Emily,

Please see the attached for the additional views requested for Scenario 2 (5-year Reinspection Cycle).

Please let me know of dates that we can walk through the details of the plan with you.

Thanks,
Lucy Redmond
925-453-9276

From: Redmond, Lucy
Sent: Friday, January 19, 2024 6:43 PM
To: Hand, Jeanette <Jeanette.Hand@conservation.ca.gov>
Cc: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>;
[courtney.smith@conservation.ca.gov](#); Sharma, Rohit@DOC <Rohit.Sharma@conservation.ca.gov>;
[REDACTED]
[REDACTED] Redmond, Lucy <LMRI@pge.com>
Subject: RE: Additional data required

Hello Jeanette,

Please see the attached letter and submission in response to the data request, dated December 20, 2023.

We look forward to further discussions and would be happy to meet in person and walk through the data request submittal in detail given our familiarity with the operation limitations. We also reiterate our request to hear back as soon as possible regarding the proposed shift of work from the 2024 work plan as part of the proposed revisions to PG&E's Revised Implementation Plan.

Should you have any questions, please contact me at 925-453-9276.

Sincerely,

Lucy Redmond
Director, Reservoir Engineering
Pacific Gas and Electric Company

From: Hand, Jeanette@DOC <[Jeanette.Hand@conservation.ca.gov](#)>

Sent: Wednesday, December 20, 2023 8:48 AM

To: Agent for Service of Process <AgentforServiceofProcess@pge.com>

Cc: Redmond, Lucy <LMRI@pge.com>; Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>

Subject: Additional data required

CAUTION: EXTERNAL SENDER!

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Hello Brian,

Please find the attached letter requiring additional data related to PG&E's proposed second round MIT schedule. Please reach out to me if you have any question about this communication.

Thank you,

Jeanette (McCracken) Hand, P.G.

Underground Gas Storage Program Manager

Senior Oil and Gas Engineer

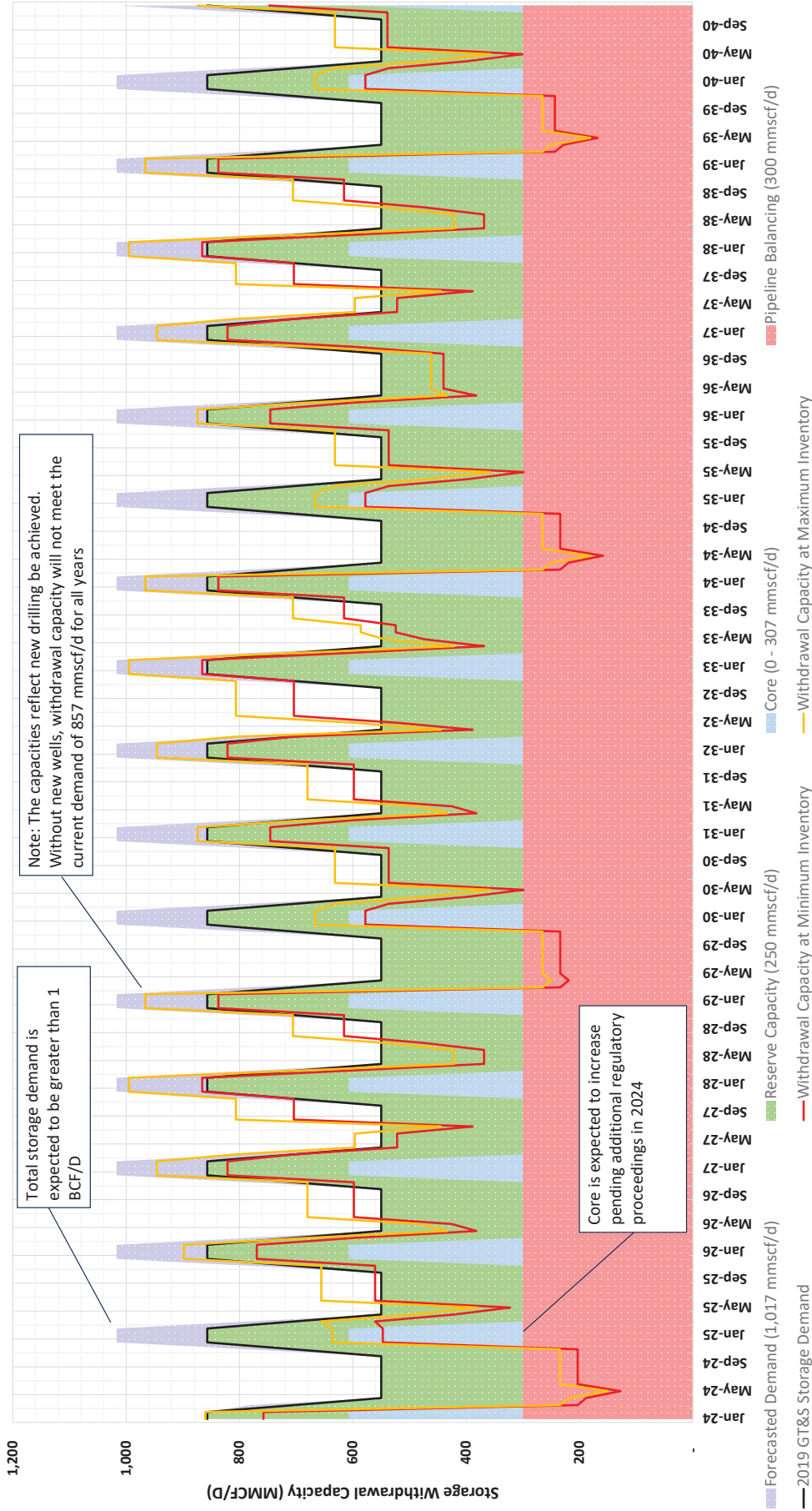
California Department of Conservation

Geologic Energy Management Division

Cell: 916-212-4890

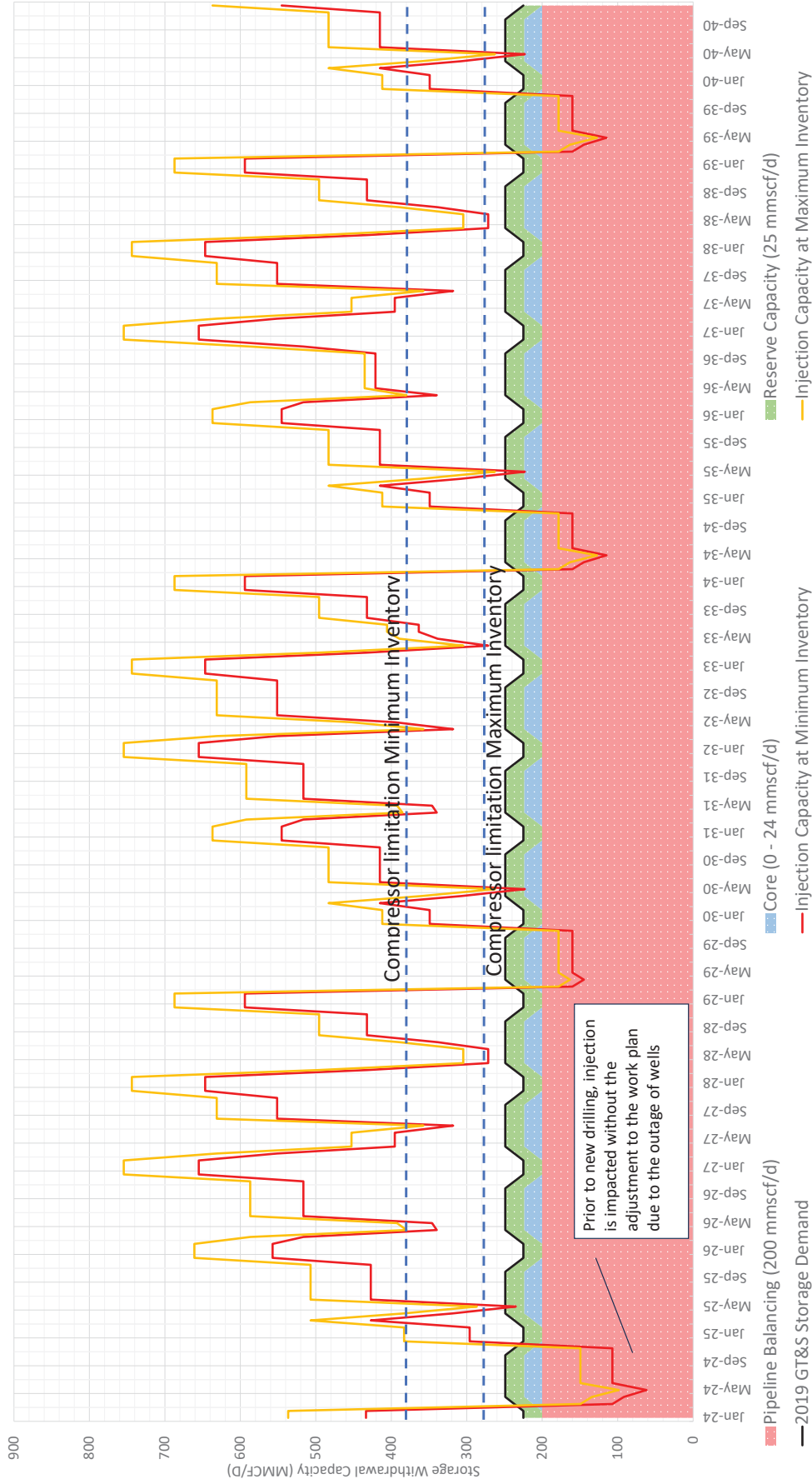
Withdrawal Capacity - 5-Year

Combined Storage Withdrawal Capacity (Max Through - End of Season/NGSS Limit) (MMCF/D)
(5-Year)



Injection Capacity - 5-Year

Combined Storage Injection Capacity (Max Through - End of Season/NGSS Limit) (MMCF/D)
(5-Year)



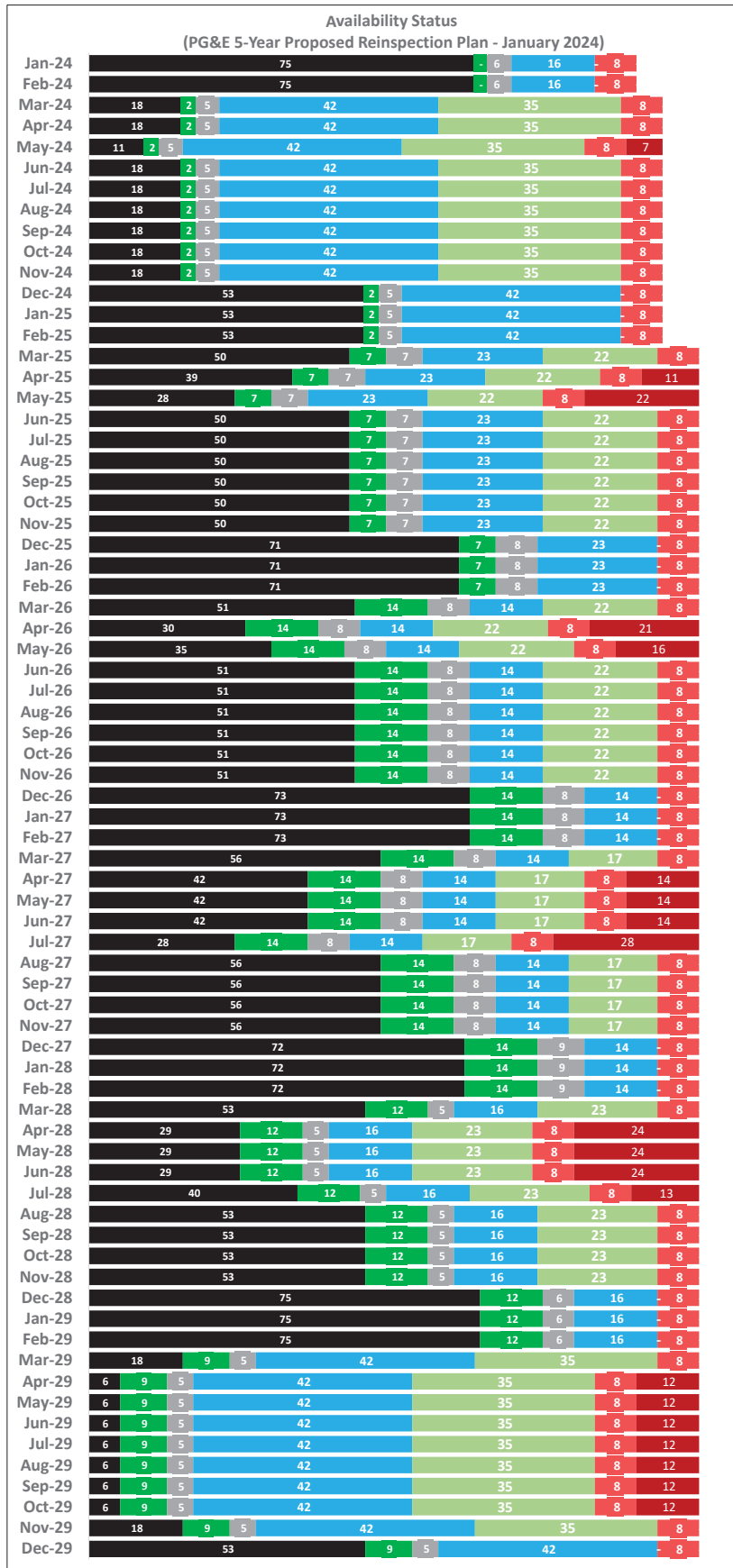
Well Availability Count

5-Year

(PG&E-15)

Legend

	Available
	Observation Wells
	Well Inspection
	Adjacent Well Outage
	New Drilling/Inspection
	Pending Abandonment
	Platform



Minimum Inventory Withdrawal Key

	Well Being Reworked with a Rig for Inspection
	Adjacent Well Taken Out of Service
	Well is Plugged and Abandoned
	Well Out of Service (2023 Rework, Sand Insp, SAPT)

Maximum Inventory Withdrawal Key

	Well Being Reworked with a Rig for Inspection
	Adjacent Well Taken Out of Service
	Well is Plugged and Abandoned
	Well Out of Service (2023 Rework, Sand Insp, SAPT)

Minimum Inventory Injection Key

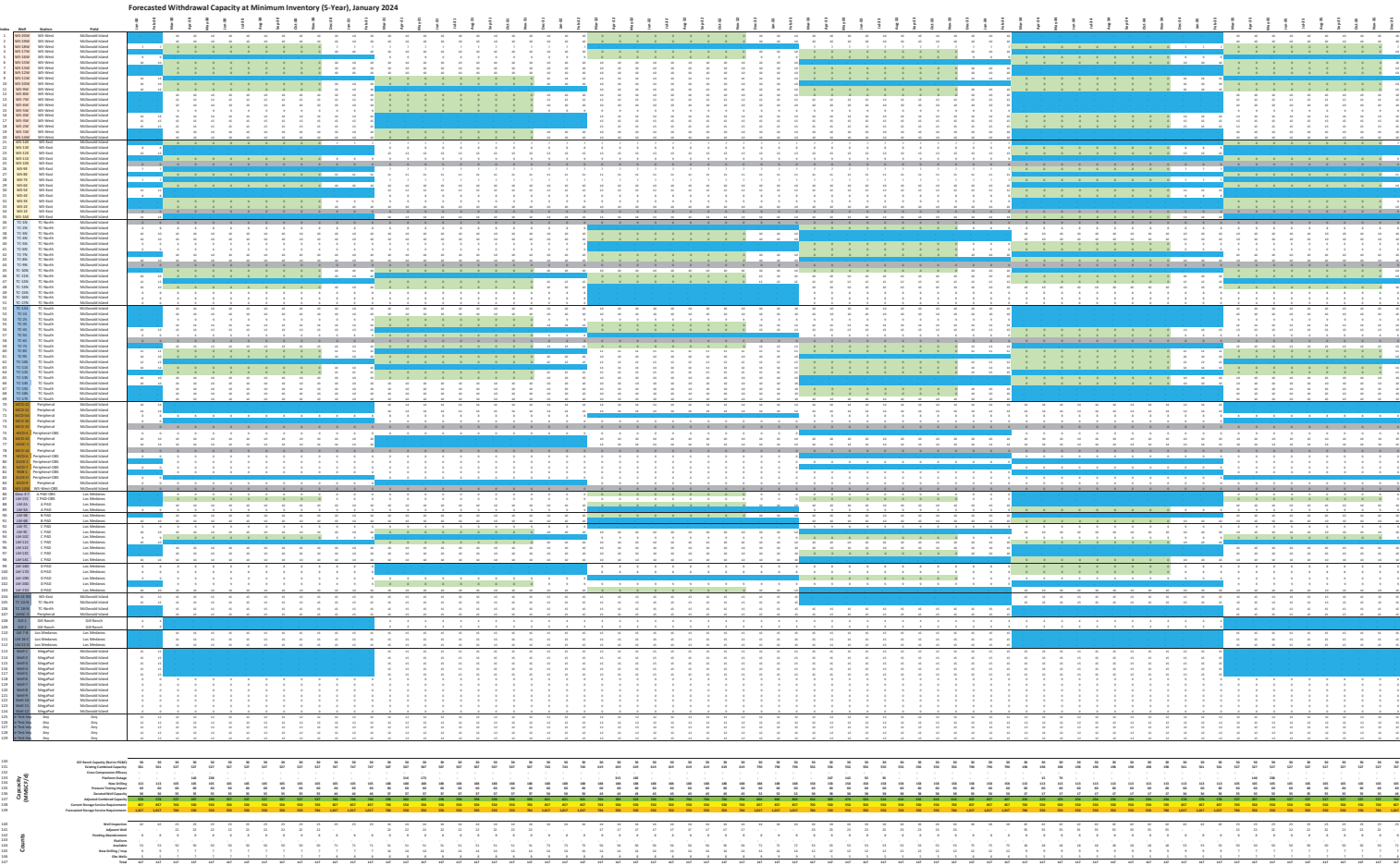
	Well Being Reworked with a Rig for Inspection
	Adjacent Well Taken Out of Service
	Well is Plugged and Abandoned
	Well Out of Service (2023 Rework, Sand Insp, SAPT)

Maximum Inventory Injection Key

	Well Being Reworked with a Rig for Inspection
	Adjacent Well Taken Out of Service
	Well is Plugged and Abandoned
	Well Out of Service (2023 Rework, Sand Insp, SAPT)

Forecasted Withdrawal Capacity at Minimum Inventory (5-Year), January 2024

[illegible]



Forecasted Withdrawal Capacity at Minimum Inventory (5-Year), January 2024

Forecasted Withdrawal Capacity at Minimum Inventory (5-Year), January 2024									
Year	Month	Year	Month	Year	Month	Year	Month	Year	Month
2023	Jan	2023	Feb	2023	Mar	2023	Apr	2023	May
2023	Jun	2023	Jul	2023	Aug	2023	Sep	2023	Oct
2023	Nov	2023	Dec	2024	Jan	2024	Feb	2024	Mar
2024	Apr	2024	May	2024	Jun	2024	Jul	2024	Aug
2024	Sep	2024	Oct	2024	Nov	2024	Dec	2025	Jan
2025	Feb	2025	Mar	2025	Apr	2025	May	2025	Jun
2025	Jul	2025	Aug	2025	Sep	2025	Oct	2025	Nov
2025	Dec	2026	Jan	2026	Feb	2026	Mar	2026	Apr
2026	May	2026	Jun	2026	Jul	2026	Aug	2026	Sep
2026	Oct	2026	Nov	2026	Dec	2027	Jan	2027	Feb
2027	Mar	2027	Apr	2027	May	2027	Jun	2027	Jul
2027	Aug	2027	Sep	2027	Oct	2027	Nov	2027	Dec
2028	Jan	2028	Feb	2028	Mar	2028	Apr	2028	May
2028	Jun	2028	Jul	2028	Aug	2028	Sep	2028	Oct
2028	Nov	2028	Dec	2029	Jan	2029	Feb	2029	Mar
2029	Apr	2029	May	2029	Jun	2029	Jul	2029	Aug
2029	Sep	2029	Oct	2029	Nov	2029	Dec	2030	Jan
2030	Feb	2030	Mar	2030	Apr	2030	May	2030	Jun
2030	Jul	2030	Aug	2030	Sep	2030	Oct	2030	Nov
2030	Dec	2031	Jan	2031	Feb	2031	Mar	2031	Apr
2031	May	2031	Jun	2031	Jul	2031	Aug	2031	Sep
2031	Oct	2031	Nov	2031	Dec	2032	Jan	2032	Feb
2032	Mar	2032	Apr	2032	May	2032	Jun	2032	Jul
2032	Aug	2032	Sep	2032	Oct	2032	Nov	2032	Dec
2033	Jan	2033	Feb	2033	Mar	2033	Apr	2033	May
2033	Jun	2033	Jul	2033	Aug	2033	Sep	2033	Oct
2033	Nov	2033	Dec	2034	Jan				

Capacity (MW)/%									
Capacity (MW)	Capacity (%)	Capacity (MW)	Capacity (%)	Capacity (MW)	Capacity (%)	Capacity (MW)	Capacity (%)	Capacity (MW)	Capacity (%)
1000	100	1000	100	1000	100	1000	100	1000	100
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1000	100	1000	100	1000	100	1000	100	1000	100
1									

Forecasted Withdrawal Capacity at Maximum Inventory (5-Year), January 2024

Asset	Asset Name	Asset Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430	1431	1432	1433	1434	1435	1436	1437	1438	1439	1440	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	1459	1460	1461	1462	1463	1464	1465	1466	1467	1468	1469	1470	1471	1472	1473	1474	1475	1476	1477	1478	1479	1480
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Forecasted Withdrawal Capacity at Maximum Inventory (5-Year), January 2024

		Date		Type		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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		Year		Category		2020		2021		2022		2023		2024		2025		2026		2027		2028		2029		2030		2031		2032		2033		2034		2035		2036		2037		2038		2039		2040		2041		2042		2043		2044		2045		2046		2047		2048		2049		2050		2051		2052		2053																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

Forecasted Injection Capacity at Minimum Inventory (5-Year), January 2024



Forecasted Injection Capacity at Minimum Inventory (5-Year), January 2024



Forecasted Injection Capacity at Minimum Inventory (5-Year), January 2024

[illegible]

Forecasted Injection Capacity at Maximum Inventory (5-Year), January 2024

Well	Section	State	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	121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Forecasted Injection Capacity at Maximum Inventory (5-Year), January 2024

[illegible]

Forecasted Injection Capacity at Maximum Inventory (5-Year), January 2024



(PG&E-15)

From: [Redmond, Lucy](#)
To: [Hand, Jeanette](#); [Reader, Emily@DOC](#)
Cc: [courtney.smith@conservation.ca.gov](#); [Sharma, Rohit@DOC](#); [REDACTED]
Subject: RE: Additional data required
Date: Wednesday, January 31, 2024 5:39:02 PM
Attachments: [Well Availability Comparison & Forecasted Withdrawal Capacity - 5-Year.pdf](#)

Hello Jeanette and Emily,

Please see the attached for the additional views requested for Scenario 2 (5-year Reinspection Cycle).

Please let me know of dates that we can walk through the details of the plan with you.

Thanks,
 Lucy Redmond
 925-453-9276

From: Redmond, Lucy
Sent: Friday, January 19, 2024 6:43 PM
To: Hand, Jeanette <Jeanette.Hand@conservation.ca.gov>
Cc: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>;
[courtney.smith@conservation.ca.gov](#); Sharma, Rohit@DOC <Rohit.Sharma@conservation.ca.gov>;
 [REDACTED]
 [REDACTED] Redmond, Lucy <LMRI@pge.com>
Subject: RE: Additional data required

Hello Jeanette,

Please see the attached letter and submission in response to the data request, dated December 20, 2023.

We look forward to further discussions and would be happy to meet in person and walk through the data request submittal in detail given our familiarity with the operation limitations. We also reiterate our request to hear back as soon as possible regarding the proposed shift of work from the 2024 work plan as part of the proposed revisions to PG&E's Revised Implementation Plan.

Should you have any questions, please contact me at 925-453-9276.

Sincerely,

Lucy Redmond
 Director, Reservoir Engineering
 Pacific Gas and Electric Company

From: Hand, Jeanette@DOC <Jeanette.Hand@conservation.ca.gov>

(PG&E-15)

Sent: Wednesday, December 20, 2023 8:48 AM

To: Agent for Service of Process <AgentforServiceofProcess@pge.com>

Cc: Redmond, Lucy <LMRI@pge.com>; Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>

Subject: Additional data required

CAUTION: EXTERNAL SENDER!

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Hello Brian,

Please find the attached letter requiring additional data related to PG&E's proposed second round MIT schedule. Please reach out to me if you have any question about this communication.

Thank you,

Jeanette (McCracken) Hand, P.G.

Underground Gas Storage Program Manager

Senior Oil and Gas Engineer

California Department of Conservation

Geologic Energy Management Division

Cell: 916-212-4890

(PG&E-15)

From: Hand, Jeanette@DOC
To: Redmond, Lucy; Reader, Emily@DOC
Subject: RE: Additional data required
Date: Thursday, February 1, 2024 8:01:36 AM

CAUTION: EXTERNAL SENDER!

This email was sent from an EXTERNAL source. Do you know this person? Are you expecting this email? Are you expecting any links or attachments? If suspicious, do not click links, open attachments, or provide credentials. Don't delete it. **Report it by using the "Report Phish" button.**

Hello Lucy,

Thank you for your additional submission. My team has began their review of the data submitted on the 19th. Can PG&E please share the Excel versions of their tables in both submissions? It is difficult to work with the PDF versions. Please reach out to me if you have questions about this request.

Thank you,

Jeanette Hand, P.G.

Underground Gas Storage Program Supervisor

Senior Oil and Gas Engineer

California Department of Conservation

Geologic Energy Management Division

Cell: 916-212-4890

From: Redmond, Lucy

Sent: Wednesday, January 31, 2024 5:38 PM

To: Hand, Jeanette@DOC ; Reader, Emily@DOC

Cc: Smith, Courtney@DOC ; Sharma, Rohit@DOC ; [REDACTED]

Subject: RE: Additional data required

Hello Jeanette and Emily,

Please see the attached for the additional views requested for Scenario 2 (5-year Reinspection Cycle).

Please let me know of dates that we can walk through the details of the plan with you.

Thanks,

Lucy Redmond

925-453-9276

From: Redmond, Lucy

Sent: Friday, January 19, 2024 6:43 PM

To: Hand, Jeanette <Jeanette.Hand@conservation.ca.gov>

Cc: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>;
courtney.smith@conservation.ca.gov; Sharma, Rohit@DOC <Rohit.Sharma@conservation.ca.gov>;

[REDACTED]

[REDACTED] Redmond, Lucy <LMRI@pge.com>

Subject: RE: Additional data required

Hello Jeanette,

Please see the attached letter and submission in response to the data request, dated December 20, 2023.

(PG&E-15)

We look forward to further discussions and would be happy to meet in person and walk through the data request submittal in detail given our familiarity with the operation limitations. We also reiterate our request to hear back as soon as possible regarding the proposed shift of work from the 2024 work plan as part of the proposed revisions to PG&E's Revised Implementation Plan.

Should you have any questions, please contact me at 925-453-9276.

Sincerely,

Lucy Redmond

Director, Reservoir Engineering

Pacific Gas and Electric Company

From: Hand, Jeanette@DOC <Jeanette.Hand@conservation.ca.gov>

Sent: Wednesday, December 20, 2023 8:48 AM

To: Agent for Service of Process <AgentforServiceofProcess@pge.com>

Cc: Redmond, Lucy <LMRI@pge.com>; Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>

Subject: Additional data required

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Hello Brian,

Please find the attached letter requiring additional data related to PG&E's proposed second round MIT schedule. Please reach out to me if you have any question about this communication.

Thank you,

Jeanette (McCracken) Hand, P.G.

Underground Gas Storage Program Manager

Senior Oil and Gas Engineer

California Department of Conservation

Geologic Energy Management Division

Cell: 916-212-4890

You can read about PG&E's data privacy practices at PGE.com/privacy.

(PG&E-15)

From: [Reader, Emily@DOC](mailto:Reader,Emily@DOC)
To: [Redmond, Lucy](mailto:Redmond,Lucy)
Cc: [Hand, Jeanette@DOC](mailto:Hand,Jeanette@DOC)
Subject: RE: Proposed work Extension into 2025
Date: Monday, February 12, 2024 3:07:00 PM

Classification: Public

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Lucy:

Thank you for the quick turnaround in identifying this well for our team to evaluate. Can you help identify the risk factors/differences between the wells that cause WS 1A-W to have a higher risk score than LM 5-B? I know the information is likely in the RMP, but it might be more streamlined if you can point us in the right direction in the RMP or summarize.

I've included Jeanette as her team will be diving into the information.

Emily

From: Redmond, Lucy <LMRI@pge.com>
Sent: Friday, February 9, 2024 1:49 PM
To: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>
Subject: Proposed work Extension into 2025

Classification: Public

Emily,

Thank you for the discussion this week regarding the Division's note on LM-5B. In response, PG&E offers the following for additional consideration as an alternate well to ensure reliability is maintained.

Notes regarding decision to change well selection for 2024

Los Medanos 5-B was originally planned to complete tubing and packer conversion in 2024. However, PG&E is proposing to defer tubing and packer conversion of some 2024 wells into 2025 to ensure reliability is maintained for '24-'25 winter. Los Medanos 5-B was one of those wells chosen to push out to 2025 due to its risk score and ranking in PG&E's Underground Storage Field Well Risk Evaluation and Construction Standard Implementation Plan. Los Medanos 5-B was last

(PG&E-15)

inspected in 2013; based on the observed feature dimensions PG&E has determined the driver of metal loss to be mechanically induced in nature. See attached for well specific information.

To keep LM-5B in the in the 2024 workplan, PG&E proposes an alternate well, Whiskey Slough 1A-W, as a candidate to defer to 2025 to ensure capacity is maintained for winter '24-'25. Whiskey Slough 1A-W has a higher risk score of 639 and Los Medanos 5-B has a risk score of 424; PG&E could accommodate this swap of wells. Well specific information for WS-1AW is also attached for reference and consideration.

Additionally, regarding our discussion on well permits, we have the following list that we are requesting CEQA prioritize completion for:

Well	API	WellSTAR Form ID
TC 7-N Suppl	04-077-20225-00	470932
WS 13-W Suppl	04-077-20241-00	474919
WS 10-E Suppl	04-077-20190-00	495021
TC 15-S Suppl	04-077-20245-00	530751
LM 13-C Suppl	04-013-20299-00	529057
WS 12-W	04-077-20264-00	524136
WS 17-W	04-077-20166-00	524167

We are happy to discuss further on any of the items above. Please let me know if you have any questions.

Thank you,
Lucy

925-453-9276

You can read about PG&E's data privacy practices at [PGE.com/privacy](https://www.pge.com/privacy).

(PG&E-15)

From: [Reader, Emily@DOC](#)
To: [Redmond, Lucy](#)
Subject: RE: Proposed Work Extension
Date: Thursday, February 22, 2024 2:26:41 PM

Classification: Public

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Will do, thanks.

From: Redmond, Lucy <LMRI@pge.com>
Sent: Thursday, February 22, 2024 2:22 PM
To: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>
Subject: RE: Proposed Work Extension

Classification: Public

Emily,

Thanks for the note back; I understand timelines can be hard to predict. Please let me know if the team has any additional questions in the meantime.

Lucy

From: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>
Sent: Thursday, February 22, 2024 2:19 PM
To: Redmond, Lucy <LMRI@pge.com>
Subject: RE: Proposed Work Extension

Classification: Public

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Lucy:

(PG&E-15)

I cannot commit to a timeline, but the recommendation from the program is complete and is in review.

Emily

From: Redmond, Lucy <LMRI@pge.com>

Sent: Thursday, February 22, 2024 12:58 PM

To: Reader, Emily@DOC <Emily.Reader@conservation.ca.gov>

Subject: Proposed Work Extension

Classification: Public

Hi Emily,

I wanted to check-in and see if you had any timeline you could share as to when we might hear back from the Division on our proposed work extension for wells into 2025.

Thanks,

Lucy

925-453-9276

You can read about PG&E's data privacy practices at PGE.com/privacy.

PG&E / CalGEM Leadership Meeting

AppA-311

February 29, 2024
McDonald Island

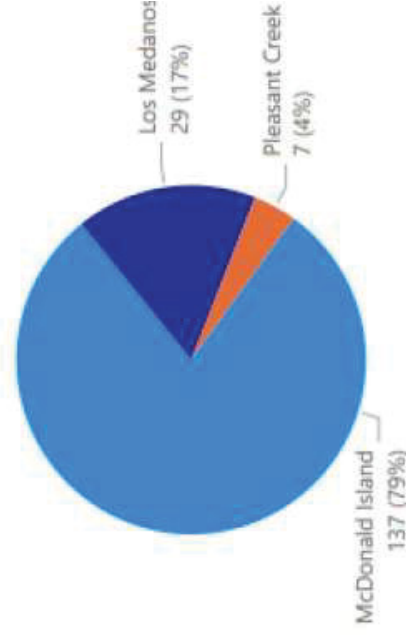
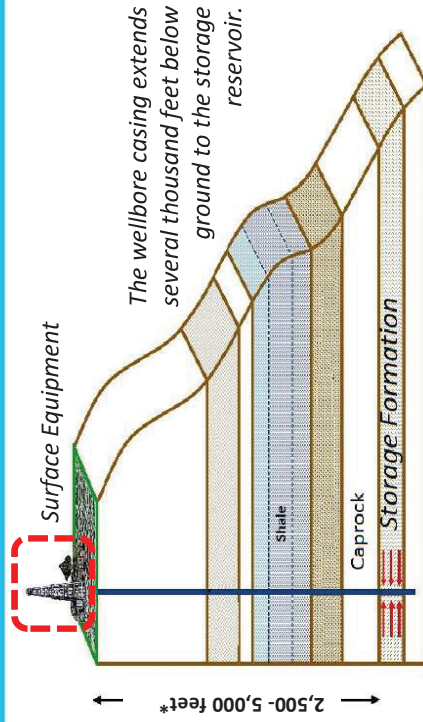
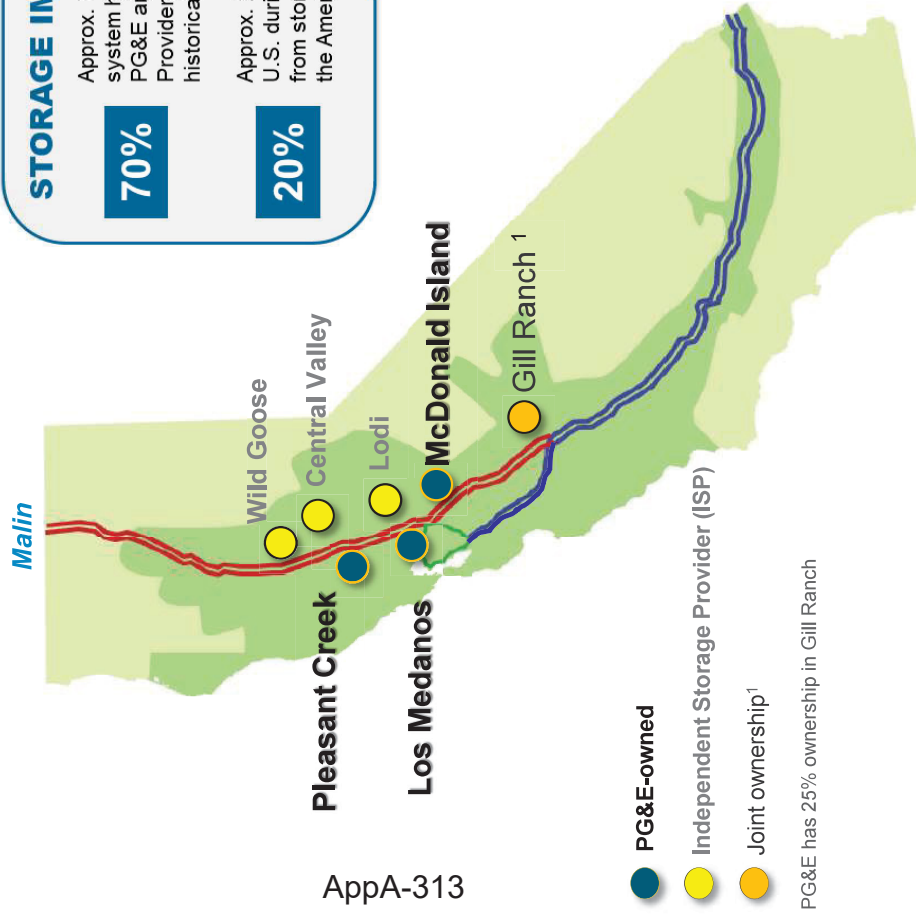


Together, Building
a Better California

(PG&E-15)

- Safety
- Introductions
- General Use of Storage
- Regulatory Background
- Plan for 2024 and Beyond
- Field Tour

Gas Storage Landscape in Northern California



(PG&E-15)

Total Inventory by PG&E Facility (173 BCF)

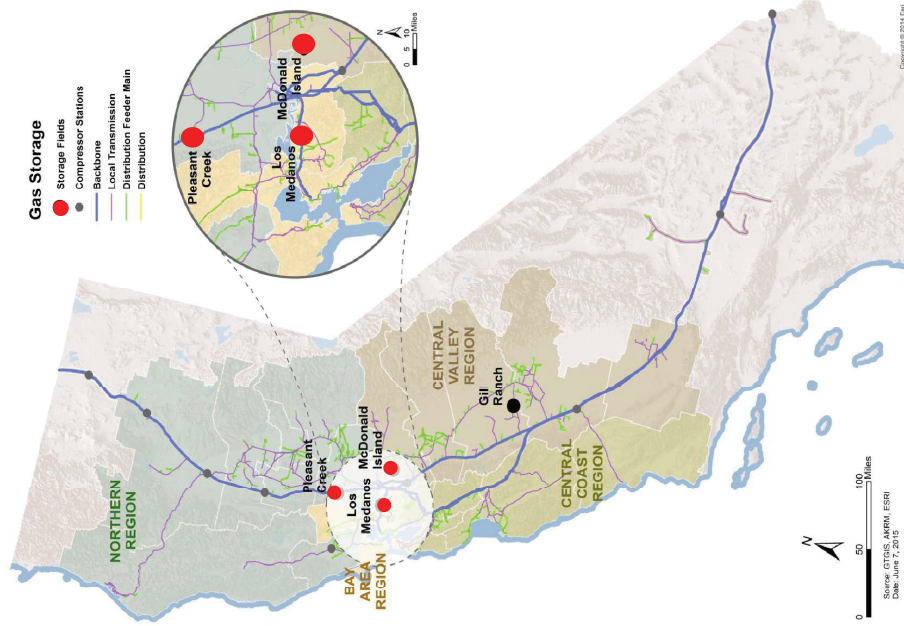
¹ PG&E has 25% ownership in Gill Ranch

PG&E's Gas Storage Assets

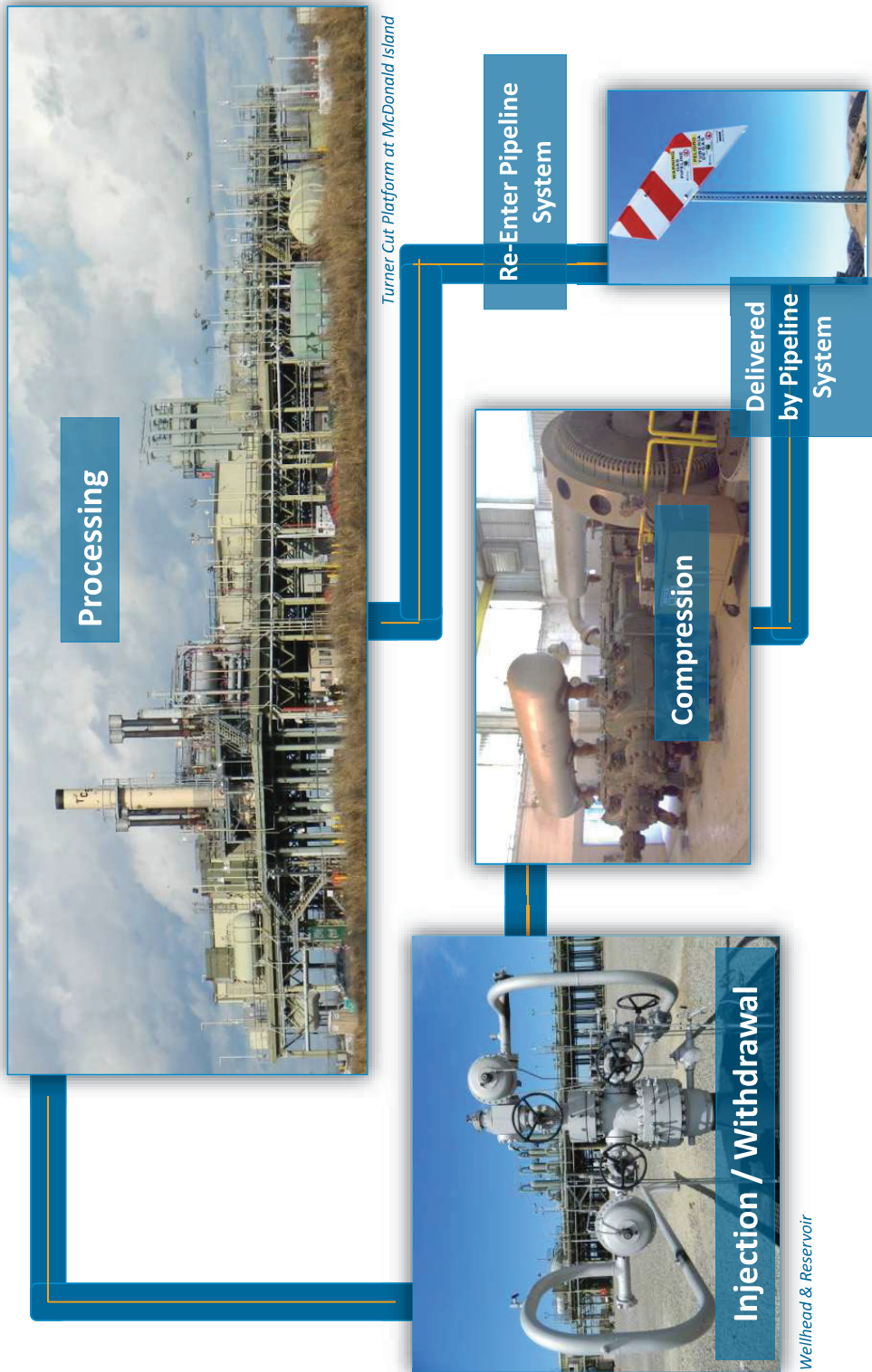
GRC-2027-PH_DR_TURN_032-Q004Supp01A1ch16

PG&E Storage Facilities (McDonald Island, Los Medanos, Pleasant Creek)		
ASSET		QUANTITY
Storage Wells		104
Transmission Pipe (miles)**		14
Downhole Safety Valves		81
Uphole Safety Valves		135
Well Meters		171
Storage Reservoirs (acres)		3,404
Storage Working Gas Capacity (bcf)		51

** Includes 2.5 miles in High Consequence Areas (HCAs)

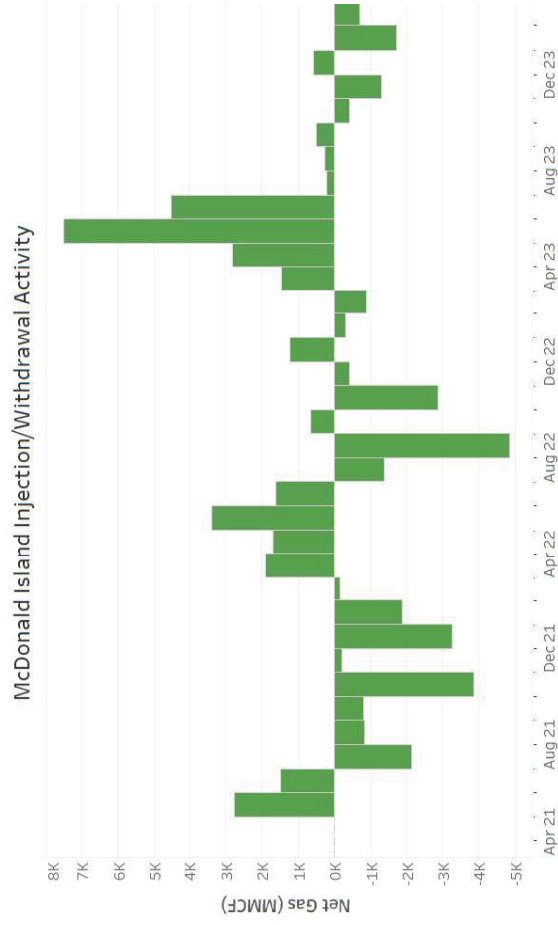
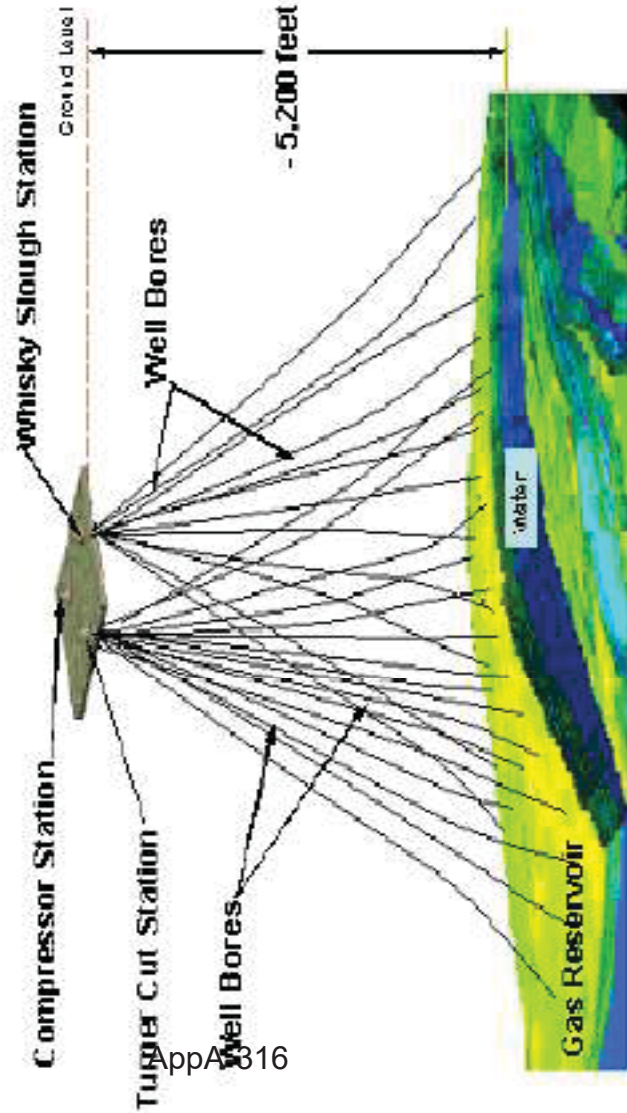


Storage Overview



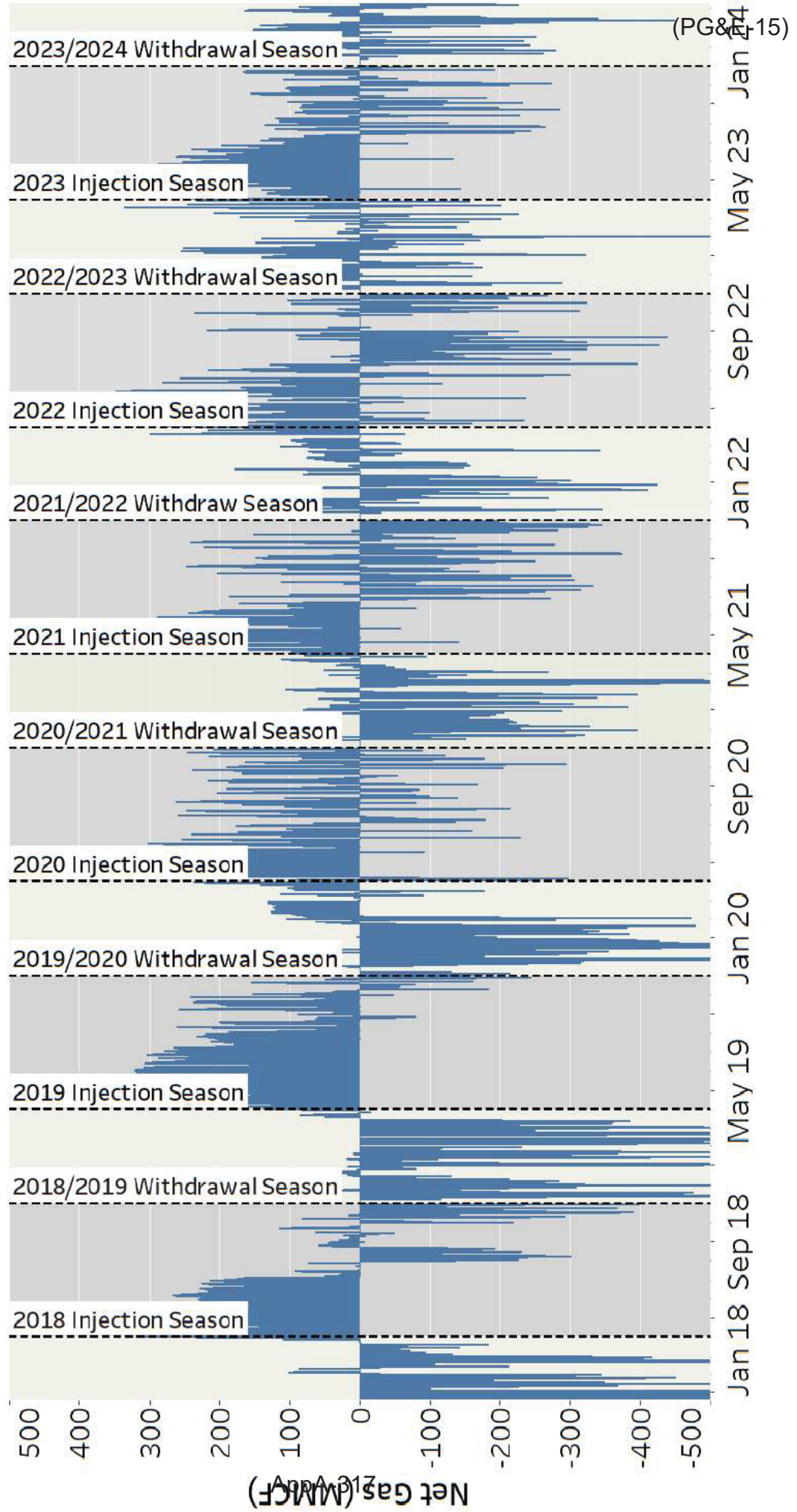
McDonald Island Injection and Withdrawal

McDonald Island Gas Storage Field



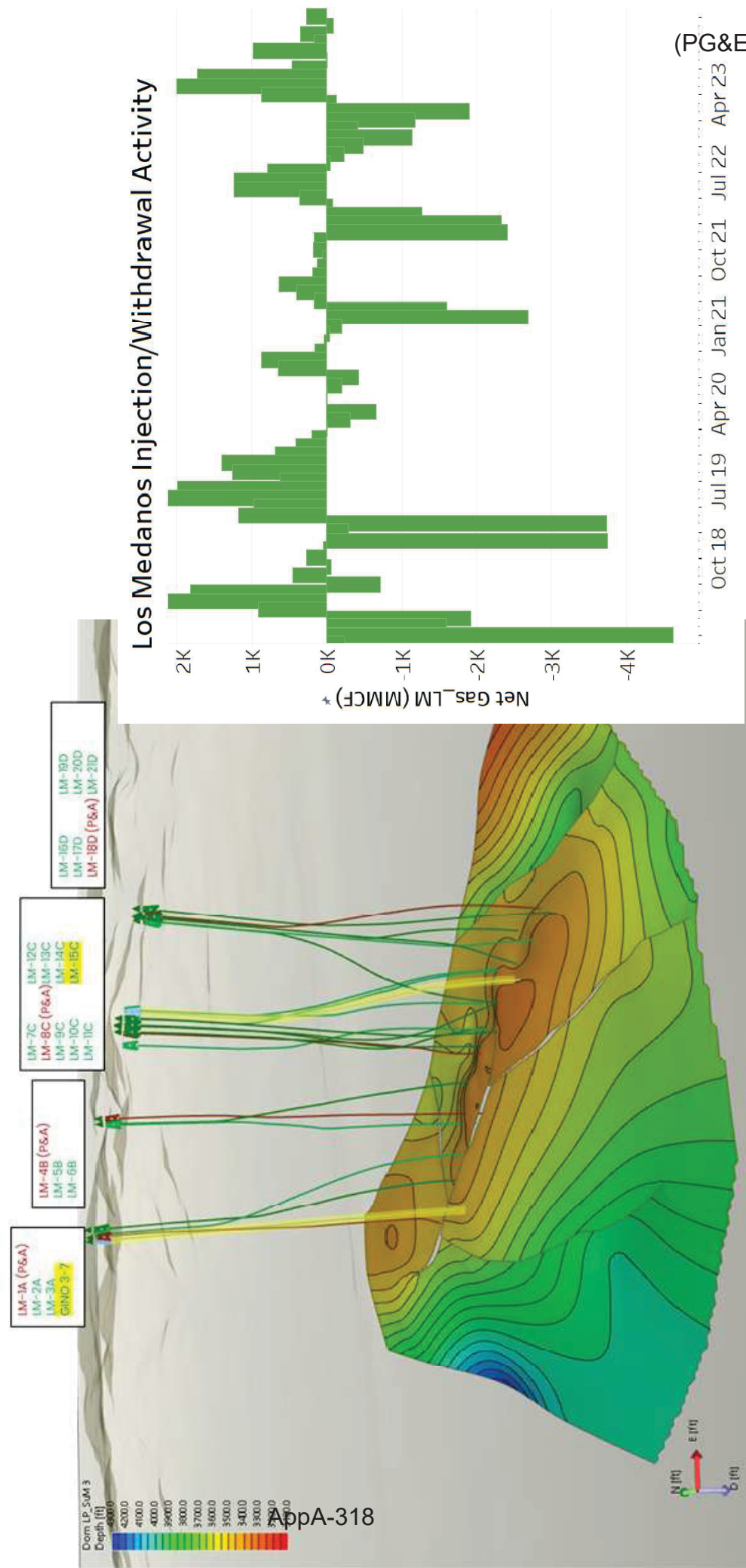


McDonald Island Injection and Withdrawal



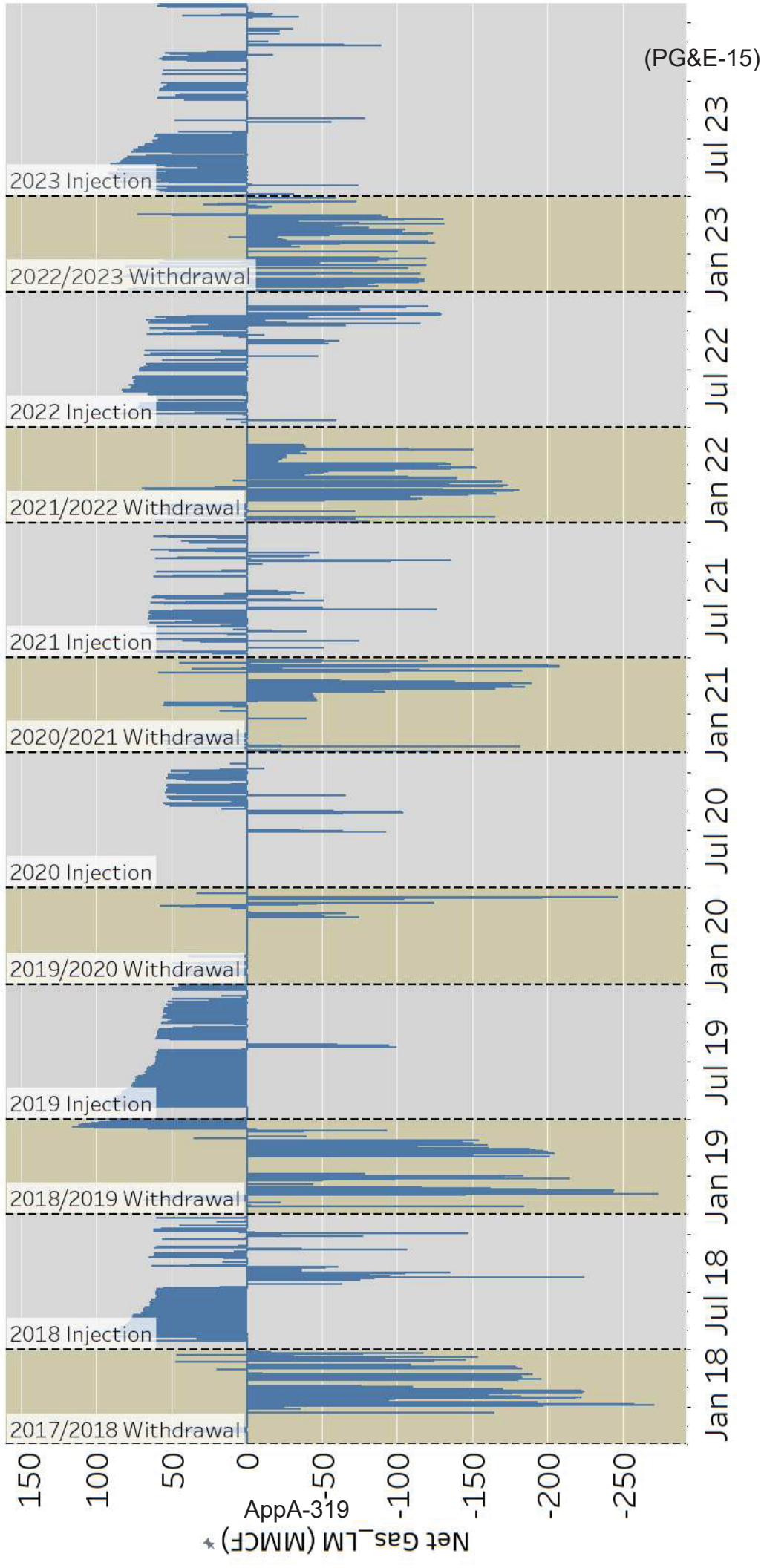


Los Medanos Injection and Withdrawal



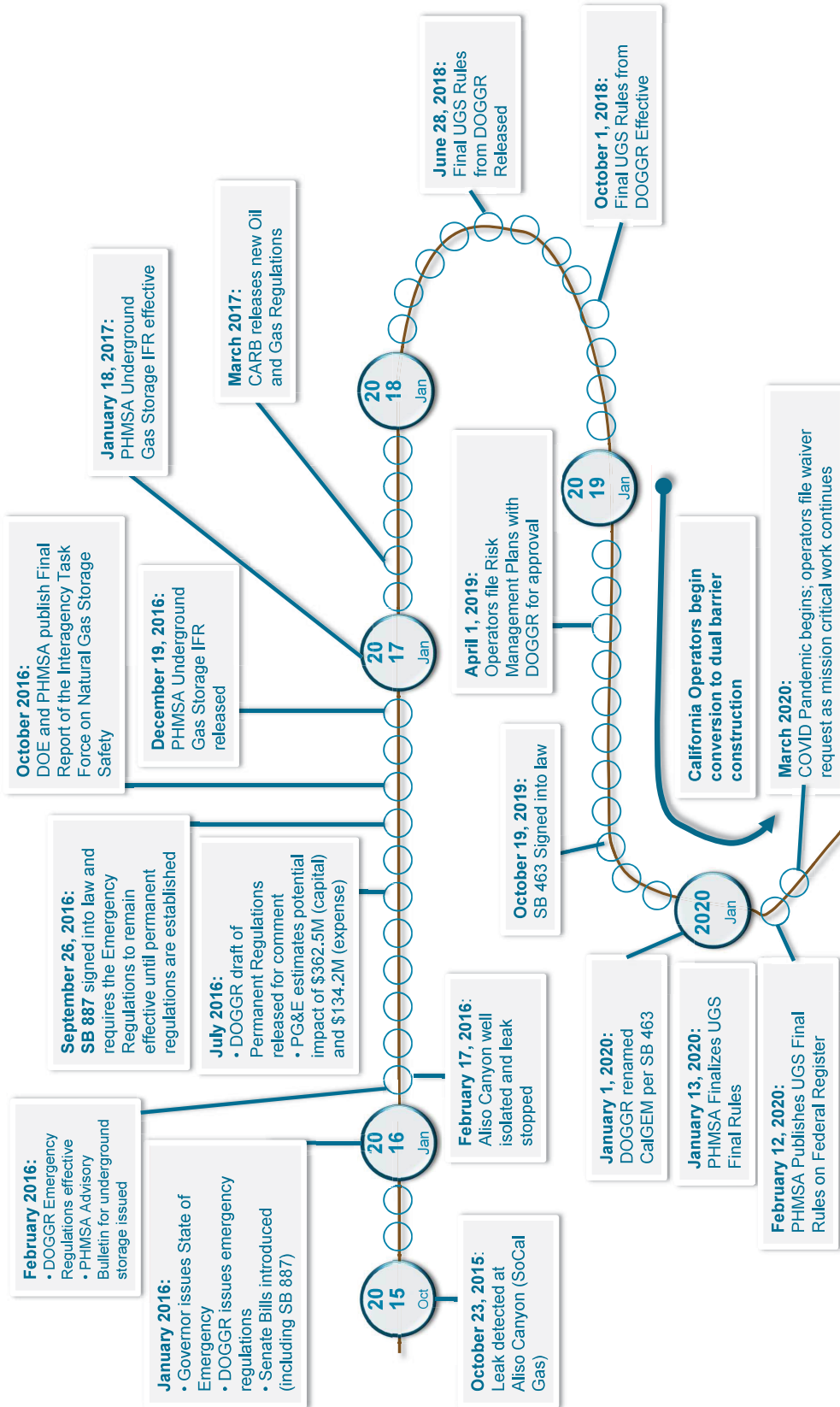


Los Medanos Injection and Withdrawal



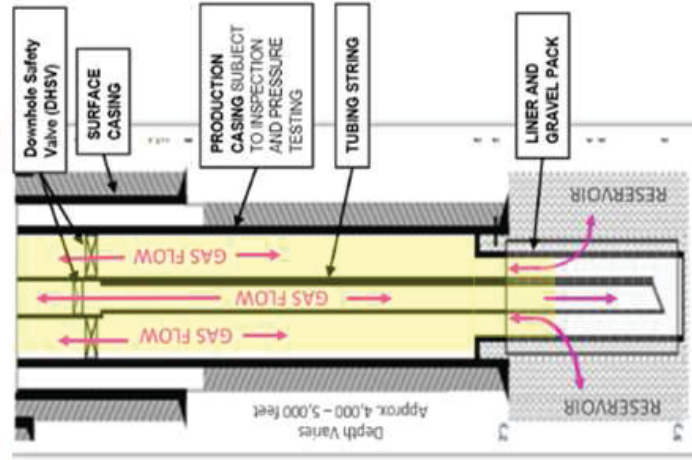
Background - Underground Gas Storage Regulation and Legislation Timeline

GRC-2027-PH_DR_TURN_032-Q004Supp01Atch16

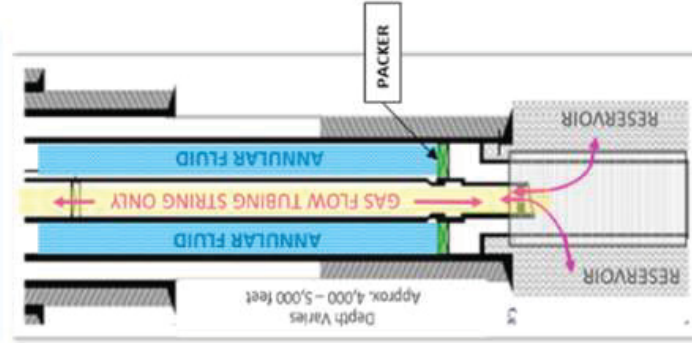


Implementing Well Construction Requirements

Historic Well Construction



Converted/Retrofit Well Construction



Well construction requirements reduce individual well capacity by restricting the flow area (highlighted in yellow).

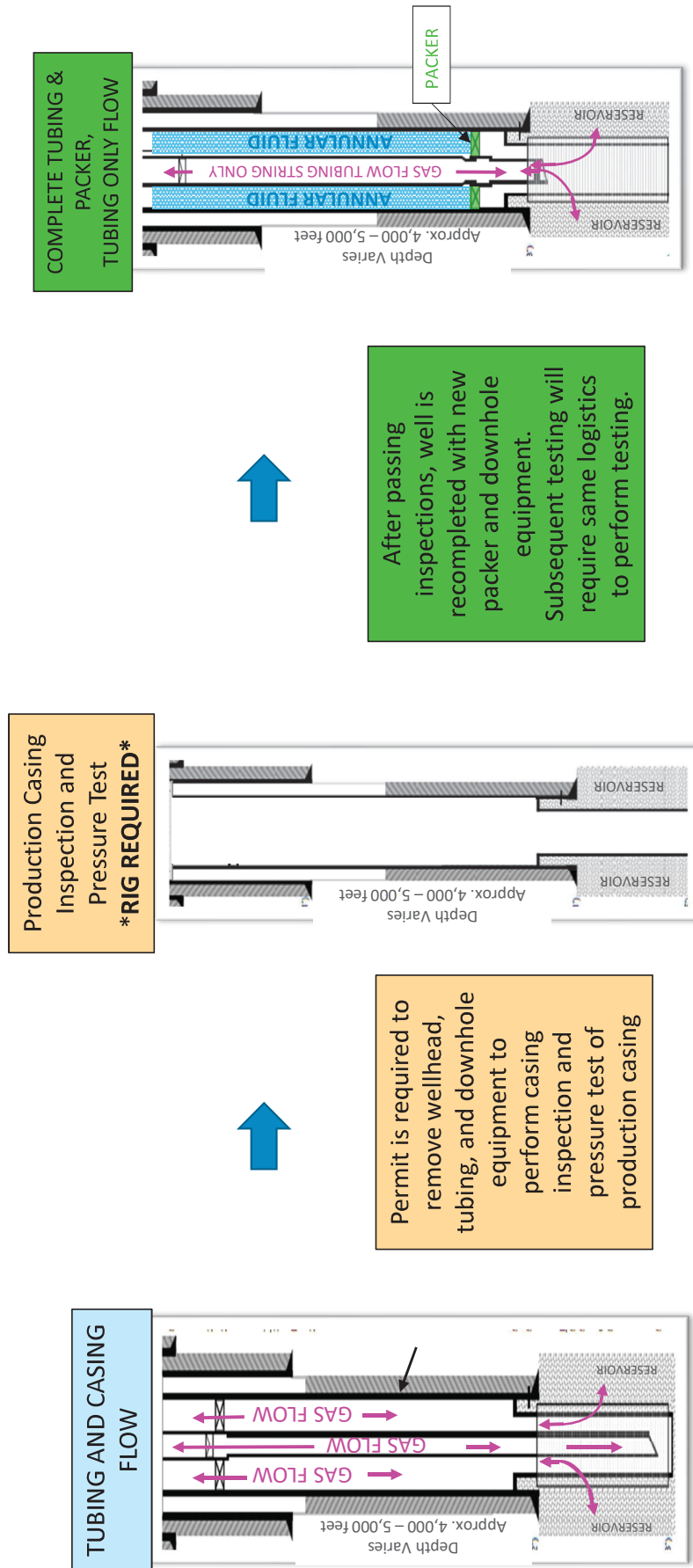
Well Construction Requirements:

- Well withdrawal capacity **is and will continue to be impacted** by CalGEM regulations.
 - Applies to all California operators.
 - Construction standard requirement of dual barrier construction conversion to be implemented 2019-2025.
 - On average PG&E sees an average 40% reduction in well capacity with conversion.
 - Loss impact has compounded year over year with phased implementation and has been amplified with adjacent well outage introduced by performing inspections.
- PG&E has maintained deliverability obligations** as the implementation and inspection frequency has been phased.

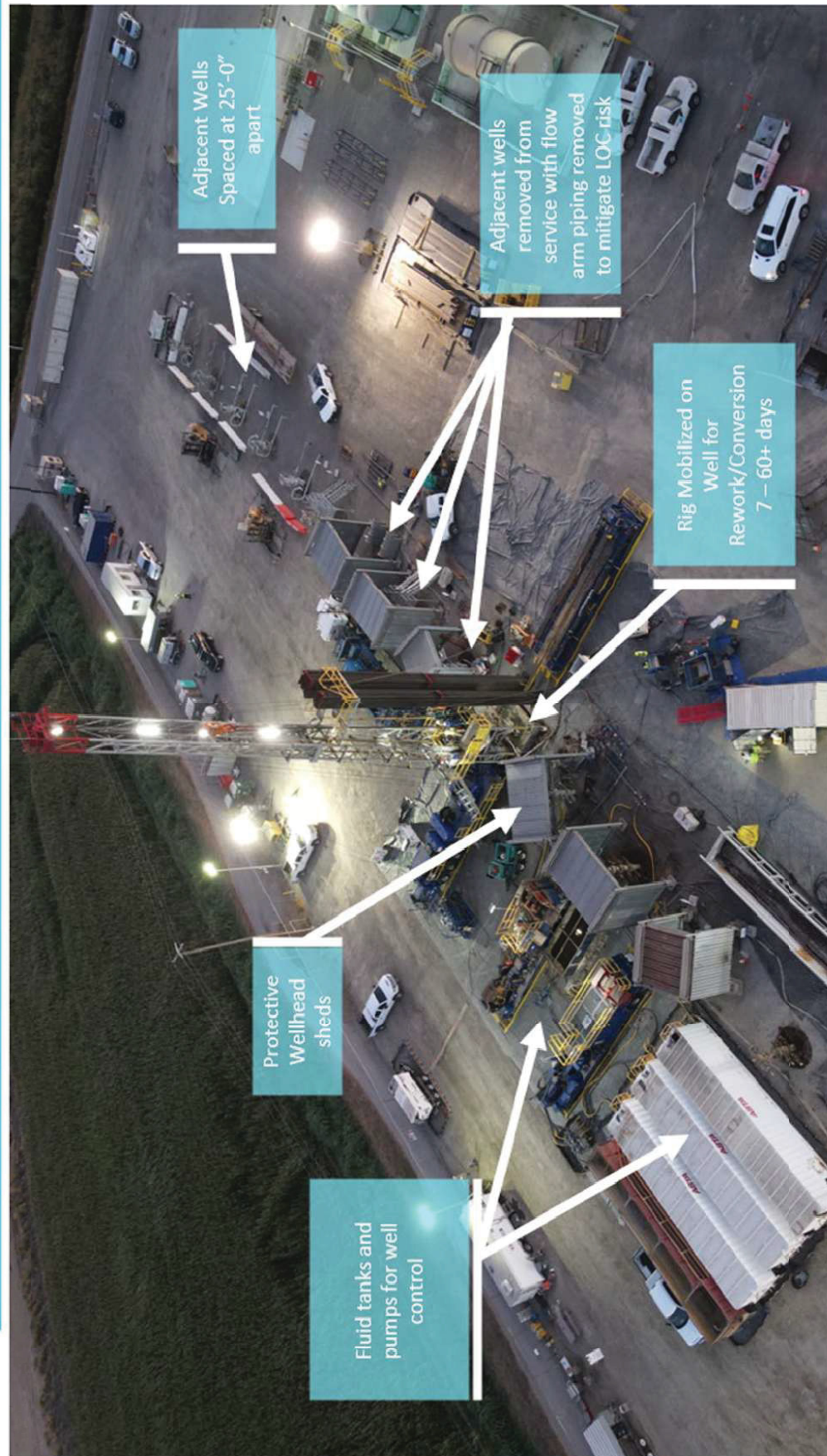
Well Construction/Inspection – Logistics for inspection

GRC-2027-PH_DR_TURN_032-Q004Supp01Atch16

(PG&E-15)

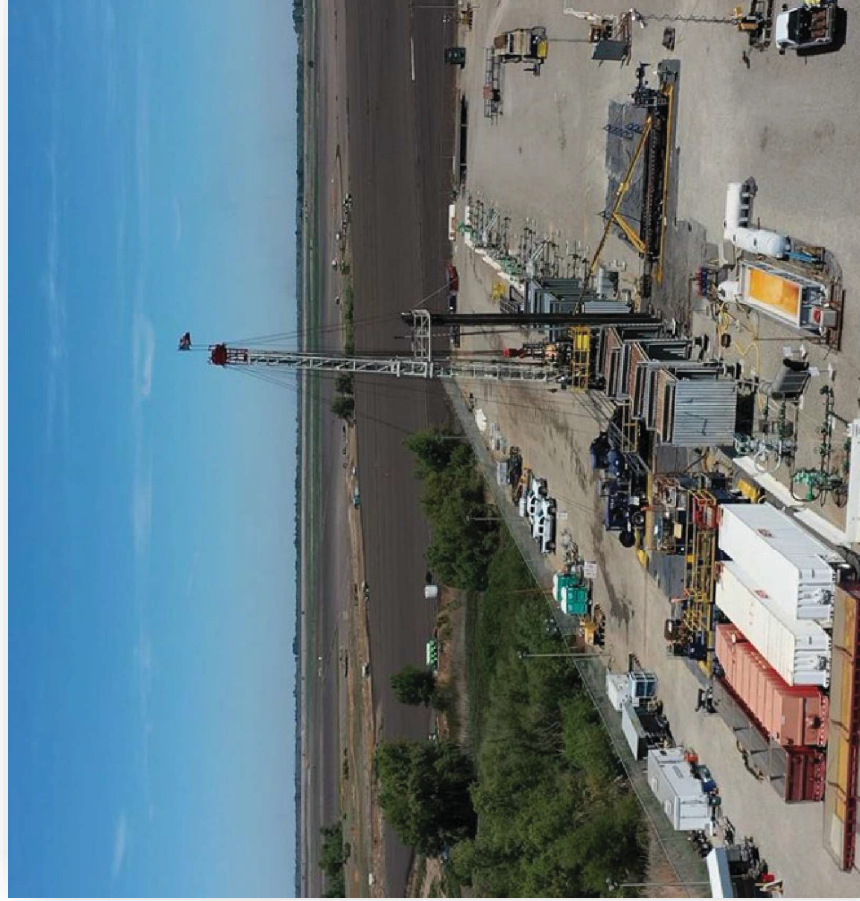


Rig Footprint at McDonald Island



Rig Footprint at McDonald Island

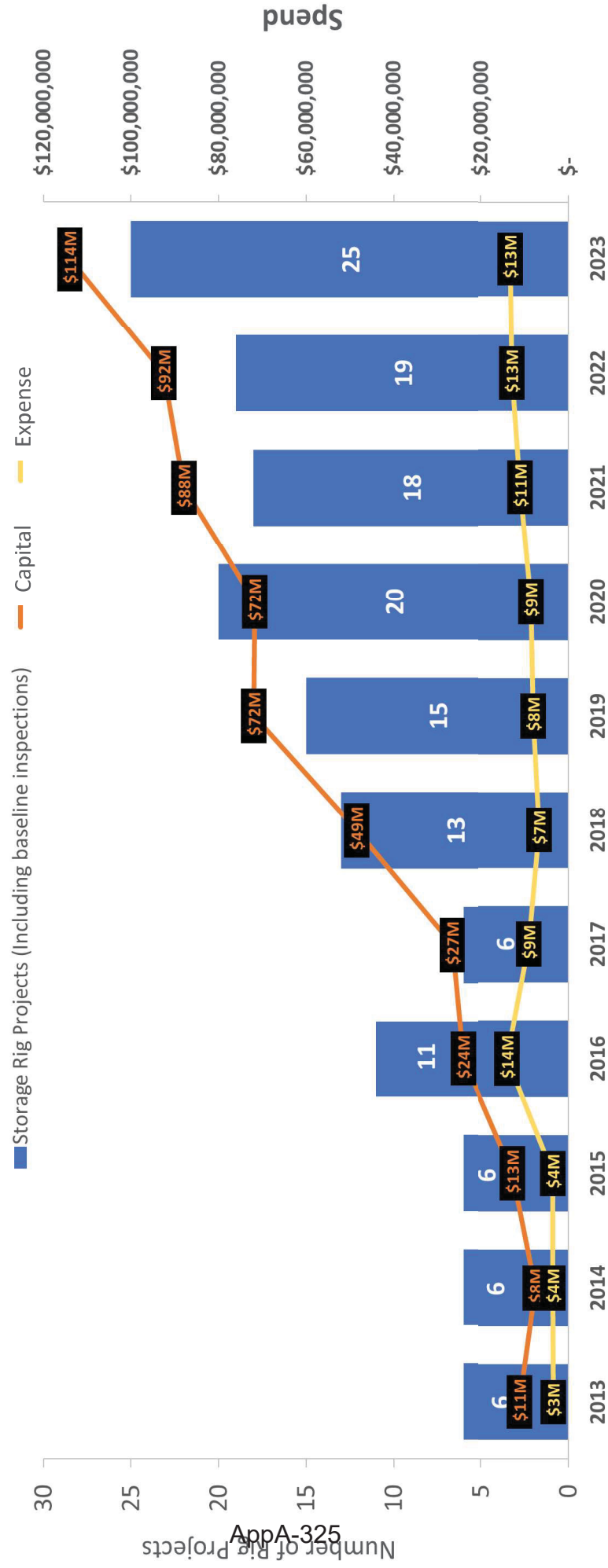
GRC-2027-PH_DR_TURN_032-Q004Supp011Atch16





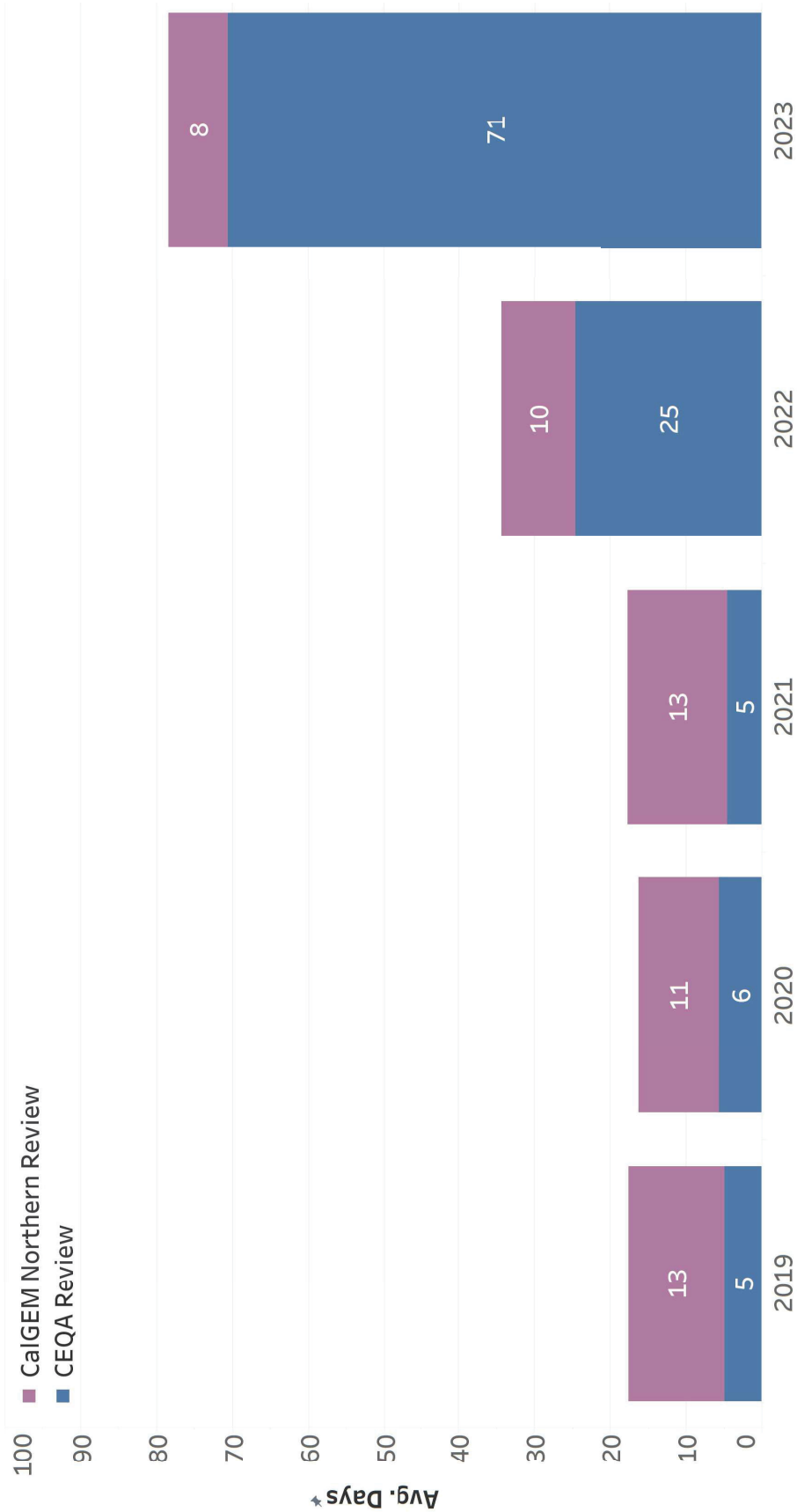
Rig Projects 2013-Current

GRC-2027-PH_DR_TURN_032-Q004Supp01A1ch16





Permitting History and Evolution



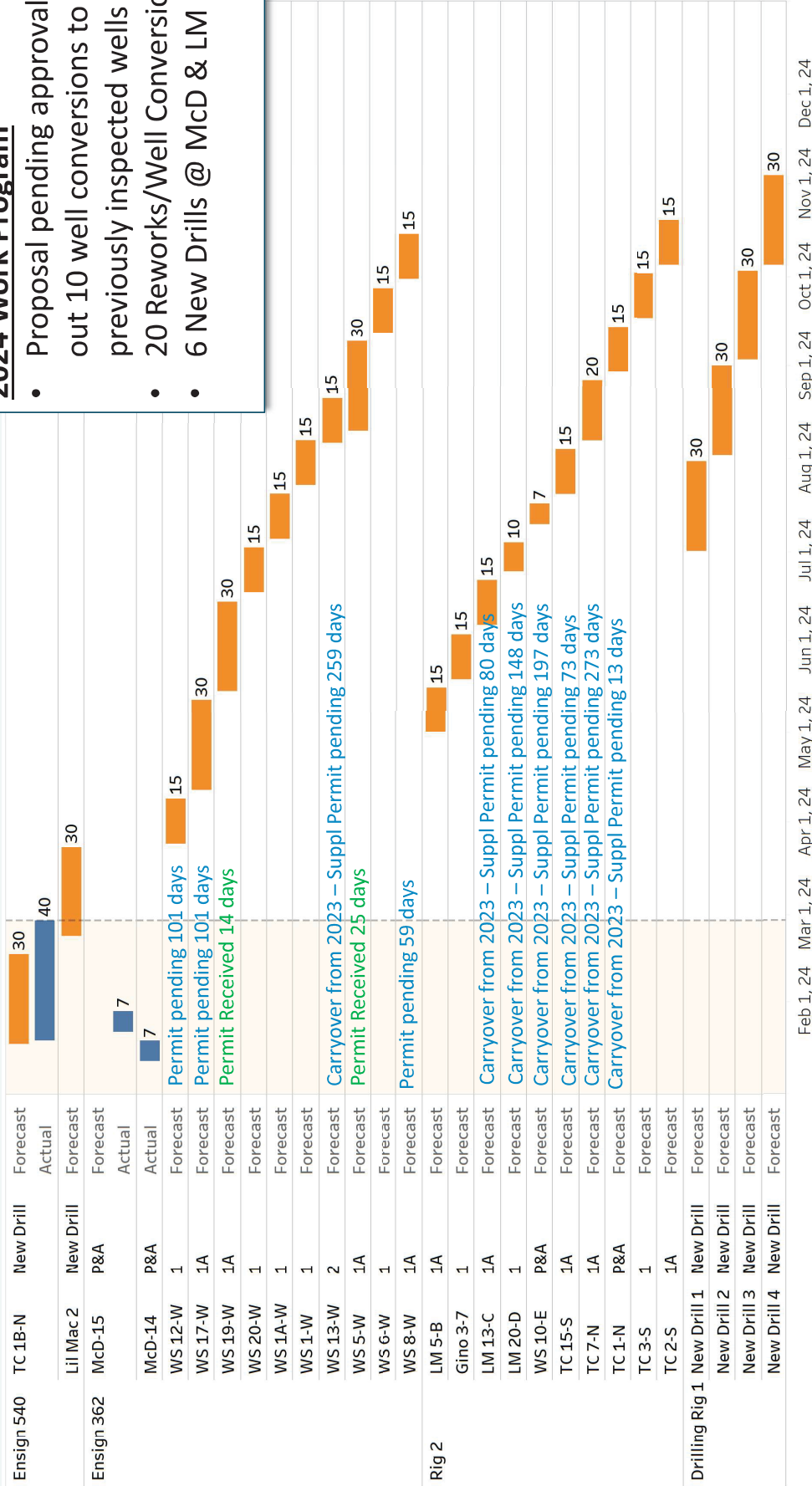


2024 Drilling and Workover Program

GRC-2027-PH1_DR_TURN_032-Q004Supp01A1ch16

2024 Work Program

- Proposal pending approval to shift out 10 well conversions to 2025 on previously inspected wells
- 20 Reworks/Well Conversions
- 6 New Drills @ McD & LM

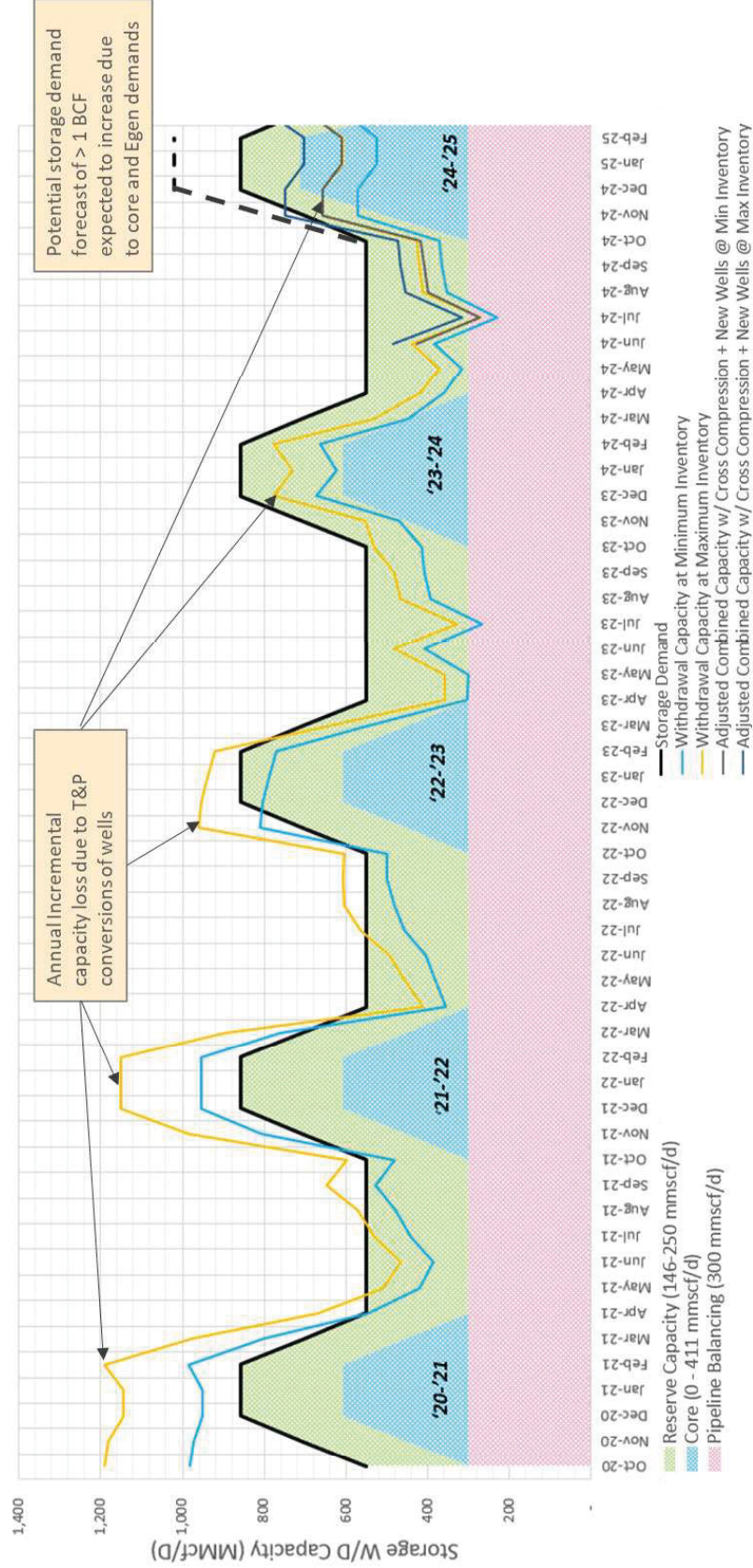


AppA-328



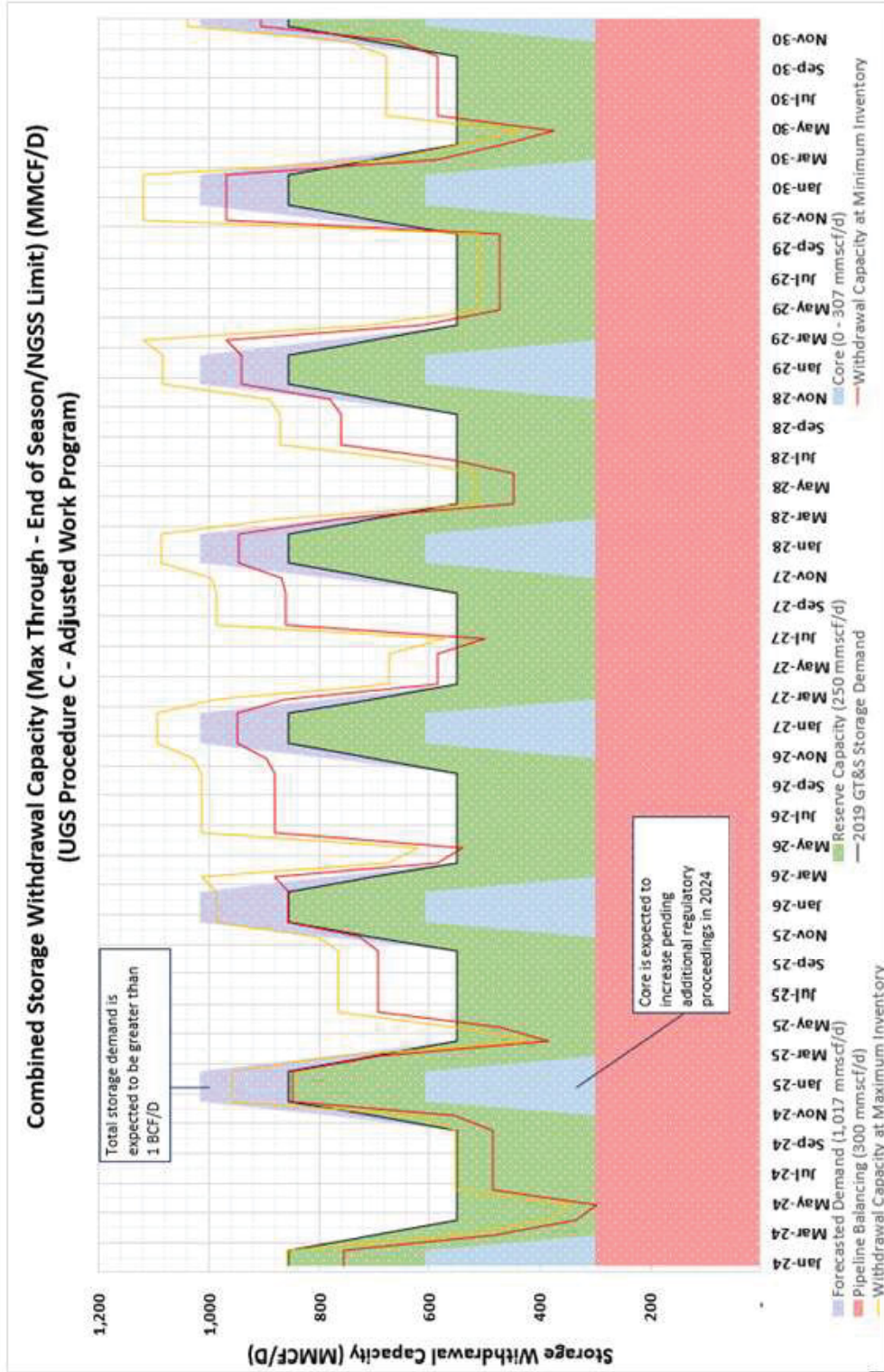
Storage Capacity

GRC-2027-PH_DR_TURN_032-Q004Supp01A1ch16

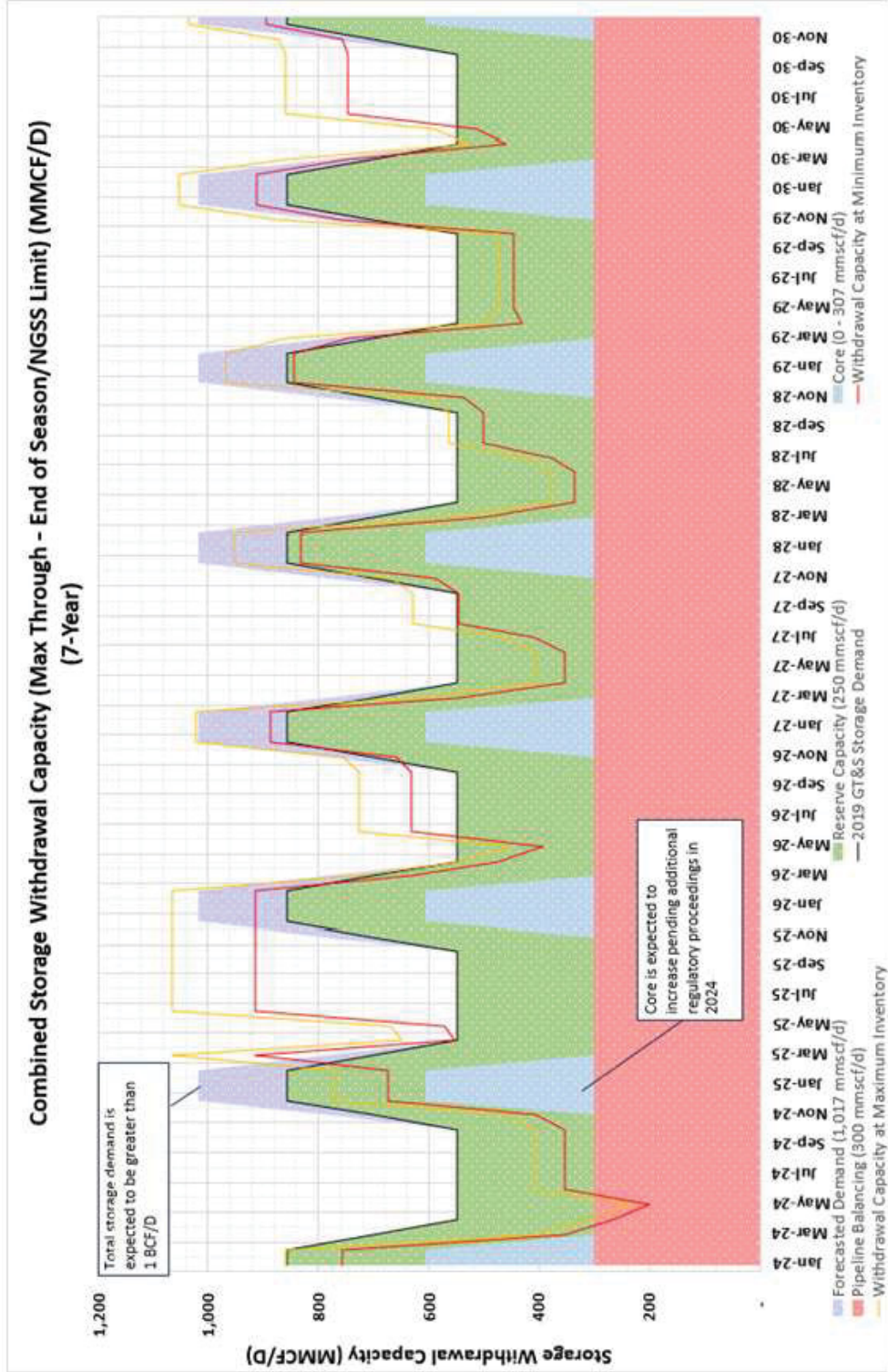


Notes:
Current forecasts are limited to EOY 2024 without reinspection plan approval.
Flowrates of recent converted wells are estimated projects and subject to flow testing.

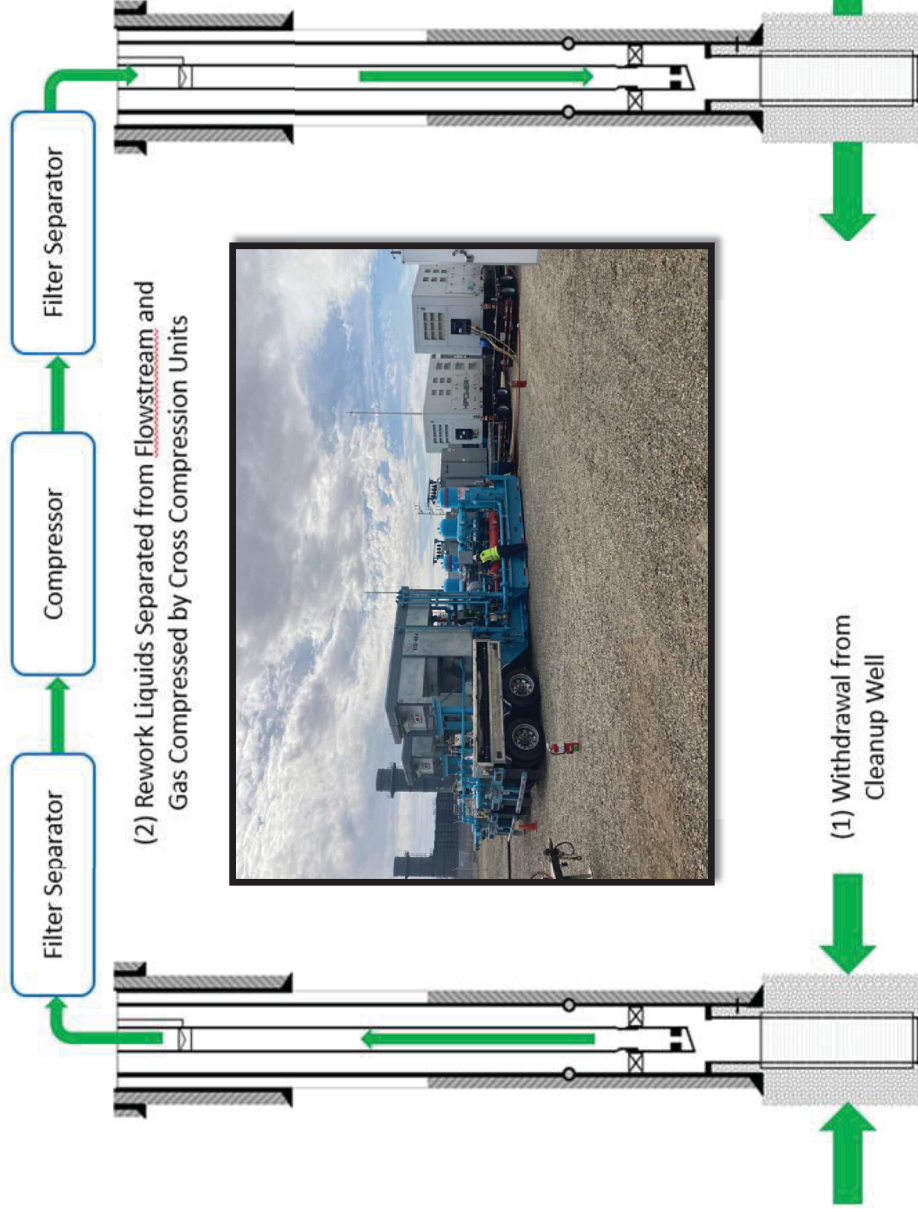
Projected Storage Capacity



Projected Storage Capacity



Cross Compression – Well Cleanup



Cross compression in storage is a new and innovative approach that allows for market independent cleanup for wells, thus reducing the number of new drills required to maintain capacity amidst T&P conversion.

Well cleanup is very important for maintaining reservoir health and well productivity.

Efficacy of cross compression is limited with increasing number of well reworks due to footprint constraints.



- Questions?
- Ready for Field Tour?

McDonald Island Overview



McDonald Island History

GRC-2027-PH_DR_TURN_032-Q004Supp01Atch16

- Largest of PG&E's three underground storage fields located ten miles west of Stockton, CA. 2nd largest in the state.
- McDonald Island is capable of 35% of Northern California's winter peak-day gas demand
- The production platforms each include ~34 wells; all are directionally drilled to minimize well interference and localize surface processing facilities
- The wells are designed for high withdrawal rates which have a total maximum wellhead deliverability of approximately 1.6 BCF/D at maximum field pressure of 2,070 psig.
- Most of the operating facilities are installed on platforms well above sea level or have been designed to operate under flooded conditions

1936
• Field Discovered in June 1936

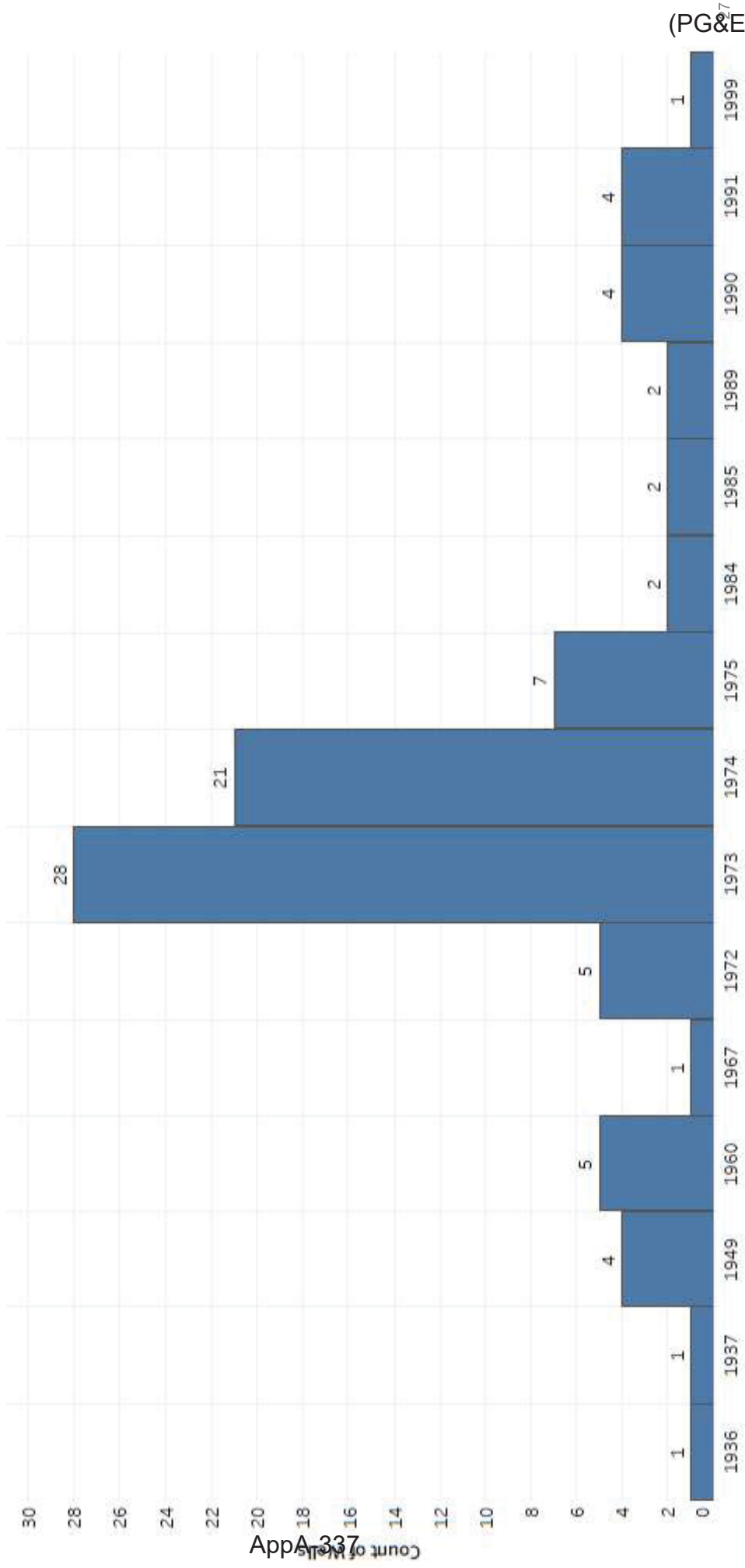
1958
• Field depleted in March 1958

1960s
• Facility constructed in early 1960s

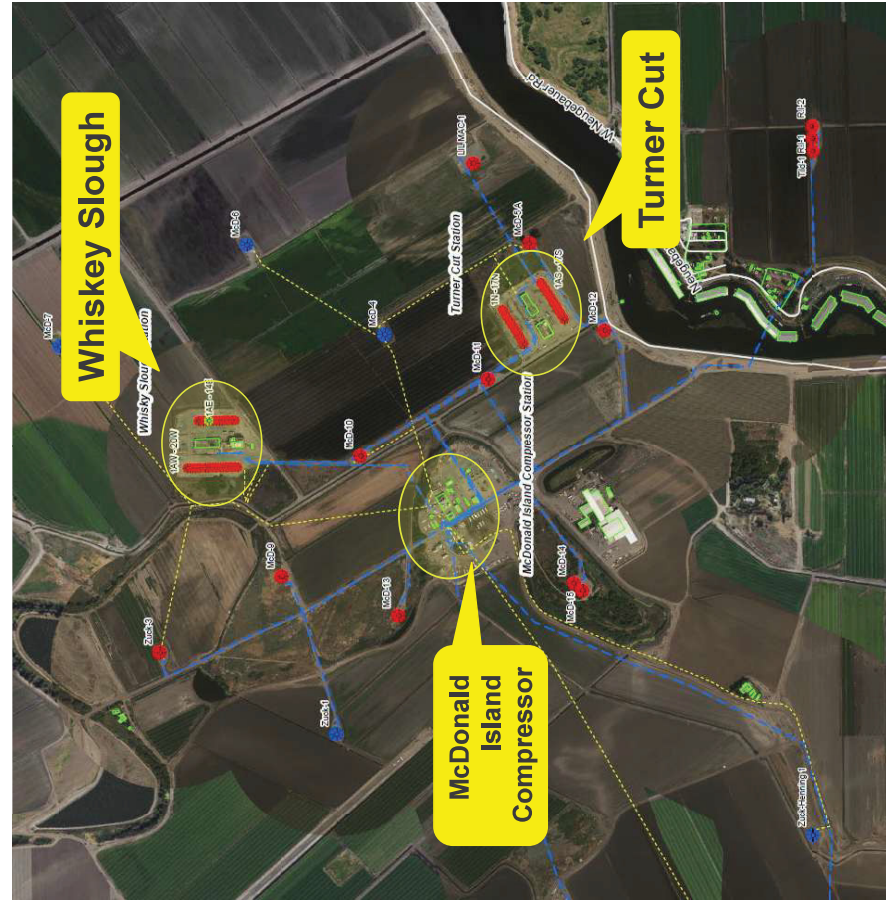
1970s
• Fully developed in 1970s



McDonald Island Well Spud Dates by Year



McDonald Island

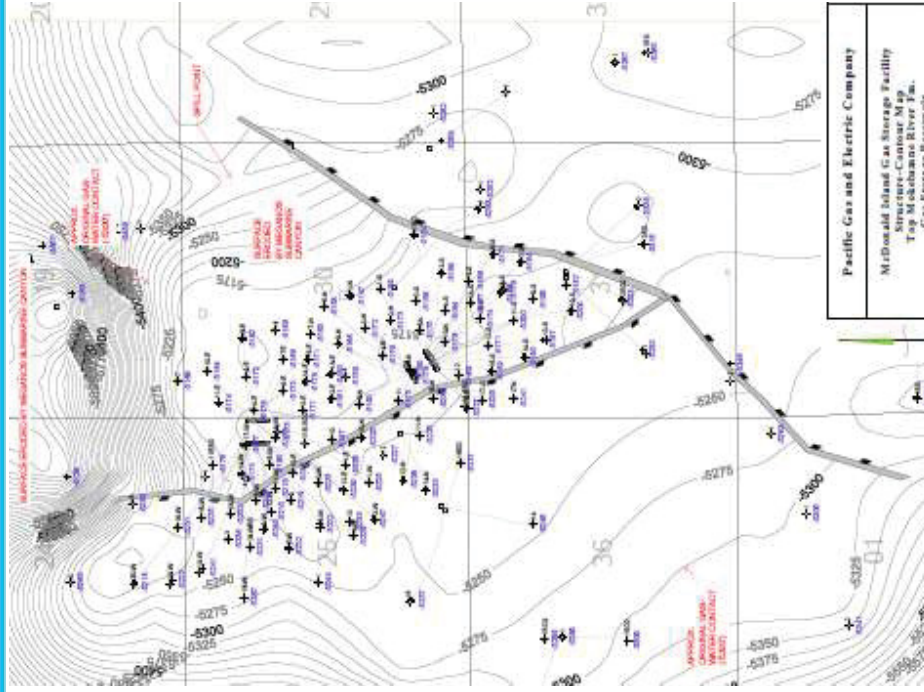


McDonald Island Stats	
Location-County	San Joaquin
Discovery Date	1936
Year Placed in Storage Service	1975
Number of Inj/WD wells	75
Number of Observation wells	7
Compressor Units	5
Compression Horsepower (bhp)	12,256
Cushion Gas (Bcf)	99.45
Working Gas (Bcf)	37.1
Total Inventory (Bcf)	136.5

McDonald Island Reservoir

GRC-2027-PH_DR_TURN_032-Q004Supp01Atch16

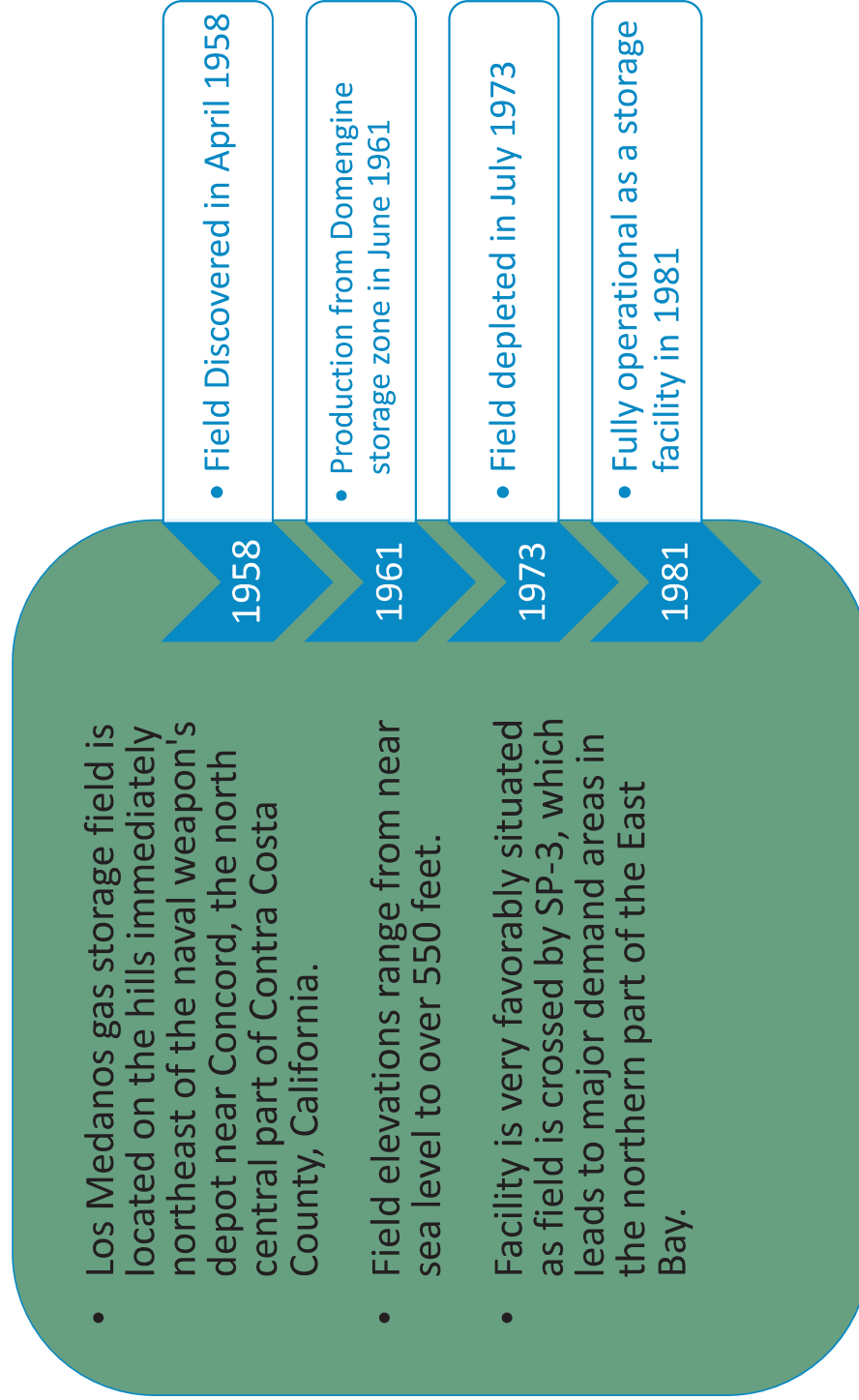
Geologic Statistics	McDonald Island
Formation	Mokelumne River
Geological Age	Late Cretaceous
Geological trapping Mechanism	Faulted Anticline
Avg. Permeability (Darcy)	1.5
Depth (feet)	5,200
Avg. Thickness (feet)	50
Areal Extent (acres)	2,760
Discovery Pressure-Wellhead (psig)	2,086
Discovery Pressure-Bottom Hole (psia)	2,365
Discovery Pressure Gradient (psia/ft)	0.455
Max Field Pressure (psig)	2,070
Facility MAOP (psig)	2,160



Los Medanos overview

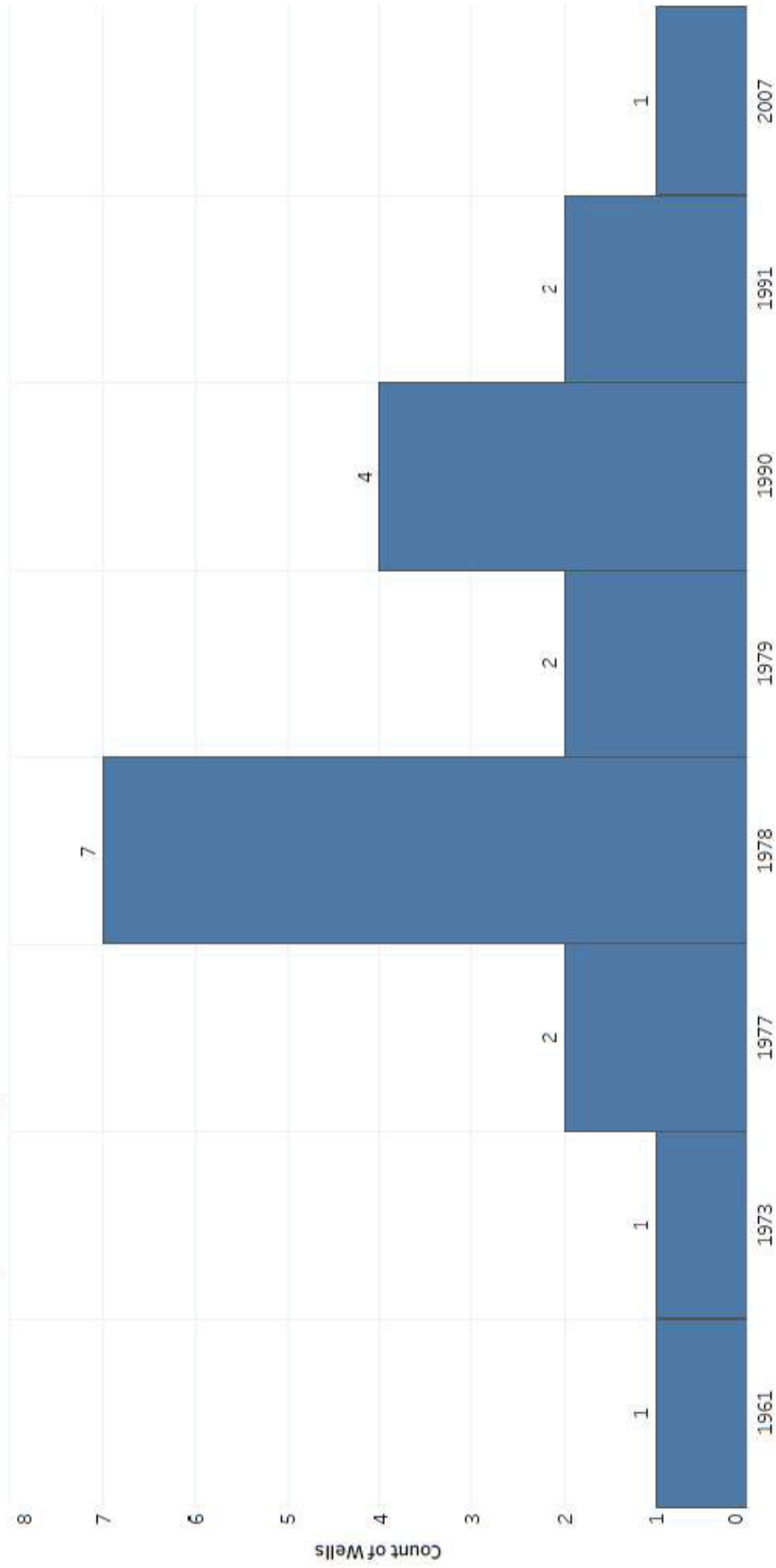


Los Medanos



Los Medanos Well Spud Dates by Year

Los Medanos - Well Spud Dates By Year



Los Medanos



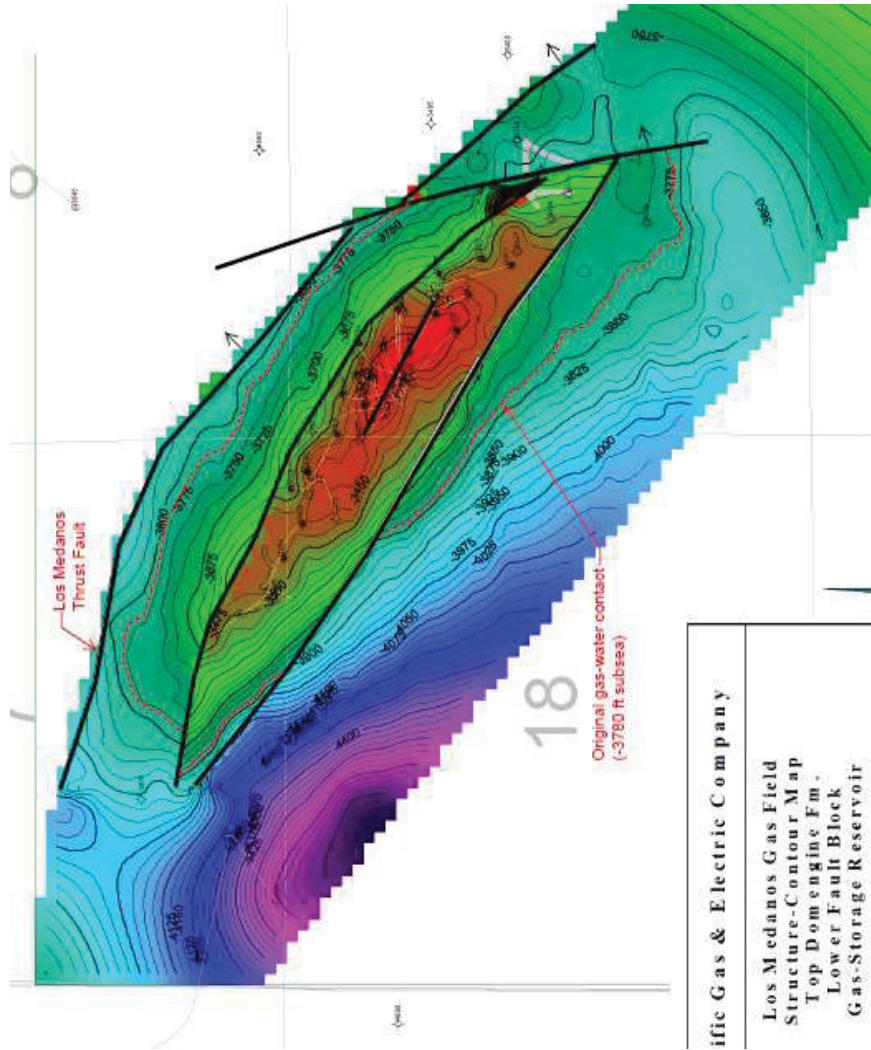
Los Medanos Stats	
Location-County	Contra Costa
Discovery Date	1958
Year Placed in Storage Service	1973
Number of Inj/WVD wells	16
Number of Observation wells	2
Compressor Units	1
Compression Horsepower (bhp)	3,733
Cushion Gas (Bcf)	17.4
Working Gas (Bcf)	11.8
Total Inventory (Bcf)	29.1

Los Medanos Reservoir

GRC-2027-PH_DR_TURN_032-Q004Supp01Atch16



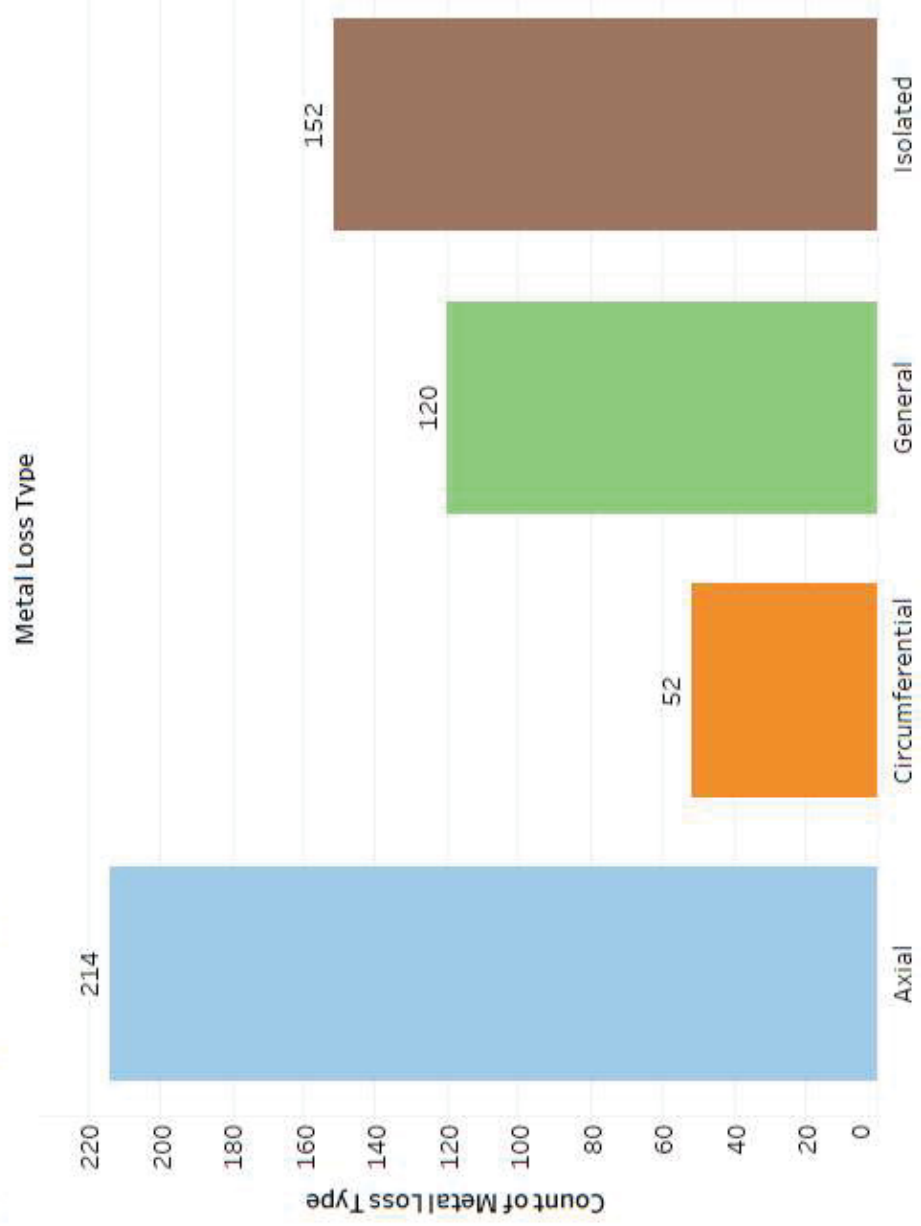
Geologic Statistics	Los Medanos
Formation	Domengine (main) Nortonville (observation)
Geological Age	Eocene
Geological trapping Mechanism	Nortonville shale formation as its cap rock
Avg. Permeability (Darcy)	0.3
Depth (feet)	4,100
Avg. Thickness (feet)	150
Areal Extent (acres)	244
Discovery Pressure-Wellhead (psig)	1,600
Discovery Pressure-Bottom Hole (psia)	1,774
Discovery Pressure Gradient (psia/ft)	0.433
Max Field Pressure (psig)	1,600
Facility MAOP (psig)	1,800



(PG&E-15)

McDonald Island Metal Loss

MFL Inspection Data



(PG&E-15)

From: [Reader, Emily@DOC](#)
To: [Redmond, Lucy](#)
Cc: [Hand, Jeanette@DOC](#)
Subject: PG&E Testing Extension Letter
Date: Thursday, February 29, 2024 4:05:09 PM
Attachments: [image001.png](#)
[image002.png](#)
[image003.png](#)
[image004.png](#)
[image005.png](#)
[PG&E Testing Extension Letter 2.29.2024.pdf](#)

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Lucy:

Thank you for the tour today of the McDonald Island facility. Please see the attached letter. As the letter states, you can contact myself or Jeanette with any questions.

Emily

**Emily Reader**

Supervising Oil and Gas Engineer
Programs II Manager | CalGEM

California Department of Conservation

715 P Street, Sacramento, CA 95814

T: (916) 862-1364

E: Emily.Reader@conservation.ca.gov



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February 29, 2024

Lucy Redmond
Pacific Gas and Electric Company
6121 Bollinger Canyon Road
San Ramon, CA 94583

RE: First Round testing schedule modification approval

Lucy Redmond:

This letter responds to the Pacific Gas and Electric Company (PG&E) January 19, 2024, letter and subsequent discussions, and more specifically to PG&E's request to reschedule mechanical integrity testing for ten wells from 2024 to 2025. PG&E's letter also responded to the California Geologic Energy Management Division (CalGEM) December 20, 2023, data request. CalGEM is reviewing PG&E's data submittal and will respond to that topic separately.

Testing, Conversion & Remediation Work Schedule

PG&E's first round testing schedule, approved in June 2021, contemplates that PG&E will complete its first round of testing required by California Code of Regulations, title 14 (CCR), section 1726.6(a)(2) and (3), and well conversion required by CCR section 1726.5, by the end of calendar year 2024. Nineteen wells were originally scheduled for testing, conversion, or remediation work in 2024.

However, and as described in PG&E's January 19 letter, PG&E explains that it has experienced more well attrition than anticipated, including well outage and subsequent decline in capacity resulting from well rework pending supplemental permits that remain outstanding, wells necessitating plug and abandonment, and wells being taken out of service to repair packers, and sanding issues. As a result, ten wells scheduled for rework or testing had to be carried over into 2024. Further, that those outages coupled with the overall reduction in capacity that results from converting existing wells to tubing and packer configuration for the remaining well population would result in insufficient capacity to meet PG&E's required storage deliverability.

For these reasons, and to allow the drilling of new wells in 2024 to address capacity concerns, PG&E has proposed to revise its approved schedule to move ten wells requiring testing or remediation to their work plan for 2025. PG&E would still perform testing and/or remediation on nine of the nineteen wells originally scheduled for 2024, plus on the ten others carried over to 2024.

(PG&E-15)

CalGEM has reviewed PG&E's request and impacts from the time needed to complete environmental review under the California Environmental Quality Act and approves rescheduling ten wells to 2025, subject to the following expectations: PG&E must prioritize the testing of wells with no previous tests and completion of remedial work of known well integrity issues, while ensuring that testing is completed as quickly as is feasible. The revised schedule approved for 2024 and 2025 is as follows:

Well Name	API Number	Testing Year
WS-20W	0407720535	2024
WS-19W	0407720467	2024
WS-17W	0407720166	2024
WS-12W	0407720264	2024
WS-8W	0407720194	2024
WS-6W	0407720192	2024
WS-1W	0407720215	2024
WS-1AW	0407720544	2025
GINO-3	0401300135	2024
WS-3E	0407720173	2025
WS-2E	0407720169	2025
TC-10N	0407720228	2025
TC-1AS	0407720551	2025
TC-1S	0407720218	2025
TC-17S	0407720258	2025
TC-16S	0407720243	2025
LM-2A	0401320138	2025
LM-5B	0401320144	2024
LM-12C	0401320307	2025
WS-13W	0407720241	Carried over to 2024
WS-5W	0407720211	Carried over to 2024
TC-7N	0407720225	Carried over to 2024

(PG&E-15)

TC-15S	0407720245	Carried over to 2024
TC-3S	0407720216	Carried over to 2024
TC-2S	0407720219	Carried over to 2024
LM-20D	0401320297	Carried over to 2024
LM-13C	0401320299	Carried over to 2024
MCD-14	0407720441	Carried over to 2024
MCD-15	0407720444	Carried over to 2024

CalGEM believes that this extension does not pose a risk to life, health, the facility, or the environment as all the ten wells being rescheduled have had casing wall thickness testing and test results show no, or minimal metal loss. Additionally, each of these wells is equipped with real time monitoring of all annuli, are inspected daily for leaks, and noise and temperature logs and through tubing logs are run annually. If there are any indications of integrity issues through these other testing and monitoring methods before testing occurs in 2025, PG&E shall immediately notify CalGEM. PG&E shall submit its real-time pressure monitoring data to CalGEM for the ten approved wells each quarter, until testing has been completed. Depending on the circumstances, CalGEM may require casing wall thickness testing sooner to further diagnose integrity concerns.

Although CalGEM is granting this extension request, PG&E should proactively seek future permits as soon as possible to reduce the potential for delay to its future testing schedule.

This approval to reschedule ten wells should not change PG&E's approach in developing its second-round testing schedule. CalGEM expects other wells to be tested in 2025, in addition to the ten wells rescheduled to 2025.

Please contact Jeanette Hand with any questions.

Thank you,



der

Supervising Oil and Gas Engineer
Programs II Manager | CalGEM

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
TURN Response to Data Request

To:	The Utility Reform Network
Recipient Name:	Michael Peter Florio
PG&E Data Request No.:	PGE_TURN005
PG&E File Name:	GRC-2027-Phi_DR_PGE_TURN005
PG&E Witness(es):	Lucy Redmond – Gas Engineering
Request Date:	February 19, 2026
Due Date:	March 5, 2026
Response Date:	March 3, 2026

Please provide electronic responses to the following questions. Hard copy responses are unnecessary. The responses should be sent as e-mail attachments to the recipients below. If the files are too large to email, please contact the Discovery Manager below to upload the documents into a folder on the Electronic Secure File Transfer (ESFT) and notify the recipient below.

GRC 2027 Discovery Manager:
Hannah Keller
at GRC@pge.com

GRC Case Coordinators
at GRCCaseCoordinators@pge.com

SUBJECT: MAT AH3-HYDROTESTING MODEL CALCULATION

EXHIBIT: (TURN-6)

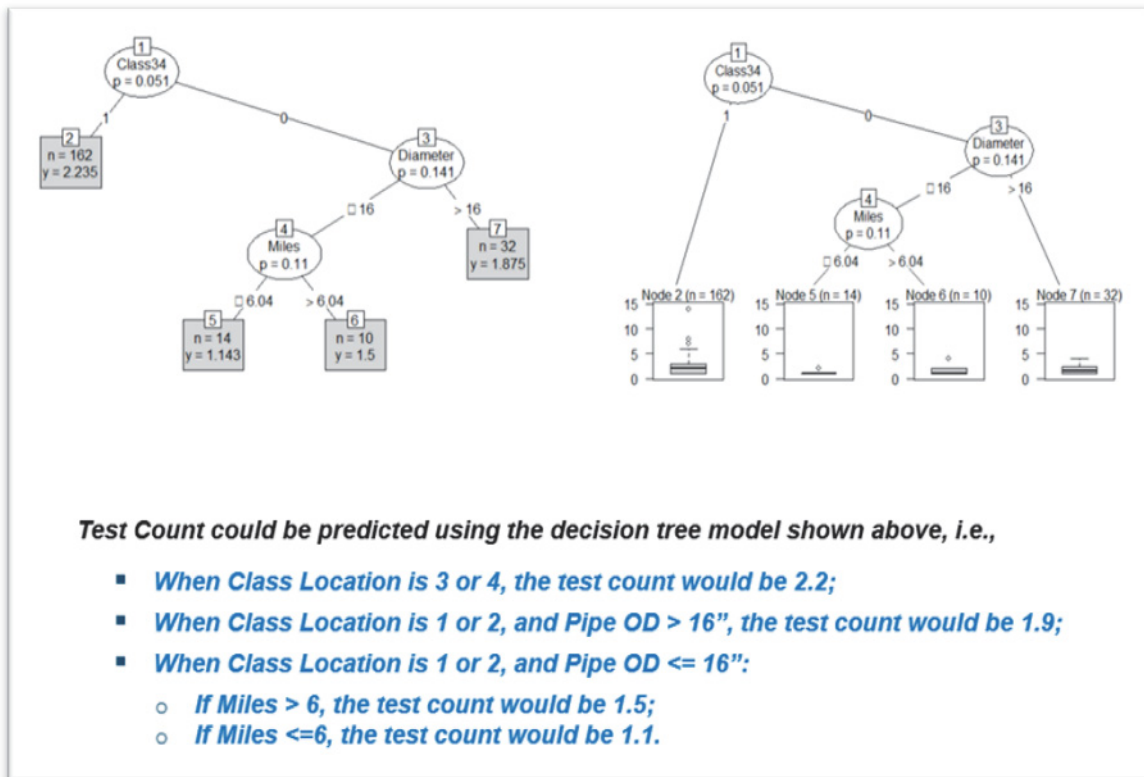
1. TURN's testimony in Chapter 6 on page 68, lines 9-13, TURN state's:

"PG&E's application of its hydrotesting Model from its Workpaper Table 5-15 to the lines in the storage field is clearly in error for one half of the projects. TURN has made a correction to the calculations using PG&E's pressure testing model and produces a total forecasted cost for pressure testing the 9.3 miles of \$5.599 million per year in base year (2024) dollars or \$5.856 million in test year (2027) dollars."

- a. Please explain why TURN states that PG&E's application of its hydrotesting model is "clearly in error" and provide the calculations TURN developed to support the forecast suggested for MAT AH3.

Q01 Response: Referring to PG&E's response to TURN-101, Q.1.b, which shows the values for the Test Count associated with each of the Temporary Assessment Names. The value for the last four projects, MDI TC North Well-to-Station Lines, MDI TC South Well-to-Station Lines, MDI WS East Well-to-Station Lines, and MDI WS West Well-to-Station Lines, ranges from 15 to 21.

Referring to PG&E's hydrotesting model, which is shown at WP Table 5-15, the value for the Test Count cannot exceed 2.2. (See the chart reproduced below from WP Table 5-15.)



PG&E has mistakenly used a test count value that is seven to ten times larger than the highest value permitted under the model. Furthermore, when the Class location, pipe diameter, and mileage is taken into account, the test count should be 1.1 for each of the four projects. TURN has corrected the mistaken test count values in its workpaper.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	Joint-CS_003-Q003
PG&E File Name:	GRC-2027-PhI_DR_Joint-CS_003-Q003
Request Date:	December 9, 2025
Requester DR No.:	001
Requesting Party:	Calpine Corporation and Sacramento Municipal Utility District
Requester:	Thomas Beach/Joseph M. Karp
Date Sent:	December 22, 2025
PG&E Witness(es):	Ryan Weber – Gas Engineering

PG&E's Use of Reserve Capacity

QUESTION 003

In D.23-11-069 (p. 902, OP 13), PG&E was directed to propose a new Curtailment Procedure for noncore customers, as a possible alternative to allocating a portion of the costs of PG&E's Reserve Capacity to noncore customers and shippers. At page 9-79, PG&E notes that the Curtailment Procedure that it filed with the Commission (A. 24-05-004) has not been approved, and therefore "with its final form and implementation framework uncertain, it is PG&E's position that the Curtailment Procedure should not be considered as a viable alternative to Reserve Capacity for firm winter peak day planning." But the Commission has now issued Decision 25-10-042 on October 30, 2025 that substantially revises PG&E's curtailment procedures based on PG&E's proposals and the record developed with other stakeholders in A. 25-04-005. Does it remain PG&E's position that "the Curtailment Procedure should not be considered as a viable alternative to Reserve Capacity for firm winter peak day planning."? Has PG&E's position changed given the issuance of D. 25-10-042? Please explain.

ANSWER 003

PG&E's position has not changed and still maintains that the Curtailment Procedure is not a viable substitute for Reserve Capacity. Despite the Commission's approval of the Curtailment Procedure, as stated in Exhibit (PG&E-3), p. 9-79, lines 24-25 served on November 10, 2025, it is still untested and unproven.

As noted in Exhibit (PG&E-3), p. 9-79 to 9-80 served on November 10, 2025, "the act of curtailment, or the act of reducing service to certain customers, is highly disruptive and should only be used during extreme circumstances, such as an Abnormal Peak Day, to preserve service to core customers. While necessary under certain emergency conditions, curtailment is not designed to support system reliability during routine peak winter days. Additionally, the ability to curtail EGEN demand depends heavily on conditions in neighboring territories and their capacity to import electricity into PG&E's service area. This dependency introduces a significant level of uncertainty, as the availability of imported electricity during critical periods cannot be guaranteed. In

contrast, Reserve Capacity's physical withdrawal from natural gas storage fields, on the other hand, offers a proven and reliable tool for meeting peak demands.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	Joint-CS_001-Q001
PG&E File Name:	GRC-2027-PhI_DR_Joint-CS_001-Q001
Request Date:	November 12, 2025
Requester DR No.:	001
Requesting Party:	Calpine Corporation and Sacramento Municipal Utility District
Requester:	Thomas Beach
Date Sent:	November 25, 2025
PG&E Witness(es):	Patrcia Gideon, Mardi Walton – Corporate Affairs

SUBJECT: PG&E GAS RATE FORECAST

QUESTION 001

PG&E's September 19, 2025 email to parties in this case provided its gas revenue requirement and rate tracking tool for third quarter 2025. However, the tool does not appear to include natural gas transportation rates for Electric Generation (EG) customers.

- a. Please provide PG&E's 2025-2029 forecast of G-EG rates, including both backbone (BB) and local transmission (D/T) rates, consistent with the rate tracking tool forecasts. Please include the components of this forecast (e.g. local transmission, SGIP, CPUC Fee, AB32 ARB COI Fee, AB21 GHG Compliance Cost, Inventory Management, Balancing Accounts, NCA LT Cost Subaccount, GTS Late Implementation Amortization, GT&S related pension, Distribution, and any other components).
- b. Please provide PG&E's forecast of 2025-2029 backbone (Redwood and Baja path) rates for annual firm on-system service. Please include volumetric rates that assume a 100% load factor.
- c. Do the rates shown in the tracking tool for the G-NT industrial rate include or exclude Public Purpose Program (PPP) and GHG cap & trade (C&T) costs? For example, does the \$5.0697 per Dth rate for G-NT-T in 2026 include these rate components? Please provide the underlying components for the G-NT rate forecast, as specified in part (a) of this question.
- d. Do the rates shown in the tracking tool for the G-NT industrial rate include gas commodity costs? If they do, please specify those forecasted gas commodity costs, and their source.

ANSWER 001

- a. Please see attachment "*GRC-2027-PhI_DR_Joint-CS_001-Q001Atch01.xlsx*" for the detailed 2025-2029 EG rates by component.

- b. Please see attachment "*GRC-2027-PhI_DR_Joint-CS_001-Q001Atch02.xlsx*" for PG&E's forecast of 2025-2029 backbone (Redwood and Baja path) rates for annual firm on-system service, including volumetric rates that assume a 100% load factor. Rates shown for 2025 and 2026 are as adopted in Decision 24-03-002 in PG&E's 2023 Gas Transmission and Storage Cost Allocation and Rate Design Application. Rates shown for 2027 through 2029 are as filed in PG&E's 2027 CARD Application on November 21, 2025.
- c. The rates shown in the tracking tool include the Public Purpose Programs (PPP) and GHG rate components. Please see attachment "*GRC-2027-PhI_DR_Joint-CS_001-Q001Atch01.xlsx*" for the detailed 2025-2029 industrial rates by component.
- d. The industrial rates do not include gas commodity costs.

September 1, 2025
AVERAGE END-USER GAS TRANSPORTATION RATES AND PPP SURCHARGES
(\$/th; Annual Class Averages)⁽⁹⁾ (11)

	Industrial			Electric Generation	
	Distribution	Transmission	BB-Level Serv.	Dist./Trans.	BB-Level Serv.
TRANSPORTATION CHARGE COMPONENTS					
1 Local Transmission ⁽¹⁾	\$.18680	\$.18680	\$.00000	\$.18680	\$.00000
2 Self Generation Incentive Program	\$.00000	\$.00000	\$.00000	\$.00000	\$.00000
3 CPUC Fee ⁽³⁾	\$.00254	\$.00254	\$.00254	\$.00034	\$.00034
4 AB32 Air Resource Board Cost of Implementation Fee ⁽⁶⁾	\$.00271	\$.00271	\$.00271	\$.00271	\$.00271
5 AB32 Greenhouse Gas Compliance Cost (Non-Covered Entities Pay Only)	\$.14753	\$.14753	\$.14753	\$.14753	\$.14753
6 Inventory Management	\$.01025	\$.01025	\$.01025	\$.02595	\$.02595
7 Balancing Accounts ⁽²⁾	\$.04437	\$.00218	\$.00250	\$.00091	\$.00276
8 NCA - Local Transmission Cost Subaccount ⁽¹⁰⁾	\$.00630	\$.00630	\$.00000	\$.00630	\$.00000
9 GTS Late Implementation Amortization	\$.03276	\$.03276	\$ (.00542)	\$.03276	\$ (.00542)
10 GT&S-related Pension	\$.00274	\$.00274	\$.00089	\$.00274	\$.00089
11 Distribution - Annual Average ⁽⁶⁾	\$.35372	\$.01274		\$.00216	\$.00216
12 VOLUMETRIC RATE - Average Annual	\$.78972	\$.40654	\$.16100	\$.40819	\$.17691
13 CUSTOMER ACCESS CHARGE - Class Average Volumetric Equivalent ⁽⁴⁾	\$.01011	\$.00160	\$.00171	\$.00196	\$.00046
14 CLASS AVERAGE TRANSPORTATION RATE	\$.79983	\$.40814	\$.16270	\$.41015	\$.17737
15 PUBLIC PURPOSE PROGRAM SURCHARGE/TAX ⁽⁵⁾	\$.15277	\$.08192	\$.08192		
16 END-USE RATE ⁽⁷⁾	\$.95260	\$.49006	\$.24462	\$.41015	\$.17737

NOTES

- (1) Based on PG&E's GT&S Cost Allocation and Rate Design (CARD) Decision 24-03-002
- (2) Based on November recorded balances and forecasted December.
- (3) CPUC Fee based on the proposed Resolution M-4874, will be effective January 1, 2025 (including RF&U). G-EG customers pay a reduced CPUC fee as updated in 2018 GCAP D.19-10-036.
- (4) Based on PG&E's GT&S Cost Allocation and Rate Design (CARD) Decision 24-03-002
- (5) Decision 04-08-010 ordered the removal of PPP cost recovery from transportation rates. On March 1, 2005 PG&E began to treat PPP as a tax. Filed AL 4992-G updated PG&E's 2025 PPP Surcharge
- (6) The G-NGV2 Distribution rate component includes the cost of compression, station operations and maintenance, and state/federal gas excise taxes, and the average A-10 electric rate.
- (7) CARE Customers receive a 20% discount off of PG&E's total bundled rate and are exempt from the CARE portion of PG&E's Public Purpose Program Surcharge (G-PPPS) rates and cost recovery of t
- (8) AB32 provides the Air Resource Board recovery of its administration costs associated with the implementation of AB32. Wholesale and certain large customers are directly billed by the ARB, and are exempt from PG&E's cost of implementation component of \$0.00271 per therm
- (9) Billed Transportation rates paid by all customers include an additional GHG Compliance Cost of \$0.14753 and Operational Cost component of \$-0.00165. Covered Entities within classes and the wholesale class (i.e. customers that currently have a direct obligation to pay for allowances directly to the Air Resource Board) will see a line credit on their bill equal to the GHG Compliance Cost \$0.14753 per therm times their monthly billed therms
- (10) The NCA - Local Transmission Cost Subaccount was created to comply with OP 82 in the 2019 GT&S Decision (19-09-025) and Advice Letter 4288-G
- (11) Rates are unrounded

AVERAGE END-USER GAS TRANSPORTATION RATES AND PPP SURCHARGES

(\$/th; Annual Class Averages) ^{(a) (11)}

	Industrial			Electric Generation	
	Distribution	Transmission	BB-Level Serv.	Dist./Trans.	BB-Level Serv.
TRANSPORTATION CHARGE COMPONENTS					
1	Local Transmission ⁽¹⁾	\$.19604	\$.19604	\$.00000	\$.00000
2	Self Generation Incentive Program	\$.00000	\$.00000	\$.00000	\$.00000
3	CPUC Fee ⁽³⁾	\$.00254	\$.00254	\$.00034	\$.00034
4	AB32 Air Resource Board Cost of Implementation Fee ⁽⁸⁾	\$.00271	\$.00271	\$.00271	\$.00271
5	AB32 Greenhouse Gas Compliance Cost (Non-Covered Entities Pay Only)	\$.14753	\$.14753	\$.14753	\$.14753
6	Inventory Management	\$.01060	\$.01060	\$.02684	\$.02684
7	Balancing Accounts ⁽²⁾	\$.05019	\$.01685	\$.01749	\$.01769
8	NCA - Local Transmission Cost Subaccount ⁽¹⁰⁾	\$.03133	\$.03133	\$.00000	\$.00000
9	GTS Late Implementation Amortization	\$.00515	\$.00515	\$.00048	\$.00048
10	GT&S-related Pension	\$.00274	\$.00274	\$.00089	\$.00089
11	Distribution - Annual Average ⁽⁶⁾	\$.36116	\$.01306	\$.00221	\$.00221
12	VOLUMETRIC RATE - Average Annual	\$.80999	\$.42855	\$.18224	\$.43073
13	CUSTOMER ACCESS CHARGE - Class Average Volumetric Equivalent ⁽⁴⁾	\$.01197	\$.00191	\$.00202	\$.00229
14	CLASS AVERAGE TRANSPORTATION RATE	\$.82196	\$.43046	\$.18426	\$.43303
15	PUBLIC PURPOSE PROGRAM SURCHARGE/TAX ⁽⁵⁾	\$.13860	\$.07651	\$.07651	
16	END-USE RATE ⁽⁷⁾	\$.96056	\$.50697	\$.26077	\$.43303

NOTES

(1) Based on PG&E's GT&S Cost Allocation and Rate Design (CARD) Decision 24-03-002

(2) Based on November recorded balances and forecasted December.

(3) CPUC Fee based on the proposed Resolution M-4874, will be effective January 1, 2025 (including RF&U). G-EG customers pay a reduced CPUC fee as updated in 2018 GCAP D.19-10-036.

(4) Based on PG&E's GT&S Cost Allocation and Rate Design (CARD) Decision 24-03-002

(5) Decision 04-08-010 ordered the removal of PPP cost recovery from transportation rates. On March 1, 2005 PG&E began to treat PPP as a tax. Filed AL 4992-G updated PG&E's 2025 PPP Surcharges effective January 1, 2025.

(6) The G-NGV2 Distribution rate component includes the cost of compression, station operations and maintenance, and state/federal gas excise taxes, and the average A-10 electric rate.

(7) CARE Customers receive a 20% discount off of PG&E's total bundled rate and are exempt from the CARE portion of PG&E's Public Purpose Program Surcharge (G-PPPS) rates and cost recovery of the California Solar Initiative Thermal Program.

(8) AB32 provides the Air Resource Board recovery of its administration costs associated with the implementation of AB32. Wholesale and certain large customers are directly billed by the ARB, and are exempt from PG&E's cost of implementation component of \$0.00271

(9) Billed Transportation rates paid by all customers include an additional GHG Compliance Cost of \$0.14753 and Operational Cost component of \$-0.00165. Covered Entities within classes and the wholesale class (i.e. customers that currently have a direct obligation to pay

(10) The NCA - Local Transmission Cost Subaccount was created to comply with OP 82 in the 2019 GT&S Decision (19-06-025) and Advice Letter 4288-G

(11) Rates are unrounded

AVERAGE END-USER GAS TRANSPORTATION RATES AND PPP SURCHARGES
(\$/th; Annual Class Averages) ^{(b)(11)}

		Industrial		Electric Generation	
		Distribution	BB-Level Serv.	Dist./Trans.	BB-Level Serv.
TRANSPORTATION CHARGE COMPONENTS					
1	Local Transmission ⁽¹⁾	\$2.1990	\$2.1990	\$0.0000	\$0.0000
2	Self Generation Incentive Program	\$0.0000	\$0.0000	\$0.0000	\$0.0000
3	CPUC Fee ⁽³⁾	\$0.0254	\$0.0254	\$0.0034	\$0.0034
4	AB32 Air Resource Board Cost of Implementation Fee ⁽⁶⁾	\$0.00271	\$0.00271	\$0.00271	\$0.00271
5	AB32 Greenhouse Gas Compliance Cost (Non-Covered Entities Pay Only)	\$1.4753	\$1.4753	\$1.4753	\$1.4753
6	Inventory Management	\$0.1031	\$0.1031	\$0.02609	\$0.02609
7	Balancing Accounts ⁽²⁾	\$0.02086	\$0.1401	\$0.01561	\$0.01565
8	NCA - Local Transmission Cost Subaccount ⁽¹⁰⁾	\$0.02188	\$0.02188	\$0.00000	\$0.00000
9	GTS Late Implementation Amortization	\$0.00006	\$0.00006	\$0.00006	\$0.00004
10	GT&S-related Pension	\$0.00274	\$0.00274	\$0.00089	\$0.00089
11	Distribution - Annual Average ⁽⁶⁾	\$36706	\$0.1309	\$0.00222	\$0.00222
12	VOLUMETRIC RATE - Average Annual	\$79558	\$43476	\$17962	\$19546
13	CUSTOMER ACCESS CHARGE - Class Average Volumetric Equivalent ⁽⁴⁾	\$0.0681	\$0.0108	\$0.0115	\$0.0031
14	CLASS AVERAGE TRANSPORTATION RATE	\$80239	\$43583	\$18077	\$19577
15	PUBLIC PURPOSE PROGRAM SURCHARGE/TAX ⁽⁵⁾	\$13599	\$0.7390	\$0.07390	
END-USE RATE ⁽⁷⁾		\$93838	\$50973	\$25467	\$43858

NOTES

- (1) Based on PG&E's GT&S Cost Allocation and Rate Design (CARD) Decision 24-03-002
- (2) Based on November recorded balances and forecasted December.
- (3) CPUC Fee based on the proposed Resolution M-4874, will be effective January 1, 2025 (including RP&U). G-EG customers pay a reduced CPUC fee as updated in 2018 GCAP D.19-10-036.
- (4) Based on PG&E's GT&S Cost Allocation and Rate Design (CARD) Decision 24-03-002
- (5) Decision 04-08-010 ordered the removal of PPP cost recovery from transportation rates. On March 1, 2005 PG&E began to treat PPP as a tax. Filed AL 4992-G updated PG&E's 2025 PPP Surcharges effective January 1, 2025.
- (6) The G-NGV2 Distribution rate component includes the cost of compression, station operations and maintenance, and state/federal gas excise taxes, and the average A-10 electric rate.
- (7) **CARE Customers receive a 20% discount off of PG&E's total bundled rate and are exempt from the CARE portion of PG&E's Public Purpose Program Surcharge (G-PPPS) rates and cost recovery of the California Solar Initiative Thermal Program.**
- (8) AB32 provides the Air Resource Board recovery of its administration costs associated with the implementation of AB32. Wholesale and certain large customers are directly billed by the ARB, and are exempt from PG&E's cost of implementation component of \$0.00271 per therm
- (9) Billed Transportation rates paid by all customers include an additional GHG Compliance Cost of \$0.14753 and Operational Cost component of \$0.00185. Covered Entities within classes and the wholesale class (i.e. customers that currently have a direct obligation to pay for allowances directly to the Air Resource Board) will see a line credit on their bill equal to the GHG Compliance Cost \$0.14753 per therm times their monthly billed therms
- (10) The NCA - Local Transmission Cost Subaccount was created to comply with OP 82 in the 2019 GT&S Decision (19-09-025) and Advice Letter 4288-G
- (11) Rates are unrounded

2028
AVERAGE END-USER GAS TRANSPORTATION RATES AND PPP SURCHARGES
 (\$/th: Annual Class Averages) ^{(b) (1)}

	TRANSPORTATION CHARGE COMPONENTS			Industrial		Electric Generation	
	Distribution	Transmission	BB-Level Serv.	Dist/Trans.	BB-Level Serv.		
1	\$22651	\$22651	\$0.0000	\$22651	\$0.0000	\$0.0000	
2	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	
3	\$0.00254	\$0.00254	\$0.00254	\$0.00254	\$0.00034	\$0.00034	
4	\$0.00271	\$0.00271	\$0.00271	\$0.00271	\$0.00271	\$0.00271	
5	\$14753	\$14753	\$14753	\$14753	\$14753	\$14753	
6	\$0.1114	\$0.1114	\$0.1114	\$0.02819	\$0.02819	\$0.02819	
7	\$0.0235	\$0.01571	\$0.01732	\$0.01550	\$0.01736	\$0.01736	
8	\$0.02180	\$0.02180	\$0.0000	\$0.02180	\$0.0000	\$0.0000	
9	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000	
10	\$0.00274	\$0.00274	\$0.0089	\$0.00274	\$0.00089	\$0.00089	
11	\$38394	\$0.1374		\$0.0233	\$0.0233	\$0.0233	
12	\$82125	\$44440	\$18212	\$44764	\$19934		
VOLUMETRIC RATE - Average Annual							
13	\$0.00848	\$0.00134	\$0.00143	\$0.00165	\$0.00039		
14	\$82973	\$44574	\$18356	\$44928	\$19973		
CLASS AVERAGE TRANSPORTATION RATE							
15	\$13798	\$0.07589	\$0.07589				
PUBLIC PURPOSE PROGRAM SURCHARGE/TAX ⁽⁵⁾							
16	\$96771	\$52163	\$25945	\$44928	\$19973		
END-USE RATE ⁽⁷⁾							

NOTES

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- (2) Based on November recorded balances and forecasted December.
- (3) CPUC Fee based on the proposed Resolution M-4874, will be effective January 1, 2025 (including RP&U). G-EG customers pay a reduced CPUC fee as updated in 2018 GCAP D.19-10-036.
- (4) Based on PG&E's GT&S Cost Allocation and Rate Design (CARD) Decision 24-03-002
- (5) Decision 04-08-010 ordered the removal of PPP cost recovery from transportation rates. On March 1, 2005 PG&E began to treat PPP as a tax. Filed AL 4992-G updated PG&E's 2025 PPP Surcharges effective January 1, 2025.
- (6) The G-NGVZ Distribution rate component includes the cost of compression, station operations and maintenance, and state/federal gas excise taxes, and the average A-10 electric rate.
- (7) CARE Customers receive a 20% discount off of PG&E's total bundled rate and are exempt from the CARE portion of PG&E's Public Purpose Program Surcharge (G-PPPS) rates and cost recovery of the California Solar Initiative Thermal Program.
- (8) AB32 provides the Air Resource Board recovery of its administration costs associated with the implementation of AB32. Wholesale and certain large customers are directly billed by the ARB, and are exempt from PG&E's cost of implementation component of \$0.00271 per therm for allowances directly to the Air Resource Board) will see a line credit on their bill equal to the GHG Compliance Cost \$0.14753 per therm times their monthly billed therms
- (10) The NCA - Local Transmission Cost Subaccount was created to comply with OP 82 in the 2019 GT&S Decision (19-09-025) and Advice Letter 4288-G
- (11) Rates are unrounded

2029
AVERAGE END-USER GAS TRANSPORTATION RATES AND PPP SURCHARGES
(\$/th: Annual Class Averages) ^{(b) (1)}

		Industrial		Electric Generation	
		Distribution	Transmission	BB-Level Serv.	Dist./Trans. BB-Level Serv.
TRANSPORTATION CHARGE COMPONENTS					
1	Local Transmission ⁽¹⁾	\$,23412	\$,23412	\$,00000	\$,23412 \$,00000
2	Self Generation Incentive Program	\$,00000	\$,00000	\$,00000	\$,00000 \$,00000
3	CPUC Fee ⁽³⁾	\$,00254	\$,00254	\$,00254	\$,00034 \$,00034
4	AB32 Air Resource Board Cost of Implementation Fee ⁽⁸⁾	\$,00271	\$,00271	\$,00271	\$,00271 \$,00271
5	AB32 Greenhouse Gas Compliance Cost (Non-Covered Entities Pay Only)	\$,14753	\$,14753	\$,14753	\$,14753 \$,14753
6	Inventory Management	\$,01188	\$,01188	\$,01188	\$,03009 \$,03009
7	Balancing Accounts ⁽²⁾	\$,02296	\$,01663	\$,01826	\$,01644 \$,01830
8	NCA - Local Transmission Cost Subaccount ⁽¹⁰⁾	\$,02163	\$,02163	\$,00000	\$,02163 \$,00000
9	GTS Late Implementation Amortization	\$,00000	\$,00000	\$,00000	\$,00000 \$,00000
10	GT&S-related Pension	\$,00274	\$,00274	\$,00089	\$,00274 \$,00089
11	Distribution - Annual Average ⁽⁶⁾	\$,40187	\$,01442		\$,00244 \$,00244
12	VOLUMETRIC RATE - Average Annual	\$,84798	\$,45420	\$,18381	\$,45803 \$,20229
13	CUSTOMER ACCESS CHARGE - Class Average Volumetric Equivalent ⁽⁴⁾	\$,01016	\$,00161	\$,00171	\$,00197 \$,00046
14	CLASS AVERAGE TRANSPORTATION RATE	\$,85813	\$,45581	\$,18553	\$,46000 \$,20276
15	PUBLIC PURPOSE PROGRAM SURCHARGE/TAX ⁽⁵⁾	\$,13996	\$,07787	\$,07787	
16	END-USE RATE ⁽⁷⁾	\$,99809	\$,53368	\$,26340	\$,46000 \$,20276

NOTES

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- (2) Based on November recorded balances and forecasted December.
- (3) CPUC Fee based on the proposed Resolution M-4874, will be effective January 1, 2025 (including RP&U). G-EG customers pay a reduced CPUC fee as updated in 2018 GCAP D.19-10-036.
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- (7) CARE Customers receive a 20% discount off of PG&E's total bundled rate and are exempt from the CARE portion of PG&E's Public Purpose Program Surcharge (G-PPPS) rates and cost recovery of the California Solar Initiative Thermal Program.
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Data Response

PG&E Data Request No.:	TURN_061-Q002
PG&E File Name:	GRC-2027-PhI_DR_TURN_061-Q002
Request Date:	October 30, 2025
Requester DR No.:	TURN-PG&E-061
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	November 14, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: PG&E-03, CHAPTER 5 -- FOLLOW UP TO TURN-33, DSL & VINTAGE REPLACEMENT

QUESTION 002

In response to TURN-33, Q.5.a, PG&E acknowledges that the 710 miles of pipelines now classified as DSL operate below 20% SMYS. Were any of these pipelines evaluated under PG&E's transmission integrity management program prior to 2025?

ANSWER 002

PG&E objects to this request because past integrity evaluations are not relevant to how these pipelines will be evaluated and assessed going forward, and because the request imposes an undue burden due to the volume of data required. DSL work is guided by the current condition of the pipe and associated risk, which PG&E actively monitors and manages. In line with current standards, PG&E evaluates asset integrity based on present and known risks, not historical data as historical data does not inform current asset conditions. Prior to the recent code clarification, the 710 reclassified lines were considered Transmission lines and managed with regulatory compliance per 49 CFR § 192 Subpart O.

Consistent with Subpart P 192.1007(d), PG&E identifies and implements measures to address risks, including an effective leak management program. PG&E performs leak surveys on all DSL lines and uses survey findings to establish risk rankings and mitigation strategies. Depending on leak incident history, PG&E selects appropriate measures such as accelerated leak surveys, corrosion reviews, pipe replacement, repair, or integrity assessments.

PG&E uses leak history on DSL segments to determine the most appropriate preventative and mitigative (P&M) measures. For example, on segment DFM 2408-01 in Dublin, repeated leaks warranted full pipe replacement.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_061-Q008
PG&E File Name:	GRC-2027-PhI_DR_TURN_061-Q008
Request Date:	October 30, 2025
Requester DR No.:	TURN-PG&E-061
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	November 14, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: PG&E-03, CHAPTER 5 -- FOLLOW UP TO TURN-33, DSL & VINTAGE REPLACEMENT

QUESTION 008

In response to TURN-33, Q.5.a, PG&E states: “This risk-based work is essential for maintaining pipeline safety and comply with DIMP regulations under 49 CFR § 192 Subpart P § 192.1007(d) which state that operators are required to identify threats, rank risks, and implement mitigation strategies.” Please break down the cost between (a) the work that is required to identify threats and rank risks for the 710 miles of DSL pipeline and (b) the work that is required to implement mitigation strategies for the 710 miles of DSL pipeline.

ANSWER 008

49 CFR § 192 Subpart P § 192.1007(d) requires operators to identify and implement measures to address risks. Operators determine and implement measures designed to reduce the risks from failure of its gas distribution pipelines. These measures must include an effective leak management program (unless all leaks are repaired when found).

PG&E is utilizing the transmission threat identification and transmission risk analysis process to identify the threats and risks for these higher pressure distribution lines. In addition, PG&E is performing leak survey on all DSL pipelines and uses the findings from the surveys in conjunction with the threat and risk analyses to determine mitigation strategies.

PG&E then uses a comprehensive scoping review to determine the appropriate Preventative & Mitigative (P&M) measures and/or mitigation. These include P&M measures such as accelerated leak survey and corrosion reviews, and mitigations such as pipe replacement, repair, or integrity assessments. The intent is to effectively manage the integrity of these higher pressure DSL pipelines that will not receive 49 CFR § 192 Subpart O inspections.

Because DSL are managed under 49 CFR § 192 Subpart P, there is not a required integrity assessment interval. PG&E is choosing to schedule the assessments based on the risk and the leak incident history.

PG&E does not have a cost breakdown of the threat identification and risk ranking costs but they are minimal because they are performed with all gas transmission pipelines through an automated algorithm. For mitigations, PG&E separates them into Thad categories under MAT JTB, as stated in PG&E's previous response to "*GRC-2027-Phi_DR_TURN_33-Q005Supp01*".

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_061-Q009
PG&E File Name:	GRC-2027-PhI_DR_TURN_061-Q009
Request Date:	October 30, 2025
Requester DR No.:	TURN-PG&E-061
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	November 14, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: PG&E-03, CHAPTER 5 -- FOLLOW UP TO TURN-33, DSL & VINTAGE REPLACEMENT

QUESTION 009

Please provide a cost-benefit evaluation of the work that PG&E proposes to conduct as DSL Integrity Management.

ANSWER 009

DSL Integrity Management (IM) is newly proposed work designed to address threat assessments, direct assessment (DA) activities, preventative and mitigative measures, and NT-ILI evaluations for DSL pipelines. This risk-based work is essential for maintaining pipeline safety and to comply with DIMP regulations under 49 CFR § 192 Subpart P and 49 CFR § 192.1007(d) which state that operators are required to identify threats, rank risks, and implement mitigation strategies, including effective leak management programs. While DSL lines do not have 49 CFR § 192 Subpart O integrity assessment requirements, PG&E's approach ensures that risk-driven evaluations are performed to confirm the integrity and safe operations of these pipelines that operate between 100 and 1,040 psig but whose operating stresses are less than the 20% or higher SMYS pipelines that are covered by Subpart O.

PG&E is forecasting to spend \$40.1 million in expense during the 2027 GRC period (2027-2030) to perform evaluations on selected, risk prioritized segments. For the 713.8 miles of DSL, this forecast equates to approximately \$56,234 per mile. As a comparison, PG&E is forecasting \$1,100 million in expense to comply with the Subpart O required assessments on transmission segments due in 2027-2030. The Subpart O required spend for the 5,654 miles of Gas Transmission pipeline equates to \$193,495 per mile. The risk informed assessments, reassessment intervals and mitigations on these lower risk DSL lines, is a cost-effective strategy to manage their risks.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_061-Q012
PG&E File Name:	GRC-2027-PhI_DR_TURN_061-Q012
Request Date:	October 30, 2025
Requester DR No.:	TURN-PG&E-061
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	November 14, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: PG&E-03, CHAPTER 5 -- FOLLOW UP TO TURN-33, DSL & VINTAGE REPLACEMENT

QUESTION 012

If the answer to question 10 is “yes,” please explain in detail the elements within the DIMP under which PG&E is required to use ILI and direct assessment methods to evaluate the safety of distribution lines and the frequency of those required evaluations.

ANSWER 012

Please refer to Exhibit (PG&E-3), Ch. 1, Section C.1.a., p. 1-7, lines 3-10, for details on the transmission definition change and D.23-12-003 in which the Commission authorized PG&E:

...to maintain pipeline segments that are reclassified from transmission to distribution pipelines in accordance with maintenance requirements of 49 CFR Part 192 and GO 112-F for transmission pipelines until PG&E proposes to change this maintenance practice in a future general rate case or other rate-settling application. . . ¹

Note that with respect to 7.5 miles of piping operating at or below 60 psig that were reclassified from transmission to distribution PG&E is requesting approval to follow distribution maintenance requirements. Until this request is approved, PG&E will continue to maintain the reclassified piping in accordance with Transmission Pipeline requirements. The remaining reclassified piping from transmission to distribution will continue to be maintained in accordance with Transmission Pipeline Requirements.²

Further, the Distribution Integrity Management Program (DIMP) uses leak history, risk calculation, Third Party Damage (TPD) history, cracking threats, untested pipe, etc. on

¹ D.23-12-003, p. 46, Conclusion of Law 16. Transmission Maintenance Requirements are outlined in Appendix A of the decision.

² Exhibit (PG&E-3), Ch. 1, Section C.1.a. page 1-8, lines 1-18.

segments of Distribution Supply Line (DSL) to determine what Preventive and Mitigative (P&M) measure is most appropriate, which could potentially include ILI and other integrity assessments. For example, on DFM 2408-01 in Dublin, CA, there were numerous leaks that necessitated replacing the section of that pipe. In other cases, PG&E may choose to repair and adjust our cathodic protection (CP) system or perform integrity assessment.

To comply with 49 CFR § 192 Subpart P § 192.1007(d) which requires operators to identify and implement measures to address risks, determine and implement measures designed to reduce the risks from failure of its gas distribution pipeline in which these measures must include an effective leak management program (unless all leaks are repaired when found), PG&E is performing leak survey on all DSL pipeline and uses the findings from the survey to determine risk ranking and mitigation strategies. Depending on leak incident history, PG&E will select a preventative and mitigative (P&M) measure such as accelerated leak survey, corrosion review, pipe replacement, repair, or integrity assessment to address these risks (potentially including ILI and other techniques). The intent is to evaluate the integrity of these higher pressure DSL pipelines that will not receive 49 CFR § 192 Subpart O inspections. The integrity assessments do not have a required assessment interval. PG&E is choosing to schedule the assessments based on the risk and the leak incident history.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_056-Q002
PG&E File Name:	GRC-2027-Phi_DR_TURN_056-Q002
Request Date:	October 22, 2025
Requester DR No.:	TURN-PG&E-056
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	November 5, 2025
PG&E Witness(es):	Chris Warner – Gas Engineering

SUBJECT: FOLLOW UP TO DATA REQUESTS TURN-05, TURN-33, TURN-34

QUESTION 002

With respect to PG&E's response to TURN-005, Q.3, please extend the data provided in the file GRC-2027-Phi_DR_TURN_005-Q003Atch01 ILI Upgrades to include all of the projects completed in 2022, 2023, and 2024.

ANSWER 002

Please see "*GRC-2027-Phi_DR_TURN_056-Q002Atch01*" for an updated file with projects completed in 2022 and 2023. PG&E objects to a portion of this request to the extent that it calls for production of 2024 data that was not available at the time PG&E's cost model was put together for the 2027 GRC forecast.

AppA-368

AppA-369

[illegible]

GRC-2027-PH_UPL_056-000A0001

Old & New Data Combined - Values Only			
Year	PNC-ID	Upgrades Values	Value Over Cost
2015-1043	Values:	1	30 \$ 970,693.00 \$ 1,666,700.75 42%
2016-1043	Values:	4	12 \$ 1,428,847.75 \$ 1,428,847.75 0%
2017-1100	Values:	3	12 \$ 1,162,820.46 \$ 2,081,680.72 23%
2017-1104	Values:	1	12 \$ 1,418,506.46 \$ 1,428,847.75 1%
2018-1205	Values:	2	36 \$ 1,785,951.75 \$ 1,785,951.75 0%
2018-1207	Values:	1	36 \$ 2,284,315.46 \$ 1,785,951.75 31%
2018-1218	Values:	2	36 \$ 2,276,779.05 \$ 2,072,322.75 10%
2018-1284	Values:	4	36 \$ 2,338,929.38 \$ 2,725,042.70 7%
2020-1442P	PNC Value:	1	12 \$ 1,177,756.14 \$ 1,428,847.75 22%

SUMMARY OUTPUT									
Regression Statistics									
R	0.9999								
R Square	0.9999								
Adjusted R	0.9999								
Standard Error	13759.5								
Observations	9								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	2	1.3E+12	6.37E+11	1.2E975	0.3456201				
Residual	6	3.11E+10	5.18E+09						
Total	8	4.41E+12							
Coefficients									
Intercept	50078	792579	1.57E+07	0.22382					
Value Dim	13268.5	2920747	1.36E+02	0.22386					
Value Dim	13268.5	2920747	0.175001	0.986177	42998.2	69412.21	42998.2	69412.21	

RESIDUAL OUTPUT

Observations		Residual
1	1666701	-690008
2	1666701	-341300
3	1666701	100000
4	1428848	-104019
5	1808153	132288
6	1785952	100000
7	2072323	204659
8	272505	-186335
9	1428848	-51452

AppA-373

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	CalAdvocates_125-Q002
PG&E File Name:	GRC-2027-PhI_DR_CalAdvocates_125-Q002
Request Date:	September 11, 2025
Requester DR No.:	PubAdv-PG&E-125-SWC
Requesting Party:	Public Advocates Office
Requester:	Sophie Chia
Date Sent:	September 23, 2025
PG&E Witness(es):	Christopher Warner – Gas Engineering

SUBJECT: ASSET FAMILY - TRANSMISSION PIPE –PIPELINE INVESTIGATIONS (MAT JTD)

QUESTION 002

In PG&E's 2023 General Rate Case (GRC), PG&E requested \$20 million, and the Commission authorized \$19 million for MAT JTD. PG&E recorded \$4.4 million in 2023 and \$5.3 million in 2024 for MAT JTD. Please explain in detail the projects PG&E forecasted in the 2023 GRC and why the projects were not performed or materialized in 2023 and 2024

ANSWER 002

The Pipe Investigations program (MAT JTD) covers work that includes: investigations on anomalous conditions and potential mechanical damage to evaluate fitness for service (FFS); investigations on the cause and extent of failures or incidents to comply with 49 CFR § 192.617; data validation to perform research for valid and invalid strength test records and pipeline material records; establish MAOP to comply with 49 CFR § 192.619; perform risk-based assessment and preliminary field engineering and studies on pipelines; and verify pipeline components.

In addition, for the 2023 GRC and 2027 GRC, PG&E incorporated the work required by Mega Rule Part 1 (RIN1), effective on July 1, 2020. RIN1 changes include a new code section 49 CFR § 192.607 that requires verification of material properties that are not traceable, verifiable, and complete (TVC) and are needed for establishing the maximum allowable operating pressure (MAOP) per 49 CFR § 192.624 or for use in integrity management fracture mechanics analyses per 49 CFR § 192.712 and 49 CFR § 192.714. Under PG&E's Opportunistic Inspections Program (OIP) that was created in 2017 in anticipation of the new Mega Rule material verification requirements, PG&E opportunistically performs pipe property verification inspections and testing. These opportunistic material inspections are identified during the design and excavation phases of projects.

In the 2023 GRC when PG&E first incorporated RIN1, PG&E estimated 1,157 digs would be executed for 49 CFR §192.607 and used the historical costs referenced in the

2023 GRC, Workpaper Table 5-36. PG&E did not provide a project level forecast and estimated the number of digs due to uncertainty around RIN1. The underspend in 2023 to 2024 recorded costs compared to adopted was due to overestimation in dig count forecast in the 2023 GRC, driven by uncertainty around RIN1 compliance and the decrease in opportunistic inspections available due to Transmission Definition implementation. RIN1 compliance was completed at a lower cost in 2023 and 2024 than forecasted in the 2023 GRC.

PG&E continues to execute MAT JTD work as discussed in Exhibit (PG&E-3), p. 5-115 to 5-120 and remains fully compliant with 49 CFR §192.607. Most verification of material property verification work is opportunistic in nature and depends on whether the locations of excavations performed by other project work are on pipe segments needing material property verification. The elimination of potential projects based on pipe investigations, which verify material properties and help avoid unnecessary assessments (e.g., strength testing or pipe replacement), is included in MAT JTD. These projects are generally identified several months prior to execution. Because of the uncertainty around where opportunistic digs may occur and the short cycle of projects initiated to confirm that work is not required, MAT JTD used a 5-year historical average in its 2027 GRC.

The cancellation of scheduled projects due to pipe investigations—such as material property verification that eliminates the need for activities like strength testing or pipe replacement—is incorporated within MAT JTD. These determinations are generally identified several months prior to execution.

MAT JTD work is expected to continue to use field investigations, material properties testing, pipeline verification, and research in order to reduce costs by confirming more expensive projects, such as strength test and replacements, are not required.

PACIFIC GAS AND ELECTRIC COMPANY
General Rate Case 2027 Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_032-Q004
PG&E File Name:	GRC-2027-Phi_DR_TURN_032-Q004
Request Date:	July 29, 2025
Requester DR No.:	TURN-PG&E-032
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	August 12, 2025
PG&E Witness(es):	Lucy Redmond – Gas Engineering

SUBJECT: EX. PG&E-3, CHAPTER 9, SECTION E (PEAK DAY SUPPLY STANDARD)

QUESTION 004

Please provide copies of all correspondence between PG&E and CalGEM since 1/1/22, as well as presentations and/or notes from any meetings or telephone calls between the parties during that time, including but not limited to communications regarding PG&E's proposed risk-based reinspection frequency.

ANSWER 004

Please see GRC-2027-Phi_DR_TURN_032-Q004AtchIndex for the list of attachments provided which detail the most recent correspondence PG&E exchanged with CalGEM regarding the reinspection frequency.

PG&E will provide additional correspondence in a supplemental data response.

PACIFIC GAS AND ELECTRIC COMPANY
General Rate Case 2027 Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_032-Q004
PG&E File Name:	GRC-2027-Phi_DR_TURN_032-Q004Supp01
Request Date:	July 29, 2025
Requester DR No.:	TURN-PG&E-032
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	August 12, 2025 (Original) August 27, 2025 (Supplemental)
PG&E Witness(es):	Lucy Redmond – Gas Engineering

SUBJECT: EX. PG&E-3, CHAPTER 9, SECTION E (PEAK DAY SUPPLY STANDARD)

QUESTION 004

Please provide copies of all correspondence between PG&E and CalGEM since 1/1/22, as well as presentations and/or notes from any meetings or telephone calls between the parties during that time, including but not limited to communications regarding PG&E's proposed risk-based reinspection frequency.

ANSWER 004

Please see GRC-2027-Phi_DR_TURN_032-Q004AtchIndex for the list of attachments provided which detail the most recent correspondence PG&E exchanged with CalGEM regarding the reinspection frequency.

PG&E will provide additional correspondence in a supplemental data response.

ANSWER 004 SUPPLEMENTAL 01

PG&E is providing the correspondence with CalGEM regarding the reinspection frequency that has occurred between 2022 and current date.

Please see attachment GRC-2027-Phi_DR_TURN_032-Q004AtchIndexSupp01 for the listing of correspondence by date related to the storage portfolio investments being provided.

PACIFIC GAS AND ELECTRIC COMPANY
General Rate Case 2027 Phase I
Application 25-05-009
Data Response

PG&E Data Request No.:	TURN_032-Q004
PG&E File Name:	GRC-2027-Phi_DR_TURN_032-Q004Supp02
Request Date:	July 29, 2025
Requester DR No.:	TURN-PG&E-032
Requesting Party:	The Utility Reform Network
Requester:	Hayley Goodson
Date Sent:	August 12, 2025 (Original) August 27, 2025 (Supplemental01) January 16, 2026 (Supplemental02)
PG&E Witness(es):	Lucy Redmond – Gas Engineering

SUBJECT: EX. PG&E-3, CHAPTER 9, SECTION E (PEAK DAY SUPPLY STANDARD)

QUESTION 004

Please provide copies of all correspondence between PG&E and CalGEM since 1/1/22, as well as presentations and/or notes from any meetings or telephone calls between the parties during that time, including but not limited to communications regarding PG&E's proposed risk-based reinspection frequency.

ANSWER 004

Please see GRC-2027-Phi_DR_TURN_032-Q004AtchIndex for the list of attachments provided which detail the most recent correspondence PG&E exchanged with CalGEM regarding the reinspection frequency.

PG&E will provide additional correspondence in a supplemental data response.

ANSWER 004 SUPPLEMENTAL 01

PG&E is providing the correspondence with CalGEM regarding the reinspection frequency that has occurred between 2022 and current date.

Please see attachment GRC-2027-Phi_DR_TURN_032-Q004AtchIndexSupp01 for the listing of correspondence by date related to the storage portfolio investments being provided.

ANSWER 004 SUPPLEMENTAL 02

Please see attachment “GRC-2027- Phi_DR_TURN_032-Q004Supp02AtchIndex.xlsx” for a list of the recent correspondence being provided from PG&E to CalGEM in response to the May 22, 2025 letter from CalGEM in which PG&E was directed to conduct well inspections on a prescriptive interval of 7-years.

PACIFIC GAS AND ELECTRIC COMPANY
2027 General Rate Case Phase I
Application 25-05-009
Data Request

To:	The Utility Reform Network
Recipient Name:	Jalal Awan
Request Date:	March 11, 2026
PG&E Data Request No.:	PGE_TURN027
PG&E File Name:	GRC-2027-PhI_DR_PGE_TURN027
Due Date:	March 18, 2026
PG&E Witness(es):	Daven Phelan – Gas Engineering
Response Date:	March 19, 2026

Please provide electronic responses to the following questions. Hard copy responses are unnecessary. The responses should be sent as e-mail attachments to the recipients CC'ed in the transmittal. If the files are too large to email, please contact the Discovery Manager below to upload the documents into a folder on the Electronic Secure File Transfer (ESFT) and notify the recipient below.

GRC 2027 Discovery Manager:
Hannah Keller
at GRC@pge.com

GRC Case Coordinators
at GRCCaseCoordinators@pge.com

SUBJECT: GD PIPE REPLACEMENT

EXHIBIT: (TURN-03) GAS DISTRIBUTION MAINS AND SERVICES –PIPELINE REPLACEMENT PROGRAMS

- Referring to Exhibit TURN-03, page 28, lines 1-2 and footnote 45, TURN explains that the “weighted average of \$3.87 million per mile” was derived from “R.24-09-012, Spreadsheet of Distribution Replacement Costs Data, cell B9, submitted by PG&E on Nov. 5, 2025.” Please confirm that by “cell B9,” TURN was referring to the sheet entitled “Costs by Operating District,” Row B9, and that the referenced figure appears in column x.

Q01 Response:

Yes, that is the correct reference. TURN notes that Row B9 is defined by PG&E (Column D) as the “average cost of gas distribution main **and service** replacement activities, per mile of main,” calculated as B15 divided by B13. Based on this definition, TURN understands the \$3.87 million per mile value may include both main **and service** replacement costs across divisions, and therefore may overstate mains-only unit costs. The \$3.87 million per mile replacement cost is also ~29% higher compared to ~\$3 million per mile figure provided by SoCalGas pursuant to the ALJ’s ruling issued Sept. 24, 2025 in the long-term gas planning proceeding (R.24-09-012). TURN notes that PG&E states the opposite in Note 2 of the “Costs by Operating District” tab, indicating the value may undercount costs.

2. Row B9, column z of the “Costs by Operating District” sheet referred to in Question 1 states: “The value for ‘cost per main mile replaced’ was derived using recorded costs and units from 2021 - 2024 which were then averaged. Due to volumes of work differing by PG&E operating districts (divisions), PG&E provides a weighted average for this value in the last column. Any ratesetting activity should rely on the forecast presented in the General Rate Case (GRC). The value presented in this spreadsheet is different from the forecast methodology used in the GRC or other proceedings.” At the time TURN prepared exhibit TURN-03, had TURN read this language?

Q02 Response:

Yes. TURN reviewed Row B9, column z of the “Costs by Operating District” sheet. As noted in TURN-03 (p. 29, lines 1–7):

“PG&E acknowledges this discrepancy exists ‘due to volumes of work differing by PG&E operating districts (divisions)’ and cautions that ‘any ratesetting activity should rely on the forecast presented in the General Rate Case’ rather than historical actuals. This caveat is problematic: if historical costs are materially lower than PG&E’s proposed unit costs for the 2027 GRC application, and lower than comparable gas utility per mile unit costs for pipeline replacement, PG&E’s own 2021-2024 historical average cost data should be used with appropriate escalators.”

TURN also notes that, to the extent PG&E’s planned gas distribution pipeline replacement work includes activities beyond mains replacement, this should be clearly specified, and PG&E bears the burden to reconcile and explain the differences between the costs presented in R.24-09-012 and those reflected in its GRC testimony.

3. At the time TURN prepared Exhibit TURN-03, what was TURN’s understanding as to how the 2021-2024 data used to calculate the 2021-2024 average presented in Row B9 of the spreadsheet referred to in Question 2 were presented in terms of escalation, that is, whether the 2021-2024 dollars were presented in a common 2024 figure, with the 2021-2023 figures appropriately escalated to 2024 dollars, or whether they were unescalated?

Q03 Response:

At the time TURN prepared Exhibit TURN-03, TURN understood the 2021–2024 recorded cost data to be presented in nominal dollars for each respective year (i.e., un-escalated), rather than converted into a common-dollar basis. However, given that the data were provided as 2021-2024 aggregated averaged figures (i.e., not broken down by year) and submitted pursuant to the ALJ’s ruling (issued Sept. 24, 2025) in the long-term gas planning proceeding, TURN assumed these values to be representative benchmarks for evaluating cost effectiveness, project implementation, and cost comparisons within the relevant SB1221 planning timeframe (i.e. for the 2026-2030 time period). TURN proposed its own escalators based on the assumption that the “weighted average of \$3.87 million per mile” derived from “R.24-09-012, Spreadsheet of Distribution Replacement Costs Data, cell B9, submitted by PG&E on Nov. 5, 2025” was an appropriate baseline cost (albeit likely overestimated for mains-only cost/mile as described in

TURN's response to Q1) for MAT14D pipeline for years 2027-2030 (see WP_TURN-3_Table7_Table8_Table9, tab 'Table 8 | Table 9'). TURN consequently escalated MAT 14A and MAT 50A using material-type cost relationships reflected in PG&E's own forecast unit costs which includes escalation factors for 2027-2030 projected costs (see WP_TURN-3_Table7_Table8_Table9, tab 'Table 8 | Table 9', Rows 6,7).

4. If TURN's answer to Question 3 was that it had no understanding, what was TURN's assumption, at the time it prepared Exhibit TURN-03, as to how the 2021-2024 data used to calculate the 2021-2024 averages presented in Row B9 of the spreadsheet referred to in Question 2 were presented in terms of escalation, that is, whether the 2021-2024 dollars were presented in a common 2024 figure, with the 2021-2023 figures appropriately escalated to 2024 dollars, or whether they were unescalated?

Q04 Response:

Please see response to Q3 above.

5. If, in fact, the data used to calculate the 2021-2024 averages presented in Row B9 of the spreadsheet referred to in Question 2 were not escalated to 2024 dollars, that is, the 2021 data were stated in 2021 dollars, the 2022 data were stated in 2022 dollars, the 2023 data were stated in 2023 dollars and the 2024 data were stated in 2024 dollars, does TURN agree that the resulting \$3.87 million per mile 2021-2024 average, before it can be used to reasonably forecast future costs, needs to be adjusted to reflect appropriate cost escalation? If not, explain the basis for your answer.

Q05 Response:

Yes. If the 2021–2024 data were un-escalated and reflected main replacement costs per mile (explicitly excluding all services), converting the time series to a common year (e.g., 2024 dollars) would provide a more consistent historical average in lieu of the \$3.87 million per mile simplifying assumption. However, as noted in response to Question 3, TURN assumed the data submitted pursuant to the ALJ Ruling to serve as planning-period benchmarks for 2026–2030. Accordingly, TURN used the \$3.87 million per mile division-wide average (noting a range from approximately \$7.43 million in San Francisco to \$2.61 million in North Valley) as an appropriate baseline for the 2027–2030 GRC timeframe.

6. Does TURN agree that, when using 2021-2024 recorded costs to forecast 2027 costs for gas distribution pipeline replacement, the 2021-2024 costs need to be escalated to 2027 dollars? If not, explain the basis for your answer.

Q06 Response:

Please see responses to Questions 3 and 5. TURN agrees that, in general, escalation of historical costs to a common year is appropriate. TURN's approach applies escalation in a manner consistent with the use of the \$3.87 million per mile value as a baseline benchmark for MAT14D within the 2026–2030 planning timeframe, and consequently applies pipeline material-based escalators for MATs 14A and MAT50A. Accordingly, TURN does not adopt and cautions against using separate or duplicative escalation.

7. Exhibit TURN-03, page 6, lines 6-7, states: “TURN proposes adopting PG&E’s recorded historical costs as the baseline, appropriately escalated and differentiated by material type.”

- a. Explain what TURN means by “appropriately escalated.”

Q07a Response:

By “appropriately escalated,” TURN means using the simplifying assumption of PG&E’s 2021–2024 historical weighted average cost as the baseline for MAT 14D (plastic) for the 2027-2030 period, and then differentiating MAT 14A and MAT 50A using material-type cost relationships reflected in PG&E’s own forecast unit costs, which include escalation factors for 2027-2030 projected costs (see WP_TURN-3_Table7_Table8_Table9, tab ‘Table 8 | Table 9’).

- b. What escalation factors did TURN apply to PG&E’s recorded historical costs in developing its forecast for PG&E’s gas distribution pipeline replacement programs (MATs 14A, 14D and 50A)?

Q07b Response:

TURN applied the following factors in developing its forecast for MATs 14A, 14D, and 50A:

- Capital escalation from 2024 to forecast year: 1.0000 for 2027, 2028, 2029, and 2030.
- Material type escalation factor, with MAT 14D (plastic) as baseline = 1.0000.
- MAT 14A factor = 1.3831 (calculated as Row 1 / Row 2) – includes 2027-2030 inflation escalation.
- MAT 50A factor = 1.3503 (calculated as Row 3 / Row 2) – includes 2027-2030 inflation escalation.

- c. Please provide a workpaper showing all calculations TURN performed to “appropriately” escalate PG&E’s recorded historical costs in developing TURN’s forecast for PG&E’s gas distribution pipeline replacement programs (MATs 14A, 14D and 50A).

Q07c Response:

Please see workpaper WP_TURN-3_Table7_Table8_Table9, specifically tabs “02. Exh 3_Ch4WP 4-27 14A_D_50A” and “Table 8 | Table 9.”

8. Does TURN agree that PG&E, when it prepared its forecast unit cost for its gas distribution pipeline replacement programs in MATs 14A, 14D and 50A, PG&E used recorded historical unit costs as the baseline, differentiated by material type, and escalated to 2027 dollars? If not, explain the basis for TURN’s disagreement.

Q08 Response:

TURN understands that PG&E used recorded historical unit costs (2022-2024) (see WP_TURN-3_Table7_Table8_Table9, tab ‘02. Exh 3_Ch4WP 4-27 14A_D_50A’). However, as noted in TURN’s response to Q6, for reasons not described in PG&E’s application, average recorded costs (2022-2024) presented in the GRC are consistently higher than the 2021–2024 costs

provided pursuant to the ALJ Ruling in R.24-09-012 (weighted average \$3.87 million per mile); and also exceed SoCalGas median costs per main mile replaced (see TURN-03, Figure 9, p.29). More specifically, average 2022–2024 GRC unit costs (in 2024 \$) are higher across all MATs i.e. \$5.64 million per mile (MAT 14A, +46%), \$4.16 million per mile (MAT 14D, +7.5%), and \$6.43 million per mile (MAT 50A, +66%), relative to the \$3.87 million per mile 2021–2024 benchmark (see WP_TURN-3_Table7_Table8_Table9, tab “02. Exh 3_Ch4WP 4-27 14A_D_50A”). TURN’s position is that PG&E has not sufficiently justified these higher recorded costs shown in the GRC, and the burden remains on PG&E to do so.

9. For purposes of this question, PG&E asks TURN to assume that the following is true and accurate:

After the Paradise fire, PG&E has been performing gas distribution pipe replacement in Butte county as part of the effort to rebuild the community (“Butte Rebuild Work”). Due to the unique circumstances of this work, PG&E has been able to perform the Butte Rebuild Work at a substantially lower cost than normal pipeline replacement. For example, PG&E gas operations obtained significant efficiencies by sharing trenching costs with PG&E electric operations and with other utilities, such as telecommunications utilities. As a result of this and other efficiencies, PG&E’s average cost per mile for the Butte Rebuild Work performed in MATs 14D and 50A has been less than half its average cost per mile performing traditional pipeline replacement work. In addition, the Commission’s decision in PG&E’s 2023 GRC ordered this work excluded from the GRC revenue requirement. PG&E has also excluded Butte Rebuild Work from its forecast presented in this 2027 GRC application.

- a. If TURN assumes that the foregoing was true and accurate, does TURN agree that, for purposes of forecasting PG&E’s 2027-2030 gas distribution pipeline replacement unit cost for MATs 14D and 50A, when forecasting based on historic recorded unit costs, it would be reasonable to exclude the historic recorded costs associated with Butte Rebuild Work?

Q09a Response:

Yes. TURN did not dispute this treatment in its testimony.

Consistent with D.23-11-069 and as reflected in workpapers (WP_TURN-3_Table7_Table8_Table9, tab “02. Exh 3_Ch4WP 4-27 14A_D_50A,” footnote (a): “Pursuant to D.23-11-069, all 2023–2026 costs and units for gas work associated with MAT 14D, MAT 50A, and MAT 50B completed in the Town of Paradise are excluded and recorded and presented in a CEMA review proceeding”), Butte Rebuild Work costs appear to be excluded.

- b. If your answer to Question 9.a was anything other than an unqualified yes, explain the basis for your answer.

Q09b Response:

Not applicable.